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Studies on Physico-chemical and mineral evaluation of flaxseed

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Abstract

The present investigation was carried out to study the physical, chemical and mineral composition of flaxseed. The results obtained indicates the mean length (5.21 mm), width (2.17 mm), thickness (0.78 mm), weight of thousand seeds (6.99g), true density (1058 kg m⁻³), angle of repose (24.59°) of the flaxseed. The chemical composition results showed the moisture content 6.5 percent, fat 36.7 percent, carbohydrate 26.1 percent, protein 19.67 percent, ash 2.41 percent and crude fibre 5.49 percent. The phosphorus content of flaxseed was found to be highest 638 mg/100gm than other minerals; calcium 231.5 mg/100gm, magnesium 288.2 mg/100gm, zinc 21.67 mg/100gm and iron 2.83 mg/100gm. Finally, it can be concluded from the results that flaxseed found to be rich in nutrients that makes it potential source for value addition in food commercialization.

Keywords: Flaxseed, crude fibre, phosphorus, value addition

Introduction

Flaxseed (*Linum usitatissimum*) is a blue flowering annual herb which produce small flat seeds varying from golden yellow to reddish brown colour belonging to family *Lineaceae*. Flaxseed possesses crispy texture and nutty taste (Morris 2007; Rubilar *et al.*, 2010) ^[3, 6]. Flaxseed is also known as linseed and these terms are used interchangeably. Flaxseed is often used to describe flax when consumed by humans while linseed denotes when it is used specifically for industrial applications (Morris 2007) ^[3]. Almost all parts of linseed plant are utilized for various purposes. Seed contains oil which after refining is used for edible purpose (Singh *et al.*, 2011) ^[9]. The stem yields fiber of good quality possessing high strength and durability. Humans have been consuming flaxseed since ancient times. It has been cultivated for fiber as well as for medicinal purposes and as nutritional product (Tolkachev and Zhuchenko 2000).

Canada is the world's largest producer and exporter of flaxseed. The important flaxseed growing countries include India, China, United States, and Ethiopia. India ranks first among the leading flaxseed producing countries in terms of acreage accounting 23.8% of the total and third in production contributing to 10.2% of the world's production (Singh *et al.*, 2011) ^[9]. In India flaxseed is mainly cultivated in Madhya Pradesh, Maharashtra, Chhattisgarh and Bihar. It is interesting to know that flaxseed was native of India and was a staple food crop. In India, flaxseed is still being consumed as food and as well as for medicinal purposes.

Flaxseed contains functional components such as dietary fibre, oil, protein and phenolic compounds, which are responsible for a number of health benefits. Flaxseed has a unique fatty acid profile. It is high in polyunsaturated fatty acids and low in saturated fatty acids. Linoleic acid, an omega-6 fatty acid, constitutes about 16% of total fatty acids whereas a-linolenic acid constitutes about 57%, the highest of any seed oil (Ramcharitar *et al.*, 2005) ^[5].

Materials and Methods

Flaxseed was obtained from local market, Parbhani. The proposed research was carried out in Department of Food Chemistry and Nutrition, College of Food Technology, VNMKV, Parbhani.

Physical properties of flaxseed

The various physical properties such as weight was measured using digital electronic weighing balance. Whereas, shape, Colour, taste and flavour of raw oil seeds were determined by visual observations.

To measure physical property such as thousand kernel weight, one thousand kernels were counted and weighed by a digital weighing balance in three replication and mean value was recorded.

