



PHYSICO-CHEMICAL AND SENSORY PROPERTIES OF BARLEY BREAD ENRICHED BY FREEZE DRIED DATE POMACE POWDER

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Abstract: Bread is the principal cereal product. Date pomace is a by-product of the date syrup industry. The main objective of this work is to evaluate physico-chemical and sensory properties of barley bread supplemented by freeze dried date pomace powder of Garn Ghzel date variety. Barely bread was prepared after incorporation of 0, 5, 10, 15 and 20% of freeze dried date pomace powders. The results show that the rate of incorporation of date pomace powder has a significant effect on physico-chemical (thickness, weight before and after cooking, volume, specific volume, moisture, dry matter, ash, pH, wet gluten, dry gluten and color) and the sensory properties of barley bread in terms of appearance/shape, crust, brown color, chewing, date aroma, general acceptability. All barley bread samples were acceptable; however, the samples fortified by 20% of freeze dried date pomace powders are the most preferred. Findings showed that good and acceptable barley bread could be produced using freeze dried date pomace powder at different levels.

Keywords: Barely bread, freeze drying, date pomace powder, physico-chemical properties, sensory properties.

1. Introduction

Bakery products are consumed all over the world [1]. Baked products are gaining popularity because of their availability, ready to eat convenience and reasonably good shelf life [2]. Common bakery products include biscuit, muffin, cake, bread, pastries and pies [3].

Bread is one of the commonest staple food eaten world over [4]. It is the major baked product that is widely acceptable and consumed as a very convenient form of food worldwide; however, there are increasing demands toward consumption of high fiber breads due to their health prompting properties. It is a good source of nutrients, such as macronutrients (carbohydrates, protein and fat) and micronutrients (minerals and vitamins) that are all essential for

human health [5].

Barley (*Hordeum vulgare*) is a widely consumed cereal important for human nutrition. Approximately 80-90% of the barley harvest is used as animal feed and to produce malt. However, barley is now receiving renewed interest as an ingredient in functional foods due to its high concentrations of bioactive compounds such as β -glucans and polyphenols. Additionally, consumption of barley is associated with lower total and serum cholesterol, improved postprandial glucose and insulin response and reduced incidence of heart disease and cancer [6].

Date pomace is a by-product of date syrup industry [7]. However, information on incorporation of date pomace powder in barley bread is unusual.

The use of fruit and vegetable by-products as natural food additives has recently been suggested, due to their high content of polyphenols, carotenoids, dietary fiber, or other bioactive compounds [8].

The objectives of this work were to study the valorization of date pomace powder of Garn Ghzel date variety by incorporation into barley bread product and to determine its physico-chemical and sensory properties.

2. Materials and methods

Preparation of date pomace powder

Date syrup was prepared according to Al-Farsi (2003) [9] method with a slight modification: A chopper was used to cut dates into pieces of 1 cm, and then mixed with an equal amount of distilled water.

The mixture was stirred for 20 min at 60°C in a water bath, (DK-420, China). Finally, the juice was extracted through a muslin cloth. Left material after juice extraction is called date pomace. It was freeze dried in a laboratory freeze dryer model (LD 2- 8 CHRIST BETA PLUS, Germany) for 24 hours at a pressure and temperature of 0.12 mbar and -40°C, respectively. Samples were ground and sieved in a sieve of 1 mm diameter [7].

Barley bread preparation

The barley bread formula was adapted from the recipe of Ndangui (2015) [10] with some modifications. Barley bread formula was shown in Table 1.

Table 1.

Enriched barley bread formulation

Ingredient (g)	Control	BBDPP5	BBDPP10	BBDPP15	BBDPP20
Barley flour	100	95	90	85	80
Date pomace powder	0	5	10	15	20
Yeast	3.0	3.0	3.0	3.0	3.0
Salt	2.0	2.0	2.0	2.0	2.0
Margarine	5	5	5	5	5
Water	60	60	60	60	60

Control, BBDPP5, BBDPP10, BBDPP15 and BBDPP20 Barley Bread: prepared with 0%, 5%, 10%, 15% and 20% of Date Pomace Powder, respectively.

Physicochemical properties of barley bread

According to Mohd. Jusoh et al., (2008) [11] with some modifications, the thickness of barley bread was measured using a digital vernier caliper with a precision of up to 0.01 mm.

The bread weight was determined according to Olubunmi et al., (2015) [5] with some modifications, weighing the bread before and after cooking, using the laboratory scale (Kern, Imlab France) and the readings recorded in grams.

The barley bread volume was determined by using Rapeseed displacement method. This was done by loading millet grains into an empty box with calibrated mark until it reached the marked level and unloaded back. The bread sample was put into the box and the measured millet was loaded back again. The remaining millet grains left outside the box was measured using measuring cylinder and recorded as loaf volume in cm³ [5].

