

## Biochemical, Sensorial And Novel Product Development From *Carica Papaya* Seeds: An Insight

Dr. Jyoti D. Vora<sup>1</sup>, Akshata Nayak<sup>2</sup>, Shafaque Khorajia<sup>3</sup>

1. Guide: Head, Department of Biochemistry & Food Science and Quality Control  
Ramnarain Ruia College, Matunga, Mumbai – 400019

2, 3 Student: Department of Food Nutrition and Dietetics, College of Home Science, Nirmala Niketan, Mumbai-400020

Corresponding Author: Dr. Jyoti D. Vora .

---

**Abstract:** *Carica papaya*, commonly known as papaya, pawpaw and papita; is a delicious fruit with loaded nutrients having beneficial effect on human body. Papaya also has antioxidant effects and anticancer properties which improve heart health, fight inflammation, improve digestion and help to maintain overall health and wellness.

Papaya seeds are small, round, black colored, encased in a gelatinous coat in the inner cavity of the fruit having a strong flavor similar to black pepper and small amounts of it are beneficial for overall health. The seeds contain large amounts of nutrients, including fibre (22g %) which is effective for combating constipation and other digestive problems.

The present study was undertaken with the aim of developing nutritionally enriched product with incorporation of papaya seeds and its oil; thereby enhancing the well-being.

Gastro-free churan balls were prepared using papaya seed as a main ingredient and blending it with other components like ajwain, jeera, methi, etc. Oil and water were added in the ratio of 1:2, which acted as a binding agent to form balls. The product was standardized as natural product with no added preservatives and may be aimed to relieve constipation issues.

Sensory evaluation was conducted to determine the overall acceptability of the product. Further, nutritional and shelf life study were also conducted in which it was seen that the product is nutritionally rich with diverse nutrients, including fibre (16g %).

The shelf life study was performed and it was observed that the total plate count was minimal in first few weeks, with gradual increase in later weeks. Also; the growth of spoilage organisms (coliforms, yeast and molds) originated after 2weeks indicating decline in quality and further stating the product is microbiology safe for consumption for only 2weeks. However, further study may be effective to further enhance the nutritive quality and shelf life of the product. The sensory evaluation concluded that the product was acceptable by majority of the trained panelists.

**Key Words:** Ripe papaya, Papaya seeds, proximate analysis, oil extraction, Novel Product Development, nutritional and shelf life analysis, sensory evaluation.

---

Date of Submission: 15-09-2018

Date of acceptance: 30-09-2018

---

### I. Introduction

Food is one of the most important thing for living beings to live after air and water. This shows the importance of food in life. Food in general consists of carbohydrates, proteins, fats, minerals and vitamins which are useful for living body to sustain health. Food is the core of human living. Food is not only a source of nourishment; but also a means to elevate the emotional quotient in an individual.

Different frameworks were prepared for successful product development. Consumer acceptance is of great importance. Also, Sensory Evaluation is an important criterion for overall acceptability of the novel product. The limitation and appropriateness of different sensory attributes were studied.

**About *Carica papaya* Linn:** *Carica Papaya* is commonly known as papaya, pawpaw and in Hindi it is called Papita. The Sanskrit name is Chirbhita. *Carica papaya*, is a huge herbaceous plant, resembling a tree and belonging to the Caricaceae (papaya) family, originated in Central America and is now grown in tropical areas world-wide for its large, sweet, melon-like fruits. Papayas are spherical or pear-shaped fruits. They have flesh that is rich orange in color with either yellow or pink hues.

Some varieties of papaya are:

1. Coorg Honey Dew: The plant bears greenish-yellow oblong-shaped fruits with orange thick flesh and good flavor.
2. Pusa Majesty: The fruits are medium-sized, 1-1.5 kg in weight, round in shape and have better keeping quality.
3. Pusa Delicious: The fruit is medium-sized (1-2 kg) with deep orange flesh having excellent flavor
4. Washington: Fruits are round to ovate, medium-large in size with few seeds. When fruit ripens, the color of fruit skin attains a bright yellow color.
5. Pusa Dwarf: It is dioecious variety which contains dwarf plants and medium-sized (1-2 kg) oval fruits.
6. Solo: The fruits are small with deep pink pulp and a sweet taste.
7. Ranchi: The fruits are oblong with dark yellow pulp and sweet taste.

