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Production and Consumers' Acceptability of Meat Turnovers Produced From Wheat and Millet Flour Blends

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Abstract

Millet based turnovers were developed by combination of millet flour at 30% and 50%. The control was made up of 100% wheat flour. The wheat flour was fortified with the millet flour which increased the level of protein (9.45%) of the turnover produced from 70% wheat flour and 30% millet flour. It was much higher than that of 7.29% for control turnover. Fat content of the control (MS1) is 17.5%, MS2 and MS3 had 15.92% and 22.42% respectively. It was observed that turnover produced from 70% wheat flour and 30% millet flour had the highest fat content than that of the control. The control had 49.17% carbohydrate, MS2 had 48.33% and MS3 also had 52.71%. The sensory properties of the turnover samples showed that the control was significantly ($p<0.05$) different in texture, taste and overall acceptability of 5.0 score of approximately and the remaining attributes had a mean score of 4.0. Sample MS2 (70%wheat flour and 30% millet flour) and sample MS3 (50% wheat flour and 50% millet flour) was least preferred in terms of colour aroma and texture with a score of approximately 3.0. While sample M2 (50% wheat flour and 50% millet flour) had the mean value of approximately 5.0 for overall acceptability including the control and was not significantly ($p<0.05$) different from the control. This indicates that millet flour could be used in the production of quality turnovers and could also be used for substituting wheat flour up to 50% level in turnover production without any effects on the sensory attributes of the product.

Keywords: Millet; Millet Turnovers; Proximate; Composite Flour; Ghana

Introduction

Millets have been considered as the staple food worldwide, especially in the diets of African and Asian people [1,2]. Millets are currently cultivated and consumed in Ghana and most Africa countries and this provides a significant contribution towards the protein requirement to the people who consume it [1]. For many years, the cereal has attracted enormous attention because of the way it adapt various soil and climatic factors [3]. Millet has a lot of health benefits and is a good source of energy, protein, minerals and vitamins. Millet protein has is a good source of essential amino acids excluding threonine and lysine but rather contain high amount of methionine. Millet is termed as nutria-cereals because it contains abundant micronutrients and phytochemicals [1]. Nowadays, baked products form part of the major processed foods on Ghanaian market and this industry is rapidly changing with advancements in developments of new products [4]. The products made from bakery industry comply with consumers' health and their eating habits and to achieve this goal the modernization of bakery plants and new product developments are necessary [5]. Wheat flour is used to produce bakery products, due to its unique functional properties. Meat turnover is a well-known snack usually made from wheat flour. It is the best common pastry that can be taken while hot or warm [6].

The development of new products has achieved greater impact for the past years and this is as a result of increased in population. This has prompted a change in perspective in the utilization of cereals and grains for wheat products, particularly baked goods, bread, and cakes in Ghana and sub-Sahara Africa [7]. There has been additionally a huge move from utilization of indigenous foods, for example, grains, organic product, leguminous plants and vegetable to increasingly refined foods. In any case, the generation of wheat in Ghana is very low and far below residential necessity. Wheat plant cannot be cultivated in Ghana due to climatic reasons [8]. The climatic condition in Ghana favours the cultivation of indigenous plants such as plantain, banana, maize, sorghum and millet, cassava, yam, cocoyam and sweet potatoes, soybean and cowpeas. These raw materials can be prepared into composite flour and utilized economically in the pastry industry.

The nutritional importance of wheat flour cannot be underestimated, particularly in less developed countries where bread, noodles and other products provide a substantial proportion of the diet. It contains carbohydrate 68.5%, protein 12.6%, fat 2%, minerals 2.10% consisting of vitamin E, thiamine, riboflavin etc. Wheat is also a good source of minerals like selenium and magnesium, nutrients essential to good health [9].

