Metabolism, Nutrition, and Exercise

Code: SCI3005

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Period 5

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General Information

Introduction

Acknowledging that even at rest the body is physiologically quite active, one can only imagine how much more active the different systems in the body become during exercise. Exercise, nutrition, and metabolism all tie together: in order to do exercise, your muscles need to become metabolically active and require more nutrients, more oxygen, and efficient clearance of waste products. In this course, we will study the biochemical responses of the body to the increased physiologic demands of exercise.

Studying and discussing how the body performs and responds to physical activity, requires knowledge of the way the body functions at rest. Therefore, this course will build on knowledge you have acquired in basic and intermediate courses on human physiology, biochemistry, and cell biology. The main goal is to create an understanding of the adaptation in biochemical mechanisms during exercise. It will not turn you into an exercise biochemist or sport nutritionist, but it will help you to elaborate on and contribute to the debate surrounding exercise physiology. You might become that person that friends and family turn to in order to get an educated advice on healthy nutrition, exercise, and training.

Aim and approach – Intended Learning Outcomes (ILOs)

The goal of this course is to provide you with a solid understanding of the key aspects in energy metabolism related to exercise. In addition, the course aims to teach students a set of skills that are relevant for a future career in research. Therefore, the aims of this course are twofold: the pursuit of knowledge, and acquiring skills and developing competencies. In this this course, we want you to …

… identify, explain and discuss the different types of muscles and their working mechanisms (ILO 1)
… identify, explain and discuss the main metabolic pathways and how they are regulated (ILO 2)
… identify, explain and discuss the different types of hormones and their working mechanisms, and how they affect metabolism (ILO 3)
… identify, explain and discuss the different types of micromolecules and their role in metabolism and fatigue (ILO 4)
… use the knowledge you gathered in the points above to examine energy production and metabolic regulation, the effects of exercise duration and intensity, the effects of nutritional status, the effects of training, and the mechanisms of fatigue in the context of different types of exercise (ILO 5)
… make use of prior knowledge (ILO 6)
… recognise and define gaps in your knowledge and understanding (ILO 7)
… develop proper information-searching skills (ILO 8)
… relate and integrate information from various sources (ILO 9)
… communicate effectively (ILO 10)
… put theory into practice (ILO 11)

How do we get there?

· By discussing theories, models, and ideas in the first 5 tasks (ILOs 1-5) in a PBL format (ILOs 6-10).
· By offering you a list of suggested readings, but not telling you which chapter of which book should be read for what task (ILOs 8-9).
· By applying the acquired knowledge by means of providing a recommendation on nutrition, and exercise and/or training in relation to a specific case (ILO 11).

The course starts with a theoretical framework on the basics of exercise biochemistry and exercise physiology. In four tasks, you discuss the physiology of muscles, the metabolism of macronutrients, the hormonal regulation of metabolism, and the biochemical and physiological role of micronutrients in relation to exercise and fatigue. In task 5, everything should come together in a discussion on the different types of exercise. The course builds on the knowledge you have obtained in basic and intermediate courses, such as biochemistry, human physiology, and cell biology. In addition, you are encouraged to relate to appropriate knowledge from other courses. This course is meant as a culmination where all relevant knowledge acquired in previous courses comes together and is applied. This first, theoretical part of the course is rounded off with a written exam.

The second part of the course starts with a plenary discussion on a case study (task 6). As a group, you will advise a patient how to reach the set goals by means of proper nutrition and exercise. Subsequently, we will discuss the case studies selected for your take-home assignment (for more information, see below). This is done in the form of presentations for which you can receive bonus points, adding to the grade for the take-home assignment (to a maximum grade of 10,0). By doing so you have the opportunity to discuss your findings and, if applicable, remaining questions or issues in relation to the case study, as well as receive feedback on how to proceed. The second part of the course is rounded off by a recommendation on a particular case, in the form of a written recommendation (take-home assignment).

You are most likely used to a PBL format where a task is accompanied by a list of specific readings in which you will find the answers to the learning goals. However, this is not the way things work in real life. In a true research environment, a research question is not accompanied by a list of references in which the solution can be found. Considering the fact that it is highly likely that your future career lies in research, it is relevant to acquire a variety of skills. Whereas most courses focus primarily on learning content, which is certainly also a significant goal in this course, it alone will not assure success. In this course, we expect you to develop good information searching skills, learn how to relate and integrate information from various sources including linking prior knowledge to newly acquired information, define what you do not know and outline what you still need to learn, and improve your (academic) communication skills. Therefore, it is important (and sufficient) in this course to let the learning objectives guide your study process.