Papaya seeds are round, black and crunchy to bite; having a strong flavor (slightly bitter, spicy and peppery) that is a cross between mustard seeds and mild peppercorns. Papaya seeds are rich in providing multiple health benefits but still they are used in moderation. Due to its tremendous medicinal properties it can be used in various products. Papaya seeds can be used as dressing on salads, yogurts, smoothies, eggs, soups, granola bars and mix, cereals and others. Papaya seeds are a natural and healthy alternative to black pepper with a similar taste profile.

## **II. Review Of Literature**

A detailed and exhaustive review of scientific literature highlights the following aspects of *Carica papaya* as a research endeavor:

1. Papaya is considered as nutraceutical fruit due to its multifaceted medicinal properties. The notable therapeutic properties of papaya include anti-fertility, diuretic, anti-hypertensive, anti-helminthic; wound healing, antifungal, antibacterial, antitumor and anti-oxidant.
2. In one study, the physiochemical properties of papaya seed oil were investigated and the oil obtained was found to have high oxidation resistance.
3. Research showed that the leaf extract of papaya was found to cure dengue fever by increasing the platelet count, WBC count and neutrophil count.
4. The Papaya seed water extract was found to have antioxidant activity and also has protective and curative properties.
5. *Carica papaya L.* (Caricaceae) is traditionally used to treat various skin disorders, including wounds, thereby evaluating the wound healing and anti-microbial activity of *C. papaya*.
6. The fatty acids recognized in the seed extracts of *C. papaya* (from ripe fruit) are considered to reduce the number of parasites from parasite stages.
7. Papaya seeds as a rich source of biologically active isothiocyanate which are effective against certain cancers.
8. Papain and lycopene, the enzymes present in papaya, are capable of inhibiting both formation and development of cancer cell.
9. One study evaluated wherein papaya seed flour was incorporated in hamburgers and its technological and sensorial qualities were evaluated. Incorporation of seed flour improved the technological quality in terms of cooking yield, moisture retention, and reduced shrinkage. Furthermore, the sensory quality of the burgers was not diminished.
10. The oil from *Carica papaya* has high fat as well as possesses antioxidant properties which could provide nutritional and health benefits when consumed.
11. The essential oil extracted from papaya seed was shown to have antifungal activity as when tested, they showed to have inhibitory effect against all the tested *Candida* strains.

## **III. Aims And Objectives**

- The aim of research endeavor is to extract essential bioactive from *Carica papaya* seeds and use them in development of an innovative and cost-effective product which would be subjected to Total Quality Management (TQM) and organoleptic analysis.
- To develop a novel product having a positive impact on human health and wellness.
- To develop a nutritionally enhanced product which would be subjected to Total Quality Management (TQM) and organoleptic analysis.
- To carry out proximate analysis to determine the physical and chemical properties of seed and extracted bioactive.
- To carry out shelf life study to analyze spoilage by any microorganism.

- To carry out Hazard Analysis Critical Control Point (HACCP) of the novel product.
- To manage Critical Control Points (CCP's) of novel product through modular approach.
- To look into the quality control of the developed product
- To carry out sensory evaluation and organoleptic analysis to understand the acceptability of the developed product for consumers.

#### **IV. Materials And Methods**

**Papaya Fruit:** Whole papaya fruit were obtained from local fruit market in Mumbai, India and care was taken that the ripe fruit was fresh and without any external damage.

**Pretreatment of papaya fruit:** Obtained papaya were washed, wiped and stored in cold (refrigeration).

**Sample preparation:** Seeds of papaya fruit were collected and washed with water to eliminate the pulp residues; then dried under sun light and then packaged and stored at room temperature for further analysis.

**Sun drying** (1 to 2 weeks): The seeds were spread in thin layer on a thin cloth and were kept under sunlight for over 1-2 weeks to dry completely. Further, it is ground into coarse powder using electric grinder/mixer. This was stored in air tight container for further proximate analysis, novel product development and oil/bioactive extraction.

The seeds can be dried in a dehydrator for approximately 4 hours at 70°C. The optimum temperature for dehydration is 50-70°C.

#### **Chemical composition papaya seed and Novel Product (Gastro-free Churan balls):**

The Official Methods of Analysis of the Association of Official Analytical Chemists (AOAC) 18th edition (2005) and 12th edition (1978) were used to determine the carbohydrate, energy, crude fiber, protein and fat content of seed, while the determination of ash and moisture contents was done according I.S. 4333 [Part II]: 2002 methods of analysis of food grains Part II moisture and AOAC, 17th edition official methods 923.03 respectively. For the analysis of novel product, in addition to the macro-nutrient analysis, certain micro-nutrients were also estimated such as calcium, iron and vitamin C by using AOAC methods, 1978 and 2005.

