ORIGINAL ARTICLE

Development of micronutrients rich homemade extruded food products with the incorporation of processed foxtail millet, wheat and chickpea

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Abstract | Introduction | Methodology | Results | Conclusion | References | Citation | Tables / Figures

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Citation

Gautam L, Chaturvedi N, Gupta A. Development of micronutrients rich homemade extruded food products with the incorporation of processed foxtail millet, wheat and chickpea. Indian J CommHealth. 2014;26, Suppl S2:288-293

Source of Funding : Nil **Conflict of Interest:** None declared

Abstract

Background: Food based approaches are recognized as an essential part of an urgently needed more comprehensive strategy for improving nutrition by increasing the availability and consumption to combat iron and other micronutrient deficiencies. **Aims & Objective:** The specific objective of the study was utilization of Foxtail millet (Setariaitalica) along with other flour for production of micronutrients rich ready-to-eat snack products using homemade extrusion cooking. **Material and methods:** Methods Composite flour were prepared using processed Foxtail millet flour (FMF) and other processed flours namely; wheat flour (WF), and chick pea flour (CPF). Nutritional properties of the blends were analyzed by using standard procedure. Two homemade extruded products namely; namkeensev, seviyan were prepared with four treatments T0, T1, T2, & T3. The commonly consumed recipes were developed by incorporating 50%, 75% and 100% of best result malted composite flour (FMF+CPF+WF). **Results:** The organoleptic qualities of these extruded samples were analyzed by panelists on a 9 point hedonic scale. The result indicate that the processed composite flour (FMF+CPF+WF) based products were significantly accepted at the level of $p<0.05$ 50% incorporation followed by 75% and 100% respectively.**Conclusions:** The present study conclude that, processed composite flour (Foxtail millet; wheat; chickpea) in the ratios of (50:50) could be used to produce nutritive quality of homemade extrudates with acceptable sensory properties as they deliver vehicles for malnourished children

Key Words

Foxtail millet; processed composite flour; home-made extruded products; Micronutrients

Introduction

Cereals Like wheat maize are stable food for majority of population around the world. They are source of carbohydrate and supply of calories and other nutrients to the consume. Apart from value addition by processing to traditional products from these gains development of new products offers a variety and convenience quality cost better product quality and no-process effluents (Camire et al., 1990). In India, a vast majority belongs to the poor strata and their diet consist mainly of cereals and millets like maize and sorghum. These are mainly rich in carbohydrate but deficient in proteins and in certain amino acid like lysine which leads to malnutrition. Extrusion cooking is an important processing technique in food processing it is used increasingly in traditional food processing for their modernization and industrialization it modifies the nutritive value of extruded products qualitatively and quantitatively. (Janson. et al., 1978, Joshi, 1997). Foxtail millet (Setariaetalica) are cheaper and nutritional comparable or even superior of major cereals, especially with respect to protective nutrient (Gurmukh, et al., 2003). Millets or whole grain consumption also helps lowered the risk of cardiovascular disease, Is chemic stroke type II