Readings

In relation to developing information-searching skills, there is no main book for this course. Instead, an inexhaustive list of suggested readings is provided in the course environment (Student Portal > Course Material), these books are all available in Reading Room at UCM and/or in the UM library. If possible, use the most recent edition of the book. In addition to the books listed, e-readers are also available via the Student Portal.

A recurring issue students tend to face when confronted with a course that does not provide a list of required readings, is the question in how far you need to know a certain topic for the exam. It is impossible to provide a clear answer to this question. A guideline to your study process is to constantly ask 'why?' and subsequently look for a satisfying answer to that why-question. At some point, you will run out of why-questions or you will simply be unable to find the answer anywhere. That is when you have really made an effort to try to understand the concepts, mechanisms, and processes involved.

You are encouraged to use whatever sources help you to find the answer to the learning goals; varying from books to scientific publications, from online lectures or documentaries. Some books or sources may be more appropriate to answer certain questions. Let the learning goals guide your study process.

Attendance requirement

This course has a 100% attendance expectation. The attendance requirement for the 10 tutorial meetings is 85%. This means that you are expected to be present at all scheduled meetings, but you are allowed to miss two regular tutorials without further consequences. If you miss more meetings, you will have to apply for an additional assignment (via the Student Portal). In order to qualify for an additional assignment you have to have valid reasons for all missed sessions. If you do not meet the attendance requirement, you are not eligible for a resit. You automatically fail the course if you miss over 30% of the scheduled meetings.

The Systematic Literature Search workshop in week 2 of the course is mandatory and is not considered one of the regular tutorial meetings to which the 85% attendance requirement applies. Additionally, the guest lectures in week 3 and 5 are not mandatory, but since the lecturers travel to UCM especially for you, we consider it a matter of courtesy that you attend these lectures.

Workshop Study Skills

As a student, you know how to study by now. You have passed several exams, you are able to constructively contribute to discussions in tutorial meetings, so you must be doing something good. But you might be surprised to find out that the way you have been studying the past years is actually not the best way for long-term retention of knowledge. This workshop will show you which learning strategies are most effective and will help you develop self-regulated learning skills.

Workshop Systematic Literature and Data Searching (mandatory)

When positioning your own research (questions, methods, data, etc.) in a research paper or research proposal – or when writing a review – you do not want to miss important existing literature or data on your topic. To prevent such omissions a systematic literature or data search is often conducted with the aim to retrieve all relevant literature and data. In this workshop a demo will be given on how to develop a systematic search strategy – usable in multiple databases – and where to search for data.

After this two hour workshop and demo you will know:

- Where to search for existing data on a topic
- How to build a search strategy.
- Where to pay attention to when using search strategies in different databases.
- Get some hands-on experience in systematic searching.

To make optimal use of this workshop, you have to prepare in advance:

- Have a research topic at hand.
- Check the video 'How to find e-books, e-journals and articles' (https://library.maastrichtuniversity.nl/information-skills/workshops-courses/systematic-literature-and-data-searching-for-reviews-research-proposals/)
- Check the tutorial 'Finding information for your research' (https://tutorials.library.maastrichtuniversity.nl/find-research-information/)

After the workshop, you may want to refer back to the tutorial 'PubMed Basics': https://tutorials.library.maastrichtuniversity.nl/pubmed-basics/

Assessment

This course contains two elements of assessment:

1. a written exam consisting of five open questions (50% of the overall course grade) – for more information, see below;
2. a written assignment. You will receive one combined grade (counting towards 50% of the overall course grade) for:
    a. a 2500-3500 word recommendation (excluding references) on a specific case study – for more information, see below;
    b. bonus and minus points for the presentation of your individual case study (insufficient/fail = -0.5, sufficient/good = 0, excellent/distinguished = +0.5)

These two elements of assessment serve the purpose of assessing all learning objectives (content/knowledge and skills/competencies) of the course; the essay questions in the exam function to cover the breadth of the field, and the written assignment allows you to demonstrate your acquired expertise.

