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Studies on effect of malting on physiochemical characteristics of wheat malt and barley malt used for preparation of probiotic beverage

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Abstract
Effort have been made to analyse physiochemical properties of Wheat and Barley and development of process technology for Preparation of Sprouted Wheat Malt and sprouted barley Malt. Physicochemical properties of Wheat, Barley. Sprouted Wheat malt and sprouted barley malt were evaluated. Wheat and barley was analysed for physical characteristics viz. Bulk Density, True Density, Angle of Repose and 1000 Kernel weight. The wheat barley sprouted wheat malt and sprouted barley malt was analysed for proximate viz. moisture, ash, protein, carbohydrate, total fibre and fat. These properties are common quality of concern when considering cereals as food ingredients and are related to the microstructure of materials.

Keywords: Wheat, barley, sprouted wheat, sprouted barley

Introduction
Cereals are grown over 73% of the total world harvested area and contribute over 60% of the world food production providing dietary fibre, proteins, energy, minerals and vitamins required for human health. The possible applications of cereals or cereal constituents in functional food formulations could be summarized. As fermentable substrates for growth of Probiotic microorganisms, especially lactobacilli and bifidobacteria, as dietary fibre promoting several beneficial physiological effects, as prebiotics due to their content of specific non-digestible carbohydrates, as encapsulation materials for Probiotic in order to enhance their stability. Probiotic products are usually standardized based on the presumption that culture viability is a reasonable measure of Probiotic activity, thus the ability of the strain to attain high cell population is of primary importance. A concentration of approximately 107 cells ml-1 at the time of consumption is considered functional. Pulses are the chief source of dietary proteins in India. India is one of the leading grain legume producing nations, pulses are still in short supply in the country (Gomes and Malcata, 1999) [6].

The development of non-dairy Probiotic products is a challenge to the food industry in its effort to utilize the abundant natural resources by producing high quality functional products. In this respect, Probiotic containing baby foods or confectionery formulations have been developed by adding the strains as additives (Saarela *et al*., 2000) [18].

Non-dairy Probiotic products have a big worldwide importance due to the ongoing trend of vegetarianism and to a high prevalence of lactose intolerance in many populations around the world. However, there is no question that the dairy sector, which is strongly linked to Probiotics, is the largest functional food market, accounting for nearly 33% of the broad market, while cereal products have just over 22%. A total of 78% of current Probiotic sales in the world today are delivered through yogurt. Fruit juices, desserts, and cereal-based products featuring Probiotics may be other suitable media for delivering Probiotics (Cargill, 2009) [5].

Among many possible sources for cereal-based Probiotic carriers, wheat bran stands out. The proximate composition of wheat bran as compared to other primary wheat fractions and major cereal grains the milled bran fraction makes up about 15% w/w of whole wheat kernel. It is very high in fiber content, with protein and starch; it is rich in healthful bioactive components such as phenolic compounds and other antioxidants (Kim *et al*., 2006) [12]. Bran also contains significant amounts of dietary fibers that could function as prebiotics in the lower gut. Fermented wheat bran as a Probiotic carrier would enhance consumer health via the benefits of Probiotics, bran fiber, and healthful bioactive components, the latter of which are reported to increase with fermentation (Katina *et al*., 2007) [10].

Materials and Methods

The Wheat grains, Barley grains and other required raw material were procured from local market of Parbhani.

Chemicals

All the chemicals used in this investigation were of analytical grade. They were obtained from Department of Food and Industrial Microbiology and Department of Food Chemistry and Nutrition, College of Food Technology, V.N.M.K.V., Parbhani.

Processing and analytical equipments

The processing and analytical equipment's included, hot air oven, muffle furnace, soxhlet apparatus, micro kjeldhal assembly, glass wares, an electronic balance with the accuracy of 0.0001g for weight measurements were obtained from College of Food Technology, V.N.M.K.V., Parbhani.

All samples were analyzed for moisture, crude protein, crud fat, crude fiber, total ash and total carbohydrate contents according to their respective standard methods as described in A.A.C.C., 2000 [1].

Results and Discussion

The knowledge of physical properties of seeds helps in development of processing technology (Fellows, 2000). In order to characterize various physical characteristics of wheat and barley *viz*., 1000 kernel weight, bulk density, true density, porosity etc. were investigated and data on these physical properties are depicted in table 1.

Data presented in table 1. revealed that the bulk density of selected cereal grains was observed to be 691.60 and 643.52 Kg/m3 for wheat and barley respectively. The true density were calculated and found to be 1190.00 and 987.00 Kg/m3 for wheat and barley respectively. The higher values of true and bulk densities may be regarded as a consequence of volumes and shape of grain as reported by (Lawton, 1980) [14]. These factor is important because it determines the capacity of storage, packaging and transport systems (James, 2005) [8].

