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Rheological qualities and sensory evaluation of bread prepared with barley malt syrup

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Abstract
Scientific studies have shown that the use of malt syrup in bread making as an alternative to synthetic improvers such as emulsifiers, preservatives and enzymes improves organoleptic, technological and nutritional qualities. To evaluate the rheological properties, nutritional values and sensorial characteristics of bread prepared with malted barley syrup. Two samples of breads were prepared with and without the addition of malted barley syrup in the formula. Several types of assessments on rheological properties, nutritional values and sensory characteristics were performed by comparing the control bread with the bread containing malted barley syrup in order to determine the effectiveness of its incorporation into the bread formulation. After evaluating the rheological properties of the dough for each type of bread, we observed that during the fermentation, after incorporation of the barley syrup into the bread formulation, the dough obtained swells better during the fermentation and reaches a maximum volume of 5.5 ml. Similarly, the dough prepared by the barley syrup has a better extensibility and a high elasticity compared to the control. Results of sensory analysis showed that barley syrup was able to mask flour taste and salty taste as well as yeast odor. In addition, this ingredient has developed a pleasant smell and it has kept moisture in the breadcrumb. This was highly appreciated by the panelists of sensory analysis. Finally, after comparing the nutritional value of each type of bread sample, we can conclude that the bread prepared in barley syrup is less caloric than the bread. In addition, this syrup has provided bread with an additional source of protein, mineral salts, especially Calcium, Magnesium and Potassium. Malted barley syrup favors the process of fermentation. In addition, it helps in the development of gluten, which leads to an improvement in the elasticity, and the extensibility of the dough. In addition, malt, increases the moisture retention properties improving the freshness and the quality of preservation. Thus, the bread obtained has a delicious crust that is smooth and crisp and brings to our daily diet nutrients such as potassium and phosphorus.

Keywords: barley malt syrup, dough, bread, fermentation, elasticity, extensibility, nutritional values

1. Introduction
Malt is a germinated cereal, usually barley, which is cooked to release all its aromas. Malt is mainly used for making alcoholic beverages such as whiskey and especially beer. It is also used in the manufacture of food products such as malt vinegar or certain coffee substitutes (roasted malt barley) [1, 2], Recently, malted barley syrup which is a sweetening concentrate produced from sprouted barley seeds is used in bakery, to give more flavor to the dough. It has a syrupy dark brown appearance and has a distinctive smell. Its sweetening power is half that of table sugar. Malt syrup is incorporated in food products for various purposes. It is added to bread mixes to provide easily fermentable carbohydrates [1, 2].
Scientific studies suggest that the use of malt syrup in the manufacture of bread as alternative synthetic improvers such as emulsifiers, preservatives, enzymes and even in place of sugar has the following advantages: Additional source of sugars, soluble proteins and minerals, promote the activity of yeast, adds moderate proteolytic activity to the dough that aids the aeration of the dough and the development of gluten during fermentation, ensures the formation of maltose from starch after thermal inactivation of the yeast in the oven, improves the crumb of bread its color, the texture of the crust, increases the moisture retention properties of the finished product, improving freshness and preservation quality [3, 2].
The objectives of this project were to develop a bread made from barley syrup and to examine the effectiveness of the incorporation of this ingredient on the rheological, organoleptic and nutritional characteristics of bread.

2. Materials and methods
In this study, two types of bread have been prepared: one made with malted barley syrup (experimental sample) and another prepared without any additional ingredient (sample control). For the preparation of each bread, wheat flour (800g), Bakery yeast (5g), Salt (10 g), Water (500 ml), 7.5 g malted barley syrup (Maltax 10 - senson) had been used. Wheat flour was chosen for its high gluten content (8-14%), it brings 361 cal per 100g. The Bakery yeast used for kneading are composed of live cells of Saccharomyces cerevisiae, a unicellular fungus. They contribute to the taste of the bread, allowing the release of the flavors present in the flour. It is the natural source richest in vitamins of group B. The salt plays several roles during the elaboration of the dough during kneading; it contributes largely to fix the aromas of bread. It improves the plastic qualities of the dough (taking tenacity and firmness) and strengthens the gluten. During the fermentation: It ensures a uniform production of carbon dioxide and thus a better structure of the crumb. It fixes the water in the dough and thus limits the crusting effects of

dough pieces. During cooking: It improves the retention of gases, avoids the formation of too large cells and thus contribute to the proper development of bread. It influences the coloring of the bread crust when cooking and it acts on the fineness of the crus. The roles of water in bread making were to dissolve the ingredients * (* salt, yeast, etc.), moisturize the flour, (thus forming a paste), promotes the relaxation of gluten, it is indispensable for the life of the yeast and allows to obtain pasta at the desired temperatures at the end of kneading [4].

