ORIGINAL ARTICLE e-ISSN: 2349-0659 p-ISSN; 2350-0964

Nutrient Dense Ready to Prepare *Meetha cheela* for Elderly People at Risk of Malnutrition

Vyoma Agarwal*, Ila Joshi

Abstract

Elderly people suffer from a number of physical, psychological, and social changes which makes them vulnerable to malnutrition. These changes present the need to develop nutrient dense products which can be easily prepared by them. The present study was planned with the objective to prepare such a product. The ingredients for the ready to prepare (RTP) *sweet cheela* mix were subjected to various processing techniques to increase nutrient availability and digestibility. A combination of wheat, green gram whole, and finger millet *(ragi)* was used in different proportions (15%, 30%, 45%, and 60%) in the first stage of value addition. Value addition was carried out in the most acceptable variation from Stage 1, using processed mango, nuts, and oilseeds in different proportions (10%, 20%, and 30%). The RTP *meetha cheela* mix of the most acceptable variation was selected through sensory evaluation and then subjected to biochemical analysis and shelf life assessment. The results revealed MCF3 (30%) to be the most acceptable variation after Stage 2 value addition, which contained flours of malted finger millet, wheat, green gram along with dried ripe mango, almonds, raisins, sunflower seeds, and sesame seeds. The prepared mix had statistically significant higher amount of fat, fiber, ash, carbohydrate, energy, Vitamin C, β carotene, Vitamin E, calcium, potassium, and total antioxidant activity. Low moisture levels and vacuum packaging provided the product a good shelf life till 3 months.

Keywords: Antioxidants, Elderly, Macro nutrients, Micronutrients, Nutrient dense, Ready to prepare, Total antioxidant activity, Value added

Asian Pac. J. Health Sci., (2022); DOI: 10.21276/apjhs.2022.9.2.29

Introduction

Population aging is one of the most discussed global phenomena in the present century. Countries with a large population like India have a large number of people aged 60 years or above.[1] Aging is a multidimensional process of physical, psychological, and social changes in humans. Elderly people are suffering the triple burden in respect of high burden of morbidity, social negligence, and financial dependency. These changes typically alter eating habits and reduce nutrient availability and absorption, which can lead to nutritional deficiencies and various health problems.[2] It is difficult to maintain dietary quality with an overall low intake of energy levels. There is a gap in the recommended nutrient intake from diets, which support disease prevention and health promotion and actual nutrient consumption in elderly people older people become vulnerable to malnutrition because of these reasons.[3]

Problems such as, tremors, weaknesses, problems with gripping, and lifting the arm and hand lead to problems associated with preparing food, clearing table, serving food in plate, and holding the plate. Problem in shopping, carrying a shopping bag, cooking food, chewing, and self-feeding may lead to energy deficiency among them.[4] These problems often lead to feelings of guilt and shame. Practice of opting for smaller meal portions, reducing the frequency of meals and inability to cook independently, have been linked with increasing risk of malnutrition.[5]

The dietary guidelines for the elderly people emphasize the value of nutrient-dense and high-quality foods. Some elderly people live alone or only with their spouses. Cooking for one or two people is not very stimulating. Availability of "ready-meals" might present an opportunity to have better healthier food choices. Such meals can also help in reducing the risk of a monotonous diet for elderly persons who do not know how to cook and have a low interest in cooking related activities.

Department of Home Science, IIS (Deemed to be University), Jaipur, Rajasthan, India.

Corresponding Author: Vyoma Agarwal, Department of Home Science, IIS (Deemed to be University), Jaipur – 302 020, Rajasthan, India. E-mail: vyoma.agarwal@iisuniv.ac.in

How to cite this article: Agarwal V, Joshi I. Nutrient Dense Ready to Prepare Meetha cheela for Elderly People at Risk of Malnutrition Asian Pac. J. Health Sci., 2022;9(2):146-151.

Source of support: Nil

Conflicts of interest: None.

