DEVELOPMENT OF MULTI-TEXTURED NUTRIENT DENSE TART TO SUPPORT IMMUNE HEALTH IN CANCER CARE

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MASTER OF VOCATION IN FOOD PROCESSING TECHNOLOGY

Submitted by

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UNDER THE GUIDANCE OF

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CERTIFICATE

This is to certify that this dissertation entitled ***"DEVELOPMENT OF MULTI - TEXTURED NUTRIENT DENSE TART TO SUPPORT IMMUNE HEALTH IN CANCER CARE"*** is a bonafide record of independent work carried out by **Ms. Meghna. R, Post Graduate student of M.VOC Food Processing Technology** , St. Teresa's College, Ernakulam from 23-12-2024 to 29-03-2025 under the guidance and supervision of Mrs. Ajini. A.S, Senior Scientist of this institute. It is further certified that she had independently reviewed the literature, performed all the tests, analyzed the results and critically discussed the findings in presenting data.

This is in partial fulfillment of the requirements for the **M.VOC Food Processing Technology** , ***Mahatma Gandhi University.***

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DECLARATION

I, MEGHNA R, hereby declare that thesis entitled **"DEVELOPMENT OF MULTI-TEXTURED NUTRIENT DENSE TART TO SUPPORT IMMUNE HEALTH IN CANCER CARE"** submitted to **ST TERESA'S COLLEGE, ERNAKULAM** in partial fulfillment of the requirement for the award of the degree of the MASTER OF VOCATION IN FOOD PROCESSING TECHNOLOGY is a bonafide record of original work done by me, under the supervision and guidance of AJINI A S, supervising guide, CEPCI Laboratory and research institute, Kollam. No part of this work has been submitted for the award of any Degree/ Diploma / Fellowship or other similar title to any university.

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ABSTRACT

Functional foods play a significant role in enhancing health and preventing diseases. This study focuses on the development and nutritional evaluation of a multi-textured, nutrient-dense tart formulated with Masoor Dal, Soursop, and Guava. The tart was designed to provide high antioxidant content and an enriched vitamin and mineral profile, making it a potential functional food for immune support and overall well-being. The results revealed that the tart contained a high concentration of antioxidantsand vitamin C, along with essential macronutrients and micronutrients. Masoor Dal contributed significantly to the protein content, while Soursop provided bioactive compounds known for their anticancer and immune-boosting properties. Guava further enhanced the formulation with its rich vitamin C content, which is crucial for immune function and iron absorption. The tart exhibited a balanced nutritional composition, including carbohydrates, proteins, fats, crude fibre, and total ash, ensuring a well-rounded dietary profile. Essential minerals such as calcium, iron, and potassium were also present in significant amounts, supporting various physiological functions.The high antioxidant capacity of the tart suggests potential benefits in reducing oxidative stress, which is a key factor in chronic diseases, including cancer. The findings indicate that this tart could serve as a functional dietary option for individuals seeking nutrient-dense, health-promoting foods. This study provides a foundation for the development of innovative, health-focused food products that can contribute to immune enhancement and disease prevention.

CHAPTER-1
INTRODUCTION

INTRODUCTION

Cancer is one of the most major worldwide health challenges, with millions of new cases diagnosed each year. The disease and its rigorous treatments-chemotherapy, radiation therapy, and immunotherapy-damage the body's metabolism, causing nutritional deficits, weight loss, and immunosuppression. Appropriate nutrition is essential for cancer patients due to changes in appetite, taste perception, gastrointestinal distress, and metabolic demands. Malnutrition affects cancer patient outcomes, quality of life, and survival rates despite medical breakthroughs. This requires a planned approach that replenishes critical nutrients and improves cancer patients' food palatability and acceptability(Rajeswari,2022). Nutritional intervention in cancer care now targets immune system strengthening and well-being. In this context, functional foods with bioactive chemicals that boost immunity, lower inflammation, and boost energy have gained popularity. A balanced diet with antioxidants, vitamins, minerals, and high-quality proteins helps reduce medication adverse effects and improve infection resistance.Despite the importance of nutrition in cancer care, specialised food options for cancer patients' unique nutritional needs are lacking.Traditional hospital diets and nutritional supplements may lack diversity, flavour, and immune-boosting bio actives.This project intends to create a multi-textured, nutrient-dense tart that is tasty and suited to cancer patients' nutritional needs to improve dietary adherence and health outcomes.

Cancer treatment relies on proper diet to help the body fight the disease. Cancer patients' metabolic changes increase energy needs, muscle atrophy, and vitamin shortages, which affect strength, immunological function, and recuperation. Many cancer patients have cancer cachexia, which causes substantial weight loss, muscular depletion, and systemic inflammation, lowering prognosis and therapy responsiveness. Muscle mass, energy balance, and quality of life can be improved with proper nutrition.Cancer patients need precise macronutrients and micronutrients. Proteins are needed for muscular, immunological, and tissue repair.Healthy fats keep cells healthy and inflammation under control, while carbohydrates provide energy and prevent muscular breakdown. Vitamins A, C, D, and E, zinc, selenium, and omega-3 fatty acids also modulate immune function and reduce oxidative stress (Kamal et al., 2022). Due to the risk of diarrhoea, constipation, and gut flora imbalance after cancer treatments, fibre and probiotics are essential for gut health. A cancer-specific diet can help manage treatment-related adverse effects such nausea, loss of appetite, and taste changes. Since many patients have heightened taste sensitivity or food aversions, food textures and flavours become important in deciding meal intake. Innovative food products like the multi-textured nutrient-dense tart strive to address nutritional deficits and sensory issues by incorporating immune-supportive elements while assuring palatability.

The immune system fights infections, inflammation, and cancer.Cancer therapies like chemotherapy and radiation impair the immune system, rendering patients more prone to infections and slower recovery.To maintain immunological resilience and boost defences, a nutrient-dense diet rich in immune-supportive substances is necessary.Immune-boosting foods can be added to everyday meals to increase immunity naturally. Vitamin C is an important immune-supportive food in cancer therapy due to its antioxidant characteristics and white blood cell function. Cancer patients have high oxidative stress due to chronic inflammation and treatment damage, but vitamin C reduces it (Kussmann, 2024).Vitamin C-rich citrus fruits, berries, and leafy greens make great nutrient-dense diets.Vitamin D, which regulates T-cell function and reduces inflammation, is also vital to immunological health. Fortifying meals with vitamin D can help cancer patients maintain immunological homeostasis due to diminished sun exposure and metabolic changes.

Trace minerals zinc and selenium boost immunity and antioxidant defence.Zinc aids wound healing, cellular regeneration, and infection resistance, while selenium boosts detoxification and oxidative damage defence.Nuts, seeds, whole grains, and shellfish are perfect for nutrient-dense tarts since they contain these minerals.Omega-3 fatty acids, found in flaxseeds, walnuts, and fatty fish, also reduce treatment-induced inflammation and muscle atrophy in cancer patients.

By supporting gut health and microbial balance, probiotics and prebiotics boost immunity. Probiotic-rich foods like yoghurt, kefir, and fermented vegetables help boost immune response and minimise gastrointestinal issues linked with cancer therapies because gut-associated lymphoid tissue (GALT) regulates a large part of immune function. Functional diets with these elements can promote immunity holistically and improve digestibility and nutrient absorption. Polyphenols and flavonoids, found in berries, dark chocolate, green tea, and herbs, are antioxidants and anti-inflammatory chemicals that prevent cancer and boost immunity.These bioactive substances neutralise free radicals, decrease inflammation, and alter immunological pathways, making them useful in cancer diets.Immune-supportive elements in a multi-textured tart aim to provide a comprehensive nutritional solution that meets cancer patients' dietary needs while being visually appealing and tasty.

Functional foods have gained attention for their potential to provide health benefits beyond basic nutrition, particularly in cancer care where patients often struggle with malnutrition, compromised immunity, and poor appetite.A tart is an excellent medium for delivering nutrient-dense ingredients in a convenient and palatable format. Its layered structure allows for the incorporation of a variety of functional ingredients, including fibre-rich grains, antioxidant-packed fruits, protein-rich nuts and seeds, and probiotic-rich dairy or plant-based alternatives (Shaver et al., 2021).A well-crafted tart can provide a pleasurable eating experience while ensuring adequate nutritional intake.It can be

customized based on individual dietary needs, accommodating variations such as gluten-free, dairy-free, or low-sugar options.A tart's visual appeal and psychological impact on food consumption can stimulate the senses and encourage better food intake.

The development of a multi-textured, nutrient-dense tart requires a strategic selection of ingredients that not only enhance taste and texture but also provide functional health benefits. The immune system relies on a complex interplay of vitamins, minerals, proteins, and bioactive compounds to function optimally.A well-balanced multi-textured tart offers a combination of crispiness, smoothness, and creaminess, making it more enjoyable and easier to consume.This variety in texture not only improves sensory appeal but also addresses specific dietary challenges that cancer patients often face.In conclusion, the development of a multi-textured nutrient-dense tart is a strategic approach to addressing the dietary challenges faced by cancer patients.By incorporating immune-boosting ingredients, optimizing texture for enhanced palatability, and ensuring an appealing presentation, this functional food has the potential to provide a comprehensive nutritional solution while improving the overall eating experience.

