International Journal of Food Science and Nutrition
ISSN: 2455-4898, Impact Factor: RJIF 5.14
www.foodsciencejournal.com
Volume 2; Issue 1; January 2017; Page No. 144-147

Development of buckwheat cookies supplemented with wheat flour

Nisar Hussain, Murtaza Ali, Sajid Hussain, Khawar Mehmood, Muhammad Nasir

Department of Food Science, The Agriculture University Peshawar, Pakistan

Abstract
The present study was conducted to the development of buckwheat cookies supplemented with wheat flour. Dehulling and Milling of common buckwheat was conducted to obtain flour. Obtained buckwheat and wheat flour were examined for their proximate compositions. Buckwheat flour contained 11.6% moisture, 15.79% crude protein, 1.81% crude fat, 1.83% ash, 0.70% crude fiber content 68.27% N.F.E while wheat flour found having moisture content 13.12%, crude fiber content 1.93%, crude fat 1.42%, crude protein content 12.53%, ash content 1.57% and 69.43% N.F.E respectively. Wheat flour at 10, 20, 30, 40 and 50% ratio was incorporated with buckwheat flour to make composite flour and the developed cookies were analyzed for proximate analyze. Supplementation of wheat flour significantly influenced the proximate of buckwheat flour based cookies. Moisture contents, crude fiber contents and N.F.E (Nitrogen Free Extract) increased whereas crude fat contents, crude protein contents and ash content decreased.

Keywords: Buckwheat, supplemented buckwheat cookies and chemical properties

1. Introduction
The term cookies comes from the Dutch word koekje, that's mean little cake and the name biscuit is the Latin word which mean bis coctum (Macrae *et al.,* 1993) [27]. Cookies and biscuits are very vital from the bakery products. Both are like and eat by all the age groups mostly school going kids, needs more energy like proteins per unit body weight as compared to adults (Shahzad *et al*., 2006) [32]. These are ideal for availability of essential nutrients. Cookies and biscuits are different from other bakery items such as cakes and bread because these contain lower moisture contents as compare to other bakery foods, relatively free from microbial spoilage and longer shelf life (Wade, 1988). Cookies are prepared by supplementing different low priced sources like pulses and legumes flour with wheat flour (Akubor and Onimawo, 2003) [3].
In supplementation, proteins giving constituent for biscuits should have sweet flavor, high protein efficiency ratio and low water absorption capacity. It should neither negatively influence on the dough spread ratio, texture and nor cause any significant changes in the consistency of dough (Lorenz, 1983) [26]. The challenge of selecting the best-suited protein source has suited the baking factory to examine such components that assign desirable functional and nutritional characteristics to the baked items (Tyagi *et al*., 2006) [35].
Common buckwheat *Fagopyrum esculentum* moench (sweet buckwheat) broad leafy herbaceous crop and belongs to the family Polygonaceae. Its seeds structurally and chemically resemble to wheat grains therefore, it is consider as pseudo cereal. It was originated from East Asia and then promoted into Europe countries about the 15th century, the cultivation of this miracle crop was spread in many other countries of the world such as The United States of America, Canada, China, Latin America and Africa, with an annual production of about one million tons. First, to encourage its cultivation in different regions agriculture is characterized mainly semi-wild buckwheat crop does not need any specific soil and fertilizer, it is cultivated in the high altitude areas of above 3,000 meters in Bhutan and Nepal. (Pomeranz and Robbins.1972, and Eggum *et al*, 1980) [30, 12].
There are various species of buckwheat grown throughout the world, but nine of them only has nutritional and agricultural value (Krkoskova and Mrazova, 2005) [23]. Mostly, two types of buckwheat (Common buckwheat and Tartary buckwheat) used as a source of food throughout the world. These two species of buckwheat cultivated in mountainous region of Pakistan mostly in Gilgit Baltistan at the area of 948 hectares with an annual production of 1798 metric tons. (Agri. Stat. 2007) [1]. Because of high nutritional and medicinal value, its production has been increased in recent year. Being a gluten free it has medicinal value and used in gluten free food preparation for those who has gluten allergy (celiac patients) (Bonafaccia *et al*., 2003) [9].
Buckwheat is an excellent source of micronutrients like potassium, manganese, copper, iron, and zinc (Ikeda and Yamashita, 1994) [19]. In contrast with cereals, buckwheat contained more crude protein, high in lysine content and gluten free that makes it important from medicinal and nutritional viewpoint. Therefore, it used to prepare an alternate gluten free food for celiac patients (Javornik and kreft, 1984 and Eggum, 1980) [20, 13]. Buckwheat foodstuffs are considered as a good nutritional and medicinal value food (Bonafaccia and Kreft, 1998 and Mazza, 1989) [8]. They found that there was a well concentration of amino acid in buckwheat (Kato *et al.,* 2001) [22]. Among them needed amino acids like lysine, threonine and tryptophan are in high value (Liu *et al.,* 2001) [25].

