Development of Nutri Rich Cakes with Soya Chunk Flour and its Quality Evaluation

Dr. Chandrashree Lenka[1]*, Anushriya Sahoo[2], Shibani Bidyadhar[3]

[1] Professor, P.G. Department of Home Science, Rama Devi Women's University, Bhubaneswar, India

[2] Assistant Professor, P.G. Department of Home Science, Rama Devi Women's University, Bhubaneswar, India

[3] Research Scholar, Department of Home Science, Sambalpur University, Odisha, India

Email- [1] chandrashree66@gmail.com

ABSTRACT:

The soybean, otherwise known as 'vegetarian meat' is a staple in many cultures around the world since the time of immemorial. The process of "defatting" or removing the oil from soy flour ultimately produce soya chunks which contain outstanding amount of protein. The objectives of the present endeavour was to develop Nutririch cakes with soya chunk flour and their quality evaluation. Three different types of cakes were formulated by incorporation of different ingredients in different proportions such as wheat flour(whole), soy chunk flour, jaggery, curd, oil, cardamom powder, baking soda, and baking powder. The quality of the developed cakes were evaluated by using sensory evaluation and observing the self life of the product. The overall acceptability of Cake-1 was found to be the best according to the score of sensory evaluation with 13.43g protein, 19.95g fat, 41.91g carbohydrate, 390.55kcal energy, 114.31mg calcium, 55.18mg phosphorus, and 8.67mg iron per 100gm of product. Self life of the developed cakes was also found to be 4-5days. Comparative cost analysis showed the experimental cakes were less expensive than the market available cakes. Thus it can be concluded that developed soy Chunk flour cakes which are rich in protein, antioxidants and phytonutrients can be used as a food supplement at food service centres for children, adolescent girls, pregnant and lactating mothers to address triple burden of malnutrition.

Keywords: Soy Chunks, Nutririch Cakes, Nutritional quality, Sensory evaluation, Self life.

INTRODUCTION:

With the changing landscape of Indian society, food preferences are quickly transforming from traditional fare to instantly available ready-to-eat foods. Mostly bakery products are taking toll now-a-days among the instant foods because of its self life, taste alteration and value addition. Food preferences and lifestyle of present generation also plays a significant role for prevalence of malnutrition not only among children but also among adults and elderly. So protein supplementation is essential for mitigating the triple burden of malnutrition from the society.

According to the Indian Market Research Bureau, more than 80% of Indians are reportedly protein-deficient, and the most recent National Sample Survey shows that per capita protein consumption in India is dropping in both urban and rural areas(National Protein Day 2021 report). This is a cause for concern, especially in India where a majority of the population follow either a vegetarian or a flexitarian diet (casual vegetarianism), even plant-based sources of protein go unnoticed. Compared to non-vegetarian meals, vegetarian diets, in the opinion of more than 76% of mothers, offer fewer alternatives for foods high in protein. This makes it difficult to dispel the idea that how to enrich vegetarian diet with enough protein.

According to Dr. Raj Bhandari, a member of the National Technical Board of Nutrition and Health at NITI Aayog, "Consumption of protein-rich meals and pulses, which are affordable and naturally available, high in fibre and iron, need to be popularised" (National Protein Day 2021 report).

Soya chunks are otherwise known as vegetarian meat full of polyunsaturated fats, proteins and omega 3 fatty acids. 100 grams of uncooked soya chunks have 345 calories, 52 grams of protein, 0.5 grams total fat, 33 grams carbohydrates and 13 grams dietary fibre. They are also rich in calcium and iron while providing no extra sugar or sodium to the body.

It also promotes faster metabolism and muscle growth. They are excellent for the condition of the skin, hair, and bones. Akinola *et a.l*, 2017 found in their study soy chunks effectively cut harmful cholesterol levels in the body and shield the heart from diseases .It also helps people to lose weight by preventing extra fat from building up around their organs. Because the chunks are high in fibre, the food leave our system more slowly and keeps us full for longer that is why this is advisable for diabetics.

