Study on Nuritional Aspects of Some Cereals of Bangladesh

Aleya Mowlah[1], *Rahima Begum*[1], *Golam Mowlah*[1] *and* *Syed Hadiuzzaman*[2]

[1]Institute of Nutrition and Food Science, University of Dhaka, Bangladesh.
[2]Department of Botany. University of Dhaka, Dhaka, Bangladesh.

Introduction

About half of the ploughed land of the world is used for growing cereals that include a large parts of Asia and Africa. And cereals provide 70 and 50 per cent of total energy in the common diet of the people in Asia and Latin America respectively[1, 2]. In developing countries like Bangladesh 95% of the population consumes cereals as its dietary staple where rice is the predominant one follwed by wheat, maize, barley, millet and sorghum. As a response to the urgent need of the present world for alleviating hunger and poverty, improving of nutritional status of the people and controlling of both malnutrition and overnutrition, effective steps for prduction, processing, distribution, marketing and education in the aspects of cercals foods are seems to be vitally important, especially for a country like Bangladesh which is characterized by segmented and scattered (non-farming) type of agricultural production practices[3]. In a situation as prevailing in Bangladesh, plant resouces of food especially the cereals are the most important food crops, and undoubtedly, in the context of existing food energy gap cereal crops can play an important role in narrowing the food and protein energy gap of Bangladesh[3]. Therefore, the increase of cereal productions and development of improved varieties in terms of food, nutritional and processing qualities are important steps for meeting the future world food and nutritional needs and requirements. As the food composition of cereals are the deteminants for ascertaining their nutritional quality and at the same time, the food composition of cereals depend largely on (a) extrinsic factors like soil conditions and structures. availability of plant nutrients, use of fertilizer and water, sunlight and energy; and (b) intrinsic factors like plant characteristics. crops species, varieties and other genetic influences[4]. So the food quality of the agricultural produces are dependent on the locality and geographical

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position. And also evaluation of the nutritional qualities of cereal varieties together with their development and plant culture in the laboratory and pilot-plant production practices in the field is essential both for economic and nutritional point of view. Therefore, the assessment of nutritional qualities of cereal varieties like rice, wheat, corn, barley, sorghum and millets are very important both for cultural and nutritional point of view in the context of Bangladesh as very little and insufficient informations are available on the proximate composition and quality assessment of new varieties of cereals developed in Bangladesh. However, some scattered analytical findings are available on some staple cereals in India[5-6] Pakistan[7-8] and Philippines[9]. Informations are avalilable on the nutritional values of Iraqi rice produced and grown under irrigation project in Iraq[10] and nine varieties of widely cultivated rice grown in experimental farm of Assam during 'Kharif' Season.[11]

In this study some nutritional quality aspects of almost all locally produced cereals varieties of Bangladesh have been investigated with respect to major nutrients and minerals contents, along with the processing effects on nutritional values of rice varieties.

Materials and Methods

The cereals used in this investigation were: six varieties of rice (oryza sativa) like Brishail (BR_4), Progati (BR_{10}), Mukta (BR_{11}), Kiron (BR_{22}), Dishery (BR_{23}) and N. Sall; five varieties of wheat (Triticum aestivum) like Agrani, Sonalika, Barkat, Akbar and Kanchan; three varieties of corn (Zea mays) like Shuvra, Bornali and Popcorn; three varieties of barley (Hordium valgare) like BVH-67, Islampur and Centinella; two varieties of proso millet (Panicum miliacium) like Kumardhan, and Bagaikandi and three varieties of foxtail milllet (Setaria italica) like Lakhipur-2, Bogra-1 and Titas.

All analysis were performed in quadruplicate. The datas were subjected to analysis of varience and range test.

Proximate Analysis : Moisture contents: Moisture contents were determined following standard procedure. Sample of grain was weighed and placed in an oven at 105°C for 4-5 hours, cooled in desciccator and weighed. This procedure of heating and weighing were repeated until a constant weight was obtained. The differences between the initial and final weights indicated the amounts of moisture contents of the sample.

Crude Protein : The crude protein was estimated by Kjeldhal method as described by Juliano.[12]

Fat Contents : Fat was estimated as crude ether extract of the dried materials. Fat was extracted by soxhlet apparatus with petroleum ether as solvent The estraction was continued for 18 hours. The extracted ether was evaporated to dryness. The flask containing the extracted fat samples were kept in a dessiccator and weighed. The difference in weight between the flask with fat sample and the empty flask was recorded as total fat content of sample.

Grude fibre, Ash and Thiamine contents : Cude fibre, ash and thiamine contents were determined followeing the AOAC methods.[13]

Carbohydrate contents : Carbohydrate content was determined by difference, that is, by substracting from hundred the sum of the values for moisture, protein, fat, ash and crude fibre contents per hundred grams of the sample.