Received: 03/11/21 **Revised:** 04/12/21 **Accepted:** 27/01/22

Methodology

A ready to prepare (RTP) mix was developed for the elderly people namely, *Meetha cheela* (sweet pancake). It is a commonly consumed, soft, sweet snack. Emphasis was laid on increasing nutrient density of *Meetha cheela*, providing good quality protein, making it micronutrient rich, antioxidant rich, fiber rich, and substitute refined sugar with fruit sugar. Value addition was carried out by the use of processing techniques and nutrient rich foods, suitable for elderly people.

Selection of Food Ingredients

Keeping in mind the nutritional requirement of elderly people, food ingredients for developing RTP recipes, were selected from different food groups. This included foods rich in protein (green gram whole and skim milk powder), fiber (whole wheat, finger millet, and green gram whole), β carotene (ripe mango), iron (finger millet), calcium (skim milk powder, finger millet, almond, sunflower seeds, and gingelly seeds), and Vitamin E (almonds and sunflower seeds).

Application of Processing Techniques on Raw Food Items

Processing of the raw pre-treated food items was done to increase digestibility, nutrient retention, shelf-life, and to check enzymatic deterioration. Different processing techniques were applied depending on the use of food items in the development of nutritious RTP products.

Blanching

The vegetables were dipped into boiling water (80–90° C) for a minute and then immersed into iced water.[6]

Drying

The fruits and vegetables were dried using vacuum dryer at National Institute of Food Technology Entrepreneurship Management (NIFTEM), Sonipat.

Malting

The whole grains were steeped in water for a period of 10 h. After 10 h, the water was drained and the grains were kept at a temperature of 25–30°C for germination, for 48 h.[7] The moisture from the germinated grains was removed by spreading on a blotting paper. Drying of these germinated grains was carried out in a hot air oven at 60°C. The dried cereals were then ground in an electric grinder to a fine powder and stored in air tight containers.

Preparation of RTP *Meetha cheela* (Pancake) Mix

The basic recipe of RTP *Meetha cheela* mix was standardized and was treated as control for comparison purpose. It was coded as MC111 in which 40 g wheat flour, 40 g skim milk powder, and 1 g cardamom were used. All the three ingredients were mixed and vacuum packed in aluminum foil Mylar bags of 0.08 mm thickness.

Stage I - Value Addition of RTP *Meetha cheela* Mix and Sensory Evaluation

Value addition of the control RTP *Meetha cheela* recipe was carried out by incorporating processed cereals and pulses in varied proportions. First, wheat flour was totally replaced with malted wheat flour. Thereafter, a flour was developed by combining malted green gram flour and malted finger millet flour in the ratio of 1:1. This developed flour substituted the malted whole wheat flour in different proportions, namely, 15% (MC112), 30% (MC113), 45% (MC114), and 60% (MC115).

Sensory evaluation of the *cheelas* prepared from four variations was carried out by a panel of ten semi trained judges comprising faculty members from IIS (deemed to be University), Jaipur. For assessment, 9-point hedonic scale was used and a comparison was made with the control recipe.

Stage II - Value Addition of Malted *Meetha cheela* Mix and Sensory Evaluation

Value addition of the most acceptable variation from Stage I was done, using a mixture of dried ripe mango powder along with roasted almonds, sesame seeds, and sunflower seeds and raisins in the ratio 1:1:1:1:1. The malted cereal pulse mix of RTP *Meetha cheela* was substituted with the fruit-seed-nut mixture in different proportions, namely, 10% (MCF1), 20% (MCF2), and 30% (MCF3). Sensory evaluation was performed by the same panel of judges, using 9-point hedonic scale to select the most acceptable nutritious RTP *Meetha cheela*.

Reconstitution

50 ml water was added to the nutritious *Meetha cheela* mix to make a batter. Thereafter, the pancakes were prepared by spreading the batter on a hot griddle and cooking on a low flame for 3 min. Addition of sugar/jaggery/sweetener, and ghee was optional.

