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Millet and vegetable paste incorporated sakinalu: A Telangana state traditional snack

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Abstract

Vegetables are richest source of micronutrients and are crucial to a balanced diet. An attempt was made to incorporate vegetables and millets to popular traditional Telangana state snack "sakinalu" – a rice and sesame-based preparation, to increase the nutritional content. An attempt was made to incorporate sorghum flour at 20% and sesame seeds at 20%, 30%, 40% and 50% and fresh pastes of vegetable such as carrot, beetroot and tomato at 5%, 10% and 15%. Sakinalu made with 60% rice flour and 40% sesame seeds was selected as control for the incorporation of sorghum flour and vegetable pastes. Then millet and vegetable incorporated sakinalu was prepared by incorporating 20% of sorghum flour and vegetable pastes at the level of 5%, 10% and 15%. Whereas among vegetable paste incorporated sakinalu 10% carrot paste, 15% beetroot paste and 15% tomato paste incorporated sakinalu showed highest overall acceptability. Nutritional analysis showed that carrot incorporated sakinalu contains moisture (4.47%), ash (3.59%), protein (13.90%), fat (24.91%), crude fiber (6.15%), carbohydrates (53.11%), calcium (505.73 mg/100 g), iron (8.28 mg/100 g), and zinc (4.86 mg/100 g). Beetroot incorporated sakinalu contains moisture (4.38%), ash (3.48%), protein (14.08%), fat (24.66%) crude fiber (6.18%), carbohydrates (53.38%), calcium (504.06 mg/100 g), iron (8.49 mg/100 g), and zinc (4.83 mg/100 g). Whereas tomato incorporated sakinalu contains moisture (4.54%), ash (3.78%), protein (13.96%), fat (24.54%) crude fiber (6.11%), carbohydrates (53.16%), calcium (503.43 mg/100 g), iron (8.17 mg/100 g), and zinc (4.81 mg/100 g). The results showed that there was significant ($p \leq 0.05$) increase in proximate and mineral composition of millet and vegetable paste incorporated sakinalu as compared to control sakinalu.

Keywords: Traditional snacks, sakinalu, millets, vegetables, incorporation

Introduction

Variety of foods and sufficient amounts of the nutrients needed for optimum health are found in a well-balanced diet. To sustain their health, people need a particular amount of calories and nutrients. While staying within the daily calorie limit, a balanced diet gives a person access to all the nutrients they require.

Micronutrient malnutrition, which contributes to 40–50% of infant mortality in India, is a significant public health problem (Rai *et al*., 1999) [15]. Concerns regarding the nutritional worth of foods and how to feed a growing population have grown in recent years. Fortification and enrichment of food sources can help to address the shortage of critical nutrients.

Sakinalu is a traditional snack of Telangana made with freshly ground rice flour, sesame seeds, and carom seeds that is deep-fried and has a round, concentric shape (Sudha, 2016) [6]. The shaping of them is the most difficult and time-consuming step in the preparation. Sakinalu are made by twisting the dough between fingers to form concentric circles. Thin concentric rows are the uniqueness of sakinalu. After drying of sakinalu for 20-30 mins, they are fried until golden brown colour.

The most popular sakinalu are the white, tella varieties, which are simply salted. People uses chilli powder, red chilli paste, or green chilli paste for spicier variations. The preparation of sakinalu for Sankranti and weddings is customary in Telangana state. One of the wedding traditions in Telangana is that the bride's family presents the groom's family sakinalu, sweets, and a few other savoury foods, who then distribute them among their relatives. Depending on the family tradition, each sakinalu can contain 21 to or more concentric circles.

Sakinalu is a nutritious snack item which is excellent source of protein, vitamin, B1, calcium, phosphorous, iron, manganese, vitamin E, vitamin D and fiber so can be explored as healthy snack (Janaki, 2022) [8]. When millets and vegetables are added to traditional preparations like sakinalu, the nutritional content of the cuisine may be increased. The need exists for locally accessible, low-cost, and highly nutrient-dense materials to be employed as a means of enhancing nutritional status (Negi and Roy, 2004) [12].