OBJECTIVE

- To develop a multi-textured tart with immune-supportive nutrients.
- To analyze its nutritional composition.
- Assessing its microbial safety, consumer acceptability, and organoleptic properties such as appearance, aroma, taste, texture, and overall acceptability.

CHAPTER-2

REVIEW OF LITERATURE

1.1 INTRODUCTION

Cancer is a life-threatening condition characterised by uncontrolled division of cells, which takes its origin at any part of the body, and can spread by growing beyond its boundaries to adjoining parts or to other organs of the body. It is regarded as one of the major leading causes of death. (Saini et al., 2020) has found out that the most spreading cancer globally is the prostate, breast,lung, stomach, non-melanoma skin malignancies but there are 100 types of cancers that affects humans.(Anand et al., 2008) has revealed that 5-10% of all cancer cases can be attributed to genetic defects, whereas the remaining 90-95% have their roots in the environment and lifestyle. The lifestyle factors include cigarette smoking, dietary factors such as fried foods & red meat, alcohol, sun exposure, environmental pollutants, infections, stress, obesity, and physical inactivity. The study also shows that out of all cancer related deaths, almost 25-30% are due to tobacco, as many as 30-35% are linked to diet, about 15-20% are due to infections, and the remaining percentage are due to other factors including radiation, stress physical inactivity, environmental pollutants.

Cancer was considered to be an incurable disease in the past. But with the advent of chemotherapy, radiation therapy, surgery and various other treatment modalities, most of the cancers can be treated effectively and cured, provided timely diagnosis and treatment is made.

1.1.2 IMPACT OF NUTRITION ON CANCER THERAPY

Eating the right food is very important for both the prevention and treatment of cancer. A well-balanced, nutrient-dense diet can help keep our immune system healthy, make it easier to fight cancer, and help cancer patients respond better to radiation and treatment. (Chace, 2022) have found out that some eating habits have been linked to a lower risk of getting cancer. Some of these are diets that are rich in phytochemicals, antioxidants, and substances that reduce inflammation. Oxidative stress plays a big role in the development of cancer, and these constituents help fight it. A nutrient-dense diet helps people get better during treatment and prevents getting cancer by lowering the side effects of treatment, like tiredness, poor nutrition, and stomach pain.

(Green and Grossman, 2019) have revealed that when it comes to cancer and its therapies, healing foods are lifesavers since they boost general health and aid with symptom control. These foods have important bioactive chemicals, minerals, and vitamins that the body needs for cell repair and immune system performance. The study shows that eating a lot of plant-based foods, like nuts, leafy greens, legumes, and berries, is linked to better health. This is because these foods contain micronutrients that help heal and reduce inflammation. Another common sign in cancer patients is cachexia, which means they are losing a lot of weight and muscle. To avoid this problem and keep their muscle mass, they need to make sure that they consume enough protein. Eating more nutrient-dense, easily digestible foods can help patients handle treatments better and help them get better faster.

Individualised nutrition programs are becoming more important in cancer care because people with different types of cancer, treatment plans, and general health needs have different food needs. (Rajeswari, 2022) have reported that it is important for food treatments to be tailored to each patient's needs. Some people may need to change how much fibre they eat because of stomach issues, while others may need to eat more protein because of muscle loss caused by chemotherapy.

Personalised nutrition plans make sure that patients get the best possible nutritional support. They do this by taking into account the metabolic changes, food intolerances, and nutritional deficits. Medical treatment that includes dietary changes can also help people live longer and have a better quality of life generally.

For people with cancer, nutritional support is a multifaceted approach that includes personalised meal plans, healing foods, and dietary measures that keep cancer from happening. More attention to the role of nutrition in prevention and treatment can greatly improve the outcomes for patients and their overall health.

1.1.3 INTEGRATING NATURAL PRODUCTS INTO CANCER THERAPY

Natural goods are being used more and more in cancer treatment because people are interested in them as chemo-preventatives, ways to limit their food intake, and plant-based diets. These plant-based foods, herbs, and bioactive component items have been shown to help fight cancer because they reduce inflammation, boost the immune system, and protect cells from damage. Researchers are still looking for ways to use natural goods in cancer prevention and treatment plans to help therapies work better and improve patients' quality of life.

Cancer-fighting chemicals found in food are an important part of lowering the risk of getting cancer and stopping tumour growth.(Boretti, 2022), the natural substances found in fruits, veggies, and whole grains, like carotenoids, flavonoids, and polyphenols, are very good at fighting cancer. Some of the functions that these useful chemicals do are neutralise free radicals, control gene expression, and stop cancer cells from starting in certain stages. Curcumin, which is found in turmeric, has been the subject of a lot of study because it might slow the growth of tumours. Resveratrol is an antioxidant that can be found in grapes and berries. It has also shown promise in stopping the growth of cancer cells. Polyphenols in green tea, sulforaphane in cruciferous vegetables, and lycopene in tomatoes have all been linked to a lower chance of cancer. As a possible addition to normal cancer treatments, eating foods that contain these chemo-preventive substances may help protect against cancer getting worse or coming back.

The main purpose of this project is the development of multi textured tart using immune supportive ingredients. Cancer patients during the course of chemotherapy requires diet that mainly contains high amount of antioxidants, vitamin C, protein, and dietary fibre. So, to develop this product with the requirements as said above, the main ingredients that I have used includes masoor dal, soursop and guava with an added advantage that it can be easily prepared in the household using the readily available products in the market.

2.1 MASOOR DAL (RED LENTILS)

Masoor Dal is widely recognized for its nutritional benefits, particularly its high protein content, making it an essential component of vegetarian diets. It is an excellent source of dietary fiber, which promotes digestive health and aids in maintaining stable blood sugar levels. The presence of polyphenols and flavonoids gives Masoor Dal strong antioxidant properties, which help reduce oxidative stress and inflammation. Research has demonstrated its potential role in reducing the risk of cardiovascular diseases by improving lipid profiles and reducing blood pressure. Additionally, it is a significant source of iron, folate, and potassium, which contribute to improved hemoglobin levels and overall heart health. Its rich amino acid profile makes it an effective plant-based protein source for muscle growth and repair. The lentil is also low in fat and calories, making it an ideal component of weight management diets. Furthermore, its prebiotic properties support gut microbiota, enhancing digestion and overall gut health.

(Fig. 1.1)

3.1 SOURSOP (ANNONA MURICATA)

Soursop, also known as Graviola, is a tropical fruit recognized for its rich vitamin and mineral content. It is particularly high in vitamin C, which plays a crucial role in enhancing immune function and combating infections. It also contains significant levels of B vitamins and minerals such as potassium, magnesium, and phosphorus, contributing to overall metabolic functions. (Love and Paull, 2011) Soursop can be used for preparing juice, pulp, ice cream, mousse, jelly, soufflé, and sorbet, cakes, soursop punch & and white chocolate-soursop mousse.

(**Fig. 2.1)**

Calories	53.1–61.3
Moisture	82.8 g
Protein	1.00 g
Fat	0.97 g
Carbohydrates	14.63 g
Fiber	0.79 g
Ash	60 g
Calcium	10.3 mg
Phosphorus	27.7 mg
Iron	0.64 mg
Vitamin A (β-carotene)	0
Thiamine	0.11 mg
Riboflavin	0.05 mg
Niacin	1.28 mg
Ascorbic acid	29.6 mg
Tryptophan	11 mg
Methionine	7 mg
Lysine	60 g

Nutritional composition of soursop per 100g

Soursop has gained attention for its potential anticancer properties due to the presence of acetogenins, which have demonstrated inhibitory effects on cancer cell proliferation in preclinical studies.

Additionally, its antioxidant and anti-inflammatory properties help protect cells from damage caused by free radicals, reducing the risk of chronic diseases such as diabetes and cardiovascular disorders. Soursop's dietary fiber content supports digestive health, alleviating issues such as constipation and promoting gut motility. Studies suggest that its natural antimicrobial properties may help combat bacterial and viral infections, further contributing to its therapeutic value. Regular consumption of soursop has also been linked to improved skin health due to its vitamin C and antioxidant content, which aid in collagen synthesis and wound healing.

