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Research Paper

The effect of cooking methods on the physical and chemical properties of durum wheat flakes

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Abstract

In this study, the physical properties and chemical compositions of durum wheat and their used flakes were developed; where the moisture content, dry matter and ash content of the soaked wheat flakes was higher than that of the flakes prepared with durum wheat flour. However, lipids, proteins, and total carbohydrates were detected in the flakes of durum wheat flour, and were observed to be higher than those found in flakes prepared with soaked wheat at highly-significant difference-quenched ($P < 0.05$).

The contents of the major minerals (K, Ca, Na and Mg) and minor elements (Fe) were detected in wheat flour flakes at levels higher than those observed in the soaked wheat flakes.

The organoleptic estimate of the sensory characteristics of a sample of tempered wheat flakes represents average scores in terms of appearance, color, taste and tenderness compared to flakes prepared with wheat flours.

Key words: durum wheat, flakes of durum wheat, chemical composition, grades of minors.

1. Introduction

The durum wheat have an economical importance in the world, where is the great consumed food for people around the world, who represent the fifth calories rapports in the human aliments (Zohary and Hopf, 2000). The cereals are the basis of the daily and main food for people in most countries of the world where wheat grains contain all the essential ingredients that the human body needs such as: minerals, antioxidants, vitamins and the fibers. Wheat grains are wonderful for the health of our children which gives grace and intelligence. By making the child strong and healthy from an early age, he will be given the necessary vigor to resist the innumerable evils and miseries that threaten the future of the younger generation and immunize him against so many diseases that are believed to wrong, inevitable (Boudreau. A., 1992). For this reason in our study, we prepared the durum wheat similar to corn flakes as a snack food at different procedures of cooking and investigate the effect of these procedures on some important physicochemical and nutritional properties.

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2. Matériel et Méthodes

2.1. Collection of samples

The cereal (durum wheat) was obtained from legumes processing company located in BISKRA, ALGERIA. They were all harvested in 2016; these wheat seeds have been manually cleaned to remove foreign bodies and damaged kernels.

Treatment methods for the preparation of durum wheat flakes

Preparation of flakes of durum wheat

Soaking: Soaking of durum wheat was carried out at room temperature (25 ° C) for 12 h in fresh distilled water in all the soaking experiments. (Seed / water ratio = 1/10).

Flake Formation: Hardened durum is filtered from water and formed into flakes where the space between the extruder rolls was set to two different widths from 600 µm to 800 µm.

Cooking: Toast and dry the durum wheat flakes in the oven at 180 ° C-200 ° C for 20 minutes.

The flakes obtained were analyzed and the following quality parameters were evaluated.

Preparation of flakes from durum wheat flour

The durum wheat was milled separately using a hammer mill (Retch RM 200.) In 1 mm sieve flours, we want to keep the maximum amount of nutrients in the grain. That's why we keep all the nutrients of the grain and only throw away the inedible parts, to produce the total amount of flour we need and thus reduce waste to a minimum.

After preparing the dough with soft wheat flour in the mixer with distilled water and then forming flakes at two different widths 700µm-900µm with extruder.

Cooking: Toast and dry the durum wheat flakes in the oven at 150 ° C to 180 ° C for 15 minutes.

The flakes obtained were analyzed and the following quality parameters were evaluated.

2.2. Physicochemical properties of durum wheat flakes soak and soft wheat flour

Water content

The moisture content of the durum wheat flakes was measured in a brand oven isothermal vacuum (MEMMERT model 700), according to the method described by the AFNOR standard (NF V 03-707). Drying at 130 ° C, of a test sample of 5 ± 0.001 g to constant weight. (AFNOR 1991).

Ash content

The ashes were measured by complete incineration to constant weight at 900 ° C. for three hours in a LINN muffle furnace, a test sample of 5 ± 0.001 g according to the standard N.F.V03-720 (AFNOR, 1991).

Determination of minerals

The contents of minerals, magnesium (Mg) and iron (Fe) were determined according to the method of A.O.A.C. (2000) using a Perkin-Elmer 2380 atomic absorption spectrophotometer. The flame photometer was applied for the determination of calcium (Ca), potassium (K) and sodium (Na) according to the method described by Pearson (1976).).

Determination of lipids

Lipids were determined by the gravimetric method after extraction with petroleum ether on a Soxhlet system (method No. 30-25) (AACC, 1995).

Determination of the raw fiber

The estimate was made using Wend's method.

Solubility of the raw proteins

Protein solubility of raw and processed flours was determined according to Clemente et al., (1998) in water or in 0.5N NaCL at pH 7.0 and 1:2 (w/v) ratio. The pH was adjusted by 0.5 N HCL or 0.5 N NaOH. The suspension was shaken for 1h at room temperature and centrifuged at 6000 rpm for 15 min. Supernatant was analyzed for nitrogen by micro-kjeldahl method. Protein solubility is expressed as a percentage of the total protein content (N x 6.25) in each sample. Total nitrogen and non-protein nitrogen contents in samples were determined using a micro-kjeldahl method (A.O.A.C, 2000). Crude protein content was calculated using a factor of 6.25. An extraction of samples with 10% trichloroacetic acid (TCA) was carried out for determination of non-protein nitrogen (Singh and Jambunathan, 1981).

