Research Article

Physico-chemical and Sensory evaluation of Cookies prepared from Wheat and Defatted Soy Flour

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Abstract

The present study was carried out to evaluate the quality characteristics of protein enriched cookies which could be used as a protein supplemented cereal snack food. The defatted soy flour was incorporated at the levels of 0%, 10%, 20% and 30% with wheat flour and sugar was replaced by stevia powder. Prepared cookie samples were subjected to physico-chemical and sensory analysis to evaluate the suitability of the cookies for consumption. Protein, ash and moisture content of the defatted soy cookies increased with progressive increase in proportion of defatted soy flour. The fat and free fatty acids were decreased with corresponding increase in the percentage of defatted soy flour. Nine-point hedonic scale ranking method was used to evaluate the sensory characteristics of prepared cookies.

Keywords: cookies, defatted soy flour, stevia, physio-chemical characteristics, sensory

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Introduction

Bakery biscuits are ready to eat, convenient and inexpensive food products containing digestive and dietary principles of vital importance. Biscuits owing to their long shelf life are considered useful for nutritional enrichment in feeding programs [1]. Bakery industry is the one of the largest food industries in India with an annual turnover about 3000 billion. Protein Energy Malnutrition (PEM) is the most important nutritional problem facing children in developing countries [2], including India. Therefore, various preparation based on cereal-pulse combination are of paramount importance to improve the protein quality of Indian diet. The cookie formula consists of refined flour, hydrogenated fat, sugar and other additives. The refined flour lacks in dietary fiber and micronutrients which are important health promoting components. Among soy products, defatted soy flour may be the best source of isoflavones and other micro ingredients that have been linked to positive health benefits, because it is the least processed form of soy. It contains up to 50% protein, making it a more concentrated source of protein than full-fat soy flour [3].

Granulated sugar plays a significant role in many dietary health problems such as diabetes, coronary heart disease and obesity. Stevia (Stevia rebaudiana) is used in many parts of the world as a non-caloric sweetener. Use of stevia in bakery, confectionary and in other food industries and in household products is recommended by various researchers. Stevia has been evaluated for sweetness in animal response testing [4]. There is an ample scope to enhance the nutritional value of cookies both quantitatively and qualitatively using nutritious food ingredients. In this regard, there are several food ingredients with exceptional nutritional qualities because of their nutraceutical and /or nutritional components, such as millets, oil seeds, condiments and other novel ingredients. Value addition to existing foods with such ingredients is a simple and feasible way of enhancing nutritional values of foods and in turn the health benefits [5].

Materials and Methods

This chapter deals with the detail of the materials used, the procedures for the development and determination of physico-chemical and sensory characteristics of defatted soy cookies. The experimental work was carried out for studies on development, quality evaluation and storage stability of high protein cookies in the product development laboratory of Agricultural Process and Food Engineering, S.V.P.U.A & T, Meerut. The cookies were formulated by taking combination of wheat flour and different levels of defatted soy flour. Quality of high protein cookie was evaluated on the basis of nutritional, physico-chemical and sensory characteristics.

Procurement of Raw Materials

The wheat flour, defatted soy flour, stevia powder, milk powder, hydrogenated vegetable oil, baking powder, ammonium bicarbonate and chocolate essence were purchased from the local market.

Development of Cookies

Wheat flour was mixed with soy flour and cookies were prepared according to the following treatments using the recipe described below.

Treatments:

T0 - Cookies made by 100% wheat flour
T1 - 10g Soybean flour & 90g wheat flour
T2 - 20g Soybean flour & 80g wheat flour
T3 -30g Soybean flour & 70g wheat flour

Proper creaming of stevia and hydrogenated vegetable oil was done. Creamed material was mixed with soy flour, wheat flour, milk powder, baking powder and chocolate essence. All the materials were mixed by hand until a firm dough was formed. The dough was rolled out in a baking tray and cut into round in shape with a cookie cutter. The cookies were placed in greased aluminium trays and baked in convection oven at 150ºC for 30 minutes. The cookies were kept out from oven and cooled at room temperature. At last, the cooled cookies were packed into LDPE bags and stored for further studies at ambient condition.