4.1 GUAVA (PSIDIUM GUAJAVA)

Calories	77-86g
Miosture	2.8-5.5g
Crude fiber	0.9-1.0g
Protein	0.1-0.5
Fat	0.43-0.7mg
Ash	9.5-10mg
Carbohydrate	9.1-17mg
Calcium	17.8-30mg
Phosphorous	0.30-0.70mg
Iron	200-400 I.U
Carotene	0.046mg
Thiamine	0.03-0.04mg
Riboflavin	0.6-1.068mg
Niacin	40 I.U.
Vitamin B3	35 I.U
Vitamin G4	36-50mg

Nutritional composition of Guava per 100g

Guava is a highly nutritious fruit, known for its exceptional vitamin C content, which is significantly higher than that of citrus fruits. This makes it a powerful immune booster, helping to protect against infections and enhance overall immunity. In addition to vitamin C, guava is rich in dietary fiber, aiding digestion and promoting bowel regularity. Its polyphenol and carotenoid content contribute to strong antioxidant properties, which help combat oxidative stress and reduce the risk of chronic diseases such as cancer and cardiovascular ailments. The presence of lycopene, a potent antioxidant, has been

associated with reduced risks of prostate cancer and other malignancies. Guava also exhibits antimicrobial properties, which have been shown to be effective against common bacterial pathogens. It contains significant amounts of potassium, aiding in blood pressure regulation, and folate, which is crucial for prenatal development.(Kumari, 2017) Due to the presence of a rich amount of pectin, a high quality natural jelly is obtained from guava. Processed guava pulp is an excellent raw material for preparation of various other guava products. Guava juice, blended RTS beverages, Guava wine, Guava powder, jam, toffee, cheese, ice cream topping, nectar etc. are some important products of guava.

The fruit's low glycemic index and high fiber content make it an excellent choice for diabetics, as it helps in managing blood sugar levels. Additionally, guava leaves have been traditionally used in herbal medicine for their anti-inflammatory and pain-relieving properties. The fruit is also beneficial for skin health due to its high vitamin A and C content, helping in collagen formation and reducing signs of aging.

(Fig. 3.1)

Dietary restriction is a new method that might help cancer treatments work better and improve patient results. (Aminzadeh-Gohari et al.,2024) studied to find out how they affect the growth of cancer and the results of treatment. The study says that putting cancer cells under metabolic stress by limiting food intake can make them more susceptible to treatments like radiation and chemotherapy. By changing the nutrients that are available, dietary restriction can lower inflammation, boost autophagy, and slow the growth of tumours. Also, foods that are similar to fasting can protect healthy cells from harm while making cancer cells more sensitive to treatment, which lowers the risk of side effects. Food

restriction must be carefully thought out for each cancer patient to make sure they don't become malnourished and get enough energy to heal. Future study should look into the best ways to eat for different types of cancer and different types of patients.

(Fig. 4.1)

Dietary supplements and plant-based meals have also been looked into as possible extra treatments for cancer patients. (Bianco, 2019), a plant-based diet is very important for cancer patients. She points out that whole foods, herbs, and supplements can help. A plant-based diet is good for managing and preventing cancer because it is full of vitamins, antioxidants, and fibre. These all work together to lower inflammation, improve gut health, and boost immune function. There is also some proof that nutritional supplements like medicinal mushrooms, probiotics, and omega-3 fatty acids can help cancer patients deal with side effects of their treatment, boost their immune systems, and improve their overall health. Even though plant-based meals and supplements may help, it is very important to make sure that patients get enough protein, minerals, and essential fatty acids to avoid deficiencies. Personalised cancer treatment plans that include evidence-based dietary approaches can help patients get better care and make their treatments more effective. Natural products, dietary restriction methods, and plant-based diets are important in cancer care because they improve patients' health, boost therapeutic responses, and keep them from having to go through chemotherapy. Adding these methods to regular

cancer treatments could lead to more effective and whole-person cancer management plans, as more study is done to find out how they can be used to treat cancer.

NUTRITIONAL MANAGEMENT DURING CANCER TREATMENT

Good nutrition is very important for everyone, but it's particularly important for cancer patients who are going through treatment. It can help them stay strong, deal with side effects, and have a good quality of life. However, a lot of cancer patients don't get enough nutrients because the sickness and its treatments change their metabolism. These patients need special treatments, like taking extra nutrients, to make up for these deficiencies. (Shaver et al., 2021) have found out the importance of nutritional supplements are in cancer care & that how they can improve disease outcomes, boost the immune system, and fight malnutrition. Cancer patients getting radiation, chemotherapy, or surgery may have serious side effects like feeling sick, loss of appetite, and having trouble absorbing nutrients. This can make it hard for them to get all the nutrients they need just by eating. Adding important vitamins, minerals, and macronutrients to our diet can help with treatment-related problems, speed up healing, and improve your overall health. The cost-effectiveness of the supplements is also looked upon in this study. They have said that hospitalisation rates and treatment costs could go down if serious malnutrition and its effects are stopped. Comprehensive cancer care should always remember how important it is to make sure that people get enough nutrition by using methods that work and don't cost a lot of money.

It is important to make dietary guidelines that are specific to cancer patients in order to give them evidence-based nutritional advice that improves the effectiveness of treatment and their health. (Zhao et al.,2020) have said about personalised meal plans and found out a number of dietary suggestions which are meant to meet the unique nutritional needs of cancer patients. For such patients to fight the damaging effects of the disease and their treatment, they need to eat meals that are high in calories, protein, and vitamins. The suggestions made include that people should eat a variety of whole foods, such as lean meats, dairy, vegetables, and omega-3-rich foods like nuts and fish. Staying hydrated is

another important part of diet control because being dehydrated can result in side effects like feeling tired and having trouble going to the toilet worse. Also, people with certain signs might need to change what they eat. For example, people with mouth sores might need foods that are softer, and people who have lost a lot of weight might need foods that are high in calories. Cancer patients should follow standard dietary advice so that they can better handle their treatments and keep their nutrition stable as they go through their journey.

Even though dietary recommendations are available, it is still hard to give cancer patients reliable and effective nutrition care. (Laviano et al.,2018) have said that the different nutrition care methods implies that the quality and effectiveness of dietary interventions can vary. A big problem with nutritional management is that there aren't any standardised processes. This is because dietary advice varies from healthcare provider to healthcare provider, location to location, and institution to institution. To make things even more complicated, cancer patients' dietary needs are very different depending on factors like the type of cancer, its stage, and the treatment plan they are following. A lot of doctors and nurses focus on treating the sickness instead of making sure patients get enough food, which makes malnutrition in cancer patients less common. Care gaps are made worse by the fact that nutrition isn't checked very often and there aren't many specialist dietitians available. In order to beat these obstacles, a multidisciplinary team must work together to incorporate medical nutrition therapy into established cancer treatment plans, so that each patient can receive personalized nutritional assistance.

Proper nutritional management is very important during cancer therapy to improve long-term outcomes, keep patients healthy, and reduce problems linked to treatment. Differentiation in nutrition care is a problem that needs to be fixed first, even though food standards and nutrient supplements are good starting points. In the future, detailed plans for cancer care should include personalised eating plans. There should also be more nutritional counselling available and the creation of standardised processes.

DIETARY STRATEGIES FOR CANCER PREVENTION

(Kamal et al., 2022) give a thorough review of dietary changes that can help avoid cancer. They stress the importance of plant-based diets, foods high in antioxidants, and eating less processed and high-fat foods. A diet full of fruits, veggies, whole grains, and lean meats has phytochemicals, vitamins, and fibre that help protect cells and fix DNA that is damaged. This lowers the risk of cancer. In addition, eating a lot of red and processed meats, refined sweets, and alcohol has been linked to a higher chance of cancer because they cause inflammation and cancer Kamal et al. stress how bad it is to eat these foods.People can greatly reduce their chance of developing cancer by eating a healthy, well-balanced diet.

(Gacche, 2021), these foods contain polyphenols, flavonoids, carotenoids, and omega-3 fatty acids, all of which are naturally occurring chemicals that can help fight cancer. Because of their antioxidant qualities, these bioactive substances aid in the fight against cancer by lowering levels of chronic inflammation and free radicals. Some functional foods, like berries, green tea, cruciferous vegetables, and turmeric, have been shown to stop cancer from starting. They do this by changing gene expression and stopping tumour growth. Good gut health helps the immune system and gets rid of toxins, which is why fermented foods high in probiotics are good for cancer patients. Including functional foods in our daily diet is one way to improve our health and lower our risk of getting cancer.

(Kussmann, 2024) looks into the role of alternative eating habits in cancer care by focussing on the benefits of traditional healing foods and holistic nutritional therapies. Traditional meals from places like Asia and the Mediterranean are full of nutrients that help keep inflammation at bay and fight off sickness. These diets are based on whole foods, healthy fats, and herbal ingredients that have been used for a long time as medicines. More research has been done on herbal medicine, dietary fasting, and nutraceutical supplements as possible ways to use complementary nutrition to help avoid cancer. Using integrative nutrition methods to prevent cancer covers a lot of ground. They fix nutritional imbalances and improve overall health. These methods combine standard medical nutrition treatment with knowledge from generations of cooks.

