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NUTRITIONAL CHARACTERIZATION OF THE PERIPHERAL LAYERS OF BARLEY GRAINS CULTIVATED IN ALGERIA

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Abstract: *The purpose of this paper is to stady the different analyzes were carried out in this work on the peripheral layers (PL) of barley grains of the Saida variety. Barley is the most important cereal rich in primary metabolite than secondary, which are beneficial for human health. Barley flour is based on peripheral layers which are generally intended for cattle feed, for their nutritional values linked to the supply of a food rich in vitamins, proteins, fibers etc. The analysis of polyphenols by liquid chromatography method at high pressure (RP- HPLC-LC 2030C 3D), allowing the detection of a phenolic acid (Syringic acid), the source of brut fibers with a gram of PL is 0.8%. Mineralcontents assessed by the spectrophotometric technique of atomic absorption, reveals that calcium and magnesium are the most abundant with values of 2.8 (mg / kg) and 2.1 (mg / kg) respectively.*

Keywords*: Wheat, peripheral layer, proteins, fibers, RP-HPLC- LC-2030C 3D.*

1. Introduction

Cereals are plants cultivated mainly for its seeds, used in human and animal nutrition, often ground in the form of refined flour or more or less complete, but also in whole grains, we find such as wheat, barley, rye or dicotyledons such as sesame, quinoa, etc. Particularly barley has very interesting biological properties, due to its richness in secondary metabolites which are beneficial to human health. Studies have shown that barley contains phenolic compounds in free form and bound from the outer layer of the bran fraction [1] which have the potential to lower blood cholesterol and glucose levels and contribute to the intestinal microbial balance [2] [3] [4]. However, the peripheral layers of barley kernels (PL) have nutritional potential and contain most of the micronutrients such as fiber [5] and minerals which can greatly contribute to the increase of nutritional quality [6] and reduces of numerous diseases such as colon cancer, diabetes, obesity and cardiovascular disease [7] [8]. Barley is rich in protein, complex carbohydrates and fat-soluble vitamin E (tocols) [2] [9] Phenolic groups are the most abundant phenolic compounds in the walls of barley grains in cell-bound form, the main phenolic acids are ferulic acid, vanillic acid, syringic acid and p-coumaric acid [10] [11]. Several studies have focused on milling barley in order to obtain products other than standard flour from cell walls rich in fiber and bioactive phytochemicals [10] [12]. The ain of this study is to conduct research on the peripheral layers of barley grains of the Saida variety from the Sidi Bel Abbes Algeria region [13] through a more in-depth study. An analysis of the polyphenols with the HPLC method was

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carried out, determination of the raw fibers, as well as the determination of some minerals by atomic absorption pectrophotometer.

2. Matherials and methods

Plant material and extraction

The objective of this research is to highlight the consumption of the peripheral layers of barley grains (Hordeum Vulgare) of the Saïda variety cultivated in Algeria. A manual dissection method under the binocular lens was adopted to obtain the peripheral layers (PL) at the mature stage; they were kept until analysis to be powdered. A quantity of 10 g of the PL was extracted twice with 200 ml of methanol by the infusion method.

Characterization of Phenolic Compounds by RP-HPLC-LC-2030C 3D Analysis

The phenolic investigation for the crude extract of barley variety (Saida) was carried out using a high performance liquid chromatography coupled with UV-vis detector RP-HPLC-LC-2030C 3D (Shimadzu Prominence-i; LC-2030C 3D). The analytical were evaluated using a processing data system. The separation was achived on a Supelco C18 column (25cm x4.6mm, 5 µm) at room temperature. The mobile phase consisted of water / acetic acid (pH = 3), phase B consisted of methanol / acetic acid (pH = 3). The gradient elution system was as follows at the minute 0.01 min the concentration of solvent B is 5% until the 2nd minute, from the 2nd minute up to the 40th minute the gradient will successively change from 5% to reach 100% of solvent B, then will remain 100% until the 45th and the length wave was 280 nm. Phytochemicals were identified from a combination of retention time and spectral matching.

Mineral content by atomic absorption spectrophotometer

Regarding the mineral assay protocol [14] we used a brand atomic absorption spectrophotometer (SHIMADZU model AA7000). The samples were first mixed with 65% nitric acid, then 30% of hydrogen peroxide H2O2 was added, followed by heating at 90 to 120°C to remove all the solvent, after cooling, hydrolysis followed by filtration were carried out The samples were atomized by a flame (Acetylene-air) and the reading was made at lamps and wavelengths specific to each chemical element, results were expressed as mg / kg of DW.

