

Nutritional Characteristics of Flaxseed and Its Application in Gummy Candy Preparation

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Abstract

Flaxseed or *Linum usitatissimum*, is a nutrient-dense functional food that is high in α -linolenic acid (ALA), dietary fibre, lignans, and proteins. It has several health benefits, including better digestive health, anti-inflammatory qualities, and cardiovascular protection. Flaxseed has drawn attention as a component in the creation of functional foods because of its high fibre and polyunsaturated fatty acid content. The nutritional makeup of flaxseed is examined in this study, with a focus on its antioxidant activity, omega-3 fatty acid concentration, and its uses in food formulations. In particular, adding flaxseed to gummy candy is being researched as a cutting-edge strategy to improve the nutritional value of confections. While maintaining product stability, the study assesses how adding flaxseed affects gummy texture, sensory qualities, and customer acceptability. The findings show that

without appreciably sacrificing flavour or texture, flaxseed-enriched gummy sweets have higher fibre content, better amounts of omega-3 fatty acids, and greater antioxidant qualities. This study demonstrates flaxseed's potential as a useful component in confections, providing a tasty and healthful substitute for conventional candies.

Keywords: Flaxseed, omega-3 fatty acids, dietary fiber, lignans, functional foods, gummy candy, food innovation.

Introduction

Now a days good health is a challenge of living as the current civilization where several degenerative lifestyle diseases are plagued. Mainly these diseases happened due to unhealthy food consumption. To much using food additives, uncontrolled food processing of food that effects the health. Growing awareness about the role of healthy diet and look up for wellness has fuelled interest in foods that work like medicine. Functional foods are provide healthy benefit beyond basic nutrition (Katare, Saxena, Agarwal, Prasad, & Bisen, 2012). Flaxseeds (*Linum usitatissimum*) is a super functional food. Flaxseed is a blue flowering crop that produces small in size and various colour ranging from golden yellow to reddish brown. The texture of flaxseed is crispy and nutty chewy taste (Gutte, Sahoo, & Ranveer, 2015). Flaxseed is one of the plant source of alpha-linolenic acid (omega 3 fatty acid) and soluble mucilage. It is also contain fat, protein and dietary fibre. Averaged 41% fat, 20% protein, 28% total dietary fibre, 7.7% moisture and 3.4% ash (Morris, 2003). Flaxseeds are three groups of compounds and also characterized by biological activity and functional properties: omega -3 family PUFA, soluble dietary fibre in the form of mucus and phytoestrogen properties lignans. Flaxseed gum (FSG) form about 8% of the seed mass weight although its dependent on extraction. Flaxseeds gum is a heterogeneous polysaccharide determined of xylose, galactose, glucose, arabinose, rhamnose and fucose. Flaxseeds gum is a good water holding capacities, because of its marked swelling capacity and high viscosity in aqueous solution. FSG also have gelation characterized that could form a thermos-reversible cold -set gel. The gelling temperature was lower (Chen, Xu, & Wang, 2006). FSG is

extract from the mixture of 2 type flaxseeds one is brown and another one is golden varieties by hot water extraction method. The average molecular weight was recorded as 1,322 kDa with a poly dispersity ratio of 1.6 for Mw/Mn and 2.4 for Mn/Mz. (Safdar, et al., 2019).

Composition

Flaxseed is rich in protein, dietary fibre and fat. The composition may vary with genetics, method of seed processing and growing environment (Soni, Katoch, Kumar, & Verma, 2016). Brown flaxseed is average 41% fat, 20% protein, 28% total dietary fibre, 7.7% moisture and 3.4% ash (Anonymous, 2001). Golden flaxseed is also contain 20-30% protein, 35-45% oil. It is known that flaxseed is a good source of polyunsaturated fatty acids.

Flaxseed Functional Food

Flaxseed is considered as functional food due to presence of 3 main bioactive components –alpha-linolenic acid, lignans and dietary fibre (Soni, Katoch, Kumar, & Verma, 2016). Here dietary fibre is important bioactive components which is also known as mucilage. Mainly its contain insoluble fibre which is fraction cellulose and lignin and the soluble fiber fraction are the mucilage (Soni, Katoch, Kumar, & Verma, 2016). Mainly soluble fiber form gel when it mix with water.

Flaxseed Gum Preparation

Brown and golden flaxseed selected for gum preparation. First extract all non-adherent mucilage from the flaxseed coat layer. After that soak flaxseed in deionized water (18.2m ohm) at 50°C for 2 hour under gentle magnetic stirring, the flaxseed to water ratio should be 1:10. The pH of the seed adjust either pH4 or pH8 with 0.1M HCl. Then, the flaxseed suspension is filter through a nylon mesh and the unredeemed solution centrifuge at 18500g for 15 min to remove impurities. After that supernatant was mixed with absolute ethanol in 1:2 ratio and stirring 1 hour under mechanical process. Again, the ethanolic suspension centrifuge at 18500g for 10 min. Collect polysaccharide globule and reconstitute then add 1M NaOH solution to adjust pH= 10. Complete dissolution of

the gum globule. The pH of the gum solution is adjusted at the isoelectric point, and keep stirring for 1 hour. Then, final centrifuge at 18500g for 30 min than neutralized with 1M NaOH. After that dialyzed against MilliQ water for 72 hour and record until no observable changes in the conductivity of the intermittently renewed. Then lyophilization or freeze drying for 7 days at -80°C. Finally, prepared flaxseed gum powder.

Nutritional Value

The nutritional value of Flaxseed is present here in table as mention below; Not only these but also flaxseeds are a good source of dietary fibre, omega-3 fatty acids and omega-6 fatty acid also including alpha-linolenic acid.

Nutrients	Amount per 100 g of edible flaxseed
Moisture (g)	6.5
Protein ($N \times 6.25$) (g)	20.3
Fat (g)	37.1
Minerals (g)	2.4
Crude fiber (g)	4.8
Total dietary fiber (g)	24.5
Carbohydrates (g)	28.9
Energy (kcal)	530.0
Potassium	750.0
Calcium (mg)	170.0
Phosphorous (mg)	370.0
Iron (mg)	2.7
Vitamin A (μg)	30.0
Vitamin E (mg)	0.6
Thiamine (B1) (mg)	0.23
Riboflavin (B2) (mg)	0.07
Niacin (mg)	1.0
Pyridoxine (mg)	0.61
Pantothenic acid	0.57
Biotin (μg)	0.6
Folic acid (μg)	112

Morris 2007; Gopalan et al. 2004; Payne 2000

Conclusion

Gelatin which is used as a thickener its totally come from animal source and commonly derived from collagen which

is taken from animal body parts (pigs' skin, cow bones, fish bones). Normally gelatin contains lots of protein. If not careful too much protein can cause several health problems including: Bone disorders, kidney problems, Increased risk of cancer, Liver disorders, heart disease. Whereas flaxseed gum is totally plant-based thickener. It contains omega 3 fatty acid which is good for brain function, heart health and also omega 6 fatty acid which contributes to overall development. It is also containing good amount of protein. In future, we can make gummy candy from flaxseed also.

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