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Hulled Roasted Barley Drink as an Alternative to Coffee: Sensory Evaluation, Chemical Composition and Caffeine Content, Antioxidant Activity and Economic Evaluation

Ghazza Mahfooz Ali [1]

ABSTRACT

In this research, the chemical composition, caffeine content, antioxidant activity, and sensory and economic evaluations of hulled roasted barley grains as an alternative coffee drink, were studied. Hulled barley grain variety Giza 134 was cleaning and roasting at about 200 °C for 35,45 and 55 minutes and compared to a sample of Brazilian coffee. The sensory evaluation results, of roasted barley coffee drink at a temperature of 200 °C for a period of 35,45 and 55 minutes, and compared to the Brazilian coffee drink, showed that roasted barley coffee drink at 200 °C for 55 minutes received the highest scores compared to both roasted barley coffee drink at 200°C for 45 and 35 minutes, and was very near to Brazilian coffee drink. Also, color evaluation was performed for each sample of roasted barley and that of the Brazilian coffee sample. The percentages of protein, fat and ash in hulled roasted barley grains were lower than that of the Brazilian coffee, as these percentages reached 13.20%, 3.84%, and 3.33% in hulled roasted barley grains, while those percentages in Brazilian coffee reached 17.54%, 18.23% and 4.31%, respectively. The moisture, total carbohydrate and starch contents of hulled roasted barley grains were higher than those found in Brazilian coffee. The percentage of crude and dietary fiber decreased in roasted barley grains compared to that in Brazilian coffee, Also, total phenols and antioxidant activity decreased in hulled roasted barley grains compared to Brazilian coffee, reaching 166.22 mg gallic acid/100g and 52.18% in hulled roasted barley grains, while they reached to 1577 mg gallic acid/100g and 90.20% in the Brazilian coffee. The caffeine content of hulled roasted barley grains was zero per cent, while its percentage in Brazilian coffee was 0.87%. The results showed that the mineral contents (magnesium, calcium, iron, potassium and sodium) were higher in the Brazilian coffee (160.67, 57.30, 21.30, 2200 and 93.33 mg / 100 g) compared to hulled roasted barley grains (149.69, 32.97, 15.03, 700 and 76.67 mg / 100 g), respectively. On the other hand, the global production of coffee is about 6 million tons, produced in 9 countries, and Egypt imports about 137 thousand tons, representing about 2.30% of that production, with a cash value estimated at 2.10 billion pounds. It can be provided through a barley coffee drink, with complete replacement, while it can be reduced to about 1.04 billion pounds in the case of 50% replacement, and about 0.50 billion pounds in the case of 25% replacement only. So, consuming barley coffee instead of natural coffee beans in different proportions can lead to the provision of hard currency.

Keywords: Coffee, Barley, Roasting, Chemical composition, Dietary fibers, Antioxidant activity, Sensory evaluation.

INTRODUCTION

Coffee is one of the most popular beverages in the world due to the organoleptic and stimulating properties of its beans (Ballesteros *et al*., 2014 and Shalaby & Elhassaneen, 2021). Coffee beverages represent 75% of the total non-alcoholic beverage market and their consumption is increasing (Reguengo *et al*., 2022). The world coffee production reaches about 6 million tons in 2022, and that production is concentrated in 9 countries (FAO, 2022). Barley (*Hordeum vulgare L.*) also has been used as a coffee-like beverage. In Ethiopia, barley is roasted and served as a coffee-like beverage. Barley is a type of cereal that has high dietary fiber content and is often used as traditional medicine in China (Zeng *et al.*, 2020). Some studies showed that barley is effective in controlling blood glucose levels (Minaiyan *et al.*, 2014), atherosclerotic and cardiovascular disease (Gangopadhyay *et al.*, 2015), and cancers such as colon and lung (Czerwonka *et al.*, 2017).