A lot of people can avoid getting cancer by following traditional nutrition rules, eating functional foods, and making other dietary changes that are based on proof. A balanced diet lowers the chance of

cancer by lowering inflammation and oxidative stress. It also helps keep cells and the immune system healthy. Changing our diet to avoid getting sick is an important part of managing public health and sickness, especially since studies are finding more and more links between food and cancer.

FUTURE OF NUTRITIONAL INTERVENTIONS IN CANCER CARE

(Ravasco, 2019) nutritional approaches that are tailored to the needs of each patient can improve treatment outcomes and quality of life. Recent study suggests that eating a lot of bioactive substances, antioxidants, and anti-inflammatory foods may help lower the side effects of treatment and improve immune function. As the field of nutrition continues to grow, precision nutrition, which means making sure that a patient's diet fits their specific genetic, metabolic, and microbial profiles, has a lot of promise to make health better. In the future, researchers hope to find better ways to help cancer patients with their nutrition by creating dietary guidelines that combine science knowledge with clinical practice.

(Gorter&Peper, 2011) the people with cancer should change their diet, take herbal supplements, and do mind-body practices as part of their treatment plans. The main goal of these strategies is to improve health by making the defence system stronger. Plant-based diets, fasting-like routines, and traditional healing foods are some of the new ideas being looked into as possible ways to make chemotherapy work better while lowering its side effects. Foods high in phytonutrients, medicinal mushrooms, and probiotics may help control inflammation, boost resistance to cancer, and improve gut health, according to researchers.

New food treatments that target specific metabolic pathways in cancer cells are becoming possible thanks to progress in cancer nutrition (Zhu et al., 2021) talk about more modern methods, such as intermittent fasting, which may help the body heal and renew itself, and ketogenic diets, which try to starve cancer cells of glucose while keeping healthy cells working. Cancer patients have special nutritional needs that are being met with the help of new research in nutrigenomics and metabolomics. Digital health technologies and artificial intelligence are also being used in cancer nutrition programs to track patients' nutritional state in real time and make personalised food suggestions. In the future,

the main goals of cancer nutrition will probably be to improve treatment outcomes and survival rates. This means that a multidimensional approach will probably be needed, mixing dietary advice with targeted medicines.

(Barrett et al., 2020) looked at the quality, completeness, and alignment with current evidence-based guidelines of nine websites for national cancer organisations that give help on food and nutrition. There were some differences and possible gaps in the information that were found by looking at material related to diet advice for cancer prevention, treatment, and survivorship. Throughout the study, different websites gave different advice on which foods, supplements, and eating habits can help with treatment-related side effects. However, most of them stressed how important it is to eat a balanced diet full of fruits, vegetables, and whole grains. Websites that didn't give clear information on controversial topics like eating red meat, eating healthy food, and eating sugar could be confusing for cancer patients and their caretakers. Based on the poll, some groups made suggestions that were backed up by solid research and reliable sources, while others did not. The writers stressed the need for standardisation and making dietary information easier to find so that people with cancer can get strong, evidence-based dietary advice. A study found that the best way to improve care and support for cancer patients was for national cancer groups to work together to make unified dietary guidelines based on the newest nutrition and oncology research.

(Sierpina et al., 2015) looked into the role of nutrition and metabolism in cancer survivorship and drew attention to methods that combine traditional oncology with changes to diet and lifestyle. They say that personalised nutrition methods, like plant-based diets, anti-inflammatory foods, and metabolic management, can help with long-term healing and lower the risk of recurrence. They also stressed how important it is to treat metabolic syndromes, which include obesity and insulin resistance and are linked to worse results for people with cancer. Mind-body therapies, nutritional counselling, and dietary advice based on evidence are all parts of complete survivorship care, which was emphasised as an important part of integrative medicine in the study.(Jamil et al., 2024) did a thorough study of all the ways that healthy eating lowers the risk of stomach cancer. The study looked at how eating habits,

micronutrients, and food pollution affect the growth of gastric cancer. It focused on the protective effects of antioxidants, fibre, and probiotics. The authors talked about dietary risk factors like nitrosamines, processed foods, and eating too much salt while promoting a diet high in fresh fruits and vegetables and polyphenols. Their study supports the idea that functional nutrition can help prevent stomach cancer and suggests that changes to people's diets should be a part of both large-scale public health programs and individualised programs for preventing cancer.

(Hiatt et al., 2023) did a study on the Pathways to Prevention program in 2023. This program wants to improve the results of cancer patients by focussing on nutrition as a way to keep them from getting cancer. According to their study, dietary treatments that promote healthier eating and lifestyle changes can lower the risk of getting cancer, having it get worse, and having it come back. Scientists put together information from clinical trials and large-scale population studies that show a link between a plant-based diet, eating less red meat, and eating more whole foods and a better chance of not getting cancer. Along with pushing for nutrition advice to be a part of oncology care, they talked about problems that make it hard for cancer patients and survivors to stick to their diets. What the study found was that cancer care and survivorship programs should include nutrition-based preventative programs to improve people's long-term health.

CHAPTER-3

MATERIALS AND METHODS

MATERIALS AND METHODS

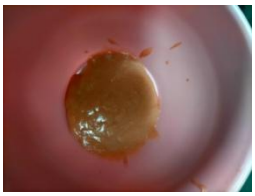
The details of materials and methods adopted in the present study, entitled Development of multi-textured nutrient-dense tart to support immune health in cancer care are briefly described in this chapter. The materials were procured from the Kollam supermarket, India. The details are given below:

RAW MATERIALS

Butter, Sugar, Masoordal, Egg, All-purpose flour, Vanilla extract, Whipping cream powder, Gelatin, Soursop puree, Guava puree, and Milk.

Unsalted butter
Fig (5.1)

Whipping powder
Fig (5.3)



Masoor dal
Fig (6.1)

Vanilla Extract
Fig (6.2)

Guava puree
Fig (6.3)

Soursop puree
Fig(6.5)

Milk
Fig(6.5)

TYPES OF EQUIPMENT USED

Microwave oven, Spatula, Grinder, Moulds, Beater, Siever, Bowl, Measuring cups, Pan

Microwave oven
Fig (7.1)

Mould
Fig (7.2)

Bowl
Fig (7.3)

Spatula
Fig (7.4)

Measuring Cups
Fig (7.6)

Siever
Fig (7.8)

Pan
Fig (7.9)

METHOD OF PREPARATION

In a bowl good quality masoor dal was washed to remove dust and dirt and placed in an absorbent towel to remove extra water. The dried masoor dal was roasted in oven to remove any water and to bring out their natural flavors. The masoor dal were roasted at 130 degrees Celsius for 10-12min. The dried masoor dal was grinded to create a fine powder. In a bowl butter was melted with spatula, one egg yolk, sugar if needed, vanilla extract, grinded masoor dal and maidawas added to the mix of the ingredients and was made into a dough formation. Dough was allowed to rest for 30 min in refrigerator. After that it was made into small balls and made them into thin sheets and mouldedit. It was kept in the refrigerator for 15 min. After that it was baked for 130 degrees Celsius for 200 temperature. For preparation of the cream whipping powder and milk was beated with beater until it became fluffy. The main ingredient sour sop puree and guava puree was poured and then beated again. Now in a small pan little amount of water was added and boiled, then 2-3 teaspoons of gelatin was taken in a small bowl and melted them with boiled water. After that it was added into the mix and beated again. Baked biscuit layer was done and the puree mix was added on the top and refrigerated them for 1 hour. Finally we get delicious tasty multi textured tart.

Multi-Textured Tart
Fig (9.1)

EVALUATION OF PHYSICO-CHEMICAL PARAMETERS

ESTIMATION OF MOISUTRE

PRINCIPLE

The moisture content of food is estimated by measuring the bulk of the product before and after water removal by evaporation. The evaporation method's drying conditions are normally standardized in terms of temperature and time.

APPARATUS: Hot air oven, a dessicator and flat bottom dishes.

PROCEDURE

5-10g of homogenized sample was weighed approximately in flat bottom glass dishes that have been dried and weighed earlier.

The dish containing the sample was placed in hot air oven set to 100^0 C for 1-2 hours.

It was then cooled in adesiccator for halfanhour at a time until the difference between successive readings was less than 2mg.

CALCULATION

$$\text{□□□□□□□□(\%□□ □□□□)} = \frac{(\text{□}_{\text{□}} - \text{□}_{\text{□}}) \times \text{□□□}}{\text{□□□□□□ □□ □□□□□□}}$$

ESTIMATION OF PROTEIN

PRINCIPLE

The kjeldahl method is used to determine the nitrogen content of foods. The protein content of a sample can be determined by assuming a protein-to-nitrogen ratio for that sample.

REAGENTS:Conc: H_2SO_4(98%),NaOH(40%),catalyst($CuSO_4$+$NaSO_4$),2% Boric acid (2g boric acid made up to 100mL with distilled water),mixed indicator (bromocresol+methyl red),HCl.