#### **Chemical properties of oil:**

The Official Methods of Analysis of the Association of Official Analytical Chemists (AOAC) 18th edition (2005) were used to determine chemical properties of oil such as the saponification value, iodine value and acid value.

#### **Sensory Evaluation:**

- a. A sensory evaluation was performed with-
  - Extracted papaya seed oil
  - Novel product (Gastro free churan balls)
- b. The extracted papaya seed oil was presented to the semi-trained panelists from ASTM certified laboratory for the aroma and olfactory acceptability
- c. A questionnaire comprising of 17 questions was prepared and given to a panel of trained members. The initial part of the evaluation was non invasive and latter part was invasive which includes the tasting of the samples.
- d. The samples were analyzed by visual, olfactory and gustatory response.

**Shelf life studies:** For shelf life studies, microbial analysis were done where total plate count, yeast and mold count and coliform count were used to determine spoilage by molds or coliform for a period of 1month.

#### **Oil extraction:**

Oil was extracted from the dried seeds. The extraction was performed in a Soxhlet apparatus with petroleum ether as solvent at a temperature of 70°C for a period of 3-4 hours. The solvent was recovered in a rotary vacuum evaporator, and the oil was extracted.

#### **Novel Product Development: Gastro-free churan balls:-**

Gastro-free churan balls were prepared by incorporating papaya seed and papaya seed oil and were standardized as natural product with no added preservative.