Finally, the malted barley syrup used for experiments contains approximately 65% maltose, 30% complex carbohydrate and 3% protein. It has a syrupy, dark brown appearance, and has a distinctive odor that can be described as "malty". Its sweetening power is half that of table sugar. The weight measures for each ingredient were taken by a Diet scale PACK 4 (d=0.1g). The dough was prepared (Fig.1) by mixing and kneading all the ingredients together the flour, salt, sugar or barley syrup, water, and leaven for 30 minutes. Then, the dough was left still for 2 hours in a warm atmosphere and then divided into 3 or 4 identical portions and shaped. Finally, the dough was left still for another 12 hours in the warm and baked at 220°C for 20 to 25 minutes by an induction type oven (Hartolini)

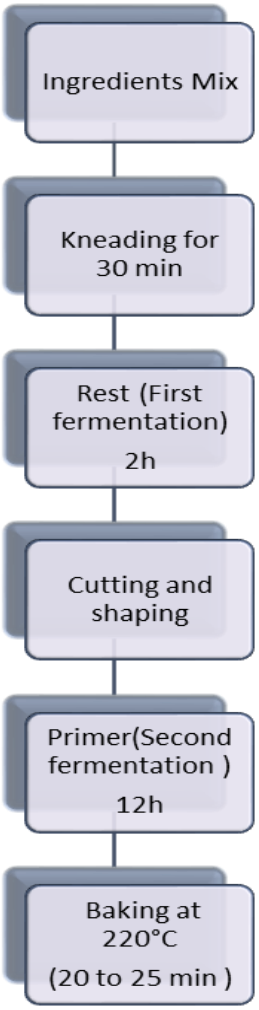

Fig 2: Preparation method of bread

2.1 Organoleptic characteristics

The effectiveness of the incorporation of barley malt syrup on the rheological, organoleptic and nutritional characteristics of bread have been examined. For the organoleptic characteristics a descriptive sensory analysis was conducted using 25 female's students in food Science from Saint Joseph university selected for perception of the basic tastes (sweet and sour) and for their daily preference bread consumption with an average age of 22± 1,5. Two samples were presented to each tester: Sample 106: bread made with barley syrup and Sample 251: Control bread. Panelists had to provide the appropriate intensity for each sensory characteristic. During the sensory evaluation, the panelists were spaced at least 2 m to avoid interaction. The test was carried out under air conditioned and artificial lighting environment. The objective of the descriptive tests was to arrive at an efficient description of the analyzed samples. The descriptors are provided, in this case, with an intensity scale which starts from a level 0 or 1 up to a level n marking an important character on the concerned attributes.

Table 1: Intensity scales for each attribute

Organoleptic Characteristics	Low intensity 1	Hight intensity 5
Odor	Pleasant	Yeast smell
Taste	Flour taste/ salty	Sweet
Visual Perception		
Appearance of the crust	Smooth	Torn
Crunchiness of the crust	Soft	Crispy
Aspect of the mie		
Color	White	Golden
Texture in mouth	Wet	Dry

2.2 Evaluation of the rheological qualities

2.2.1 The development (or the growth)

It measures the volume of growth (development) of the dough during fermentation (initial volume + volume gain after fermentation). This increase in volume is related to the fermentative activity but also incorporates the ability of the dough to deformation and its gas retention [5].

2.2.2 Elasticity

It is the capacity of the dough to completely or partially recover its shape after a given deformation (± intense) and the stop of this deformation. The elasticity is detected: by the imprint of the finger on the dough which quickly fades away. At the end of kneading of the mass dough after stretching and loosening [5].

2.2.3 The extensibility

It is the capacity of elongation or deformation of the dough. It can be evaluated by stretching (uniaxial or biaxial). The normal state is defined by a rupture occurring after stretching the dough from 20 to 30 cm by observing the possible tearing of surfaces at shaping or the end of primer [5].

2.3 Nutritional analysis

The nutritional analysis for each type of bread (100 g) was evaluated according to the nutritional values of flour and barley syrup from U.S.D.A. presented in table 2 [6].