The flow chart for the production of barley bread is presented in Fig. 1.



Fig.1. Flow chart for the production of barley bread based on freeze dried date pomace powder

The specific volume (volume to mass ratio) (cm^3/g) was thereafter calculated. The specific volume (volume/mass ratio) (cm^3/g) was calculated as follows:

$$\text{Specific volume (cm}^3/\text{g)} = \frac{\text{Bread volume}}{\text{Bread weight}} \quad (1)$$

According to Sassi (2008) [12] with some modifications, gluten extraction was obtained by mechanically kneading flour dough and washing with a buffered NaCl solution and then squeezing and weighing the residue (AACC 38.12, ICC Standard 137).

$$\text{GH\%} = \text{Pg} \times 10 \quad (2)$$

GH: wet gluten (retained)

Pg: gluten weight.

The total gluten was dried in a hot plate for 4 minutes and then weighed [12].

The color of barely bread was determined using Minolta chroma meter. Color value

is based on L^* (lightness–darkness), a^* (redness–greenness) and b^* (yellowness–blueness) according to the method of Rosa *et al.* (2015) [13] with some modification.

Sensory evaluation

The determination of acceptability level was based on appearance/form, crust, brown color, chewiness, date aroma and overall acceptability were conducted using a 9-point hedonic scale (9=liked very much, and 1= disliked very much) [5].

Statistical analysis

All analysis was performed with three repetitions, while color with six and the results were expressed as the mean \pm standard deviation (SD). Results were submitted to the analysis of variance (ANOVA) and the means were compared with Tukey (HSD) test using XL STAT 2016. Differences were considered to be significant at $P < 0.05$.

3. Results and discussion

Changes in barley bread enriched with date pomace powder are shown in Table 2.

Physico-chemical characteristics of barley bread

Table 2.

Physico-chemical characteristics of barley bread prepared with date pomace powder					
	Control	BBDPP5	BBDPP10	BBDPP15	BBDPP20
Thickness (cm)	6.4±0.4 ^a	5.73±0.23 ^{ab}	5.33±0.23 ^b	5.33±0.23 ^b	5.07±0.23 ^b
Pre-cooking weight (g)	160.21±0.55 ^c	170.85±0.05 ^a	159.64±0.02 ^d	161.32±0.00 ^b	153.27±0.06 ^e
Post-cooking weight (g)	130.35±0.32 ^e	132.97±0.02 ^c	140±0.00 ^a	136.12±0.08 ^b	130.99±0.18 ^d
Volume (cm ³)	44.75±0.25 ^{bc}	44.33±0.58 ^c	44.08±0.14 ^c	45.5±0.5 ^{ab}	46±0.00 ^a
Specific volume (cm ³ /g)	0.35±0.00 ^b	0.33±0.00 ^c	0.31±0.00 ^d	0.33±0.00 ^c	0.35±0.00 ^a
Moisture (%)	40.81±0.96 ^b	39.90±0.52 ^b	45.64±1.98 ^a	41.75±0.30 ^b	40.23±1.02 ^b
Dry Matter (%)	59.19±0.96 ^a	60.10±0.52 ^a	54.36±1.98 ^b	58.25±0.30 ^a	59.77±1.02 ^a
Ash (%)	3.81±0.00 ^a	2.97±0.01 ^a	2.05±0.00 ^a	1.51±0.01 ^a	0.93±1.16 ^a
pH	6.03±0.02 ^{ab}	5.94±0.02 ^c	5.94±0.02 ^c	6.04±0.04 ^a	5.97±0.02 ^{bc}
Wet gluten (%)	29.77±0.23 ^a	27.63±0.13 ^b	24.87±0.10 ^c	19.32±0.06 ^d	14.72±0.20 ^e
Dry gluten (%)	9.09±0.8 ^a	8.24±0.3 ^b	8.16±0.04 ^b	5.65±0.12 ^c	4.41±0.08 ^d

Control, BBDPP5, BBDPP10, BBDPP15 and BBDPP20: prepared with 0%, 5%, 10%, 15% and 20% replacement of barley flour with date pomace powder, respectively. Results are expressed as mean values of three determinations ± SD; analysis of variance (ANOVA) p<0.05 with Tukey (HSD) tests.

The thickness of enriched barley bread decreases with the increase in the rate of incorporation of freeze-dried date pomace powder, it is higher for the control with a value of 6.4 ± 0.4 cm and lower for BBDPP20 with 5.07 ± 0.23 cm.

Significant differences observed between enriched breads weight (before and after cooking) with values varied from 153.27 ± 0.06 to 170.85 ± 0.05g and from 130.35 ± 0.32 to 140 ± 0.00g respectively.