Nutritional Analysis

Nutritional analysis of macro and micronutrients (moisture, ash, protein, crude fiber, fat, carbohydrates, β-Carotene, Vitamin C, Vitamin E, sodium, potassium, calcium, iron, and omega 3 fatty acid) and assessment of total antioxidant activity of the nutritious RTP *Meetha cheela* were carried out in the Research laboratory of the department of Home Science. Estimation of some of the nutrients, namely, β-Carotene, Vitamin E, and Omega 3 fatty acid done at Sima Labs, New Delhi.

Assessment of Shelf Life

Shelf life of vacuum packed RTP *Meetha cheela* mix was assessed over a period of 3 months at an interval of 15 days, on the basis of its sensory, biochemical, and microbiological parameters. Sensory evaluation was performed by a panel of ten judges, using 9-point hedonic scale. Peroxide value, moisture content, Vitamin C, and Vitamin E content and total antioxidant activity of the mix were analyzed, using standard methods. Microbiological analysis was done, using total plate count method, coliform count, and fungal count methods.

Results And Discussion

Sensory Evaluation of *Meetha cheela* (Stage I Value Addition)

Stage I value addition was carried using malted green gram and malted finger millet flour, which were added in the control recipe of *cheela* (MC111) in different proportions and coded as MC112 (15%), MC113 (30%), MC114 (45%), and MC115 (60%). The result of sensory evaluation on the basis of various sensory attributes is presented in Figure 1. The mean scores of *Meetha cheela* (stage I value addition) for color ranged between 8.0 ± 0.94 and 7.4 ± 0.84, appearance 8.0 ± 0.94 and 7.4 ± 0.8, texture 8.0 ± 0.94 and 7.3 ± 0.67, taste 8.0 ± 0.81 and 7.1 ± 0.87, after taste 7.9 ± 0.87 and 7.3 ± 1.25, and overall acceptability 8 ± 0.94 and 6.9 ± 0.87. Of all the variations MC114 scored maximum for all the attributes. It was also observed that the mean score for taste of MC114 (8 ± 0.81) was even higher than that of control cheela MC111 (7.8 ± 0.63). Variation MC115 had the lowest mean scores for all the sensory attributes. Statistical analysis showed non-significant difference in scores all attributes across all the variations ($P \leq 0.05$).

In a study by Shelly,[8] malted finger millet was developed and compared with the unmalted finger millet porridge. Porridge developed, using 5% of malted finger millet flour and milk, had

higher sensory acceptance in terms of color, appearance, flavor, and overall acceptability in comparison to control. Malting had a significant positive influence on all the sensory parameters. Desai[9] too reported higher acceptability of cakes developed using malted finger millet flour. The sensory scores of supplemented cake samples (20%, 40%, and 60%) malted finger millet flour for all the sensory attributes were same as that of control sample.

Sensory Evaluation of *Meetha cheela* (Stage II-Value Addition)

The most acceptable variation of *Meetha cheela* from stage I (MC114) was selected for Stage II value addition and a fruit-nut-seed mix was added to it for further nutrient enhancement in different proportions. These were then coded as MCF1 (10%), MCF2 (20%), and MCF3 (30%) [Table 1]. Sensory evaluation of these *cheelas* was carried out, using 9-point hedonic scale. Figure 2 shows the mean sensory scores obtained for the three variations of *Meetha cheelas.*

Results of sensory evaluation revealed that MCF3 had the highest mean scores for color (8.2 ± 0.63), appearance (8.1 ± 0.87), texture (7.8 ± 0.66), taste (8.2 ± 0.78), after taste (8.1 ± 0.56), and overall acceptability (8.0 ± 0.81), as compared to the control (MC114) and other variations. The increase in acceptability seems to be due to increase in amount of fruit-nut-seed mixture. However, this mixture could not be added beyond 30%, due to decrease in binding capacity of the *cheela* batter. Statistical analysis revealed difference in scores to be non-significant for all the attributes across all the variations at 5% level of significance.

Proximate Nutrient Content of RTP *Meetha cheela* Mixes

Macronutrient content of the control (MC111) and the most acceptable value added RTP *Meetha cheela* mix (MCF3) was analyzed. Analysis of the proximate nutrients was carried out using standard techniques and chemicals of analytical grade. The analysis was conducted in triplicates for both the mixes. The results are presented in Table 2.