PROCEDURE

Digestion: In a kjeldahl flask,roughly 0.7-2.2g of the sample was weighed before adding the catalyst(0.7g$CuSO_4$ +15g anhydrous Na_2SO_4).25 mL of concentrated H_2SO_4 was poured carefully into the kjeldahl flask. The material should now be of a greenish hue. The kjeldahl flask was placed on a heat mantle and heated until a white solid mass developed, with no charred material remaining.

Distillation: In the flask containing the white substance, 20mL of distilled water and a mixed indicator was added. The color of the solution changed to pink. Then, a distillation unit was connected to the kjeldahl flask. 40 percent NaOH was added once it has begun to boil.

Ammonia is freed in the presence of stream and NaOH,which subsequently condenses into a liquid and is trapped in boric acid.The trapped ammonium borate solution will change color from pink to green.

Titration: The distillate was titrated against standard HCL until a pink colorwas formed as the end point.The HCl titrant volume used was recorded.

CALCULATION

$$\square\square\square\square\square\ \square\square\square\square\square\square\square\square(\square/100\ \square\square\ \%)$$

$$= \frac{\square\square\square\square\square\ \square\square\square\square\square \times \square\square\square\square\square\square\square\square\square\ \square\square\ \square\square\square \times 100}{\square\square\square\square h\square\ \square\square\ \square\square\square\square\square\square}$$

ESTIMATION OF FAT

APPARATUS: Soxhlet apparatus

REAGENTS: Petroleum ether

PROCEDURE

In a thimble, about 10g of the sample was weighed. The Soxhlet device was kept in place. The circular bottom flask with glass beads was placed on the heating mantle and the extraction chamber with thimble slightly above it.The petroleum ether was poured in. It first poured into the circular bottom flask. Ether was maintained as one-fourth of the thimble. The condenser was connected and the heating mantle was activated.The fat was collected in the round bottom flask. it was filtered and concentrated.It was placed in a hot air oven for 30 minutes and weighed.

CALCULATION

$$\square\square\square\ \square\square\square\square\square\square\square\square\square\square = \frac{\square\square\square\square h\square\ \square\square\ \square\square\square \times 100}{\square\square\square\square h\square\ \square\square\ \square\square\square\square\square\square}$$

ESTIMATION OF CRUDE FIBRE

APPARATUS: Digestion flask, muffle furnace, hot air oven, Goochcrucible, desiccator, muslin cloth.

REAGENTS: Sulphuricacid,0.225N, (12.5g of H_2SO_4), sodium hydroxide,HCL, ethyl alcohol

PROCEDURE

The asbestos is placed inside the Gooch crucible as a mat to fill the small holes.

PREPARATION OF ASBESTOS

Asbestos and 5% NaOH in water bath (digestion for 8 hours). It was washed in 1 liter of boiling water with a muslin cloth.Asbestos and HCL in water bath (digestion for 8 hours). It was washed in 1litre of boiling water with a muslin cloth.The asbestos was taken in aChina dish then, placed it in a hot air oven at 110 degreesCelsius for 1 hour.Then the asbestos was placed in a crucible, which was placed in the muffle furnace for 1 hour.

PREPARATION OF SAMPLE

Fat free residue and 1g sample in digestion flask. 200 ml of H_2SO_4 Solution was added to the digestion flask and boiled for 5 minutes. Boiling briskly was continued for exactly 28 minutes with frequent rotation of the flask to ensure thorough wetting and mixing of the sample.

After boiling, the flask was removed and filtered immediately through a muslin cloth. It was washed with boiling water until washings are no longer acid.The sample was transferred to the digestion flask, and was washed with the muslin cloth with 200 ml of NaOH solution.The flask was connected to the reflux condenser, placed on the preheated hot plate, and brought to boil in 5 minutes and boiled exactly 28 minutes.After 28 minutes, the flask was removed and immediately filtered through a Gooch crucible.

The residue was washed thoroughly first with water and then with 15 mlof ethyl alcohol. The crucible and contents were dried at 110 ^{0}C to a constant weight (1hour). It was cooled in desiccator and weighed.The crucible and contents were ignited in an electric muffle furnace at 600^{0}C for 20 minutes. It was cooled in a desiccator and weighed. The loss in weight on ignition was determined.

CALCULATION

$$\square\square\square\square\ \square\square\square\square\square, \% = \frac{\square\square\square\ \square\square\ \square\square\square\square\square\ \square\square\ \square\square\square\square\square\square\square\ (\square)}{\square\square\square\square\square\ \square\square\ \square\square\square\square\square\square\square} \times \square\square\square$$

ESTIMATION OF TOTAL SUGAR

APPARATUS: Burette, Volumetric flask, Glass wool

REAGENTS: Fehling's Solution A and B, Methylene Blue (1% aqueous solution)

PROCEDURE

A. Preparation of sugar solution

I. Reducing sugar estimation- A solution of the sugar-containing sample was prepared, by weighing accurately about 4-5 g of the sample into a beaker and adding about 100 ml of warm water. The solution

was stirred until all the soluble matter was dissolved and filtered into a 250 ml volumetric flask. The beaker was washed into the volumetric flask and the solution was made up to volume.

II.Total sugar estimation-Nonreducing sugars were hydrolyzedto reducing sugars by pipetting 100ml of the solution preparedinto a conical flask, adding 10 ml dilute HCL and boiling for 5min.After cooling, the solution was neutralizedto phenolphthalein with 10% NaOH and made up to volume in 250 ml volumetric flask. This solution was used for titration against fehlings solution.

B.Titrations

i. The burette was filled with the sugar solution. 10 ml of mixed Fehling's solution was pipetted out into a conical flask and 4 drops of 1% methylene blue was added. The solution was brought to boil and whilst boiling, the sugar solution was addedfrom the burette until the blue colordisappeared.This gave the approximate value of the titration.

CALCULATION

$$\square\square\square\square\ \square\square\square\square\ \% = \frac{\square.\square\square \times \square\square\square \times \square.\square}{\square \times \square \times \square\square}$$

ESTIMATION OF CARBOHYDRATE

PRINCIPLE

Total carbohydrate content of the food must be calculated by subtractions of the sums of the protein, totalfat, moisture and ash. Along with fats and proteins, carbohydrates are one of the three major macronutrients included in food. Organic substances known as carbohydrates are composed of carbon, hydrogen, andoxygen, often in ratios1:2:1. The main purpose of carbohydrates in the diet is to give the body a source of energy.

PROCEDURE

0.1g of sample was taken in a test tube,and 2.5 mL of HCl was added, and it was placed in a water bath for about 2 hours when an orange color was present. After the color was present, a pinch of $NaCO_3$was added until the effervescence ended. Made up to mL distilled water. 50 ml of it was taken and centrifuged for 20 minutes at 2000rpm.A series of samples were taken in a test tube, distilled water was added and make up 1ml,and 4 ml of anthrone reagent was also added. It was placed on a spectrophotometer and the value was noted.

CALCULATION

□□□□□□□□□□□□□ (%) − (□□□□□□□□ + □□□ + □□□□□□□□ □□□□□□□□ + □□□□□ □□□□□)

ESTIMATION OF VITAMIN C(ASCORBIC ACID),(DPPH ASSAY)

PRINCIPLE

Ascorbic acid reduces the 2,6-dichlorophenol indophenol dye to a colorless leuco-base, Theascorbic acid gets oxidized to dehydroascorbic acid. Though the dye is a blue coloredcompound, the end point is the appearance of pink color. The dye is pink colored in acid medium. Oxalic acid is used as the titrating medium.

MATERIALS REQUIRED

Oxalic Acid 4%.

Dye Solution: 42mg sodium bicarbonate was weighed into a small volume of distilled water.

52mg 2,6-dichloro phenol indophenol was dissolved in it and made up to 200mlwith distilled water.

Stock Standard Solution: 100mg ascorbic acid was dissolved in 100ml of 4% oxalic acid solution in a standard flask (1mg/ml).

Working Standard:10mL of the stock solution was diluted to 100ml with 4% oxalic acid. The concentration of working standard is 100g/mL.

PROCEDURE

5ml of the working standard solutionwas pipetted out into a 100ml conical flask.10ml of 4% oxalic acid was added and titrated against the dye (V, mL). End point is the appearance of pink colour which persists for a few minutes. The amount of the dye consumed is equivalent to the amount of ascorbic acid.The sample (0.5-5g depending on the sample) was extracted in 4% oxalic acid and made up to a known volume (100mL) and centrifuged.5mL of this supernatantwas pipetted out, 10ml of 4% oxalic acid was added and titrated against the dye (V2 mL).

