Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
www.phytojournal.com
JPP 2020; 9(1): 2309-2312
Received: 04-11-2019
Accepted: 06-12-2019

Shaikh RP
Department of Food Chemistry and Nutrition, College of Food Technology, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, India

Gadhe KS
Department of Food Chemistry and Nutrition, College of Food Technology, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, India

Syed SJ
Department of Food Chemistry and Nutrition, College of Food Technology, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, India

Corresponding Author:
Shaikh RP
Department of Food Chemistry and Nutrition, College of Food Technology, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, India

Studies on physico-chemical and functional properties of flaxseed flour

Shaikh RP, Gadhe KS and Syed SJ

Abstract
The present work was proposed to study the physico-chemical and nutritional properties of flaxseed flour were investigated. Flaxseed is an oil seed used for the preparation of various nutritious food product as it is the rich source of alpha-linolinic acid which is essential amino acid. Result obtained were indicated that color of the flaxseed was brown in color, length, width, and thickness were, 5.20mm, 2.80mm and 0.80mm. Further chemical composition was reported and results showed that the moisture content 5.6 percent, fat content 35.2 percent, protein content 20.16 percent, ash content 2.6 percent, fiber content 6.3 percent and carbohydrate content 25 percent. Roasted and non-roasted flaxseed flours (*Linum Usitatissimum*) were evaluated for their proximate composition, mineral profile and functional properties. Significant increase in the crude protein, crude fiber, ash and mineral contents in the both roasted and non-roasted was observed. Roasted flour was observed to have highest value of water absorption capacity, bulk density such as (0.83g/cm^3), and (1.80g/g) as compared to non-roasted flour. Mineral profile and proximate composition of the roasted flaxseed flours showed that this can be added in the many types of food applications, while roasting effectively reduces the antinutritional factor of the flaxseed. Finally, it can be concluded from the obtained results that flaxseed was high in nutrients that makes it potential source for value addition in food commercialization.

Keywords: Flaxseed, roasting, flour, physicochemical and functional properties, mineral composition

Introduction

Flax (*Linum usitatissimum* L.), a member of the *Linaceae* family, is one of the most important oilseed crops for industrial as well as food and feed purposes. Flaxseed has been used as a human food since ancient times. Nowadays flaxseed is gaining popularity in the food sector for its functional properties, since it is a rich source of essential fatty acids, omega-6 essential fatty acids, lignans, vitamins and minerals. Desired health benefits have led to the development of a wide range of flaxseed fortified foods including breakfast cereals, snack foods, and soups (Daun *et al.*, 2003)[5].

The flaxseed is one of the grains gaining popularity in this respect. Flaxseed (*Linum Usitatissimum)* is generally cultivated for linen fiber or for oil from its seeds which is also called as linseed oil. The flax has been used as a precious nutritional product and as a traditional medicine from ancient times. Flaxseed is richest source of alpha-linolenic acid, lignans and other nutritional components. The protein content of flaxseed was recorded about 20 per 100 grams of dried grain. Flaxseed has an amino acid profile comparable to that of soybean flour and contains no gluten (Hongzhi *et al.*, 2004) [7]. The flaxseed contains both soluble and insoluble fibers. About one-third of the fiber in flaxseed is soluble and it may help to lower cholesterol and to regulate levels of blood sugar. The remaining two-thirds of the fiber in the flaxseed is insoluble which aids digestion by increasing bulk and preventing constipation. (Institute of Medicine, 2002)[8].

The commercial utilization of flaxseed proteins in food products depend on its functional properties before its incorporation in various food products. The improvement in a range of functional properties may be achieved either by genetic modification, chemical processing or physical treatment of the proteins (Oomah and Mazza, 1993) [11]. The functional properties of different proteins can be employed to figure out the fact that how flour proteins can be used to supplement, fortify, enrich or replace more expensive protein sources which are used traditionally(Akobundu *et al.*, 1982) [1].

