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# Proximate analysis of brown sugar flaxseed toffees using different concentrations of flaxseed powder

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## Abstract

Flax (*Linum usitatissimum*) is an important plant and has nutritional value. It has been used since past for curing abdominal pain and other medical purposes. People can use flaxseed powder to fulfill their nutritional requirements. The present study was planned for conducting proximate analysis of brown sugar flaxseed toffees. Raw organic flaxseeds were purchased from market, washed, dried and grinded to fine powder form. Using different concentrations of flaxseed powder, brown sugar toffees were made and divided into different treatment groups. Both sensory and proximate analysis were performed. In Sensory analysis, it was found that among all the treatments, group 5 (containing 2.5% flaxseed powder) has the highest rate of overall acceptability. High level of flaxseed powder resulted in decrease of mean score value of sensory analysis. A 2.5% level of flaxseed powder resulted in acceptable product. It was depicted that most desirable nutrients like protein and fat were increased with increase of flaxseed powder. In conclusion, flaxseed powder made brown sugar toffees with 2.5% concentration have good nutritional values along with acceptable physical characteristics.

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## Introduction

Flax (*Linum usitatissimum*) is an annual plant belonging to Linaceae family and is mainly grown as an oilseed crop. It grows up to 60cm height with slender fibrous stem. Its fruit has seed called flaxseed or linseed (Pradhan *et al.,* 2010). In past, in many countries including Egypt, Greece, it has been used as an energy source and for medical purposes mostly to relieve abdominal pains (Oplinger *et al.,* 1989). Until 1990s, Flax was mainly used to produce fabrics (materials) and papers, while flaxseed oil was also important for products used in animal feed (Singh *et al.*, 2011). Flax was first conferred in the United States mainly to create fiber for cloths (Laux, 2011). Flax contains many functional food ingredients mainly lignans, polysaccharides (excluding starch) and omega 3 fatty acid (α-linolenic acid) (Bozan and Temelli, 2008). Flaxseed has 40% lipids, 20% protein and 30% dietary fibers (Daun *et al.,* 2003). Out of total fatty acids contents of flaxseed, 52% is of essential fatty acid called α-linolenic acid (ALA) which has beneficial effect on health (Oomah, 2001; Coskuner and Karababa, 2007). All the ingredients including lignans, dietary fibers, and lipid contents impart beneficial health effects to the consumer (Singh *et al.,* 2011). Soluble dietary fiber is about 1/3 in flaxseed and helps in regulation of blood glucose and cholesterol level. While insoluble dietary fibers make up 2/3 of linseed and play role in prevention of constipation (Morris *et al.,* 2005).

Although many evidences support the usage of flaxseed but still people are unaware of nutritional benefits of flaxseed and its application in development of food products. The following study is designed for the development of brown sugar flaxseed toffees and to gauge their aptness with various concentrations of flaxseed powder.

## Materials and methods

The following research was performed in school of Nutrition and Dietetics, the University of Faisalabad. First, raw organic flaxseeds were procured from a grocery store (without any specification to color, aroma etc.), cleaned and grounded to fine powder form. Toffees were prepared by mixing brown sugar, butter and six different concentrations of flaxseed powder (Table 1). The sensory analysis was performed to determine color, texture, aroma, mouth feel, chewability, and color properties of these flaxseed enriched brown sugar toffees (Larmond, 1980).

Based on physical characteristics, the overall acceptability was also determined. All the treatment groups were then subjected to proximate analysis for determination of moisture, protein, fat, and ash contents following the protocol described by (AACC, 2000).

### *Statistical analysis*

The final data was statistical analyzed using SPSS software (v25) by comparing mean values (one-way ANOVA) (Field, 2009).

## Results and discussion

### *Sensory analysis*

Sensory analysis based on physical characteristics was also performed for flaxseed brown sugar toffees and mean score values are presented in Table 2. Color score results for both control and experimental groups indicated that increase in mean values occurs with increase in concentration of flaxseed powder. Millard reaction may also have affected color of flaxseed toffees (Borrelli *et al.,* 2003).

