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Age wise preferences for fortified Aloo Tikki with soybean

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Abstract
Food fortification process includes addition of nutrients and bioactive components in foods. Fortification used as a tool to prevent malnutrition which is cost-effective, applicable and defensive methodology for malnutrition such as salt fortification, milk fortification and rice fortification in rising countries. Fortification is useful for the people suffering from undernourishment mostly influencing children and generative women. Soybean is single one houseplant which provide complete protein along with many other important nutrients like iron, manganese, copper, molybdenum, potassium and vitamin K, dietary fiber, Isoflavone, fat (63% polyunsaturated fatty acids, 23% monounsaturated fatty acids and 14% saturated fatty acids also provide omega-3 fatty acids), 30% carbohydrates and 38-40% protein (70% protein characterized by the blend of glycinin & β-conglycinin). The present research is intended to evaluate sensory quality and overall consumer acceptability of different blends of fortified aloo tikki with soybean by hedonic rating test. For preparation of different blends, boiled grated aloo was blended with boiled grinded soybean (Control group - 100% potato + 0% soybean, Sample A - 75% Potato + 25% Soybean, Sample B - 50% Potato + 50% Soybean and Sample C - 25% Potato + 75% Soybean). The sensory characteristics like appearance, mouth feel, texture and overall acceptability of fortify aloo tikki were evaluated by 50 panelists (Male 23 and female 27) by using 9-Point hedonic rating test. The results concluded that both age group 18-29 year and 30-40 year gave higher acceptability for sample B which hold equal ratio of soybean and aloo. Appearance of sample A and texture of Sample C were highly preferred by both age groups. Respondents of 18-29 year age group prefer sample A (52%) for mouth feel and respondents of 30-40 year age group prefer sample B (64%).

Keywords: Fortification, soybean, alootikki, sensory evaluation

Introduction
Food fortification is adding specific nutrients which are not naturally present in food (Iodine in salt) or non-nutrient bioactive components in food products known as food fortification. In developing countries, where malnutrition rate is very high and people could not afford a balance diet and suffering from nutrient inadequacies, fortification used as a tool to prevent micronutrients deficiencies to improve nutrients quantity and quality in their diet and also prevent many connected insufficiencies (Washington: National Academy of Sciences, 2003) [16]. The main nutritional root cause is micronutrient scarcities in diet influencing mostly children and generative women which results in many diseases, increasing mortality and morbidity, reduce work capacity, disability and premature death (Method & Tulchinsky, 2015, Verma, 2015, Black *et al*., 2013, Ramakrishnan, Goldenberg & Allen, 2011) [15, 23, 20]. The best way to combat malnutrition is food fortification used from several years which is cost-effective, applicable and defensive methodology for malnutrition (Method &Tulchinsky, 2015, Bhagwat, Gulati, Sachdeva & Sankar, 2014) [15, 5]. Locally available resources give benefit due to low charge and easily accessibility for rapid improvement in micro nutritional status of malnourished people such as salt fortification, milk fortification and rice fortification. Half of the world's population around 3 billion people takes benefit by rice fortification as they consume rice as their main staple food; De Pee, Tsang, Zimmerman & Montgomery, 2018) [8]. Implementation of fortification fruitfully precise nutrients insufficiencies and improve health. Exact assessment of dietary intake of different age group and sex is essential before food fortification because people are mystified about their nutrient requirements and dietary scarcity. Before fortification, understanding of food intake is important because it is used as a

biomarker. It helps to identify which age group is at risk and which nutrient is lacking in their diet. Thoughtful application of fortification, play a progressive role in the success of fortification (Dwyer T. J. *et al.,* 2015) [12]. In plant kingdom, soybean is the single one to provide complete protein with many other important nutrients like iron, manganese, copper, molybdenum, potassium and vitamin K. The structure of soybean holds different nutrients fat (63% polyunsaturated fatty acids, 23% monounsaturated fatty acids and 14% saturated fatty acids also provide omega-3 fatty acids), 30% carbohydrates and 38-40% protein from which more than 70% protein characterized by the blend of glycinin and β-conglycinin that are essential proteins for humans (S.K. Giri *et al*., 2012, K. Liu *et al*., 1997) [11, 14]. Constipation is one of the most common problems in all age groups but mainly affect pregnant women, children and elderly people are prevented by dietary fiber and physical activity. Soybean contains good amount of dietary fiber (Patil A.G. *et al.,* 2010) [18]. Isoflavone present in soybean lessen the prevalence of menopausal symptoms, hormone dependent prostate cancer and breast cancer, cardiovascular disease, osteoporosis and colon cancer (T. Clarkson *et al.,* 2000, H. Yu *et al.*, 1991, H. Adlercreutz *et al.,* 1990, H. Adlercreutz *et al*., 1992, D. Rose *et al*., 1986) [7, 24, 2, 1, 26]. Anti-nutrient element (trypsin inhibitor, protease inhibitor, phospholipids, saponins and phytates) were shattered during cooking and processing. Different varieties of dishes produced by soybean are delicious and easily digestible and a good replacement of meat (J.L. Penalvo *et al*., 2004) [19].