Among cereals, millets are unique due to their higher amount of calcium, dietary fibre, polyphenols and protein [10]. Millets are found to have higher quantity of minerals when compared to wheat. The composition of millet flour comprises protein 12.6 %, fat 2.0%, carbohydrate 68.5 %, starch 66.8 %, total Sugar 1.7 %, vitamin E 0.6%, thiamin 0.30%, Riboflavin 0.07%, Niacin 1.7%, Folate 51%. [11]. Generally, millet proteins are a good source of vital amino acids excluding lysine and threonine, while they are rich in methionine and also rich in phytochemicals and micronutrients [12,13]. Millet flour is a good source of vitamins B, magnesium, and antioxidants. Millet is likewise an awesome source of different dietary minerals such as manganese, phosphorus and iron. The proteins found in millet are essential source of amino acids except lysine and threonine but are surprisingly high in sulphur comprising amino acids methionine and cysteine [14]. Apart from this, some important fatty acids like linoleic, oleic and palmitic acids discovered in free form and monogalactosul, diacylglycerols, digalactosyl diacylglycerols, phosphatidylethanolamine, phosphatdyl serine and phosphatidyl choline within the certain form present in millets[15]. Other fatty acids i.e. arachidic acid, behenic acid, erucic acid are discovered in small amounts. Millet oil will be an awesome supply of linoleic acid and tocopherols [16]. Millet is an alkaline forming grain that is gluten-free [17]. Vitamin B consisting of Niacin, folacin, riboflavin, and thiamine and phosphorus are found in millets that play a key position in strength synthesis within the body.

The expansion of indigenous raw materials, for example, millet flour as composite ingredient to wheat flour would expand the wholesome and utilitarian qualities of wheat flour. Hence, the purpose of the study was to produce acceptable Meat turnovers from composite millet and wheat flour blends

Materials and Methods

Source of raw Materials

A bowl of millet, wheat flour, baking powder, salt, margarine, eggs, onions and corn beef were procured from Bolgatanga market, the millet was destoned, washed, dried, before milling into flour.

Preparation of millet/wheat composite flour

Composite flour samples comprising wheat and millet flours were formulated by substituting millet flour with wheat flour at the percentage of 100:,70 and 50%, level of wheat flour substitutions (70:30 and 50:50) respectively, one hundred percent (100%) wheat flour was used as control using the method described by [18]. In all three different samples were prepared.

Ingredients	MS 1	MS 2	MS 3
Wheat flour	100g	50g	70g
Millet flour	-	50g	30g
Margarine	60g	60g	60g
Baking powder	5g	5g	5g
Nutmeg	1 teaspoon	1 teaspoon	1 teaspoon
Salt	½ teaspoon	1 teaspoon	1 teaspoon
Eggs	2	2	2
Corn beef	50g	50g	50g
Onions	2 medium	2 medium	2 medium
water	100 ml	100 ml	100 ml

Table 1: Measurement for Millet Composite meat turnovers

Method of Preparing of Turnovers

The method described by with minor alterations was used for the preparation of the meat turnovers [19]. A straight dough procedure was used for the preparation of the meat turnovers. Ingredients such as nutmeg (1 teaspoon), salt (½ teaspoon), margarine (100 g), baking powder (5 g), water (100 mL), and millet flour were added in right proportions to each of the flour blends and the control flour. The substitution level of millet flour into wheat flour was (50% and 30%) for making the meat turnover dough. The blends were mixed with ingredients in a Philip's food mixer (for 5 min). Water was added to the flour inside the food mixer and the mixture was transferred into a floured surface. The resulting dough rolled using rolling pin and was cut and filled with the chopped onions, corn beef and carrot. The other side was folded over, and the edges were pressed close with a thumb. Then it was exposed to baking at the temperature of 180 °C for 25 minutes.

Proximate composition

The functionality of flours of cereals grains, which depends to a great extent upon starch and protein content of flours, contribute a lot to the formulation and properties of the final product Therefore, flours were analyzed for their physicochemical and functional properties. Particularly, the functional properties are required for the formulation of value added composite bakery products. Moisture, ash, Protein, fat, and carbohydrate were determined by the methods [20]. The carbohydrate content was calculated by subtraction method.

Sensory Analysis

Fifty (50) semi-trained panelists, who were familiar with meat turnovers quality attributes, were randomly selected from staff and students of the Hotel, Catering and Institutional Management Department, Bolgatanga Polytechnic. The tasting was carried out in the Food Production Laboratory, Department of Hotel, Catering and Institutional Management; Bolgatanga Polytechnic .This environment enabled easy access to fifty (50) panels of judges. Each panel member was provided with a sensory ballot sheet and coded samples of MS1 (100% wheat flour, MS2 (70% millet flour and 30% wheat flour) and MS3 (50% wheat flour and 50% millet flour) to assess the colour, taste, aroma, texture and overall acceptability of the products. They were provided with drinking water to rinse their mouth before and after testing each sample, they were requested to complete the questionnaires on the ballot sheet independently.