Roasting is an important processing step to develop the unique physical, chemical and sensorial characteristics of roasted coffees (Wang and Lim, 2015). During the roasting process, the coffee bean is subjected to high temperatures, resulting in chemical-physical changes in its structure. Initially, when the coffee bean reaches temperatures above 180°C the coffee bean begins to form the compounds responsible for the color, flavor, and aroma of roasted coffee beans (Ebrahimi-Najafabadi *et al*., 2012). Different roasting

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[1]Department of Food Science and Technology. Lahej University.
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parameters give different results based on the physical-chemical and sensory evaluation properties of the roasted sample. In general, the color of roasted coffee beans ranges from light-dark brown to black depending on the roasting temperature. Increasing roasting parameters will affect moisture content, fat, peroxide value, acid value, furan and sensory. Roasted barley grains from covered barley are used to prepare non-alcoholic beverages such as coffee substitutes and roasted barley tea, called mugi-cha in Japan (Tatsu *et al*., 2020). The coffee substitutes based on roasted barley were developed to reduce the potential risks of coffee consumption associated with high caffeine content (Majcher *et al*., 2013).

Caffeine is an alkaloid compound with antibacterial and antifungal activity against various microorganisms (Dziki *et al*., 2015). Caffeine has been mostly used as a dietary ingredient and psychostimulant by about 80% of the world's population (Willson, 2018). Caffeine has been associated with some beneficial effects in adults; however, regular consumption higher than the recommended intake may cause undesirable effects such as anxiety and tension (Jin *et al.*, 2016), and headache (Espinosa Jovel and Sobrino Mejía, 2017). Caffeine intakes higher than 300 mg a day, also lead to spontaneous abortion in pregnant women, and affect foetal growth and lactating conditions (Lyngsø *et al.*, 2017). The negative effects of caffeine are more obvious in older adults under medication as a high concentration of caffeine in plasma could increase the risk of interaction with the drugs. Some medications such as cimetidine, disulfiram, oestrogens, and quinolone class antibiotics have the potential to increase caffeine-related side effects (Higdon and Frei, 2006). Excessive coffee consumption and caffeine-containing products may increase the likelihood of adverse effects (Jagim *et al*., 2020). This study focused on roasted barley drink usage as an alternative to coffee for nutritional, health and economic reasons.

MATERIALS AND METHODS

Materials

Three kilograms of hulled barley grains (*Hordeum vulgare* L.) Giza134 was obtained from the Agricultural Research Center, Giza, Egypt.

One kilogram of Brazilian coffee was purchased from Carrefour in Alexandria City, Egypt.

Methods

Barley grains roasting:

The hulled barley grains were carefully cleaned to be free from broken grains and extraneous matter. Barley grains were divided into three sections when roasted at 200 °C with a difference in the period. The first section was for 35 minutes, the second section for 45 minutes, and the third section for 55 minutes, and then cooled to room temperature, hulled roasted barley grains were milled using a high-speed blender to a fine powder and stored in polythene bags in the refrigerator at 4-5 °C until used.

Preparation of barley coffee drink:

A small spoon of roasted barley coffee was added to a cup of water with a little sugar, mixed and then boiled. The samples were prepared hot for a group of ten coffee drinkers.

Analytical methods

Physical methods:

Color measurement was estimated using the Hunter color difference meter. (Ultrascan VIS) Measurements for (yellow), (red), and lightness. Hue and purity values were recorded.

Chemical methods:

Proximate composition of roasted barley coffee and Brazilian coffee including moisture content, crude protein, crude fat, total ash, starch content and crude fiber contents, were carried out according to the Association of Official Analytical Chemists (AOAC, 2000), procedures and total carbohydrates were calculated by difference.

Dietary fiber:

The dietary fiber fractions including neutral detergent fiber (NDF), and acid detergent fiber (ADF) were determined as described by Van Soest *et al*. (1991), using an Ankom 200 fiber analyzer unit (ANKOM Technology Corporation Maced on, NY, USA). Acid detergent lignin (ADL) was determined according to Van Soest and Mcqueen (1973) by solubilization of ADF with 720ml/L sulfuric acid. The concentration of cellulose and hemicellulose were calculated as follows

The concentration of cellulose = (ADF-ADL)

The concentration of hemicellulose = (NDF- ADF)

Mineral content:

Minerals including (Mg, Ca, Fe, K and Na) were estimated using Atomic Absorption Spectroscopy Thermoscientific ICE 3000 Series. Potassium and sodium were determined by Flame Photometer, Jen Way, as described in the A.O.A.C (2000).