Sesame seeds are essential for a healthy diet. 5-6% moisture, 15-20% fibre, 10-15% protein, 43-45% lipid, 5-6% ash, 62.74 g ergocalciferol, and 1283 mg calcium are

present in sesame seeds. High levels of unsaturated fatty acids (83–90%), primarily 37–40% linoleic acid, 35–43% oleic acid, 9–11% palmitic acid, and 5–10% stearic acid with traces of linolenic acid, are found in sesame seeds. Sesame seeds are rich in phenols, phytosterols, and phytates, which are bioactive compounds and antioxidants. They are also rich in polyunsaturated fatty acids (PUFA) and short chain peptides.

Sorghum popularly called jowar, is the "king of millets" and is the fifth in importance among the world's cereals, after wheat, rice, maize and barley. Maharashtra and southern states like Karnataka and Andhra Pradesh together produce close to 80% of the nation's sorghum (Chavan *et al*., 2016) [5]. The nutrient composition of sorghum grain indicates that it is a good source of energy, protein, fiber, fat-soluble vitamins (D, E and K) and some B-complex vitamins (riboflavin, thiamine, and pyridoxine) and minerals. Sorghum has 77.13 percent carbohydrates, 8.36 percent protein, 3.21 percent fat and 3.21 percent fiber. 100 grams of sorghum contains 70 mg of calcium, 170 mg of magnesium, 440 mg of potassium and 4.0 mg of iron. Sorghum is completely free of gluten. Starch (32.1–72.5 g/100 g) in sorghum is composed mainly of amylose (3.5%–19.0%) and amylopectin (81.0%– 96.5%). The proportion of amylose and amylopectin influences the rheological and digestibility properties of sorghum. Sorghum contains resistant starch which has been recommended in fighting human obesity and feeding diabetic people.

Vegetables are an essential component of the human diet. Vegetables and their products are low in calories but high in vitamins, and are vital for a well-balanced diet. Vegetable dry matter is composed of lipids, proteins, and carbohydrates, minerals, vitamins, and phytonutrients. Vegetables contain a wide range of flavors, give energy, hydration for the body, are high in liposoluble and water-soluble vitamins, fibres such as cellulose and pectin that aid in intestinal transit, and are high in minerals. Aside from nutrition, they are high in non-nutritive compounds such as phytochemicals and antioxidants, which reduce the incidence of cardiovascular disease, stroke, cancer, chronic diseases, and other lifestyle maladies.

Sakinalu contains healthy proportion of cereals (rice) and oil seeds (sesame seeds) with very less processing, so it has potential to provide sufficient amount of various nutrients like protein, calcium, iron, vitamin E, vitamin D and lots of phenolic compounds. So, the present study was planned to enriched traditional snack sakinalu with sorghum and vegetables to incorporate additional nutrients.

Materials and Methods

Raw materials

Rice, sorghum flour, sesame seeds and required vegetables (carrot, beetroot and tomato) were procured from the local market in Hyderabad.

Preparation of rice flour

Aged rice was taken. Rice was sorted and cleaned to make sure there were no sand or dust. Then the rice was soaked for 2 hours. Later, rice was spread on cotton cloth until it was semi dry. Further rice was grinded to fine flour in local flour mill.

Preparation of vegetable pastes

Fresh and matured vegetables were selected for preparation of pastes. Carrot and beetroot were peeled and cut in to pieces and pressure cooked until soft and mashed into a fine puree. Tomatoes were blanched, peeled, blended and strained.

