DESIGN AND FABRICATION OF SPIRAL SNACK 360 MAKER

A PROJECT REPORT

Submitted by

AGILAN T

GURUDEV S

SREE MANIKANDAN G

VISHAL K

In partial fulfilment of the degree

of

BACHELOR OF ENGINEERING

In

MECHANICAL ENGINEERING

K. RAMAKRISHNAN COLLEGE OF TECHNOLOGY

(An Autonomous Institution, affiliated to Anna University Chennai and Approved by AICTE, New Delhi)

SAMAYAPURAM – 621 112

DECEMBER 2024

DESIGN AND FABRICATION OF SPIRAL SNACK 360 MAKER

A PROJECT REPORT

Submitted by

AGILAN T

GURUDEV S

SREE MANIKANDAN G

VISHAL K

In partial fulfilment of the degree

of

BACHELOR OF ENGINEERING

In

MECHANICAL ENGINEERING

K. RAMAKRISHNAN COLLEGE OF TECHNOLOGY

(An Autonomous Institution, affiliated to Anna University Chennai and Approved by AICTE, New Delhi)

SAMAYAPURAM – 621 112

DECEMBER 2024

K.RAMAKRISHNAN COLLEGE OF TECHNOLOGY
(AUTONOMOUS)
SAMAYAPURAM – 621 112

BONAFIDE CERTIFICATE

Certified that this project report titled "**DESIGN AND FABRICATION OF SPIRAL SNACK 360 MAKER"** is the Bonafide work **OF AGILAN T (811722114006), GURUDEV S (811722114017), SREE MANIKANDAN G (811722114042), VISHAL K (811722114052) ,**who carried out the project under my supervision. Certified further, that to the best of my knowledge the work reported hereindoes not form part of any other project report or dissertation on the basis of which a degree or award was inferred on an earlier occasion on this or any other candidate.

SIGNATURE

Dr. R YOKESWARAN M.E., Ph.D.,
HEAD OF THE DEPARTMENT
ASSOCIATE PROFESSOR
Department of Mechanical Engineering
K.Ramakrishnan College of
Technology (Autonomous)
Samayapuram – 621 112

SIGNATURE

Mr.R RAMKUMAR, M.E (Ph.D.)
SUPERVISOR
ASSISTANT PROFESSOR
Department of Mechanical Engineering
K.Ramakrishnan College of
Technology (Autonomous)
Samayapuram – 621 112

Submitted for the viva-voice examination held on ……

INTERNAL EXAMINER **EXTERNAL EXAMINER**

DECLARATION

I jointly declare that the project report on **"DESIGN AND FABRICATION OF SPIRAL SNACK 360 MAKER "** is the result of original work done by us and best of our knowledge, similar work has not been submitted to **"K RAMAKRISHNAN COLLEGE OF TECHNOLOGY"** for the requirement of Degree of **BACHELOR OF ENGINEERING**. This project report is submitted on the partial fulfilment of the requirement of the award of Degree of **BACHELOR OF ENGINEERING**.

SIGNATURE

_____

AGILAN T

_____

GURUDEV S

_____

SREE MANIKANDAN G

v

_____

Place: Samayapuram

Date

VISHAL K

ACKNOWLEDGEMENT

It is our great pride that we express our gratitude and in-debt to our institution "**K. RAMAKRISHNAN COLLEGE OF TECHNOLOGY (Autonomous)**", for providing us with the opportunity to do this project.

I am glad to credit honourable chairman **Dr. K. RAMAKRISHNAN**, **B.E.,** for having provided for the facilities during the course of our study in college.

I would like to express our heartly and sincere thanks to our beloved Executive Director **Dr. S. KUPPUSAMY, MBA, Ph.D.,** for forwarding to our project and offering adequate duration in completing our project.

I would like to thank **Dr. N. VASUDEVAN, M.E., Ph.D.,** Principal, who gave opportunity to frame the project the full satisfaction.

I whole heartily thanks to **Dr R YOKESWARAN**, **M.E., Ph.D.,** Head of the department, Mechanical Engineering for providing his encourage pursuing this project.

I express my deep and sincere thanks, with much gratitude to my project guide **Mr. R RAMKUMAR, M.E., (Ph.D)** Department of MECHANICAL ENGINEERING, for his incalculable suggestions, creativity, assistance and patience which motivated me to carry out this project.

I render my deep and sincere thanks to our project coordinator **Mr. G ARUNKUMAR, M.E., (Ph.D**) and other staff members for providing valuable information during the course.

I wish to express my special thanks to the officials and Lab Technicians of our departments who rendered their help during the period of the work progress

ABSTRACT

The tiny, automated Spiral Snack 360 Maker was created to simplify the traditional method of creating this well-liked snack. The machine guarantees consistent murukku strand size, shape, and quality by utilizing a hydraulic press mechanism, motorized operations, and accurate extrusion technology. It is perfect for small enterprises and home-based snack production because of its user-friendly design, which allows for efficient production with little human interaction. High output rates are maintained while portability and convenience of use are guaranteed by the machine's robust and small design. Performance and longevity are increased by integrating strong parts like a hydraulic system, a well-designed shaft, and dependable bearings. The goal of this project is to provide a workable solution for snack manufacture by fusing technology and tradition.

Keywords: Compact Machine, Spiral Snack, Hydraulic Press, Automatic, Compact Design

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1
INTRODUCTION

1.1 INTRODUCTION TO THE SNACK

A beloved food with a long history in Indian culture, particularly in South India, is murukku. Its name, which comes from the Tamil word for "twist," emphasizes the distinctive spiral or coiled structure that it has, which is the result of a particular extrusion technique. The snack has a unique and Savory flavour profile because it is usually made with rice flour and seasoned with sesame seeds, cumin seeds, and asafoetida. Murukku is praised for its adaptability; it can be eaten as a tea break snack, as a festival accompaniment, or even as a convenient travel snack because of its extended shelf life.

Figure 1.1 Snack Murukku

Outside of its native area, murukku has become incredibly popular over time and is now a mainstay in Indian homes all over the world. It is a timeless culinary delight since it may arouse nostalgia while satisfying contemporary palates. The snack's popularity is evidence of its ability to bring people together via common memories and tastes, which has led to a strong need for effective production techniques.

Murukku represents the inventiveness of age-old culinary methods that have been handed down through the centuries, in addition to its cultural value. Modern developments have brought semi-automatic and completely automated technologies that streamline production, guaranteeing uniformity and efficiency, whereas in the past, its preparation needed handcrafting complicated shapes. Another factor contributing to murukku's ongoing appeal is its adaptability; it may be made in a variety of ways to suit a range of palates, such as ribbon pakoda, kai murukku, and mullu murukku. Murukku has become an iconic snack around the world due to its ageless appeal that cuts across national and cultural borders.

