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Comparative Study on the Sensory Quality of Prepared Biscuit and Cake from Amaranthus and Sorghum

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Biscuit and cake were prepared from amaranthus and sorghum flour at the proportion of 20, 30, 40 and 50% with wheat flour. Sensory evaluation was carried out and there was no significant difference ($p \leq 0.05$) in texture in the different biscuit made from amaranthus flour. However there was significant difference in color, taste, smell and overall acceptance in amaranthus biscuits. In case of sorghum biscuit there was significant difference in texture and no significant difference in color, taste, smell and overall acceptance. Similarly, there was significant difference in color, texture, smell, taste and overall acceptance between amaranthus cakes. However, there was significant difference in color of sorghum cake and the difference was insignificant in texture, taste, smell and overall acceptance. Thus it can be concluded that biscuit and cake can be made commercially, It can be recommended that biscuit and cake from amaranthus and sorghum can be promoted as potential health benefiting food products.

Keywords: Amaranthus, Sorghum, Biscuit, Cake, Sensory quality

Introduction

Cereal crops, particularly sorghum (*Sorghum bicolor*) and amaranth (*Amaranthus hybridus)*, have recently experienced increased interest due to their potential health benefits and therapeutic applications. It has been suggested that the intake of whole grain foods is beneficial to the prevention and management of diabetes mellitus. Study have found that 70% ethanol extracts from different cultivars of sorghum (*Sorghum bicolor*), has shown high inhibitory activities against α-glycosidase and also strongly inhibited degradation of starch by pancreatic and salivary α-amylase indicating the potential for development of effective anti-diabetic agents (Kim *et al*., 2011). Sorghum have also positive effects on body cholesterol metabolism by increasing plasma High Density Lipoprotein (HDL) - cholesterol level, cholesterol turnover or fecal bile acid excretions; and also possibly inhibiting cholesterol synthesis (Cho and Ha, 2003).

Sorghum grain has been found to be responsible for low plasma glucose level in test subjects (Taylor and Emmambux, 2010). It is also a rich source of phytochemicals, responsible for significantly lower plasma non HDL-cholesterol and liver esterified cholesterol concentration in hamsters, providing health benefits when incorporated into human diets. Lipid extract of sorghum grains have exhibited cholesterol lowering properties by increasing cholesterol excretion from the body (Hoi *et al*., 2009). The sorghum extract contained high amount of antioxidants, principally phenolic compounds exhibiting high levels of free radical scavenging activity, anti-oxidant capacity and anti-lipid peroxidative activity compared with α-tocopherol (Kim *et al.*, 2010). The research results have indicated that sorghum extracts can be used as a source of antioxidant and antimicrobial ingredients in the food industry (Kil *et al*., 2009).

Amaranth (*Amaranthus* L.) has also stronger radical scavenging ability than other cereals due to presence of various antioxidants; phenolic compounds such as anthocyanins and betalains and flavonoid glycosides (Asao and Watanabe, 2010). The sour dough fermentation of pseudocereals with *Lactobacillus plantarum* C48 and *Lactococcus lactis* subsp. *lactis* PU1, previously selected for the biosynthesis of γ-aminobutyric acid (GABA), showed amaranth flour was the most suitable to be enriched of GABA. GABA is a four-carbon non-protein amino acid which acts as the major inhibitory neurotransmitter of the central nervous system and responsible for induction of anti-hypertensive, prevention of diabetes, diuretic and

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tranquilizer effects. Thus it is used in pharmaceutical preparations and functional foods such as gammalone, dairy products, gabaron tea and shochu (Coda *et al*., 2010).

These underutilized cereals, with numerous health benefits, have ample possibility of processing them into desirable and nutritious processed products by baking, germination, malting, extrusion, popping, puffing, flaking, pelleting, etc. Thus local and improved cultivars of these cereals need to be evaluated for processing and nutritional characteristics keeping in view of retention of protein quality and quantity during processing (Vivas *et al*., 1992).