Thus developing bakery products with soya chunk flour taking into demands of the present generation will be a better alternative. In the present research an attempt has been made to prepare ready to eat protein rich cakes with soya chunk flour to address the nutritional needs of the people at different ends.

METHODOLOGY:

Three different types of Nutririch cakes were developed by incorporating different ingredients in different proportions, and the nutritional value of cakes for protein, fat, carbohydrate, energy, calcium, phosphorus and iron were calculated by using corresponding nutritive values of food stuffs from Indian food Composition Table, ICMR(Longvah et al.,2017). In the second phase, the quality of the cakes were determined by sensory evaluation using numerical scoring test, Nine point hedonic scale ,and digestibility test. Ten panel members were selected for sensory evaluation and written consent for participation was obtained from the panel members (Sri lakshmi,2015) .

Table1.1: Composition of three varieties of Cakes

Sl. No	Cakes	Proportions	Ingredients
1.	Cake-1	10:7.5:7.5:7.5:7.5	wheat flour, Soya powder(chunk), jaggery, curd, oil, cardamom powder, baking soda, baking powder
2.	Cake-2	10:9:6:7.5:7.5	wheat flour, Soya powder(chunk), jaggery, curd, oil, cardamom powder, baking soda, baking powder
3.	Cake-3	11.5:9:6:7.5:6	wheat flour, Soya powder(chunk), jaggery, curd, oil, cardamom powder, baking soda, baking powder

The proportion of ingredients in the first Cake was 100g wheat flour, 75g soya(chunk) powder, 75g jaggery, 75g curd and 75g oil(10:7.5:7.5:7.5:7.5). The composition of second Cake was 100g wheat flour, 90g soya powder, 60g jaggery, 75g curd and 75g oil(10:9:6:7.5:7.5). And the composition of third Cake was 115g wheat flour, 90g soya powder, 60g jaggery, 75g curd and 60g oil(11.5:9:6:7.5:6).

Sensory Evaluation: In a lab setting, sensory properties were evaluated under controlled circumstances. A professional panellist conducts the testing, noting on a score sheet different aspects such as appearance, flavour, colour, taste, texture, and general acceptability while adhering to the sensory characteristics. Ten panellists were chosen for sensory evaluation. The judges used a scorecard to rate the prepared cakes on a six point hedonic scale for their appearance, flavour, colour, taste, texture, and general acceptability.

RESULT AND DISCUSSION:

Table 1.2 revealed the nutritive value of cakes per 100gm. It was observed that Cake-3 had a highest protein content i.e,15.82g/100g,followed by Cake-1 and Cake-2 i.e, 13.43g and 15.37g, respectively. Lenka *et al*.(2020) in their study found that cake prepared with only whole wheat flour as control sample had 5.45g of protein. In the present research the protein content of the cakes were significantly higher because of addition of soya chunk flour.

The fat content of the developed Cake-1 and Cake-2 was 19.95g where as for Cake-3 it was16.27g. The fat content of the cakes developed with chick pea flour by Lenka *et al*.(2020) were lower in comparison to the cakes developed in the present research and within the range of 14.45 to 14.83gm per 100 gm .The fat content of the market available cakes were significantly higher than the experimental cakes i.e.15.2-20gm/100gm .

Similarly CHO content of the developed cakes ranged between 39.57g to 42.19gm/100gm which was at par with the cakes developed by Lenka *et al*(2020). However the energy contents of the developed cakes were ranged   from 379.36 kcal to 400.32kcal but the value was found to be lower than control whole wheat cake developed by Lenka *et al.,2020* i.e, 418kcal   and   the energy content of market available cakes i.e. 387-424kcal (Lenka *et al*.,2020).