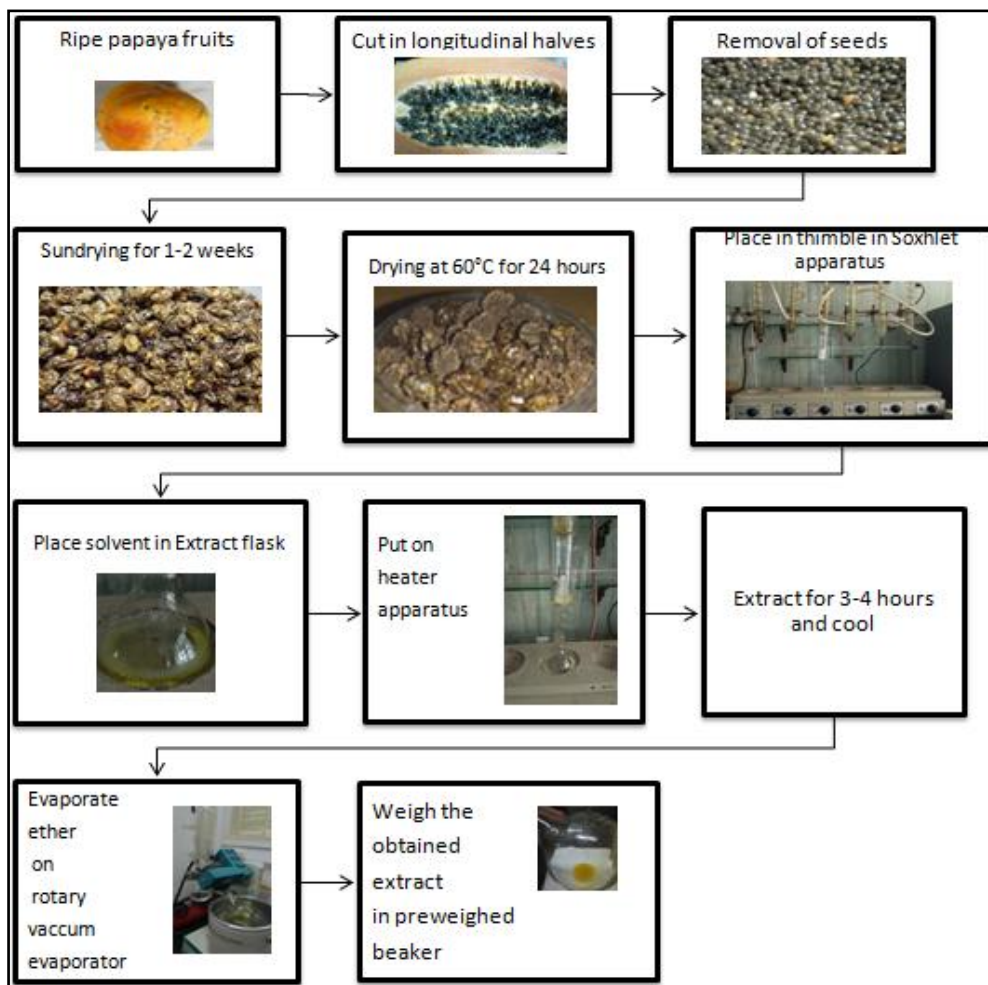


Fig. 1: Flow Chart For Oil/ Bioactive Extraction (Soxhlet Apparatus)



Fig. 2: Flow Chart For Novel Product Development

## **V. Assessment Of Critical Control Points (CCPs) In The Production Of Gastro Free Churan Balls**

HACCP is a systematic approach with the point of food safety to identify and control risks and hazards associated with a particular food, production process or practice.

It is a system which manages food safety in all aspects and directs it to control any biological, chemical, and physical hazards occurring during production, procurement and handling, and also manufacturing, distribution and consumption of the finished product.

The main aim of HACCP system is to prevent any hazards occurring in the production process which causes the finished product to be unsafe and also to design appropriate steps to reduce these risks to safe level. Developing an efficient HACCP system basically helps in achieving consistent product quality by minimizing hazards that indirectly inculcate in each level of manufacturing.

### **Identification of Critical Control points:**

A critical control point (CCP) is a point in a food manufacturing and production process at which control can be applied and, as a result, a hazard can be prevented, eliminated, or reduced to an acceptable level.

### **Critical Control Points for Gastro-free Churan Balls**

#### ➤ **Raw materials:**

1. Papaya seeds, ajwain seeds, cumin seeds, fennel seeds, coriander seeds, fenugreek seeds, rock salt, black salt, asafoetida, black peppercorns should be clean, whole, entire and not broken, should be fresh and of good quality.
2. Papaya seed oil used should be fresh and not rancid.
3. The water used for kneading should be potable.

#### ➤ **Process control:**

1. During extraction of oil, the Soxhlet apparatus should be maintained at 70°C and there should be continuous water flow to the unit for proper extraction.
2. Avoid excess roasting as it causes discoloration and burnt odors and flavor to the product.
3. The ingredients should be used in proper proportions.

#### ➤ **Addition and mixing of all the ingredients:**

1. The Gastro-free churan balls should be of desired consistency.
2. The raw materials after roasting and grinding into refine powder are to be added and mixed well in a clean and dry utensil.

#### ➤ **Harvesting of the product:**

1. The product should be filled in a clean sterilized air tight container.
2. Keep at room temperature and maintaining proper conditions until further use.

#### ➤ **Finished Product Inspection:**

1. The final product should have nice visual appeal, proper nutritional blend and also minimal microbial factor.

#### ➤ **Storage:**

1. The Gastro-free should be stored in clean, dry and sterilized air tight containers.

#### ➤ **Sensory evaluation:**

1. The product should be presented in a clean dry container.

## **VI. Assessment Of Organoleptic Acceptability (Sensory Evaluation)**

Sensory evaluation is quite important in food industry. Starting from product development, products are evaluated in terms of their sensory attributes to get their profile and to know if their target consumers would prefer to buy them.