**Table 1.** Categories of different groups with different amount of flaxseed powder.

| Flaxseed toffees treatment groups | Concentration of flaxseed powder |
|---|---|
| $T_0$ | Control |
| $T_1$ | 0.5% |
| $T_2$ | 1% |
| $T_3$ | 1.5% |
| $T_4$ | 2% |
| $T_5$ | 2.5% |
| $T_6$ | 3% |

The aroma score for both control and other groups indicated that highest amount of flaxseed powder (3%, $T_6$) caused decrease in mean values. Texture mean values also showed random increase in values indicating that flaxseed powder has no significant effect on texture of these toffees. Compared both control and experimental group, flavor and mouth feel characteristics were much better in $T_5$ which may be that this treatment group contained proper concentration of flaxseed powder. Chewability mean scores were almost same for both control and $T_5$.

It was observed that flaxseed toffees containing 2.5% flaxseed powder ($T_5$) showed the best results than all other treatments. Group $T_6$ having high concentration of flaxseed powder (3%) also showed good results close to $T_5$. Similar findings for flaxseed cookies were also performed by Ganorkar and Jain (2014).

**Table 2.** Mean values of different factors observed during sensory analysis.

| Treatments | Aroma | Chewability | Mouthfeel | Flavor | Texture | Color |
|---|---|---|---|---|---|---|
| $T_0$ | 7 ± 0.0 | 7.67 ± 0.57 | 6 ± 1.0 | 6.67 ± 0.57 | 7 ± 0.0 | 6.33 ± 0.57 |
| $T_1$ | 6.67 ± 0.57 | 6.67 ± 0.57 | 6 ± 0.0 | 6 ± 0.0 | 6 ± 0.0 | 5.67 ± 0.57 |
| $T_2$ | 6.67 ± 0.57 | 6.67 ± 0.57 | 6 ± 1.0 | 6 ± 0.0 | 5.67 ± 0.57 | 5.33 ± 0.57 |
| $T_3$ | 6 ± 0.0 | 6.67 ± 0.57 | 6.33 ± 0.57 | 6 ± 0.0 | 6 ± 0.0 | 5.33 ± 0.57 |
| $T_4$ | 6 ± 0.0 | 6.67 ± 0.57 | 6.67 ± 0.57 | 7.33 ± 0.57 | 7 ± 0.0 | 6.67 ± 0.57 |
| $T_5$ | 7.33 ± 0.57 | 7.33 ± 0.57 | 8 ± 0.0 | 8 ± 0.0 | 8 ± 0.0 | 8 ± 0.0 |
| $T_6$ | 6.33 ± 0.57 | 7.33 ± 1.15 | 7 ± 0.0 | 7 ± 0.0 | 7 ± 0.57 | 7 ± 0.0 |

The overall acceptability of all these groups was also analyzed which indicated that group 5 containing 2.5% flaxseed powder has the highest rate in this scenario (Fig. 1).