Nutrient estimation results of value added RTP *Meetha cheela* (MCF3) revealed mean content of protein (26.56 ± 0.97), fat (5.34 ± 0.72g/100 g), fiber (6.13 ± 0.67g/100 g), ash (0.95 ± 0.09g/100 g), and energy (376.18 ± 1.02Kcal/100 g) to be significantly higher than that of control recipe (MC111).

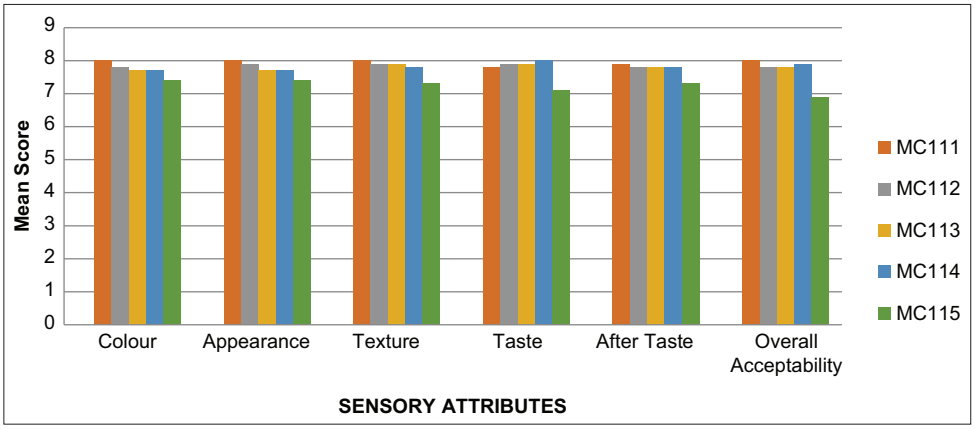

Figure 1: Mean sensory scores of *Meetha cheela* (Stage I-value addition)

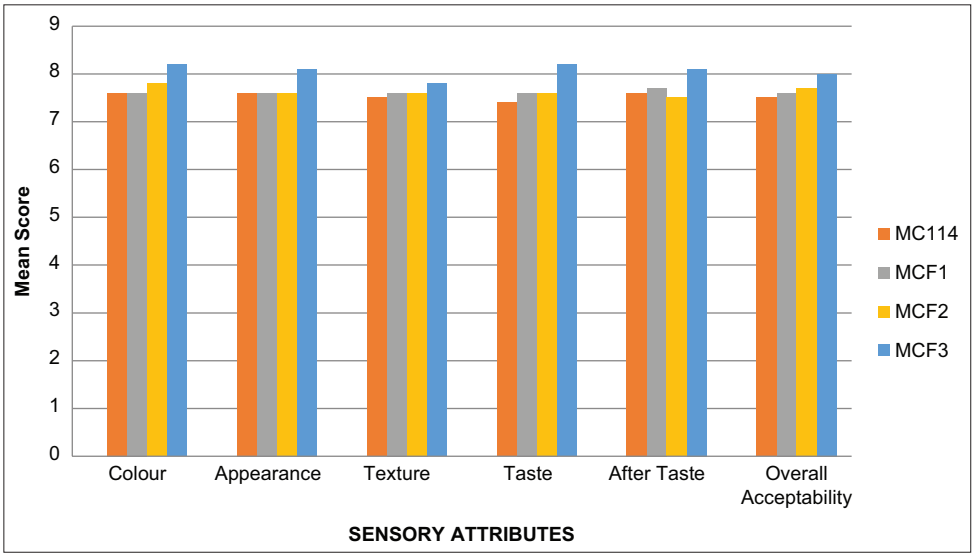

Figure 2: Mean sensory scores of *Meetha cheela* (Stage II-value addition)

Protein content too increased after value addition, however, not significantly.

Micronutrient Content of RTP *Meetha cheela* Mixes

Micronutrients of importance during old age are iron, calcium, sodium, and potassium. These were analyzed for both MC111 and MCF3, using standard procedures. The results are shown in Table 3.