Standardization of millet and vegetable paste incorporated sakinalu

All the ingredients (rice flour, sorghum flour, sesame seeds, carrot paste, beetroot paste and tomato paste) required to prepare millet and vegetable paste incorporated sakinalu was weighed individually according to desired proportions as shown in Table 1. The steps followed for preparation of sakinalu are given in Figure 2. Vegetable incorporated sakinalu was developed by incorporating beetroot paste, carrot paste and tomato puree in different proportions as given in Table 2 in the best selected control sakinalu through sensory evaluation.

Table 1: Proportions used to prepare millet and vegetable paste incorporated sakinalu

Ingredients in grams	Proportions per 100 grams of product		
	S1	S2	S3
Rice flour	40%	40%	40%
Sesame seeds	40%	40%	40%
Sorghum flour	20%	20%	20%
Carrot paste	5%	10%	15%
Beetroot paste	5%	10%	15%
Tomato puree	5%	10%	15%

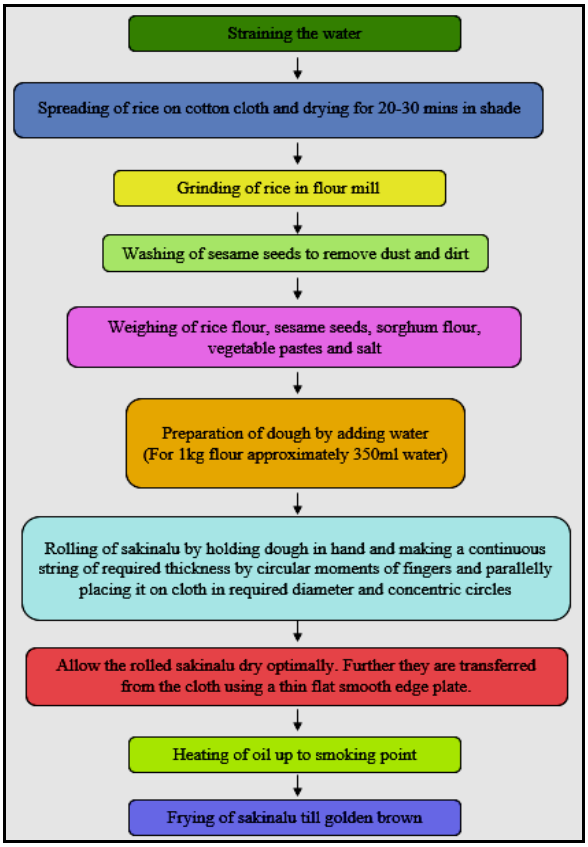

Fig 1: Schematic diagram for preparation of millet and vegetable paste incorporated sakinalu

CS111 CS121 CS131

Plate 1: Variations of carrot paste incorporated sakinalu

BS111 BS121 BS131

Plate 2: Variations of beetroot paste incorporated sakinalu

TS111 TS121 TS131

Plate 3: Variations of tomato paste incorporated sakinalu

Sensory evaluation

The millet and vegetable paste incorporated sakinalu was developed by incorporating 20% sorghum flour and beetroot paste, carrot paste and tomato puree in different percentages (5%, 10%, 15%). The developed products were subjected to sensory evaluation. Sensory parameters for millet and vegetable paste incorporated sakinalu included appearance, colour, flavour, texture, taste, after taste, crispiness, hardness, crunch, oiliness and overall acceptability. A semi trained panel of 20 members were selected to evaluate the millet and vegetable paste incorporated sakinalu. Panelists assigned a hedonic rating scale of 1 to 9, with 1 indicating extremely disliked and 9 indicating extremely liked. (Meilgaard, *et al*., 1999) [11]. The best accepted product from each formulation was selected for proximate analysis.

Proximate composition of millet and vegetable paste incorporated sakinalu

The proximate composition of control sakinalu and sakinalu with added sorghum flour and fresh carrot paste, beetroot paste and tomato paste were determined in triplicates. According to AOAC methods (2005) [2] moisture, ash, fat

and crude fiber were assessed. Protein was assessed by AOAC method (2010) [4]. Carbohydrate was assessed using the method AOAC (2006) [3]. Minerals such as copper, zinc, iron and manganese were assessed by AAS along with sodium and potassium by flame photometer (AOAC, 2000) [1].