Exam

The exam in this course consists of five questions that each includes two parts:

a. Relational level: *compare/contrast, explain, integrate, analyse, relate;* student shows understanding of several components which are integrated conceptually showing understanding of how the parts contribute to the whole; **3 points**

b. Extended abstract level: *apply, theorize, generalize, predict, create, hypothesise, reflect, generate, evaluate;* student is able to conceptualize at a higher level of abstraction and apply; **5 points**

The theoretical framework discussed in the first part of this course, the five tasks, will be addressed in the exam; i.e. for every task there is one full question as described above.

An inspection hour for the exam will take place in tutorial meeting 10 in week 7 and appear in your personal online schedule to make sure the room is reserved and all students in the course are aware. The inspection hour is not mandatory. In case you do not feel the need to attend (for whatever reason) then feel free.

During this plenary session of approximately 60 minutes, all exam questions are discussed and insight is provided in how the answers were assessed. The exam is discussed in a lecture format, so everyone is kindly requested to be on time.

Take-home assignment

The purpose of the writing assignment in this course is to allow students to apply the acquired knowledge on biochemical and physiological principles involved in exercise in a recommendation on a specific case.

Topic of the recommendation

The writing assignment in this course gives you an opportunity to apply what you have learned during the course. It allows you to search for biochemical and physiological principles either from the course or outside of the course and use this to provide a suitable recommendation on a specific case.

You are encouraged to come up with your own case study. You can always check with your tutor on the appropriateness of the case. The content of the recommendation should be comprehensive and an extension to what has been discussed in the course. The recommendation should include an advice on nutrition, and exercise and/or training in relation to a specific case. Every claim and advice should supported by appropriate biochemical and physiological mechanisms, processes, and theories. Please refer to Appendix B for a list of possible topics for the take-home assignment.

Note: You are not allowed to use a paper from either this course or another course, which you failed in the past and improve that paper and hand that in. Your choice of topic and approach need to be new in that sense. However, they may obviously fit your academic interests as expressed in other courses at UCM and your curriculum.

Format of the recommendation

The recommendation should be between 2500 to 3500 words, excluding references. If the word count is between 2250-2500 or 3500-3750, 0.5 points are subtracted from the final grade for the recommendation. If the word count is below 2250 or above 3750, the recommendation will not be graded and considered a fail. For further information about the structure and the grading criteria of the recommendation, please refer to Appendix A.

When you use information from a scientific article, university textbook or internet source, make sure you include the reference. Not doing so, is a form of plagiary. Do not take this lightly. Copying and pasting pieces of text from the internet is as much a form of plagiary as is copying from a book!

In addition to scientific articles or university textbooks, there is nothing against using the internet as a source. However, if you use an internet site, always put a reference to it in your report; omitting to do so and being caught in doing it, results in an annulment of the whole report.

The take-home assignments are to be handed in before the deadline (see schedule on page 12). This deadline cannot be extended. Failure to comply with it loses you all credits on the writing assignment.

Presentation

The main goal of the presentation is to present an idea, or a problem, or a question, or a discussion statement that is related to or part of your recommendation. This idea, problem, question or discussion statement should be presented in such a way that it can form the starting point for a discussion between you and the group and also serves as the basis for the group to e.g. give feedback, or critically respond to the claims and statements made.

The presentations take place during the tutorial meetings in the second part of the course (week 6 and 7). You will be assigned to a specific timeslot in which you will give your presentation. When not giving a presentation during a meeting, you will participate as a member of the audience.

Every student has 30 minutes for the presentation. This includes questions and group discussion. A computer and a beamer will be available.

Setup of the presentation

The presentation should contain at least the following items:

- General introduction & context – *this part includes the patient characteristics, referral issues, and agenda*
- Presentation of the problem/idea/question/issue
- Group discussion - presenter leads the discussion

Assessment of the presentation

The tutor will assess the presentations. The assessment for the presentation is based on:

- The quality of the general introduction – *are you able to present your patient, the referral issues, and agenda in such a way that the audience has enough insight to understand the context for your recommendation?*
- The quality of the presentation of the main issue or problem – *are you able to deduce a problem/idea/question/issue from the greater topic of your recommendation and present this in a comprehensible and argumentative way? In other words, are you able to critically evaluate your own work?*
- The handling of questions/discussions – *are you able to handle questions or a discussion on the topic?*

The presentation should NOT be a mere summary of your final recommendation. It is a presentation on a work in progress and thus an opportunity to receive comments and responses to a line of thinking you want to use in your recommendation. The presentation should be theoretically informed and needs to be introduced in a way that leads the audience step by step to the issue of your critical investigation.

