The Effect of Cooking Process on the Physical and Chemical Properties of Chickpea Flakes and Faba Bean Flakes

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Abstract

In the present paper, an evaluation has been made for preparing the flakes of legumes (chickpea and faba bean) at deferent processes of cooking, where the analysis indicate that the physical properties and chemical compositions (Ash, Fat, Moisture, Protein and total carbohydrates) of the flakes of soaked chickpea (Cps) and soaked faba bean (Fbs) are proximate to flakes of chickpea flour (Cpf) and flakes of faba bean (Fbf) at significant differences ($P<0.05$); were observed between the two type of cooking flakes.

Major minerals contents (K, Ca, Na and Mg) and minor elements (Fe) were detected in flakes chickpea flour and flakes faba bean flour at elevated levels than that observed in flakes of soaked legumes. The investigation of the organoleptic evaluation of sensory characteristics for samples of the flakes from the soaked chickpea Cps and soaked faba bean Fbs, the flakes from the flours of chickpea Cpf and flours of faba bean Fbf represent no considerable difference between control, replacement levels regarding appearance, color, taste, and tenderness.

Key words: Chickpea, faba bean, flakes, processes of cooking, chemical compositions.

1. Introduction

Legumes occupy an important role in human nutrition because they are significant nutritional sources of healthy protein, and are great sources of fibre, complex carbohydrates, vitamins and minerals (Costa et al., 2006 and Wang et al., 2010). Pulses are low in fat and glycaemic index (Cuvelier et al., 2017) and is relatively free from anti-nutritional factors (Wood and Grusak, 2009). New research on legumes consumption has been shown to protect against certain cancers, high cholesterol, type 2 diabetes and obesity (Hall et al., 2016). Where the significance of pulses was recognized with the Food and Agriculture Organization of the United Nations (FAO UN) declaring 2016 the international year of the pulse (FAO, 2016), promoting the role of pulses in the sustainable supply of healthy food (McDermott and Wyatt, 2017).

Inclusion of legumes in the daily diet has many beneficial physiological effects in controlling and preventing various metabolic diseases where are generally consumed after various processes like soaking, cooking, milling, roasting, puffing, and germinating. Effect of cooking methods on some of the quality parameters of the finished products has been studied by different researchers like: Nisha et al. (2005), Nergiz and Gökgöz. (2007) and Demet al. (2012).

Among the grain legumes, faba bean (Vicia faba L.) and chickpea (Cicer arietinum L.) are the world leading grain legumes and are the used as rich source of proteins. Faba bean and chickpea are a high yielding legume with good nutritional profile; being consumed by humans. For this reason in our study, we prepared legumes (fababean, chickpea) 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.

2. Materials and methods

2.1. Sample collection

Chickpea (Cicer arietinum L.), faba bean (Vicia faba L.), were obtained from a legume processing company in BISKRA, ALGERIA. They were all harvested in 2016; this legumes seeds were manually cleaned to remove foreign materials and damaged grains.

2.2. Processing methods to preparation of flakes Chickpea and flakes faba bean

Preparing the flakes from the soaked chickpea PS and soaked faba bean FS

Soaking of legumes: Soaking of Chickpea and faba bean was conducted at room temperature (25ºC) for 12 h in fresh deionizer water was used in all soaking experiments. (Seeds/water ratio = 1/10).

Forming into flakes: The soaked chickpea and soaked faba bean are filtered from water and forming into flakes where roller gap set to two different widths 800µm-1000µm.

Roasting: Roasting and drying the flakes of chickpea and flakes of faba bean with the oven at 180°C - 200°C for 18 minutes.

The resulting flakes were analyzed and the following quality parameters assessed,

Preparing the flakes from the flours of chickpea PF and flours of faba bean FbF

The samples were separately milled using a hammer mill (Retch. RM 200.), into flours of 1 mm sieve size and preparation of dough by chickpea flours and faba bean flours in the mixer by deionizer water, and forming into flakes where roller gap set to two different widths 600µm-900µm.

Roasting: Roasting and drying the flakes of chickpea and flakes of faba bean with oven at 150°C - 180°C for 20 minutes or 15 minutes.