The volume of the loaves varies from 44.75 ± 0.25 to 50.67 ± 0.58 cm³ and the specific volume ranges from 0.31±0.00 to 0.35±0.00 (cm³/g). According to Ndangui (2015) [10], bread volume variation can be attributed mainly to different levels of carbon dioxide production and the degree of starch gelatinization. The results obtained are similar to those of Ndangui (2015) [10], for which the volume of bread decreases with the increase in the sweet potato flour substitution rate.

The water content of barley breads enriched with freeze-dried date pomace powder ranges from 39.90 ± 0.5 to 45.64 ± 1.98%. These results are superior to those of Obiegbuna et al. (2013) [4] who studied the influence of sugar replacement by date pulp flour on physicochemical, organoleptic properties and on bread preservation. The difference in results is due to the difference in the preparation of bread.

According to the results obtained the ash content decreases with the increase in the concentration of date pomace powder (DPP) from 3.81 ± 0.00 to 0.93 ± 1.16%. Obiegbuna et al. (2013) [4] obtained similar results.

The pH of different breads varies from 5.94 ± 0.02 to 6.04 ± 0.04, The results obtained is in agreement with those reported by Semić et al. (2010) [14].

According to Ouazib (2017) [15], the gas retention capacity depends on the quantity and especially the quality of the gluten to

form a paste that can retain the released CO₂. Wet gluten extracted from wheat flour is a viscoelastic substance consisting mainly of the insoluble fraction of proteins (gliadins and glutenins). It has properties of extensibility, elasticity and toughness that can influence the behavior of the pasta in production and the quality of the finished product (bread, biscuit, ...) [12]. The wet and dry gluten of barley breads produced is high for control with 29.77 ± 0.23 and $9.09 \pm 0.8\%$ and low for BBDPP20 with 14.72 ± 0.20 , $4.41 \pm 0.08\%$. These results are consistent with

those obtained by Sassi (2008) [12] for whole semolina and Halaby *et al.* (2014) [16] for different wheat flour.

The breads enriched with different concentrations of date pomace powder (5-20%) are characterized by: A proportional difference in the different brightness (L*), redness (a*) and yellowing (b*) parameters of different fortified breads (Fig. 2);

