

Comparison of Nutritional and Physiochemical Properties of Bangladeshi Wheat Varieties

¹Md. Shahedur Rahman and ²Md. Abdul Kader

¹Department of Biotechnology and Genetic Engineering,
Islamic University, Kushtia-7003, Bangladesh

²Department of Biotechnology & Genetic Engineering,
University of Development Alternative (UODA), Dhaka, Bangladesh

Abstract: In this present work it is tried to find out the comparative nutritive values and physiochemical properties of the five new varieties of wheat seeds (BAW-1059, BAW-1064, BARI GAM-24, BARI GAM-23 and BARI GAM-22). From the study it was revealed that the moisture content of the wheat varieties studied was from 8.098% to 9.078%, where the lowest value (8.098%) was in BAW-1064 and the highest value (9.078%) in BARI GAM-22, the ash content of the wheat varieties studied ranges from 1.8% to 2.16% and fiber content was from 1.93% to 2.1%. The total protein content of wheat varieties was from 9.10% to 10.01%, the starch content of the samples was from 67.50% to 69.50% and the lipid content was from 1.0% to 1.8%. The reducing sugar was found ranges from 5.33 mg/gm to 8.66 mg/gm and the free sugar content of different varieties of wheat was ranges from 41.5 mg/gm to 47.5 mg/gm. The results suggest that BARI GAM-24 has the highest amount of nutritive values than others. As there is not sufficient research on nutritional quality among Bangladeshi wheat varieties, for this reason this study is significant in providing an opportunity to explore the available and some new wheat varieties and to further improve their nutritional excellence and also essential for setting nutritional regulations for domestic and export purposes.

Key words: Wheat varieties · Nutritive values · BARI GAM-24 · Chemical composition · Physiochemical characteristics

INTRODUCTION

Wheat is one of the most important food crops for about 35% of the human population forming a staple diet in over 60 countries and being 10-20% of the daily calorific intake. Wheat became one the last cereal crops to be successfully transformed [1] and it is the second staple food crop in Bangladesh. It is estimated that 556.4 million tones of wheat will have been produced in 2003, accounting for 30% of the world's cereal production [2]. In Bangladesh wheat is cultivated approximately 15.89 luck acres of land each year. The production of wheat is about 11.75 luck metric tons per year. It is the most widely consumed cereal, owing to high nutritional values combined with the dough forming properties of the gluten. In terms of proteins and mineral contents, wheat is superior to rice and maize and almost equal to barley, oats and rye in nutritional value [3]. The coherent gluten makes it pre-eminently suitable for bread making. The starch exists in cereals in the form of grains covered by a

thin membrane of cellulose. Small amounts of sugars are also often present in cereals. The minerals calcium and phosphate are present in abundant. Phosphate is the part of phytic acid (Inositol hexaphosphate), which interferes the absorption of calcium. Some cereals (wheat and rye) contain the enzyme phytase, which hydrolyzes phytic acid and reduces the anticalcifying effect. Wheat contains many enzymes including amylolytic, proteolytic and oxidising, vitamins B₁, E, B₂ and β -carotene which precursors of vitamin A. Especially vitamins B₁ and E are abundant in wheat, chiefly in the germ and bran. Fermented Wheat Germ Extract (Avemar) can be used for treatment of cancer, autoimmune diseases [4] and as an immunomodulator [5]. Cereals contribute more than 75% of calories in our diets because the majority of people in our country take large amounts of this type of foodstuff daily. Rice and wheat are the main cereal grains consumed in Bangladesh. These are the cheapest sources of calories [6]. Between these two cereals wheat is the second most important cereal providing 9% of the daily

calorie intake in Bangladesh. Wheat is considered as utmost among the cereals largely due to the fact, that its grain contains protein with unique chemical and physical properties. Besides being a rich source of carbohydrates, wheat contains other valuable components such as protein, minerals (P, Mg, Fe, Cu and Zn) and vitamins like thiamine, riboflavin, niacin and vitamin E. However, wheat proteins are deficient in essential amino acids such as lysine and threonine [7]. Among cereals and legumes wheat is the best in term of low fat content. In Bangladesh there is a very few reports on the nutritional values of different foodstuffs and thus people are not aware of choosing foodstuffs. The nutritional aspect of wheat has a great importance in our daily dietary menu.

The present study compare the nutritional (total protein, lipid, starch, free sugar, reducing sugar) and physiochemical properties (moisture, ash, crude fibre content) of five varieties of Bangladeshi wheat.

MATERIALS AND METHODS

Materials: Five new varieties of wheat seeds (BAW-1059, BAW-1064, BARI GAM-24, BARI GAM-23 and BARI GAM-22) of wheat seeds were collected from Bangladesh Agricultural Research Institute (BARI) during September to December 2009. The seeds were cleaned, dried in the sunlight and kept in a polythene bag and stored in a desiccator for experimental purpose.