The mean iron content of value added MCF3 (3.21 ± 0.35mg/100 g) was significantly ($P \leq 0.05$) higher than the mean iron content of control MC111 (2.75 ± 0.67mg/100 g). The mean calcium content of MCF3 (784.84 ± 0.76mg/100g) too, was found to be more than that of MC111 (700.47 ± 1.23mg/100 g) and the difference was significant at 5% level of significance. The estimated amount of sodium and potassium was 1.03 ± 0.42 mg and 155.5 ± 1.34 mg/100 g for MC111, respectively, and 1.98 ± 0.54 mg and 305.57 ± 0.67 mg/100 g for MCF3, respectively. Increment in sodium and potassium content was almost double. Statistically, content of all the four minerals, namely, iron, calcium, sodium, and potassium increased significantly on value addition ($P \leq 0.05$).

Mean Antioxidant Content of RTP *Meetha cheela* Mixes

The nutrients that act as antioxidants, namely, β-carotene, Vitamin C, and Vitamin E were also analyzed for their content, using standard methods. Results are presented in Table 4.

The estimated mean value for β-carotene in MC111 was 1.33 ± 0.32μg/100 g and it increased significantly ($P \leq 0.5$) to 265.37 ± 1.97μg/100 g on value addition (MCF3). The amount of Vitamin C in MCF3 was 5.89 ± 0.87mg/100 g which was found to be negligible in MC111. Vitamin E too, was significantly higher in MCF3 (1.62 ± 0.45mg/100 g) as compared to MC111 (0.1 ± 0.17mg/100 g). Thus, significant increase in the content of all the three antioxidants was observed in the nutritious *Meetha cheela***s**. The results of the present study were in line with the results of other researches. An increase in the protein content, with the incorporation of malted finger millet and sprouted green gram in the weaning food was observed in another study. Ash content of weaning food increased with increase in level of finger millet and green gram, which could be due to high ash content of green gram. Fiber content in weaning food increased with increased proportion of finger millet, which seems to be due to high fiber content of finger millet. Mineral content too, was reported to be high in malted weaning food, which could be attributed to high minerals content of finger millet. It was suggested that finger millet being the cheapest source of calcium and other nutrients, may be used to prepare common daily food stuffs to increase its nutritional value, acceptability and palatability of the products.[10] It was reported that cake samples enriched with malted finger millet flour to have high mineral content of calcium, iron, phosphorus, as well as, that of crude fiber.[9] In a study, finger millet was utilized to prepare malt drink with wheat and green gram. The micronutrients such as calcium (193mg/100 g) and phosphorous (268mg/100 g) were found to be high with good amount of carbohydrate (79g/100 g) and energy (365Kcal/100 g). It was also reported that processing techniques such as malting, aided in increasing the bioavailability of nutrients.[11]

Table 1: Value addition of MC114 by incorporating fruit-nut-seed mix in varied proportions

Ingredients	*MC114 (Control)*	*MCF1 (10%)*	*MCF2 (20%)*	*MCF3 (30%)*
Malted wheat flour+malted finger millet+malted green gram (g)	40	36	32	28
Fruit-nut-seed mix (g) (Dried mango, almonds, raisins, sesame seeds, and sunflower seeds)	-	4	8	12
Skim milk powder (g)	40	40	40	40
Cardamom powder (g)	1	1	1	1

Table 2: Mean proximate nutrient content of control (MC111) and the most acceptable RTP *Meetha cheela* (MCF3) mixes

Nutrients	*Mean content (MC111)*	*Mean content (MCF3)*
Moisture (per cent)	4.87±0.72^a	5.55±0.56^b
Fat (g/100 g)	0.82±0.89^a	5.34±0.72^b
Fiber (g/100 g)	4.67±0.96^a	6.13±0.67^b
Ash (g/100 g)	0.63±0.78^a	0.95±0.09^b
Protein (g/100 g)	24.27±0.14^a	26.56±0.97^a
Carbohydrate (g/100 g)	64.06±0.37^a	55.47±0.95^b
Energy (Kcal/100 g)	360.7±1.34^a	376.18±1.02^b

Mean±SD, Mean with different superscript in a row denote significant difference at $P \leq 0.05$

Total Antioxidant Activity of RTP *Meetha cheela* Mixes

The total antioxidant activity of MC111 and MCF3 was analyzed, using DPPH radical scavenging activity (per cent inhibition). The results revealed mean antioxidant activity of MC111 to be lower (42.13 ± 0.94) than that of MCF3 (66.52 ± 0.72). The difference was found to b significant at 5% level of significance.