Figure 1.2 Ring Murukku Machine

1.2 HISTORY OF THE SNACK

1.2.1 Ancient Origins

Murukku has its roots in ancient Tamil Nadu, where it was a common dish made for religious ceremonies and momentous events. It was frequently created by hand using basic equipment and methods, with family members cooperating in a group endeavour. Early murukku preparation demonstrated the inventiveness of traditional Indian cooking, which depended on locally accessible materials and equipment. Murukku represented joy, wealth, and the value of sharing food, and it was more than just a snack. The recipes for murukku have been passed down

through the years with little alteration, demonstrating its enduring appeal. Making murukku together became a treasured cultural pastime, and its preparation was frequently linked to happy events.

1.2.2 Industrial Revolution and Modern Machines

The creation of murukku underwent substantial modifications with the start of the industrial revolution, going from a handcrafted treat to a mass-produced snack. Faster and more efficient production was made possible by the development of semi-automated and eventually completely automatic gear. This change guaranteed uniformity in taste, shape, and quality in addition to helping to meet the rising demand. By incorporating contemporary technology, producers were able to try out several varieties, adding new tastes and forms to appeal to a wider range of consumers. These days, murukku-making machines are essential to the snack sector because they enable mass production to satisfy both home and foreign market demands. Mechanization and Machinery.

Machinery and Mechanism

Over time, the equipment needed to produce murukku has changed dramatically. To extrude the dough into the proper shape, early devices were rudimentary presses that needed to be operated by hand. The entire process, from mixing the dough to frying it, is automated by modern equipment that have sophisticated mechanics. Features like conveyor belts for smooth operation, temperature controls for frying, and nozzles that can be adjusted to create various designs are all included in these machines. These devices guarantee consistency in the finished product and improve hygiene by reducing the need for human involvement. Murukku-making machines that incorporate robotics and computer programming have further transformed the market by allowing producers to scale output effectively without sacrificing the snack's distinctive flavour.

Introduction to Flour

The creation of murukku relies heavily on flour, with rice flour serving as the main component. The introduction of pre-milled rice flour has made the process of achieving the correct texture easier. Previously, rice was soaked, dried, and ground at home. Black gram flour, or urad dal, is added to improve the snack's flavour and nutritional value. Chickpea or wheat flour are used in some recipes to offer texture and variation. Careful consideration is given to the manufacture of murukku, as the texture and flavour are greatly influenced by the quality of the flour used. To maintain uniformity in large-scale production, commercial snack manufacturers now source premium, pre-processed flours.

Continuous Snack Making Machines

Continuous snack-making machines, which provide a smooth workflow, have completely changed the murukku production process. These machines combine several production steps into one automated system, such as feeding dough, shaping, frying, and packing. Higher productivity and quicker production cycles are guaranteed by these machines, which do away with the necessity for personal involvement at every level. Continuous snack-making machines are especially helpful for large-scale producers since they assist satisfy the constantly rising demand from consumers while upholding stringent quality standards. They can be used to make a variety of snacks other than murukku because they are made to accommodate changes in form and recipe.

Evolution of Snack (Murukku) Making

The development of murukku-making is a reflection of both technological improvements and the shifting dynamics of culinary activities. From its beginnings as a time-consuming, handcrafted snack to its present position as a mass-produced treat, murukku has evolved to fit contemporary lives without sacrificing its traditional character. New designs, flavours, and healthier preparation techniques, such air-fried versions, have been made possible by advancements in machinery. This development has made sure that murukku is still relevant in the fast-paced

world of today, appealing to consumers who are health-conscious while maintaining its classic charm.

Legacy and Modern Impact

In Indian culinary tradition, murukku is a rare dish that represents the ideal fusion of innovation and tradition. Its history as a handmade snack serves as inspiration for contemporary modifications that satisfy a range of palates. The snack's widespread appeal in international marketplaces highlights both its cultural relevance and the possibility for Indian snacks to flourish there. This tradition has been further cemented by murukku-making machines, which have made the snack available to people all over the world and guaranteed that its distinct flavour and texture will be maintained for many generations to come.

1.3 PURPOSE OF SNACK MACHINE

To overcome the drawbacks of conventional snack preparation techniques—which are time-consuming, labour-intensive, and can yield variable results—the murukku machine was created. Due to the increased demand for murukku brought about by its widespread appeal across cultures and geographical areas, manual methods were no longer able to keep up with demand. Large-scale, effective production was made possible by the invention of murukku machines, which preserved the snack's original flavour and texture. In order to produce snacks of superior quality, these machines guarantee consistency in frying, uniformity in seasoning, and accuracy in shape. Murukku makers' workload is greatly reduced by automating the process, which makes it simpler for households, small enterprises, and large manufacturers to prepare murukku. By reducing direct human interaction with the materials, these machines also improve hygiene and provide a safer and more hygienic production process.

1.3.1 Supporting Small Businesses

Small snack companies frequently have trouble maintaining quality while juggling production numbers. Because Murukku machines allow small businesses

to efficiently create big numbers, they offer a viable option. These devices are available even to individuals with little technological knowledge because they are made to be easy to use and require little training. By enabling small enterprises to compete with larger producers and reach a wider audience, this empowerment has promoted economic growth and entrepreneurship.

1.3.2 Catering to Festival Demand

Murukku plays a crucial role in festive feasts during Indian holidays like Diwali and Pongal, and it is closely associated with these occasions. During these periods, the demand for murukku increases, putting strain on conventional preparation techniques. Murukku machines greatly cut down on production time without sacrificing the snack's authenticity, which helps fulfil this rising demand. During the busiest holiday seasons, this guarantees that customers will have access to fresh, premium murukku.

1.3.3 Ensuring Hygiene

Nowadays, when food safety and cleanliness are of the utmost importance, murukku machines are essential to ensuring safe and hygienic production. These devices reduce human contact with the ingredients by automating the majority of the procedures, which lowers the possibility of contamination. For producers hoping to meet strict food safety standards and satisfy health-conscious customers, this is especially crucial

1.3.4 Expanding Varieties

Manufacturers can experiment with various forms, sizes, and flavours thanks to features found in modern murukku machines. With their inventive designs and classic spiral shapes, these machines can accommodate a wide range of customer requirements. This adaptability has made it possible to launch additional murukku varieties, like flavoured or low-oil varieties, increasing the snack's appeal to a wider range of consumers.

1.3.5 Promoting Export Opportunities

Murukku machines' dependability and effectiveness have made it easier to export the snack to foreign markets. Now, producers can make murukku in large quantities while maintaining the quality and flavour criteria required by international standards. This has contributed to murukku's rise to global popularity as a snack and strengthened its standing as a representation of Indian culinary culture.