Flaxseed can be added to baked products as a whole seed, imparting a healthy appearance and increased texture quality. However, flaxseed can be ground (milled) prior to consumption to obtain the potential health benefits from the omega-3 fatty acids and lignans. Flaxseed is high in mucilage (gums) that can increase the water absorption properties of the dough, which can impact mixing time and dough handling characteristics. The American Institute of Baking recommends additional formula water at a rate of 75 percent of the added ground flaxseed by weight (Anonymous 1995) [2]. The functional properties of commonly used plant materials like soybean, cowpea and pigeon pea are studied extensively by many scientists (Narayana and Rao, 1982) [9].

Materials and methods
The good quality of flaxseed was procured from Parbhani local market. The seeds were cleaned manually. The moisture content of seed was determined using the hot air oven method (AOAC, 2000).

Cleaning and roasting of seeds
The seeds were cleaned manually, dried in air and half of grains were roasted. Roasting of whole flaxseed were done using conventional oven at temperature of 160-180 °C for different time treatments like 5, 10, and 15 min.

Milling of Flaxseed Grains
Roasted and raw grains were milled through a “Grinder” and sieved to obtain full fat flaxseed flours. All types of flours were packed in polythene bags and stored at room temperature until used.

Analytical methods
The flaxseed were analyzed for chemical composition namely moisture, protein, fat, ash, crude fiber and minerals composition includes calcium, phosphorus, iron was carried out as per the method given by (AOAC, 2005) [3]. nutrient were analyzed in duplicate and result were expressed on dry weight basis.

Proximate analysis
Different chemical properties of samples were analyzed for moisture content, ash, fat, protein and total carbohydrate. All the determinations were done in triplicate and the results were expressed as the average value.

Moisture content
Moisture content was determined as per the method given by (AOAC, 2005) [3]. It was calculated using following formula.

$$\% \text{ Moisture content} = \frac{\text{Loss in weight}}{\text{Weight of sample}} \times 100$$

Ash
Drying the sample at 100 ^{0}C and churned over an electric heater. It was then ashes in muffle furnace at 550 ^{0}C for 5 hrs. It was calculated using the following formula:

$$\% \text{ Ash content} = \frac{\text{Weight of ash}}{\text{Initial Weight of sample}} \times 100$$

Fat
AOAC (2005) method using soxhlet apparatus was used to determined crude fat content of the sample. The percent of crude fat was expressed as follows:

$$\% \text{ Crude Fat} = \frac{\text{Weight of oil}}{\text{Weight of sample}} \times 100$$

Protein
Protein content was determined using AOAC (2005) method. Percentage of nitrogen and protein calculated by the following equation:

$$\% \text{ Nitrogen} = \frac{TS - T_B \times \text{Normality of acid} \times 0.014 \times \text{Dilution factor}}{\text{Aliquot taken} \times \text{Weight of sample}} \times 100$$

Where, Ts = Titre volume of the sample (ml), TB = Titre volume of Blank (ml), 0.014= M eq. of N
% Protein = Nitrogen × 6.25

Total carbohydrate
Total carbohydrate content of the samples was determined as total carbohydrate by difference, calculated by subtracting the measured protein, fat, ash and moisture from 100.

Determination of minerals
Two grams of defatted sample was weighed and heated at 550 ºC. Then, the obtained ash were digested with concentrated Hydrochloric acid (HCL) on hot plate. The digested material was then filtered using what man No. 42 filter paper and the final volume made to 100ml with distilled water that was further used for analysis with respects to iron, calcium, potassium, contents by using methods (Ranganna S. 1986)[12].

Functional properties
Water and oil absorption capacities
The determinations of water and oil absorption capacities were carried out according to the method as described by (Sosulski *et al*., 1976) [16]. After mixing a 10 ml distilled water or oil with 1 g flaxseed flour, the contents were allowed to rest at 30± 2 °C for 30 minutes and then centrifuged at 200g for 30 minutes and finally the water and oil absorption capacities of the flours were expressed as grams of water or oil absorbed by 1g of flaxseed flour.