2. Materials and Method
The present research work was carried out at (PCSIR) Pakistan Council of Scientific and Industrial Research Laboratories Skardu during 2012-2013.

2.1 Collection of raw materials
Common buckwheat (sweet) *Fagopyrum esculentum* and wheat flour was selected for the development of Buckwheat cookies. Whole buckwheat was procured from District Ghancha Baltistan

and wheat flour, sugar, industrial fat and other ingredients used in cookies preparation were purchased from local market and brought to PCSIR (Pakistan Council of Scientific and Industrial Research) Laboratory Skardu. Dehulling and Milling of Buckwheat was conducted at PCSIR Laboratory Skardu. The hulls removed through blower and dehulled buckwheat obtained. The dehull grains were milled by using laboratory mill. The flour sealed in polyethylene bags and stored in refrigerator for further use.

2.2 Preparation of buckwheat cookies

The buckwheat cookies were prepared at 10, 20, 30, 40 and 50 % levels of wheat flour by supplementing with buckwheat flour according to the official method of AOAC (2000) [5]. The recipes used to prepare buckwheat cookies are explain in table 1.

Table 1: Weight of ingredients used in cookies preparation

S. No.	Ingredients	Weight
1.	Flour	500 gm
2.	Sugar	250 gm
3.	Industrial fat	250 gm
4.	Baking powder	6.50 gm
5.	Salt	0.040 gm
6.	Egg	1

2.3 Proximate composition

Proximate composition includes moisture, crude protein, crude fat, crude fiber, ash, and nitrogen free extract. Moisture was determined by oven dehydration method at 105°C up to the constant weight. Crude protein was determined by using Kjeldhal method; crude fat was determined by ether extraction method using soxhlet apparatus. Crude fiber was determined by acid digestion and alkali digestion method. Ash content was determined in muffle furnace at 550°C for 6 hours. For all these determinations powdered and oven dried sample were used in triplicate in accordance with standard procedures. NFE was calculated by difference (AACC 2000) [4].

Statistical analysis: The data achieved from different treatments were statistically evaluated in MSTAT-C software by using (CRD) completely randomized designed while (LSD) least significant difference test at 5% level of significance was used to separate means according to the described method by Steel and Torrie (1997) [24].

3. Results and Discussion

The product was prepared with different ratios of ingredients in different trials. The products with different ratio of ingredients were assayed for their proximate composition i.e. crude fat, ash content, crude fiber, crude protein, moisture, N.F.E (nitrogen free extract).

3.1 Proximate composition of buckwheat flour and wheat flour

Buckwheat (common buckwheat) flour and wheat flour used in present research work were investigated for their chemical composition. Data regarding the percentage chemical compositions were presented in table 2. This shows that shows proximate composition of buckwheat and wheat flour. The data shows that buckwheat flour contained 11.6% moisture, 15.79% crude protein, 1.81% crude fat, 1.83% ash, 0.70% crude fiber content 68.27% N.F.E. These results are in close conformity with the outcomes of Bonafaccia, *et al*. (2003) [9], who confirmed that buckwheat flour contained 7.89 to 10% moisture, 10. 23 to 17% crude protein, 1.3 to 2.8% ash, 1.1 to 3.5% crude fat, 0.7 to 1.8% crude fiber and 64 to 73% N.F.E (Fessas *et al.* 2008, Bilgicli, 2009) [14, 7]. Buckwheat flour contained from 8.5 to 19% of crude protein contents depending on the variety, fertilizer and pesticides used that are probably to affect the overall concentration of buckwheat protein contents (Fornal, 1999) [15].