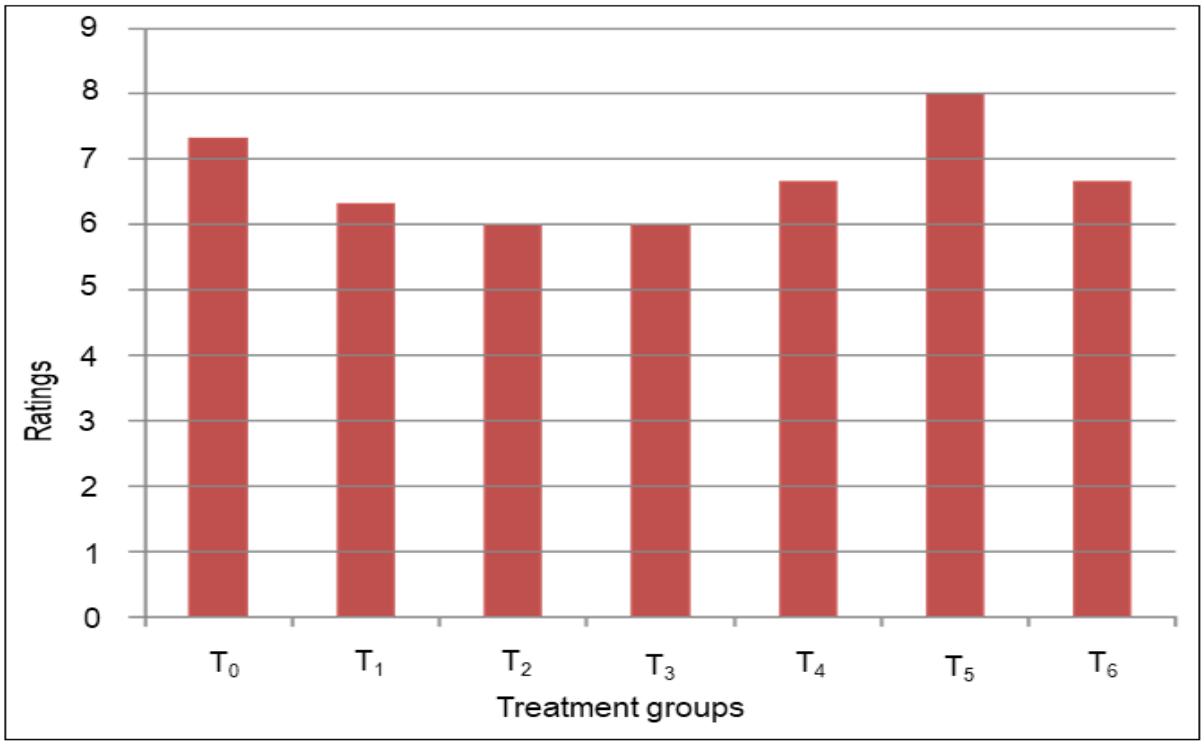


**Fig. 1.** Graph showing overall acceptability of all treatments and control group containing different concentration of flaxseed powder; group 5 with 2.5% mean score value indicated the highest rate of overall acceptability.

*Proximate analysis*

Different parameters of proximate analysis were performed for flaxseed toffees. The moisture content of all the treatment groups of flaxseed fortified toffees was determined and highest mean moisture level was observed in $T_5$ group (Fig.2).