Bulk density
It was determined according to the method of (Okaka and Potter 1979) [10]. 50g flaxseed flour was taken into a 100 millilitre volumetric cylinder. The cylinder was tapped several times on a laboratory bench to attain a constant volume. The bulk density (g/cm^3) was then calculated as weight of flaxseed flour (g) divided by flour volume (cm^3).

Results and Discussion
Physical properties of flaxseed
Various physical properties of Flaxseed were determined, and results obtained are presented in Table 1.

Table 1: Physical Parameters of flaxseed

Physical parameter	Observation
Color	Light brown
Shape	Flat oval
Length (mm)	5.20±0.02
Width (mm)	2.18±0.01
Thickness (mm)	0.80±0.01
Weight of 1000 seed (g)	7.00±0.03

*Each value is an average of three determinations

The data given in Table 1 revealed various physical characteristics of flaxseed such as colour is an important characteristic for determining the visual acceptance. The colour of flaxseed was found to be light brown to tan, whereas, flat to elongated oval in shape. Different dimensional properties like length, width, and thickness was measured and showed 5.20(mm), 2.18 (mm) and 0.80 (mm) respectively. The results for 1000 kernel weight was reported to 7.00 (g) respectively. Results reported are in close agreement with these findings of (Singh *et al.*, 2011) [15].

Chemical and mineral composition of non-Roasted and roasted flaxseed flour

The data refers to various chemical and mineral properties such as moisture, fat, carbohydrate, protein, ash and crude fiber of roasted and non-roasted flaxseeds flour were determined and results obtained and illustrated are Table 2 and Table 3 respectively.

Table 2: Proximate composition of flaxseed flour.

Chemical properties	Mean Value (%)	
	Roasted flaxseed flour	Non roasted flaxseed flour
Moisture	4.13±0.02	6.71±0.15
Ash	3.25±0.0	3.21±0.04
Total Protein	20.27±0.28	20.21±0.44
Total Carbohydrate	28.54±0.2	25.12±0.09
Crude fiber	7.11±0.09	7.05±0.27
crude fat	36.41±0.54	36.55±0.13

*Each value represents the average of three determinations

The chemical composition of roasted and non-roasted flaxseed flour sample were presented in Table 2. Moisture content of non-roasted flour is significantly higher (6.71%) in moisture content as compared to roasted flour (4.13%). Ash, fiber and carbohydrate content of roasted and non-roasted flaxseed flour were (3.24%), (3.21%), (7.11%), (7.05%), (28.24%), (25.12%). Crude protein content was not much affected by roasting, both flour has approximately 20% protein. The crude fat content of the non-roasted flaxseed flour (36.55%) and roasted flaxseed flour (36.41%) were non-significantly affected. Results reported are in close agreement with the finding of (Shahzad *et al.*, 2008) [13].

Table 3: Mineral composition of Flaxseeds

Minerals (mg/100gm)	Roasted flaxseed flour	Non roasted flaxseed flour
Calcium (Ca)	215.01±0.2	233±0.1
Phosphorus (P)	820.25±0.1	635±0.1
Iron (Fe)	5.3±0.03	2.85±0.02

The mineral composition of flaxseed were analyzed and results revealed that the minerals such as phosphurs and iron increased with roasting from 635 to 820mg/100g and 2.85 to 5.56mg/100g, respectively. Result reported are in close agreement with these findings of (Shinde *et al.*, 2019) [14].

Functional properties

Some functional properties of different flaxseed flours are presented in Table 4. The bulk density of a good material is important in relation to its packaging. As shown in Table 4, the bulk density was lowest (0.78g/cm3) in non-roasted flaxseed flour and highest (0.83g/cm3) in roasted flaxseed flour. It is obvious from the results that roasting significantly increased the bulk density of flours.

