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Chemical Analysis of Flaxseed, Sweet Basil, Dragon Head and Quince Seed Mucilages

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Abstract: Mucilage, a complex carbohydrate with a great capacity to absorb water, should be considered a potential source of industrial hydrocolloid.To examine moisture, dry weight, yield, ash and protein content, mucilaginous material were extracted from seeds by mixing the seeds with distilled water (1:20 w/v), stirring the seed-water mixtures for 3 h at 75°C, separating the mucilage extract from the seeds by filtration through a muslin and were precipitated with 3 times its volumes of 96% ethanol. The precipitates were separated by centrifugation (6500 rpm, 15 min). The data were analyzed by one-way ANOVA and Tukey test and compared in one significant levels of $p<0.05$. The linseed mucilage had 4.57% moisture, 95.43% dry weight, 8.6% yield, 5.8% ash and 12.3% protein. The basil mucilage had 4.86% moisture, 95.14% dry weight, 2.07% yield, 0.84% ash and 10.9% protein. The dragon head mucilage had 4.93% moisture, 95.06% dry weight, 1.88% yield, 0.28% ash and 45.7% protein. The quince mucilage had 4.38% moisture, 95.62% dry weight, 10.9% yield, 8.24% ash and 20.9% protein. Results showed significant differences in yield mucilage content between flaxseed and quince with together and with basil and dragon head. Significant differences in ash content were observed between flaxseed and quince with basil and dragon head. The dragon head had significant difference in protein content with flaxseed, basil and quince.

Key words: Mucilage; flaxseed, sweet basil, dragon head, quince, chemical analysis

INTRODUCTION

Hydrocolloids are highly hydrophilic substances that are soluble or dispersible in water, increasing system viscosity. From a chemical point of view, they are polysaccharides (gum Arabic, guar gum, carboxymethylcellulose, carragenan, starch, pectins) or proteins (such as gelatin). Some of them can form gels under certain condition, while others can act only as thickeners. On account of these properties they are used as food additives to obtain particular textural characteristics (Glicksman, 1982). Flax (*Linum usitatissimum* L.) is grown as either an oil crop or as a fiber crop, with fiber (linen) derived from the stem of fiber varieties and oil from the seed of linseed varieties (Diederichsen *et al*., 2003).

The seed of flax is flat and oval with a pointed tip and varies in color from dark brown to yellow (Freeman, 1995).

In 1903 Hilger hydrolyzed flaxseed mucilage and found in the hydrolytic products the sugars d-glucose, d-galactose, l-xylose and l-arabinose, together with an acid by-product. In 1913 Neville verified the work of Hilger on linseed mucilage. Linseed mucilage contains d-galacturonic acid, l-rhamnose, l-galactose and d-xylose (Anderson *et al*., 1947). Linseed mucilage yields in addition to sugars, an acid complex which contains pentoses and hexoses (Abderhaldens S., Biochemische Handlexikon). Previous studies have revealed that linseed mucilage consists of 2 of polysaccharides: A neutral arabinoxylan and an acidic pectic-like material (Hunt and Jones, 1962; Muralikrishna *et al*., 1987).

Linseed mucilage is a gumlike material associated with the hull of linseed and comprises about 8% of the seed weight (Bhatty and Cherdkiatgumchai, 1990; BeMiller, 1973). Mucilaginous constituents of Linseed (*Linum usitatissimum* L.) have been shown to have a considerable potential for use as food gum (BeMiller, 1973; Mazza and Biliaderis, 1989). Linseed mucilage as an emulsifying agent have been used for chocolate milk (Manson *et al*., 1948). Functionally, linseed gum resembles gum Arabic more closely than any of the other common gums (BeMiller, 1973).

Basil (*Ocimum basilicum* L.) belonging to the Lamiaceae species, is an annual, herbaceous, 20-60 cm Length and white-purple flowering plant which come from India and Iran. It is cultivated in Mediterranean countries and in various regions with temperate and hot climates (Akgül, 1993; Özcan and Chalchat, 2002). Basil has been

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used traditionally as a medicinal herb in the treatment of headaches, coughs, diarrhea, constipation, warts, worms and kidney malfunctions (Simon *et al*., 1999).

Dragon head originates in the Caucasian region and is cultivated for ornament and may be locally naturalized in East and East Central Europe. An annual or perennial herb, or dwarf shrub. Dragon head is cultivated for its seeds from which oil is extracted, the seed contains up to 30% of a drying oil. http://www.naro.de/Deutsch/KULTURPF/Drachenkopf/Anbaute.html.