Pysico chemical properties
Moisture content

Moisture content of cookies was determined by [6] method in a hot air oven method. 10g of samples were weighed in low flat-bottomed petri dishes. The petri dishes and its content were places in oven, thermostatically controlled at 105^0C and heated until successive weighing showed no further loss in weight. At the end, the dishes were removed from the oven and placed in desiccators, allowed to cool and weighed. Following formula was used to estimate moisture content of samples.

$$\text{Moisture content}(\%) = \frac{\text{Loss in weight of sample}}{\text{Initial weight of sample}} \times 100$$

Fat content

Fat content of cookies was determined by [6] methods. Cookies were obtained between 5 and 10 g and were crushed, the mass of 250 ml Erlenmeyer flask was determined, then 5 g of sample was added to the flask and the mass of the flask along with crushed cookies were determined. 10 ml of hexane was added to the flask containing the sample and were mixed for 1 min, then the hexane was poured off the container. Then again 5 ml of hexane was added to the flask containing the sample and mixed for 1minute, then the hexane is poured off from the sample. The process is repeated one more time. A water bath under a hood using a 600 ml beaker on a hot plate was prepared and the water was boiled. The flask was heated with the sample, in the hot water bath for about 5 minutes to evaporate any residual hexane. The flask was removed from the water bath and the mass of the flask and the rinsed sample was determined.

Calculation

$$\text{fat content}(\%) = \frac{\text{weight of residue left}}{\text{weight of sample taken}} \times 100$$

Protein estimation

Protein content of cookies was determined by [6] methods using Kjeldhal Apparatus. 1g of finely ground cookies was transferred into digestion flask and copper sulphate, potassium sulphate were added. Further 25ml of concentrated sulphuric acid was poured, mixed and kept for heating. The heating was continued until frothing ceased, further the

sample was boiled for digestion. The flask was cooled after digestion and the digested liquid was filtered. The volume of this sample was made up to 100 ml. The water was boiled in steam generator gently.

A 5ml of aliquot sample was transferred into distillation tube through the small funnel. The steam trap thus compelled the steam to pass through the distillation tube. The ammonia liberated from the reaction mixture was absorbed into 5ml of 2% boric acid solution. Distillation was continued for 15 minute. Thus solution mixture was titrated against N/100HCL using mixed indicator.

Calculation

$$\% \text{ Nitrogen} = \frac{(\textit{sample titre} - \textit{blank titre}) \times \textit{Normality of HCL} \times 14 \times \textit{Volume made of the digest} \times 100}{\textit{Aliquot of digestion taken} \div \textit{weight of sample taken} \times 1000}$$

$$\textit{Protein content} = 6.25 \times \text{Nitrogen } \%$$

Ash Content

Muffle furnace (TANCO model) was used to determine the ash content of the samples. [6] method was used to determine the total fat content. The apparatus was used in the following manner

The crucible and lid were placed in the furnace at 525^0C overnight. Then the crucible and the lid were weighed. 10gm of sample was weighed into the crucible. Then the crucible was placed in the muffle furnace for 6 hours at 525^0C. After this, the crucible was cooled down. Crucible was again weighed with the ash left. The following formula was used to calculate the ash content.

$$\text{Ash content } (\%) = \frac{\text{final weight of ash}}{\text{initial weight of sample}} \times 100$$

Free Fatty Acids

5g of snack food sample was weighed in flask then 50 ml of neutralized isopropyl alcohol was added and well shaked to dissolve. 2-3 drops of phenolphthalein indicator added and titrated against 0.25(N) NaOH till pink color appeared and persisted for 30 second.

Calculation

$$\text{FFA } (\%) = \frac{\text{volume of NaOH used for titration} \times \text{Normality of NaOH solution} \times \text{Equivalent weight of free fatty acid}}{\text{weight of sample} \times 1000} \times 100$$

Sensory Analysis

The sensory attributes including taste, colour, texture, flavour, crispness and overall acceptability were evaluated by a 10 member panel. The Nine-point hedonic scale was used to evaluate the degree of liking and disliking for preference of the biscuits.

Statistical Analysis

To test the significance of the effect of treatment and storage period on quality parameters, analysis of variance (ANOVA) of the collected data (n=3) for different properties was carried out as applicable to experiments of randomized design. Data was analyzed with the help of STATPAC (OPSTAT) software and the analysis of cookie samples were carried out at 5% level of significance.

Results and Discussion

Physico-Chemical Properties of Refined Wheat Flour and Defatted Soy Flour

The nutrition information of the refined wheat flour and defatted soy flour purchased from the market showed 1.20% of fat, 11% of protein content, moisture and ash were 13.20% and 0.64%, respectively while the defatted soy flour showed good amount of protein content i.e., 54% and the fat content is only 0.85 %. This shows that the utilization of defatted soy flour increases the protein content as well as reduces the fat intake. The ash content of the defatted soy

flour was found 5.85% revealing high mineral content, while the moisture content was found 9% which signifies its shelf life and storage.