Raw fabers content (Weende)

The method is based on the solubilization of non-cellulose compounds in solutions of sulfuric acid and potassium hydroxide. 1g of each sample was added to 150 ml of 1.25 % sulfuric acid as well as 3-5 drops of the anti-foaming agent n-octanol, they were boiled for 30 min then the crucibles were washed 3 times with hot distilled water. Then the same steps were repeated three times, but with 1.25% potassium hydroxide except that of the last wash which was with cold deionized water and 25 ml of acetone. The crucibles were removed and then weighed after drying at 105 ° for 1 hour, the content represents the crude fibers plus the ash content (F1), to remove the ash, the crucibles were placed in a muffle furnace at 550° for 3 hours and reweighed after cooling in a desiccator (F2) and the results were expressed in%.

$$\% \text{ Crude fiber} = (F1 - F2 / F0) \times 100$$

Where:

F1: Gross fiber weight + ash
F2: Ash weight
F0: Weight after grinding

3. Results and discussion

Results of Phenolic Compounds Characterization by RP-HPLC-LC-2030C 3D Analysis

The analysis of total polyphenols of crude extract from the peripheral layers of barley grains (Saida) was carried out by the RP-HPLC-LC-2030C 3D method using 4 modes of identification. The chromatogram obtained (Figure 1) showed a peak of syringic acid (4-hydroxy-3,5-dimethoxybenzoic acid) within 280 nm. Based on studies by López-Perea et *al.*, 2019 [15] on the quantification of phenolic acids in barley husks showed that ferulic acid and benzoic acid showed a higher concentration with 50% acetone; however, benzoic acid was observed at a high concentration with 80% methanol which is consistent with our results by detection of syringic acid.

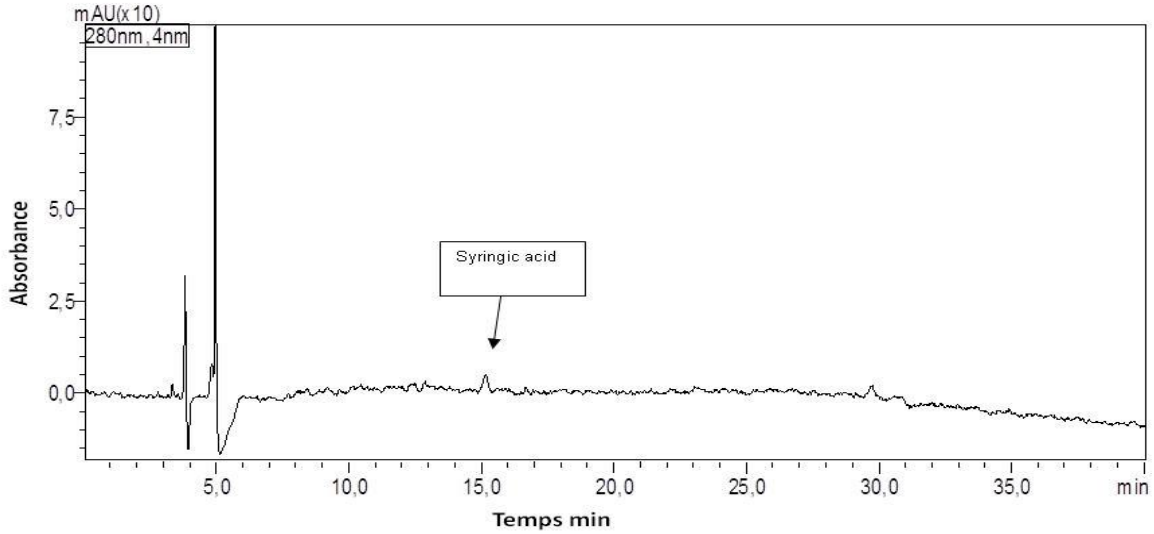

Fig.1. HPLC chromatogram of the crude extracts of peripheral layer of barley (Saida) variety

Results of minerals

The microelement content of the peripheral layers of the wheat grains obtained (Figure2) shows that calcium is the most abundant mineral with the value of 2.79 mg / kg compared with 2.09 mg / kg of Mg, 0.82 mg / kg of iron , 0.23 mg / kg of Mn and 0.04 mg / kg of Cu. Afify et al., (2016) (16), asserted that sprouted barley have the highest levels of Mg (0.83 ± 0.03 and 0.34 ± 0.01 mg 100g-1) which confirms our results, as well as the K and Fe contents decreased by the germination of barley and these results are in agreement with that of Hubner et *al.* (2010) (17), which are decreased from 3.7 to 2.8 mg 100g-1) after germination.