The quince, which grows as a shrub in the wild, is a small tree only about 3-4 m high. The seeds are extensively used, on account of the mucilage of outer surface. Most of the quince seed of the market comes from southern Russia, Southern France and the Cape of Good Hope. Quince seed mucilage affords an additional example of the natural occurrence of methoxyuronic acids. Quince seed mucilage is a complex of a cellulosic fraction with a more readily hydrolyzed polysaccharide (Schmidt, 1844; Kirchner *et al*., 1874). The linkage is not easily broken by the action of dilute acid or alkali at room temperature, but hot dilute acid liberates reducing sugars, cellulose and a gum (Kirchner *et al*., 1874). Arabinose, a mixture of methylated and unmethylated aldobionic acids and a cellulosic fraction were liberated in the hydrolysis of quince seed gum. Xylose was identified in the further hydrolysis of the aldobionic acids.

The aim of the current study was studied moisture, dry weight, yield, ash and protein content in seed mucilage of linseed, sweet basil, dragon head and quince. Such studies are useful in exploring the potential of mucilage as a hydrocolloid preparation for food and nonfood applications.

MATERIALS AND METHODS

Samples of linseed (*Linum usitatissimum* L.), sweet basil (*Ocimum basilicum* L.), dragon head (*Lallemantia iberica Fisch* and *C. Meyer*) and quince (*Cydonia oblonga M.*) were obtained from local supplier in Urmia.

Extraction of mucilage: Removal of mucilage from seeds was achieved following the procedure of Mahrane *et al.* (2004) with minor modifications. The demucilaged seeds were oven-dried at 105°C for 24 h.

Mucilaginous material were extracted from seeds that be cleaned before without water, by mixing the seeds with a quantity of water for a fixed period followed by drainage of the seed and analysis of the collected liquid. These extractions at water to seed ratio (20:1 w/v) were conducted in glass erlans stirred by a small propeller stirrer. A heated magnetic stirring was used to preheat the water to 75°C, to stir the suspension and to maintain the temperature throughout the extraction. The seed-water mixtures were stirred for 3 h at 75°C. Separation of the seeds from the liquid was generally performed by muslin and was precipitated with 3 times its volumes of 96% ethanol. The precipitates were separated by centrifugation (6500 rpm, 15 min). The demucilaged seed were oven-dried at 105°C for 24 h.

Chemical analysis

Determination of moisture content: The extracted mucilage was dried in an oven for 4 h at 70°C (Sepulveda *et al*., 2007) for remove the excess water that mucilage be absorbed then mucilage extraction. Mucilage was weighted and replaced in an oven at 105°C for 24 h (AOAC, 925.09). After drying the dried mucilage cooled and again weighted. The moisture content was calculated using the following equation (Amin *et al*., 2007).

$$\text{Dry weight \%} = \text{weight of dry sample} \div \text{original weight of sample} \times 100$$

$$\text{Moisture \%} = 100 - \text{dry weight content \%}$$

Determination of mucilage yield: Mucilage yield was calculated according to the following equation (Kadivar, 2001).

$$\text{Mucilage yield} = Wm\,[1-Mm/100]/[1-Mf/100] \times 100$$

Where,
Wm = Weight of the recovered mucilage
Mm = Moisture content of the recovered mucilage %
Wf = Weight of the original sample
Mf = The moisture content of the original sample %

Determination of protein content: Protein content of the mucilage preparations was analyzed using the Lowry *et al.* (1951) method.

Determination of ash content: The total ash content was determined according to Amin *et al*.(2007) method. Oven-dried mucilage (Sepulveda *et al.* 2007) was weighted then, the sample was ignited in a furnace at 550°C until light gray ash produced, or the weighted was constant. The sample was cooled and weighted soon after reaching room temperature. The total ash content was calculated using this equation.

$$\text{Total ash\%} = \text{ash weight} \div \text{original sample weight} \times 100$$

Statistics The data of parameters measures were analyzed and compared with together by methods of Analysis of Variance (ANOVA) and Tukey using SPSS (version 11.5) and at a significant level of $p<0.05$.

RESULTS

The dried mucilage of linseed had in average 4.56% moisture, 95.43% dry weight, 8.6% yield, 5.8% ash and 12.2% protein. The mucilage of sweet basil had in average 4.86% moisture, 95.14% dry weight, 2.08% yield, 0.84% ash and 10.9% protein. The mucilage of dragon head had in average 4.93% moisture, 95.06% dry weight, 1.88% yield, 0.28% ash and 45.7% protein. The mucilage of quince had in average 4.38% moisture, 95.62% dry weight, 10.97% yield, 8.2% ash and 20.9% protein.

Some of the chemical properties of the mucilage that were isolated from linseed, basil, dragon head and quince are summarized in Table 1.