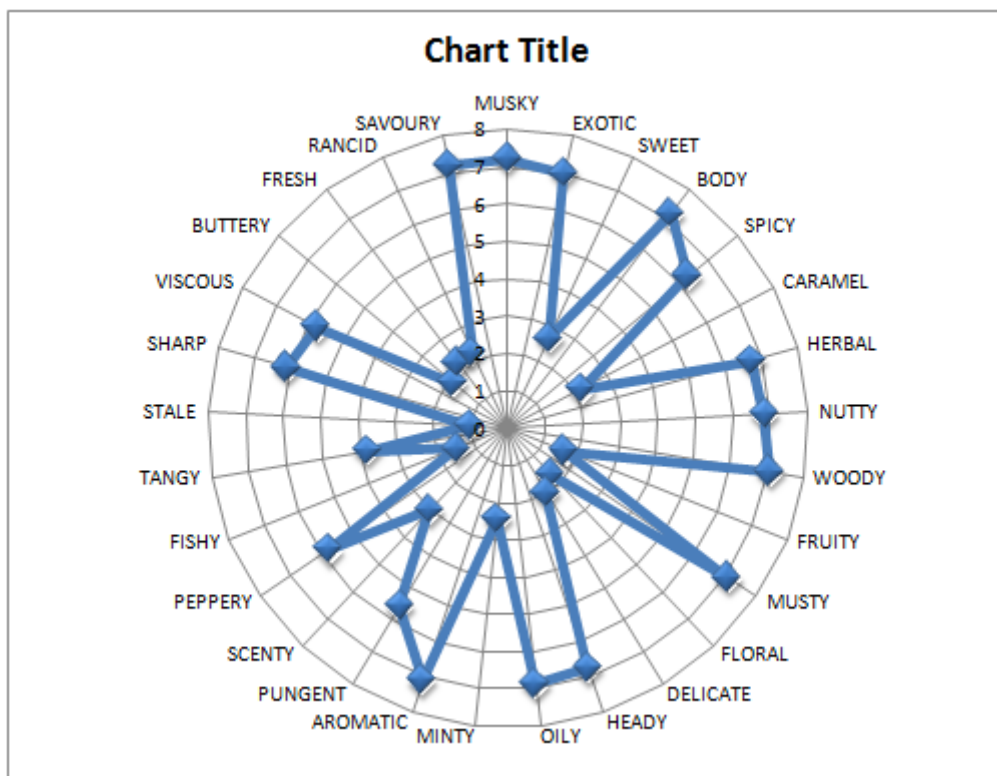
Sensory evaluation is a critical component in measuring the success of food product. It is one of the major component to understand the overall acceptability of the novel product amongst consumers or panelists. Historically, it has been associated with product experts and later as a more passive member of product development team.

Sensory evaluation plays a proactive role in generating new product ideas based on sensory attributes and consumer segments which are identified only through sensory behaviour.

The most widely used scale for measuring sensory for measuring acceptability of products is Hedonic scale.

**A) Papaya seed oil (Appearance & Odor/Aroma):**

The appearance and odor were evaluated by trained panel in an ASTM certified laboratory.



**Fig.3: Representation Of Sensory Evaluation Of Oil (Spider Web)**

The above figure depicts trained panelist's perception towards the product i.e. the papaya seed oil. The radar shows the average rating of the various sensorial characteristics basically the Aroma and Olfaction attributes of the oil. The oil analyzed by the panelists suggested a sharp, peppery aroma with an herbal trace.

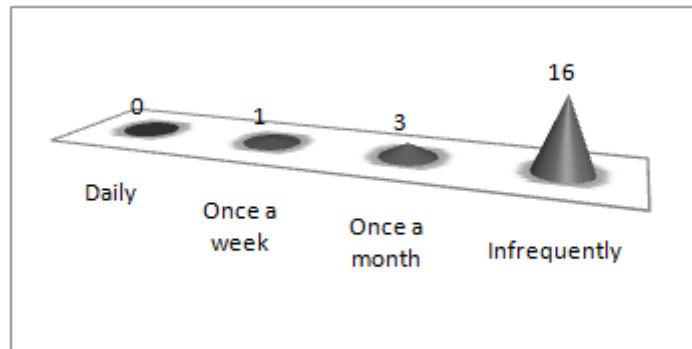
**B) Sensory Analysis of Gastro-free churan balls:**