Nutritional Composition of Wheat - Soybean Cookies

The protein content of the cookies increased with the increase in supplementation. The increase in protein content could be due to the soya fraction of the blended flour as the soya flour has higher protein (40.2%) as compare to wheat flour (12.1%). The protein content of the biscuits increased from 6.98 to 18.61% as shown in **Figure 1** with the increase in soybean flour from 0 to 30%. Addition of defatted soy flour improve the quantity and quality of protein content of the food product, thereby has the great potential in combating with protein energy malnutrition [7].

There was slight reduction in fat content with increase in defatted soy flour incorporation. The fat content of the biscuits decreased from 25.44 to 20.91% with the increase in soybean flour from 0 to 30% as shown in **Figure 2**.

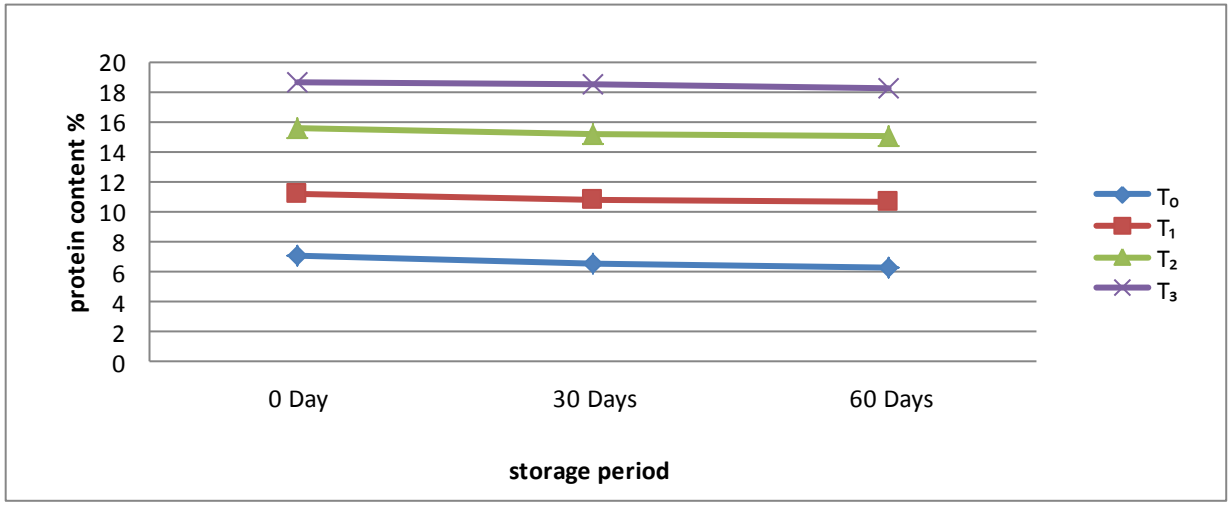

Figure 1 Evaluation of Protein content of defatted soy cookies during ambient storage

