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Original Research Article

Nutritional and Biochemical Composition of Hulled Barley

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Abstract

Hordeum vulgare (L.), "Poor man's crop" has many health benefits because of its beta-glucan content than other cereals. Barley has the advantage of cholesterol lowering due to its high soluble fibre. In the present research work, hulled barley was examined for it's nutritional and biochemical profile. Functional properties and bioactive compounds were also studied by standard methods. Hulled barley contained appreciably higher bioactive compounds. Proximate content showed higher protein and lower fat content. Functional properties and physical properties were also found more effective than whole kernel which was also supported with the results of other studies.

Keywords

Hordeum vulgare (L.), powder, functional properties, bioactive compounds

Introduction

Hordeum vulgare (L.), commonly known as barley in English and jau in Hindi, belongs to the Poaceae family. It's a rabi crop that is sown in the month of October and harvested in March and May in India [1]. Whole barley grains are converted into flour. Barley flour has a number of nutritional advantages. It has many health benefits such as it is fibre rich, easily digestible, hypoglycemic and hypocholesterolemic in nature [2]. Barley flour is rich in B complex vitamins and some vital minerals like calcium, iron and phosphorus. The health benefits of barley are due to its beta-glucan content [3]. Besides this, it is rich in certain phenolic substances such as ferulic acid, caffeic acid, lignans & phytates, some flavonoids like quercetin and kaempferol content as well. Therefore, it possesses antioxidant and anti-inflammatory properties also [4]. It has a sweet and nut-like flavour that gives a rich flavour to bakery products while it is not beneficial for celiac

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patients who are gluten intolerant.

Barley can be used in many ways such as soups, stews and salads. Barley has been used to make breads and noodles in some studies [5] [6]. It can be very beneficial if barley can be used in daily routine recipes as barley is loaded with goodness of nutrients and many beneficial compounds.

Rationale of the study

Different types of research were performed in this direction [7] [8] but no work was done on nutritional composition with bioactive compounds and functional properties of barley after the process of dehulling. Besides this barley is rich in various health benefits, therefore present study was planned to know nutritional and biochemical composition of barley after the process of hulling as it is mostly consumed after dehulled only.

Objectives

- To examine the physical and proximate analysis of the hulled barley variety
- To evaluate the functional properties of hulled barley

Research Methodology

The Nutritional and Biochemical evaluation of Hulled Barley (*Hordeum vulgare* (L.)) was conducted at Central University of Haryana. The following headings provide a description of the research methods -

Purchase of Materials

Barley grains were collected from the local market of Mahendragarh, Haryana. The sample was ground into a fine powder using an electric stainless-steel grinder before being kept in poly-ethylene terephthalate airtight containers. The analysis step included the use of chemicals and reagents, and the analysis was carried out three times to reduce inaccuracy. Barley kernels and dehulled barley flour has been depicted in figure


Figure 1: Barley Flour & whole barley kernel

Physical Properties

Size: Length, width, and thickness were used to determine size with the precision of 0.1mm using vernier callipers.

Thousand Kernel Weight: It was measured by weighing one thousand grains on an electric scale.

Bulk Density: Bulk density was measured by putting kernels into measuring cylinders to a specific level and calculated using following formula

$$\text{Bulk density} = \frac{weight(g)}{volume(ml)}$$

True Density: The toluene displacement technique was used to determine the real density of barley grain, which is defined as the mass-to-volume ratio of the grain.

$$\text{True density} = \frac{weight(g)}{volume\ of\ toluene\ displaced(ml)}$$

Porosity: Porosity was determined by using the bulk density and true density.

$$\text{Porosity } (\varepsilon) = \left(\frac{p_t - p_b}{p_t}\right) \times 100$$

where P_t is the true density and P_b is the bulk density

Proximate Composition: In this part of study, ash, moisture, crude fibre, acid-insoluble ash, gluten and carbohydrates were determined using standard methods [9]. Protein content was estimated by Lowry technique [10]. Fat content was examined by Soxhlet method [11].

Functional Properties

Water Absorption Capacity: It was calculated using following formula

$$\text{WAC } (\%) = \frac{w_2 - w_1}{w_0} \times 100$$

Here, W_0 = sample weight, w_1 = centrifuged tube weight + sample weight, w_2 = centrifuged tube weight + sediment weight

Oil Absorption Capacity: Oil absorption capacity was as per following equation

$$\text{OAC (\%)} = \frac{w_2 - w_1}{w_0} \times 100$$

Where, W_0 = sample weight, w_1 = centrifuged tube weight + sample weight, w_2 = centrifuged tube weight + sediment weight

Emulsion Activity: A percentage emulsion activity was determined to represent the emulsion layer's height in relation to the mixture's overall height.

$$\text{Emulsifying activity (EA\%)} = \frac{height\ of\ emulsified\ layer}{height\ of\ total\ contents\ in\ the\ tube} \times 100$$

Emulsion Stability: Emulsion stability was assessed using the same procedure. The calculation of emulsion stability was

$$\text{Emulsifying solubility (ES\%)} = \frac{height\ of\ emulsified\ layer}{height\ of\ total\ contents\ in\ the\ tube} \times 100$$

Estimation of Bioactive Compounds

Total Phenolic Content (TPC): Standard method of Folin-phenol Ciocalteu's and results were expressed as Gallic acid equivalent [12].

Total Flavonoid Content (TFC): The colorimetric technique with aluminium chloride was used to assess the total flavonoid concentration [12].

Total Tannins: Folin's sodium carbonate method was employed for the determination of tannin and the findings were represented as tannic acid equivalents.

