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EXTRACTION AND CHEMICAL COMPOSITION OF FLAXSEED GUM (MUCILAGE) FROM DIFFERENT FLAXSEED VARIETIES

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ABSTRACT

The flaxseed gum was extracted from three different varieties from Maharashtra region namely NL-260, RLC-4, SLS-93 at different soaking temperature (30^{0}C, 60^0 C and 90^{0}C). The gum yield obtained in range from 5.1.-8.0%. The highest yield 8.0% was obtained from NL-260 at 90^{0}C and lowest yield 5.1% was obtained from SLS-93 at30^{0}C. The gums extracted from three varieties were evaluated for chemical composition. The moisture content ranged from 3.2-3.5% found highest(3.5%) in RLC-4 and lowest (3.2%) in NL-260. The crude fat content of gum was found to very low ranged from 0.39-0.44% highest (0.44%) in RLC-4 and lowest (0.39%) in SLS-93.The protein content of gum ranged from 2.93-3.12% highest (3.12%) in NL-260 and lowest (2.93%) in RLC-4. The ash content of gum ranges from2.85-3.11% found highest (3.11%) in NL-260 and lowest (2.85%) in RLC-4. The carbohydrate portion of flaxseed gum can be classified into a neutral and acidic fraction ranged from 0.52-0.56 and 0.58-0.64 g.g^{-1}respectively. In present study it was found that the per cent yield of gum increased as soaking temperature increased. It was also found that gum yield and chemical composition of gum of three different varieties of flaxseed varied significantly.

KEY WORDS
Flaxseed
Linum Usitatissimmum Flaxseed gum
Yield
Chemical composition

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INTRODUCTION

Flaxseed, or Linseed (*Linum Usitatissimmum*), popularly known as Alsi, Jawas, Aksebija in Indian languages, is blue flowering rabi crop and a member of family Linaceae. It is grown throughout the world including Canada, India, China, United States, Ethiopia and all over Europe. India contributes almost 20 per cent of the total world production of linseed. (FAO STAT, 2013) The renewed interest in flaxseed as a food source is due to it's health benefits attributed to it's components including lignans, á-linolenic acid (ALA), and soluble flaxseed gum (SFG) (Hall *et al*., 2006)

Flax mucilage (soluble flaxseed gum, SFG) occurs mainly at the outermost layer of hull. This fibre-rich hull is able to release mucilaginous material (soluble gum) easily when soaked in water. In earlier research analyses were based on the gum extracted from the whole seed or flax meal. (Qian *et al*.,2012)

The flaxseed coat, together with the endosperm, forms six layers. Mucilage or gum comes from the secondary wall material in the outermost layer (Daun *et al*., 2003). It is easily extracted from the seed coat by soaking in water. When hydrated, the mucilage cells swell, and their content exude on the surface of the seeds. Mucilage or gum makes up approximately 8% of the total seed weight. Several reports showed that extraction yield, protein content and physicochemical properties of the resulting mucilage depend on both the procedure and the variety of the raw material. (Barbary *et al*., 2009)

Flax mucilage contains between 50–80% carbohydrates and 4–20% proteins and ash. The major constituent of flax mucilage consists of two polysaccharide components, neutral and acidic. The neutral fraction contains L-arabinose, D-xylose and D-galactose in a mole ratio of 3.5:6.2:1 and the acidic fraction contains L-rhamnose, L-fucose, L-galactose, and D-galacturonic acid in a mole ratio of 2.6:1:1.4:1.7 (Oomah *et al*., 1995).

However several work done on extraction and chemical composition of flaxseed gum but local varieties need to study for their gum yield and chemical composition. So present study is deals with extraction of gum at varying temperature from three different local varieties and their comparative study of chemical composition.

MATERIALS AND METHODS

Present study was carried out in Department Food Chemistry and Nutrition, College of Food Technology, Parbhani in year 2015.

Materials

Three different varieties of flaxseed namely, NL-260, RLC-4 and SLS-93 obtained from Oilseed Research Centre, Latur, Maharashtra, India.

Extraction of gum

Mucilage or gum in the seed coat of flaxseed was extracted following a method modified from method by (Wang *et al.*, 2010). Flaxseeds were washed with running water for 3 min to remove the surface dust. The washed flaxseed were suspended in distilled water in a ratio 1:10 (w/v) and kept under shaking for 12 h at different temperature (30ºC,60ºC and 90ºC). Then suspension was filtered through a sieve to remove the seeds and the resultant viscous solution was filtered through a double layer of cotton wool. The gum was precipitated from the viscous solution by the addition of two volumes of 98% ethanol, according to the method of (Cui *et al.*, 1994) with some modifications. After allowing stand for 1 h at 4ºC, the precipitate was collected by centrifugation at 6500 rpm for 30 min. The precipitated solid was subsequently dried in a hot air oven at 45ºC for 12 h and ground into a fine gum powder.

Chemical composition of flaxseed gum

Determination of moisture content

Moisture content of flaxseed gum powder from three varieties of flaxseed were estimated by method described by A.O.A.C. (2000)

Determination of crude fat

Crude fat content of flaxseed gum powder from three varieties of flaxseed were estimated by method described by A.O.A.C. (2000)

Determination of protein

Protein content of flaxseed gum powder from three varieties of flaxseed were estimated by Microkejeldhal method described by A.O.A.C. (2000)

Determination of ash

Ash content of flaxseed gum powder from three varieties of flaxseed were estimated by method described by A.O.A.C. (2000)

Determination of neutral sugar

The concentration of neutral sugar was determined by a colorimetric assay following a method described by (Thammarat *et al.,* 2014).