Draft & Peer review session

Peer feedback is considered an important element of this course. It allows you to receive feedback on the draft version of the paper and improve it before handing in the final version. In addition, you will learn from assessing your fellow student's papers in terms of giving feedback, but also in terms of critically looking at your own paper while assessing those of others.

For the peer review session in week 7, we expect you to bring two copies of your draft to class. During this session, everyone will read two draft papers and provide feedback.

Format of the draft

Although it is hard to set a strict guideline for the number of words for your draft, you can take 1800 as a minimum. Keep in mind that a draft is more than an outline. It is very difficult, not to say impossible, to give constructive feedback on a list of bullet points. In addition to that, the more elaborate your draft is, the more feedback you can expect and the less work you need to do in order to finish your final report. In essence, a draft is a nearly complete and finished report, with the exception that it can still be changed. Feel free to add a list of questions you still have with regard to the content of your own report (facts, theories, sources, interpretations).

Resit

Students who initially fail the course, but who have complied with the compulsory attendance requirement and took part in all of the assessment during the course, are eligible for one resit.

The overall grade for this course consists of a grade for the exam (50%) and a grade for the take-home assignment (50%). The resit serves the purpose of lifting your overall grade to sufficient/above 5.5. It does not replace the overall grade. Hence, the resit can be either on the exam OR on the take-home assignment. In case of a resit, you will have to redo that part of the assessment for which you received the lowest grade. In case of redoing the recommendation, you can either rewrite the original recommendation, incorporating the feedback you received, or choose a new case study and write a new recommendation. In addition, bonus and minus points as described above, will be annulled and the grade for the recommendation replaces the grade for this assignment.

In order to receive a grade for the exam you will have to do a serious attempt at passing the exam. If it is not deemed a serious attempt, you will not receive a grade and you will not qualify for a resit. The same thing holds for the take-home assignment. If it is not deemed a serious attempt, you will not receive a grade and you will not qualify for a resit.

Course coordinator

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Overview of meetings, lectures and deadlines

week	day	meeting	topic	deadlines
1	Monday 09/04/2018	Tutorial group meeting 1	Introduction course Pre-discussion Task 1	
	Thursday 12/04/2018	Tutorial group meeting 2	Post-discussion Task 1 Pre-discussion Task 2	
		Workshop: Study Smart – L. Bevers		
2	Monday 16/04/2018	Tutorial group meeting 3	Post-discussion Task 2 Pre-discussion Task 3	
	Thursday 19/04/2018	Tutorial group meeting 4	Post-discussion Task 3 Pre-discussion Task 4	**Prepare workshop Systematic Literature and Data Search** (see page 8)
		Workshop: Systematic Literature and Data Search – V. Janssen ***(Mandatory)***		
3	Monday 23/04/2018	Tutorial group meeting 5	Post-discussion Task 4 Pre-discussion Task 5	
	Thursday 26/04/2018	Tutorial group meeting 6	Post-discussion Task 5 Pre-discussion Task 6 Case Study	
		Lecture: master Health Promotion – F. Schneider		
4	Monday 30/04/2018	Tutorial group meeting 7	Post-discussion Task 6 Case Study Pre-discussion Exam	
	Thursday 03/05/2018	Exam		Check your timetable for more details
5	Monday 07/05/2018	*Lecture: master Movement Sciences* – T. Bovend'Eerdt		
	Thursday 10/05/2018	*No meeting*		
6	Monday 14/05/2018	Tutorial group meeting 8	Student presentations (1)	
	Thursday 17/05/2018	Tutorial group meeting 10	Student presentations (2)	
7	*Monday 21/05/2018*	*No meeting*		
	Thursday 24/05/2018	Tutorial group meeting 10	Inspection hour exam	**Thursday May 24th 2018 9.00AM:** Deadline draft version Take-home assignment – bring 2 hardcopies to class
			Peer feedback session	
8	Monday 28/05/2018	*No meeting*		**Friday June 1st 2018 11.00PM/23:00hrs**: Deadline Take-home assignment – upload via the Student Portal > SafeAssignment and drop a hardcopy in OSA mailbox.
	Thursday 31/05/2018	Take-home assignment		

Note that this is a preliminary schedule. Please check your timetable and the announcements on the Student Portal on a regular basis.