Table 4: Functional properties of different flaxseed flours

Functional properties	Roasted flaxseed flour	Non roasted flaxseed flour
Bulk density (g/ml)	0.83±0.05	0.78±0.1
Water absorption capacity (g/g)	1.80±0.08	1.48±0.06
Oil absorption capacity (g/g)	1.31±0.02	1.20±0.01

Result revealed that the functional properties such as water absorption capacity and oil absorption capacity of different flaxseed flour are (1.80g/g), (1.48 g/g), (1.31 g/g), (1.20g/g). The fat absorption capacity is a prominent factor in food formulations because it improves flavour and increase the mouth feel of foods. In this study fat absorption capacities were higher in roasted flaxseed flour (1.31g/g). Result reported are in close agreement with these findings of (Egbekun and Ehieze 1997) [6] and (Azher and saini 2016)[4].

Conclusion

It can be concluded from the findings of present research that roasting of flaxseed results in the reduction of antinutritional factor and improvement in the chemical, minerals, functional and nutritional properties of flaxseed flours. The improvement in the functional properties of flaxseed flour ultimately increases its suitability for its utilization in a number of food products. Hence flaxseed can be incorporated in commercial flours and provides which are low in protein as composite flour that can be utilized in bakery products like cookies, muffins, biscuits, and buns. Consumption of foods formulated or fortified with flaxseed flours would be an important step toward relieving protein malnutrition in the poor countries of the world.

References

1. Akobundu EN, Cherry JP, Simmons JG. Chemical, functional and nutritional properties of egusi seed protein products. Journal of Food Science. 1982; 47(1):829-835.
2. Anonymous. General baking information American Institute of Baking. Technical Bulletin, 1995, XVII(4).
3. AOAC. Official Methods of Analysis. Association of Official Analytical Chemists International. In: Horwitz, W. (Ed.), 18th Ed. AOAC Press, and Arlington, VA, USA, 2005.
4. Azhar K, Saini C. Effect of roasting on physicochemical and functional properties of flaxseed flour. Cogent Engineerin. 2016;, 3:1.
5. Daun JK, Barthet VJ, Chornick TL, Duguid S. Structure, composition, and variety development of flaxseed. In: Flaxseed in Human Nutrition (Eds S.C. Cunnane LH, Thompson). AOCS Press, Champaign, IL, USA, 2003
6. Egbekun MK, Ehieze MU. Proximate composition and functional properties of fullfat and defatted beniseed (*Sesamum indicum* L.) Flour. Plant Foods for Human Nutrition. 1997;. 51(1):35-41.
7. Hongzhi Y, Zhihuai, Hequn T. Determination and removal methods of cyanogenic glucoside in flaxseed. ASAE/CSAE meeting presentation, 2004, 40-66.
8. Institute of Medicine. Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids, Nat. Acad. Press Washington, 2002.
9. Narayana K, Narasinga R. Functional properties of raw and heat processed winged bean (*Psophocarpus tetragonolobus*) flour. Journal of Food Science. 1982; 42:534-538.
10. Okaka JC, Potter NN. Functional and storage properties of cowpea-wheat flour blends in bread making. Journal of Food Science. 1977; 42(1):822-833.
11. Oomah BD, Mazza G. Flaxseed proteins. A Review Food Chemistry. 1993; 48(1):109-114.
12. Ranganna S. Handbook of Analysis and Quality Control for Fruit and vegetables Products. Second Edition. Tata McGraw Hill Publishing Limited, New Delhi, 1986.

13. Shahzad H, Faqir MA, Masood SB, Munir AS. Chemical Compositions and Functional Properties of Flaxseed Flour. Sarhad Journal of Agriculture, 2008, 24(4).
14. Shinde E, Pawar V, Sontakke M, Kale P, Salve R. Comparative study on effect of roasting treatment on nutritional properties of flaxseed. International Journal of Chemical Studies. 2019; 7(2):33-35.
15. Singh KK, Mridula D, Rehal J. Physical and chemical properties of flaxseed. International journal of Agro physics. 2011; 26(1):423-426.
16. Sosulski FW, Garratt MD, Slinkard AE. Functional properties of ten legume flours. Institute of Food Science and Technology Journal. 1976; 9(1):66-69.