Data Analysis

The data obtained from the scores of the 9- point hedonic scale by the respondents of different blends of each plantain/wheat composite turn-over samples (70% and 50%) and 100% wheat flour meat pies were calculated and divided by number of respondents, and 5 (neither like nor dislike) being the cut-off point. All scores from 5 to 9 were regarded as like while below 5 was regarded as dislike. The results were expressed as mean values. Statistical analysis was done using the One-Way Analysis of Variance (ANOVA) to examine the significant level of all parameters that were measured. Turkey Test was used to find out where the significant difference of all the samples in each parameter lies. The means were separated by Least Significant Difference (LSD) Test. Significance were accepted at $P \leq 0.05$ [21,22]. A structured sensory ballot sheet was also used to find out from respondents on their acceptability of the composite meat turnovers. Data collected were analyzed and recorded as percentage (%).

Results and Discussion

Samples	Moisture%	Ash%	Fat%	Protein%	Carbohydrate%
MS1	24.17±0.03	1.89±0.05	17.50±0.50	7.29±0.23	49.17±0.19
MS2	25.98±0.23	2.50±0.07	15.92±1.02	7.11±0.24	48.33±1.56
MS3	14.43±0.433	1.31±0.02	22.42±0.54	9.45±0.13	52.71±1.12

Table 2: Proximate Composition of Wheat and Millet Turnovers

Sample MS1-(100% wheat flour); Sample MS2-(70% wheat flour and 30% millet flour); Sample MS3-(50% wheat flour and 50% millet flour)

The protein level increased from 7.1%, 7.3% and 9.4 for MS1, MS2 and MS3 respectively. The increased in the protein content may be as a result of addition of millet flour and eggs which where blended with the wheat flour. However, it may not be economically desirable to use eggs to achieve that level of improvement. The moisture content of the turnovers ranged from 14.4%, (sample MS3) to 24.2% (sample MS1) and 25.0% (sample MS2) .The increase in moisture content could be the result of increase in the levels of substitution with millet flour which may attribute to the water absorption properties of the turnovers.

The ash content of the turnovers increased from 1.3 to 3.0% with increase in the substitution of millet flour. The increase in the ash content could make the product a good source of minerals.

Fat content increased with increase in replacement percentage of wheat flour with millet flour. In 100% wheat flour turnover, the fat content is 18.0%, 16.0 % and 22.4% for wheat-millet flour blends of 70:30 and 50:50 respectively. The observation indicated that, the sample (MS3) had the highest fat content which could be as a result of millet flour combination. The carbohydrate contents and energy values increased progressively from 48.3% (sample MS2), 49.1% (sample MS2) and 53.0 (sample MS1). This increase in carbohydrate is attributed to the decrease in the levels of millet added. These differences may be due to recipe formulation and methods of preparation.

SUMMARY				
Groups	*Count*	*Sum*	*Average*	*Variance*
MS1	5	100.02	20.004	341.011
MS2	5	99.84	19.968	331.8482
MS3	5	100.32	20.064	391.8559

Table 3: summary of the ANOVA

A fellow up analysis was conducted to compare the three samples means. It is clearly from the table that the mean for sample 1(mean=20.004, sd=341.011) and sample 3 (mean=20.064, sd=391.8559) are almost same and that of sample 2 (mean=19.968, sd=331.8482). Comparing the three samples means it is clearly shows that the means are very closely relative indicating that there is no significance difference in the means among the three samples.

ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	0.02352	2	0.01176	3.31E-05	0.999967	3.885294
Within Groups	4258.86	12	354.905			
Total	4258.884	14				

Table 4: analysis of variance among the three samples

From the results of the ANOVA table it is clearly shows that p-value=0.999967 is significantly greater than 0.05 indicating that the means are not significantly different from each other's among the three samples. This implies that a follow up analysis would not be conducted since there are not statistical significant differences among the three samples.

Samples	**Colour**	**Aroma**	**Texture**	**Taste**	**Level of acceptability**
MS1	4.3±0.8	4.3±0.8	4.6±0.7	4.6±0.7	4.5±0.6
MS2	4.0±0.7	4.0±0.8	4.3±0.8	4.4±0.7	3.4±0.6
MS3	3.1±1.1	2.7±1.1	2.9±1.0	2.8±1.1	3.0±0.6
LSD	1.424	1.460	1.500	1.430	0.262

Table 5: Sensory Attribute of the Turnovers

The Mean sensory scores of millet turnovers produced from varying percentage of millet and wheat flour is shown in Table below

Sample MS1-(100% wheat flour); Sample MS2-(70% wheat flour and 30% millet flour); Sample MS3-(50% wheat flour and 50% millet flour)