1.4 RAW MATERIALS

1.4.1 Rice Flour

The main component used to make murukku is rice flour, which gives it its light structure and crispy texture. To make a smooth flour, rice grains were traditionally carefully soaked, dried, and ground. The murukku dough was made malleable and easier to extrude into complex shapes thanks to this procedure. Commercially accessible rice flour now makes this step easier and provides consistency and convenience for manufacture on a big scale. The final product is directly impacted by the quality of the rice flour, so obtaining premium flour is crucial for the best outcomes.

Figure 1.3 Rice Flour

When making murukku, rice flour is usually combined with other ingredients such as sesame seeds, urad dal flour, chickpea flour (besan), and seasonings. This mixture gives the dough the proper pliability and elasticity to be shaped into elaborate spirals with a murukku press or other machine. Because of its low gluten level, the flour is perfect for frying because it keeps the murukku from getting overly chewy or dense. Murukku is a tasty snack that is loved in many parts of the world because of its neutral flavour, which also lets the spices and aromatics in the recipe take centre stage.

1.4.2 Split Black Lentils Flour

Another essential component of murukku that adds to its depth of taste and nutritious content is urad dal, also known as black gram flour. The snack's overall flavour profile is improved and made more appetizing by the faint nutty taste of urad dal. Additionally, murukku is a healthy snack choice that appeals to people who are health-conscious because to the protein and fibre content of urad dal. To get the right flavour and texture, the amount of urad dal flour in the dough needs to be properly regulated.

Figure 1.4 Split Black Lentils

1.4.3 Butter or Oil

Figure1.5 Butter

For the finished product to have a uniformly smooth texture, butter or oil is a necessary ingredient in murukku dough. The snack's flavour is also improved by the fat addition, becoming rich and filling. Additionally, oil or butter keeps the dough from drying out during the extrusion process, which facilitates shaping. Whether using contemporary vegetable oil or classic ghee, the choice of fat might affect the snack's flavour and shelf life.

1.4.4Spices and Seasonings

Murukku's distinct flavour is mostly determined by the spices and seasonings used in its creation, such as cumin seeds, sesame seeds, and asafoetida. Asafoetida contributes a hint of umami, while cumin and sesame seeds offer a lovely crunch and a delicate scent. These spices provide health advantages like improving digestion in addition to being flavour enhancers. Murukku is a snack that can be made in a variety of ways because the seasoning blend is frequently tailored to local preferences.

1.4.5 Water

The binding agent that binds all the ingredients together to create a cohesive dough is water. The consistency of the dough is greatly influenced by the amount and quality of water used, which also affects the extrusion and frying processes. A dry and crumbly dough can be produced by using too little water, while too much water can make the dough sticky and challenging to work with. To produce murukku of superior quality, the proper balance must be struck.

1.5 SNACK INDUSTRY

Due to the snack's growing popularity and rising demand, the murukku industry has grown remarkably over the years. Originally limited to homes and neighbourhood markets, murukku manufacture has since grown into a flourishing sector that serves both local and foreign consumers. In order to satisfy consumer demands while preserving the snack's original flavour and quality, computerized manufacture has replaced small-scale, manual production. Murukku comes in a variety of shapes and sizes these days, ranging from mass-produced versions offered by major snack companies to artisanal, handmade varieties. The versatility of the murukku sector to adjust to local and international tastes is another advantage; producers provide flavoured and healthier choices to satisfy a range of consumer preferences. The murukku industry, a major player in the Indian snack market, has stimulated economic growth and produced a large number of job possibilities, especially in rural areas where raw ingredients are collected and processed.

1.6 SNACK MAKING MACHINES

The production of this traditional snack has been completely transformed by murukku-making machines, which provide consistency and efficiency that manual methods cannot match. Numerous machine types have been created over

time to meet the demands of diverse production scales, ranging from tiny enterprises to massive industrial facilities. Every machine type has special features that make production easier while maintaining high-quality results.

1.6.1 Manual Press Machines

The most basic type of murukku-making apparatus is a manual press machine, which is frequently utilized in homes and small-scale businesses. Users can manufacture a variety of forms and designs with these machines, which are made up of a hand-operated press with interchangeable nozzles. Manual machines are economical and appropriate for creating small amounts of murukku, despite the fact that they demand physical labor.

Figure 1.6 Manual Press Machines

1.6.2 Semi-Automatic Machines

To increase productivity, semi-automatic murukku machines integrate mechanical operations with human input. The extrusion process is automated by the motors in these machines, which lessens the amount of physical labour needed to form the dough. Medium-sized companies who must strike a compromise between production volume and operating expenses are best served by semi-automatic machinery.

Figure 1.7 Semi-Automatic Snack Machine

1.6.3 Fully Automatic Machines

For large-scale industrial production, fully automated murukku-making machines are ideal since they operate smoothly and require no human involvement. Automated dough mixing, continuous extrusion, accurate shape, and temperature-controlled frying are common features of these devices. The snack can be produced, packed, and sealed in a single process by manufacturers thanks to advanced models' integrated packaging technologies. With their ability to produce thousands of units per hour while preserving consistency in size, shape, and flavour, fully automatic machines are incredibly effective.

Figure 1.8 Fully Automatic Machine

1.6.4 Specialized Machines for Varieties

Large-scale and small-scale manufacturing requirements are met by specialized machines that produce a range of murukku, revolutionizing the traditional snack-making process. Different kinds of murukku, including plain, mullu, achu, ribbon, and thenkuzhal murukku, can be handled by these machines, which guarantee consistency in size, shape, and texture while drastically lowering the amount of manual work required. With sophisticated features like automated dough extrusion, variable pressure settings, and Molds that can be adjusted, these machines can effectively create complex patterns while maintaining a high standard of quality. Certain high-end models have digital controls for accuracy and can be customized to fit local tastes and cooking methods. Additionally, stainless steel construction for durability and hygienic reasons, as well as safety features to avoid operational hazards, are common features of contemporary murukku machines. These developments are a vital resource for both home-based business owners and commercial snack manufacturers since they not only increase output but also preserve the genuine flavour of murukku.

Figure 1.9 Specialized Machines

1.7 IMPORTANCE OF SNACK MACHINES

In order to satisfy the needs of contemporary consumers while maintaining the heritage of this traditional snack, murukku machines are essential. They ensure that murukku stays relevant in the fast-paced world of today by bridging the gap between traditional culinary traditions and modern production necessities. These devices are essential for solving problems including a lack of workers, uneven quality, and labour-intensive preparatory procedures. These devices guarantee that producers may maintain strict hygienic and quality standards while greatly boosting output by automating the creation of murukku. Murukku machines provide a productive, affordable option for both small and large companies, enabling them to serve an expanding customer base.