Table:1.2: Nutritive value of all Cakes/100gm

Sl. No	Proportions of ingredients	Protein (g)	Fat (g)	CHO (g)	Energy (Kcal)	Calcium (mg)	Phosphorus (mg)	Iron (mg)
Cake-1	10:7.5:7.5:7.5:7.5 (W:S:J:C:O)	13.43	19.95	41.91	390.55	114.31	55.75	8.67
Cake-2	10:9:6:7.5:7.5 (W:S:J:C:O)	15.37	19.95	39.57	400.32	124.44	53.69	9.32
Cake-3	11.5:9:6:7.5:6 (W:S:J:C:O)	15.82	16.27	42.19	379.36	132.48	58.22	9.42
Lenka et al.2020	Control cake	5.45	22.92	47.86	418.78	51.37	-	1.95
	Chick pea flour cakes	9.65-11.77	14.45-14.43	37.04-35.68	323.06-334.16	89.57-94.80	-	-
	Market Available cakes	3-7	15.2-20	54.59	387-424	-	-	-

(W- Wheat Flour, S-Soyabean (Chunk) Powder, J-Jaggery, C-Curd, O-Oil)

The experimental soya chunk flour cakes had an unusually high calcium content of 114.31-132.48 mg, which was almost two times more than that of control cakes and developed chick pea flour fortified cakes, developed by Lenka *et al*., 2020 i.e., 89.57mg to 94.80mg.

On the other hand developed soya chunk flour had significant phosphorus concentrations i.e, 55.18mg, 53.69mg, and 58.22mg/ 100gm of cake 1,cake2 and cake -3 respectively.

Equally impressive amounts of iron were also found in these three Cakes, with Cake-3 having the greatest concentration (9.42mg) of iron whereas Lenka *et al*., 2020, found only 2.67mg of iron per 100gm in her studied cake.

Sensory evaluation of Cakes by numerical scoring test

Table 1.3: Mean sensory characteristics of Cakes:

Sl. No	Characteristics	Mean SD	Cake-1	Cake-2	Cake-3	P-value
1	**Appearance**	**Mean**	**8.9**	**8.85**	**8.45**	0.469
		SD±	**0.69**	**1.05**	**0.86**	
2	**Taste**	**Mean**	**8.85**	**8.55**	**8.65**	**0.052**
		SD±	**0.57**	**0.43**	**0.74**	
3	**Colour**	**Mean**	**8.8**	**8.7**	**8.8**	**0.934**
		SD±	**0.58**	**0.78**	**0.71**	

4	Flavour	Mean	8.8	8.8	8.5	0.666
		SD±	0.78	0.85	0.91	
5	Texture	Mean	8.75	8.60	8.70	0.921
		SD±	0.88	0.80	0.82	
6	Overall Acceptability	Mean	8.78	8.65	8.70	0.0543
		SD±	0.63	0.71	0.63	

Table 1.3 displays the average values of the sensory evaluation of the various cakes. The table reveals that mean score of appearance of developed cakes which range from 8.45±0.86 to 8.9±0.69 but cake-1 was found to be more acceptable for appearance in comparison to others having mean score 8.89±0.69. However statistically it was evident that there was no significant difference in mean score of appearance of the Cakes.

The mean score of taste for Cake-1 was found to be 8.85±0.57 which was more acceptable in comparison to other two cakes. Mean score of taste of the developed cakes was ranged from 8.55±0.43 to 8.85±0.57. Statistically significant difference in taste of the cakes at $p<0.05$ level was found in this study.

It was interesting to note that mean score of colour for Cake-1 and Cake-3 was same i.e., 8.8±0.58 and 8.8±0.71, whereas for Cake-2 it was 8.7±0.078. However no significant statistical difference between score of colour of the cakes was found in this study.

The mean score for flavour of Cakes 1 and Cake 2 was 8.8±7.8 and 8.8±0.85. **So** Cake-1was found to have better flavour in comparison to Cake-2 and Cake-3.No significant statistical difference in mean score of flavour of the cakes was found in this study.

The mean score for texture of the cakes were varied from 8.6±0.80 to 8.75±0.88. However Cake-1 score was higher in comparision to other ones but no statistical significant difference in texture of the cakes was found in this study.

The mean score for overall acceptability of the cakes were varied from 8.7±0.63 to 8.78±0.63. However Cake-1 score was higher for overall acceptability in comparison to other cakes so it was found to be the best one. On the other hand a statistical significant difference in overall acceptability of the cakes was also found in this study.