ANTIOXIDANT ACTIVITY (DPPH ASSAY)

The free radical scavenging capacity of the antioxidant compound 1,1-diphenyl-2-picryl-hydrazil (DPPH) is frequently assessed. This test is based on the premise that when DPPH accepts hydrogen (H) from a scavenger molecule, such as an antioxidant, it is reduced to DPPH2, resulting in a purple color shift to yellow and a drop in absorbance at 515nm (Crini&Lichtfouse, 2019), DPPH is a commercially accessible and stable organic nitrogen radical that interacts with hydrogen/electron donor chemicals and has a maximal UV-Visible absorption spectrum of 515-520nm (Marcotullio, 2019).

PROCEDURE

An orbital shaker was used to mix 0.1g of sample with 100mlof ethanol overnight. Ethanol was used to dilute 10mL of supernatant into 100mL. The Standard was made by weighing 0.1g of Butylated Hydroxy Toluene (BHT) and diluting it with ethanol to 100ml.From then, roughly 10mL of standard was produced up to 100mL.The standard and samples were taken at various concentrations (0.1, 0.3, 0.5, 0.7, 1.0, 1.3, and 1.5) and made up to 3ml with ethanol. In the test tubes holding the sample and standard, 1 ml. of DPPH was added. When DPPH was added, a purple colorwas formed. A UV-Visible Spectrometer was used to measure the absorbance after 30 minutes.

CALCULATION

$$\frac{\square.\square\ \square\square}{\square_{\square}\ \square\square} \times \frac{\square_{\square}}{\square\square\square} \times \frac{\square\square\square\ \square\square}{\square\square\square\square\square\ \square\square\ \square\square\square\square\square} \times \square\square\square\square\square$$

ESTIMATION OF ASH CONTENT

APPARATUS: Muffle furnace, silica crucible, desiccator, tongs, Bunsen burner.

PROCEDURE

In a muffle furnace, a clean silica crucible was ignited at 400°C for 30 minutes. It was set aside to cool in a desiccator 1-2g of sample was weighed into the crucible that was previously weighed, and the precise weight of the sample taken was recorded. The process of charring the sample was continued in the crucible by maintaining it in the heating mantle until no smoke was formed. Using tongs, the charred sample was transferred into a muffle furnace set to 450°C for 5 hours. The weight of ash was

calculated by subtracting the weight of the crucible containing ash from the weight of the empty crucible.

CALCULATION

$$\text{□□□□□ □□□(\%)} = \frac{\text{□□□□□□ □□ □□□ × □□□}}{\text{□□□□□□ □□ □□□□□□}}$$

ESTIMATION OF IRON

The iron content was determined using ICP-OES Method. Sample was prepared by Microwave digestion method. About 25 g of well homogenized sample was weighed into a clean silica dish.25 ml of 20% sulphuric acid was added to it. It was mixed thoroughly with a glass stirring cod to ensure that all sample material was wetted by the acid. The stirring rod was rinsed with water into silica dish. The contents of the dish were dried thoroughly 47 steam bath or in around 110°C.When the sample was thoroughly dry, the contents of the dish were heated with a soft flame (such as that of a Bunsen burner) until all volatile or readily combustible matter had been removed.The dish was transferred to a furnace set at 250°C. Slowly the temperature was raised to 500^0C hours. Ash at this temperature for about 6 to 8 hours. The dish was removed and cooled. Ash should now be white or brownish red and essentially be carbon free. If ash contains carbon particles, sides of dish was washed down with water and 2 ml of $HNO_3$was added and mixed well. It is dried thoroughly on hot plate. The dish was removed and the furnace was cooled at 500 ^{0}C and ash for 30 minutes. The nitric acid treatment was repeated using 1 mi increments of HNO_3 until white/brownish red, carbon free ash was obtained. When clean ash was obtained, the dish was removed from furnace, cooled and 1ml HNO_3 and 10 ml of waterwas added. The hot plate was heated till sample ash was dissolved. The contents of the dish were transferred quantitatively to a 50 ml volumetric flask, the dish was heated with 10 ml of HCI (1+1) and the solution was transferred again to the same volumetric flask to volume with water. Sample blank solution was prepared by following the same procedure as described for sample. The same quantities of reagents

were used including water for both sample and blank. Both sample and sample blank were subjected to identical treatment (even the length of time kept in furnace).

CALCULATION

□□□□ (□□/□)

$$= \frac{\square\square\square\square\square\square\square\square\square\square\square\square\square\square\square\,(\square\square) \times \square\square\square\square\square\square\square\,(\square) \times \square\square\square\square\square\square\square\square\square\ \square\square\square\square\square\square\square\,(\square\square)}{\square\square\square\square\square\square\square\ \square\square\ \square\square\square\square\square\square\square}$$

MICROBIOLOGY ANALYSIS

MEDIA & REAGENTS

1.Plate Count Agar

2.Butterfield’s Phosphate Buffer solution (pH-7.2)

PROCEDURE

Aseptically 25gm of a sterile sample was weighed and this was added to 225 ml of butterfields phosphate buffer solution (pH-7.2) to achieve 10-11 dilution,then homogenized well using

stomacher.Appropriate (1+9) dilutions till 10-3 dilutionswas made and others were made as appropriate, for food homogenate.

Plating and incubation of sample

Aseptically 1ml each of the inoculum from the dilutions was pipetted out into duplicate petri plates and 18-20ml medium was poured (cooled to 45-50 ^{0}C) and the petri dishes were gently rotated clockwise and anticlockwise for uniform distribution of the inoculum with molten agar medium and allowed to solidify.Then the plates were incubated for 48 hours at 35^{0}C and the plates were examined after 48 hours of incubation and the colonies were counted.

OBSERVATION

The colonies counted were in the range of 25-250 colonies in duplicate plates.To avoid giving false ideas of precision and accuracy,while computing colony counts,only the first two digits were recorded.The second digit was raised to the next highest number only when the third digit from the left was 5,6,7,8, or 9. Zeroes used for each successive digit to the right of the second digit.Counts or estimates were reported as CFU per gm.When counts on duplicate plates or consecutive dilutions were averaged,round off counted to two significant figures only at the time of conservation to the CFU per g.The appropriate number of colonies to count on the plate is a function of colony size,platesize,and size of differential properties produced on the medium.Typically,25 to 250 colonies per plate yield reliable results.This is used as a guide unless an alternate range is indicated for specific methods.

YEAST AND MOLD

MATERIALS

MEDIA & REAGENTS

1. Yeast dextrose chloramphenicol (YEDCA)agar.
2. Chloramphenicol Antibiotic solution (100 mg/liter of medium) Stock solution is prepared by dissolving 0.1g of chloramphenicol in 10ml of distilled water.This solution is added to 990 ml of the medium before autoclaving.

3. 0.1% peptone water (pH 7.0)

PROCEDURE

Preparation of the sample in the laboratory

The sample was crushed in a sample mortar and pestle and aseptically 25gm sample was weighed in a sterile sample dish or aluminiumfoil. This was added to 225ml of 0.1% peptone water (pH-7.0) to achieve 10 minus 1 dilution then homogenized well. Appropriate (1+9)dilutions in the diluent were made till 10 minus 3 dilution,and others as appropriate,for food homogenate.

ANALYSIS PROCEDURE

Plating and incubation of the sample

Pour plate-plate Method

Aseptically 1ml each odd dilution was pipetted on pre poured, solidified agar plates and inoculum was spread with a sterile,bent glass rod,Plate each dilution in triplicate.Plates were incubated at 25 ^{0}C for 5 days and plates were stacked 3 in number in upright position. The plates were kept undisturbed until time for counting.

OBSERVATION

The plates were counted after 5 days of incubation.If there is no growth after 5 days, it was re-incubated for another 48 hrs. Plates containing 10-150 colonies were counted.Counts were rounded off to two significant figures and zeros used in the succeeding digits.If the third digit is 6 above, round off the second digit to the digit.If 4 or below,round off to digit are an even number,round off the digit above if first 2 digits are an odd number. When plates from all dilutions have no colonies,report yeast and mold count as less than 1 times the lowest dilutionReport results in colony forming units(CFU)/g based on average count of triplicate plates.Based on the experimental study, the combination of ingredients resulted in a unique dessert with a rich texture and balanced flavors. The incorporation of masoor dal added a subtle nuttiness, while the guava and soursop purees provided a refreshing tropical twist. The use of gelatin ensured a smooth and stable consistency, and the whipping cream powder contributed to a light and airy texture. The butter and egg yolk enhanced the richness, complementing the sweetness of the sugar and vanilla extract.Overall, the study demonstrates that this combination of ingredients

can successfully create a flavorful and well-structured dessert with an innovative fusion of taste and texture.

SENSORY EVALUATION

The sensory qualities of the finished product were assessed using hedonic scale rating test. It was organized in a calm environment with well light, humid free, and ventilated rooms while maintained hygiene standards. The test provides an indication of consumer preference and acceptance of the final product. For each participant in the sensory exam, a separate score sheet card is used. Instead of identifying difference, this test is better suited to identifying preferences. Hedonic Test was employed

for this purpose. A 9-point scale ranging from ‘Like Very Much’ to ‘Dislike Very Much’ with Neither Like nor Dislike as midpoint was used for this purpose. Respondents included staff and students from other departments at CEPCI whose age ranged between 21 to 50 years. Judges were asked to mark the product based on the degree of preference.