Result and Discussion

Sensory evaluation

According to result of sensory evaluation, sakinalu containing 10% carrot paste (CS1) 15% beetroot paste (BS1) and 15% tomato paste (TS1) incorporated sakinalu had highest overall acceptability. These three formulations along with control (S1) were selected for proximate analysis such as moisture, ash, protein, fat, crude fiber and minerals like calcium, copper, zinc, iron, manganese, sodium and potassium.

Proximate composition

The proximate composition of control, carrot paste, beetroot paste and tomato puree incorporated sakinalu were presented in the Table 2. The moisture content of millet and vegetable paste incorporated sakinalu increased significantly ($p \leq 0.05$) as compared to control sakinalu and ranged from 3.44 to 4.54%. Senthil *et al*. (2002) [18] reported that the most of the moisture was lost during deep fat frying. Sebastian *et al*. (2005) [17] reported that the low moisture content was achieved by deep frying, which increases food shelf life by decreasing food moisture content and gives the food a distinctive texture and flavour. Jean *et al*. (1996) [9] reported that to make the snack food brittle, the moisture content should be under 5%. There was significant ($p \leq 0.05$) increase in ash content of millet and vegetable paste incorporated sakinalu., CS1 (3.59%), BS1 (3.48%), TS1 (3.78%) compared to control S1 (2.79%). Chavan *et al*. (2016) [5] reported that the ash content of sorghum chakli ranged from 2.22% to 3.34%. Verma and Jain (2012) [19] reported that there was increase in the ash content of fresh vegetable mathri (2%) as compared to the control mathri (1.4%). The protein content of CS1 (13.90%), BS1 (14.08%) and TS1 (13.96%) was significantly ($p \leq 0.05$) higher as compared to S1 (13.83%). The similar results were reported by Patel *et al*. (2018) [14], where the protein content of carrot powder (0% - 5%) incorporated deep fried snack ranging from 13.41% to 13.67%.

The fat content of millet and vegetable paste incorporated sakinalu varied significantly ($p \leq 0.05$) and ranged from 23.24%, 24.54%, 24.66%, to 24.91% for S1, TS1, BS1, and CS1 respectively. Patel *et al.* (2018) [14] reported that the fat content of carrot powder incorporated deep fat fried snack was between 28 to 35.0%. The snack food without carrot powder had higher fat content. As carrot powder incorporation increased from 0 to 5%, the fat content reduced from 35.15% to 27%. Probably the increase in the fat content of millet and vegetable paste incorporated sakinalu than control sakinalu was might be due to the addition of fresh paste which leads to increase in the absorption of oil. There was significant ($p \leq 0.05$) increased in crude fiber content of millet and vegetable paste incorporated sakinalu i.e., CS1 (6.15%), BS1 (6.18%) and TS1 (6.11%) as compared to S1 (5.99%). Similar results were reported by Verma and Jain (2012) [19], the incorporation of vegetables increases the crude fiber content of the food product. The crude fiber content of fresh vegetable mathri was 4.87% whereas, crude fiber content of control mathri was 2.6%. The carbohydrate content of S1, CS1, BS1 and TS1 was 56.70%, 53.11%, 53.38% and 50.16% respectively. There was significant ($p \leq 0.05$) decrease in carbohydrate content of millet and vegetable paste incorporated sakinalu compared to control sakinalu. The similar results were reported by Lisiecka and Wojtowicz (2021) [10], where the content of available carbohydrates decreased in the beetroot pulp incorporated snacks from 59.33% to 45.07% as compared with the control.

The result of proximate analysis showed that among millet and vegetable paste incorporated sakinalu beetroot paste incorporated sakinalu contains high amount of protein (14.08%) and crude fiber (6.18%). Tomato paste incorporated sakinalu contains high amount of moisture (4.54%) and ash (3.78%) whereas, carrot paste incorporated sakinalu contains high amount of fat (24.91%).