When results from different researchers were examined, it was found that the scores obtained by Arab *et al*. (2010), Hefnawy *et al*. (2012), Man *et al*. (2015), Dandachy *et al*. (2019) and Lenka *et al*. (2020) for texture, taste, appearance, and overall acceptability, respectively, were at par or within the range of the mean score of the present study. It can be concluded that the developed cakes were acceptable for all of their sensory attributes similar to other bakery products like bread, cookies, cakes and pastries.

Fig.1. Cake-1 with 10:7.5:7.5:7.5:7.5 (W:S:J:C:O)

Sensory evaluation of Cakes by hedonic scale

The average sensory evaluations of the cake's for colour, flavour, appearance, and overall acceptability based on Nine point hedonic scale is placed in Figure .2 . Cake-1 was found to be extremely popular by 65% of the judges, while Cake-2 and Cake-3 were both extremely popular with 21% and 14% of the judges, respectively. In light of this, it can be said that Cake -1 was the best from a nutritional quality i.e. rich in protein and phytochemicals and likes and dislikes as well from overall sensory evaluation point of view.
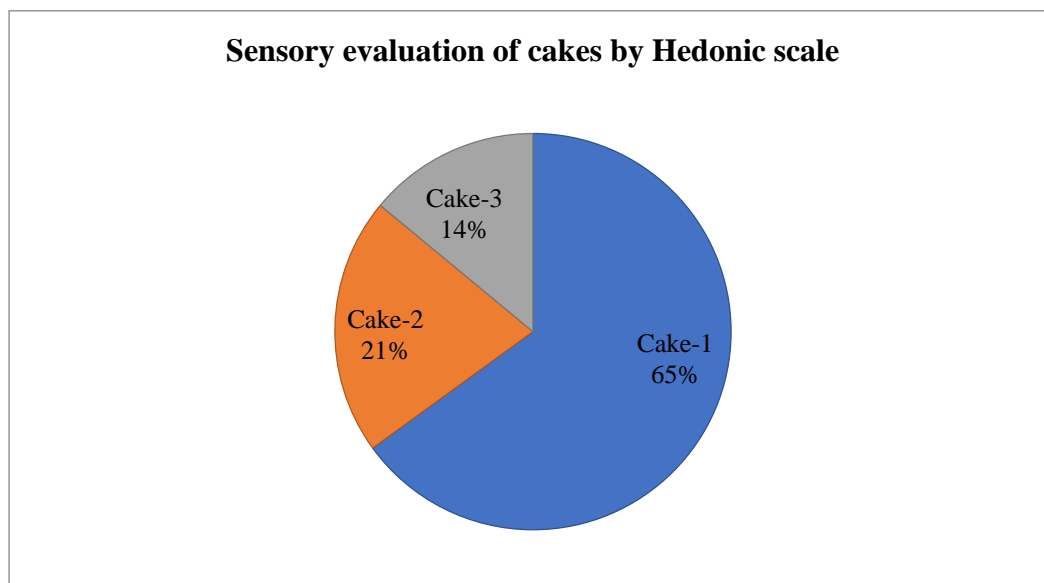

Fig.2. Sensory evaluation of cakes by Hedonic scale

Digestibility of Cakes

One of the most crucial factors in evaluating any food product is its ability to be digested. Being best one Cake-1 was supplied to panel members for one week at a rate of 20g per day . There were no serious complications among the members, such as diarrhoea, skin allergies, indigestion, etc. So, it can be inferred that the digestibility of developed Cakes made with soy bean chunk flour can be acceptable and useful for people of all ages.

To compare the self-life of commercial Cakes and developed Cakes

Table:1.4: Self-life of developed products:

Self-life of Cakes		
Sl. No	**Commercial Cakes**	**Developed Cakes**
Cake-1	5-6 days	4-5 days
Cake-2	5-6 days	4-5days
Cake-3	5-6 days	4-5days

The Table:1.4 compares the self-life of developed items with products sold commercially. Commercial Cakes have a self-life of 5–6 days, while developed Cakes have a self-life of 4-5 days. In the development of value-added products with soybeans, similar results were also noted by Kaur H. & Kaur N.(2019), Sharma D. *et al*.,(2014), Sivashankari M. *et al*.,(2021), and many others.