Methodology

Ingredient of alootikki: For the production of aloo tikki, soybean, potato, salt and oil were purchased from local market of Jhansi.

- **Preparation different levels for fortification**

a. Control = 100% potato + 0% soybean
b. Sample A = 75% potato + 25% soybean
c. Sample B = 50% potato + 50% soybean
d. Sample C = 25% potato + 75% soybean

- **Procedure for preparation**

- Potato -: At very first, wash the potato thoroughly with water to remove dirt and foreign particles, then after boiling and removing skin, grate the potato by domestic grater.
- Soybean -: Wash the soybean with water to remove dirt and husk. Then soak overnight, boil the soaked soybean and coarsely grind it. Add salt mix it well, then shallow fry in oil (refined soybean oil).

- **Sensory Evaluation**

Sensory analysis of fortified aloo tikki was done by Hedonic rating test by 50 panelists of both sexes (male and female). Appearance, texture, mouth feel and overall acceptability evaluated by panelists with 9-point hedonic rating scale and the scored as:

1 (dislike extremely) 2 (Dislike very much)
3 (Dislike Moderately) 4 (Dislike slightly)
5 (Neither like or dislike) 6 (like slightly)
7 (like moderately) 8 (like very much)
9 (like extremely)

Statistical Tool

A 9- point hedonic rating scale was used for data collection and SPSS software version was 20 used for data analysis.

Result & Discussion

Table 1: Comparison of different nutrient values between Control sample, Sample A, B & C

Treatments	Aloo Weight	Soybean Weight	Protein (gm)	Fiber (gm)	Iron (mg)	Calcium (mg)
Alootikki (Control)	150gm	0gm	2.4	2.55	.72	15
Sample A	112.5gm	37.5gm	18	10.5	4.44	101.25
Sample B	75gm	75gm	33.6	18.52	8.16	187.5
Sample C	37.5gm	112.5gm	49.2	26.43	11.88	273.75

Table 1 elaborated nutrients comparison among different levels of fortification. The highest nutrients value was visible in Sample C which contains maximum quantity of nutrients regarding protein (49.2gm) followed by sample B (33.6gm), sample A (18gm) and control sample (2.4gm). It is observed that soybean also increases the protein quantity in different formulation. Concerning iron content, the greatest amount was seen in sample C (11.88 mg) then in sample B (8.16 mg) and sample A (4.44) and in control sample (.72mg). Table also portrayed that the decreasing amount of soybean in formulation decrease the amount of calcium as control sample have lowest amount (15 mg). Controlled sample which hold least amount of Soybean (0gm) have minimum calcium, on the other hand sample C have 273.75 mg calcium which enclose the greater quantity of soybean (112.5gm). Controlled sample covers smallest amount of fiber compare to all samples as sample A hold 10.5gm, sample B have 18.52gm and sample C have 26.43gm of fiber. Laura A. P. and Sergio o. S. S. (2016) also conduct a remarkable study and concluded that adding defatted soybean flour approximately 6% in wheat flour tortillas and maize tortillas significantly enhanced the amino acid quantity mainly tryptophan and lysine, nitrogen holding values, PDCAAS and PER. Similar results were seen in investigation done by Farzana T. *et al.,* (2017) [22] as they revealed that newly developed soy-mushroom-*moringa* soup powder hold great amount of nutrients includes iron, manganese, sodium, zinc, potassium, protein, vitamin C & D and dietary fiber but also low in energy and fat level associate to locally available soup powder that mark them perfect choice of the people to accomplish their nutritional requirements. Ewulo *et al.,* (2017) [9] also examined that sample WMS4 (white maize 90% + *moringa* 7.5% + soybean 2.5%) enclose sufficient quantity of vitamins, protein, antioxidants, crude fiber with minimum amount of anti-nutrients select as best formulation.