A major breakthrough in the manufacturing of conventional snacks is the Murukku machine, like the "Spiral Snack 360 Maker," which combines convenience, consistency, and efficiency. In the past, making murukku has included tedious hand procedures that take a lot of time and expertise to produce consistent textures and shapes. This procedure can be automated with a murukku machine, allowing for quicker output without sacrificing quality or taste. Large-scale snack producers should pay special attention to this since it satisfies consumer demand while maintaining the product's original flavour.

The machine guarantees uniform shape and size for each item while increasing production, lowering the cost of manual labour, and minimizing human error. It also enables companies to expand their operations effectively, fulfilling large orders for holidays and celebrations where murukku is in great demand. These devices bridge the gap between tradition and technology with features that guarantee hygienic preparation and user-friendliness, making them essential in both small-scale and industrial snack production environments.

1.8 STATISTICS OF SNACK MAKING MACHINES

Due to the rising demand for convenience foods, the market for snack-producing machines is expanding quickly, making them an essential component of the worldwide food processing sector. In 2021, the snack food machinery market was estimated to be worth over USD 4 billion. From 2022 to 2030, it is expected to develop at a compound annual growth rate (CAGR) of about 5.5%. These devices, which include fryers, ovens, extruders, and cutting tools, have greatly increased snack production's productivity and scalability. Since they can manufacture reliable, high-quality snacks more quickly while using less labour, automated snack machines—like murukku makers—have become more and more popular. Traditional snacks like murukku are becoming more and more popular in foreign markets, which has spurred innovation in this field and produced machines that can create complex designs, including spiral snacks, to satisfy both taste and aesthetic preferences. In keeping with the global emphasis on sustainability in food processing, producers are also incorporating cutting-edge technology like IoT and AI to improve production, track equipment performance, and cut waste. Due to the cultural importance of snacks in these countries and the increase of small and medium-sized businesses purchasing reasonably priced,

portable snack-making equipment, the Asia-Pacific region—especially China and India—dominates the market.

Figure 1.10 Fish Murukku Making Machine

1.9 SNACK MACHINES IN INDIA

By fusing contemporary technology with cultural history, murukku-producing machines have transformed the traditional method of making this well-liked South Indian delicacy in India. meant from rice flour, urad dal flour, and spices, murukku is a crispy delicacy that takes a lot of work to shape and cook. These devices are meant to automate this process. A wide range of murukku-making equipment is available on the Indian market, from small manual units for home use to fully automated devices for large-scale manufacturing. These machines are commonly used by bakeries, snack makers, and home-based business owners because they can quickly and consistently produce hygienic and uniform murukkus, which lowers labour costs and production time. Numerous of these devices have easy-to-use designs with movable settings to suit various sizes, forms, and patterns, guaranteeing adaptability to a wide range of consumer preferences. Leading Indian manufacturers place a strong emphasis on using food-grade materials and stainless steel to guarantee longevity and adherence to safety regulations. Modern murukku machines with features like digital control panels, energy-efficient mechanisms, and frying systems that guarantee

uniformity in taste and texture have been developed in response to the growing demand for traditional snacks in both domestic and foreign markets. By facilitating its mass manufacture while retaining authenticity, these machines also significantly contribute to the preservation of murukku's cultural character. The growing snack market has made murukku-making equipment a necessary investment for companies trying to expand and satisfy the growing demand for this popular Indian treat. In order to ensure that the production process satisfies strict health regulations, manufacturers have also been motivated by the increased emphasis on hygiene and food safety to build machines with easily cleaned parts and food-safe coatings. Machines that produce murukku are positioned to be crucial in satisfying customer demand while maintaining the cultural significance of traditional snack foods as the Indian snack market grows. Rapid technology improvements appear to be driving increased innovation, precision, and sustainability in murukku production going forward, which will facilitate the enjoyment and sharing of this popular snack by both individuals and businesses.

Figure 1.11 Simple Machine in Small Industries

CHAPTER 2

LITERATURE SURVEY

2.1 LITERATURE REVIEW

Shalini Tadinada, et.al2023 [1] The Murukku is a savory, crunchy snack that is most popular in India. Murukku is usually made with rice flour and black gram dal. This study aimed to develop and evaluate a millet-based snack called millet murukku, using finger millet flour, jowar flour, and brown rice flour. As millets are

considered nutritionally rich foods so they can be used to develop healthy and functional foods. Different levels of finger millet flour, jowar flour, and brown rice flour were added in the proportions of 50%MMF + 35%BRF + 15%OI (Sample A), 60%MMF + 25%BRF + 15%OI (Sample B), and 70%MMF + 15%BRF + 15%OI (Sample C) for the development of murukku andits sensory attributes were analysed. The one-way ANOVA revealed a significant difference between the mean scores of at least two samples ($F(2, 15) = 3.7855$, $p = 0.046$, $p < 0.05[\alpha]$). Sample A (50%MMF + 35%BRF + 15%OI) demonstrated desirable organoleptic properties based on taste

panel studies. The selected sample A had an energy content of 599Kcal/100g, with 43.6g carbohydrates, 44.3g fat, 6.59g protein, 6.63g dietary fiber, negligible sugar content, sodium 540mg, calcium 148mg, and iron 2.34mg per 100g. While the total viable count and coliform count increased during a month storage period from 1 to 2 and 1 to 1.7 respectively, harmful bacteria such as E. coli, salmonella, and staphylococcus were absent in initial and final assessments. The pH increased from 7.1 to 7.6 during storage. The color, odor, and taste of the sample scored 4.5 initially but decreased to 3.0 at the end,

while the texture remained constant with a score of 3.0 throughout storage. Made using finger millet flour, jowar flour, and brown rice flour.

Velayudham G, et.al2021 [2] Murukku is a delicious south Indian snack product prepared at household level as evening snack and also during festival seasons. The developed semi-automatic murukku extruder comprised of electric motor, power transmission system, a self reversing screw rod, dough barrel and piston, die, and collection tray. The performance evaluation of extruder was done under three different moisture content of dough viz., 24%; 25%; and 26% respectively, and also at three different speed of self reversing screw rod viz.,18 rpm; 15 rpm; and 12 rpm respectively. The statistical evaluation of extruder efficiency and sensory evaluation of final product samples was done. The results indicated that the efficiency of murukku extruder was found maximum when the dough moisture is at 25% and the speed of self reversing screw rod at 12 revolutions per minute.