Total phenol and antioxidant activity:

The total phenolic in the methanolic extracts was assayed colorimetrically using the Folin–Ciocalteu method, according to Lime *et al*. (2006). Antioxidant activity of roasted barley coffee and Brazilian coffee were studied by evaluating the free radical scavenging activity of the 1,1 -Diphenyl- 2-picryl-hydrazyl (DPPH) radical according to the modified method, described by

Brand-williams *et al.* (1995). The IC50 value is defined as the concentration of the sample (mg/ml) containing mg ascorbic acid equivalent (AAE) for 50% inhibition of DPPH free radical.

Caffeine content:

The caffeine content of the tested samples was determined according to the method of AOAC (1995, No.960.25).

Sensory evaluation:

The sensory evaluation method was conducted according to the samples that were prepared hot for a group of ten coffee drinkers. The panelists were subjected to sensory evaluation using a 10-point hedonic scale for color, flavor, taste, texture and total acceptability, according to described by Mirghani (2012).

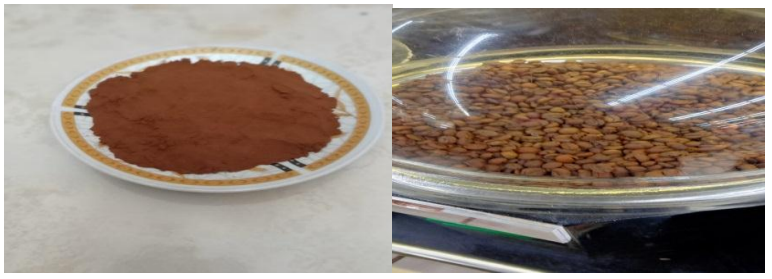
Statistical analysis

The determinations were performed in triplicate (n=3) and the data were expressed as average ± standard deviation (SD). Data were statistically analyzed using the statistical analysis system (Al- Bashir, 2007).

RESULTS AND DISCUSSION

Table 1. Sensory evaluation of roasted barley coffee drinks compared to Brazilian coffee drink

Roasted barley coffee	Color	Flavor	Taste	Texture	Total acceptability
Roasting at 200ºC for 35 min.	5.60±0.52	5.60±0.52	5.50±0.71	5.80±0.63	5.60±0.52
Roasting at 200ºC for 45 min.	6.80±0.48	7.10±0.47	7.00±0.67	7.20±0.42	7.00±0.00
Roasting at 200ºC for 55 min.	8.10±0.57	8.40±0.97	8.20±0.92	8.20±0.79	8.10±0.74
Brazilian coffee	9.19±0.12	9.30±0.16	9.40±0.08	9.24±0.14	9.28±0.15



Brazilian coffee

Fig.1. Photographs of hulled roasting barley grains at 200ºC for 35, 45 and 55 min. and Brazilian coffee

Table (1) and Figure (1), show the sensory evaluation of roasted barley coffee drinks at 200oC with different roasting times, which included 35 minutes, 45 minutes, and 55 minutes, respectively, and compared to Brazilian coffee drinks. The sensory evaluation included color, flavor, taste, texture and overall acceptance. The results of the sensory evaluation of roasted barley coffee at 200oC for 55 minutes received the highest evaluations of all the aforementioned sensory evaluations, with an average of 8.10, 8.40, 8.20, 8.20, 8.10, respectively, while the sample which was roasted at 200oC for 35 minutes, has been received the lowest values being 5.60, 5.60, 5.50, 5.80, and 5.60, respectively. The sensory evaluation resulted in not discriminating the adulterated coffee samples by 5%, 10% and 20% with barley despite pure coffee being presented as a reference Daba (2017). Moreover, it can be seen from the results of Table (1) that the panelists gave the barley drink which was roasted at 200oC for 55 minutes high score and was very near to the Brazilian coffee drink. Therefore, based on these results roasted barley sample (200oC for 55 min.) was chosen to conduct the following analysis in this research.