Tasks

Task 1. Muscle metabolic profile

Arnold Trophy and Frank Ibershift are mountain bike (MTB) buddies for quite some years now. Both live in Maastricht and from there they start their weekly MTB tour on one of the various beautiful and challenging trails in the area. They are well matched on the flat rides, but as soon as they come on a mountainous stage, Frank can not keep up with Arnold.

Frank decides to look further into the matter. Why is he unable to keep up with Arnold? Is it a matter of his energy supply being insufficient? Or is there something fundamentally different between the two with respect to their muscle profiles? Perhaps Frank should start a training regimen to improve his uphill capacities.

Task 2. Metabolism of main fuel sources

The three main fuel sources eventually have a similar fate: ATP. But how they get there is different. Cells have millions of metabolic reactions going on at any given second. Metabolic charts showing individual reactions resemble a gigantic roadmap. It looks complicated, but interestingly, all of the thousands of metabolic reactions can be grouped into six distinct categories of reaction.

Maintaining a constant cellular environment requires complex metabolic regulation that coordinates the use of nutrient pools. Fortunately, this regulation is not a conscious process. Cells have developed a rigorous, but flexible way of regulating metabolic processes.

Given that the three different fuel sources feed the three energy systems in our body, it may not be necessary to memorise every reaction step in the different pathways. The regulation of metabolic pathways is merely a matter of demand and supply, both under normal conditions as well as during exercise.

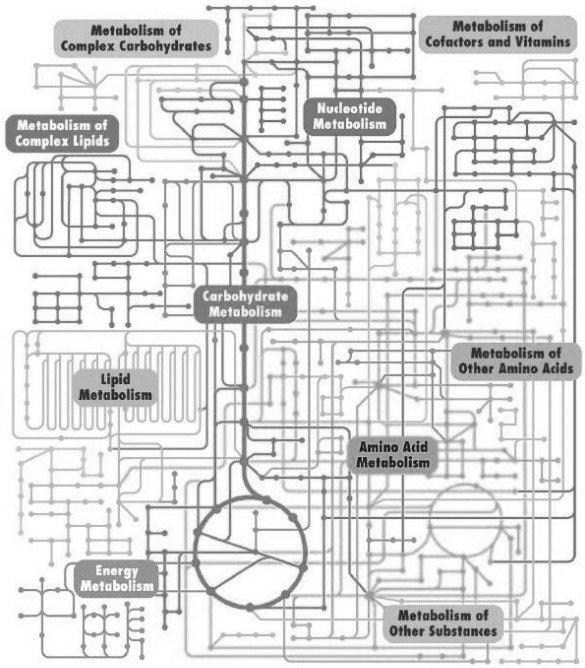
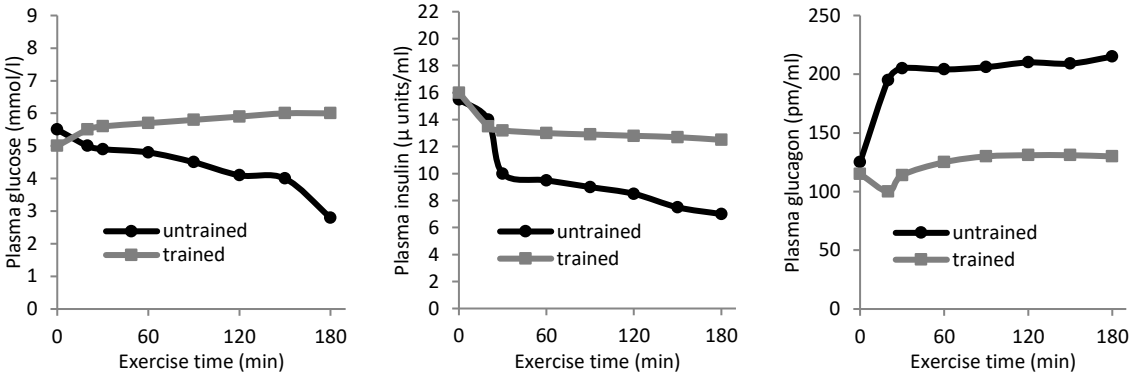


Figure 15-2
Biochemistry, Sixth Edition

Task 3. Regulating the fuel sources

The endocrine system is a complex system with many organs involved, which controls the level of hormones in the circulation. Different types of hormones act in different ways; some have acute effects, others may take more time before they exert their effect. Several hormones play a role in the regulation of metabolism, both in rest as well as during exercise. Maintaining energy levels is one of best-known examples. Various hormones, like insulin and glucagon, work to ensure glucose and free fatty acid availability for energy metabolism. But many more hormones are known to play a role. Training probably induces a change in the responses.