Sharma A, Mishra S. P, et.al2022 [3] Chakli is a coiled- round, salty, deep-fried snack commonly prepared in different occasion in tribal belt from rice and chickpea flour paste seasoned with turmeric and chili powder. In the present study various cheapest legume dhal flours viz., soybean and field pea were used to make more nutritious chakli. Instant chakli mixes and control were evaluated on sensory, nutritional and storability parameters and standardized as per desired acceptable sensory characteristics. Based upon the sensory evaluation, the optimized level of supplementation was found to be 25% supplementation of legume dhal flour in rice flour. Soybean blended mix showed better nutritional quality in comparison to other mixes in respect of higher contents of protein, calcium and phosphorus content. The prepared chakli mixes could be safely stored for 6 months at room temperature in polyethylene bags at ambient conditions as monitored by changes in moisture

content, free fatty acids and sensory quality. Soybean and field pea blended instant mixes were low in rate as compare to chickpea blended mix. Hence, it was concluded that rice based instant chakli mixes blended with soybean or field pea as per local availability could easily be formulated having high nutritional quality, low in cost and six months shelf life at local household level for developing acceptable quality of chakli. This rice based instant chakli mixes being a rich source of nutrients could be incorporated in the daily diets of poor families as a remedial measure for eradication of malnutrition.

Alpana Sharma , et.al2022 [4] Chakli is a coiled- round, salty, deep-fried snack commonly prepared in different occasion in tribal belt from rice and chickpea flour paste seasoned with turmeric and chili powder. In the present study various cheapest legume dhal flours viz., soybean and field pea were used to make more nutritious chakli. Instant chakli mixes and control were evaluated on sensory, nutritional and storability parameters and standardized as per desired acceptable sensory characteristics. Based upon the sensory evaluation, the optimized level of supplementation was found to be 25% supplementation of legume dhal flour in rice flour. Soybean blended mix showed better nutritional quality in comparison to other mixes in respect of higher contents of protein, calcium and phosphorus content.

Kavitha K, et.al2024[5] The bamboo rice and black rice were processed to yield flour. The present study aimed to analyze the physicochemical, functional and nutritional properties, and assess the storage stability of formulated instant mixes using bamboo rice and black rice flour. The physicochemical and functional properties such as moisture, ash, bulk density, true density, porosity, water holding capacity and swelling capacity were analyzed. The nutrient content of bamboo rice was found to be 78.9g of carbohydrate, 10.5g of protein, 3.7g of fibre, 63.8mg of calcium, 100mg of

phosphorus and 106.6mg of iron whereas in black rice it was found to be 81.2g of carbohydrate, 8.9g of protein, 5.2g of fibre, 48.7mg of calcium, 193.3mg of phosphorus and 86.67mg of iron. It contains phytochemical components such as alkaloids and flavonoids. The bamboo rice and black rice flour added products were formulated and compared with standard instant mix products and subjected to organoleptic evaluation by 25 semi-trained panellists.

Sasikanth Sarangam, et.al2015[6] Murukku, a traditional savory product was identified as they are low in protein and mineral contents. It is also a deep fat fried product as a result of which its fat content is significantly high. So, Murukku was prepared using both the conventional deep fat frying and oven baking for control and variable products. Variable samples were prepared by incorporating Bengal gram, Black gram and Green gram flours. It was observed that the control and variable Murukku samples (deep fat fried and oven baked ones) fat content varied with baking and the oil uptake was reduced by 46.4% and 40.23% and protein content of Murukku was almost doubled with the addition of bengal gram, green gram and black gram flour at 8% each incorporation respectively. Control samples of deep fat fried and oven baked had low protein content 6.39% and 8.64% respectively when compared to variable samples of deep fat fried and oven baked are 9.83% and 14.54% respectively.

Ramasamy Ravi, et.al 2011 [7] A study was carried out to examine the quality parameters of commercially available popular deep-fried snack-Murukku. Eight samples (four spicy and four salty) of most commonly consumed deep-fried snacks in India, viz., murukku (an extruded strands-like product made from the mixture of rice flour and black gram dhal flour) were analyzed for moisture, oil content, CIE instrumental color (L*a*b*), instrumental texture measurement (breaking strength of murukku strands),

aroma finger printing by electronic nose and sensory quality. Quantitative descriptive analysis (QDA) and results showed that sample 'A' had highest acceptance and sample D lowest acceptance scores. The results indicated that significant variations were observed in moisture content (2.21 - 3.35%), oil content (30.10 - 34.61%) and textural parameters. Electronic nose technique was found useful in fingerprinting the aroma pattern of market samples in a short time. Descriptive sensory profiling coupled with principal component analysis showed the interrelationship among and between sensory, instrumental, chemical parameters.

Theresa W. Devasahayam., et.al2003 [8] This paper examines the gastronomic rules that determine when and why "crispy foods" are eaten within the Tamil community of Malaysia. Based on ethnographic fieldwork of twenty-five Tamil Hindu families living in the Klang Valley of Peninsular Malaysia, everyday and festive culinary life reveal foods that are classified into categories of 'crispy" and "soft/wet". Situation and context determine the kind of "crispy" foods consumed. While savoury crispy foods are reserved for meals, a mixture of the savoury and sweet are eaten as snacks. I draw upon the observations of Claude Levi-Strauss, Mary Douglas and Michael Nicod to examine the processes of defining the inclusion and exclusion of particular "crispy" foods at meals and as snacks. My conclusion focuses on the textural composition of these foods, which highlights the "playful" dimension of eating and, hence, what is termed as "crispy" foods are not treated as "real" food.

Kousar A. Attar, Sammad A. Patil, et.al2020[9] Automation is the control of machines and processes by independent systems through the use of various technologies which are based on computer software or robotics. . Automation is now a necessity in the food industry to address the required

levels of quality control, production speed, labor shortages and overall profitability. Automation has taken over where humans were once commonplace. Industry decision-makers know that plant systems must constantly evolve to meet consumer requirements/demands. This means upgrading existing equipment or purchasing new equipment. Food manufacturers look towards automating their manufacturing processes because of highly competitive retailers constantly squeezing down prices, rising raw material costs and soaring utility charges in a labor-intensive manufacturing environment. Automating food production can reap many benefits.

Sarojani J.K, **et.al2021 [10]** Proso millet (Panicum miliaceum) is common and important minor millet belonging to the family Gramineae. This short duration millet variety is widely grown in India. Proso millet has high nutritive value which is rich in protein (13.96 g) and minerals (2.60) and is comparable to major cereal grains. Realizing the awareness of the consumers towards the nutritional and health benefits, proso millet was incorporated in preparation of chakli. In this study proso millet chakli was standardized with 65 per cent of proso millet flour, rice flour and other spices. The standardised chakli can be stored up to one month in aluminium pouches without any quality deterioration.

Leena Sebastian, Jamuna Prakash, et.al2005[12] Ragi was incorporated at different levels (5, 15 and 25%) to a deep fat fried snack item namely “chakli” to study its effect on fat absorption, sensory and storage parameters. Three sets of products were prepared incorporating untreated, dry heat treated and gelatinized ragi flour. The control products were without ragi flour. Results indicated that the fat absorbed by the control was 19%. Ragi flour incorporation (5%) increased fat content to 24% but on further increase of ragi flour (15 and 25%), it decreased to 19.7 and 18%, respectively.