Color values of hulled roasted barley grains and Brazilian coffee were measured using Hunter Color Difference Meter. The data are shown in Table (2). The lightness value (L) was 56.45 for roasted barley and 43.38 for Brazilian coffee. It could be concluded that the roasted barley is more luminant compared to Brazilian coffee since a high L value indicates lightness. Also, as noticed from the a, and b values in Table (2), the color of both roasted barley and Brazilian coffee samples tend to be red to yellow. However, the roasted barley sample has a lower value for red (a) and higher yellow value (b) 6.83 and 17.26 respectively, compared with those of Brazilian coffee which tends to be higher for red value (a) and lower for the yellow value being 8.73 and 11.83 for red and yellow respectively. The dominant wavelengths (hue) for the two samples are shown in Table (2) the hue value is 0.40 for roasted barley, while it was 0.74 for the Brazilian coffee sample. The purity (saturation) which is the degree of purity of the samples, and how much color is mixed with white color was measured. It was found that the purity value was 18.56 for roasted barley, while that of the Brazilian coffee sample was 14.70. These results mean the roasted barley color is purer than that of Brazilian coffee. Torma *et al*. (2019) reported that the brightness shows significantly lower values for coffee samples, 100% arabica coffee was (22.2) and 100% robusta coffee was (24.1), while, roasted barley was (33.2).

Table 2. Color values of hulled roasted barley grains and Brazilian coffee as measured using the Hunter Color Difference Meter

Sample	L Lightness	a Red color	b Yellow color	* Hue	* Purity
Hulled roasted barley grains at 200 °C for 55 min.	56.45	6.83	17.26	0.40	18.56
Brazilian coffee	43.38	8.73	11.83	0.74	14.70

*Hue = a/b

* Purity = $\sqrt{a^2 + b^2}$

Chemical composition:

Table 3. Chemical composition of hulled roasted barley grains and Brazilian coffee

Sample	Moisture %	Crude protein %	Crude fat %	Total ash %	*Total carbohydrates %
Hulled roasted barley grains at 200°C for 55min.	2.43±0.06	13.01±0.09	3.84±0.09	3.33±0.06	77.40±0.15
Brazilian coffee	1.21±0.10	17.53±0.10	18.23±0.06	4.32±0.04	58.71±0.04

*Carbohydrate content was estimated by difference 100 - % of (moisture + protein + fat + ash)

Data in Table (3) show that the percentages of protein, fat and ash in hulled roasted barley grains were lower than those in Brazilian coffee, where the average of those percentages was 13.01%, 3.84%, 3.33% in hulled roasted barley grains, while the average of those percentages in Brazilian coffee was 17, 53%, 18.23% and 4.32%, respectively. Also, it was found that the moisture content in hulled roasted barley grains was higher, reaching 2.43% than that in Brazilian coffee, which amounted to 1.21%, carbohydrate content (77.40%) was higher than that in Brazilian coffee (58.71%). Mohd Jamil *et al*. (2022) showed that the moisture content of Arabica coffee powder was 3.3% and roasted barley powder was 1.9%. Also, roasted barley powder contained lower protein and fat, and higher carbohydrate as compared to Arabica coffee powder. On the other hand, Makpoul **(**2016) reported that the ash content of roasted barley grains was 3.2%.

Table 4. Starch and crude fiber content of hulled roasted barley grains and Brazilian coffee

Sample	Starch %	Crude fiber %
Hulled roasted barley grains at 200°C for 55min.	49.26±0.83	6.54±0.09
Brazilian coffee	33..13±0.67	8.60±0.10

Data in Table (4) presented the content of starch and crude fiber in hulled roasted barley grains and Brazilian coffee. It could be observed that the percentage of starch is higher in the hulled roasted barley grains compared to that in Brazilian coffee, where the average of these percentages was 49.26% and 33.13%, respectively, while the percentage of crude fiber is lower in hulled roasted barley compared to Brazilian coffee, where the average of these percentages was 6.54% and 8.60%, respectively. Asaed *et al*. (2017) showed that the starch content in roasted barley at 200 ^{o} C for 35 min. was 32.75%. Also, Makpoul (2016) reported that the crude fiber content of roasted barley grain**s** was 10.8%.