Mineral contents : The determination, of total phosphorus (P), calcium (Ca), magnesium (Mg), sulpher (S), boron (B), copper (Cu), iron (Fe), managenese (Mn) and zinc (Zn) were performed by atomic absorption spectrophotometric method.[13]

Results

Carbohydrate contents varied little among the cereal varieties investigated ranging from 68.34 to 76.18 g/100g having corn the highest and buck wheat the lowest value (Table 1). As for protein contents the difference was noticeable as it ranged from 6.88 to 14.66 g/100g having buck wheat the highest and corn the lowest.

As the ratio of carbohydrate and protein was very important in assessing the nutritional quality of the cereals which were found to be in the order of corn > rice > wheat > sorghum > millet > barley having lowest in buck wheat.

Fat content was highest (3.78 g/100g) in buck wheat and llowest in milled N. sail (1.10g/100g) and proso millet contained 1.67g/100g fat. Milled rice, proso millet and foxtail millet showed remarkably lower amount of ash and fibre. Sorghum and barley indicated lower amounts of thiamine. Milling increased the percentage of moisture but drastically reduced contents of fat, ash, fibre and thiamine. Minerals and trace element contents of cereal varieties are presented in Table-2, Wheat (Aghrani) showed highest phophorus content (0.31 mg/100g) having lowest in milled rice, BR_4 (0.10 mg/100g). The

Table-1. Major nutrients contents (g/100g) of various cereals of Bangladesh

Sample	Varety	Moisture	Carbohy-drate	Protein	Fat	Ash	Fibre	Thiamine
Rule	N. Sail (Brown)	13.10	75.40	7.71	2.67	1.01	0.11	0.25
Wheat	Akbar	12.33	71.83	11.69	1.86	1.69	0.30	0.38
Com	Sluvra	11.61	76.18	6.88	3.68	1.49	0.20	0.36
Barley	Centinella	10.93	71.20	13.44	2.23	1.86	0.30	0.09
Proso millet	Bagaikandi	13.06	69.78	11.56	1.67	0.89	0.04	0.13
Foxtail-millet	Lakhipur-2	11.81	74.19	11.16	2.01	0.78	0.05	0.25
Sorghu-m	BVH-67	11.96	73.59	9.81	3.03	1.35	01.26	0.05
Buck Wheat	Buck Wheat	11.05	68.34	14.66	3.78	1.96	0.21	0.21

sequence of phrsphorus contents were : wheat>corn>rice brown>fox-tail millet>barley>proso millet>rice milled.

Brown rice (BR_{10}) showed highest amount of calcium (0.7mg/100g) which was lowest in wheat, Aghrani (0.16mg/100g). The sequence of calcium contents were: brown rice>milled rice>pros millet>corn> barley>foxtail millet> wheat. It was noticeable that although milling incurred about 20% loss of calcium, milled rice was still the better source of calcium.

All the varieties investigated indicated identical amounts of magnesium ranging from 0.2 mg to 0.35 mg/100g excepting wheat (Aghrani) and foxtail millet (Bogra-1) which contained 0.17 mg and 0.15 mg/100g, respectively.

Two of the five varieties of wheat like Barkat and Kanchan showed higher amount of sulpher (0.45 mg and 0.47 mg/100g, respectively). Brown rice contained 0.27mg/100g followed by corn, barley, proso millet, foxtail millet and other varieties. Brown rice (BR_{10}) contains highest amount of iron, (224ppm), retained 171 ppm after milling which were still higher than other varieties. Shuvra and popcorn variety of corn showed exceptionally lowest iron content (44 ppm). The sequence of iron contents

Table 2. Minerals and trace elements contents of cereals

Sample	Variety	P	Ca	Mg	S	Fe	Mn	Zn	Cu	B
		mg/100 gm				ppm				
R	BR4(B)	0.20	0.50	0.27	0.28	156	35	27	30	7.5
	BR4(M)	0.10	0.42	0.24	0.24	132	27	17	26	6.0
1	BR10(B)	0.21	0.60	0.25	0.22	244	35	42	39	6.0
	BR10(M)	0.12	0.48	0.22	0.19	171	27	32	32	4.4
C	BR11(B)	0.20	0.58	0.30	0.29	114	39	45	31	10.0
	BR11(M)	0.11	0.48	0.26	0.25	96	20	17	27	7.2
E	BR22(B)	0.21	0.48	0.25	0.30	156	40	42	34	8.4
	BR22(M)	0.12	0.40	0.22	0.26	96	27	32	29	7.2
	BR23(B)	0.19	0.550	0.22	0.27	141	41	42	28	9.0
	BR23(M)	0.11	0.46	0.20	0.24	87	19	25	25	8.4
	N.Sail(B)	0.20	0.46	0.35	0.26	210	47	30	37	5.4
	N.Sail(M)	0.12	0.40	0.30	0.24	144	27	27	28	4.6
W	Aghrani	0.31	0.16	0.17	0.16	74	56	49	120	0.19
W	Sonalika	0.24	0.24	0.26	0.23	76	55	46	123	0.14
E	Barkat	0.25	0.36	0.31	0.45	75	45	44	119	0.17
A	Akbar	0.21	0.29	0.30	0.18	65	50	45	115	0.18
T	Kanchon	0.26	0.24	0.20	0.47	64	63	44	129	0.19
C	Shuvra	0.22	0.36	0.31	0.20	44	39	34	35	9.5
0	Bornali	0.24	0.40	0.31	0.19	76	49	24	37	7.8
R	Popcorn	0.18	0.41	0.32	0.18	44	49	37	29	6.6
N										
B	BVH-67	0.13	0.32	0.29	0.17	84	35	36	45	7.2
A	Islampur	0.17	0.40	0.36	0.15	79	39	57	49	7.6
R										
L	Centinella	0.16	0.38	0.25	0.16	100	33	51	33	7.8
E										
Y										
PROSO—	Kumardhan	0.12	0.44	0.32	0.13	73	32	23	37	5.4
MILLET	Bagaikandi	0.13	0.43	0.25	0.15	72	35	276	39	6.6
FOXTAIL—	Titas	0.17	0.25	0.24	0.18	85	47	53	42	10.2
MILLET	Lakhipur-2	0.16	0.32	0.21	0.15	73	46	54	43	9.6
	Bogra-1	0.17	0.24	0.15	0.18	70	45	56	42	7.2