Plasma glucose (left), insulin (middle), and glucagon (right) levels in trained and untrained subjects during 3hrs of cycling.

Task 4. Nutrition: The base for human performance

So we learned that the body get energy from three main fuel sources and now you're telling me that my body actually requires seven types of nutrients?! In addition to macronutrients, required in relatively large quantities, we also need a relatively small intake of micronutrients, and an average intake of 2.5 l of water per day. But given that micronutrients, nor water, provide any energy, why should we pay attention to them? Do they perhaps play a role in metabolism?

Depending on the form of exercise, eventually sensations of fatigue will occur. Intensity, duration, and type of exercise all affect the biochemical equilibrium within the exercising muscle cells. A shortage of substrates and/or accumulation of metabolites, directly affect the mechanical machinery of the muscle cell. Fatigue may be caused by a lack of vitamins and minerals. So apparently, the inter-relationship between micronutrients, energy metabolism, and physical well-being is an important one!

Task 5. Bringing it all together (and the cup home!)

During the annual inter-UC competition, students from University Colleges from all over the Netherlands come together to compete in sports, but also in debating, dance, chess, arts, and many more. Amsterdam University College has managed to win the Great UCSRN Tournament Trophy 4 years in a row. At UCM we all agree: It is about time that we take over this ever-winning role!

Everywhere you look, in the courtyard, the common room, even in the lecture hall and classrooms, groups of students are training for different activities in the tournament. Team BUCM is training for the mixed basketball event, team RUMC is preparing for the 5k run, and team WUCM wants to take part in the newly set up weight lifting contest. However, none of the team members have followed the course Metabolism, Nutrition and Exercise, and they realise they are in urgent need of a trainer in order to stand a chance against the AUC teams.

In light of all the knowledge concerning energy production and metabolic regulation, nutritional status, type, duration, and intensity of exercise, and fatigue you acquired in the first couple of weeks of the course, you should by now be able to help these teams with proper advice on their training regimen. Assuming they follow the advice of their trainers, what do you think will happen to their muscles? They will most likely increase in volume, and the muscle fibres may even switch type…

Task 6. Case study: Morbidly obese – Losing weight, getting fit

Patient characteristics

The patient is a 50 year old male, height 1.90 m, current weight 159 kg.

Patient history

The patient has always been overweight; he had a BMI of 31.9 at the age of 40. Over the past 10 years, he has gained a lot of weight; at 48 his weight was 182 kg.

Referral issues

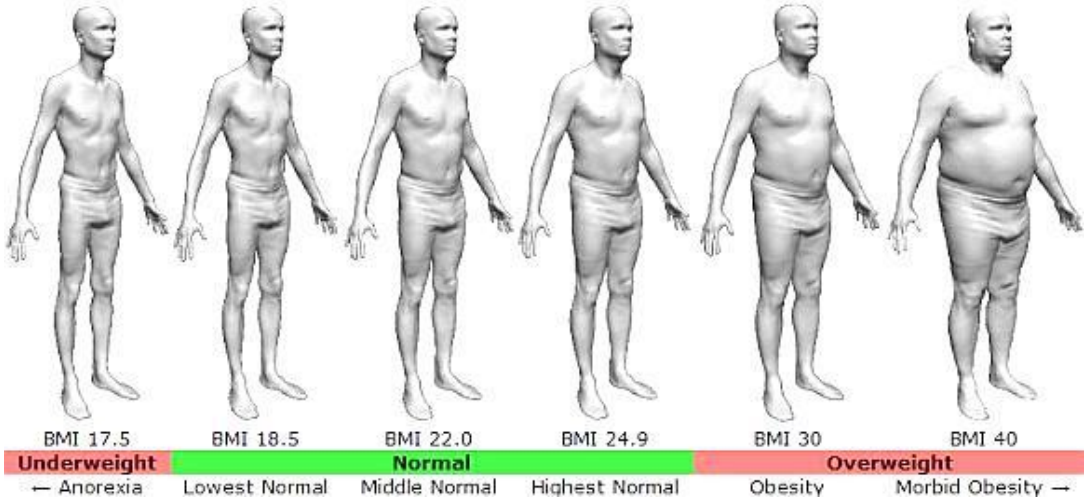
Based on the BMI classifications, the patient was obese when he was 40 years old; at 48, he was super obese, and currently he is classified as morbidly obese.