Table (5), which includes an analysis of the percentages of each dietary fiber, neutral detergent fiber (NDF), acid detergent fiber (ADF), hemicellulose, cellulose and acid detergent lignin (ADL) in the samples of hulled roasted barley and Brazilian coffee, showed a decrease in the average of these percentages in the samples of hulled roasted barley compared to Brazilian coffee, as the average of these percentages in the hulled roasted barley were 27.74%, 12.10%, 15.51%, 8.25%, and 3.80%, respectively, while they were 39.42%, 17.34%, 21.79%, and 10.34%, 7.14%, respectively, in Brazilian coffee. It is well known that the higher content of dietary fibers has provided various therapeutic functions against diabetes, obesity, hypertension, and coronary heart diseases (Fikry *et al.*, 2019). Untreated barley contained more insoluble dietary fiber (12.00–12.40 g/100g dry matter basis) than soluble dietary fiber (4.73–5.70 g/100g dry matter basis), while roasting barley showed significant results, that is, a 53.91% increase in soluble dietary fiber and 8.79% decrease in insoluble dietary fiber according to Bader *et al*. (2019). On the other hand, Djurle *et al*. (2016) and Messia *et al*. (2017) reported that the total dietary fiber content of dehulled barley ranges from 10 to 28% (on a dry matter basis).

Table 5. Dietary fiber of hulled roasted barley grains and Brazilian coffee

Sample	Neutral detergent fiber (NDF)%	Acid detergent fiber (ADF)%	Hemicellulose %	Cellulose %	Acid detergent lignin (ADL)%
Hulled roasted barley grains at 200°C for 55min.	27.74±0.14	12.10±0.10	15.51±0.09	8.25±0.06	3.80±0.02
Brazilian coffee	39.42±0.13	17.34±0.16	21.79±0.01	10.34±0.06	7.14±0.06

Table 6. Total phenols content and antioxidant activity of hulled roasted barley grains and Brazilian coffee

Sample	Total phenols (mg gallic acid /100g)	Radical scavenging activity DPPH (%)	IC $_{50}$ (mg/ml)
Hulled roasted barley grains at 200°C for 55min.	166.21±6.04	52.18±1.23	19.18±0.45
Brazilian coffee	1577±36.00	90.20±0.46	11.09±0.06

Table (6) shows the average contents of total phenols and antioxidant activity. It is clear that the content of total phenols was higher in the Brazilian coffee sample (1577 mg gallic acid / 100g) compared to that of hulled roasted barley grains (166.21 mg gallic acid / 100g). According to Table (6) Brazilian coffee has higher antioxidant activity (90.20%) inhibition of DPPH with an IC_{50} value of (11.09 mg/ml) compared to that of hulled roasted barley grains (52.18%) inhibition of DPPH with an IC_{50} value of (19.18 mg/ml). The phenolic compounds play important roles in protecting against free radicals (Rahmani *et al.,* 2014), hypercholesterolemia (Takaeidi *et al.,* 2014), cancers, asthma, and coughing (Fikry *et al.,* 2019). Contreras-Calderón *et al*. (2016) reported that the total polyphenol content (TPC) of roasted barley had a lower value (13.2 GAE/100 ml coffees) than 100% Arabica coffee (70.3 GAE/100 ml coffees). Also, Bobková *et al*. (2020) showed that aqueous coffee extracts possess variable antioxidant activity based on the roasting process and the activity reaches a maximum in light roasted coffees (DPPH inhibition ranging from 69.08 ± 1.33% to 78.55 ± 0.89%). On the other hand, it can be said that roasted barley grains are characterized by good antioxidant activity (52. 18 % with 19.8 mg/ml of IC_{50}).

As for the caffeine content in the two study samples (hulled roasted barley and Brazilian coffee), Table (7), shows that the hulled roasted barley sample was zero per cent, while the average percentage in the Brazilian coffee sample was 0.87%. Coffee has been found to contain 31 to 124 mg of caffeine for each 100 g of coffee, according to Higdon and Frei (2006). Also, Tarawneh *et al*. (2021) reported that caffeine was found in all coffee samples whereas roasted barley contains no caffeine. The highest concentration of caffeine was found in roasted coffee (Saudi habshi) with 7.3 mg/5g coffee followed by roasted coffee (Colombian) (6.4 mg/5g coffee) and green coffee (Colombian) (5.8 mg/5g coffee). Since roasted barley grains are caffeine-free, this is considered a great health advantage for human health.