Table:1.5: To compare the cost with market available Cakes and developed Cakes

Sl. No of Cakes	Developed Cakes		Market available Cakes	
	Cost of developed Cakes (100g)	**Cost per piece (Rs.)**	**Cost of Market available Cakes(100g)**	**Cost per piece (Rs)**
Cake-1	14.14	1.41	25-35	2.5 -3.5
Cake-2	14.76	1.76	25-35	2.5-3.5
Cake-3	15.67	1.67	25-35	2.5 -3.5

The cost of developed Cakes and the cost of commercial Cakes are displayed in the table: 1.5. The price of developed Cakes was Rs. 14.14 for Cake 1, Rs. 14.76 for Cake 2 and Rs. 15.67 for Cake 3per 100gm i.e Rs 1.4 to Rs. 1.7 per piece, on the contrast market-available cakes cost Rs. 25 to Rs. 35 per 100g, so roughly Rs. 2.5 to Rs. 3.5 each piece. It was found that market-available Cakes were more expensive than developed Cakes and are around double the price of the developed cakes.

CONCLUSION:

Soyabean is well known for its nutritional potential since the time of immemorial i.e, from 1000 BC. Presence of antioxidants and phytonutrients along with substantial amount of calorie, protein , fat, calcium and iron made it more popular and gave it a different identity. Till now we are in a phase of transition neither free from under nutrition nor from over nutrition and marching towards hidden hunger which is upcoming silently. Lifestyle has been changed and people are preferring ready to eat food. At this juncture development of nutri

rich bakery products with soya chunk flour otherwise known as vegetarian meat is a better alternative. In the present research three varieties of cakes were developed with incorporation of different ingredients in different proportions. After nutritional and sensory evaluation it was found that Cake-1 scored higher for all sensory attributes such as appearance, colour, texture, flavour, taste, overall acceptability having protein content 13.43gm/100gm which is almost equal to the protein content of egg. Further Cake-1also content good amount of other nutrients such as fat 19.95gm, carbohydrate 41.91gm, energy ,390.55kcal, calcium 114.31mg, phosphorus 55.75mg and iron 8.67mg. Though nutritional contribution in other experimental cakes were more than Cake-1 but due to its overall acceptability it was considered best and can be recommended as nutri rich food supplement at anganwadi centres through ICDS for children, adolescent girls, pregnant and lactating mothers to address the nutrition and health challenges.

REFERENCES:

1. Akinola, O. T. and Owoseni, A. A.2017.Analysis of the Shelf Life of Soya Bean (Glycine max) Flour.British Microbiology Research Journal,20(4):1-6.

2. Alamu, E. O., Therese, G., Mdziniso, P. and Bussie, M. .D. 2017. Assessment of nutritional characteristics of products developed using soybean(Glycine max(l.) Merr.)pipeline and improved varieties. Cogent food & agriculture,3:13.

3. Arab, A. A. E., Helmy, F. M. I and Bareh, F. G. 2010. Nutritional evaluation and functional properties of chickpea (*Cicer arietinum L.*) flour and the improvement of spaghetti produced from its. Journal of American Science. 6(10):1055-1072.

4. Barr, B. E.2019. A study of soybean processing value maximization using selective handling strategies based on the analysis of soybeans received at Iowa elevators. Lowa states university capstones.

5. Chen, K. I., Erh, M., Su N W, Liu, W. H., Chou, C., Cheng, K. C. 2012. Soyfoods and soybean products: from traditional use to modern applications. Appl Microbiol Biotechnol, 96:9–22.

6. Chen, L. , Ronald, M. L., Vadlani, P. V., Li, L. and Wang, W. 2013 Value - Added Products from Soybean: Removal of Anti-Nutritional Factors *via* Bioprocessing. 161-179.

7. Dandachy, S., Mawlawi, H and Obeid, O. 2019.Effect of processed chickpea flour incorporation on sensory properties of Mankoushe Zaatar. Foods. 8(151):1 -9.