Table 2: Proximate composition of control and millet, vegetable paste incorporated sakinalu

Sample	Moisture (%)	Ash (%)	Protein (%)	Fat (%)	Crude fibre (%)	Carbohydrates (%)
S1	3.44^{d}±0.01	2.79^{d}±0.00	13.83^{d}±0.00	23.24^{d}±0.00	5.99^{d}±0.00	56.70^{a} ± 0.00
CS1	4.47^{b}±0.01	3.59^{b}±0.01	13.90^{c}±0.01	24.91^{a}±0.03	6.15^{b}±0.00	53.11^{d} ± 0.04
BS1	4.38^{c}±0.03	3.48^{c}±0.04	14.08^{a}±0.07	24.66^{b}±0.14	6.18^{a}±0.00	53.38^{b} ± 0.14
TS1	4.54^{a}±0.01	3.78^{a}±0.01	13.96^{b}±0.01	24.54^{c}±0.01	6.11^{c}±0.00	53.16^{c} ± 0.02
Mean	4.21	3.41	13.94	24.33	6.10	52.66
S.E	0.13	0.11	0.03	0.46	0.02	0.29
C.D	0.05	0.11	0.15	0.29	0.00	0.64
C.V%	0.65	1.65	0.55	0.60	0.00	0.59

Note: Values are expressed as mean ± standard deviation of three determinations
Means within same column followed by a common letter do not differ significantly at ($p \leq 0.05$)
S1: Control sakinalu
CS1: Carrot paste incorporated sakinalu
BS1: Beetroot paste incorporated sakinalu
TS1: Tomato paste incorporated sakinalu