Table (8) presents the content of minerals (magnesium, calcium, iron, potassium and sodium) in the two samples namely hulled roasted barley and Brazilian coffee. As for magnesium, it was 149.66 and 160.66 in the two samples, respectively, while the average for calcium was 32.96 and 57.81, and iron was 15.02 and 21.31. As for potassium, its content reached 700 and 2200, while the sodium content reached 76.66 and 93.32 mg/ 100g, respectively, for the hulled roasted barley sample and the Brazilian coffee sample. Tarawneh *et al*. (2021) reported that the iron content of roasted coffee (Saudi Habshi) was 1.10 mg/kg, while the roasted barley was 1.01 mg/kg. Fe is an essential element for all living organisms, as it is involved in many metabolism processes in the cell. It is a component of some proteins and enzymes that possess a vital role in the electron transport system and synthesis of DNA. Also, it is involved in oxygen transfer from the lungs to all body parts. Despite hulled roasted barley grains containing lower amounts of the studied minerals than Brazilian coffee, the results of Table (8) confirm that hulled roasted barley grains contain good amounts of the studied minerals nutritionally.

Table 7. Caffeine content of hulled roasted barley grains and Brazilian coffee

Sample	Caffeine content (%)
Hulled roasted barley grains at 200°C for 55min.	0.00
Brazilian coffee	0.87±0.00

Table 8. Mineral contents of hulled roasted barley grains and Brazilian coffee

Sample	Magnesium mg/ 100g	Calcium mg/ 100g	Iron mg/ 100g	Potassium mg/ 100g	Sodium mg/ 100g
Hulled roasted barley grains at 200°C for 55min.	149.66±0.37	32.96±0.17	15.02±0.01	700.10±0.10	76.66±0.01
Brazilian coffee	160.66±0.37	57.81±1.00	21.31±0.02	2200.01±0.01	93.32±0.01

Table 9. The most important indicators and parameters of world coffee production, quantity and value of Egyptian imports from it in 2022

States Production	Production Quantity		Egyptian Imports			
	(1000 Tons)	%	Coffee Kinds	Quantity (Tons)	Value (Millions L.E.)	Mean of Ton Price
Brazil	2551	42.74	Roasted	110534	1802	16.30
Vietnam	900	15.08	not roasted	26863	268	9.98
Colombia	696	11.66				
Indonesia	411	6.89				
Ethiopia	390	6.53				
India	300	5.03				
Mexico	270	4.52				
Guatemala	240	4.02				
Peru	210	3.52				
World Production	5968	100.0	Total	137397	2070	15.07

Source: F.A.O., Statistical yearbook, food and agriculture, 2022.

From the data presented in Table (9), it is shown that:

- Coffee cultivation and production worldwide is concentrated in 9 countries: Brazil, Vietnam, Colombia, Indonesia, Ethiopia, India, Mexico, Guatemala and Peru. These countries produce about 42.7%, 15.1%, 11.7%, 6.9%, 6.5%, 5.0%, 4.5%, 4.1%, 4.0.%, 3.5% of the world production which reaches about 6 million tons in 2022 for each of them, respectively, Table (9).
- Egypt's imports reach about 137.4 thousand tons of worldwide output, and the value of Egypt's imports was estimated at 2.07 million pounds, with a mean ton price of about 15.07 thousand L.E. (This price was calculated based on customs dollar price equals about 16 pounds).

Through the view of these data, research results and technological points, replacing hulled roasted barley as a drink instead of coffee will achieve an economic return that saving reaches a maximum return estimated of about 2 milliards L.E. or its equivalent dollars in the case of a complete replacement, and of about 1, and saving amounts to about 1 milliard L.E in the case of 50% replacement, and about 0.50 billion pounds in the case of 25% replacement.

CONCLUSION

– This study recommends the importance of hulled roasted barley drink in terms of its nutritional value, and this drink is considered less harmful to the consumer as an alternative to coffee, as it is caffeine-free. Potential for coffee consumption associated with higher caffeine content as the roasting process of barley grains improved the taste, flavor and appearance of coffee alternatives.

– The study recommends replacing roasted barley coffee as a complete substitute for regular coffee, as this leads to savings worth 2.10 billion pounds, or its equivalent in dollars.

– The study also recommends producing a mixture of regular coffee and hulled roasted barley as a gradual change in consumption and to reduce the harmful effects of coffee and as an idea for a new research study.