diabetes, metabolic syndrome and gastrointestinal cancers (Jones et. al., 2006). Various millets viz pearl millet finger millet, proso millet, foxtail millet, kodo millet and barnyard millet are grown in India (Rao et al., 1991). Among these foxtail are minor millet which also called as Italian millets commonly known as Kangri, Korra, navana, tenai, Kakun and rala (Pawar and Pawar, 1997). In India, these are mostly used in food purpose especially by the people of lower income groups. (Malleshi et al., 1985). The nutritive value of foxtail millet is quite composing to rich. It is twice richer in protein, four times richer in mineral and fat and thrice richer in calcium as compared to rice (Gopalan et al., 1997). Foxtail millet are major sources of Protein, Fibre, Carbohydrate and other micronutrient in daily diet and thus positively impacts an health. (Thathola, 1990, Pathak et al., 2002.). Fixtail millet is rich source of some essential amino acid mainly leucine, vitamins (thiamin, riboflavin niacin) and minerals (calcium manganese, Potassium). Foxtail millet appeared as the only cereal in which lysine is only limiting amino acid it is also a good source of dietary fiber thus, beneficial for diabetic population (Singh et al., 2003). Chickpea (cicerarietinum) is the most important pulse crop in India from production and consumption point of view, & also important is Australia, Bangladesh, Iran, Iraq, Myanmar, Nepal, Pakistan, Spain, Syria, Tanzania and Turkey (Singh, 1999). During 1992. India accounted for over 70 percent of the world's production and consumption of chickpea (ICRISAT, 1993).Chickpea in seed contain 29% Protein, 59% Carbohydrate 3% Fiber 5% oil and 4% ash chickpea protein is rich in lysine and argenic but most deficient in sulfur containing amino acid methionine and cystine (Iqbal, et al., 2006). Chickpea is also a good source Ca, P, Mg, Fe and K (Chavan et al., 1989, christodulour 2005). Wheat malting increase PER (Protein Efficiency Ratio) and FER (Feed Efficiency Ratio). (Emmanual and Okroie, 2002). Malting increases the availability of amino acids. Improve digestibility and reduce the level of nutritional stress factors especially physic acid, trypsin inhibitors and tannin. (Wang and Fields 1978, Brandtzeag, et al., 1981). There is a significant increase in vitamin C during matting due to enzymatic hydrolysis of starch by amylases, diastase which degrade the starch into glucose which becomes the precursor of vitamin C (Tavr et al., 1984).

Rationale: Extruded food are the most convenience food consumed now-a-day preparation of homemade extruded recepies by the combination of cereals legume will enhance the nutrients value of the product which would be rich in protein & fiber and low in fat. The unique nutritional composition of chickpea and foxtail millet will make a great scope to meet the nutritional requirement of vegetation and poor people of our country the combination of cereal/legume based extruded products. It would consider beneficial for diabetic malnourished population.

Aims & Objectives

1. To study was utilization of Foxtail millet (Setariaitalica) along with other flour for production of micronutrients rich ready-to-eat snack products using homemade extrusion cooking.
2. Composite flour were prepared using processed Foxtail millet flour (FMF) and other processed flours namely; wheat flour (WF), and chick pea flour (CPF) and sensory acceptability of the product

Material and Methods

Raw materials: Foxtail millet, wheat, and chickpea were purchased from local commercial suppliers, consisted of processing of millet, pulse and cereal which are basically foxtail millet, Chickpea and Wheat. All these undergo for malting process in which 12 hrs steeping & 48 hrs. Germination has been performed. All these processed millet, pulse and cereal are converted into flour.

Composite flour preparation: Blends were prepared by mixing Foxtail millet flour, wheat flour and chickpea flour in the different ratios on a dry-to-dry weight basis with the standard flour. Different treatment T1, T2, and T3, were prepared with the standard T0 shown in the Table 1, 2 and 3.

Chemical analysis of the mixed flour: Analysis of proximate composition of developed mixed flour were done by using standard procedure. The parameter analyzed were as follows, moisture, Protein, Fat, Ash, Fiber, charbohydrate, iron, calcium, phosphorus and vitamin C**.**

Product development and sensory evaluation: Development of extruded product in order to select the recipes of present study various recipes based on extrutsion technique, home-made extruded products with malted foxtail millet chickpea and wheat with different proportions. Hence, recipes

were selected and made according to the instruction given in the method. One sample served as controlled designated as standard (T0) and other test recipes i.e. T1, T2, T3 were made by incorporation of mixed flour (FMF+CPF+WF) in different concentration of 50% 75% 100% respectively. Products (namkeensev and seviyan) were developed. All recipes were prepared in food science lab Banasthali University. Selection of panel members involves the screening of 20 postgraduate students. All of them were subjected to triangle deference test. In the present study, triangle difference test was conducted using ginger parantha. Among the three examples two were same and one was different the panel member were asked to pick out in each triangle set the sample. Which is different the sample were presented in following order. 1-OOX 2- OXO and 3-XOO Therefore, O - Control or duplicate sample (Simple parantha) X - Treated or odd sample (parantha with Ginger). Then 15 student having sharp discrimination, discretion and communication powers were selected and then proceeded for other evaluation. The result were draw on the basic of evaluate the products for acceptability based on its flavour, texture, taste, color and overall acceptability using nine-point hedonic scale (1 = dislike extremely to 9 = like extremely; Meilgaard et al., 1999).