The resulting flakes were analyses and the following quality parameters assessed,

2.3. Physicochemical properties of the flakes of chickpea and flakes of faba bean

- **Water content**

The moisture content of flakes chickpea and flakes faba bean is measured in an isothermal vacuum oven brand, according to the method described by the AFNOR standard (NF V 03-707).

- **Ash content**

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

- **Minerals determination**

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

- **Lipids determination**

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

- **Determination of crude fiber**

The estimation was done using the method of Wend.

- **Protein solubility**

Protein solubility of raw and processed flours was determined according to Clemente et al., (1998) (A.O.A.C, 2000).

Moisture, protein, fat, crude fiber and ash were determined in different samples flakes chickpea and faba bean according to the methods described in the A.O.A.C. (2000).

A total carbohydrate was calculated by difference.

The carbohydrate content was calculated by difference on dry basis:

[**Carbohydrate% = 100–(ash% + lipid% + protein %+ crude fiber %**)].

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

3. Results and discussion

3.1. Physical properties and chemical compositions

Data in (**figure 1**) indicate the physical properties and proximate chemical compositions of the legume samples and their flakes used in this study. Processing and cooking treatments caused a decrease in protein, crude fiber, fat contents and carbohydrates of legumes chickpea and faba bean, these decreases might be attributed to their diffusion into cooking (Alajaji and El-Adawy, 2006). Moisture, dry matter, and ash content in flakes of soaked chickpea and flakes of soaked faba bean were higher than flakes prepared by chickpea flour and faba bean flour is clarify by the decomposition of soaking water in grain of chickpeas and grain of faba bean.

Legend

Cp0: chickpea. Fb0: faba bean

Cpf: flakes prepared from chickpea flour Fbf: flakes prepared from faba bean flour

Cps: flakes prepared from chickpea soaked Fbs: flakes prepared from faba bean soaked

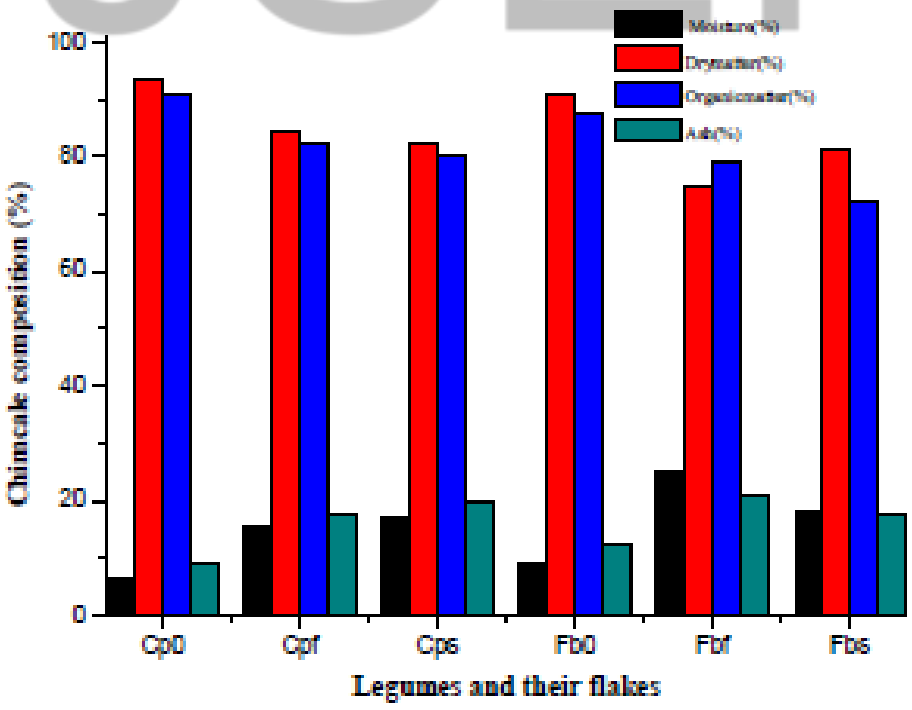

Fig.1: Chemical composition of legumes and their flakes

Moisture, dry matter, organic matter and ash.