Shelf-life Assessment of the most acceptable RTP *Meetha cheela* mix (MCF3)

The total viable bacterial count of the most acceptable RTP *Meetha cheela* mix ranged between $2.17x10^3$ ± 0.31 and 2.52×10^3 ± 2.25 CFU/g, on 1 day and 90th day, respectively. There was no significant difference in the viable bacterial count till 60th day

Table 3: Mean micronutrient content of control (MC111) and the most acceptable RTP *Meetha cheela* (MCF3) mixes

Nutrients	*Mean content (MC111)*	*Mean content (MCF3)*
Iron (mg/100g)	2.75±0.67^a	3.21±0.35^b
Calcium (mg/100g)	700.47±1.23^a	784.84±0.76^b
Sodium (mg/100g)	1.03±0.42^a	1.98±0.54^b
Potassium (mg/100g)	155.5±1.34^a	305.57±0.67^b

Mean±SD, Mean with different superscript in a row denote significant difference at $P \leq 0.05$

Table 4: Mean nutrient antioxidant content of control (MC111) and the most acceptable RTP *Meetha cheela* (MCF3) mixes

Antioxidants	*Mean content (MC111)*	*Mean content (MCF3)*
β-carotene (μg/100 g)	1.33±0.32^a	265.37±1.97^b
Vitamin C (mg/100 g)	0.0^a	5.89±0.87^b
Vitamin E (mg/100 g)	0.1±0.17^a	1.62±0.45^b

Mean±SD Mean with different superscript in a row denote significant difference at $P \leq 0.05$

Table 5: Mean microbial count, moisture, and nutrient antioxidant content and antioxidant activity of the most acceptable RTP *Meetha cheela* mix (MCF3)

Days	*Total Viable Count (CFU/g)*	*Moisture (%)*	*Vitamin C (mg/100g)*	*Vitamin E (mg/100g)*	*DPPH (% Inhibition)*
1st day (control)	$2.17\times10^3\pm0.31^a$	5.55 ± 0.56^a	5.89 ± 0.87^a	1.62 ± 0.45^a	66.52 ± 0.72^a
15th day	$2.22\times10^3\pm0.64^a$	5.55 ± 0.45^a	5.88 ± 0.16^a	1.62 ± 0.21^a	66.50 ± 0.51^a
30th day	$2.28\times10^3\pm1.09^a$	5.56 ± 0.55^a	5.85 ± 0.32^a	1.61 ± 0.15^a	66.47 ± 0.34^a
45th day	$2.32\times10^3\pm2.54^a$	5.59 ± 0.62^a	5.84 ± 0.19^a	1.59 ± 0.34^a	66.42 ± 0.45^a
60th day	$2.37\times10^3\pm1.78^a$	5.61 ± 0.35^a	5.78 ± 0.35^a	1.58 ± 0.22^a	66.40 ± 0.21^a
75th day	$2.43\times10^3\pm1.62^b$	5.62 ± 0.38^a	5.75 ± 0.23^a	1.57 ± 0.18^a	66.38 ± 0.54^a
90th day	$2.52\times10^3\pm2.25^b$	5.64 ± 0.69^a	5.70 ± 0.11^a	1.55 ± 0.32^a	66.31 ± 0.47^a

Mean±SD, Mean with different superscript in a row denote significant difference at $P \leq 0.05$

of estimation. However, significant difference was observed in the values on 75th and 90th day ($P \leq 0.05$). On the other hand, the values of bacterial count till 90 days were found to be within the limit of 50,000 CFU/g, as per the FSSAI standard for malted milk foods.[12] Fungi and coliform were not detected in the sample throughout the 90 days period [Table 5].