Statistical analysis

Measurements were taken in triplicate, with the mean of the three readings recorded as the final measurement along with the standard deviation.

Results and Discussion

The results obtained from the present study have been discussed as under:

1. Physical parameters of Barley Flour
2. Proximate parameters of Barley Flour
3. Functional properties of Barley Flour
4. Estimation of Bioactive compounds in Barley Flour

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1. Physical Parameters of Barley

The length, width, thickness, 1,000 kernel weight, bulk density, true density, and porosity are some of the physical characteristics.

Length of BH-393 is higher than the width and their ratio is 1.34, cultivars of barley that were less broad, longer, and oval. Bulk density is lower than the true density. Porosity was higher and the volume was about 21.76(mm)^3. The figure 2 below depicts these parameters.

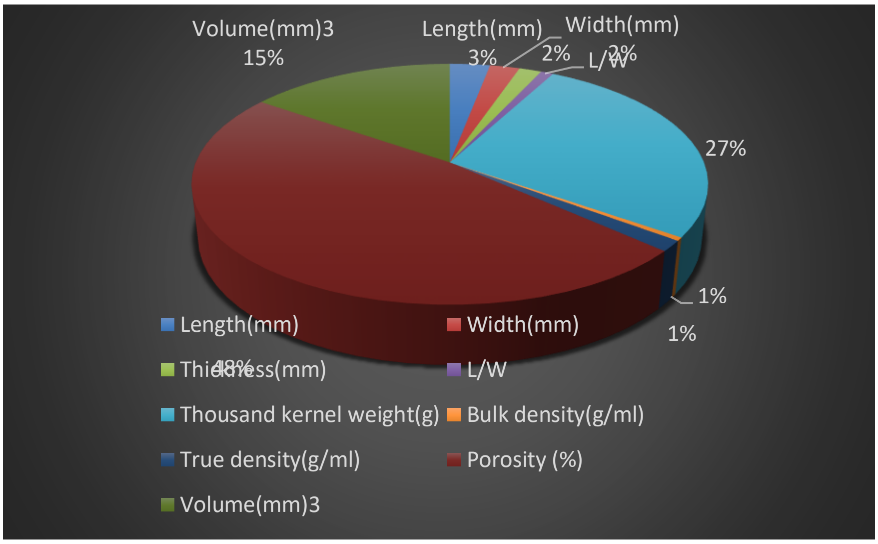

Figure 2: Physical Properties

2. Proximate composition

Proximate composition of barley powder is presented in the table 1. The moisture content of the barley powder was 7.17± 1.02, while the ash content of barley powder was 4.09 ± 0.99. Estimations depicted the crude fibre as 3.45 ± 1.02. Protein was quite high but the fat was low. This property is attributed to its hypocholesterolemic nature

Parameters	Result
Moisture content	6.93%
Ash content	0.94%
Crude fibre	0.31%
Acid insoluble ash	2.9%
protein	8.01%
Fat	1.69%

Table 1: Proximate Composition

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3. Functional Properties

Study of the functional properties of barley flour variety BH-393 presented with a marginally lower water absorption capacity than oil absorption capacity. Emulsion stability is superior to emulsion activity. Functional properties of dehulled barley have been shown in figure 3.

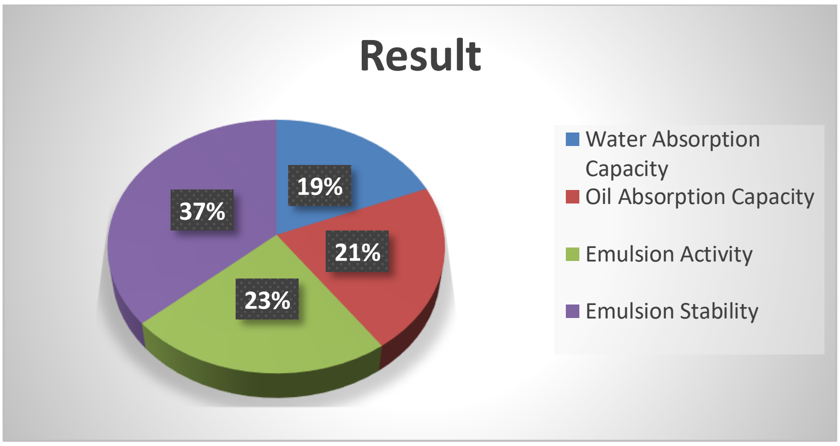

Figure 3: Functional Properties

4. Estimation of Bioactive Compounds

Total flavonoids were found significantly lower than the total phenolic content and total tannins in the barley variety BH-393 as shown in table 2 below -

Constituent	Results
Total phenolic content (mg gallic acid equivalent/g)	2.02
Total flavonoids content (mg quercetin equivalent /g)	0.43
Total tannin (mg tannin acid equivalent/g)	1.34

Table 2: Bioactive Compounds

Results are in congruence with the findings of other studies that showed increased availability of nutrients and bioactive compounds in barley after processing [13] [14].

Conclusion

The study on Hordeum *vulgare* (L.) variety BH-393 showed favourable biochemical and nutritional outcomes after dehulling. These characteristics may prove to be very beneficial in developing products with better nutritional value. The ability of food items made from cereal flours to retain taste, texture, and mouthfeel is significantly influenced by the oil absorption capacity. Oil absorption is greatly influenced by the oil retention capacity and hydrophobic proteins. These characteristics can be used to develop a final food product with more promising in providing more nutrition, taste, durability and overall functional properties.

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