Results showed (Fig. 1) significant increase in yield content in the flaxseed mucilage with the yield content in the basil and dragon head mucilage. The yield content in the quince mucilage had significant increase with the yield content in the basil and dragon head mucilage. Significant decrease was observed between the yield content in the flaxseed mucilage with the yield content in the quince mucilage. The ash content in the flaxseed mucilage had significant increase with the ash content in the basil and dragon head mucilage. The ash content in

Table 1: Chemical properties of the mucilage isolated from *Linum usitatissimum L, Ocimum basilicum L., Lallemantia iberica F. andC.M.* and *Cydonia oblonga M.* seed

Parameter (%)	Linseed	Basil	Dragon head	Quince
Moisture	4.56±0.86	4.86±0.47	4.93±1.17	4.38±1.32
Dry weight	95.43±0.86	95.14±0.47	95.06±1.17	95.62±1.32
Yield	8.60±0.38*	2.08±0.55	1.88±0.30	10.97±0.43*
Ash	5.80±1.83*	0.84±0.39	0.28±0.13	8.20±0.34*
Protein	12.20±2.05	10.90±0.66	45.70±6.72*	20.90±6.03

Data shown as mean±SEM; *: Having significant difference ($p<0.05$)

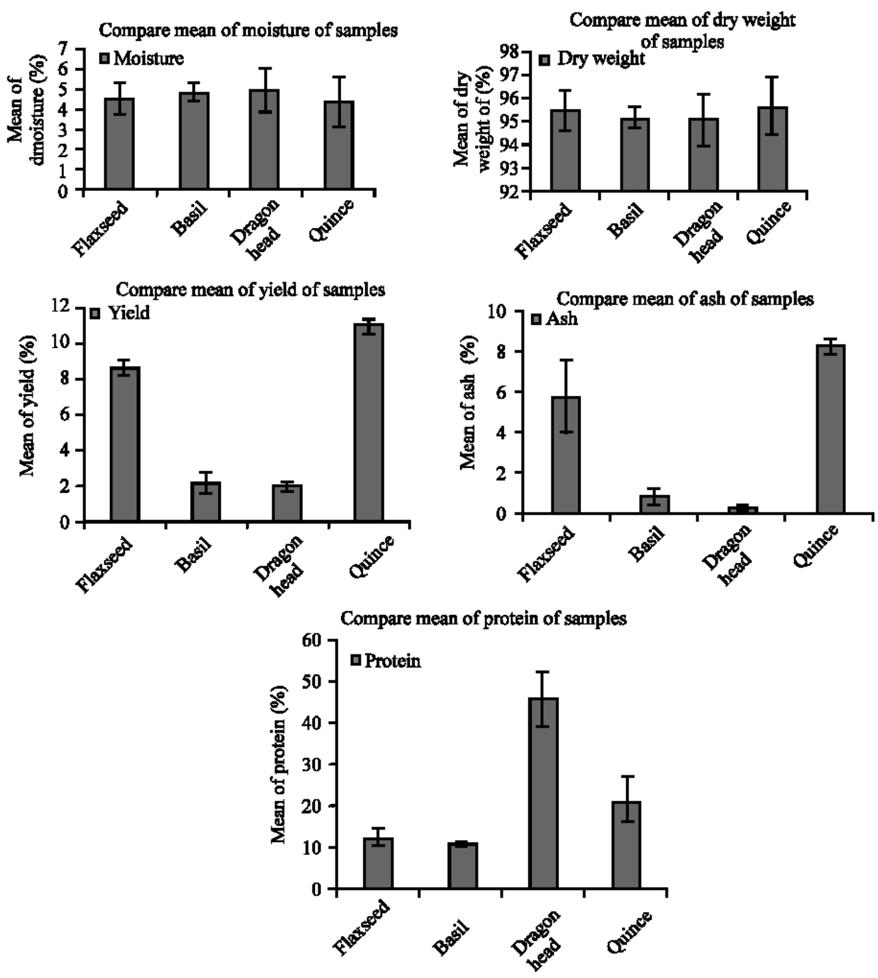

Fig. 1: Compare chemical properties of the mucilage isolated from *Linum usitatissimum* L, *Ocimum basilicum* L. and *Lallemantia iberica* F. *C.M.* and *Cydonia oblonga* M. seeds

the quince mucilage had significant increase with the ash content in the basil and dragon head mucilage. The protein content in the dragon head mucilage had significant increase with the protein content in the flaxseed, basil and quince mucilage.