The carbohydrate content was calculated by difference on a dry basis:

[% Carbohydrates = 100- (% ash +% fat +% protein +% crude fiber)].

All the above analyzes were done in triplicate and the results were reported on a dry matter basis.

3. Results and discussion

3.1. Physical properties and chemical compositions

The data in Table 1 indicate the physical properties and chemical compositions of the durum wheat samples and their flakes used in this study. Processing and cooking treatments have resulted in decreased protein, crude fiber, fat, and durum carbohydrates, and these decreases could be attributed to their diffusion in cooking (Wöese K. and al. 1997). This increase in the water content of starches after modification can be attributed to hydrophilic acetyl groups (CH_3CO) incorporated by esterification into the structure of the starches at the time of their modification (Thomas et al. (1999), Schnyder H and Baum U. 1992). These values of water content give information on the stability of decomposition flakes at different mode of cooking. This increase in ash content could be a consequence of the lowering of the content of other constituents such as lipids (Vasanthan T. and al (1999)). Dry matter content and organic matter content of the soaked wheat flakes was higher than that of the flakes prepared with the durum wheat flour is clarified by the decomposition of the soaking water in the durum wheat grains (figure 1). However, lipids, proteins and total carbohydrates were detected in durum wheat flour flakes

were higher than those found in flakes prepared with soaked wheat <grains (figure 2). This is explained by the formation of chemical modifications possibly induced by soaking these grains. These results are in agreement with those obtained by the

research of these researches: Whistler R. L. (1964). Gunaratne A. & Hoover R. (2002). Dzudie T. and Okubanjo A., (1998). Itcf and Onic, 1995. These results was confirmed by statistical analysis which showed highly significant differences (P <0.05) between the two types of cooking flakes.

Table1: the physical properties and chemical compositions of durum wheat flour and their flakes

	Water content %	Dry matter %	Organic matter %	Ach %	Raw fibre %	Fat %	Protéin %	Glucide %
Durum wheat	8.54	91.5	89.85	10.15	4.73	2. 8	13.7	68.62
Flakes of durum wheat flour	16.95	83.05	81.61	18.4	4.7	2.52	13	61.38
Flakes of soaked durum wheat	9.8	90.20	88.72	11.27	4.6	2.20	12	69.86

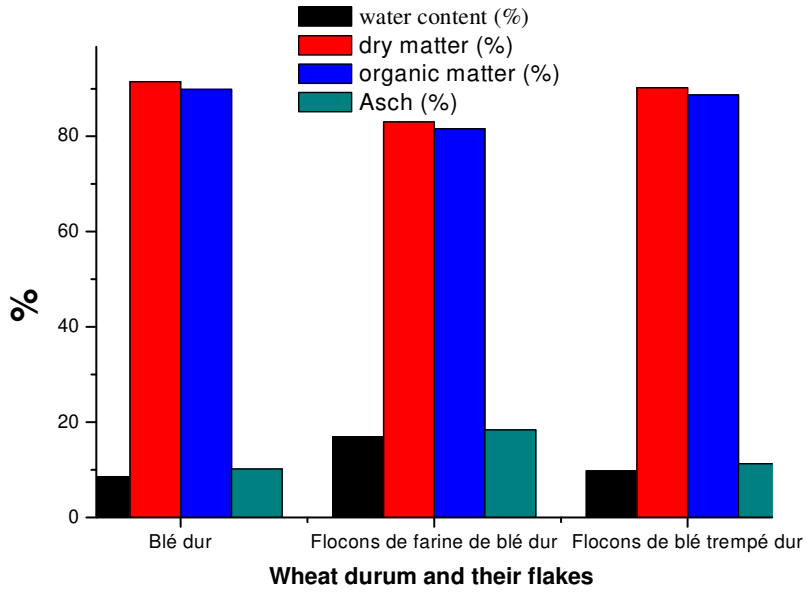

Figure 1: Chemical composition of wheat durum and their flakes ***Moisture, dry matter, organic matter and ash***