8. Dinesh, K., Agrawal, S., Billore, D., Sharma, A. N., Dupare, B. U. and Srivastava, K.2013. Soybean: Introduction, Improvement, and Utilization in India—Problems and Prospects. National Academy of Agricultural Science,2(4):293-300.

9.   Dr. Ayyappan, S. *et al*. 2014. Soybean for Household Food and Nutrition Security. National Agricultural Science Centre Complex, New Delhi.

10.   Granato, D., Massno, M. L. and de FREITAS, R. J. S. 2010. Stability studies and shelf life estimation of a soy-based dessert. Recebido para publicação em,30(3): 797-807.

11.   Hefnawy,T. M. H., ElShourbagy, G. A and Ramadan, M. F. 2012. Impact of adding chickpea (*Cicer arietinum* L.) flour to wheat flour on the rheological properties of toast bread. International Food Research Journal. 19(2): 521-525.

12.   Kathiriya, R. C., Vaghasiya, S. S. and Singh, S. N. 2019. Development of value added products using Soybean and Wheat. www.ycjournal.net,8(A):2277-7601.

13.   Kaur H and Kaur N(2019) "Development and sensory evaluation of value added bakery products developed from germinated soybean(Glycine max) varieties", Journal of Applied and Natural Science.11(1):211-216.

14.   Kohli, D., Kumar, S., Upadhaya, S., Mishra, R. 2017 .Preservation and processing of soymilk:A review. International journal of Food science and Nutrition, 2(6):66-70.

15.   Lenka, Chandrashree, Kumari, T. and Pradhan, T.2020. Fortification of Cake with chickpea flour as a protein enhancer. J. Res. ANGRAU 48(3) 49-56.

16.   Longvah, T. Ananthan, I., Bhaskarachary, K and Venkaiah, K. 2017. Indian food composition tables. Hyderabad: National Institute of Nutrition, Indian Council of Medical Research, Department of Health Research, Government of India, Hyderabad.

17.   Mazumde,r Md., A. R. and Begum, A. A.2016. Soymilk as source of nutrient for malnourished   population of developing country: A review. International Journal of Advanced scientific and technical research,6(5):2249-9954.

18.   National Protein Day 2021 report. https://www.ndtv.com/health/protein-day-2021-special-indias-right-to-protein-needs-immediate-attention-2379790.

19.   Otu, E. and F, Okibeya O. 2018 Economic Analysis of Value addition by Soybean Processing Firms In Cross River State Central Agricultural Zone, Nigeria. International Journal of Agriculture Innovations and Research,6(6):2319-1473.

20.   Ozoh, C. N. and Ibekwe, I. M. 2019. Determination of Shelf Life of Locally Produced soymilk. International journal of science and research,8(3):2319-7064.

21.   Sharma D, Gupta R, Joshi I(2014) "Nutrient Analysis of raw and processed Soybean and Development of value Added Soybean Noodles",Inventi Journal (P) Ltd.,(1).

22.   Silva, J. D., Prudencio, S., Carrao-Panizzi, M., Gregorut, C., Fonseca, F. & Mattoso, L. 2012. Study on the flavour of soybean cultivars by sensory analysis and electronic tongue. International Journal of Food Science and Technology, 47, 1630–1638.

23.   Sivashankari M, Pare A, S kumar V, Sadvatha R H, and Borkar N(2021) "Value addition of soyabean", Food and scientific reports,2(2):60-65.

24.   Sivashankari, M., Pare, A., S. Kumar, V., Sadvatha, R. H., and Borkar, N. 2021 Value addition of soyabean. Food and scientific reports,2(2):60-65.

25.   Srilakshmi, B. 2015. Evaluation of food quality.In: Food Science. New Age International (P) Limited Publishers, India. pp. 308-337.

26.   Ugwuona, F. U. 2009. Chemical and sensory evaluation of soy-fortified cassava-wheat biscuit. Journal of Tropical Agriculture, Food, Environment and Extension,8(1):55-59.