Methods: Total protein was measured by Micro-kjeldahl method [8], water soluble protein by Lowry method [9], lipid by the method of Bligh and Dyer [10], free sugar was measured by Anthrone method [11], reducing sugar by DNS (Dinitrosalicylic acid) method [12], starch by E.E. Morse method [11], moisture by direct heating method [13], ash content was measured by Straight Combustion (5500-6000c) method [14], fiber contents were determined according to the standard AOAC (1990) methods [15].

RESULTS AND DISCUSSION

Grain protein percentage is an important component of grain quality. Protein contents measured by standard Kjeldahl method show a higher level than protein contents than the other methods [7]. Table 1 show the highest mean value from the Kjeldahl method are 10.01%, 9.73% for varieties BARI GAM-24, BARI GAM-23 respectively. Low values were observed in BAW-1064 and BAW-1059. Generally grain protein contents in wheat varies between 8% and 17%, depending on genetic make-up and on external factors associated with the crop, however the protein contents in wheat measured by NIRS have been shown to be in the range of 10%~19% [16]. Thus our values for protein contents on Kjeldahl method are in this range, but mostly on the lower side of the scale.

Highest total mean fat content are present in BAW-1064 1.8%, BAW-1059 with values of 1.6%, 1.4% shown by BARI GAM-24, BARI GAM-23 with values of 1.5% and BARI GAM-22 with values of 1.0%. The most probable reason for the low level may be the presence of lipase or lipase activity, which is responsible for the hydrolysis of lipids in dormant wheat during storage [17]. The highest value of free sugar is 47.50% in BARI GAM-24 and lowest value is 41.50% in BARI GAM-23. BARI GAM-24 also contained the highest amount of reducing sugar (8.60 mg/gm), while BAW-1064 and Sufi contained the lowest amount (6.33 mg/gm). Among the tested variety starch content of BARI GAM-24 is also the highest.

Dietary fiber measurement is essential for the assessment of potential therapeutic and preventive effect of fiber intake. It has been shown that wheat is among cereals containing lowest level of fiber [18]. The values of fiber content, moisture content and ash content for each variety are given in Table 2. The highest values of fiber are 2.2 %, 2.1% for BARI GAM-23, BAW-1064 and a same value of 2.1% are shown by BARI GAM-22 respectively.

Table 1: Lipid, protein, starch, reducing sugar, free sugar and energy content of different wheat varieties of Bangladesh

Name of the varieties	Lipid (gm%)	Protein (gm%)	Starch (gm%)	Reducing Sugar (mg/gm)	Free sugar (mg/gm)	Energy (Kcal)
BARI GAM-24	1.4	10.010	69.50	8.60	47.50	330.64
BAW-1059	1.6	9.625	68.50	7.33	46.50	326.90
BAW-1064	1.8	9.100	68.00	5.33	45.50	324.60
BARI GAM-23	1.0	9.738	67.95	7.00	41.50	319.75
BARI GAM-22	1.5	9.660	67.50	5.33	42.50	321.24

Table 2: Moisture, ash and fiber content of different varieties of Bangladeshi wheat

Name of the varieties	Moisture (gm %)	Ash (gm %)	Fibre (gm %)
BARI GAM-24	8.98	1.80	1.96
BAW-1059	8.09	1.58	1.93
BAW-1064	8.91	1.63	2.10
BARI GAM-23	9.01	1.60	2.20
BARI GAM-22	9.07	2.16	2.10

The lowest value is 1.93% for BAW-1059. The highest level of ash is present in BARI GAM-22, with a value of 2.16%. The lowest level is observed in variety BARI GAM-24 with 1.8 % ashes. Our values are in some cases higher than already obtained for some other wheat varieties (1.3%~1.95%) [19]. It is also evident that highest level of moisture is present in BARI GAM-22, BARI GAM-23 and BAW-1059 with values of 9.07%, 9.01% and 8.98% respectively. The lowest level of moisture is present in BAW-1064. Our value is higher than moisture contents of other wheat varieties (6.06%) [20]. Thus moisture content appears to affect the grain hardness and is important parameter for meal as well [21]. In respect with Bangladeshi white varieties there is very little published research were done concerning nutritional quality and physiochemical properties, so findings of this study can be considered as added data.

It is concluded from the present study that the total protein content of wheat varieties was ranges from 9.10%~10.01%, the starch content of the samples was from 67.50% to 69.50%, the lipid content was found to ranges from 1.0%~1.8% and the energy content of the samples ranges from 319.75 kcal to 330.64 kcal per 100 gm edible portion. The reducing sugar was found to ranges from 5.33 mg/gm to 8.60 mg/gm and the free sugar content of different varieties of wheat was ranges from 41.50 mg/gm to 47.50 mg/gm. The moisture content of the wheat varieties studied was ranges from 8.09%~9.07%. The ash content of wheat varieties studied was ranges from 1.8%~2.16% and fibre content was from 1.93%~2.2%. This study is important in providing an opportunity to improve the nutritional quality of wheat and for setting up of nutritional and export regulations in Bangladesh.