Result and Discussion

Compositional analysis of composite flour: from the results observed that the composite flour have higher amount of moisture (7.68%), crudefibre (13.04%), protein (20.21%), carbohydrate (7.02%), iron (26.82%) and vitamin c (70%). As shown in figure 1 . A similar study were observed by (Platel K et, al. 2010).

Home made extruded products and sensory acceptabity: Namkeen Sev was made by incorporating malted mixed flour (FMF+CPF+WF) in different concentration (50%, 75%, 100%). According to taste, and over all acceptability were ranged (7.4±0.82 and 7.3±0.83) all the product were acceptable as standard recipe except the test recipe T1 that were slightly acceptable by the semi trained panels members. Deshpande H et, al. 2011 also study on development of extruded products of the foxtail millet based composite flour and found the composite flour extruded products are better appearance, texture, taste and overall acceptability.

According to the data all the test samples of saviyan T1, T2 and T3 were ranged 7.4 ± 0.92 to 8.1 ± 0.70 the overall acceptability of all malted mixed flour incorporated samples were insignificant at $P \leq 0.05$. Thus all these products were as good as standard (figure 3).

The result on the basis of sensory acceptability revealed that both NamkeenSev and Seviyan incorporated with 50% mixed flour were insignificant at $p<0.05$ compared with standard. Both 75% and 100% in corporate samples (T2 and T3) of NamkeenSev and seviyan were not comparable with standard in attributes of colour, appearance and taste.

Thus 50% incorporated sample (T1) of both products (namkeensev and seviyan) were liked by semi traindpanel member

Conclusion

The present study conclude that the extruded food are the most convenience food. Processed composite flour (Foxtail millet; wheat; chickpea) in the ratios of (50:50) could be used to produce nutritive quality of homemade extrudates with acceptable sensory properties as they deliver vehicles for malnourished children

Recommendation

Malting as a processing technique can be used to effectively enhance the nutritional / organoleptic status of foxtail millet, wheat, and chickpea. Nutritional composition of homemade extruded products which was made by composite flour of (foxtail millet, wheat and chickpea) can be use a great scope to meet the nutritional requirement of vegetarian and poor people of our country.

Relevance of the study

The present study focuses on use of processed foxtail millet based composite flour in development of homemade extruded products because it is evident from studies that malting and composite flour of millet, wheat and chickpea enhances the micronutrient content of foods.

Authors Contribution

LG: Substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data; drafting the article or revising it critically for important intellectual content; Final approval of the version to be published. NC: Final

approval of the version to be published. RP: Final approval of the version to be published. AG: drafting the article or revising it critically for important intellectual content.

Acknowledgement

I wish to thank the department of science and technology Rajasthan for financial support, the Food Science and nutrition department Banasthali University Rajasthan, for providing facilities to carry out chemical analysis, and food lab. I express immense gratitude to my esteemed supervisor Dr. Neelam Chaturvedi, Assistant Professor for supervised me.