Materials and Methods

Amaranthus and sorghum was obtained from Lamgung District. Biscuits were prepared from amaranthus and sorghum flour at the proportion of 20, 30, 40 and 50 % of total flour with remaining percentage of wheat flour. The control was also prepared with 100% wheat flour. All the products were prepared in NARC laboratory, Lalitpur. The recipe is given below

Table 1. Recipe for making biscuit from *chino* and *kaguno*

Particulars	Amount
Total flour	1000 g
Grinded Sugar	300 g
Vegetable Ghee	100 g
Baking Powder	20 g
Ammonium Bicarbonate	15 g
Water	400 ml

The procedure for making biscuit is given below

The wheat flour, amaranthus and sorghum flour were mixed well by sieving at 60 mesh size sieve.

↓

Out of given proportion of water 50g grinded sugar was added in 200 ml water. Baking powder and ammonium bicarbonate were also added.

↓

Vegetable ghee was melted and remaining amount of grinded sugar was added to make a paste.

↓

The paste of vegetable ghee and grinded sugar was added to the mix described in no 1.

↓

The solution as described in no 2 was also added to the mix as described in no 5.

↓

The remaining water was added and the dough was made.

↓

The sheet was made of thickness 4-5 mm and the biscuit were cut into circle by biscuit cutter.

↓

The biscuits were baked in hot air baking oven at 220^0 C for 17 minutes.

↓

The biscuits were cooled and packed in the polythene bag.

The recipe for making cake is given below.

Table 2. Recipe for making cake

Particulars	Amount
Total Flour	1000 g
Grinded Sugar	700 g
Vegetable Ghee	500 g
Egg	10 pieces
Baking Powder	20 g
Water	370 ml

The procedure for making cake is given below;

Half of the grinded sugar was added to the total flour.

↓

Baking powder was added to the half amount of the water.

↓

The eggs were broken and mixed well.

↓

The vegetable ghee was melted and remaining amount of grinded sugar was added to make a cream.

↓

The cream was added to the flour in no 1 and total amount of water was added to make the batter.

↓

The batter was added to the small bowl (half filled) and baked in hot air baking oven at 210^0C for 30- 35 minutes.

The cake were cooled and packed in polythene bag.

Sensory evaluation

The sensory evaluation of lab prepared products was carried out by hedonic ranking scale test as per the procedure given by Rangana, (2005).

Statistical analysis

Data obtained were analyzed statistically by using analysis of variance (ANOVA) by statistical program known as Genstat release 7.22, Discovery edition, 2004, developed by VSN International Ltd. Sample means were compared by LSD method at 95% level of significance.

Results and Discussion

Sensory quality of Biscuits prepared from Amaranth

The sensory evaluation data of biscuits made from Amaranthus is given in Table 3. There is significant difference ($p \leq 0.05$) in color, taste, smell and overall acceptance; the texture however is not significantly different among samples.

Table 3. Sensory evaluation of biscuits made from amaranthus

Parameter	Control	Amranthus 20%	Amranthus 30%	Amranthus 40%	Amranthus 50%	LSD
Color	5.33±1.18^{ab}	4.89±1.8^{b}	5.67±1.03^{ab}	6.83±1.47^{c}	6.0±1.37^{ac}	0.93
Smell	5.39±1.04^{ab}	5.39±1.09^{ab}	5.33±1.03^{b}	6.17±1.42^{a}	6.17±1.25^{a}	0.78
Taste	5.78±0.94^{a}	6.17±0.79^{ab}	6.22±0.88^{ab}	6.61±1.24^{b}	6.72±1.13^{b}	0.67
Texture	5.5±0.98^{a}	5.83±1.2^{ab}	6.11±0.96^{ab}	6.56±1.2^{b}	6.33±1.33^{b}	0.76
Ove. Acc.	5.83±0.92^{a}	6.22±0.88^{a}	6.28±1.03^{a}	7.06±1.0^{b}	6.61±1.12^{ab}	0.66