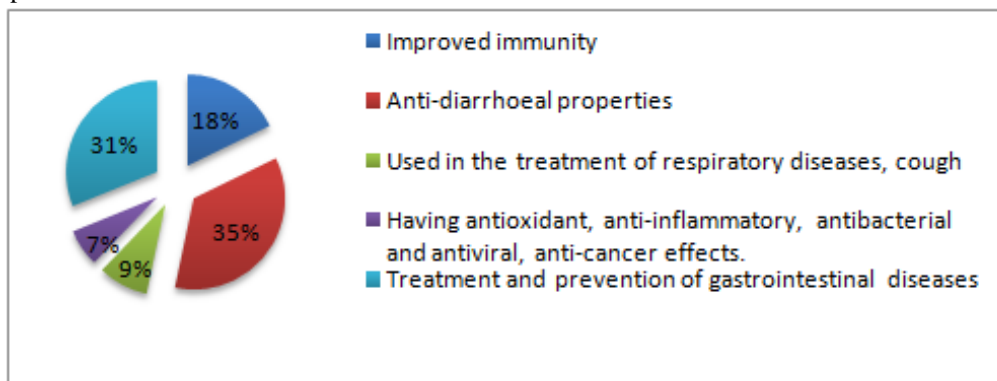
**Fig 4: Gastro-Free Churan Balls**

**i) Data Analysis- Non-invasive**

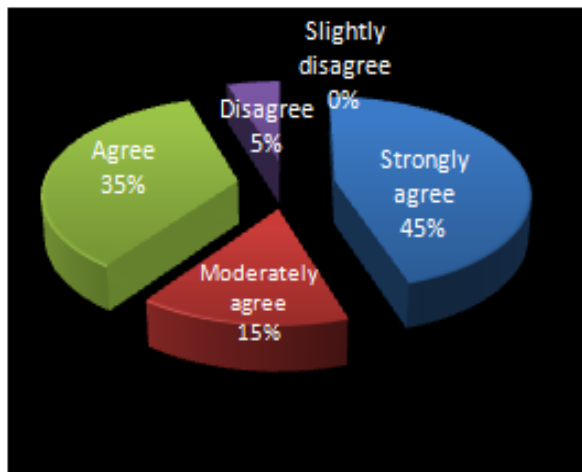
Panelist opinion on how often they consume churan.



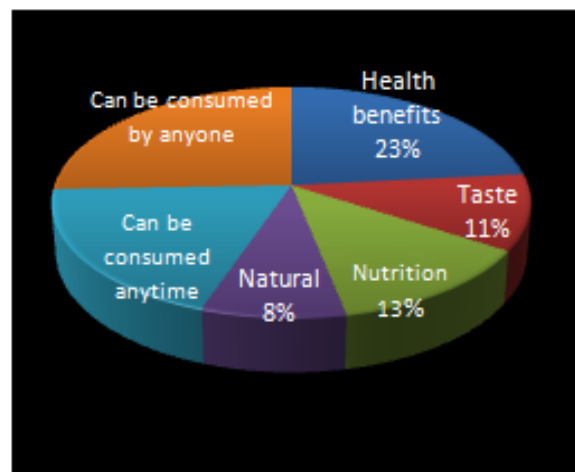
Panelist opinion on health benefits of churan.



Panelist opinion on idea of churan balls with incorporation of papaya seeds and its oil

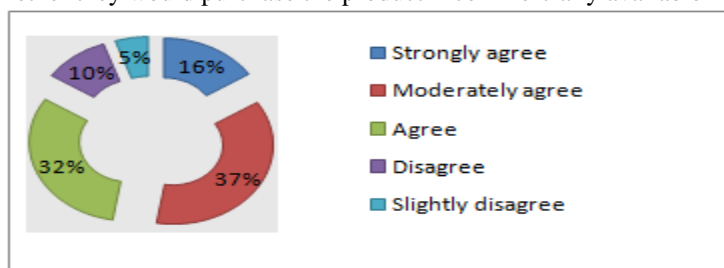


Panelist opinion on what qualities of churan appeals to them.