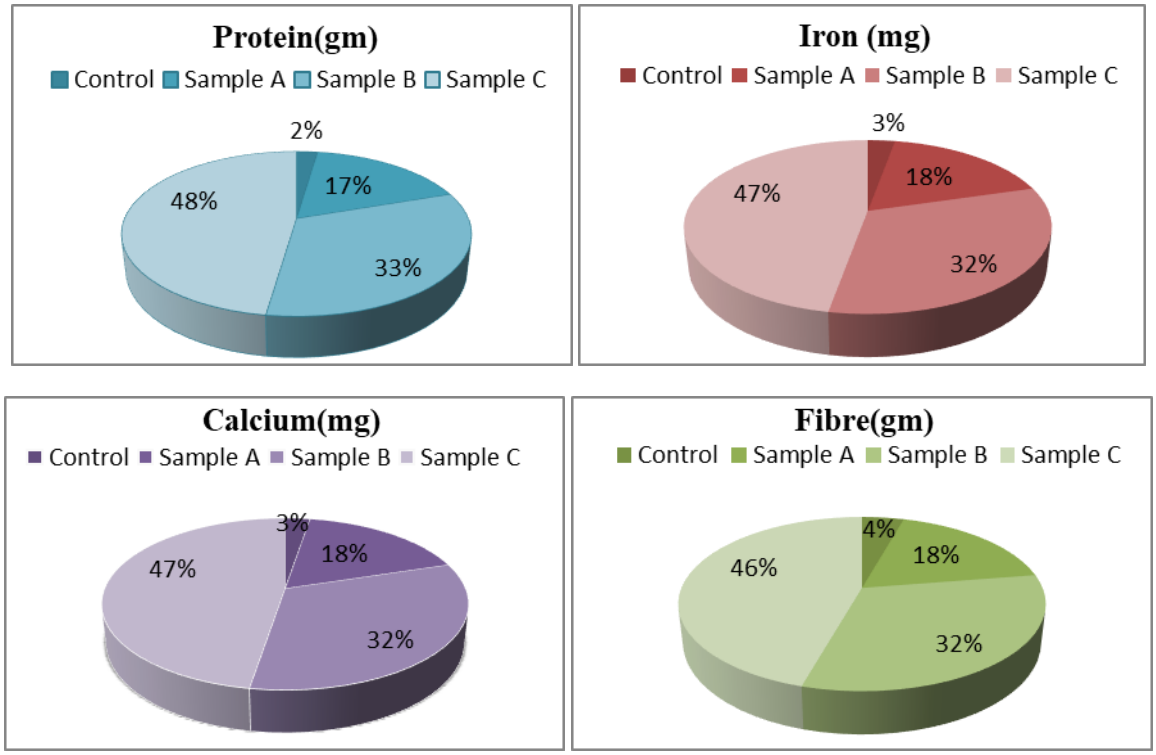

Fig 1: Comparison of different nutrient values between Control sample, Sample A, B & C

Table 2: Sensory acceptability of different age group

S. No.	Sensory Quality	Age group (years)	
		18-29 (N=25)	30-40 (N=25)
1	Appearance		
	Sample A	15 (60)	18 (72)
	Sample B	7 (28)	4 (16)
	Sample C	3 (12)	3 (12)
2	Texture		
	Sample A	2 (8)	7 (28)
	Sample B	4 (16)	5 (20)
	Sample C	19 (76)	13 (52)
3	Mouth feel		
	Sample A	13 (52)	6 (24)
	Sample B	10 (40)	16 (64)
	Sample C	2 (8)	3 (12)

Figures in parenthesis indicates percentages

Table 2 demonstrated that appearance of sample A was preferred by both age groups 18-29 year (60%) and 30-40 year (72%) whereas similar views regarding texture was seen for sample C (76% and 52%). Preference for mouth feel have greater percentage for sample A (52%) given by 18-29 year age group and 64% for sample B by 30-40 year age group. Taghdir *et al*., (2017) shown that gluten free bread developed by adding (15%) soy flour expand its nutritional properties, quality and also enhance organoleptic characteristics.