Svetlan and Musa, (2016) [18] found that the Cr and Ni content of malted barley grains at 1.4 mg / kg, while the Cu and Fe content varieds between 0.7-6.8 mg / kg and 57.7- 79.9 mg / kg respectively and they observed a strong increase in mineral and metallic elements during malting. Platel et al., (2010) (19) showed that the iron (Fe) and zinc (Zn) content was higher in malted barley than in barley. Youssef et al., 2013 [20], proved that the mineral content in barley was distributed as follows: Ca = 120-160 mg / 100g, Mg = 130-180 mg / 100g, iron = 3.27-39.9 mg / 100g Cu = 0.550-0.985 mg / 100g and Mn = 5.75-13.85 mg / 100g.

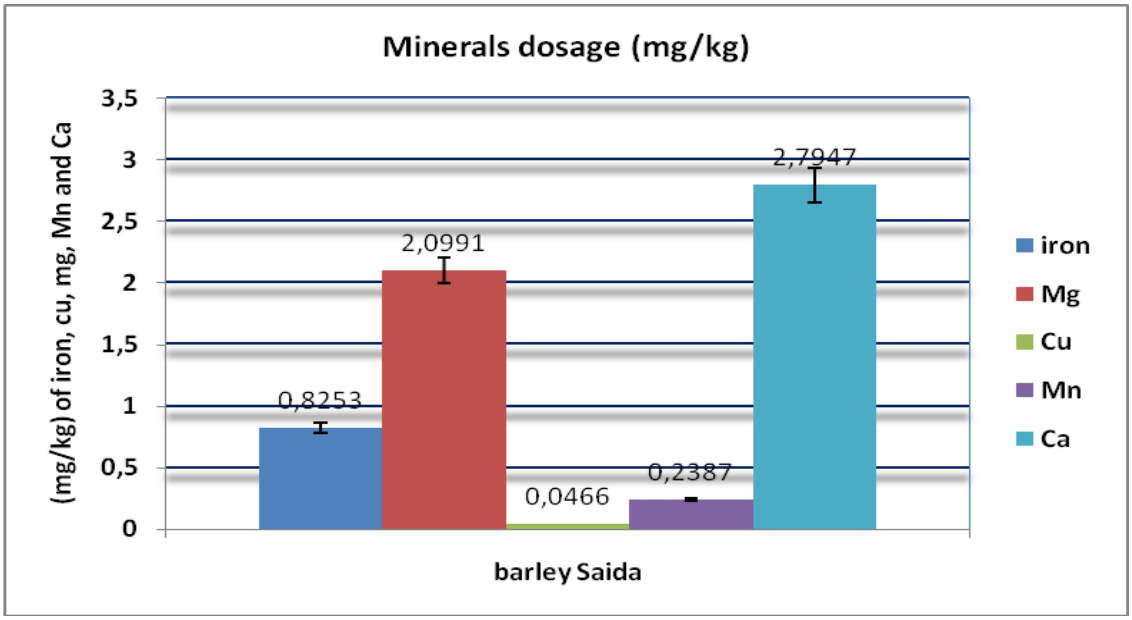

Fig.2. Mineral composition of the peripheral layers of barley grains (Saida)

Raw fiber content

According to the obtained result the crude fiber content is 0.8%, they agree with Montanuci et al., 2013 [21] who reported that the ash content of barley varieties varied from 1.73% to 2.47 % for the two varieties BRs 195 and BRs GRETA, as well as Afify et al., 2016 [16] who showed that the ash content varied from 2.54 ± 0.07 to 1.90 ± 0.01% for bare barley and demonstrated that the crude fiber contents before and after germination were; 5.21 ± 0.11, 4.84 ± 0.13%. Barley without shell is a cereal that can be considered as an energy source of food for livestock feed, according to Yaghoubfar et *al*., 2013[22], the amount of crude fiber is the lowest (1.4%) compared to the other lines. Sullivan et *al*, 2010 [18], confirmed that the amount of fiber, specifically insoluble fiber, in whole barley was significantly decreased by the peeling process.

4. Conclusion

In conclusion we can remark that the outer layers of barley kernels rich in fiber and minerals compared to wheat kernels, it may exhibit much more nutritional properties as whole kernels or as an addition to flour. The establishment of a diet rich in barley bran could replace synthetic antioxidants because of its richness in phenolic compounds which can play an important role in the prevention of certain diseases and valued the basic raw material for recipes of traditional bakery or various pasta products. More studies are needed to get more in-depth results and understand the recommended uses across multiple areas.

5. Acknowledgments

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