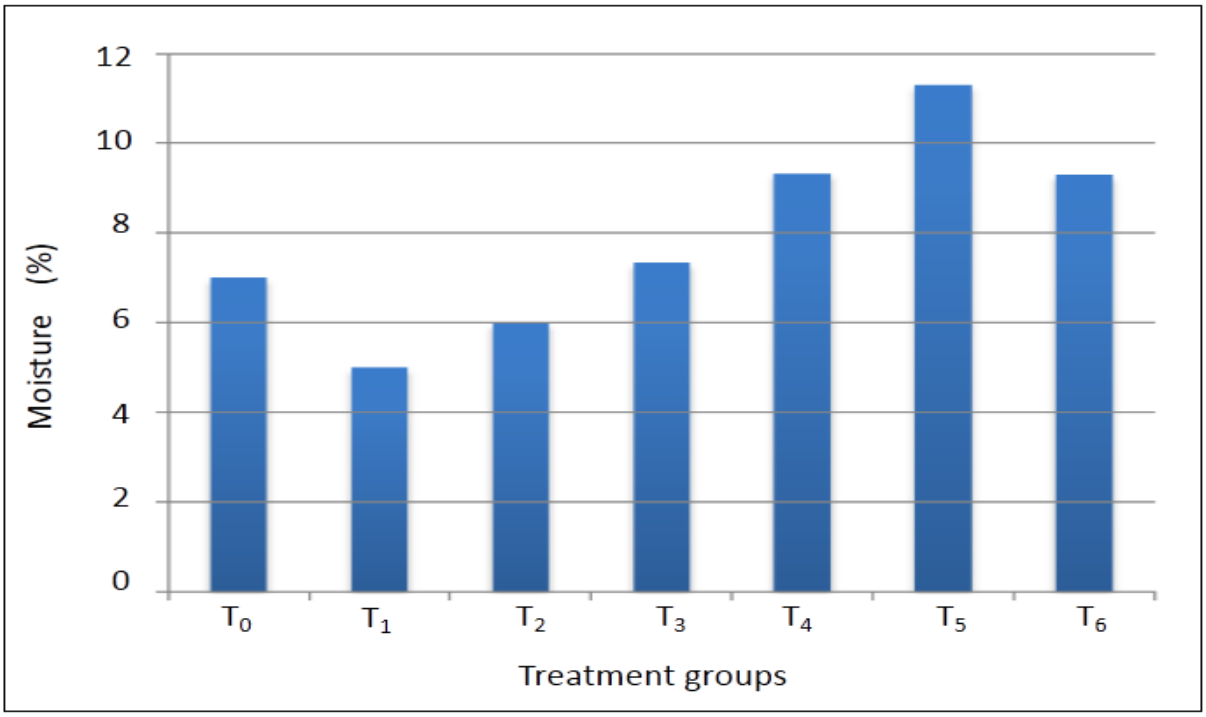


**Fig. 2.** Moisture contents of different treatment group flaxseed toffees; the highest moisture level was observed in $T_5$ having 2.5% flaxseed powder.

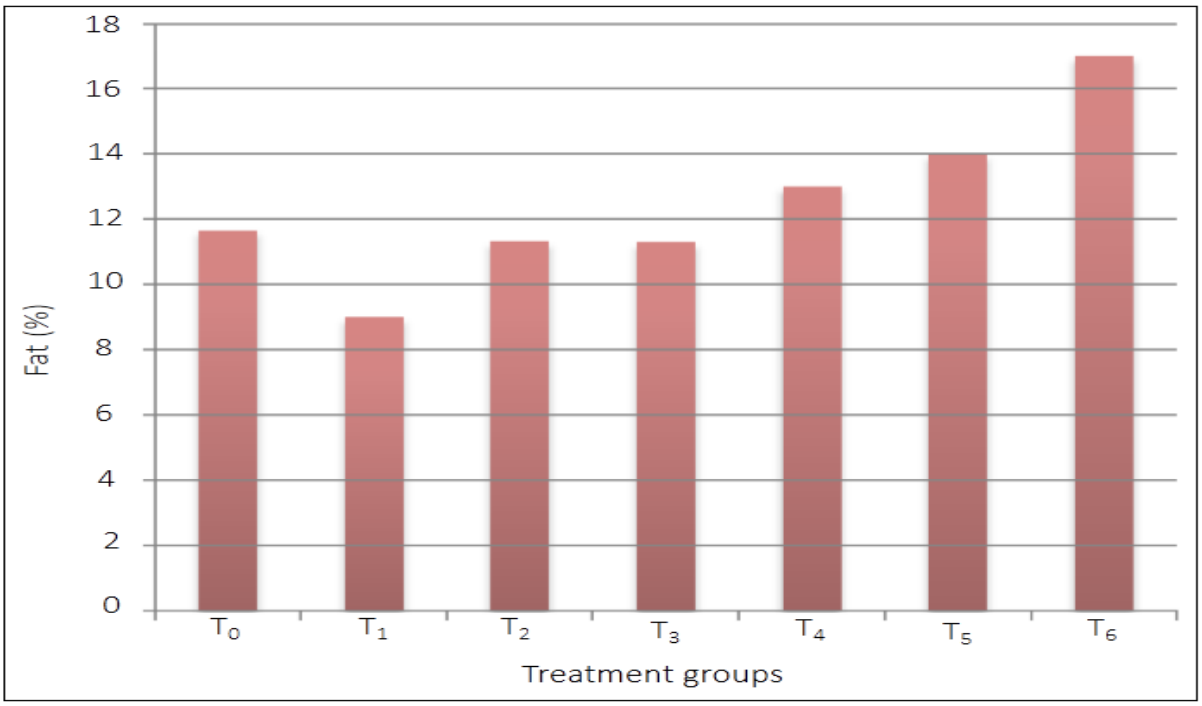


**Fig. 3.** Fat analysis of flaxseed toffees; graph indicated that group 6 (having 3% flax seed powder) showed highest level of fat.

