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Grain and Milling Quality of Barley and Their Suitability for Preparation of Traditional South Indian Products

Madhavi Reddy.M[1], Raja Reddy.P[2], Raghavendra Prasad BN[3], Munilakshmi U[4]
[1.] *ClinicalNutritionist, Department of medicine, Sri Devaraj Urs Medical College, Tamaka, Kolar, Karnataka-563 101*
[2.] *Assistant professor, Department ofPhysiology, Sri Devaraj Urs Medical College, Tamaka, Kolar, Karnataka-563 101*
[3.] *Professor, department of Medicine, Sri Devaraj Urs Medical College, Tamaka, Kolar, Karnataka*
[4.] *PhD Scholar, Department of biochemistry, Sri Devaraj Urs Medical College, Tamaka, Kolar, Karnataka*

ABSTRACT : *Barley (Hordeum vulgare L.) is grown as a commercial crop in some hundred countries world-wide and is one of the most important cereal crops in the world. Barley assumes the fourth position in total cereal production in the world after wheat, rice and maize, each of which covers nearly 30% of the world's total cereal production, hence the study was undertaken to evaluate the milling quality characteristics of different cereals and organoleptic evaluation of traditional food products. The 1000 kernel weight (44.5g) and volume (55.7ml) of the barley grains were significantly higher than wheat (42.8g) and (53.0ml) and rice (32.7g) and (46.0ml). The chemical composition of the barley grains were more for proteins(13.7g), fat(1.7g) followed by wheat(12.6g, 1.3g) and rice (8.5 g,0.9g). The cooking time for rice was less (20 min) than wheat (24min) and barley (27min). The viscosity of cooked grains was more in rice (7.4cm) followed by wheat (6.5cm) and barley (5.9cm). The mean score for appearance was highest (3.72) for barley followed by wheat (3.52) and rice (3.20). This may be attributed to the presence of carotenoids, which naturally occur in barley at higher concentrations than wheat and rice. It is less palatable than wheat. Flour made from barley can be used as substitute for wheat flour. Further research is needed to improve the palatability of barley and to formulate more barley recipes.*

I. INTRODUCTION

Over the last 15 years research efforts associated with food barley have increased significantly, revealing a number of unique cultivar- specific functional characteristics that affects both human health and functionality in food processing. New barley cultivars have been generated specifically for food use, possessing increased β-glucon, desirable starch composition profiles and improved milling or processing traits [1]. Recently, barley flour and whole grain products have been formulated in food research laboratories to increase the diversity of barley food products available and to improve the utilization potential of these healthful grains[2]. These innovations have proven that barley based foods succeed as an alternative to wheat based foods and barley does not need to be considered only as a minor ingredient. There are a variety of foods that can be made from suitable cultivars of barley and modern technology offers the means of over coming any previous limitations in palatability. The wide range in sensory and functional properties offered by diverse barley sources provides food manufacturers with unlimited product opportunities. Some 140 million tons of barley are produced annually worldwide[3]. In industrialized countries the consumption of barley as food has of its earlier importance in human nutrition[4].On December 23, 2005, the Food and Drug Administration (FDA) announced that whole grain barley and barley containing products are allowed to claim that they reduce the risk of coronary heart disease (CHD). Consequently, consumers can except to see whole barley and dry milled barley products such as flakes, grits, flour, meal and barley meal bearing the health benefit claim. Coronary heart Disease (CHD) is the cause of almost 5000,000 deaths annually. Scientific evidence shows that adding barley to one's diet can provide health benefits of serum cholesterol lowering [5].Hence the study was undertaken to evaluate the milling quality characteristics of different cereals and organoleptic evaluation of traditional food products

II. MATERIAL AND METHODS

Study was conducted in RL Jalappa hospital and research center attached to Sri Deveraj Urs Medical College, Kolar.Barley , wheat and rice was obtained from the local market in a lot, and cleaned conditioned barley, wheat and boiled rice was milled into semolina in a commercial mill and each of 100 g of barley and wheat and rice semolina was packed in air tight poaches, and stored at room temperature and was used for the study

Physico-chemical properties: One thousand kernels were counted and their weight was noted and the volume of the same thousand kernels was measured in a measuring cylinder. Density of the grains was calculated from thousand kernel weight and volume. Barley grains were pulverized in a laboratory model Wiley mill and the whole meal was analyzed for moisture, proteins, ash, fat by standard procedures [6]and the carbohydrates content was calculated by difference. Total, reducing and non-reducing sugars were estimated by Nelson Simonyi's method.