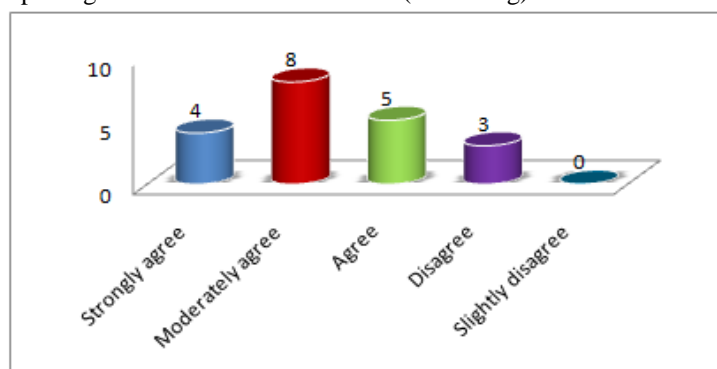


ii) Data Analysis-Invasive

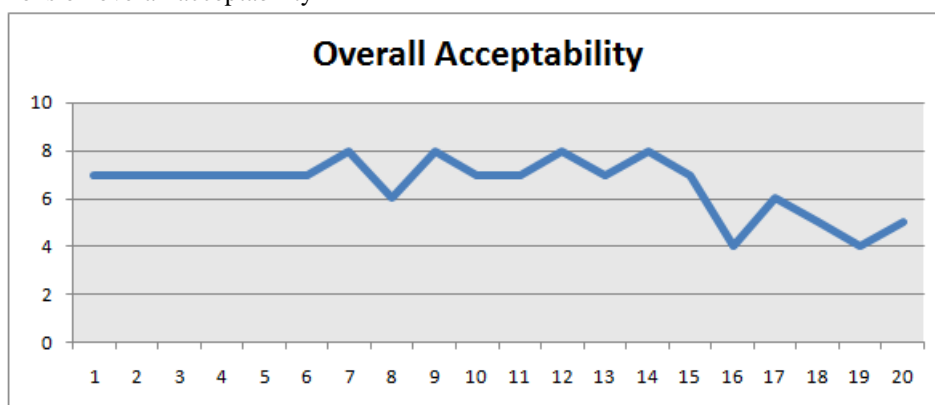
Panelist opinion on whether they would purchase the product if commercially available



Panelist opinions in the pricing of Gastro-free Churan balls (Rs.90/50g)



Panelist opinions on overall acceptability



Sensory Evaluation was carried with 20panelists through non-invasive and invasive questionnaire. The average rating of the various sensorial characteristics namely appearance, color, aroma, texture, and flavor were analyzed and overall acceptability was evaluated. The scores range from 5-8 points which fall in the category of moderate likeness. Hence, concluding to be acceptable among panelists. All the respondents agreed to consume as well as buy the product if it were to be marketed, Along with that the respondents are willing to spend more when it comes to health.

VII. Results And Discussions

A) Proximate Analysis of Papaya seed:

The papaya seeds were analyzed for its chemical composition and average values were tabulated in Table 1

Features	Chemical composition per 100g
Energy	374.47 kcal,
Crude fibre	21.96g%
Carbohydrate	31.94g%,
Crude fat	26.36g%
Crude protein	2.33g%,
Moisture Content	10.5%,
Ash content	6.91%.

Table 1: Chemical composition of papaya seeds



**B) Physical and chemical properties of the oils:**

The oils extracted presented an orange yellow color with the characteristic odor of papaya pulp. The physicochemical properties of the oils are described as below:

Features	Papaya seed oil		
Iodine Value	82.49		
Saponification Value	280.5		
Acid Value	Day 1	4.21	
	After 1 month	10.69	

**Table 2:** Physicochemical properties of Papaya seed oil (by solvent extraction)

The oil represented an acid value of 4.21, good preservation and chemical stability. The saponification ratios showed that the average molecular weight of the total fatty acid triglycerides is high. The iodine values expressed in (g I.100-1) oils obtained from the seeds were: 82.49 indicating the absence of high levels of trans fatty acids.

**C) Nutrient Analysis of Gastro-free churan balls:**

The nutritional analysis of the product was carried out to give the following results:

Nutrition Facts		
Serving Size: 1 or 2 balls after meal or anytime necessary		
Yield: 50g		
	Amounts per 50g	Amounts per 100g
Energy (kcal)	222.5	445
Carbohydrate (g)	3.96	7.92
Crude fibre (g)	7.8	15.6
Protein (g)	20.5	41
Total Fat (g)	5.54	11.08
Calcium (mg)	66.67	133.3
Iron (mg)	20.84	41.67
Vitamin C (mg)	416.67	833.34

**Table 3:** Nutrient calculations as per chemical analysis

Based on the above obtained results, it could be seen that the product is nutritionally rich with diverse sources of all nutrients. Thus, the product can be used in a defensive nutrition plan with no perceived harm even if consumed in excess.

**D) Shelf-life studies:**

Microorganisms are ubiquitous in nature and they play major role in food spoilage. Foods are rich in variety of organic compounds and many bacteria are able to decompose them because of which many kinds of chemical changes can occur in food products.

Microbiological testing was carried out to check for gradual deterioration of product over a span of 1month. In initial few weeks (0-2) only Nutrient agar showed growth, this may be due to handling and processing. The spoilage organism, coliform and yeasts & molds, growth emerged after week 2 storage which indicates a significant decline in the quality of the product. The microbial content in nutrient agar showed a 10-fold increase along with growth of yeasts and molds in Sabourauds Agar and coliform in MacConkey Agar. The growth of spoilage organism is indicative of an end to shelf life studies making it unfit for consumption. However, to check further deterioration of product, it was placed for one more week, wherein it showed presence of a large no. of viable organisms in both Nutrient and Sabourauds agar. Hence it can be concluded that the shelf life was found to be 2 weeks. The shelf life maybe increased by addition of appropriate preservatives, use of proper packaging material and also by maintaining the proper storage conditions.