* Values are means ± standard deviation

** Values with different superscript in same row are significantly different

There was no significant difference ($p \leq 0.05$) in color between the biscuit made from wheat flour (control) and bisuit made from 20% and 30% amaranthus flour. Biscuit made from 40% amaranthus flour had significantly higher value than control, 20% and 30% amaranthus four. There was no significant difference between 40% and 50% amaranthus flour where as color of biscuit made from 50% amaranthus flour had higher value than 20% amaranthus flour.The biscuit made form 20 and 30% amaranthus flour had significantly lower value than 40 and 50% amaranthus flour. The control had the significantly lower value than 40 and 50% amaranthus flour.There was no significant difference between the biscuits made from amaranthus flour but biscuit made form 40 and 50% amaranthus flour had significantly higher values than control.There was no significant difference ($p \leq 0.05$) among the biscuit made from 20, 30, 40 and 50% amaranthus flour (Table 3) but biscuit made from 40 and 50% amaranthus flour had significantly higher value than wheat flour (control). The biscuit made from 20% and 30% amaranthus flour had significantly

lower value than biscuit made from 40% amaranthus flour. The control has also significantly lower value than biscuit made from 40 and 50% amaranthus flour.

Sindhuja *et al.*, (2005) reported that cookies prepared from composite wheat flour containing 25% amaranthus flour, was comparable in terms of sensory evaluation compared to cookies prepared from wheat flour Baljeet *et al.*, 2010 revealed that increase in percentage of buckwheat flour in composite flour decrease the sensory score of biscuit. Badroja-Solarov *et al.*, (2008) reported that bread prepared with 15% amaranthus flour was acceptable in terms of sensory score)

Sensory quality of cake prepared from Amaranthus

The sensory evaluation data of cake made from amaranthus is given in Table 4. There was significant difference ($p \leq 0.05$) in texture, color, taste, smell and overall acceptance.

Table 4. Sensory evaluation of cake made from amaranthus

Parameter	Samples					LSD
	Control	Amranthus 20%	Amranthus 30%	Amranthus 40%	Amranthus 50%	
Color	8.26±1.1^{a}	7.16±0.83^{b}	7.32±0.75^{b}	6.11±1.1^{c}	6.68±1.38^{bc}	0.68
Smell	7.26±1.05^{a}	7.16±1.21^{a}	6.89±1.49^{a}	5.89±1.73^{b}	6.37±1.34^{ab}	0.89
Taste	7.53±1.26^{a}	7.37±0.68^{a}	6.95±1.27^{ab}	6.37±1.46^{b}	6.42±0.96^{b}	0.75
Texture	7.63±1.21^{a}	7.11±0.81^{ab}	6.89±1.15^{b}	6.47±0.9^{bc}	6.16±1.21^{c}	0.70
Ove. Acc.	7.84±0.9^{a}	7.37±0.76^{a}	7.32±1.0^{a}	6.53±1.35^{b}	6.63±1.01^{b}	0.66

* Values are means±standard deviation

** Values with different superscript in same row are significantly different

There was significant difference between cake made from 40% amaranthus flour and cake made from 20 and 30% amaranthus flour. The cake made from 40% amaranthus flour had significantly lower values. The cake made from wheat flour had significantly higher values than rest of the cakes. The smell of cake made from 20% and 30% amaranthus flour were significantly higher value than cake made from 40% and 50% amaranthus flour. The cake made from wheat flour was significantly higher than cakes made from 40% and 50% amaranthus flour. The taste of cake made from 20% amaranthus flour and control were significantly higher than cake made from 40 and 50% amaranthus flour. The texture of cake made from 20% and 30% Amaranthus flour were significantly higher than cake made from 50% Amaranthus flour. The texture of cake made from wheat flour was significantly higher than of cake made from 40% and 50% Amaranthus flour. The overall acceptance of 40% and 50% amaranthus flour was significantly lower than cake made from 20 and 30% amaranthus flour as well as control.

Shyam and Raghuvanshi (2015) reported that cake prepared from composite flour with 40% amaranthus flour was found to be best in terms of sensory evaluation.

Sensory Quality of biscuit prepared from Sorghum

The sensory evaluation data of biscuit made from sorghum *(junelo)* is given in Table 5. There was significant difference ($p \leq 0.05$) in texture of the biscuit. The difference in color, taste, smell and overall acceptance was insignificant.