Table 2: Nutritional Values of raw Materials

Nutritionnel Values	Flour (100g)	Malt Syrup (1 Tbsp)
Calories (Kcal)	361	67
Protein (g)	11,98	1.3
Fat (g)	1,66	0
Carbohydrate (g)	72,53	14.97
Potassium (mg)	137	67
Phosphore (mg)	133	50
Magnésium (mg)	34	15
Calcium (mg)	21	13

3. Results

3.1 Sensory analysis

According to the sensory profile of each bread in Fig.2 and Fig.3, it has been shown that the smell of the test bread has a strong yeast smell, while the bread made with barley syrup has a pleasant smell of matte, which was more appreciated by the panelists. The taste of flour, salty and sweet were pronounced in the control bread and masked in the bread made with barley syrup. For the crumb color, the control bread showed a creamy white color while the experimental breadcrumb had a color that tends to be golden, which was also more appreciated by the testers. Although, the texture of the crumb of the bread with barley syrup in the mouth was more wet and easier to chew. The perceived texture of the crust prepared with barley syrup was crisper, smooth and less torn apart, a characteristic which is desired at the technological level and more preferred by the testers. Finally, we can conclude that the barley syrup was able to mask the taste of flour and the salty taste as well as the smell of yeast. In addition, this ingredient has developed a pleasant smell and has kept moisture in the breadcrumbs. Which was very much appreciated by the panelists of sensory analysis.

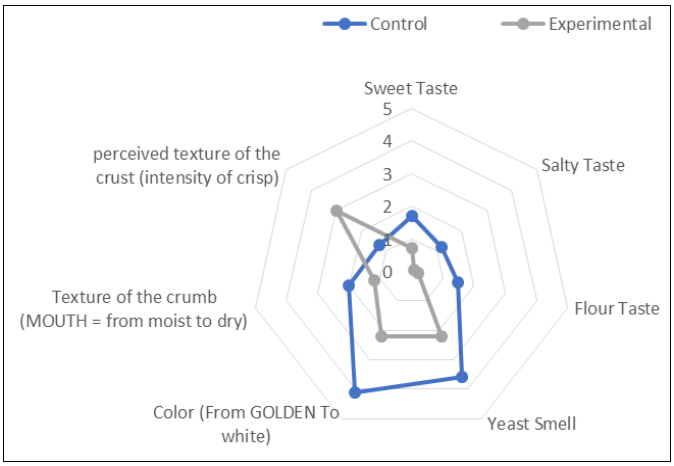

Fig 2: Sensory Profile of Bread samples

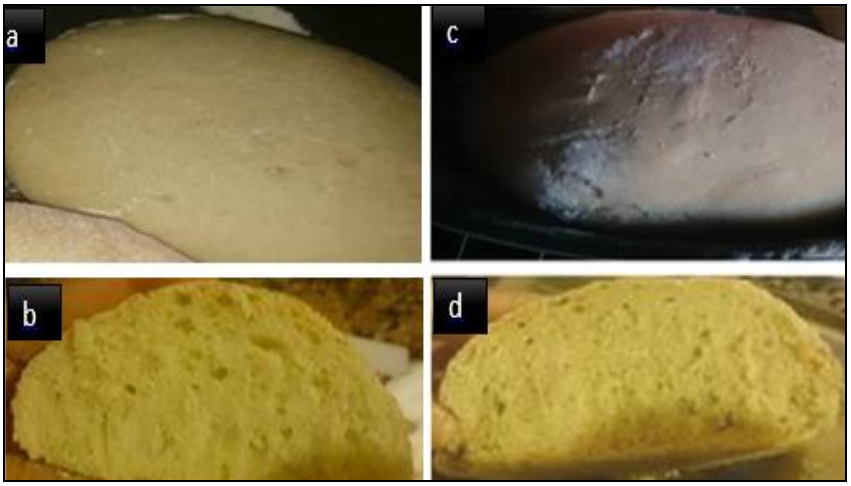

Fig 3: a) Perceived Texture of the crust for bread with barley syrup, b) Texture of the crumb bread with barley syrup, c) and d) control bread

3.2. Rheological properties

3.2.1 Dough development during fermentation

Results in Figure 4 and 5 show the variation of volume dough with fermentation. It has been demonstrated that, during the fermentation, the control dough swells less well, and the maximum volume of growth was 4.8 ml. On the other hand, when barley syrup was incorporated, the dough obtained swells better during fermentation and reaches a maximum volume of 5.5 ml. These results are in accordance with HRUŠKOVÁ *et al*. (1959) where the addition of malt showed affect significatively the proofing stability. The bread samples had an increase about 40% from original volumes during proofing [3].