Incorporation of untreated and dry heat treated ragi flour resulted in a slight decline in the sensory ratings of products. The effects were more adverse with higher level of incorporation. On incorporation of gelatinized ragi flour (5%), significantly higher ratings were obtained for texture, flavour and overall quality of products in comparison with the control. The free fatty acid content of products was very low on 0 day and increased during 4 weeks of storage.

Atwal, Prerna and Singh, et.al 2022 [13] The present study was undertaken with the objectives of evolving chakli containing green gram flour and moth bean flour to find out their acceptability and nutritive value. Chakli were prepared by using refined flour, green gram flour, moth bean flour, salt, red chilli powder and refined oil by substituting refined flour with green gram flour and moth bean flour. The different samples prepared were Control , Sample 1, Sample 2 and Sample 3 in the ratios of (refined flour: green gram flour: moth bean flour) 100, 50:25:25, 50:45:5, 50:5:45 respectively. The developed chakli were sensory evaluated using nine point hedonic scale. Results showed that overall acceptability for Sample 3 (7.85±0.81) Chakli were lying in between the category of 'like very much and like extremely whereas Control (7.6±1.53) were lying in the category of 'like moderately and like very much' by panellists. Highest energy, protein, carbohydrate and fat content were observed in Sample2 Chakli (520.8 kilocalories), (17.5 gram), (65.3 gram) and (22.2gram) respectively. Likewise fibre, calcium and iron content were observed in Sample 3 Chakli (2.4 gram) (108.6 milligram) and (5.84 milligram) respectively. Chakli (Sample 3) was most acceptable and analysed for proximate and mineral content along with control sample. Result shows that chakli prepared with green gram flour and moth bean flour (Sample 3) was found to be higher in protein (15.8 gram), fibre (1.9 gram), ash (2.5%), moisture (5.2%), calcium (19 milligram) and iron (1.1 milligram) than control chakli. Thus replacement of traditional food like refined flour with green gram

flour and moth bean flour for preparing chakli is feasible and beneficial too and also were very accepted.

2.2 LITERATURE SUMMARY

Based on the literature, the following key points can be summarized

1. **Millet-Based Murukku Development**

   Shalini Tadinada et al. (2023) explored the use of millets such as finger millet, jowar, and brown rice to create healthier murukku alternatives. Among various formulations, the sample with 50% finger millet flour, 35% brown rice flour, and 15% oil demonstrated optimal taste and nutrition, with an energy content of 599 kcal/100g. Despite minor quality changes during storage, the millet murukku remained free from harmful bacteria, offering a nutritious alternative to traditional recipes.

2. **Semi-Automatic Murukku Extruder Efficiency**

   Velayudham G et al. (2021) introduced a semi-automatic murukku extruder that efficiently produced snacks under controlled conditions. The optimal performance was achieved with dough moisture at 25% and a screw rod speed of 12 rpm. This innovation simplified murukku production while maintaining desirable sensory attributes, paving the way for scaled-up snack production.

3. **Nutritional Chakli with Legume Blends**

   A. Sharma et al. (2022) examined chakli prepared with legumes like soybean and field pea blended with rice flour. These variations enhanced protein, calcium, and phosphorus levels while maintaining affordability. The instant mixes had a shelf life of six months, demonstrating a feasible approach to developing nutrient-rich traditional snacks for combating malnutrition.

4. **Low-Fat Oven-Baked Murukku**

Sasikanth Sarangam et al. (2015) investigated the impact of baking as a healthier alternative to frying murukku. By incorporating flours from Bengal gram, green gram, and black gram, fat absorption reduced significantly, and protein content doubled compared to conventional recipes. This approach highlighted baking as a viable method for creating healthier snacks.

5. Automation in Snack Production

Kousar A. Attar et al. (2020) emphasized the role of automation in the food industry, particularly in murukku production. Automation improved quality control, production efficiency, and profitability while addressing labor shortages. This transition ensured competitive pricing and sustainability, reinforcing the relevance of automated solutions in the modern food industry.

2.3 PROBLEM IDENTIFICATION

1. Labor-Intensive Production

Traditional murukku-making is highly labor-intensive, requiring significant manual effort, which limits productivity and consistency in large-scale production.

2. Inconsistent Quality

Handmade murukku often varies in shape, size, and texture, leading to inconsistent quality and reduced consumer satisfaction in mass markets.

3. Hygiene Concerns

Manual handling in traditional methods increases the risk of contamination, compromising the hygiene and safety standards required in the modern food industry.

4. Low Production Efficiency

Conventional methods are time-consuming and cannot meet the growing demand, especially for commercial production, creating a gap in supply chains.

2.4 OBJECTIVES

1. Automation of Murukku Production

To design a machine that automates the murukku-making process, ensuring consistency in shape, size, and texture while improving production efficiency.

2. Enhancing Hygiene Standards

To develop a murukku machine that minimizes human intervention, ensuring higher hygiene and safety standards in snack production.

3. Meeting Market Demand

To create a scalable solution capable of catering to both small-scale and large-scale production needs, addressing the growing consumer demand effectively.