Table 5. Sensory evaluation of biscuit made from sorghum

Parameter	Samples				Overall acceptability
	Color	Smell	Taste	Texture	
Control	6.22±1.26^{a}	5.89±1.45^{a}	5.94±1.39^{a}	6.06±1.4^{a}	6.17±1.25^{a}
Seto junelo 20%	6.39±1.75^{a}	6.39±1.61^{a}	7.17±1.1^{b}	7.28±1.4^{b}	7.04±1.24^{b}
Seto junelo 30%	6.06±1.76^{a}	6.39±1.24^{a}	6.68±0.91^{ab}	6.89±1.3^{b}	6.56±1.2^{ab}
Seto junelo 40%	6.67±1.41^{a}	6.39±1.29^{a}	6.83±1.04^{b}	7.56±1.5^{b}	7.11±0.9^{b}
Seto junelo 50%	6.0±1.57^{a}	6.11±1.18^{a}	6.33±1.37^{a}	7.4±0.78^{b}	6.61±1.14^{ab}
Rato junelo 20%	6.67±1.46^{a}	6.11±1.02^{a}	6.56±1.15^{ab}	7.4±0.78^{b}	6.79±0.94^{ab}
Rato junelo 30%	6.22±1.17^{a}	6.17±0.86^{a}	6.67±1.08^{ab}	7.06±0.94^{b}	6.72±0.72^{ab}
Rato junelo 40%	6.33±1.19^{a}	6.33±1.24^{a}	6.33±1.5^{a}	7.11±1.23^{b}	6.72±0.96^{ab}
Rato junelo 50%	6.22±1.11^{a}	5.83±1.34^{a}	6.39±1.42^{ab}	7.11±1.37^{b}	6.5±1.1^{ab}
LSD	0.94	0.83	0.81	0.81	0.7

* Values are means± standard deviation

** Values with different superscript in same column are significantly different

There was no significant difference between the biscuit made from different proportion of amaranthus flour and control. There was no significantly different values for smell among the biscuit samples. The taste of the biscuit made from 20% seto *junelo* was significantly higher than biscuit made from 50% seto *junelo,* 40% rato *junelo* and control. Similarly, 40% seto *junelo* biscuit had significantly higher than control sample. The texture of biscuit made from wheat flour was significantly lower than biscuit made from amaranthus flour. However, there wasis no significant difference between biscuit made from different proportion of sorghum. The control sample is significantly lower than biscuits made from 20% seto *junelo* (white sorghum), 40% seto *junelo* and 20% rato *junelo* (red sorghum). Rests of the samples had insignificant values for overall acceptance.

Adebowale *et al*., (2012) revealed that biscuit made from wheat flour with 20% sorghum flour were comparable in trems of physical property to biscuit made from 100% wheat flour. Oluwamukomi *et al*., (2011) reported that biscuit made from composite flour containg 30% cassava flour was comparable in terms of sensory score to biscuit made from 100% wheat flour.

Sensory quality of cake prepared from Sorghum

The sensory evaluation data of cake made from sorghum *(junelo)* is given in Table 6. There was significant difference ($p \leq 0.05$) in color of the cake. The difference in texture, taste, smell and overall acceptance was insignificant.

Table 6. Sensory evaluation of cake made from sorghum

Parameter	Samples					LSD
	Control	Sorghum 20%	Sorghum 30%	Sorghum 40%	Sorghum 50%	
Color	7.62±1.04^{a}	6.92±1.04^{ab}	6.15±1.52^{b}	7.77±0.93^{a}	7.08±1.26^{ab}	0.92
Smell	6.92±1.19^{a}	7.0±1.0^{a}	6.77±0.83^{a}	7.23±0.73^{a}	6.92±0.86^{a}	0.73
Taste	7.08±1.04^{ab}	7.08±0.95^{ab}	6.77±0.73^{a}	7.77±0.93^{b}	7.0±0.82^{a}	0.70
Texture	7.0±1.08^{a}	6.77±1.17^{a}	6.38±0.96^{a}	7.0±0.91^{a}	6.7±1.36^{a}	0.87
Ove. Acc.	7.31±1.18^{ab}	7.08±0.86^{ab}	6.69±0.63^{a}	7.62±0.77^{b}	7.15±0.9^{ab}	0.70

* Values are means± standard deviation

** Values with different superscript in same row are significantly different

There was significantly lower value of cake made from 30% sorghum flour with cakes made from 40% sorghum flour and control. Rest of the samples had insignificant values. There was no significant difference in smell among the samples. The cake made from 40% sorghum flour had significantly lower value than 50% sorghum flour. Rests of the samples were insignificant to each other. There was no significant difference in value of the texture among the samples. There was significantly lower valued of 30% sorghum flour cake than 40% sorghum cake. Rests of the samples were insignificant.