However in **figure 2** fat, protein and total carbohydrates were detected in flakes of chickpea flour and flakes of faba bean flour is higher level than that found in flakes prepared by soaked legumes this explain by formed after possible chemical modification induced by the soaking the legumes and those cooking. These results are in agreement with individuals obtained by Guo et al., (2008) and Guo et al., (2010). These results confirmed by statistical analysis, which highly significant differences ($P<0.05$) were observed between the two type of cooking flakes.

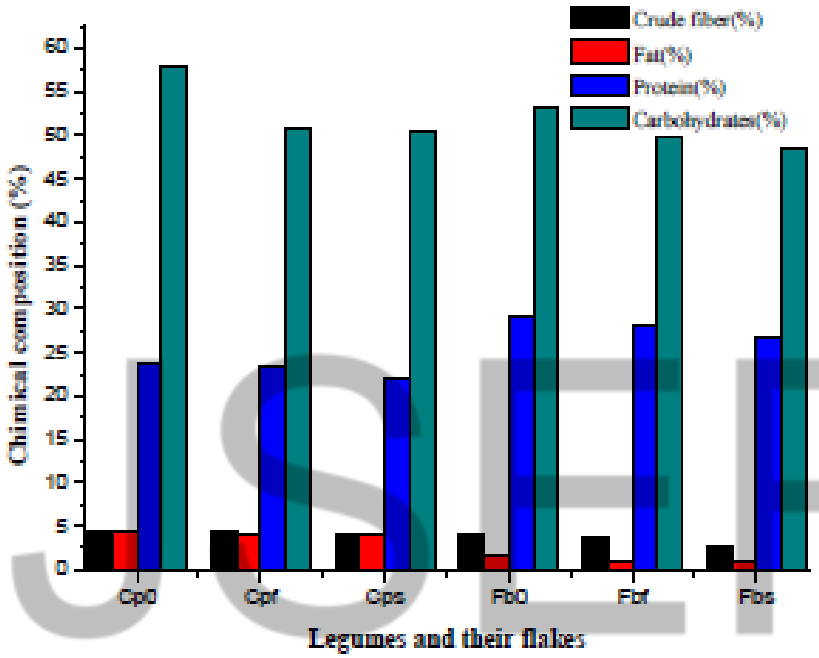

Fig.2: Chemical composition of legumes and their flakes

(Fat, protein, crude fiber and total carbohydrates).

3.2. Minerals contents

Minerals contents of chickpea flour and faba bean flour, their flakes and flakes of soaked chickpea and flakes of soaked faba bean were investigated. Data showed that major minerals (K, Ca, Na and Mg) and minor elements (Fe) were detected in flakes chickpea flour and flakes faba bean flour at higher levels than that observed in flakes of soaked legumes. The content of K, Ca, Na, Mg and Fe in raw chickpea flour (8.22mg/l, 312,129,128 and 70 mg/l), respectively and faba bean were equal about (7.826mg/l, 282.7mg/l,141mg/l,109mg/l and 0,99mg/l). These levels were decreased as processing methods applied. This decrease is mainly due to the minerals leached from the chickpea seeds and faba bean into the water during soaking treatments. Similar finding were observed by Gupta et al., (2006), Wang et al. (2008) and Wang et al., (2010).

