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Proximate, mineral and anti-nutritional (Cyanogenic glycosides) properties of flaxseed (*Linum usitatissimum*)

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Abstract

Flaxseed, natural super food with a potent nutritional punch, powerhouse of complete protein, fat, fibre, minerals and high antioxidant content, these seeds are fantastic at scavenging free radicals and helpful when used to cure constipation, diabetes, high cholesterol, heart disease, cancer, and a number of other illnesses. The purpose of the current study is to evaluate nutritional and anti-nutritional (Cyanogenic Glycosides) properties of flaxseed. Cyanogenic Glycosides is natural plant poison that can be harmful to humans. Two different types of flaxseed were procured. Flaxseed varieties were procured from the Agriculture Research Station, Agriculture University, Ummedganj, Kota viz., KBA-5 and KBA-6 respectively. The findings of the present study revealed mean composition of proximate composition with moisture (4.17%), crude protein (17.26%), crude fat (26.09%), crude fibre (16.75%), ash (2.95%), carbohydrates (32.63%) and energy 435.07 kcal per 100g of flaxseed. Average mineral composition of iron was analysed as 4.66mg, calcium 200.96mg and phosphorus with 556.10mg per 100g. Anti-nutritional factor which includes evaluation of cyanogenic glycosides in 100g sample has average value of 578.99mg in the two flaxseed varieties. It can be concluded from the above results that flaxseeds are nutrition rich food product which can be included in our daily diet and flaxseed consumption of 50g per day had no negative effects on human health.

Keywords: Flaxseed, varieties, Nutritional, anti-nutritional, health effect and Cyanogenic glycosides

Introduction

Flax (*Linum usitatissimum*) is an annual plant in the Linaceae family. This is a blue colour flowering annual herb with small flat seeds ranging in colour from golden yellow to reddish brown. Flaxseed has a crunchy texture and a nutty flavour (Rubilar *et al.*, 2010)^[18]. Flaxseed is also known as linseed, it is commonly known as *Alsi* in Hindi. *Linum usitatissimum*, which means "very useful," is the Latin name for flaxseed (Naik *et al.*, 2020). India's northern and southern areas both grow flaxseed, a cold-season crop. Flaxseed crop's typical output ranges from 210 to 450 kg of seed per hectare. And the yield of an irrigated crop can be between 1,200 and 1,500 kg/ha. It is primarily grown in Madhya Pradesh, Maharashtra, Chhattisgarh, and Bihar in India. Flaxseed is referred to as a "functional food" by some, which denotes that it can be consumed to improve one's health (Agricultural Marketing Research Centre, 2022)^[1], constipation, diabetes, high cholesterol, heart disease, cancer and several other ailments are all prevented by using it as a dietary supplement.

Flaxseeds have high content of alpha-linolenic acid (ALA), dietary fibre, high quality protein, and phytoestrogens (Goyal *et al.*, 2014)^[10]. Minerals found in flaxseeds like Iron, calcium and phosphorus can potentially reduce the chances of developing several illnesses (Bjarnadottir, 2019)^[7]. Consuming flaxseed on a daily basis can reduce cholesterol in hypercholesterolemic patients, as well as lower various markers associated with atherosclerotic cardiovascular disease (Bassett *et al.* 2009). The seeds can be eaten raw or toasted, and they can be ground or added whole to salads, breakfast cereals, and smoothies, as well as baked goods (Cunningham, 2022)^[9].

Anti-nutrients known as cyanogenic glycosides (natural plant toxins) are found in a flaxseed, the majority of which are eaten by people. Cyanogenic glycosides, which when consumed can breakdown to poisonous HCN (Bekhit *et al.*, 2013)^[5], may result in neurological symptoms such as growth retardation and central nervous system tissue damage. This can be detoxified during processing, which lowers the danger of cyanide poisoning. Flaxseeds also contain phytic acid which is frequently referred to as an antinutrient because it may inhibit the absorption of minerals such as iron and zinc. (Bjarnadottir, 2019)^[7]. In recent years, there has been an upsurge in flaxseed intake.