Table 5 shows the sensory attributes of the meat turnover prepared from wheat- millet flour blends. The texture of the meat turnover shows that the substitution with millet flour at the level of 50% has the lowest appearance score, while the substitution at 100%wheat flour (control) had the highest appearance score as statistically shown. The texture of the meat pie from wheat- millet flour blends ranged from 2.9 - 4.6. The meat turnover prepared from 100% wheat flour had the highest score for texture, while meat pie prepared from the 50% substitution of millet flour had the lowest score for texture. In terms of aroma and colour, a significant ($p < 0.05$) difference was observed in the aroma and colour sample of the meat pie prepared from wheat- millet flour blends. The aroma and colour of the meat turnover ranged from 2.7 to 4.3 and 2.8 to 4.6, respectively. The meat turnover prepared from 100% wheat flour had the highest score for aroma and colour, while the meat pie prepared from the 50% substitution of millet flour had the lowest score for aroma and taste.

The taste of the meat turnovers ranged from 2.8 to 4.6, with the meat turnovers prepared from 100% wheat flour having the highest taste, while the meat turnovers prepared from the 50% substitution of millet flour had the lowest taste score. The overall acceptability ranged from 3.0-to 4.5. The meat turnovers produced from 100% wheat flour was most preferred while the 50% substitution of millet flour was least preferred by the panelists. Based on all the substitutions for meat turnovers, the addition of millet flour was accepted. Therefore, the addition of millet flour up to 30% could be acceptable for meat turnovers production. It was observed that there was significant ($p<0.05$) difference between the control and other samples (MS2 and MS3) in the overall acceptability.

Groups	*Count*	***Sum***	***Average***	***Variance***
MS1	5	22.3	4.46	0.023
MS2	5	20.1	4.02	0.152
MS3	5	14.5	2.9	0.025

A fellow up analysis was conducted to compare the Sensory Attribute of the Turnovers of the three samples means. It is clearly from the table 5 that the mean for sample 1(mean=4.46, SD=0.023) and sample 2 (mean=4.02, SD=0.152) are almost same and that of sample 3 (mean=2.9, SD=0.025). Comparing the three samples means it is clearly shows that the means are very closely related among sample 1&2 but differ from sample 3 as indicating there is a significance difference in the means among the three samples. This implies that sample 3 is contributing the significance difference in means among the three samples.

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	6.469333	2	3.234667	48.52	0.00000178	3.885294
Within Groups	0.8	12	0.066667			
Total	7.269333	14				

Table 6: analysis of variance to Sensory Attribute of the Turnovers

From the results of table 6, it is clearly shows that the p-value=0.00000178 is significantly less than 0.05 which suggest that there is a significantly difference among the three samples Sensory Attribute of the Turnovers and these occurred as a results of sample 3. This implies that different peoples have different attributes in term of liked and disliked aroma, colour, appearance and taste of food.

Multiple Comparisons							
Dependent Variable: test							
	(I) samples	**(J) samples**	**Mean Difference (I-J)**	**Std. Error**	**Sig.**	**95% Confidence Interval**	
						Lower Bound	**Upper Bound**
Tukey HSD	MS1	MS2	.44000*	.16330	.048	.0043	.8757
		MS3	1.56000*	.16330	.000	1.1243	1.9957
	MS2	MS1	-.44000*	.16330	.048	-.8757	-.0043
		MS3	1.12000*	.16330	.000	.6843	1.5557
	MS3	MS1	-1.56000*	.16330	.000	-1.9957	-1.1243
		MS2	-1.12000*	.16330	.000	-1.5557	-.6843
LSD	MS1	MS2	.44000*	.16330	.020	.0842	.7958
		MS3	1.56000*	.16330	.000	1.2042	1.9158
	MS2	MS1	-.44000*	.16330	.020	-.7958	-.0842
		MS3	1.12000*	.16330	.000	.7642	1.4758
	MS3	MS1	-1.56000*	.16330	.000	-1.9158	-1.2042
		MS2	-1.12000*	.16330	.000	-1.4758	-.7642
*. The mean difference is significant at the 0.05 level.							

Table 7: multiple comparisons

A follow up analysis was conducted to investigate which of the samples are contributing the significance differences. From table 7 the LSD and Turkey method both agreed that sample (MS3) are contributing greater significant difference. Though three samples exhibit statistically significant difference at p-value 0.05.

Conclusion

The study revealed that blending wheat flour with millet flour had a significant effect on the overall acceptability of the meat turnovers. However, millet flour up to the level of 30% can be incorporated into wheat flour to produce meat turnovers without affecting their overall acceptability. Therefore, wheat-millet flour blends can be used in the preparation of other baked products with improved functional properties.