Preparation of polished grains: A Known quality of wheat sample with an initial moisture content of 8.5% was mixed with 4% additional water, tempered for 5 min and polished by a traditional method in a hand pounding wooden pestle andmotor for 5 min to remove around 10% bran.

Cooking properties of whole and polished grains: The percent increase in weight of soaked whole and polished grains were determined by weighing the samples before and after soaking (12 hr). Known quantities of barley grains were dropped in boiling water and cooking time was noted by pressing the cooked grains between the glass slides and the disappearance of chalky spot of barley was taken as a measure of doneness.Viscosity of the cooked polished grains was checked by using line spread test (that measures the consistency of foods in terms of their ability to spread on a flat surface) by noting the spread at four sides and taking the average.

Milling yield: A known quality of barley sample with initial moisture content of 8.5 per cent was mixed with four per cent additional water and tempered for 5 minutes. Tempered grains were milled into fine semolina in a commercial mill. The semolina was passed through an opening of 670 (32 mesh sieve) and + 32 size fraction was tempered as semolina and -32 fraction was termed as flour. The bran was separated from semolina by winnowing. The bran, semolina and flour were exposed to atmosphere and equilibrated and weighed to determine the yield .Color of the flour and semolina was observed and recorded.

Preparation of porridge and uppuma

Porridge was prepared from polished barley grains. One hundred gram polished grains were soaked overnight and cooked to soft and smashed properly after addition of equal quantity of water and added salt to taste served. Uppuma was prepared with 100 g of semolina. Chop green chilies and onions. Splutter mustered in hot oil; add black and Bengal gram dhals. Fry them for a few seconds. Add chopped onion and green chilies and fry till the onions become slightly brown. Add semolina. Fry for about a minute. Add salt and water. Cooked on slow fire till done and served.

Organoleptic evaluation: Uppuma was evaluated fresh by scoring method .Code numbers were given to different cereals. Product was repeated thrice during the course of evaluation by a panel of 10 judges. The judges were asked to score for different characters like appearance, texture, taste, chewiness, aroma and overall acceptability

STATISTICAL ANALYSIS

The data collected on milling quality and organoleptic evaluation of the product were subjected to analysis of variance and critical difference were calculated to determine any significant difference within the variables

III. RESULTS

Among the cereals under the study, the 1000 kernel weight (44.5g) and volume (55.7ml) of the barley grains were significantly higher than wheat (42.8g)and (53.0ml) and rice (32.7g) and (46.0ml). The chemical composition of the barley grains were more for proteins(13.7g), fat(1.7g) followed by wheat(12.6g, 1.3g) and rice (8.5 g,0.9g). Kumar et al (1994) observed a wide variation in 1000-kernal weight .The higher content of proteins and fat in barley grains were observed.

Table 1. Physico-chemical properties* of barley, wheat and rice

Physical properties	Barley	Wheat	Rice
Thousand kernel weight (g)	44.5	42.8	32.7
Thousand kernel volume (ml)	55.7	53.0	46.0
Density (g/ml)	0.79	0.81	0.70
Chemical properties(g/100g)			
Moisture	8.3	8.1	8.4
Proteins	13.7	12.6	8.5
Fat	1.7	1.3	0.9
Total carbohydrates	72.5	75.2	77.1

*average of three values

Table2. Comparison of physico -chemical properties of Cereals

Cereals	Mean±SD	SEM	P- value	t- value	F- value
Barley and Wheat	28.17 ±28.99 32.08 ± 29.47	10.95 12.03	0.962	-.241 -.241	.002
Barley and rice	28.17± 28.99 21.38±29.70	10.95 12.13	0.712	.416 .415	.143

P<0.05 considered as significant

Fig1. Correlation of physio -chemical properties of cereals

The mean water up take of different cereals was presented in table 2. The more percent water uptake was observed in barley grains (60%) thanwheat (62%) and rice (56%). The less cooking time for rice (20 min) thanwheat (24min) and barley (27min). The viscosity of cooked grains was more in rice (7.4cm) followed by wheat (6.5cm) and barley (5.9cm).Significantly higher bran percentage was observed in barley grains (40%), than wheat (22%) and rice (9%) whereas, the semolina and flour was less in barley than with two other cereals observed in this study.