**E) Sensory Evaluation**

1. Majority of panelists (90%) consider churan as healthy while rest (10%) disagrees.
2. 50% of the panelists like churan while rest don't. This may be due to flavor aspects.
3. Majority (80%) of panelists do not consume churan frequently.
4. 95% of panelists appreciated the idea of incorporation of papaya seed and its oil in a product.

5. After invading the product and assessing the attributes; majority (50%) of panelists indicated sharp taste; followed by mixed (45%) and bitter (35%).
6. 50% of panelists would like to consume the product again while other suggested for minute modifications.
7. 80% of the panelists prefer to consume churan balls after a meal.
8. 55% panelists consider consuming churan balls after dinner; followed by 25% after lunch and 20% anytime during the day.
9. 85% of the panelists consider the product as value for money.
10. 57% prefer laminates while 38% prefer plastic bottles as packaging material based on convenience.
11. Majority (85%) would buy the product if marketed while rest 15% would like a modified version.

**F) Packaging:**



**Fig 5: PET BOTTLE PACK**

### **VIII. Conclusion**

Papaya seeds are black, round seeds encased in a gelatinous-like substance in the inner cavity of the papaya fruit. They are usually discarded or thrown out without any treatment or use. The papaya seeds have a positive effect on health. They also have therapeutic properties and also are of medical importance. The results of this study show that papaya seeds have high nutritional value, and their flours can be used in the composition of human and/or animal feed in the category of a functional food. Gastro-free churan balls possess the novel ingredients such as papaya seed and its oil which are natural and would help to relieve constipation issues, has an acceptable organoleptic profile and benefit overall health and wellness.

The product was packed in PET bottles to maintain the shelf life and product safety. As PET bottles have barrier properties, resistance and temperature tolerances, they are supposed to be suitable for the product. The product was marked with a suitable label with basic guidelines to be met.

Thus, Gastro-free churan balls was nutritiously developed with good keeping quality, by maintaining the good laboratory practices, reducing any hazard and were sensorily accepted by the panelists.

### **Acknowledgement**

We; Akshata Nayak and Shafaque Khorajia, students of College of Home Science- Nirmala Niketan; would like to record our appreciation to all people involved directly or indirectly in successful completion of this research paper. We acknowledge with gratitude our Principal Dr. Geeta Ibrahim for providing the best possible resources in the college. We owe a deep sense of gratitude to our mentor and guide Dr. (Mrs.) Jyoti D. Vora for her guidance and support in all the possible ways. She was a constant source of inspiration and motivation throughout the period. We would also like to thank the non-teaching staff - Mr. Sunil and Mr. Vinayak of our department for helping us in every possible way. Certainly, thanks to all the respondents for their co-operation in answering the questionnaires.

### References

- [1]. C.R. Kothari, Research Methodology Methods and Techniques- 2<sup>nd</sup> Edition, (New age international (P) Ltd. Publishers. ISBN 81-224-1522-9).
- [2]. I.S. 4333 [Part II]: 2002 methods of analysis of food grains Part II moisture
- [3]. AOAC, 17th edition official methods 923.03
- [4]. Official Methods of Analysis of the Association of Official Analytical Chemists (AOAC) 18th edition (2005)
- [5]. Official Methods of Analysis of the Association of Official Analytical Chemists (AOAC) 12th edition (1978)
- [6]. B. Srilakshmi; Food Science; New Age International Publishers; 5th Edition
- [7]. Sensory Evaluation Practices; Introduction to Sensory Evaluation; 3rd Edition; <http://v5.books.elsevier.com/bookscat/samples/9780126726909/9780126726909.PDF>
- [8]. HACCP Guide for Spices & Seasonings; American Spice Trade Association, Inc.; April 2015; Printed in USA

IOSR Journal of Biotechnology and Biochemistry (IOSR-JBB) is UGC approved Journal with Sl. No. 4033, Journal no. 44202.

Dr. Jyoti D. Vora1" Biochemical, Sensorial And Novel Product Development From Carica Papaya Seeds: An Insight." IOSR Journal of Biotechnology and Biochemistry (IOSR-JBB) 4.5 (2018): 48-58.