9 - Point Hedonic Scale	
9	Like Extremely
8	Like very much
7	Like Moderately
6	Like Slightly
5	Neither Like nor Dislike
4	Dislike slightly
3	Dislike Moderately
2	Dislike Very Much
1	Dislike Extremely

CHAPTER-4

RESULT AND DISCUSSION

Results

The present investigation was undertaken to develop a nutrient-dense multi multi-textured tart to support immune health in cancer care

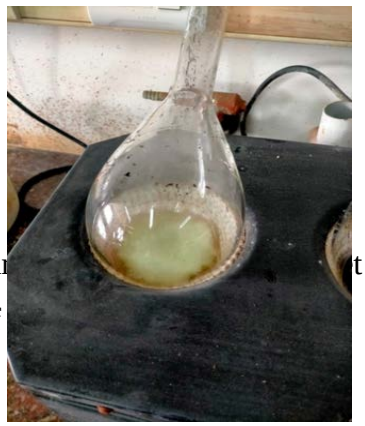
Analysis of moisture content

The moisture content was analyzed by measuring the bulk of the product before and after water removal by evaporation. The moisture content in the tart was found out to be 24.7mg per 100g of the sample.

Moistu ed tart

Analysis of protein

The protein content in the tart was det method. A protein content of 5.3g was obtained in 100g of the sample.



Analysis of fat

Determination of fat content in the ta t method. The nutrient analysis of the tart revealed 11.5g of fat per 100g of

Total Fat

Analysis of crude fibre

Determination of crude fibre in the ethod. The nutrient analysis of the tart revealed 0.3mg of crude fibre p

Analysis of sugar

The sugar content in the tart was deter olution. The nutrient analysis revealed 4.3mg of sugar per 100g of the sample

Total sugar

Analysis of carbohydrate conten

Determination of carbohydrate content i calculating by subtractions of the sums of the protein, total fat, moisture and a lysis revealed 58.1mg per 100g of the sample.

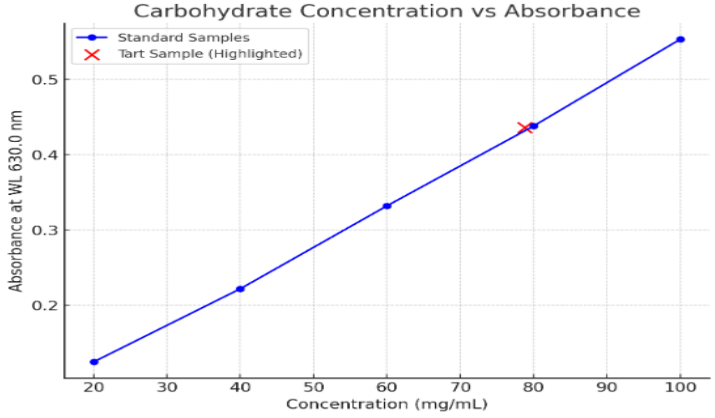
Serial dilution of carbohydrate

Standard Table

Sample Name	Concentration (mg/mL)	WL 630.0 (Absorbance)
s1	20.00	0.125
s2	40.00	0.222
s3	60.00	0.332
s4	80.00	0.438
s5	100.00	0.553
Sample Name	**Concentration (mg/mL)**	**WL 630.0 (Absorbance)**
Tart (0.1mL)	78.796	0.436

Table 3: Standard Curve for Carbohydrate Estimation

Table 4:Carbohydrate of Multi-textured Tart



Concentration (		bsorbance)
10.0		230
30.0		200
50.0		164
70.0		125
90.0		105

110.0	0.023	0.085
130.0	0.048	0.064
150.0	0.080	0.045
-	0.00	-
-	0.463 (Total)	

Standard Curve for Carbohydrate Estimation

Analysis of Vitamin C content

Determination of vitamin C in the tart was done using DPPH assay. A high content of vitamin C, with the level of 165mg per 100g of the sample was revealed.

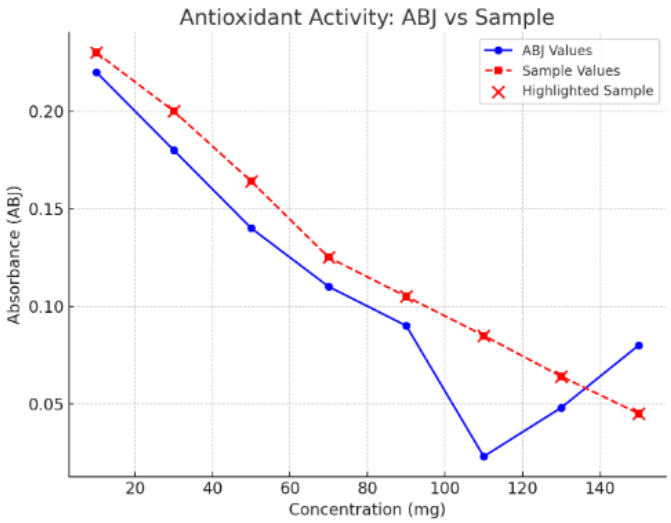


Figure 5.1.3: Antioxidant Activity Graph

The graph illustrates the antioxidant activity by plotting absorbance (ABJ) values against different concentrations (mg). It is observed that as the concentration increases, the absorbance values for both ABJ and the sample decrease. The sample values (highlighted in red) show a slightly higher absorbance compared to the ABJ values at lower concentrations, indicating a stronger initial antioxidant presence. However, at higher concentrations, both values tend to decline, signifying reduced antioxidant activity with increasing dosage.The final product exhibited a high concentration of antioxidants per 100g of the sample.

Analysis of Total Ash

Determination of ash in the tart was done by using muffle furnace. An ash content content of 0.9mg was revealed in 100g of the sample.

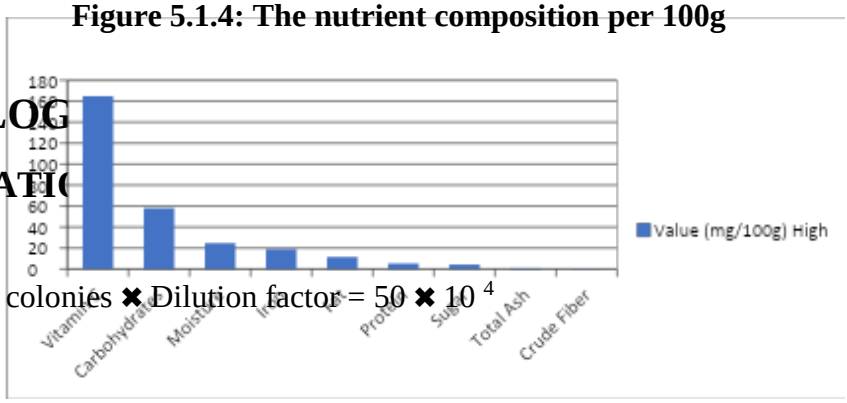
Analysis of Iron

Determination of the iron content was done using ICP-OES method. The nutrient analysis revealed the presence of 19mg per 100g of the sample.

Nutrient	Value (mg/100g)
Antioxidants	High
Vitamin C	165
Carbohydrates	58.1
Moisture	24.7
Iron	19.0
Fat	11.5
Protein	5.3
Sugar	4.3
Total Ash	0.9
Crude Fiber	0.3

Table 6: The nutrient composition of multi-textured tart per 100g

Figure 5.1.4: The nutrient composition per 100g



MICROBIOLOG

TPC CALCULATI

Average number of colonies ✖ Dilution factor = 50 ✖ 10^{4}

RESULT

Total plate count / gm = 50 ✖ 10^{4}

10^{-1} Count **10^{-2} Count** **10^{-3} Count**

10^{-4} Count

After 48 hours of incubation at room temperature, the total plate count was fount to be 50 X 10^{4}. It indicates good quality of the product in the microbial analysis. It ensures the microbial safety.

YEAST AND MOLD CALCULATION

RESULT

Average number of colonies ✖ Dilutionfactor ✖ 10 = 51 ✖ 100

= 5100 ct /ml

10^{-1}Count	10^{-2} Count	10^{-3} Count	10^{-4} Count

After 48 hours of incubation at room temperature, yeast and mold content was present, with predominant mold content. The result yeast and mold content/gm are <10 CFU. It indicates good quality of the product in the microbial analysis. It ensures the microbial safety.