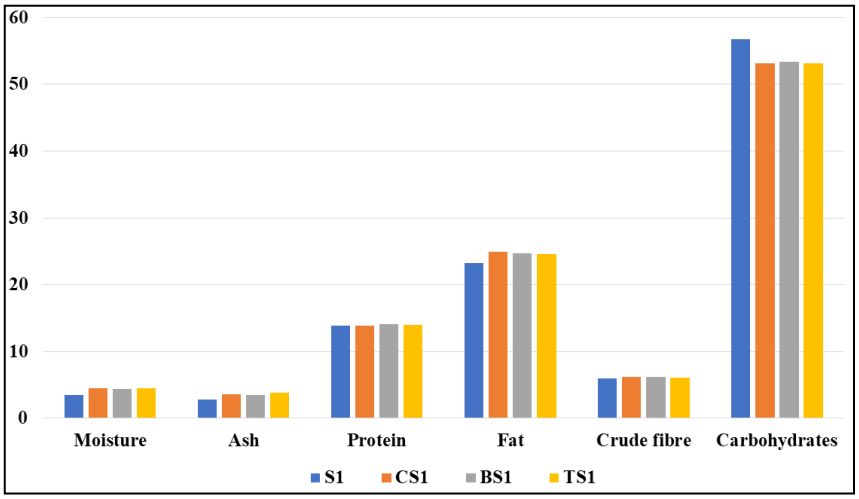

Fig 2: Proximate composition of sakinalu

Mineral composition

The mineral composition of control sakinalu and millet and vegetable paste incorporated sakinalu were presented in the Table 3. The calcium content found to be highest for CS1 (505.773 mg) followed by BS1 (504.06 mg), TS1 (503.43 mg) and S1 (469.97 mg). There was significant increase in calcium content of millet and vegetable paste incorporated sakinalu as compared to control sakinalu. There was significant increase in iron content of millet and vegetable paste incorporated sakinalu i.e., CS1 (8.28 mg), BS1 (8.49 mg), TS1 (8.17 mg) as compared to control sakinalu S1 (7.82 mg). Zinc content of control sakinalu and millet and vegetable paste incorporated sakinalu was S1 (4.24 mg), CS1 (4.86 mg), BS1 (4.83 mg) and TS1 (4.81 mg). Similar results were reported by Sarangam *et al*. (2015) [16], where the multigrain murukku had higher content of minerals like calcium and iron than control murukku. Verma and Jain (2012) [19] reported that iron content of fresh vegetable mathri was higher than control mathri. Gupta and Prakash, (2011) [7] reported that iron and calcium content of green leafy vegetables incorporated mathri was found to be increased than control mathri. Olubukola *et al*. (2017) [13] reported that calcium, iron and zinc in the ugu and spinach enriched chinchin increased as compared to control. Flour, (2015) reported that calcium and iron content of chakli was 15 mg/100 g and 0.5 mg/100 g respectively whereas millet and vegetable paste incorporated sakinalu contains 503.43 to 505.73 mg/100 g calcium and 8.17 to 8.49 mg/100 g iron. As compared to commercial chakli, millet and vegetable paste incorporate sakinalu had high amount of calcium and iron as it contains good amount of sesame seeds. So, it is more nutritious as compared to commercial chakli.

The result of mineral analysis showed that among vegetable incorporated sakinalu, beetroot paste incorporated sakinalu contains high amount of iron (8.49 mg/100 g) whereas, carrot paste incorporated sakinalu contains high amount of calcium (505.73 mg/100 g) and zinc (4.86 mg/100 g).

Table 3: Mineral composition of control sakinalu and millet and vegetable paste incorporated sakinalu

Sample	Calcium (mg/100 g)	Iron (mg/100 g)	Zinc (mg/100 g)
S1	469.97^{d}±0.00	7.82^{d}±0.00	4.24^{d}±0.00
CS1	505.73^{a}±0.03	8.28^{b}±0.00	4.86^{a}±0.00
BS1	504.06^{b}±0.03	8.49^{a}±0.00	4.83^{b}±0.00
TS1	503.43^{c}±0.03	8.17^{c}±0.00	4.81^{c}±0.00
Mean	495.80	8.19	4.68
S.E	4.50	0.07	0.07
C.D	0.13	0.00	0.01
C.V%	0.01	0.00	0.14

Note: Values are expressed as mean ± standard deviation of three determinations
Means within same column followed by a common letter do not differ significantly at ($p \leq 0.05$)
S1: Control sakinalu
CS1: Carrot paste incorporated sakinalu
BS1: Beetroot paste incorporated sakinalu
TS1: Tomato paste incorporated sakinalu

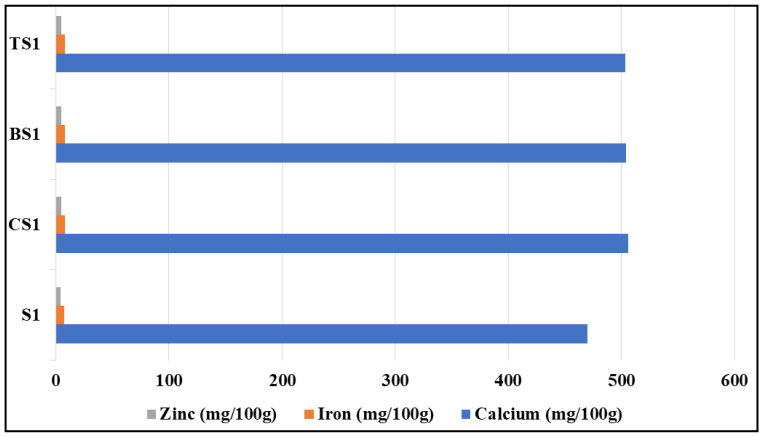

Fig 3: Mineral composition of sakinalu

Conclusion

The result of the study concluded that incorporation of millet and vegetable paste into the traditional snacks like sakinalu enhanced the nutritional content of product with acceptable sensory attributes. Incorporation of vegetables is a convenient method to combat micronutrient malnutrition. Millet and vegetable paste incorporated sakinalu being good source of proteins, crude fiber and minerals such as calcium, iron and zinc. So, should be consumed as a nutritious snack rather than ultra-processed snack foods. The vegetables like carrot, beetroot and tomato can be used to enriched traditional snacks like sakinalu. As enrichment of foods helps to address the shortage of critical nutrients.