Hussein *et al.,* (2012) reported that sponge cake prepared from 100% sorghum flour was comparable to cake prepared from 100% wheat flour.

Conclusions

It is possible to make biscuit and cake from amaranth and sorghum. The biscuits made from different proportion of amaranth and sorghum flour shows variability. The textures of most of the biscuit were insignificant difference in terms of texture, color, taste, smell and overall acceptance to control; some of them even were significantly higher values. To conclude that it is possible to make biscuits from amaranth and sorghum which is comparable to biscuit made from wheat flour. Similarly in case of cakes there was significant difference between control samples and cake made from amaranth and sorghum flour. Even though, we can make the cake from amaranth and sorghum flour comparable to wheat flour.

References

Adebowale A. A., Adeqoke M. T., Sanni S. A., Adequnwa M. O. and Fetuga G. O. (2012). Functional Properties and Biscuit Making Potentials of Sorghum-wheat Flour Composite, *American Journal of Food Technology,* 7: 372-379

Alvarez-Jubete L., Wijngaard H. and Arendt E. K. (2010). Polyphenol composition and in vitro antioxidant activity of amaranth, quinoa buckwheat and wheat as affected by sprouting and baking. *Food Chemistry*, 119(2): 770-778.

Alvarez-Jubete L., Holse M. and Hansen A. (2009). Impact of baking on vitamin E content of pseudocereals amaranth, quinoa, and buckwheat. *Cereal Chemistry*, 86(5): 511-515.

Asao M. and Watanabe K. (2010). Functional and bioactive properties of quinoa and amaranth. *Food Science and Technology Research*, 16(2): 163-168.

Bodroža-Solarov M., Filipčev B., Kevrešan Ž., Mandić A. and Šimurina O. (2008). Quality of bread supplemented with popped Amaranthus cruentus grain. *J. Food Process Eng,* 31: 602-618

Baljeet S.Y., Ritika B. Y. and Roshan L. Y. (2010) Studies on functional properties and incorporation of buckwheat flour for biscuit making. *International Food Research Journal*, 17: 1067-1076.

Burdette A., Garner P. L. and Mayer E. P. (2010). Anti-inflammatory activity of select sorghum (*Sorghum bicolor*) brans. *Journal of Medicinal Food*, 13(4): 879-887.

Cho S. H. and Ha T. Y. (2003). In vitro and in vivo effects of prosomillet and sorghum on cholesterol metabolism. *Food Science and Biotechnology*, 12(5): 485-490.

Choi Y., Jeong H. S. and Lee J. (2007). Antioxidant activity of methanolic extracts from some grains consumed in Korea. *Food Chemistry*, 103(1): 130-138.

Colmenares De Ruiz' A. S. and Bressani R. (1996). Effect of germination on the chemical composition and nutritive value of amaranth grain. *Cereal Chemisty*, 67(6): 519-522.

Del Valle F. R., Escobedo M., Sanchez-Marroquin A., Bourges H., Bock M.A. and Biemer P. (1992). Nitrogen balance in infants fed formula containing amaranth or a soy-oats formula. *Cereal Chemisty*, 69(2): 156-159.

Elmoneim A., Elkhalifa O. and Bernhardt R. (2009). Influence of grain germination on functional properties of sorghum flour. *Food Chemistry*, 121: 387–392.

Hamaker B. R., Metrz E. T. and Axtell J. D. (1994). Effect of extrusion on sorghum kafirin solubility. *Cereal Chemistry*, 71(5): 515-517.

Hoi J. T., Weller C. L., Schlegel V. L., Cuppett S. L., Lee J. and Carr T. P. (2009). Sorghum distillers dried grain lipid extract increases cholesterol excretion and decreases plasma and liver cholesterol concentration in hamsters: *Journal of Functional Foods*, 1(4): 381-386.