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People are unaware of the toxic cyanogenic compounds that are present in the flaxseed. The cyanogenic component of flaxseed may limit the potential benefits of flaxseed.

As a result, the study was designed to analyse the nutrient and anti-nutrient content of the two flaxseed varieties. The purpose of the current study is to evaluate nutritional and anti-nutritional (Cyanogenic Glycosides) properties of flaxseed. The findings of this study contribute to the development of an efficient and optimised method for using flaxseed as a functional food.

Material and Methods

Locale of the study

The Present study was conducted at the Department of Food Science and Nutrition, College of Community and Applied Sciences, Maharana Pratap University of Agriculture and Technology Udaipur, Rajasthan.

Sample Collection

Two different types of flaxseed were procured. All of the following were procured from the Agriculture Research Station, Agriculture University, Umedganj, Kota viz., Kota Barani Alsi-5 and Kota Barani Alsi- 6 respectively.

Sample preparation of the flaxseed varieties

The selected flaxseed varieties was cleaned to prevent error in the samples, winnowing and handpicking were followed by sieving to eliminate dust, foreign particles, husk, and stones. After which flaxseed was grinded using an electric mixer, and was grounded into a fine powder. In the end, flaxseed meal was kept in zip-lock bags to protect it from rotting, moisture, heat, and sunlight then all the zip locked bags were kept in the refrigerator to prevent rancidity. As a result, 2 different samples were prepared in lot of 100g for the analysis.

Proximate analysis of the selected flaxseed varieties

It is a collection of closely related substances' estimate. It involves figuring out how much moisture, crude protein, crude fat (ether extract), crude fibre and ash. To ascertain the proximate composition, standard techniques were applied (AOAC, 2000) [3]. Carbohydrate was calculated by difference of moisture, protein, fat, ash and crude fibre from 100%. The energy (E) content was calculated using, $E = (9 \times \text{Protein}) + (4 \times \text{Fat}) + (4 \times \text{Carbohydrate})$.

Mineral composition analysis

Mineral estimation of the two flaxseed varieties was done; wet ashing was used to create mineral solutions from selected samples, according to a method cited by Jain and Mogra in 2006. The titrimetric method was used to estimate calcium (Cheng and Bray, 1951) [8]. Atomic Absorption Spectrophotometer has been used to determine the iron content in the following flaxseed samples (Bishnoi and Brar, 1988). Phosphorus was analysed using standard method cited from Jain & Mogra, 2006.

Analysis of anti-nutritional content in the selected flaxseed varieties

Analysis of the anti-nutrient of the two selected flaxseed varieties was done using alkaline titration to calculate the HCN level of flaxseed meal in accordance with AOAC (2005) [2] Method 26.115.

Statistical analysis

All data obtained were analysed in duplicate and subjected to the analysis of variance (ANOVA) using Statistical Package for Social Science (SPSS) version 23.0.

Results

Proximate composition of the selected flaxseed varieties

Among the proximate parameters, a significant difference in moisture content was observed among the two selected flaxseed varieties (Table 1). The moisture content ranged between 5.00-.35%. Maximum value for fat content was noticed in variety KBA-5 with 29.18% fat content. The highest value for protein content 18.14% was detected in variety KBA-6. Maximum content of crude fibre was noticed in variety KBA-6 with 17.07% crude fibre content. Low difference was observed in the ash content of the two flaxseed varieties and the average content was found to be 2.95%. The highest value 35.64% for carbohydrates content was observed in the flaxseed variety KBA-6. The maximum mean value for energy per 100g was observed in the flaxseed variety KBA-5 with 448.00 kcal/ 100g.