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الملخص العربي

مشروب الشعير المحمص المقشر كبديل القهوة: التقييم الحسي، التركيب الكيميائي ومحتوى الكافئين، نشاط مضادات الأكسدة والتقييم الإقتصادي

غزة محفوظ علي

تم في هذا البحث دراسة التركيب الكيميائي ومحتوى الكافئين ونشاط مضادات الأكسدة والتقييم الحسي والاقتصادي لحبوب الشعير المحمص المقشر كبديل لمشروب القهوة، حيث تم تنظيف وتحميص حبوب الشعير المقشر صنف جيزة ١٣٤ عند حوالي ٢٠٠ درجة مئوية لمدة ٥٥،٤٥،٣٥ دقيقة ومقارنتها بعينة من البن البرازيلي. أظهرت نتائج التقييم الحسي لمشروب قهوة الشعير المحمص على٢٠٠ درجة مئوية لمدة ٥٥،٤٥،٣٥ دقيقة، ومقارنتها بمشروب البن البرازيلي، أن مشروب قهوة الشعير المحمص على٢٠٠ درجة مئوية لمدة ٥٥ دقيقة حصل على أعلى الدرجات مقارنة بكل من قهوة الشعير المحمص عند ٢٠٠ درجة مئوية لمدة (٤٥ و ٣٥) دقيقة وكان قريباً جداً من مشروب البن البرازيلي. وأيضاً تم إجراء تقييم اللون لكل عينة من الشعير المحمص وعينة البن البرازيلي. وكانت نسب البروتين والدهون والرماد في حبوب الشعير المحمص المقشر أقل من تلك الموجودة في البن البرازيلي، إذ بلغت هذه النسب ١٣,٢%، ٣,٨٤%، ٣,٣٣% في حبوب الشعير المحمص المقشر، بينما بلغت تلك النسب في البن البرازيلي ١٧,٥٤%، ١٨,٢٣%، ٤,٣١% على التوالي. وكان محتوى الرطوبة والكربوهيدرات الكلية والنشا في حبوب الشعير المحمص أعلى من تلك الموجودة في البن البرازيلي وأيضاً أنخفضت نسبة الألياف الخام والغذائية في حبوب الشعير المحمص مقارنة بتلك الموجودة في البن البرازيلي، وكما انخفض إجمالي نشاط الفينولات ومضادات الأكسدة في حبوب الشعير المحمص مقارنة بالبن البرازيلي حيث بلغت ١٦٦,٢٢ ملجم حمض الجاليك/١٠٠ جرام و٥٢,١٨% في حبوب الشعير المحمص المقشر، بينماوصل إلى ١٥٧٧ ملجم حامض الجاليك/١٠٠جم و٩٠,٢٠% في البن البرازيلي. وبلغت نسبة الكافئين في حبوب الشعير المحمص المقشر صفر في المائة، بينما بلغت نسبته في البن البرازيلي ٠,٨٧%. وأظهرت النتائج أن محتوى المعادن (المغنيسيوم والكالسيوم والحديد والبوتاسيوم والصوديوم) كانت أعلى في عينة البن البرازيلي (١٦٠,٦٧، ٥٧,٣٠، ٢١,٣٠، ٢٢٠٠ و٩٣,٣٣ ملجم/١٠٠ غرام) مقارنة بحبوب الشعير المحمص المقشر(١٤٩,٦٩، ٣٢,٩٧، ١٥،٠٣,٧٠٠ و٧٦,٦٧ ملجم/١٠٠ جم على التوالي. من ناحية أخرى، يبلغ الإنتاج العالمي من القهوة نحو ٦ ملايين طن، تنتج في ٩ دول، وتستورد مصر نحو ١٣٧ ألف طن تمثل نحو ٢,٣٠% من ذلك الإنتاج بقيمة نقدية تقدر بنحو ٢,١٠ مليار جنيه، ويمكن توفيرها من خلال مشروب قهوة الشعير، مع الإحلال الكامل فيما يمكن تخفيضها إلى نحو ١,٠٤ مليار جنيه في حالة الإحلال ٥٠%، ونحو ٠,٥٠ مليار جنيه في حالة الإحلال ٢٥% فقط. لذا فإن تناول قهوة الشعير بدلاً من حبوب البن الطبيعية بنسب مختلفة يمكن أن يؤدي إلى توفير العملة الصعبة.

الكلمات المفتاحية: القهوة ،الشعير، التحميص، التركيب الكيميائي، الألياف الغذائية،النشاط المضاد للأكسدة، التقييم الحسي.