Hussein N. A., Hegazy A.N. and Ibrahim T. A. A. (2012). Production and Evaluation of Gluten-Free Cakes, *Australian Journal of Basic and Applied Sciences*, 6(12): 482-491

Kil H.Y., Seonga E. S., Ghimire B. K. and Chung I. M. (2009). Antioxidant and antimicrobial activities of crude sorghum extract. *Food Chemistry*, 115(4): 1234-1239.

Kim J. S., Hyun T. K. and Kim M. J. (2010). Anti-oxidative activities of sorghum, foxtail millet and proso millet extracts. *African Journal of Biotechnology*, 9 (18): 2683-2690.

Kim J. S., Hyun T. K. and Kim M. J. (2011). The inhibitory effects of ethanol extracts from sorghum, foxtail millet and proso millet on alpha-glucosidase and alpha-amylase. *Food Chemistry*, 124(4): 1647-1651.

MacLean W. C., Lopez de Romana G., Gastanaday A., Graham G. G. (1983). The effect of decortication and extrusion on the digestibility of sorghum by pre-school children. *Journal of Nurtition*. 113: 2071-2077.

MacLean W. C., Lopez de Romana G., Placko R. P. and Graham G. G. (1981). Protein quality and digestibility of sorghum in preschool children: Balance studies and free amino acids. *Journal of Nutrition*. 111: 1928-1936

Oluwamukomi M. O., Oluwalana I. B. and Akinbowale O. F. (2011). Physicochemical and sensory properties of wheat cassava composite biscuit enriched with soy flour. *African Journal of Food Science*, 5 (2): 50 - 56

Rayas-Duarte P., Mock C. M. and Satterleei L. D. (1996). Quality of Spaghetti Containing Buckwheat, Amaranth, and Lupin Flours.Cereal Chemistry, 73(3): 381-387.

Rooney L.W., Kirleis A.W. and Murty O. S. (1986). Tradititional foods from sorghum: their production, evaluation and nutritional value. *Adance in Cereal Science and Technology*, 8: 317-253.

Schoenlechner R., Drausinger J. and Ottenschlaeger V. (2010). Functional properties of gluten-free pasta produced from Amaranth, Quinoa and Buckwheat. *Plant Foods for Human Nutrition*, 65 (4): 339-349.

Shyam S. R. and Raghuvanshi R. S. (2015). Standardization of Cakes by using Different Levels of Amaranth Flour and its Acceptability. *International Journal of Science and Research (IJSR)*, 4 (6): 1859-1861.

Sindhuja A., Sudha M. and Rahim L. A. (2005). Effect of incorporation of amaranth flour on the quality of cookies. *European Food Research and Technology*, 221(5):597-601

Sterr Y., Weiss A. and Schmidt H. (2009). Evaluation of lactic acid bacteria for sourdough fermentation of amaranth. *International Journal of Food Microbiology*, 136 (1):75-82.

Tapia-Bl´acido Delia R., Paulo J. A., Sobral and Florencia CMenegallic .(2010). Potential of *Amaranthus cruentus* BRS Alegria in the production of flour, starch and protein concentrate: chemical, thermal and rheological characterization. *J Sci Food Agric*, 90: 1185–1193

Taylor J. R. N. and Emmambux M. N. (2010). Developments in our understanding of sorghum polysaccharides and their health benefits. *Cereal Chemistry*, 87(4):263-271.

Tikekar R.V. and Karwe M.V. (2009). Development of a continuous method for puffing amaranth (*Amaranthus* spp.) seeds. *Journal of Food Process Engineering*, 32(2): 265-277.

Vivas N. E., Serna-Saldivar S. O., Waniska R. D. and Rooney L. W. (1990). Effect of tortilla chip preparation on protein fractions of quality protein maize, regular maize and sorghum. *Journal of Cereal Science*, 12, 289.

Vivas N. E., Waniska R. D. and Rooney L. W. (1992). Effects on proteins in sorghum, maize, and pearl millet when processed into acidic and basic, *Cereal Chemistry*, 69(6), 673-676.