Table 3. Grain, milling, flour and dough properties* of barley, wheat and rice

Properties	Barley	Wheat	Rice
Grain			
Water up take during soaking (%)	60.0	62.0	56.0
Cooking time (min)	27	24	20
Viscosity of cooked grins(cm)	5.9	6.5	7.4
Milling			
Bran (%)	40	22	9
Semolina (%)	35	40	37
Flour (%)	25	38	54
Flour			
Sedimentation value(ml)	28.0	39.0	32.0
Pelshenke value (min)	103.50	176.33	138.00
Water absorption (%)	55.0	50.0	50.0
Dough			
Rolability (cm)	20.30	21.50	21.10
Dough handling property	Sticky, non elastic	Sticky, elastic	Slightly pliable, sticky ,nonelastic

*Average of three values

Table 4. Comparison of grain, milling, flour and dough properties of barley, wheat and rice

Cereals	Mean±SD	SEM	P- value	t- value	F- value
Barley and Wheat	38.00 ±27.01 48.39 ±47.60	8.54 15.05	0.421	-.600 -.600	.677
Barley and rice	38.00± 27.01 42.80±37.72	8.54 11.93	0.486	-.327 -.327	.507

P<0.05 considered as significant

The sedimentation value was more in wheat (39ml) than rice and barley, whereas the pelshenkevalue (min) was more in wheat and the percent flour water absorption was more in barley (55%). The dough properties of rolability low in barley than rice and wheat with regard dough handling properties, the dough prepared from barley was sticky and non-elastic, dough from rice was slightly pliable, sticky and non-elastic whereas the dough from wheat was sticky and elastic.Mean sensory scores of uppuma prepared from different cereals are resented in table 3. The mean score for appearance was highest (3.72) for barley followed by wheat (3.52) and rice (3.20). This may be attributed to the presence of carotenoids, which naturally occur in barley at higher concentrations than wheat and rice. The mean scores were highest for taste (3.74), texture (3.61) and aroma (3.80) this may be due to the high concentration of fat in barley grains. Porridge prepared from showed highest overall acceptability followed by barley and rice respectively.

Table 3. Mean score for organoleptic evaluation* of uppuma prepared with barely, wheat and rice semolina

Characters	Barley uppuma	Wheat uppuma	Rice uppuma
Appearance	3.72	3.52	3.20
Texture	3.61	3.01	3.00
Taste	3.74	3.20	3.50
Chewiness	3.67	3.10	3.00
Aroma	3. 80	3.30	3.54
Overall acceptability	18.54	16.13	16.24
Rank	I	III	II

*Mean scores of 10 panelists
Sensory scores were based on 4, point scale, where 4= highly acceptable, and 1= poorly acceptable

Table 4. Sensory evaluation of porridge* prepared from barley, wheat and rice semolina

Characters	Barley porridge	Wheat porridge	Rice porridge
Appearance	3.54	3.50	3.45
Texture	3.67	3.54	3.10
Taste	2.10	3.12	2.34
Aroma	2.90	3.23	3.10
Mouth feel	3.10	3.22	3.01
Overall acceptability	15.31	16.61	15.00
Rank	II	I	III

*Mean scores of ten panelists
Sensory scores were based on 4, point scale, where 4= highly acceptable, and 1= poorly acceptable