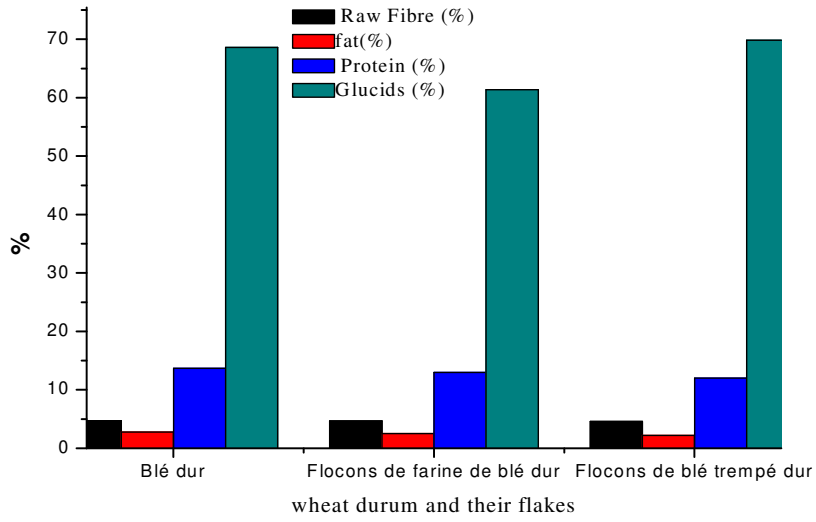

Figure 2: Chemical composition of wheat durum and their flakes ***Fat, protein, crude fiber and total carbohydrates***

3.2. Mineral content:

The mineral content of wheat durum flour and their flakes of durum wheat were studied (Table 2). The data showed that major minerals: potassium K, calcium Ca, sodium Na, magnesium Mg and minor elements iron Fe that detected in wheat flour flakes were at levels higher than those observed in the soaked wheat flakes. The contents of potassium K, calcium Ca, sodium Na, magnesium Mg and iron Fe in raw wheat flour were (8.22 mg / l, 312.129, 128 and 70 mg / l), respectively. These levels have been reduced according to the treatment methods applied between flakes prepared from flour and flakes prepared form soaked grain. This increase was mainly due to the minerals leached from the wheat seeds in the water during the soaking treatments, similar results have been observed by (Kleijer G., 2002. Lasztity R., 1984. Landi A., 1993, Hemingway R. G., 1999). Finely, these results were confirmed by statistical analysis which revealed very considerable differences ($P < 0.05$) between the two methods of cooking flakes.

	Fe (mg/l)	Mg (mg/l)	K (mg/l)	Na(mg/l)	Ca (mg/l)
Durum wheat	*6.5*	*167*	*400*	*12*	*25.33*
Flakes of durum wheat flour	*6.75*	*178*	*422*		*29.92*
Flakes of soaked durum wheat	*6.71*	*175*	*420*	*20*	*29.87*

Table 2: Mineral content of durum wheat flour and their flakes

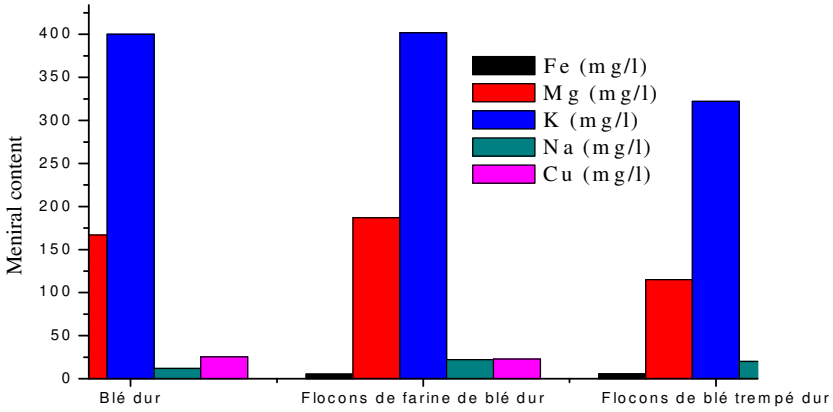

Figure 3: Mineral content in the wheat durum and their flakes.

3.3. Sensory characteristics of flakes at a different procedure

The organoleptic evaluation of the sensory characteristics of a sample of tempered wheat flakes represents average scores in terms of appearance, color, taste and tenderness compared with flakes prepared with wheat flour and durum wheat at different levels. The highest values for all sensory characteristics were observed in the control sample (Borelli G. M. et al. 1999). Flake samples with wheat flour) at all levels were found to be the highest values for all assessed sensory characteristics. There was no significant difference between control, replacement levels in appearance, color, taste, tenderness and adhesiveness in the samples of these flakes (**figure 4, figure 5**).

Figure 4: Photo of the flakes of durum wheat flour.

Figure 5: Photo of the flakes of soaked durum wheat.

4. Conclusion

We are interested in this work to study the development of prepared durum wheat processes like flakes with different cooking modes so: flakes of flour wheat durum, flakes of soaked wheat durum. These flakes have retained significant physico-chemical properties in natural wheat grains, but with very different textural shapes and properties. Therefore, it is relatively important to consider that this study has been interpreted for each flakes cooking mode and it can be concluded that the chemical composition, functional properties and values of all sensory characteristics have been observed in flakes. Wheat flour and quenching wheat flakes have approximate results.

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