CHAPTER 3
DESIGN OF SPIRAL SNACK 360 MAKER

3.1 METHODOLOGY

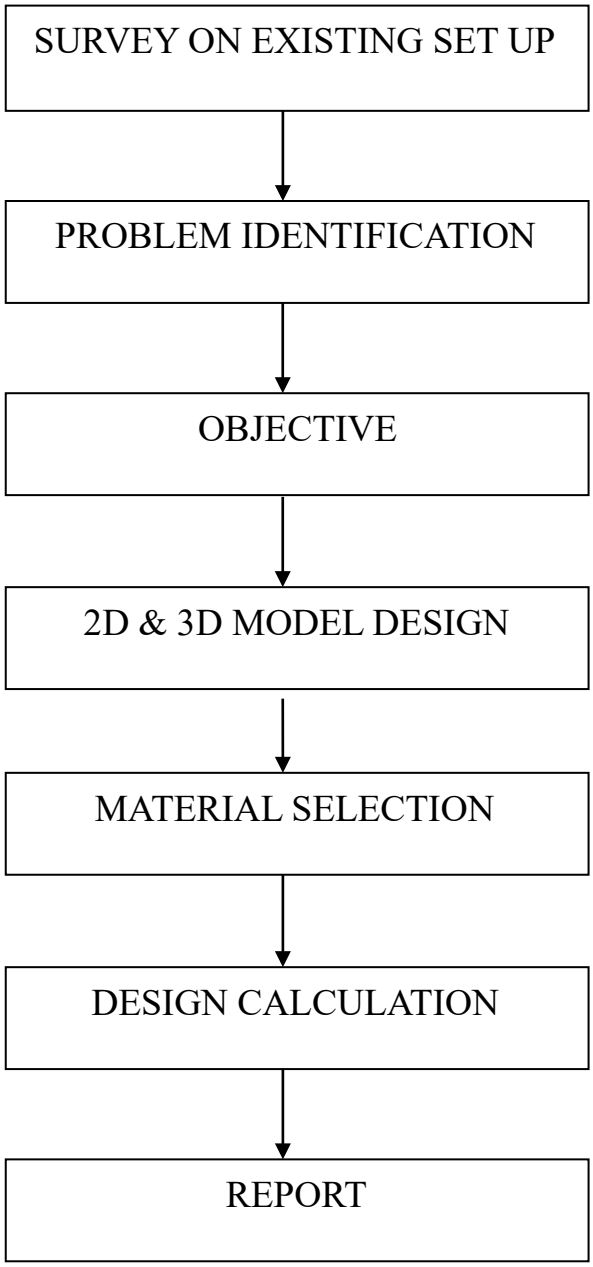
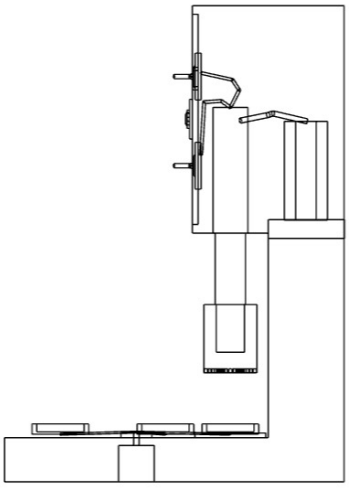
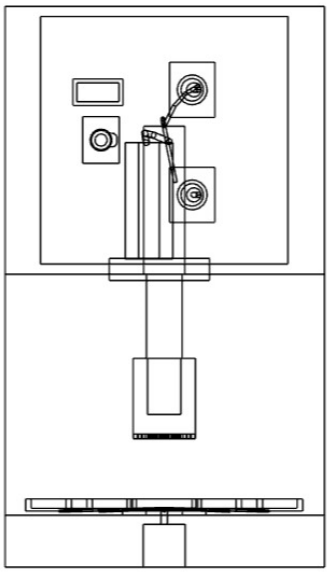


Figure 3.1 Methodology

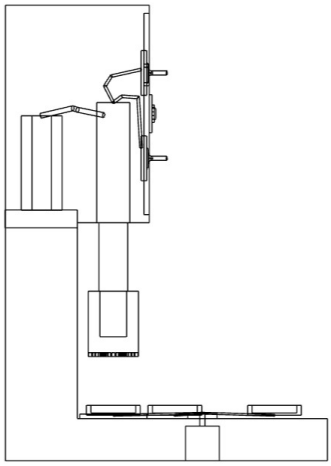
3.2 2D DRAWING



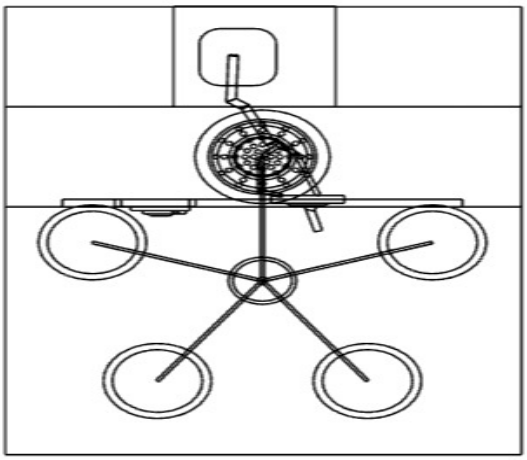
RIGHT SIDE VIEW



FRONT VIEW



LEFT SIDE VIEW



TOP VIEW

Figure 3.2 2D Drawing

3.3 3D DRAWING

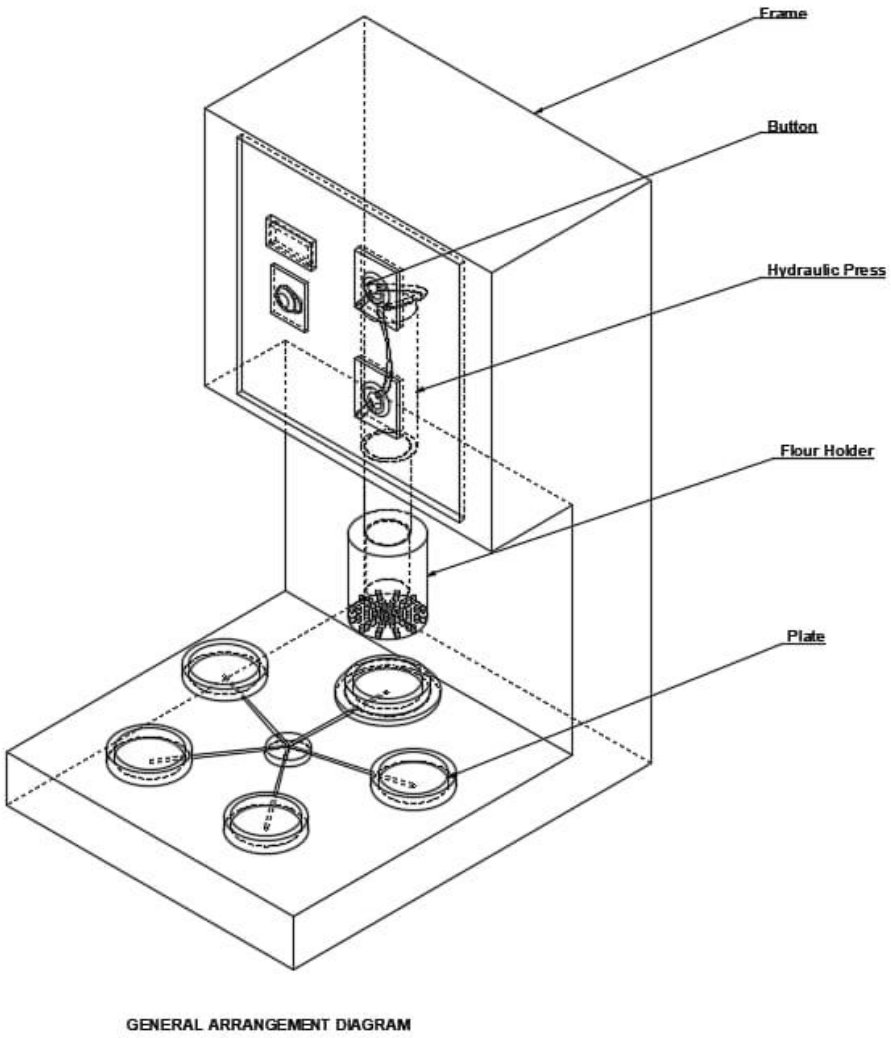


Figure 3.3 3D Drawing

3.4 BILL OF MATERIALS

- Hydraulic Press
- Flour Holder
- Snack Plate
- Buttons
- Frame
- Outer Covering Sheet
- Light Indicators
- Shaft
- Bearing
- Motor
- Nut and Bolts