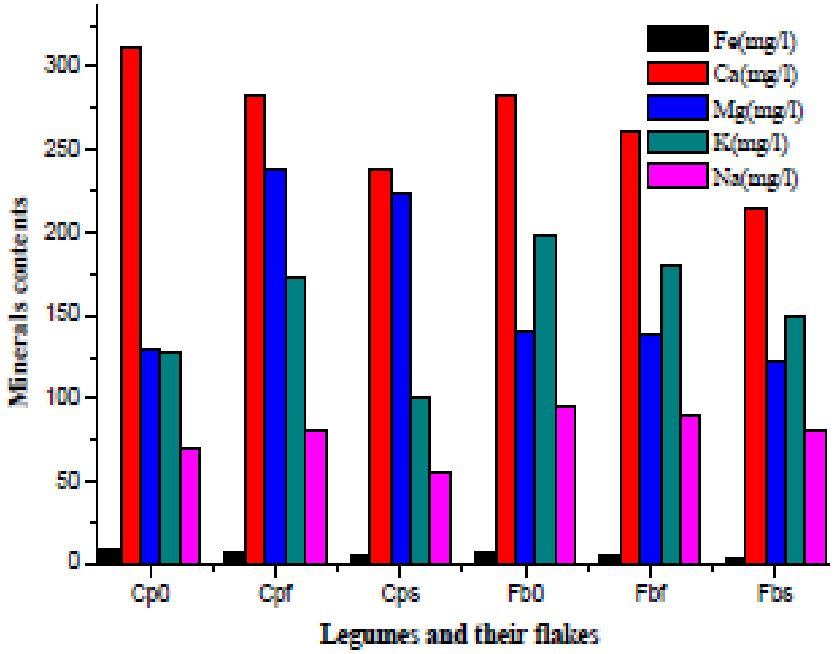

Fig 3: Minerals contents of chickpea and faba bean flours and their flakes.

3.3. Sensory characteristics of flakes at different procedure

The organoleptic evaluation of sensory characteristics for flakes sample of the flakes from the soaked chickpea Cps and soaked faba bean Fbs presented in figure 4, the flakes from the flours of chickpea Cpf and flours of faba bean Fbf : represent the mean scores for appearance, color, taste, tenderness and stickiness for prepared flakes with flours of legumes (chickpea and faba bean) and soaked legumes (chickpea and faba bean) at different levels. The highest values for all sensory characteristics were observed in control sample. Flakes samples with legumes flour at all levels were found to be the highest values for all evaluated sensory characteristics. There is no significant difference between control, replacement levels regarding appearance, color, taste, tenderness and stickiness in flakes samples contained faba bean raw. No significant differences were detected regarding the appearance of samples as a result of the presence of raw chickpea flours and their soaked of chickpea. Also, the same trend was found between faba bean flours and their soaked faba bean.

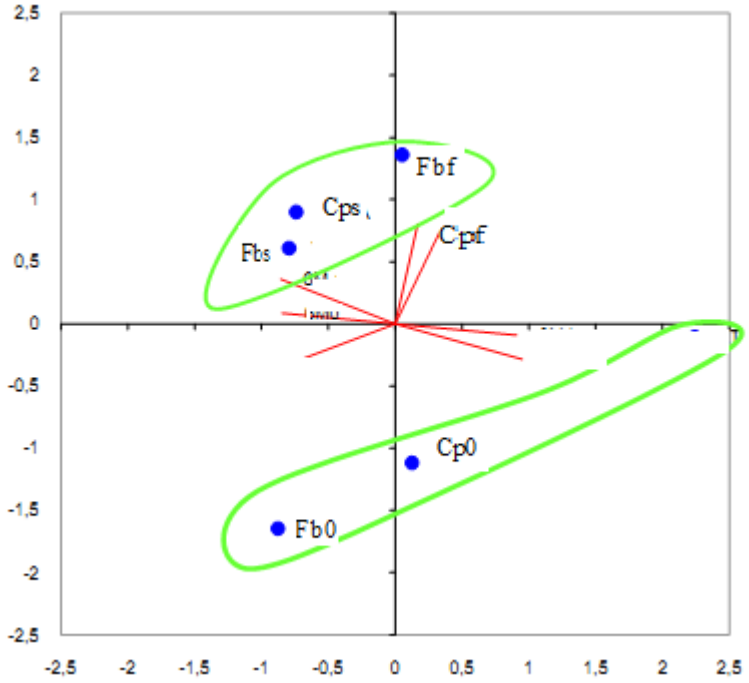

Fig. 4: Sensory characteristics of flakes at different procedure

4. Conclusion

We are interested in this work to study the development of processes suitable for preparing the legumes (chickpea and faba bean) like's crone flakes and enable suitable pre-processing parameters that allow for the formation of pulse flakes have been identified.

These flakes have maintained significant physicochemical properties in natural chickpeas and faba bean, however, with some significantly different forms and textural properties. Therefore, it is relatively important to consider that this study were interpreted for each legume (chickpeas, faba bean) prepared at different processing methods (Soaking of legumes and roasting, preparation of dough by chickpea flours and faba bean flours and forming into flakes and roasting) and it could be concluded that, chemical composition, functional properties and the values for all sensory characteristics were observed in flakes of chickpea and flakes of faba bean have the approximately results, which is acceptable product for human consumption.

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