Data shows that wheat flour contained 13.12% moisture, 12.53% crude protein, 1.42% crude fat, 1.93% crude fiber, 1.57% ash content and N.F.E 69.43%. These outcomes are in close agreement with the judgment of (Wahab,. 2001) [36], who reported that wheat flour contain 7.38% moisture, 10.40% protein, 2.15% crud fat, 2.80% crude fiber, 1.47% ash, and 75.80% NFE. Similar result also reported with the outcomes of Ahmad *et al.* (2005) [2] examined that commercially available flour contained 9.95-11.58% moisture, 0.52-0.68%, ash, 0.94-1.51% fat, 10.32-11.58% protein, 0.40-0.60% crude fiber and nitrogen free extract 74.62-77.74%.

3.1 Moisture content

Analysis of variance showed significant ($p<0.5$) effect on moisture content of common buckwheat flour based cookies by supplementation of wheat flour. Data disclosed that moisture content of supplemented buckwheat cookies increased with gradual increase in wheat flour incorporation. The mean moisture content results of test buckwheat cookies were C_O (2.88%), C_1 (3.08%), C_2 (3.16%), C_3 (3.27%), C4 (3.42%) and C_5 (3.50%). The highest mean value (3.50%) was recorded in C_5, while lowest mean value (2.88%) in C_0 (Table 3). High moisture content of supplemented cookies may be credited to high moisture content of wheat flour in contrasted to buckwheat flour. This may be due to relatively higher amount of fiber content in wheat flour than that of common buckwheat flour. The results achieved are in complete conformation with the finding of (Eastwood, 1986), examined that the incorporation of rice bran and wheat in bakery products preparation retain more moisture amount in developed products because of the existence of cellulose and hemicelluloses. Other researchers (French and Hill, 1988; Pflaumer *et al*., 1990) [16, 29], also reported that the incorporation of guar gum and CMC hold more moisture amount in baked products because of their high water holding capacity.

3.2 Crude protein content

Significant differences ($p<0.5$) were examined in protein content of buckwheat flour based cookies. Data disclosed that protein content of wheat flour supplemented buckwheat cookies decreased with gradual increase in wheat flour incorporation. The mean crude protein content results of test cookies were Co (15.87%), C1 (15.30%), C2 (14.99%), C3 (14.67%), C4 (14.37%) and C5 (13.93%). The highest mean value (15.87%) was recorded in Co, while lowest mean value (13.93%) in C5 (Table 3). High protein content of supplemented cookies may be credited to high protein content of common buckwheat flour contrasted to wheat flour. The outcomes achieved are in conformation to the results of (Baljeet *et al.* 2010) [6], estimated decreased in crude protein content as the increase in buckwheat flour in proportion of 10, 20, 30, and 40 percentage into wheat flour. This work also supported with the finding of Dhingra and Jood (2001) [10], reported decreased in crude protein content by the supplementation of wheat flour in to barley flour when the supplementation ratio increased from 0.15 % in the developed bread.

3.3 Crude fat content

Supplementation of wheat flour significantly ($p<0.5$) effect crude fat content of common buckwheat flour based cookies. Data disclosed that crude fat content of wheat flour supplemented buckwheat cookies decreased with gradual increase in wheat flour incorporation. The mean crude fat content results of test cookies were C_O (24.44%), C_1 (24.24%), C_2 (24.08%), C_3 (23.96%), C4 (23.79%) and C_5 (23.68%). The highest mean value (24.44%) was recorded in C_0, while lowest mean value (23.68%) in C_5 (Table 3). More crude fat of supplemented biscuits may be credited to high crude fat content of wheat flour contrasted to buckwheat flour. The outcomes of the study are in agreement to the results of Khan *et al.*, (2012), who estimated decreasing of fat contents in gluten free ready to serve buckwheat product. i.e. (1.01%), (0.71%), (0.59%), (0.59%) and (0.34%) it is cleared that by the addition of buckwheat flour fat contents were also increased.