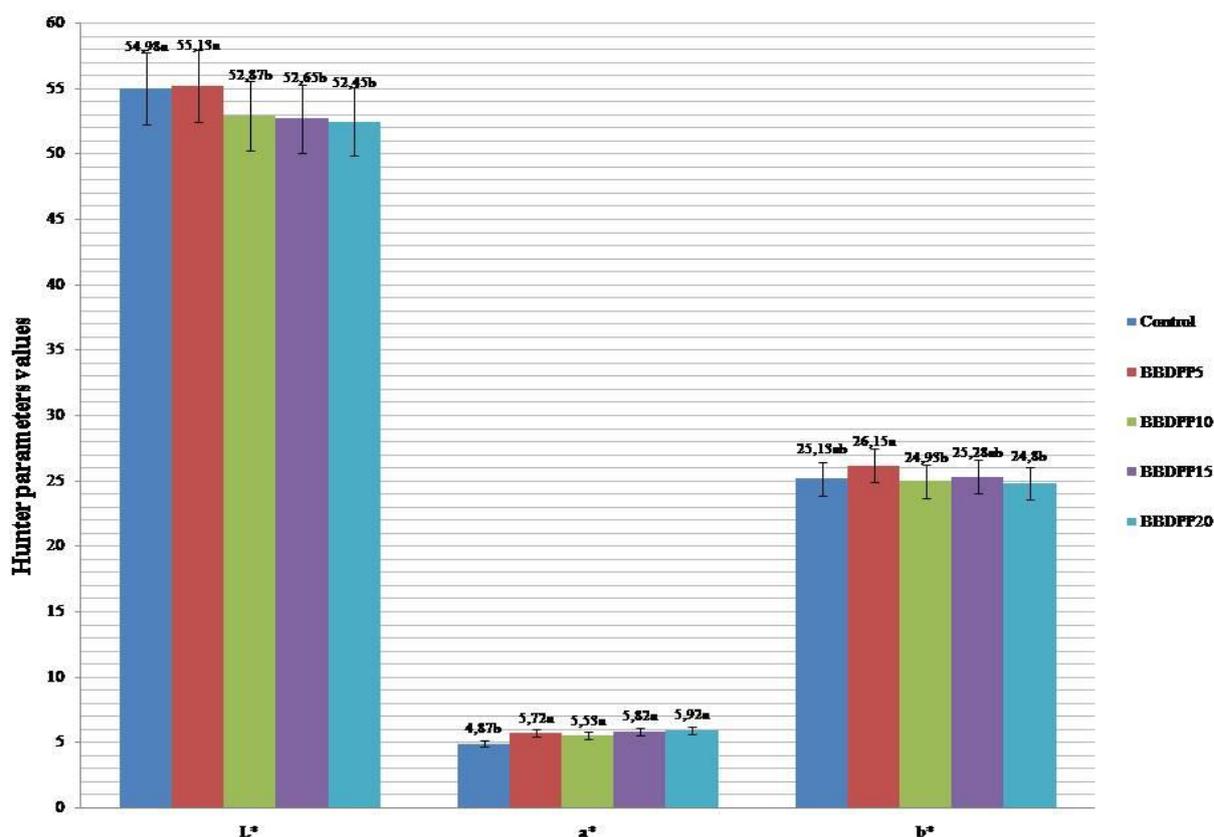


Fig. 2. Color measurements of barley bread product with different proportions of date pomace powders: 0% (Control), 5% (BBDPP5), 10% (BBDPP10), 15% (BBDPP15) and 20% (BBDPP20)

The results obtained are influenced by the amount of date pomace powder incorporated and the color of the barley flour.

These values are compared with those of Ishida and Steel (2014) [17] for bread samples available on the Brazilian market.

Sensory evaluation

Web diagram for mean sensory scores of enriched date pomace powder barley bread was presented (Fig. 3).

According to the sensory evaluation, the BBDPP20 sample has the highest score

(appearance/shape, crust, brown color, chewiness and date aroma).

The global acceptability of all samples followed the same trend. Thus, the sample containing 20% of lyophilized date pomace powder is the most preferred.

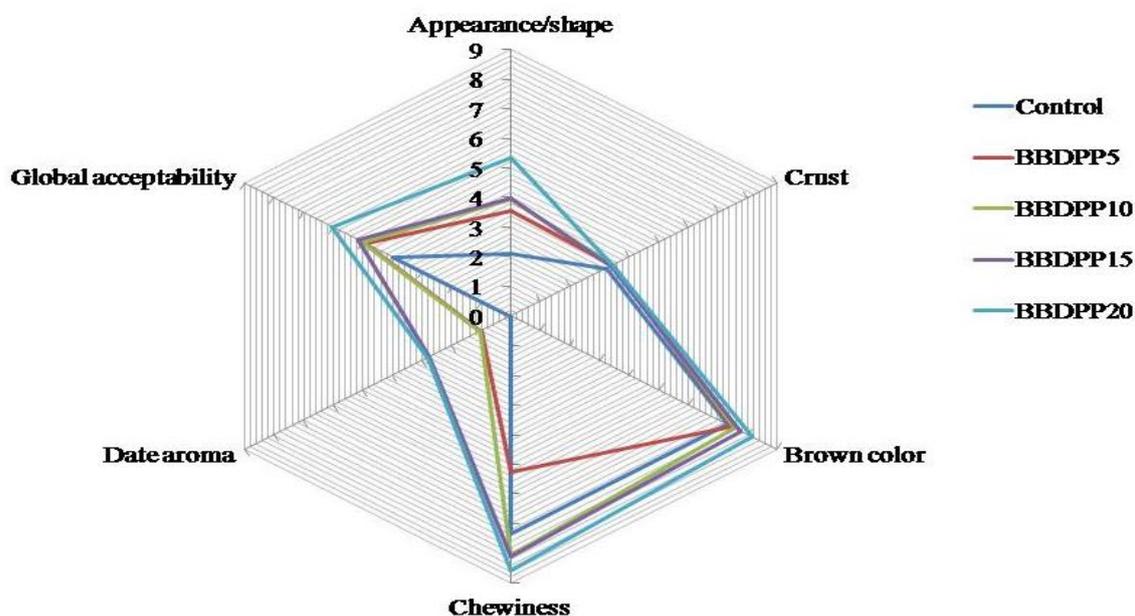


Fig. 3. Diagram for mean sensory scores of date pomace powder barley bread with different proportions of date pomace powders: 0% (Control), 5% (BBDPP5), 10% (BBDPP10), 15% (BBDPP15) and 20% (BBDPP20)

4. Conclusion

The results of this study showed that it is possible to develop barley bread with Garn Ghzel date pomace powder. The incorporation of freeze dried date pomace powder in the formulation of barley bread was found to improve physicochemical and sensory properties of samples. Barley bread prepared at incorporation rates of 5%, 10%, 15% and 20% are all acceptable in terms of global acceptability, appearance/shape, crust, brown color, chewiness and date aroma. Barley bread with 20% of date pomace powder was the most preferred.

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6. References

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