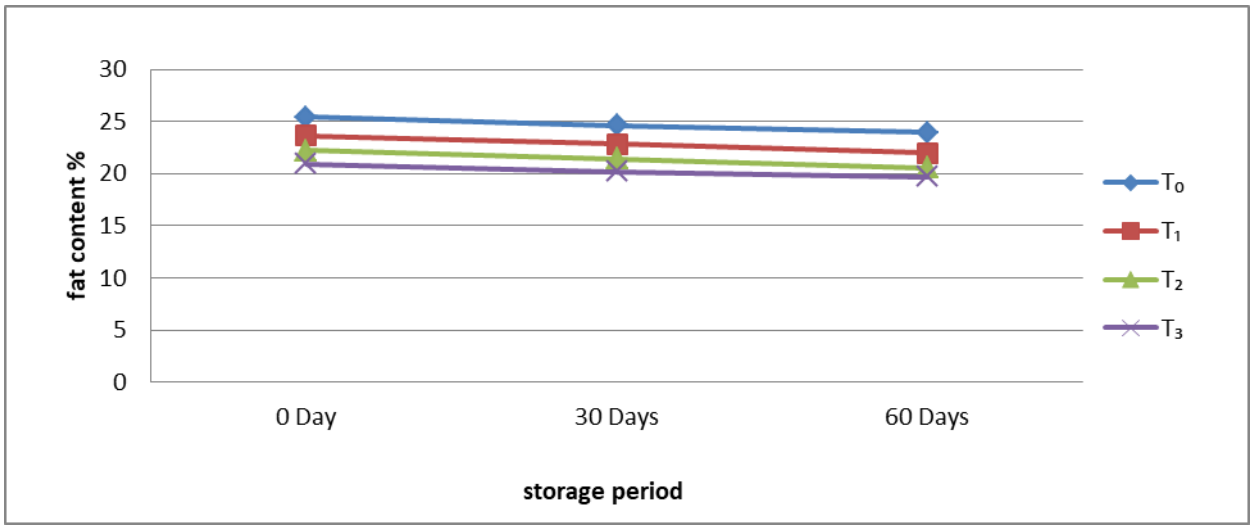

Figure 2 Evaluation of Fat content of cookie samples during ambient storage

The ash content increased from 1.52 to 2.35% with increase in the percentage of soy flour from 0 to 30% as shown in Figure 3. It was found that the ash content was the lowest in control biscuit and the highest value was recorded for the biscuits made from flour mixture containing 30% of soy flour. Ash is a non-organic compound containing mineral content of food and nutritionally it aids in the metabolism of other organic compounds such as fat and carbohydrate [8].

The moisture content of the biscuits increased from 2.30 to 2.64% with the increase in soybean flour from 0 to 30% as shown in **Figure 4**. The control sample made of 100% of wheat flour had lowest moisture content while the sample made of 30% of defatted soy flour had highest moisture content. The higher moisture content in the cookie

samples were due to the large amount of water required in optimum dough preparation and less baking time then the control cookie.

Figure 5 shows FFA content of the biscuits decreased from 0.34 to 0.22% with the increase in soybean flour from 0 to 30%. As the defatted soy flour has low fat content, which helped in preventing oxidation fat into fatty acids.

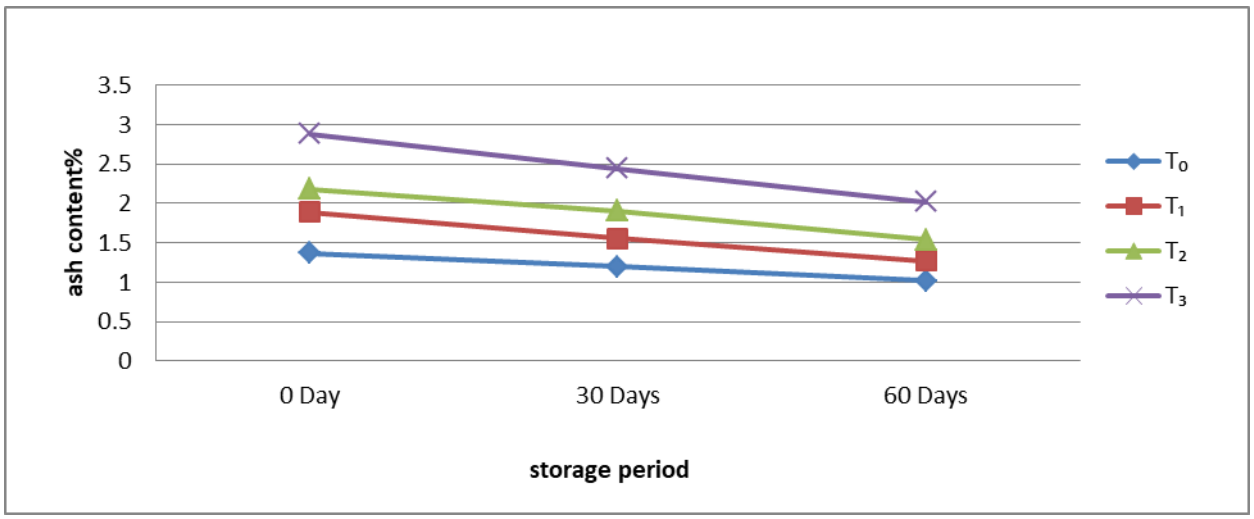

Figure 3 Evaluation of ash content of defatted soy cookies during ambient storage