M-Milled
B=Brown

were: brown rice>milled rice>barley> foxtail millet>proso millet>wheat> corn. Wheat (kanchan) has highest amount of manganese (63ppm) with milled rice (BR_{23}) having the lowest (19 ppm). The sequence of mangnese contents were: wheat> foxtail millet>corn> brown rice> barley>proso millet> milled rice. Barley (Islampur-2) contained the highest amount of zinc (57ppm) and the lowest (17 ppm) in milled rice (BR_{11} and BR_4). And the sequence were: barley>foxtail millet > wheat > brown rice > corn > proso millet > milled rice. Wheat was the best source of copper as it contained copper ranging from 115 to 129 ppm. The lowest (25ppm) was in milled rice (BR_{23}). The sequence of contents were: wheat> foxtail millet>barley> proso millet> corn>brown rice>milled rice.

Foxtall (Titas) and brown rice (BR_{11}) are the richest source of boron. All the wheat varieties showed low amount of boron having lowest (4.4 ppm) in milled rice (BR_{10}). Boron content showed much variability within the cereal varieties excepting barley and wheat.

Discussion

This study reported the major nutrients, minerals and trace elements contents of some cereals of Bangladesh. The results of this study is comparable to other studies with cereals like rice, wheat, corn, barley, millet and sorghum grown in India, Pakistan, Philippines and Assam.[6,7,9,11] However, the present study included a wide variety of cereals as it covers 23 types of cereals from rice, wheat, corn, barley and millet. The study indicated that Buck wheat is the richest source of protein among all the cereals investigated. The results with respect to minerals and trace elements maintained resemblance with those indicated by other studies with cereals from different geographical areas[6,7,14]. The results obtained in the present study gave a detailed picture of minerals and trace elements contents of a sufficient number of cereals varieties developed in Bangladesh. It indicated that the varieties within each group of cereals maintained a good parity with respect to nutritional values. That is, the new varieties are equally nutritional to those of conventional varieties. However, the results on nutrient contents of milled and non-milled rice indicated that milling considerably reduced the major nutrient contents of different rice varieties. The reduction of protein contents may be due to loss of protein fraction from pericarp and germ during the polishing process.

Similar facts have been reported on Iraqi rice and by products.[10]

Milling has also effected the food value by reducing thiamine and fibre contents. This is because milling removes the bran and germ of the grain which contain maximum thiamine and fibre[15].

Summary

Eight varieties of cereals cultivated in Bangladesh were studied to determine their moisture, carbohydrate, protein, fat, as, fibre and thiamine contents. Among them six leading cereals including their different varieties were investigated for ascertaining their micronutrients such as phosphorus, calcium, magnesium, sulpher, iron, manganese, zinc, copper and boron contents. It was found that wheat, barley and millets were the important sources of protein having highest amount in buck wheat. Also buck wheat contained highest amount of fat which was followed by corn and sorghum. Corn and wheat contained highest amount of thiamine where rice and millet were next to them. Also, a comparison between nutrient contents of milled and non-milled rice variety was done to see the effects of milling on rice grain as milled rice is more commonly used instead of non-milled rice. The results indicated a considerable reduction of nutritive values by the milling process and a drastic reduction of fat (58%) fibre (47%) and thiamine (24%).

This study revealed that wheat (Agrani), wheat (Kanchan), and barley (Islampur-2) are the best sources of phosphorus, managanese and zinc, respectively; that brown rice (BR_{10}) is the highest source of calcium and iron; and that wheat is the best source of copper and sulpher. Although more studies are needed to fix nutritional status of the available cereal foods of Bangladesh, the present study will be the basis of further study in this respect as at provides a thorough comparative nutritional values of cereals commonly used in the diets of Bangladesh. As such this study will also be useful in preparing food-balance sheet for the people of Bangladesh.

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