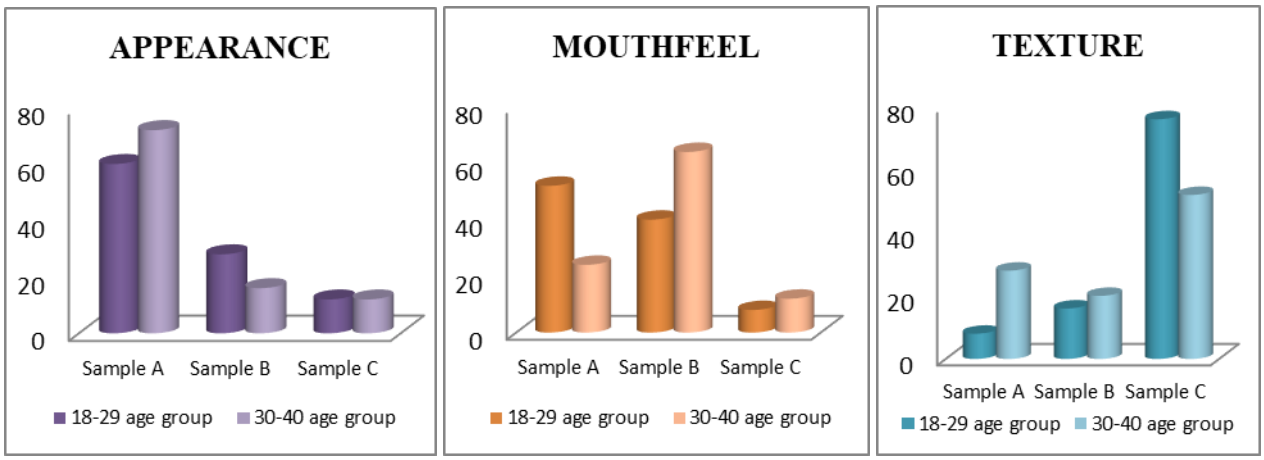

Fig 2: Sensory acceptability of different age group

Table 3: Sensory acceptability of different blends among female and male of two age groups

S. No.	Sensory quality	Female (years)		Male (years)	
		18-29 (N=16)	30-40 (N=11)	18-29 (N=9)	30-40 (N=14)
1	Appearance				
	Sample A	8 (50)	8 (72.7)	7 (77.7)	10 (70.1)
	Sample B	5 (31.2)	2 (18.1)	2 (22.2)	2 (14.2)
	Sample C	3 (18.2)	1 (9.1)	0 (0)	2 (14.2)
2	Texture				
	Sample A	1 (6.2)	4 (36.3)	1 (11.1)	3 (21.4)
	Sample B	2 (12.5)	3 (27.2)	2 (22.2)	2 (14.2)
	Sample C	13 (81.2)	4 (36.3)	6 (66.6)	9 (64.2)
3	Mouth feel				
	Sample A	9 (56.2)	2 (18.1)	4 (44.4)	4 (28.5)
	Sample B	6 (37.5)	9 (81.8)	4 (44.4)	7 (50)
	Sample C	1 (6.2)	0 (0)	1 (11.1)	3 (21.4)

Figures in parenthesis indicates percentages

Table 3 unveiled that regarding appearance, females and males of both age group 18-29 year and 30-40 year gave majority of acceptability for sample A i.e. 50%, 72.7% ,77.7%, and 70.1% respectively. Concerning the texture, 18-29 year of both females and males prefer sample C (81.1% and 66.6% respectively) due to crunchy texture but females of 30-40 year prefer two samples i.e. - A (36.3%) and sample C (36.3%) although males of 30-40 year preferred texture of sample C (64.2%). Majority of appropriateness regarding mouth feel was seen for sample A (56.2%) by 18-29 year old females while 30-40 year old females pick out sample B (81.8%) . Males of 18-29 year mostly prefer sample A and B (44.4%) and males of 30-40 year prefer sample B (50%). Amin *et al.*, (2016) [3] conclude that 5% to 10% pea flour and soybean flour added in cookies mark highest concerning flavor, color, texture and taste in sensory evaluation.