3.4 Crude fiber content

Supplementation of wheat flour significantly ($p<0.5$) effect crude fiber content of common buckwheat flour based cookies. Data disclosed that crude fiber content of wheat flour supplemented buckwheat cookies increased with gradual increase in wheat flour incorporation. The mean crude fiber content results of test cookies were C_O (0.72%), C_1 (0.88%), C_2 (1.01%), C_3 (1.16%), C4 (1.29%) and C_5 (1.35%). The highest mean value (1.35%) was recorded in C_5, while lowest mean value (0.72%) in C_0 (Table 3). High crude fiber content of supplemented biscuits may be credited to high crude fiber of wheat flour contrasted to buckwheat flour. The present data achieved are in complete conformation with the finding of Baljeet *et al.* (2010) [6], who observed incorporation of buckwheat flour significantly effect on crude fiber content. Hooda and Jood (2005) [18], reported similar result increase in dietary fiber with 10% replacement of wheat flour with fenugreek flour. Our finding also supported with the study of (Hamid and Luan 2000; French and Hill, 1988) [16], who find out that supplementation of CMC in baked biscuits restrain more fiber content then to guar gum supplemented biscuits.

3.5 Ash content

Supplementation of wheat flour significantly ($p<0.5$) effect on ash content of common buckwheat flour based cookies. Data disclosed that ash content of buckwheat cookies decreased with gradual increase in wheat flour incorporation. The mean ash contents results of test buckwheat cookies were CO (1.70%), C1 (1.59%), C2 (1.50%), C3 (1.33%), C4 (1.05%) and C5 (0.95%). The highest mean value (1.70%) was recorded in C0, whereas lower mean value was found in C5 (0.95%) shown in (table 3). Decrease in ash content of supplemented buckwheat cookies with the increase in incorporation level of wheat flour is evidently due to the presence of high ash content in buckwheat flour than to wheat flour. The outcomes achieved are contrary with the finding of Rani *et al.* (2008) [31], who examined that the addition of soya bean flour result increased ash content in biscuits developed from wheat flour. Ndife *et al.* (2011) [28], also point out increased in ash content in whole wheat flour based bread with increase in different supplementation levels of soyabean flour which are in contrary with the present studies.

3.6 NFE (Nitrogen Free Extract)

Supplementation of wheat flour significantly ($p<0.5$) effect Nitrogen free extract (N.F.E) contents of common buckwheat flour based cookies. Data disclosed that carbohydrate content of buckwheat cookies increased with gradual increase in wheat flour incorporation. The mean carbohydrate content results of test cookies were CO (54.39%), C1 (54.91%), C2 (55.24%), C3 (55.61%), C4 (56.08%) and C5 (56.59%). The highest mean value (56.59%) was observed in C5, while lower mean value was found in C0 (54.39%) shown in (Table 3). Increase in nitrogen free extract (N.F.E) was observed when the supplementation of wheat flour increase. It might be due to the reason that common buckwheat contained higher crude protein content, ash content and crude fat than that of wheat flour, thus, as the supplementation level of common buckwheat decreased the NFE increased. The results achieved are in complete conformation with the results (Balajeet *et al.* 2010) [6], reported increase in the NFE content by the addition of buckwheat in wheat supplements flour.

Table 2: Proximate Composition of Buckwheat flour and wheat flour

Sample type	Moisture %	Crude Protein %	Crude Fat %	Crude Fiber %	Ash %	N.F.E %
Buckwheat Flour	11.6	15.79	1.81	0.70	1.83	68.27
Wheat flour	13.12	12.53	1.42	1.93	1.57	69.43

Table 3: The products prepared with different formulations were analyzed for proximate composition.