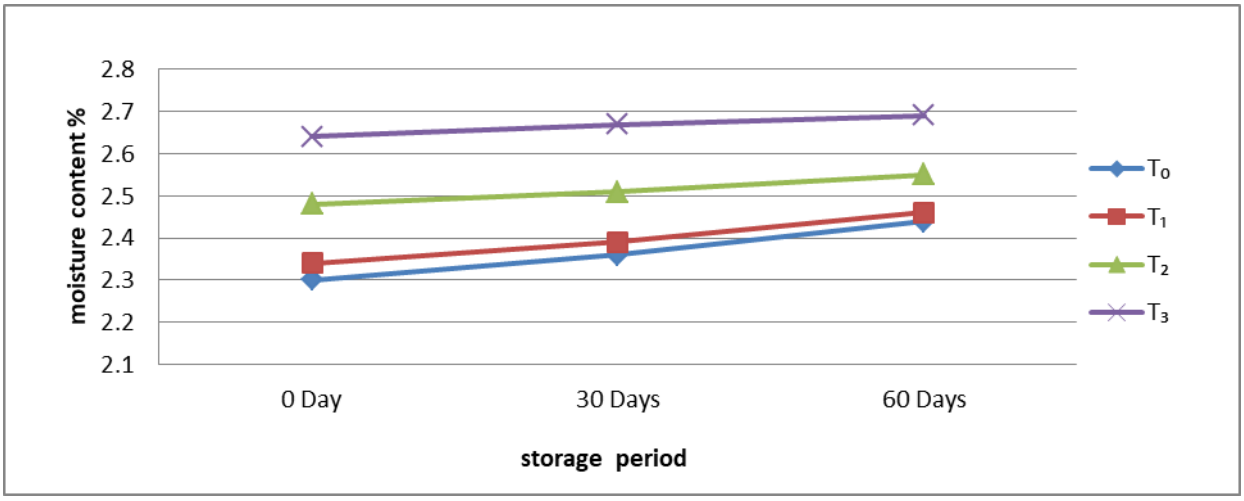

Figure 4 Evaluation of moisture content of cookie samples during ambient storage

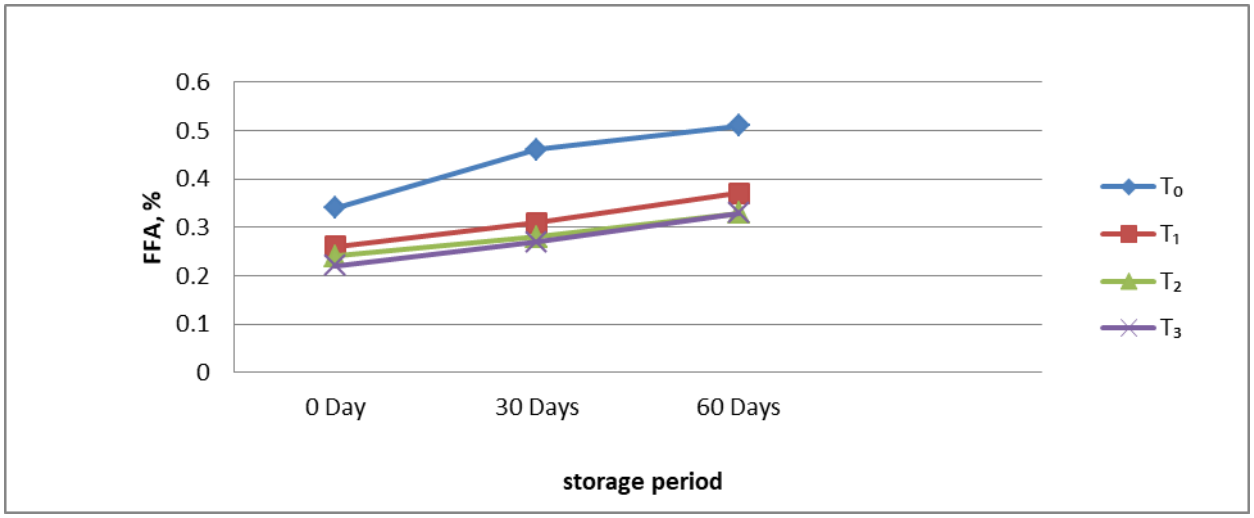

Figure 5 Evaluation of FFA of defatted soy cookies during ambient storage

Sensory Evaluation of Cookie Samples

Sensory characteristics of the all four samples were determined by taking the sensory attributes flavour, colour, taste, texture, crispiness and overall acceptability. Hedonic rating test method was used for the evaluation of different samples had been presents in **Figure 6**.