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Tables

TABLE 1 PREPARATION OF COMPOSITE FLOUR

	Flours		
	Foxtail millet	Chickpea	Wheat
Ratios in %	40	30	30

TABLE2 STANDARDIZATION FORMULATION OF COMPOSITE FLOURS DEVELOPMENT FOR NAMKEEN SEV

Sr. no.	Flours	Proportion of Composite FlourSamples			
		T0	T1	T2	T3
1	Basen	100	50	25	-
2	Mixed flour (FMF+CPF+WF)	-	50	75	100

TABLE 3 STANDARDIZATION FORMULATION OF COMPOSITE FLOURS DEVELOPMENT FOR SEVIYAN

Sr. no.	Flours	Proportion of Composite FlourSamples			
		T0	T1	T2	T3
1	Refined flour	100	50	25	-
2	Mixed flour (FMF+CPF+WF)	-	50	75	100

TABLE 4 CHEMICAL ANALYSIS OF THE COMPOSITE FLOUR

Proximate composition	Mixed flour	
	Unprocessed	Malted
Moisture (g/100g)	11.6	11.91(7.68)
Protein (g/100g)	13.9	16.71 (20.21)
Fat (g/100g)	3.7	2.7 (27.02)
Crude fibre (g/100g)	4.6	5.2 (13.04)
Ash (g/100g)	3	2.2 (26.66)

Carbohydrate (g/100g)	63.7	68.2(7.02)
Iron (mg/100g)	4.1	5.4(26.82)
Calcium (mg/100)	93.6	53.5(42.84)
Phosphorus (mg/100)	319	182 (42.62)
Vitamin C (mg/100)	3	5.10 (70)