The patient is suffering from back pain, which is limiting his activities of daily living and enjoyment of life. The patient's previous occupation was standing (chef). He then moved to seated work (taxi), but at the moment he can no longer work at all due to debilitating pain. The patient spends 6-7 hours per day watching TV and DVD's and this is one of the few enjoyments in life for the patient.

The patient feels very limited. He stated that he often attends his children's primary school to assist with reading and other tasks and that having this outlet makes him feel useful. His children also enjoy it.

Agenda

Patient wants to lose weight and get back in shape. Patient wants to get to 140 kg by December. He wants to reach a healthy BMI in two years from now. So by the time he is 52, he wants to weigh 90 kg. The patient has strong motivation to reach his goals; he wants to be fit enough to undertake fun things with his children (like biking, hiking, and playing soccer in the backyard).

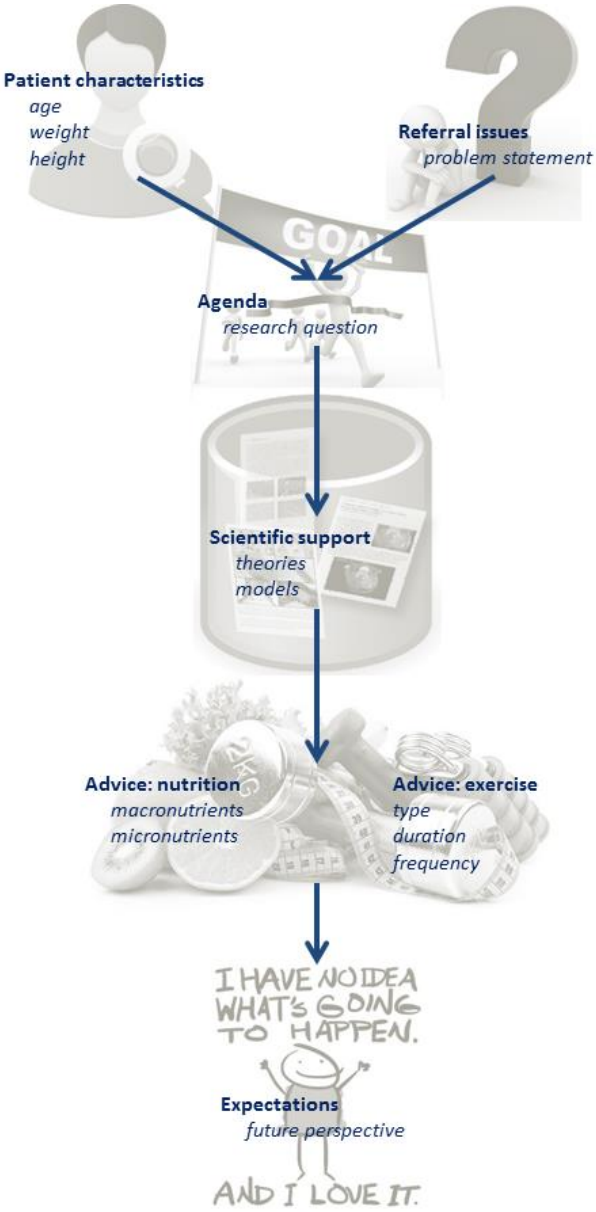


(obtained from: http://www.scientificpsychic.com/health/Body-Mass-Index-BMI.html)

Appendix A. Structure and grading criteria take-home assignment

The recommendation should include the following parts:

Patient characteristics	age, weight, height – *this should be as concrete and exact as possible. Even if you are dealing with a fictitious patient, you have to provide values for these variables. You might want to focus on an actual existing 'patient' (e.g. you); this allows for a concrete advice.*
Referral issues	problems (e.g. obese, underweight, fitness) – *the problem statement: what is the patient's problem that needs to be solved?*
Agenda	what goal(s) does the patient want to reach (e.g. lose/gain weight, improve fitness levels) – *the research question: what is the goal?*
Scientific support	theories and models that help develop the advice given – *your practical advice, both nutrition and exercise, should be preceded by sound, scientific support. Do not avoid using contradicting theories; this actually allows you to write an interesting scientific discourse, concluding by choosing one theory over another. Make sure you always link the theory to the goals of the patient.*
Advice: nutrition	diet plan (precise and practical) – *this should be as exact as possible. You do not have to list the number of sandwiches someone should eat, but you do have to give an indication of the number of calories (macronutrients, both absolute and in percentage). In addition, if applicable an advice on micronutrients should also be provided.*
Advice: exercise	exercise plan (precise and practical) – *clearly indicate the type, duration, and frequency of training for your patient.*
Expectations	future perspective, based on the recommendations – *a brief overview of what the patient can expect, based on your advice; e.g. when can the patient expect to reach the set goals, what are the pitfalls and limitations of your advice?*



Elements and criteria to consider

CONTENT

A	*Introduction: Introducing the patient (Patient history)* · Patient characteristics - Clear and precise description of the patient - e.g. age, weight, height - Short patient history - e.g. used to be slim, used to be active · Referral issues - Clear and precise description of the issue(s) - e.g. obese, underweight, certain level of fitness - Clear but brief elaboration on the issue(s) - Clear but brief explanation on why this(/these) issue(s) require(s) advice · Agenda (Research Question) - Clear and precise description of the goal(s) of the patient - e.g. lose/gain weight, improve fitness levels, including the timeframe in which the goal(s) have to be reached · Brief reasoning - why is it relevant to set these goal(s) - e.g. health benefits, winning the championship
B	*What needs to change?* · Scientific support - Current status of the patient - e.g. muscle metabolic profile - Clear elaboration on what needs to change to reach the goal - e.g. muscle fibre shift, diet change, etc. - Scientific support - metabolic concepts and mechanisms, biochemical and physiological mechanisms · Use of resources in a meaningful and convincing way: - Use of current literature and research - Support for the advice is based on relevant facts and evidence - Claims are backed up with sufficient and reasonable sources, warrants and/or data
C	*Advice on nutrition (Practical application)* · Nutritional advice - precise and practical advice on nutrition, including: · Macronutrient content of diet · Micronutrient content of diet - e.g. possible deficiencies with a brief explanation (not just listing micronutrient deficiencies) · Meal frequency and timing
D	*Exercise/training advice - precise and practical advice on exercise/training including:* · Type of exercise - e.g. high-intensity/endurance/high-intensity intermittent training · Duration of exercise - e.g. number of repetitions · Frequency of exercise - e.g. 3 days per week, with 1 day of rest in between
E	*Expectations and evaluation (Discussion and conclusion)* · Critical elaboration on the advice provided: - Elaboration on achievability of goals - Expectation of when the goals will be achieved · Critical elaboration on the research conducted: - Elaboration on strengths and limitations of the advice - Judgment on whether revision or refinement is appropriate and necessary - Dealing with possible counter arguments or critique · Conclusion follows logically from the research conducted; it provides an answer to the research question · Indicating possible future questions and future research

DELIVERY

F	*Paper is written towards the reader in order to make the content comprehensible:* · Introduction provides an adequate framework for the paper · Unified paragraphs which are coherent and fully developed · Flow from one paragraph to the other · No repetition of information or ideas
G	*Language* · Words are chosen correctly, avoiding jargon, yet applying relevant terminology · Sentences are clear and concise · Spelling · Grammar
H	*Referencing* · In-text references are consistent · In-text references are mentioned in reference list and vice versa · Reference list is consistent, clear and according to one style of reference
I	*Lay-out* · Appropriate and consistent use of headings, font type and size, indent, line and paragraph spacing

Appendix B. Possible topics take-home assignment

- Your personal training programme and balanced diet: what is your goal? (losing weight/improve condition/burn fat/…)

- Soccer world cup in Qatar – prepare the soccer players for the heat and humidity

- You are coaching a tennis player who claims to benefit from creatine supplementation. Analyse the effects on performance and advise your tennis player.

- Nutritional strategies to promote post-exercise recovery.

- A couple of months after following a diet and losing weight, a significant part of the lost weight is back. Do not discuss the psychosocial and behavioural factors; focus on the physiological, biochemical, and molecular parameters.

- A friend wants to compete in the Giro d'Italia Femminile. Advise her with respect to nutrition and training programme.

- Compose the perfect diet for a sprinter/swimmer/ cyclist/rower/soccer player/… *pick one*

- …