Proximate composition of flaxseed

Proximate Analysis

Different chemical properties of samples were analysed 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 adopting AOAC (2005) [1] method as following:

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

Fat

AOAC (2005) [1] method using Soxhlet apparatus was used to determine crude fat content of the sample. The percent of crude fat was expressed as follows:

$$\% \text{ Crude Fat} = \frac{\text{Weight of dried ether soluble material}}{\text{Weight of sample}} \times 100$$

Protein

Protein content was determined using AOAC (2005) [1] method. Percentage of nitrogen and protein calculated by the following equation:

$$\% \text{ Nitrogen} = \frac{\text{TS} - \text{TB} \times \text{Normality of acid} \times 0.014}{\text{Weight of sample}} \times 100$$

Where, Ts = Titre volume of the sample (ml), TB = Titre volume of Blank (ml), 0.014= M eq. wt. of N₂.

$$\% \text{ Protein} = \text{Nitrogen} \times 6.25$$

Total carbohydrate

Total carbohydrate content of the samples was determined as total carbohydrate by difference that is by subtracting the measured protein, fat, ash and moisture from 100 phenol sulphuric acid method as given by AOAC (2005) [1].

Ash

Drying the sample at 100 °C and charned over an electric heater. It was then ash in muffle furnace at 550 °C for 5 hrs. By AOAC (2005) [1]. It was calculated using the following formula:

$$\% \text{ Ash content} = \frac{\text{AW}}{\text{IW}} \times 100$$

Where, AW = Weight of Ash and IW= Initial weight of dry matter

Result and Discussion

Physical properties of flaxseed

Different physical properties such as shape, length, width, thickness, weight of thousand kernel, true density and angle of repose of flaxseed were evaluated and results obtained are

presented in Table 1.

Table 1: Physical properties of flaxseed

Physical Parameters	Observation
Shape	Flat oval
Length (mm)	5.21
Width (mm)	2.17
Thickness (mm)	0.78
Wt. of thousand seed (g)	6.99
True density (kg m ⁻³)	1058
Angle of repose (degree)	24.59

*Each value represents the average of three determinations

The physical characteristics of flaxseed was observed to be flat oval in shape. the mean length, width, thickness, weight of thousand seeds, true density, angle of repose of the flaxseed was 5.21 mm, 2.71 mm, 0.78 mm, 6.99 g, 1058 kg m⁻³ and 24.59° respectively.

Similar trends in densities have been reported for flaxseed (Selvi *et al.*, 2006) [7].

Chemical properties of flaxseed

Data pertaining to various chemical properties like moisture, fat, carbohydrates, protein, ash, and crude fiber were investigated and results obtained are depicted in Table 2

Table 2: Chemical composition of flaxseed

Chemical Parameters	Mean Value*
Moisture (%)	6.5 ± 0.03
Total Fat (%)	36.7 ± 0.03
Total carbohydrates	26.1 ± 0.1
Total Protein (%)	19.67 ± 0.04
Ash	2.41 ± 0.01
Crude Fiber	5.49 ± 0.02

*Each value represents the average of three determinations

The data in the above table showed that the moisture content 6.5 per cent, fat 36.7 per cent carbohydrate 26.1 per cent, protein 19.67, ash 2.41 and crude fiber 5.49 respectively. These results were in close agreements with the findings of Morris (2007) [3], Morris (2003) [4] and Kajla (2015) [2].

Mineral composition of flaxseed

The results given with respect to various minerals such as Ca, P, Mg, Fe, Cu and Zn were determined and accordingly results presented in Table 3.

Table 3: Mineral content in flaxseed

Minerals	Average value (mg/100g)
Calcium	231.5
Phosphorus	638.3
Magnesium	288.2
Iron	2.83
Copper	14.1
Zinc	21.67

*Each value is an average of three determinations

The mineral content of flaxseed was evaluated and found that the phosphorus content of flaxseed found to be highest (638.3 mg) than the rest of other minerals. From the results obtained it was clearly seen that flaxseed is potent source of phosphorus. The study showed that flaxseed was good sources phosphorus, calcium, iron, zinc and calcium. Results are in line with those reported by Morris (2007) [3].

Conclusion

Flax seeds contain important quantities of compounds with functional and bioactive properties whose effects on the prevention of certain non-transmissible chronic diseases have been tested. These characteristics make flax seeds an attractive source of functional ingredients for the preparation of food stuffs. Importance of these properties in determining the size of the machines particularly that of the separation, transfer, and sorting equipment. Flaxseeds can be processed into various value added products such as energy bars, ladoo, cookies, beverages like smoothies.

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