Treatments	Moisture	Crude fat	Crude fiber	Crude protein	Ash content	NFE
C_O	2.88 D	24.44 A	0.72 E	15.87 A	1.70 A	54.39 F
C_1	3.08 C	24.24 B	0.88 D	15.31 B	1.59 AB	54.91 E
C_2	3.16 BC	24.10 BC	1.01 C	14.99 C	1.50 B	55.24 D
C_3	3.27 B	23.96 C	1.16 B	14.67 D	1.33 C	55.61 C
C_4	3.42 A	23.79 D	1.29 A	14.37 E	1.05 D	56.08 B

Appendices

Co= (Control) 100 % common buckwheat flour C1 = (90% buckwheat + 10% wheat flour)
C2 = (80% buckwheat + 20% wheat flour) C3 = (70% buckwheat + 30% wheat flour)
C4 = (60% buckwheat + 40% wheat flour) C5 = (50% buckwheat + 50% wheat flour)

4. Acknowledgments

I acknowledge that Murtaza Ali, Sajid Hussain, Yasir Abbas and Faizullah Khan help me to carry out this research work and also writing of this research paper.

4.1 Conclusion and Recommendation

It is concluded from this research work that supplementation of wheat flour with buckwheat flour could produce acceptable cookies having nutritional and medicinal value.

Supplementation of wheat flour significantly influenced the proximate and mineral composition of buckwheat flour based cookies. Moisture contents, crude fiber contents and N.F.E (Nitrogen Free Extract) increased whereas crude fat contents, crude protein contents and ash content decreased. It is recommended further research work on development of nutritious baked products supplementing buckwheat flour with other cereals, Buckwheat leaves are used as green tea in many countries of the world so it is recommended to carry out research work on green tea. It is also recommended to investigate other varieties of buckwheat grown in Pakistan.