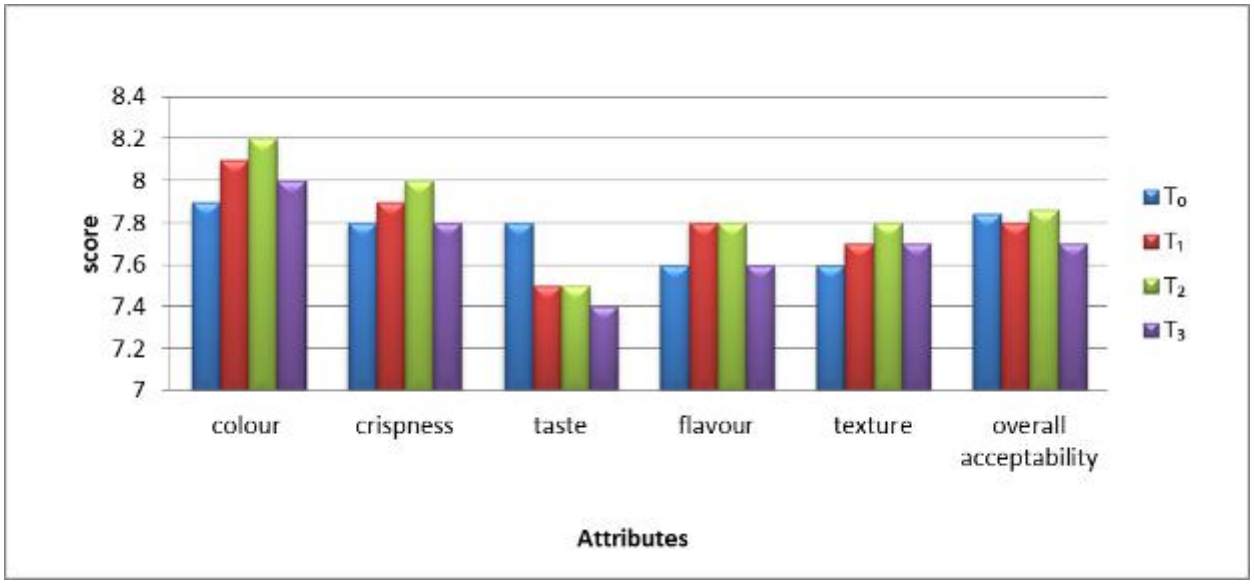

Figure 6 Sensory evaluation of cookies

The colour characteristics of cookies showed to be darker with increase in concentration of defatted soy flour which enhanced consumer appeal up to 20 % of incorporation of defatted soy flour. The colour scores of cookie enriched with 10% (8.10), 20% (8.20) and 30% (8.00) defatted soy flour showed that the cookie prepared from 20% of defatted soy flour to be the best among the all four cookie samples.

The crispness score increased slightly with the increase in the levels of defatted soy flour, the highest crispness score was recorded for the cookie prepared from 20% defatted soy cookie samples (8.00).

The flavour score of the cookies prepared with incorporation of defatted soy flour at different levels showed that cookies prepared with 10% (7.80) and 20% (7.80) incorporation of defatted soy flour scored highest for flavour.

The taste score decreased slightly with the increase in the levels of defatted soy flour, the highest taste score was recorded for the control cookie samples (7.80). The cookie samples T1, T2 and T3 prepared from different levels of defatted soy flour scored 7.50, 7.50 and 7.40 respectively.

The texture score increased slightly with the increase in the levels of defatted soy flour, the highest texture score was recorded for the cookie prepared from 20% defatted soy cookie samples (7.80).

The overall acceptability of defatted soy flour cookie samples was determined by taking average of all the values pertaining to colour, crispness, flavour, texture and taste. It was found that sample T_2 containing 20 % of defatted soy flour found to secure maximum score (7.86) followed by T0 (7.84) and T_1 (7.80) while least overall acceptability was observed in T_3 sample containing 30 per cent of defatted soy flour

Conclusion

The finding of this research revealed that, the cookies produced with defatted soy flour substitution, upto 30%, were nutritionally superior to that of the refined wheat flour cookies. On the basis of overall acceptability of cookies, it could be concluded that 20% DSF incorporation in preparation of cookies could be considered optimum with respect to sensorial quality characteristics. Protein content, moisture content and ash content of the cookie samples increased with the level of incorporation of defatted soy flour while fat and free fatty acids of cookie sample decreased with corresponding increase in the percentage of defatted soy flour.

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