DISCUSSION

The study results show that the improved tart is very good for health, especially because it has a lot of antioxidants and vitamin C. It looks like a promising useful food that might be good for your health, especially for your immune system as they neutralise free radicals, antioxidants greatly lower oxidative stress and lowers the chance of getting chronic diseases like heart disease, cancer, and neurodegenerative conditions. The high vitamin C content, mostly from guava and soursop, helps the tart's ability to boost the immune system,and speed up collagen production for better skin and tissue repair. The addition of Masoor Dal to the recipe gave the tart a useful protein boost and made it a healthier choice overall. To repair muscles, keep enzymes working, and help cells grow, you need important macronutrients like proteins. Masoor Dal is a plant-based source of protein that is high in important amino acids and adds to the protein quality of the tart as a whole. It is especially helpful for cancer patientsto get enough protein to keep their muscles and immune systems healthy.

Soursop is another important part of the recipe, and it is known to help fight cancer and boost the immune system. Biologically active chemicals in the fruit, like acetogenins, have shown promise as an anticancer agent by killing cancer cells and stopping the growth of tumours. On top of that, soursop is known to have antimicrobial and anti-inflammatory qualities that are good for your health. By adding it to the snack, it makes it more useful, turning it into more than just a healthy snack and maybe even a medicine. Guava is a fruit that is high in vitamin C and makes the developed tart even healthier. Vitamin C is a very strong antioxidant. It helps the immune system work, heals wounds, and absorbs non-heme iron from plant-based sources. The tart has a lot of vitamin C, which suggests that it might help lower the strength and duration of infections, making the immune system stronger overall. Guava

also has a lot of dietary fibre, which helps theto body digest food and keep blood sugar levels steady. The fibre in the tart is good for gut health because it helps digestion.

The product has the right amount of macronutrients (like carbs, proteins, and fats) and important micronutrients (like calcium, potassium, and iron). The tart has carbohydrates, mostly from natural sources, it gives energy that lasts for a long time. This makes it a good choice for a healthy snack.The tart also has a modest amount of fat, which makes it more energy dense and helps fat-soluble vitamins get into the body better. Healthy fats help the brain work, keep cell membranes strong, and keep hormones in order. Including the total ash content in the study makes it even more clear that important minerals are present, which adds to the food's nutritional value.

The tart is also a healthier option to regular sweet snacks because it has less sugar, which lowers the risk of blood sugar spikes and supports metabolic health over the long term. Small amounts of crude fibre are present in foods, but they play a big role in digestive health by keeping bowel movements regular and avoiding constipation. Fibre also helpskeep off weight by makingfeel full and lowering your total calorie intake. Overall, the developed multi- textured tart is a one-of-a-kind mix of taste, nutrition, and health benefits. The tart has a lot of antioxidants, a lot of vitamin C, and a good mix of macronutrients and micronutrients. This makes it a possible functional food choice for cancer patients who want to improve their immune system, digestive health, and general health. Food technology and nutrition studies can get better in the future, which could help make the formula even better.

CHAPTER-5

SUMMARY AND CONCLUSION

SUMMARY AND CONCLUSION

The development of a multi-textured, nutrient-dense tart for immune health in cancer care focuses on delivering essential nutrients such as vitamin C, antioxidants, protein, calcium, iron, carbohydrates, and healthy fats. Key ingredients like soursop and guava provide high vitamin C and antioxidants,

which help combat oxidative stress and support immune function. Masoor dal serves as a rich plant-based protein source, while nuts and seeds contribute to iron, and healthy fats, ensuring a balanced macronutrient profile. By incorporating diverse textures, this tart enhances palatability and digestibility, making it a suitable dietary option for cancer patients who often experience taste changes and nutritional deficiencies.

As global interest in functional foods and dietary supplementation grows, this nutrient-dense tart offers a practical and enjoyable way to support cancer patients'nutritional needs. With a carefully designed formulation that aligns with global supplementation strategies, it provides immune-boosting and energy-sustaining benefits crucial for recovery and overall well-being. Integrating such scientifically backed, whole-food-based formulations into oncology nutrition can enhance patient adherence, bridge dietary gaps, and contribute to a more holistic approach to cancer care worldwide.

Future trends in oncology nutrition emphasize the integration of personalized and functional foods tailored to individual patient needs, leveraging advancements in nutrigenomics and food science.The development of nutrient-dense, immune-supporting formulations like this tart aligns with the growing demand for whole-food-based dietary interventions that enhance treatment outcomes and quality of life. Innovations in ingredient processing, bioavailability enhancement, and sustainable sourcing will further refine such formulations, making them more accessible and effective. As research continues to highlight the role of diet in cancer recovery, incorporating multi-textured, nutrient-rich foods into oncology care is expected to become a standard approach in personalized nutrition strategies.

SENSORY VALUATION

SCORE CARD

HEDONIC SCALE

NAME:

PRODUCT:

DATE:

There is only one sample. Taste the samples and check how much you like or dislike each of the characteristics.

Sample	Appearance	Aroma	Texture	Taste	Overall Acceptability
Multi-Textured Tart					

9 - Point Hedonic Scale	
9	Like Extremely
8	Like very much
7	Like Moderately
6	Like Slightly
5	Neither Like nor Dislike
4	Dislike slightly
3	Dislike Moderately
2	Dislike Very Much
1	Dislike Extremely

CHAPTER-6
REFERENCE

REFERENCE

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SENSORY VALUATION

SCORE CARD

HEDONIC SCALE

NAME : SUBI

PRODUCT: MULTI TEXTURED TART

DATE: 9-02-25

There is only one sample.Taste the samples and check how much you like or dislike each of the characteristics.

Sample	Appearance	Aroma	Texture	Taste	Overall Acceptability
Multi-Textured Tart	9	9	9	9	9

9 - Point Hedonic Scale	
9	Like Extremely
8	Like Very much
7	Like Moderately
6	Like Slightly
5	Neither Like nor Dislike
4	Dislike slightly
3	Dislike Moderately
2	Dislike Very Much
1	Dislike Extremely

SENSORY VALUATION

SCORE CARD

HEDONIC SCALE

NAME: KRISHNA

PRODUCT: MULTI TEXTURED TART

DATE:9-02-25

There is only one sample.Taste the samples and check how much you like or dislike each of the characteristics.

Sample	Appearance	Aroma	Texture	Taste	Overall Acceptability
Multi-textured tart	9	8	9	9	9

9 - Point Hedonic Scale	
9	Like Extremely
8	Like Very much
7	Like Moderately
6	Like Slightly
5	Neither Like nor Dislike
4	Dislike slightly
3	Dislike Moderately
2	Dislike Very Much
1	Dislike Extremely

SENSORY VALUATION

SCORE CARD

HEDONIC SCALE

NAME: DEVIKA

PRODUCT: MULTI TEXTURED TART

DATE: 9-02-25

There is only one sample.Taste the samples and check how much you like or dislike each of the characteristics.

Sample	Appearance	Aroma	Texture	Taste	Overall Acceptability
Multi-Textured Tart	9	9	9	8	9

9 - Point Hedonic Scale	
9	Like Extremely
8	Like Very much
7	Like Moderately
6	Like Slightly
5	Neither Like nor Dislike
4	Dislike slightly
3	Dislike Moderately
2	Dislike Very Much
1	Dislike Extremely

SENSORY VALUATION

SCORE CARD

HEDONIC SCALE

NAME: KARTHIKA

PRODUCT: MULTI TEXTURED TART

DATE:9-02-25

There is only one sample.Taste the samples and check how much you like or dislike each of the characteristics.

Sample	Appearance	Aroma	Texture	Taste	Overall Acceptability
Multi-Textured Tart	9	8	8	8	8

9 - Point Hedonic Scale	
9	Like Extremely
8	Like very much
7	Like Moderately
6	Like Slightly
5	Neither Like nor Dislike
4	Dislike slightly
3	Dislike Moderately
2	Dislike Very Much
1	Dislike Extremely

SENSORY VALUATION

SCORE CARD

HEDONIC SCALE

NAME: VISHNU PRIYA

PRODUCT: MULTI TEXTURED TART

DATE: 9-02-25

There is only one sample.Taste the samples and check how much you like or dislike each of the characteristics.

Sample	Appearance	Aroma	Texture	Taste	Overall Acceptability
Multi-Textured Tart	9	9	9	9	9

9 - Point Hedonic Scale	
9	Like Extremely
8	Like Very much
7	Like Moderately
6	Like Slightly
5	Neither Like nor Dislike
4	Dislike slightly
3	Dislike Moderately
2	Dislike Very Much
1	Dislike Extremely

SENSORY VALUATION

SCORE CARD

HEDONIC SCALE

NAME: AMRITHA

PRODUCT: MULTI TEXTURED TART

DATE: 9-02-25

There is only one sample. Taste the samples and check how much you like or dislike each of the characteristics.

Sample	Appearance	Aroma	Texture	Taste	Overall Acceptability
Multi-Textured Tart	8	9	9	9	9

9 - Point Hedonic Scale	
9	Like Extremely
8	Like very much
7	Like Moderately
6	Like Slightly
5	Neither Like nor Dislike
4	Dislike slightly
3	Dislike Moderately
2	Dislike Very Much
1	Dislike Extremely