Moisture content in the RTP mix, ranged between 5.55 ± 0.56% on the 1st day and 5.64 ± 0.69% the 90th day of storage period [Table 5]. There was increase in the moisture content but the increase was statistically not significant ($P \leq 0.05$). Peroxide value was not detected in the sample throughout the storage period. There was a statistically non-significant decrease ($P \leq 0.05$) in Vitamin C content of the stored RTP mix over a period of 3 months. The amount of Vitamin C decreased from 5.89 ± 0.87 mg on the 1st day to 5.70 ± 0.11 mg/100 g on the 90th day of storage period. Similarly, Vitamin E showed a non-significant decrease ($P \leq 0.05$) from 1st day of storage (1.62 ± 0.45mg/100 g) to 90th day (1.55 ± 0.32mg/100 g). The total antioxidant activity of 66.52 ± 0.72% inhibition on 1st day of storage, reduced to 66.31 ± 0.47% inhibition on 90th day, but the decrease was statistically not significant ($P \leq 0.05$).

The sensory evaluation of RTP *Meetha cheela* over a period of 3 months, showed mean score for color to reduce from 8.2 ± 0.63 to 8.0 ± 0.63 on the 90th day. Mean scores for appearance decreased from 8.1 ± 0.87 to 8.0 ± 0.32, for texture decreased from 7.8 ± 0.78 to 7.7 ± 0.45, for taste it decreased from 8.2 ± 0.78 to 8.0 ± 0.57, and for after taste it decreased from 8.1 ± 0.56 to 8.0 ± 0.56 on 90th day of storage. The decrease in the mean values of the various attributes was very minor and statistically not significant ($P \leq 0.05$). The overall acceptability of the *cheelas* did not change throughout the 3 months and were "liked very much" by the panel of judges.

The stable quality parameters of the *cheela* mix during the 3 months storage period can be attributed to low moisture and fat content and vacuum packing. It has been reported that lipid oxidation was lowest in pasta packed in metallic bags using vacuum, as compared to packing with ambient air or nitrogen.[13] Singh *et al*.[14] packed chicken snacks aerobically and under vacuum and stored for 30 days. There was a significant lower amount of bacterial, fungal, and mold count in vacuum packed chicken snack. Overall sensory attributes of vacuum packaged products were higher than aerobically packaged products. The reduction in moisture was less in vacuum packaged chicken snacks as compared to the aerobically packaged chicken snacks. It was found that storage in vacuum packaging revealed better quality with respect to its physicochemical, microbiological, and sensory qualities. In another research, the effect of vacuum packaging and 12 other packaging treatments was assessed, on the microbial count of the packed wheat flour. One of the best decontamination procedures was found to be vacuum packaging, which fully inhibited fungal development and mycotoxin production.[15] Vacuum packaging was most effective in retarding oxidative rancidity and prolonged shelf life of fresh fish by suppressing growth of psychrotropic aerobes associated with spoilage.[16] Atrea *et al*.[17] evaluated the use of vacuum packaging (alone) or with addition of oregano essential oil, as an antimicrobial treatment for shelf-life extension of fresh Mediterranean octopus and found that based on sensory evaluation (odor), the use of vacuum packaging extended the shelf-life of octopus. Researchers studied the effect of moisture on the shelf life of wheat flour during a storage period of 60 days. Lower flour moisture (9%) was found to be suitable for storage stability and longer shelf life of wheat flour.[18]

Conclusion

The developed value added RTP *Meetha cheela* (sweet pancake) was highly acceptable. The final mix was significantly higher in nutrients, namely, Vitamin C, Vitamin E, β carotene, calcium, and potassium and had higher total antioxidant activity. It provided better quality protein, due to a mix of malted cereal and pulse. The mix had a stable shelf life till a period of 3 months. This product can be commercialized and used for the benefit of the elderly who are at the risk of malnutrition, as the mix is nutrient dense, easy to prepare, and consume.

Copyright and Permission Statement

I/We confirm that the materials included in this chapter do not violate copyright laws. Where relevant, appropriate permissions have been obtained from the original copyright holder (s). All original sources have been appropriately acknowledged and/or referenced.