REFERENCES

1. Tama's, C., B.N. Kisgyo'rgy, M. Rakszegi, M.D. Wilkinson, M. Yang, L. La'ng, L. Tama's and Z. Bed, 2009. Transgenic approach to improve wheat (*Triticum aestivum* L.) nutritional quality. *Plant Cell Rep.*, 28: 1085-1094.
2. FAO, 2003. Food Outlook No 4. FAO Global Information and Early Warning System on Food and Agriculture, Rome.
3. Wikipedia, the Free Encyclopedia, 2010. Online: <http://en.wikipedia.org/wiki/Wheat>.
4. Boros, L., M. Nichelatti and Y. Shoenfeld, 2005. Fermented Wheat Germ Extract (Avenar) in the Treatment of Cancer and Autoimmune Diseases. *Ann. NY Acad. Sci.*, 1051: 529-542.
5. Kenner, D. Avenar, 2009. A Clinically Versatile Functional Food. Online: http://www.dankenresearch.com/kenner/index.php?option=com_content&view=article&id=62:avemar-a-clinically-versatile-functional-food&catid=37:article&Itemid=28.
6. Jensen, R.T. and N.H. Miller, 2008. The Impact of the World Food Price Crisis on Nutrition in China, pp: 1-34. Online: http://docs.google.com/viewer?a=v&q=cache:NBG4jTNvLRQJ:www.hks.harvard.edu/var/ezp_site/storage/fckeditor/file/pdfs/centers-programs/centers/cid/publications/faculty/wp/176.pdf+wheat+is+the+cheapest+sources+of+calories+%2B+pdf&hl=en&pid=bl&srcid=ADGEESi-WN-l6A1Z-JRbrV5SST1TeSo-X7voW23BFX-qmWsmwXxWgN9Po1cC6oRUF2nhx_LBIQiDyZrhgY1-njiL5bR4FpIEg--FROM_yLTPag8jgyhaFxF-DRBiKXLmTP2rM994RYd5&sig=AHIEtbQWGdG1w_XdVqBr2nomlWXYGqGcsw.
7. Ikhtiar, K and Z. Alam, 2007. Nutritional composition of Pakistani wheat varieties. *J. Zhejiang Univ. Sci. B.*, 8: 555-559.
8. Jayaraman, J., 1985. Laboratory manual in Biochemistry. Wiley Eastern Ltd. New Delhi, ed. 75: 66, 67, 121, 123.
9. Lowry, O.H., N.J. Rosebrough, A.L. Farr and R.J. Randall, 1951. Protein measurement with the folin phenol reagent. *J. Biol. Chem.*, 183: 265-275.
10. Bligh, E.G. and W. Dyer, 1959. A rapid method of total lipid extraction and purification. *Biochem Physiol.*, 37: 911-917.

11. Morse, E.E., 1947. Anthrone in estimating low concentration of sucrose. *Anal. Chem.*, 19: 1012-1013.
12. Miller, G.L., 1972. Use of DNS Reagent for Determination of Reducing Sugar. *Anal. Chem.*, 31: 426-428.
13. Pearson, D., 1970. *The chemical analysis of foods.* Churchill J. A. London, U.K., pp: 4-5.
14. Triebold, H.O. and L.W. Wurand, 1969. *Food Composition and Analysis.* Van Nostrand Reinhold Co. New Work, U.S.A. 2nd Ed., pp: 31.
15. AOAC., 0000 *Official Methods of Analysis (OMA).* 15th Edn., Association of Official Analytical Chemists, Arlington, Virginia.
16. Hruschka, W.R. and K.H. Norris, 1982. Least squares curve fitting of near infrared spectra predicts protein and moisture content of ground wheat. *Appl. Spectrosc.*, 36: 261-265.
17. Rose, D.J. and O.A. Pike, 2006. A simple method to measure lipase activity in wheat and wheat bran as an estimation of storage quality. *J. Am. Oil Chem. Soc.*, 83: 415-419.
18. Anderson, J.W. and S.R. Bridges, 1988. Dietary fiber contents of selected foods. *Am. J. Clin Nutr.*, 47: 440-447.
19. Kamal, A.M.A., M.R. Islam, B.L.D. Chowdhry and M.A.M. Talukder, 2003. Yield performance and grain quality of wheat varieties growing under rain fed and irrigated conditions. *Asian J. Plant Sci.*, 2: 358-360.
20. Jamil, M. and U.Q. Khan, 2002. Study of genetic variation in yield components of wheat cultivars Bakhtawar-92 as induced by gamma radiation. *Asian J. Plant Sci.*, 1: 579-580.
21. Gaines, C.S. and R.N. Windham, 1998. Effect of wheat moisture content on meal apparent particle size and hardness scores determined by NIRS. *Cereal Chem.*, 75: 386-391.