5. References

1. Agri Stat. Northern areas agricultural statistics survey report, Fruit Production in Northern Areas. Dept. Agri. Northern Areas Pakistan. 2007, 53-69.
2. Ahmad I, Ahmad N, Kausar T, Ashraf M. Effect of maltogenic amylase on the shelf lifeof bread. Pak. J Food Sci. 2005; 15(3-4):15-19.
3. Akubor PI, Onimawo IA. Functional properties and performance of soybean and maize flour blends in cookies. Plant Foods Hum. Nutr. 2003; 58:1-12.
4. Amrican Association of Cereal Chemist (AACC) Official methods of analysis (by Dr. William Horwitz) 17th Ed. Gaithersburg, MD, USA. 2000.
5. AOAC. Association of Official and Analytical Chemists. Official methods of analysis Washington, D.C. 2012.
6. Baljeet SY, Ritika BY, Roshan LY. Studies on functional properties and of buckwheat flour for biscuit making. Int. J Food Res. 2010; 17:1067-1076.
7. Bilgicli N. Effect of buckwheat flour on chemical and functional properties of tarhana. Food Sci. Technol. 2009; 42:514-518.
8. Bonafaccia G, Kreft I. Possibilities for the development of new products from minor cereals. In: H. Corke and R. Lin (eds), Asian Food Product Development, Science Press, Beijing. 1998, 1-5.
9. Bonafaccia L, Gambelli N, Fabjan N, Kreft I. Trace elements in flour and bran from common and tartary buckwheat. Food Chem. 2003; 80:9-15.
10. Dhingra S, Jood S. Organoleptic and nutritional evaluation of wheat breads supplemented with soybean and barley flour. Food Chemistry, 2001; 77:479e-488.
11. Eastwood MA. Vegetable Fiber: its Physical Properties. Pro. Nut. Soc. 1986; 32:137.
12. Eggum BO, Kreft I. Javornik B. Chemical composition protein quality of buckwheat. (Fagopyrum esculentum Moench). J. Plant Foods. Hum. Nutri. 1980; 30(3):175-179.
13. Eggum BO. The protein quality of buckwheat in comparison with other protein sources of plant and animal origin. Buckwheat. Symp. Ljubljana. 1980; 1-3:115-120.
14. Fessas D, Signorelli M, Pagaai A, Mariotti M, Jametti S, Schirald A. Guidelines for Buckwheat Enriched Bread: Thermal Analysis Approach. J. Therm. Anal. Cal. 2008; 9(1):9-10.
15. Fornal L. Chemizm nasion gryki i kierunki spozywczego wykorzystania. Biuletyn Naukowy. 1999; 4:7-17.
16. French SJ, Hill MA. High fiber foods comparison of some baked products containing guar gum and pectin. Journal of Plant Foods, 1988; 6:101-109.
17. Hamid AA, Luan YS. Functional properties of dietary fiber prepared from defatted rice bran. Food Chem. 2000; 68(1):15-19.
18. Hooda S, Jood S. Organoleptic and nutritional evaluation of wheat biscuits supplemented with untreated and treated fenugreek. 2005.
19. Ikeda S, Yamashita Y. Buckwheat as a dietary source of zinc, copper and manganese. J Fagopyrum. 1994; 14:29-34.
20. Javornik B, Kreft I. Characterization of buckwheat proteins. J. Fagopyrum. 1984; 4:30-38.
21. Jiang P, Burczyn FS, Campbell C, Pierce G, Austria AJ, Briggs JC. Rutin and flavonoid contents in three buckwheat species Fagopyrum esculentum, F. tataricum, and F. homotropicum and their protective effects against lipid peroxidation. Food Res Intern, 2007; 40(3):356-364.
22. Kato N, Kayashita J, Tomotake H. Nutritional and physiological functions of buckwheat protein. Recent Res. Devl. Nutri. 2001; 4:113-119.
23. Krkoskova B, Mrazova Z. Prophylactic components of buckwheat. Food Res. Int. 2005; 38(5):561-568.
24. Larmond E. Laboratory Mehthods for Sensory Evaluation of Foods. Deppt of Agri. Canada. pub. No. 1637. Ottawa. 1977.
25. Liu Z, Ishikawa W, Huang X, Tomotake H, Kayashita J, Watanabe H *et al*. A buckwheat protein product suppresses 1,2-dimethylhydrazine-inducedcolon carcinogenesis in rats by reducing cell proliferation J Nutr. 2001; 131:1850-1853.
26. Lorenz K. Protein fortification of cookies. Cereal Foods World. 1983; 28(8):449-452.
27. Macrae RR, Robinson K, Sadler MJ. Encyclopedia of Food Science. Food technol. and Nutr. Academic Press Harcourt Brace Jovanovich Pub., London. 1993; 4:345.
28. Ndife J, Abdulraheem LO, Zakaria UM. Evaluation of the nutritional and sensory quality of functional breads produced from whole wheat flour and soya bean flour blended. Afr. J Food Sci. 2011; 5(8):466-472.
29. Pflaumer PF, Smith ED, Hudson WG. Cookies containing psyllium Plant Foods for Human Nutrition. 1990; 40(2):115-121. (FSTA 14: 16A859, 1980).
30. Pomeranz Y, Robbins GS. Amino acid composition of buckwheat protein. J Agri Food Chern. 1972; 20(2):270-274.
31. Rani A, Domont GB, Pedrosa C, Ferrera ST. Functional properties of purified vicilins from cowpea (Vigna unguiculata) and pea (Pisum sativum) and cowpea protein isolate. J. Agri. Food Chem. 2008; (51):5792-5797.
32. Shahzad H, Anjum FM, Butt MS, Khan MI, Asghar A. Physical and sensoric attributes of flaxseed flour Supplemented cookies. Turk. J Biol. 2006; 30:87-92.
33. Steadman KJ, Burgoon MS. Phytic acid, tannin and rutin in buckwheat seed milling fractions. J Sci Food Agri. 2001; 81:1094-1100.
34. Steel RGD, Torrie JH. Principles and Procedures of Statistics. Mc. Graw Hill Pub. Co. Inc. New York. 1997.
35. Tyagi SK, Manikantan MR, Oberoi HS, Kaur G. Effect of mustard flour incorporation on nutritional, textural and organoleptic characteristics of biscuits. J Food Engr. 2006; 80:1043-1050.
36. Wahab S. Effect of calcium fortification on the overall quality of wholewheat flour leavened and unleavened bread. The Assessment of Post Doc. Scholar. Zhe Jiang University. Code: Z091092001. 2001.