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References

1. AOAC. Method of analysis. 17th ed. Washington, DC: Association of Official Analysis Chemists; c2000.
2. AOAC. Official methods of analysis. 18th ed. Arlington, VA: Association of Official Analytical Chemists; c2005.
3. AOAC. Official methods of analysis. 18th ed. Washington, DC: Association of Official Analytical Chemists; c2006.
4. AOAC. Official methods of analysis. 18th ed. Washington, DC: Association of Official Analytical Chemists; c2010.
5. Chavan UD, Jagtap YK, Shinde MS, Patil JV. Preparation and nutritional quality of sorghum chakli. International Journal of Recent Scientific Research. 2016;7(1):8404-8411.
6. Chef S. Sudha Kumar-Ruchi Yatra. Culinary tales from Telangana. Hyderabad: Incredible India, Tourism Department, Government of Telangana; c2016. p. 1-100.
7. Gupta S, Prakash J. Nutritional and sensory quality of micronutrient-rich traditional products incorporated with green leafy vegetables. International Food Research Journal. 2011;18(2):23-27.
8. Janaki PS. Understanding the food culture and native foods of Telangana state - A step towards healthy dietary diversity. Indian Food Anthropology - Eat Right Movement. Selective and Scientific Books; c2022. p. 148-65.
9. Jean IJ, Work R, Camire ME, Briggs J, Barrett AH, Bushway AA. Selected properties of extruded potato and chicken meat. Journal of Food Science. 1996;61:783-9.
10. Lisiecka K, Wojtowicz A. Effect of fresh beetroot application and processing conditions on some quality features of new type of potato-based snacks. Journal of Advanced Research. 2021;141.
11. Meilgaard M, Civille GV, Carr BT. Sensory evaluation techniques. 3rd ed. Boca Raton, FL: CRC Press; c1999.
12. Negi PS, Roy SK. Changes in beta carotene and ascorbic acid content of fresh amaranth and fenugreek leaves during storage by low-cost technique. Plant Foods for Human Nutrition. 2004;58:225-230.
13. Olubukola A, Olasunkanmi G, Kehinde T, Durodoluwa JO, Adebooye C. Proximate, mineral, sensory evaluations and shelf stability of chinchin enriched with ugu and Indian spinach vegetables. International Journal of Biochemistry Research and Review. 2017;18(4):1-14.
14. Patel KK, Liaquati SA, Patel YK. Deep fat fried carrot powder incorporated wheat, rice and gram flour based snack food. International Journal of Agricultural Engineering. 2018;11(Special Issue).
15. Rai LPW, Selwa M, Sahni RC, Bhatia B. Physical and mental fatigue may be due to iron deficiency anemia. 1st ed. Anubav Rai Publication; c1999. p. 210.
16. Sarangam S, Chakraborty P, Chandrasheker G. Development of low fat multigrain murukku – A traditional savoury product. International Journal of Research; c2015.
17. Sebastian L, Gowri BS, Prakash J. Quality characteristics of ragi incorporated “chakli” - An Indian deep-fried product. Journal of Food Processing and Preservation. 2005;29(5):319-330.
18. Senthil A, Ravi R, Bhat KK, Seethalakshmi MK. Studies on quality of fried snacks based on blends of wheat flour and soya flour. Food Quality and Preference. 2002;13:267-273.
19. Verma S, Jain S. Fortification of mathri with fresh and dehydrated vegetables and assessment of nutritional quality. Rajasthan Journal of Extension Education. 2012;20:155-158.