References

1. Singh P, Raghuvanshi RS (2012) Finger millet for food and nutritional security. Afr J Food Sci 6: 77-84.

2. Ahmad M, Wani TF, Wani SM, Masoodi FA, Gani A, et al. (2016) Incorporation of carrot pomace powder in wheat flour: effect on flour, dough and cookie characteristics. J Food Sci Tech 53: 3715-24.

3. Saha BC, Nichols NN, Cotta MA (2011) Ethanol production from wheat straw by recombinant Escherichia coli strain FBR5 at high solid loading. Bioresour Technol 102: 10892-7.

4. Sade FO (2009) Proximate, antinutritional factors and functional properties of processed pearl millet (Pennisetum glaucum). J Food Technol 7: 92-7.

5. Kohn LT, Corrigan J, Donaldson MS. (2000) To err is human: building a safer health system. Washington, DC: National academy press (US).

6. Ike CC, Emeka-Ike PC, Nwokorie CC, Anochie CC (2015) Microbiological quality evaluation of locally prepared snacks sold in Aba metropolis, Abia State, Nigeria. Int J Sci Engr Appl Sci (IJSEAS) 1: 2395-3470.

7. Kotsianis IS, Giannou V, Tzia C (2002) Production and packaging of bakery products using MAP technology. Trends in Food Science & Technology 13: 319-24.

8. Adebayo-Oyetoro AO, Ogundipe OO, Adeeko KN (2016) Quality assessment and consumer acceptability of bread from wheat and fermented banana flour. Food Sci Nutr j 4: 364-9.

9. Topping D (2007) Cereal complex carbohydrates and their contribution to human health. J Cereal Sci 46: 220-9.

10. Devi PB, Vijayabharathi R, Sathyabama S, Malleshi NG, Priyadarisini VB, et al. (2011) Health benefits of finger millet (Eleusine coracana L.) polyphenols and dietary fiber: a review. J Food Sci Technol 51: 1021-40.

11. Kumar P, Yadava R, Gollen B, Kumar S, Verma R, et al. (2011) Nutritional contents and me dicinal properties of wheat: a Review. Life Sci Med Res 22: 1-10.

12. Singh KP, Mishra A, Mishra HN (2012) Fuzzy Analysis of Sensory Attributes of Bread Prepared from Millet-Based Composite Flours. LWT-Food Sci Technol 48: 276-82.

13. Mal B, Padulosi S, Ravi SB (2010) Minor millets in South Asia: learnings from IFAD-NUS Project in India and Nepal. Maccarese, Rome, Italy: Bioversity Intl and Chennai, India: M.S. Swaminathan Research Foundation. P: 1-185.

14. Bagdi A, Balázs G, Schmidt J, Szatmári M, Schoenlechner R, et al. (2011) Protein Characterization and Nutrient Composition of Hungarian Proso Millet Varieties and the Effect of Decortication. Acta Alimentaria 40: 128-141.

15. Amadou I, Amza T, Yong-Hui S, Guo-Wei L (2011) Chemical Analysis and Antioxidant Properties of Foxtail Millet Bran Extracts. Songklanakarin. J Sci Technol 33: 509-15.

16. Moreno MDL, Comino I, Sousa C (2014) Alternative Grains of Potential, Raw Material for Gluten-Free Food Development in the Diet of Celiac and Gluten-Sensitive Patients. Austin J Nutri Food Sci 2: 1016.

17. Adebowale AA, Adegoke MT, Sanni SA (2012) Functional Properties and Biscuit Making Potentials of Sorghum-wheat Flour Composite. Am J Food Technol 7: 372-9.

18. Oke EK, Idowu MA, Sobukola OP, Bakare HA (2017) Quality attributes and storage stability of bread from wheat–tigernut composite flour. J Cul Sci 17: 75-88.

19. Kumar D, Tyagi V, Ramesh B, Pal S (2010) Genetic diversity in finger millet (Eleusine coracana L.). Crop improvement 37: 25-8.

20. AOAC (2004) Official method of Analysis of the Association of official Analytical chemists. 15th edn, Washington. USA.

21. Golan A, Kahn V, Sadvski AY (1977) Relationship between Polyphenols and Browning in Avacado Mesocarp- Comparison between the Fuerte and Lerman Cultivars. J Agric Food Chem 25: 1253-9.

22. Ibean V, Onyechi U, Ani P, Clinton O (2016) Composition and Sensory Property of Plantain Cake. Afr J Food Sci 10: 25-32.