Table 1: Physical characteristics of wheat and barley

Parameter	Bulk density (Kg/ m³)	True density (Kg/ m³)	Porosity (%)	Angle of repose (º)	1000 Kernel Weight. (g)
Wheat	691.60	1190.00	42.57	24.52	20.70
Barley	643.52	987.00	39.01	22.76	16.19

* Each value represents the average of three determinations

Porosity is the measure of intergrain space present in grains it could be observed that porosity was found to be 42.57 and 39.01 per sent for wheat and barley respectively. The angles of repose for wheat and barley was found to be24.52 and 22.76 degree respectively. Kochhar and hira (1997) [13] and kashaninejad *et al*., (2006) [9] reported that determination and consideration of physical properties of cereal grains such as bulk density, true density, percent porosity angle of repose and 1000 kernel weight has an important role to design equipment and facilities for handling, processing and storage. Weight and of 1000 kernel were found to be 20.70 and 16.19 g for wheat and barkey respectively which are comparable with the findings of Byoung *et al.,* (2004) [4]. These physical properties affect not only the conveying characteristics of solid materials, but they also influence the heating loads of food materials (Baryeh, 2004).

Mineral characteristics of wheat, barley, wheat malt and barley malt

The mineral content of the given cereal grains were studied with respects to various minerals viz., calcium, iron, potassium and magnesium. The results are obtained for various minerals are presented in table 2. Result Obtained for mineral compotion of wheat and barley malt (i.e.451.4mg/100g) then that of other minerals includes iron, potassium, and magnesium shown significant variations in results.

Table 2: Mineral composition of wheat, barley, wheat malt and barley malt

Sample	Availability of quantity in mg / 100 gm			
	Calcium	Iron	Potassium	Magnesium
Wheat	43.02	3.5	196.17	172.6
Barley	172.4	5.77	295.5	172.4
Wheat malt	163.20	4.96	312.68	227.10
Barley malt	451.4	7.99	563.8	238.3

* Each value represents the average of three determinations

The above table 2 shown the results of mineral analysis of wheat and barley, wheat malt and barley malt. The findings of present investigation are well in accordance with the results of. Result are less or more similar with result given by Naydun and Mehmet (2015), Solange A.K.A. *et al.,* (2014) [19].

Physiochemical characteristics of Wheat, barley, wheat malt and barley malt

The proximate composition of wheat and barley, wheat malt and barley malt is essential in optimizing chemical characteristics of flour. The whole cereal grain flours *viz.* wheat, barley, wheat malt and barley malt were tested for different chemical characteristics i.e. moisture, crude fat, crude protein, ash, crude fiber and total carbohydrates. The results pertaining to the same are depicted in table no. 3

Table 3: Chemical characteristics of Wheat, barley, wheat malt and barley malt

Grains	Moisture (%)	Crude Protein (%)	Crude Fat (%)	Ash (%)	Crude fiber (%)	Total carbohydrates (%)
Wheat	12.9	12.3	1.89	1.8	2.11	67.8
Barley	12.6	11.06	1.91	2.1	9.9	63.5
Wheat malt	14.54	14.19	1.73	1.02	1.65	79.42
Barley malt	7.18	11.76	1.27	1.95	8.15	65.43

* Each value represents the average of three determinations

Cereals are commonly used as a source of carbohydrates followed by protein in the human diet. The results on the proximate analysis of the wheat and barley are showed in Table 3. The moisture for wheat (12.9%), protein 12.3%), crude fat (1.89%), ash (1.8%) crude fiber (2.11%) and Carbohydrate (67.8%). The results of the proximate analysis of the barley grain had moisture seed (12.6), protein (11.06%), crude fat (1.91%), ash (1.8%), crude fiber (9.9%)

and Carbohydrate (63.5%). Similar results were obtained by Hussain I. *et al.,* (2010) [7] for wheat and Belitz *et al.* (2009) [3] for barley.

Whereas, results of proximate composition of sprouted wheat flour (wheat malt) were shown to be increased as compare to wheat flour the variation in results may be due to due to germination effect moisture content (14.54%), protein (14.19%), crude fat (1.73%), ash (1.02%), crude fibre (1.65) and carbohydrate (79.42%) for barley malt These values of chemical properties recorded in the present study were similar to the values reported by Kavitha and Parimalavalli (2014) [11].

From table 3 also showed that the chemical composition of barley malt decreased in ash content (1.95%) and stated that the decrease in ash content of barley on germinating and malting could be due to solubility in water and subsequent loss on leaching during these processing methods. The losses could also have been due to redistribution of ash from barley seeds, roots and shoots developed during malting. The carbohydrate content of barley malt was 65.43%. The crude protein content observed was 11.76% in malted barley. Slight variations in protein content were observed which could be attributed these changes due to leaching losses and translocation of protein from seeds to roots and shoots.

The data is in agreement with the study of Taylor (1983) [20] who reported transfer of much of the nitrogen to the roots and shoots in case of sorghum during malting. The crude fat content of malted barley was noted to be 1.27% and the crude fiber content in malted barley was 8.15% respectively. In case of crude fat content no marked change was observed, while considerable increase in crude fiber was observed. The high fiber content of germinated barley could be of dietary importance, if incorporated in fiber supplements. These records are good agreement with findings given by Pawar and Machewad (2006) [17]. Results are less or more similar whit result given by Muhammad *et al.,* (2011) [15].

Conclusion

After reviewing all the topics about Wheat and barley malt that are included in the present paper, it can be concluded that, Cereal grains are an important source of protein, carbohydrates, vitamins, minerals and fiber for people all over the world and can be used as sources of non-digestible carbohydrates that besides promoting several beneficial physiological effects can also selectively stimulate the growth of Lactobacilli and Bifidobacteria present in the colon, thereby acting as prebiotics. Cereals contain water-soluble fiber, oligosaccharides and resistant starch and thus have been suggested to fulfil the prebiotic concept.

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