Treatment group containing 3% of flaxseed powder was showed highest values for crude fat than all other groups (Fig. 3) which may be due to high amount of flaxseed powder. Fig. 4 indicates protein values for all groups, and it is depicted that $T_6$ with 3% flaxseed showed the highest protein contents. Similar trend was also observed for ash content analysis.

Similar findings were also reported by others (Hussain *et al.*, 2008; Azza *et al.*, 2016).

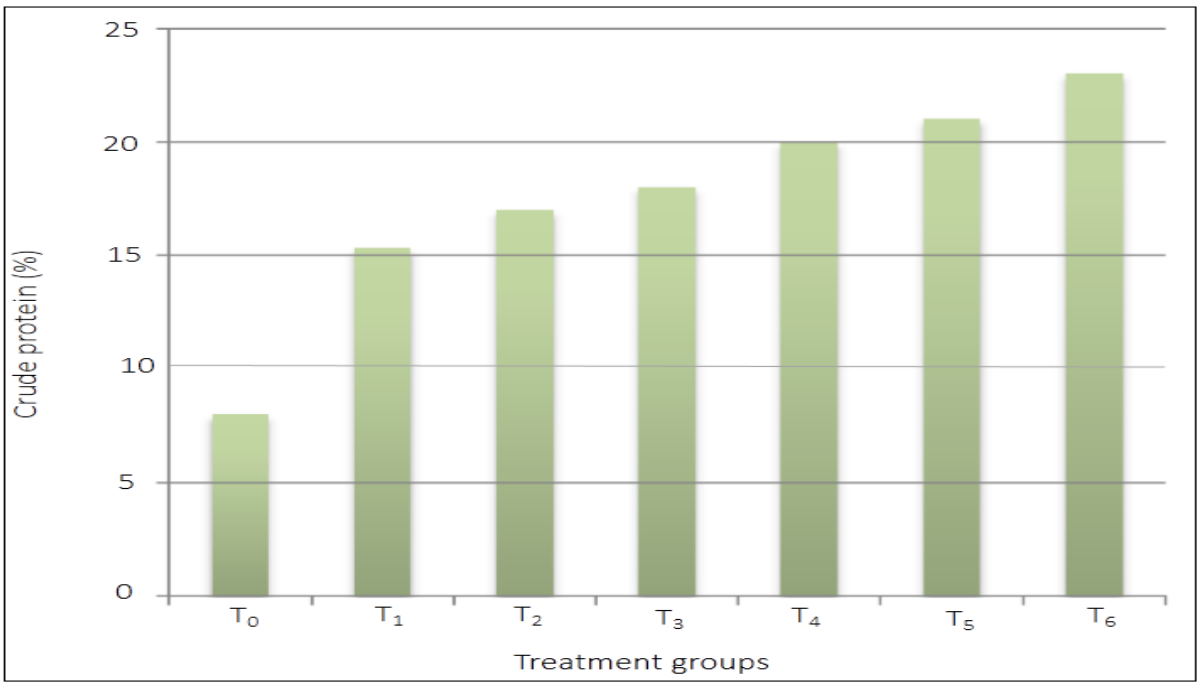


**Fig. 4.** Graph indicating the protein concentration in different treatment groups; $T_6$ showed highest protein contents than all others.

## Conclusion

Although proximate analysis values showed highest values for group 6 (with 3% flaxseed powder) but close to $T_5$. The overall acceptability was found good for $T_5$ group with 2.5% flaxseed powder. High level of flaxseed powder resulted in decrease of mean score of sensory analysis. It was concluded that flaxseed made brown sugar toffees with 2.5% concentration of flaxseed have good nutritional values along with physical characteristics.

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