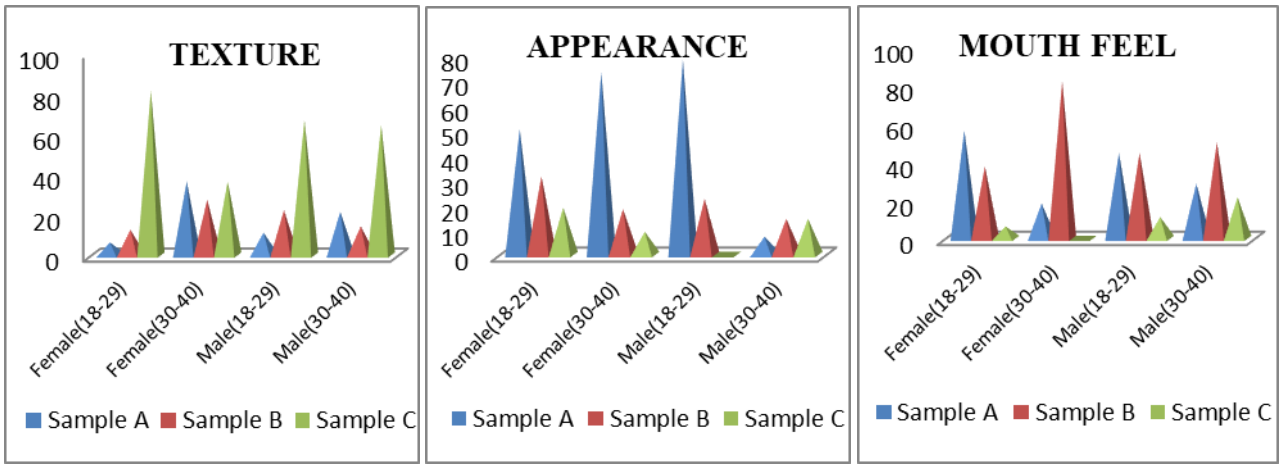

Fig 3: Sensory acceptability of different blends among female and male of two age groups

Table 4: Overall age wise acceptability of fortified Aloo Tikki

Sample	18-29 year(n=25)		30-40 year(n=25)	
	Frequency	%	Frequency	%
Sample A	2	8	8	32
Sample B	17	68	11	44
Sample C	6	24	6	24

Table 4 represented a comparative analysis of overall acceptability between different age groups. Sample B contains maximum acceptability by both age groups (68%) by 18-29 year and (44%) by 30-40 year. Sample A contains minimum acceptability by 18-29 year (8%) and sample C have least acceptability by 30-40 year (24%). M. O. *et al.*, (2011) unveiled that blend (wheat flour 30%+ cassava 60%+ soybean flour 10%) for biscuit achieve maximum overall acceptability.

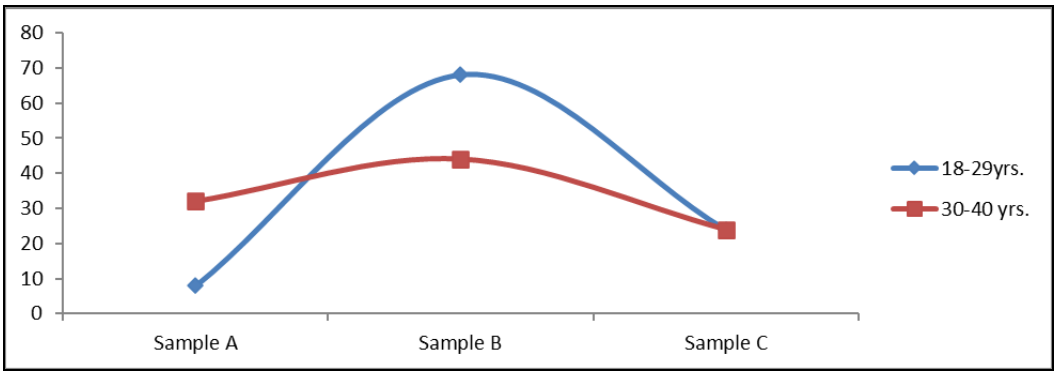

Fig 3: Overall age wise acceptability of fortified aloo tikki

Conclusion

Conclusion strained from the study disclosed that sensory acceptability was analyzed by appearance, texture and mouths feel. The results concluded that both age group 18-29 year and 30-40 year gave higher acceptability for sample B which hold equal ratio of soybean and aloo. Appearance of sample A and texture of Sample C was highly preferred by both age groups. Suitability for mouth feel have greater percentage for sample A (52%) through 18-29 year age group and 64% for sample B by 30-40 year age group.

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