Figures

FIGURE 1 EFFECT OF MALTING ON PROXIMATE COMPOSITION CONTENT ON COMPOSITE FLOUR

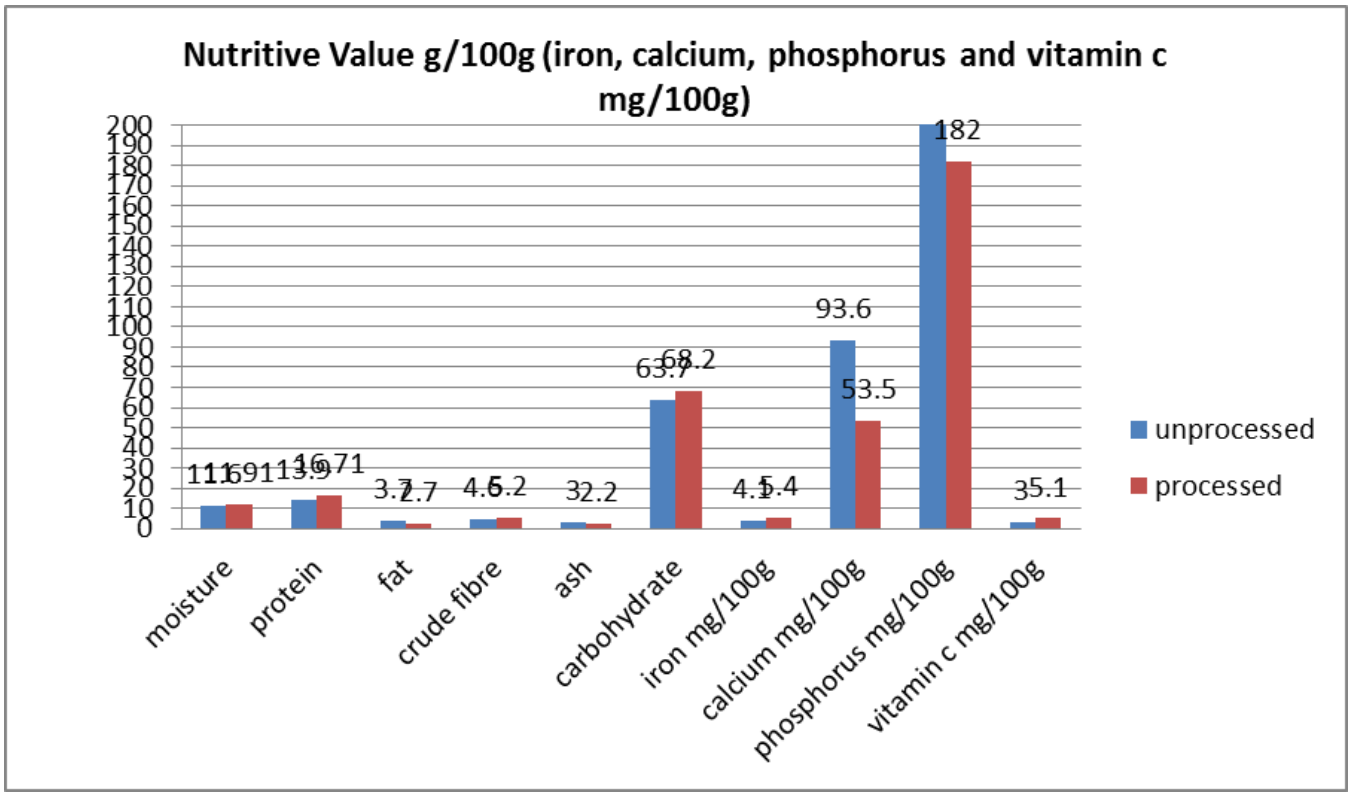

FIGURE 2 EVALUATION OF FOOD PRODUCT I (NAMKEEN SEV) IN TERM OF COLOUR, APPEARANCE, TASTE, AFTER TASTE AND OVER ALL ACCEPTABILITY

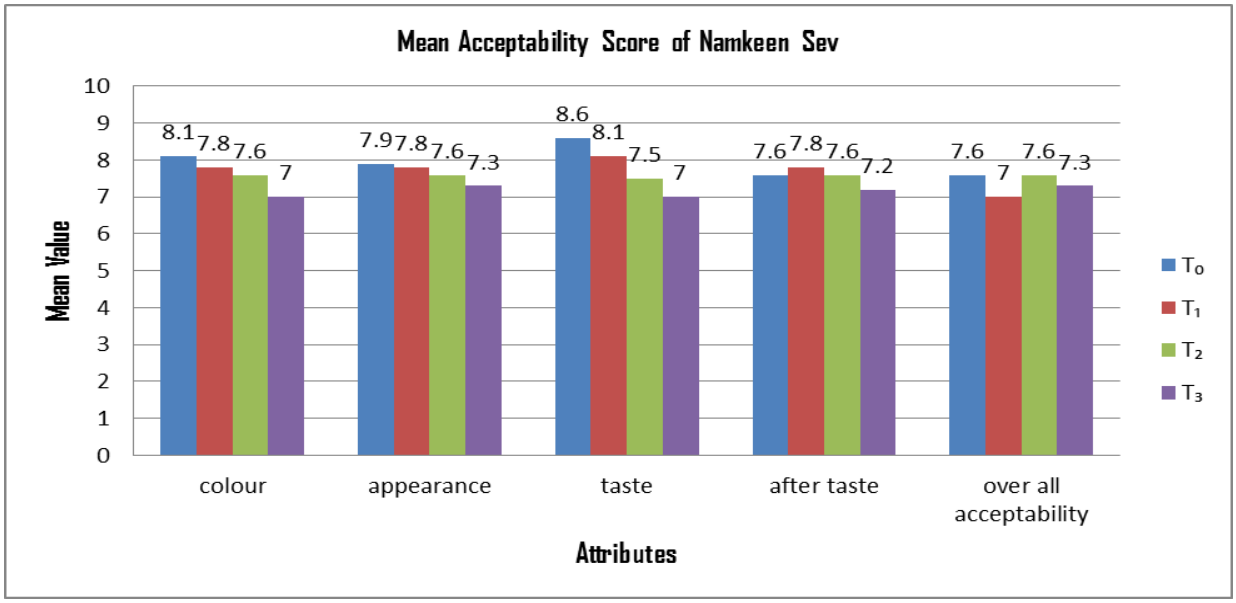

FIGURE 3ACCEPTABILITY EVALUATION OF FOOD PRODUCT II (SEVIYAN) IN TERM OF COLOUR, APPEARANCE, TASTE, AFTER TASTE AND OVER ALL ACCEPTABILITY