To 0.4 mL of 1% mucilage solutions (w/v in water) in a test tube were added 0.4 ml of 6 mg/ml resorcinol and 2 mL of 75% sulphuric acid. The tube was shaken by vortex and heated at 90ºC in a water bath for 30 min and subsequently placed in a cold-water bath for 30 min in dark. The optical density of the solution was determined at 480 nm and compared to a standard solution D-xylose. The neutral sugar content was expressed as milligrams of D-xylose equivalents per milligrams of the mucilage powder.

Determination of acidic sugar

The concentration of acidic sugar was determined by a colorimetric assay following a method described by (Thammarat *et al.,* 2014) 0.5 ml of 1% gum solution was treated with 0.5 mL of concentrated sulphuric acid. After continuous stirring for 5 min at 10ºC, the suspension was centrifuged for 10 min at 2000g at room temperature. The supernatant was considered as the mucilage hydrolysate. To 0.4 ml of the gum hydrolysate in a test tube, 40μl of 4 M potassium sulfamate solution (pH 1.6) and 2.4 ml of 75 mM sodium tetra borate in sulphuric acid solution was added. The tube was mixed by vortex and heated at 100 ^{0}C in a water bath for 20 min, then placed in a cold water bath for 10 min in the dark. 80 μL of m-hydroxydiphenyl solution was added to the test tube and shaken three times by vortex. Between 10 min and 1 h after dissolution, the optical density of the solution was determined at 525 nm, with D-galacturonic acid as the standard. The acidic sugar content was calculated as milligrams of D-galacturonic acid per milligrams of the gum powder.

RESULTS AND DISCUSSION

Flaxseed gum is a water soluble hydrocolloid was extracted in an aqueous solution following by ethanol precipitation. The gum yield from three flaxseed varieties at different soaking temperature is presented in Table 1.

The gum yield ranged from 5.1-8.0%. It was found that as soaking temperature increased, gum yield increased and gum yield also varied as per varieties. The highest yield 8.0% was observed from NL-260 at 90^0 C temperature and lowest yield 5.1% observed from SLS-93 at 30^0 C temperature. These values are higher than values described by (Thammarat *et al.,* 2014).

3.2 Chemical composition of flaxseed gum:

The chemical composition of gum from three different flaxseed varieties is presented in Table 2.

Moisture content from three flaxseed varieties was evaluated and it ranged from 3.2-3.5%. The highest value (3.5%) found in RLC-4 and lowest (3.2%) in NL-260.

Crude fat content from flaxseed gum were found very low. The highest value 0.44 % found in RLC-4 and lowest value

Table 1: Per cent yield of flaxseed gum from different varieties at different temperature

Sr. No.	Variety	% Yield at different Temperature		
		30ºC	60ºC	90ºC
1	NL-260	5.8	7.4	8
2	RLC-4	5.4	6.5	6.9
3	SLS-93	5.1	5.5	5.9

Table 2 : Chemical composition of flaxseed gum from different varieties

Sr. No.	Parameter	NL-260	RLC-4	SLS-93
1	Moisture (%)	3.2(0.1)^a	3.5(0.1)^c	3.4(0.2)^b
2	Crude fat (%)	0.40(0.01)^b	0.44(0.01)^c	0.39(0.01)^a
3	Protein (%)	3.12 (0.01)^c	2.93(0.06)^a	3.07 (0.07)^b
4	Ash (%)	3.11 (0.01)^c	2.85 (0.03)^a	3.06 (0.06)^b
5	Neutral sugar g.g^{-1}	0.52 (0.02)^a	0.56 (0.01)^c	0.55 (0.01)^b
6	Acidic sugar g.g^{-1}	0.64(0.02)^c	0.58 (0.01)^a	0.62 (0.01)^b

Values in the same row followed by different letters (a-c) are significant ($p < 0.05$). Figures in parenthesis are standard deviation.

0.39% in SLS-93.

The protein content of flaxseed gum from three varieties ranged from 2.93-3.12%.The highest value 3.12% found in NL-260 and lowest value 2.93 %found in RLC -4.

The Ash content of gum ranged from 2.85-3.11%, highest in NL-260 and lowest in RLC-4.

The carbohydrate portion of flaxseed gum can be classified into a neutral and acidic fraction. The content of the neutral and acidic fractions, expressed as milligrams of D-xylose and D-galacturonic acid per milligrams of the gum powder, respectively, is shown in Table 2.

It was found that neutral sugar ranged from 0.52-0.56 $g.g^{-1}$ (gram of D-xylose per gram of gum powder) and found highest value in RLC-4 and lowest value in NL-260.The acidic sugar ranged from 0.58-0.64 $g.g^{-1}$ (gram of galactouronic acid per gram of gum powder) and found highest in NL-260 and lowest in RLC-4. It was found that content of acidic sugar in gum from all three varieties was more than that of neutral sugar. These values of chemical composition of gum found similar in accordance values described by(Thammarat *et al.,* 2014).

In present study it was found that the per cent yield of gum increased as soaking temperature increased. It was also found that gum yield and chemical composition of gum of three different varieties of flaxseed varied significantly.

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