DISCUSSION

The linseed mucilage had 4.56% moisture content. Mazza and Biliaderis (1989) reported that the dehydrated and lyophilized samples contained 5-6% moisture. This showed that the moisture content in the linseed mucilage in this study was lower compared to which Mazza and Biliaderis were reported. Varying methods for the mucilage extraction have influenced the obtained moisture content. The moisture content in the dragon head mucilage (4.93%) was higher than the moisture content in the other seeds mucilage. There are no references for the moisture content in the basil, dragon head and quince mucilage.

The yield content in the linseed mucilage was 8.6% that was lower than the yield content in the solin mucilage (9.2%) that was reported by Kadivar (2001). The yield in the different cultivar of linseed was vary from 4.6-5.5 (g/100 g). Neville (1913) prepared the mucilage of flaxseed in yield as high as 6.3% that is lower than the result is reported in this study. Anderson (1947) reported that the mucilage yield was 5.8% that is lower than of which is reported in present study, the difference may be attributed to the use of different linseed cultivar and difference extraction procedures. Kadivar (2001) reported solin mucilage yield 3.2% (without alcoholic precipitation), 5.4% (with alcoholic precipitation) that is lower than reported in present study. May pointed out that the yields depended on the cultivar and extraction conditions. Cui *et al.* (1994) reported yields of mucilage from flaxseed range from 3.6-9.4% that is in agreement with the result that is reported in present study. Mahrane *et al.* (2005) reported the mucilage yield of Persian flax 10.3% that is higher than is reported in this study. There are no references for the yield content in the basil, dragon head and quince mucilage.

The ash content in the linseed mucilage in this study is 5.8% that is higher than 0.87% that was reported by Anderson *et al.* (1947). That may reflect difference in seed composition. Fedeniuk *et al.* (1994) reported that the ash content of flaxseed mucilage were 6.3, 7.7 and 4.4% in different conditions that these are not agreement with the result in this study. There are no references for the ash content in the basil, dragon head mucilage. The protein content in the linseed mucilage in present study is 12.3% that is higher than 11.7% that was reported by Kadivar (2001). This difference could be attributed to different linseed cultivar. Fedeniuk *et al.* (1994) reported the protein content in different condition 19.7 and 22.8% that these are higher than is reported study. This difference may be attributed to the condition in which the analyses were done. Mahrane *et al.* (2005) reported the protein content between 0.51-11% (w/w) that is lower than is reported in this study. This different could be due to different extraction procedure. There are no references for the protein content in the basil, dragon head and quince mucilage.

In present study the highest moisture content was in the dragon head mucilage (4.93%) and the lowest was in the quince mucilage (4.38%). No significant differences in moisture were observed between samples. The highest dry weight content was in the quince mucilage (95.62%) and the lowest dry weight content was in the dragon head mucilage. No significant differences in dry weight were observed between samples.

The highest yield content was in the quince mucilage (10.97%) and the lowest was in the dragon head mucilage (1.88%). Results showed significant increase in yield content in the flaxseed mucilage (8.6%) with the yield content in the basil (2.07%) and dragon head mucilage (1.88%). The difference between the flaxseed and the basil mucilage yield could be attributed to extraction of mucilage that mucilage from linseed was separated easily but mucilage of basil in extraction time was stick to seed and separate was done hardly that after extraction residue mucilage has been stayed on seed. The difference between the flaxseed and the dragon head mucilage yield could be attributed to climatic conditions that seeds were cultivated and related to the seed composition. The yield content in the quince mucilage (10.9%) had significant increase with the yield content in the flaxseed, basil and dragon head mucilage. The difference between the quince and the flaxseed, basil and dragon head mucilage yield could be attributed to quince size that was very big contributed to the flaxseed, basil and dragon head mucilage yields.

The ash content in the flaxseed mucilage (5.8%) had significant increase with the ash content in the basil (0.84%) and dragon head (0.28%) mucilage. This difference could be attributed to yield content mucilage in this seeds, that the basil and dragon head had the yield content lower than flaxseed yield mucilage, then had the lower ash content contributed to flaxseed ash content. The ash content in the quince mucilage (8.24%) had significant increase with the ash content in the flaxseed, basil and dragon head mucilage. This difference could be attributed to yield content mucilage in this seeds, that the quince had the highest yield content between seeds, then will had the highest ash content in contributed to other seeds. The protein content in the dragon head mucilage (45.7%) had significant increase with the protein content in the flaxseed (12.3%), basil (10.9%) and quince (20.9%) mucilage. This can be attributed to the comminuted nature of the seed; proteins in the matrix would be exposed to the extraction media, thereby facilitating their solubilization and extraction.

CONCLUSION

- The quince seed mucilage had the highest yield, ash and dry weight content than other seeds mucilage.
- The dragon head seed mucilage had highest moisture and protein content than other seeds mucilage.
- This study shed some light on understanding these mucilage potential applications in the food industry.

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