References

1. Verma R, Khanna P. National program of health-care for the elderly in India: A hope for healthy ageing. Int J Prev Med 2013;4:1103.
2. Amarya S, Singh K, Sabharwal M. Changes during aging and their association with malnutrition. J Clin Gerontol Geriatr 2015;6:78-84.
3. Zimmerman M, Snow B. Nutrition through the Life Cycle: From Childhood to the Elderly Years. Place Unknown: Creative Commons; 2014 Available from: http://2012books.lardbucket.org/books/an-introduction-to-nutrition/s17-nutrition-through-the-life-cyc.html [Last accessed on 2022 Jan 02].
4. Bartali B, Salvini S, Turrini A, Lauretani F, Russo CR, Corsi AM, *et al*. Age and disability affect dietary intake. J Nutr 2003;133:2868-73.
5. Nyberg M, Olsson V, Pajalic Z, Örtman G, Andersson HS, Blücher A, *et al*. Eating difficulties, nutrition, meal preferences and experiences among elderly: A literature overview from a Scandinavian context. J Food Res 2015;4:22-37.
6. Chung YC, Chiang BH, Wei JH, Wang CK, Chen PC, Hsu CK. Effects of blanching, drying and extraction processes on the antioxidant activity of yam (*Dioscorea alata*). Int J Food Sci Technol 2008;43:859-64.

7. Nithya KS, Ramachandramurty B, Krishnamoorthy VV. Assessment of anti-nutritional factors, minerals and enzyme activities of the traditional (Co7) and hybrid (Cohcu-8) pearl millet (*Pennisetum glaucum*) as influenced by different processing methods. J Appl Sci Res 2006;2:1164-8.
8. Shelly J, Dabur RS, Chhabra R. Studies on shelf life of milk based malted ragi porridge. Haryana Vet 2017;56:9-12.
9. Desai AD, Kulkarni SS, Sahoo AK, Ranveer RC, Dandge PB. Effect of supplementation of malted ragi flour on the nutritional and sensorial quality characteristics of cake. Adv J Food Sci Technol 2010;2:67-71.
10. Goswami P, Mehra M, Pratibha P. Studies on proximate composition of ragi based developed instant mixes. Int J Curr Microbiol Appl Sci 2017;6:3401-5.
11. Begum JM, Begum S, Pandey A. Nutritional evaluation of fingermillet malt. Int J Sci Environ Technol 2016;5:4086-96.
12. FSSAI. Food Safety and Standards (Food Products Standards And Food Additives) Regulations. New Delhi, India: Ministry of Health and Family Welfare; 2011. Available from: https://www.fssai.gov.in/cms/food-safety-and-standards-regulations.php [Last accessed on 2021 Dec 20].
13. Manthey FA, Sinha S, Wolf-Hall CE, Hall CA 3rd. Effect of flaxseed flour and packaging on shelf life of refrigerated pasta. J Food Proc Preserv 2008;32:75-87.
14. Singh VP, Sanyal MK, Dubey PC, Mendirtta SK. Quality assessment of vacuum packaged chicken snacks stored at room temperature. J Stored Prod Postharvest Res 2011;2:120-6.
15. Schmidt M, Zannini E, Arendt EK. Screening of post-harvest decontamination methods for cereal grains and their impact on grain quality and technological performance. Eur Food Res Technol 2019;245:1061-74.
16. Kumar P, Ganguly S. Role of vacuum packaging in increasing shelf-life in fish processing technology. Asian J Biosci 2014;9:109-12.
17. Atrea I, Papavergou A, Amvrosiadis I, Savvaidis IN. Combined effect of vacuum-packaging and oregano essential oil on the shelf-life of Mediterranean octopus (*Octopus vulgaris*) from the Aegean Sea stored at 4 C. Food Microbiol 2009;26:166-72.
18. Nasir M, Butt MS, Anjum FM, Sharif KA, Minhas R. Effect of moisture on the shelf life of wheat flour. Int J Agric Biol 2003;5:458-9.