Table 1: Composition of proximate principles in different varieties of flaxseed

Proximate Principles (per 100g)	KBA-5	KBA-6	Mean	± SD
Moisture (g)	5.00	3.35	4.17	.63
Crude Fat(g)	29.18	23.00	26.09	2.77
Crude Protein (g)	16.38	18.14	17.26	.79
Crude Fiber (g)	16.44	17.07	16.75	.81
Ash (g)	3.00	2.91	2.95	.17
Carbohydrate (g)	29.62	35.64	32.63	2.82
Energy (Kcal)	448.00	422.15	435.57	44.98

Mineral composition of the selected flaxseed varieties

Observing the data for mineral content of the selected flaxseed varieties it was revealed that (Table 2), iron content among the two flaxseed varieties have average 4.66mg/100gm iron maximum value was observed in KBA-6, i.e., 4.82mg/100gm. The maximum value for Calcium per 100gm was observed in flaxseed variety KBA-5 with 203.74mg/100g The highest value 562.85mg/100g for phosphorus content was observed in the flaxseed variety KAB-5.

Table 2: Composition of Minerals in Selected Flaxseed Varieties

Proximate Principles (Values per 100g)	KBA-5	KBA-6	Mean	±SD
Iron (mg)	4.50	4.82	4.66	±0.20
Calcium (mg)	203.74	198.22	200.96	±4.93
Phosphorus (mg)	562.85	549.35	556.10	±12.00

Analysis of the anti-nutritional (Cyanogenic glycosides) content of the selected flaxseed varieties

In the current study the anti-nutrient content cyanogenic glycosides was estimated in two varieties of selected flaxseed, in raw flaxseed powdered sample the highest cyanogenic glycosides content was observed as 584.66 mg per 100g in variety KBA-6 and followed by KBA-5 with 573.33mg/100g.

Discussion

According to Khare *et al.*, (2021) [15], flaxseeds are nutrient-dense oilseeds that are a reliable source of dietary fibre (lignans), protein, vital fatty acids, iron, calcium, zinc, phosphorus, and magnesium, as well as antioxidants that are

crucial for human growth and development. According to the Indian Food Composition Table (2017), flaxseed contains 28.3g carbohydrates, 37.7g fat, 203g protein, 2.4g minerals and 4.8g fibre per 100gm. Kajla *et al.*, (2017) ^[14] concluded that good fats, high-quality protein, fibre, and minerals can all be found in flaxseeds. The germination process can boost the nutritional value of flaxseeds. He also stated that raw and germinated flaxseed contain 6.65% to 7.29% of moisture. The protein content of flax seeds ranges between 20 and 30%. Dietary fibre content reaches 28% by weight of whole seed, with a soluble/insoluble fraction ratio ranging from 20:80 to 40:60 (Martinchik *et al.* 2012) ^[16].

Table 3: Nutritional composition (%) of flaxseed

Component	Golden Flax	Brown Flax
Moisture	6.73 ±0.03	6.52±0.04
Ash	2.84±0.01	2.63±0.01
Total Lipids	37.57±0.71	38.13±1.39
Crude protein	23.24±0.06	24.42±0.11
Carbohydrates	29.61±0.76	28.29±1.45

(Sheisa *et al.* 2013) ^[19].

According to Gutte *et al.*, (2015) ^[11], antinutrients are found in flaxseeds. Linustatin and neolinustatin, p-gentiobiosides of acetone cyanohydrin and methyl ethylketone cyanohydrin, respectively, have been discovered as the two main cyanogenic glucosides found in flaxseed. Cyanogenic glycoside levels in whole flaxseed range from 250 to 550 mg per 100 g. The results of the present study are in line with this and were found statistically significant.

Conclusion

In conclusion, flaxseeds have high physiological energy value, good levels of proteins and fibre, calcium, iron, and phosphorus, and low carbohydrate content. Additionally flaxseeds rich in wholesome fats that are good for the human body also referred to as a "functional food" by some, which denotes that it can be consumed to improve one's health. Constipation, diabetes, high cholesterol, heart disease, cancer, and several other ailments are all prevented by using it as a dietary supplement. Flaxseeds' high phenolic content and antioxidant activity effectively imply that they can improve health when added to dietary products. Flaxseed's variety and quantity of nutrients can contribute to its ability to have a positive impact on health and add value to food preparation. Flaxseeds can be included in our daily diet and flaxseed consumption of 50g per day had no negative effects on human health.

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