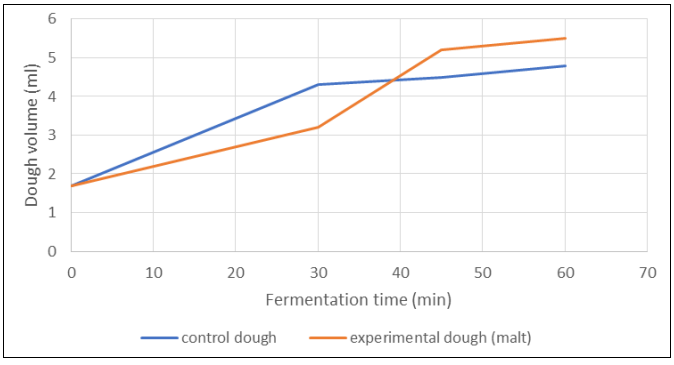

Fig 4: The variation of volume dough with fermentation time

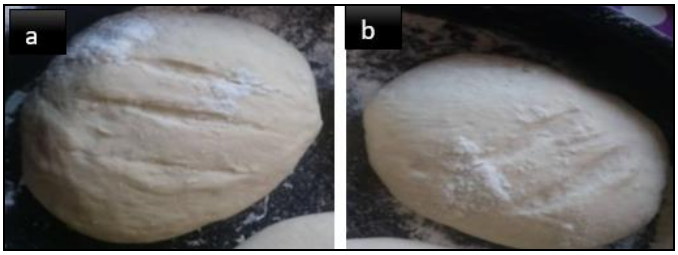

Fig 5: Dough Growth with fermentation a) barley dough, b) Control Dough

3.2.2 Elasticity

For the elasticity, an immediate recovery was observed of the initial form after deformation of the dough prepared with barley syrup compared to the control dough. It has not been observed a surface tears at the end of the primer for the control paste.

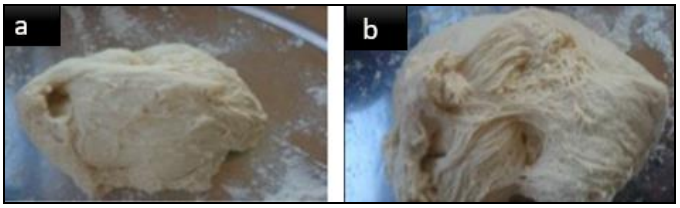

Fig 6: Recovery state of Dough after deformation a) barley dough, b) Control Dough

3.2.3. Extensibility

For the extensibility, a dough rupture had been occurred after stretching 25 cm the barley dough and 16 cm the control dough. Although, the dough prepared with barley syrup had the better extensibility.

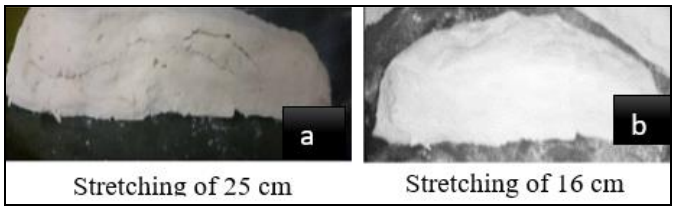

Fig 7: Elongation of Dough a) barley dough, b) Control Dough

The effects of malt addition on the rheological characteristics were found in:

- Water absorption and dough consistence
- Decrease of elasticity and increase of extensibility

2.3 Nutritional assessment

Table 3: Nutritional Values for each bread

Nutritionnel Values	Bread with barley syrup (100 g)	Control Bread (100 g)
Calories (Kcal)	366	381
Protein (g)	13	11
Fat (g)	1.66	1.66
Carbohydrate (g)	73	76
Potassium (mg)	147	137
Phosphore (mg)	140	133
Magnésium (mg)	37	34
Calcium (mg)	23	21

Table 3 present the nutritional values for each bread examined. Obviously, the bread made with barley syrup is less caloric than the control bread. Therefore, the malt syrup used has provided the bread with an additional source of protein; potassium, calcium and magnesium.

3. Conclusion

Malted barley syrup gives the dough an enzymatic activity that favors the fermentation process so that the addition of synthetic enzymes or sugar is not necessary. Similarly, it helps development of gluten, which leads to an improvement in the elasticity, and extensibility of the dough. In addition, malt increases the moisture retention properties improving freshness and preserving quality. Thus, the bread obtained has a delicious wet taste and a smooth crispy crust, as well as adding to our daily diet a variety of nutrients such as potassium, calcium and phosphorus.

4. References

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