CHAPTER 4
DESIGN CALCULATION

4.1 SPECIFICATION OF MOTOR

Speed = 300 rpm

Voltage = 220 v

Horsepower = 0.335 hp

Material = copper

Capacity of AC motor = watts (W) /746

Watts = 250, volts = 230v

HP = 250/746

HP is approximately 0.335 horse power

4.2 SPECIFICATION OF FRAME ROD

Material : MILD STEEL(Square Type) – 600*300*200 mm

4.3 SPECIFICATION OF FRAME SHEET

Material : Aluminium Sheet – 600*300*200 mm

4.4 DESIGN OF HYDRAULIC PRESS

Force = P * A

P-pressure= 5 Mpa

A-Area = 3.14 / 4 * d^2 , d = 0.1 m

A=0.00785 m^2

F = 5 * 10^6 * 0.00785

F = 39250 N (4 tons approximately)

4.5 SELECTION OF BEARING

Radial Load On Bearing = Lr

Lr = T/r = 7.64/0.006

Lr = 1273.34

CHAPTER 5
COST ESTIMATION

Table 5.1 Cost Estimation

SL No	Items	Quantity	Unit Cost(Rs)	Proposed Cost(Rs)	Total Cost(Rs)
1	Hdraulic Press with Motor	1(Nos)	5500	5500	
2	Frame(with aluminium sheet)	600 ×300×200(1 nos)	3000	3000	
3	Shaft	1(Nos)	300	300	
4	Bearing	2(Nos)	200	400	
5	Motor	0.5hp-1400 rpm (1Nos)	1500	1500	
6	Flour Holder	1 (Nos)	300	300	
7	Snack Plate	5(Nos)	30	150	
8	Nut and Bolt	10(Nos)	20	200	
9	Buttons	3(Nos)	50	150	
10	Light Indicator	1(Nos)	100	100	
11	Miscellenous	-	1000	1000	
			TOTAL	**12,600**	

CHAPTER 6
CONCLUSION

The creation of the Spiral Snack 360 Maker, which focuses on murukku, a popular treat with roots in Indian cuisine, represents a major advancement in the automation and modernization of traditional snack preparation. In order to meet the increasing demands of efficiency, uniformity, and hygiene in food production, this study shows how traditional food methods can be smoothly integrated with contemporary technology. The machine maintains the genuine flavor and texture of murukku while guaranteeing high production rates that satisfy both domestic and international markets by automating labor-intensive procedures. Additionally, it bridges the gap between industrial scalability and artisanal workmanship, empowering both large-scale producers and small-scale entrepreneurs. Additionally, the machine's adaptability enables the development of novel murukku types, guaranteeing its continued relevance in a changing consumer environment. In addition to satisfying consumer needs, the Spiral Snack 360 Maker helps preserve murukku culture, guaranteeing that this beloved snack will always be a part of festivals and family customs around the globe. This project demonstrates how engineering solutions can revolutionize the food business by highlighting how technology can respect and improve customs while promoting cultural and economic advancement.

REFERENCES

[1] Elumalai, P., Soltani, M., & Lakshmi, S. (Eds.). (2023). Immunomodulators in Aquaculture and Fish Health. CRC Press.Publishing..

[2] Sharma, A., Singh, M., Vishwakarma, N., Singh, A., Singh, S. K., & Pandre, B. P. Effect of vocational training program on the knowledge, skill development and income generation of tribal farm women and rural youth of Shahdol.

[3] Kavitha, K., & Ilakkiya, B. (2021). Proximate Composition, Phytochemical Analysis and Invitro Antioxidant Potentials of Aqueous Extract of Coconut Sugar. FoodSci: Indian Journal of Research in Food Science and Nutrition, 20-28.

[4] Kerr, W. L., Ward, C. D. W., McWatters, K. H., & Resurreccion, A. V. A. (2000). Effect of milling and particle size on functionality and physicochemical properties of cowpea flour. Cereal chemistry, 77(2), 213-219.

[5] Sarangam, S., Chakraborty, P., & Chandrasheker, G. (2015). Development of low fat multigrain murukku-A traditional savoury product. International Journal of Research, 15.

[6] Devasahayam, T. W. (2005, January). Power and pleasure around the stove: The construction of gendered identity in middle-class south Indian Hindu households in urban Malaysia. In Women's Studies International Forum (Vol. 28, No. 1, pp. 1-20). Pergamon.

[7] Attar, K. A., Patil, S. A., Patil, P. D., Sutar, A. D., Patil, S. A., & Bartake, G. (2020). Development and Fabrication of Automatic Chakali Making Machine.

[8] Mandal, P. K., Cytyarasan, S., Pal, U. K., Rao, V. K., & Das, C. D. (2011). Development of Snacks (Murukku) by Incorporation of Broiler Skin. J Meat Sci, 7(2), 54-57.

[9] Atwal, P., Singh, U., & Kushwaha, S. (2022). Development and Organoleptic Evaluation of Chakli Prepared from Green Gram Flour (Vignaradiata L. Wildzek.) and Moth Bean Flour (Vignaacontifolia). Asian Food Science Journal, 21(11), 64-70.

[10] Sebastian, L., Gowri, B. S., & Prakash, J. (2005). QUALITY CHARACTERISTICS OF RAGI (ELEUSINE CORACANA)-INCORPORATED "CHAKLI"–AN INDIAN DEEP-FRIED PRODUCT. Journal of food processing and preservation, 29(5-6), 319-330.

[11] Ravi, R., Singh, V. K., & Prakash, M. (2011). Projective mapping and product positioning of deep fat fried snack. Food and Nutrition Sciences, 2(6), 674-683.

[12] Mandal, P. K., Cytyarasan, S., Pal, U. K., Rao, V. K., & Das, C. D. (2011). Development of Snacks (Murukku) by Incorporation of Broiler Skin. J Meat Sci, 7(2), 54-57.

[13] Sarojani, J. K., Hegde, S. C., Desai, S. R., & Naik, B. K. (2021). Standardization and nutrient composition of the proso millet chakli. In Biological Forum–An International Journal (SI-AAEBSSD-2021) (Vol. 13, No. 3b, pp. 44-50).