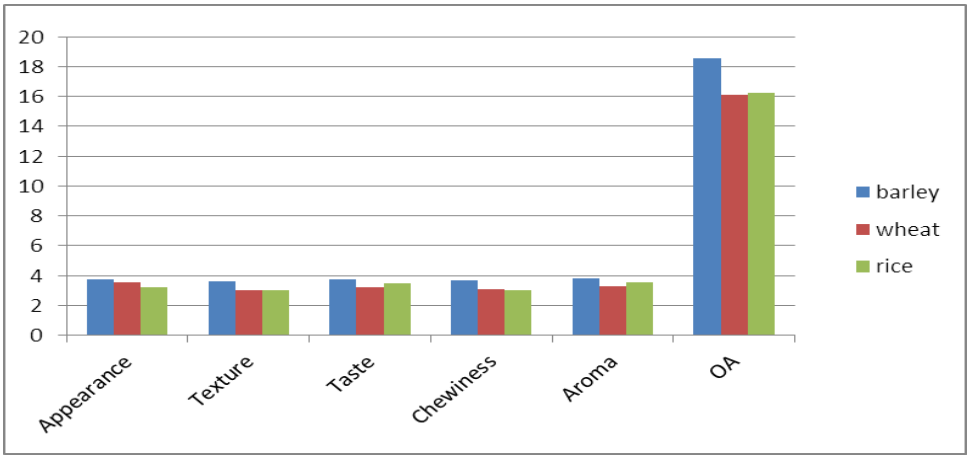

Fig.1 Organoleptic evaluation of uppuma prepared from barley, wheat and rice

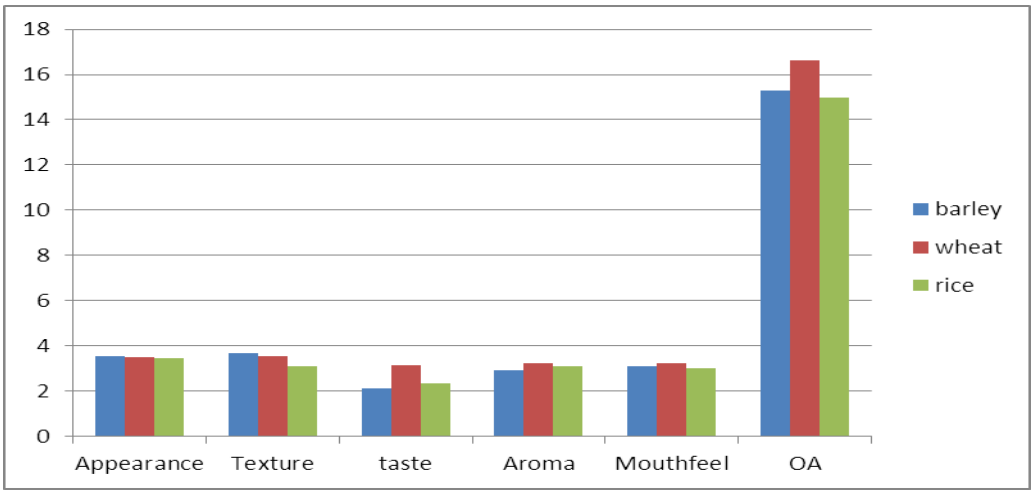

Fig.2 Organoleptic evaluation of porridge prepared from barley, wheat and rice

IV. DISCUSSION

Food produced from barley is a good source for many nutrients such as protein, fiber,minerals andB-complex vitamins [7]. The nutritive value of barley is, generally, similar to that of the main cereal staple foods. The composition of the barley grain and the percentage of macronutrients are similar to those of wheat although it is considered to have a poorer nutritive value than wheat because of its higher fiber content. Carbohydrates, proteins and fats are something around 73.5%, 12.5% and 2.3% in barley and 72.5%, 13.7% and 1.9% in wheat respectively. Likewise, the concentration of vitamins and minerals in both cereals are close to each other [8]. Barley is a food known for its high fiber content- ranging from 15.3% to 31.6% compared with 9.6% in whole meal wheat flour. Barley kernel,crushed barley and pearled barley are used as pot barley, to make porridge, pie fillings and so on. It can be cooked as an alternative to rice, pasta or potatoes, or added to stews [9]. Barley flakes are used for porridge and gruel or as an ingredient in muesli or breakfast cereals [10].Cereals have been an essential part of the human diet since the beginning of agriculture and are most economic source of energy [11]. It is good for digestive and nervous system as it contains an important amino acid L tryptophan and is helpful for sleeplessness, depression, anxiety and premenstrual syndrome.

V. CONCLUSION

Barley comes under cereal grains and is staple food in most countries of the Middle East. It is having almost equal importance to wheat. However, it is less palatable than wheat. Flour made from barley can be used as substitute for wheat flour. Further research is needed to improve the palatability of barley and to formulate more barley recipes.

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