International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Index Copernicus Value (2013): 6.14 | Impact Factor (2015): 6.391

Proximate Analysis and Objective Evaluation of Recipe Made with Sunflower Meal

Dr. Yamunadevi Puraikalan[1], Dr. Sabitha Natarajan[2]

[1]Assistant Professor, Nutrition Science Department, Dominican University, Illinois-60305, USA

[2]Associate Professor and Head, Department of Nutrition and Dietetics, Vellalar college for Women, Erode,-12, Tamilnadu, India

Research Highlights: The present study throws light on the benefits of sunflower meal to the community by incorporating it in the cookies. The food industry should focus on the production of value-added products with sunflower meal for achieving sustainable development in health and nutrition.

Abstract: ***In the recent years, good health and proper nutrition plays a important role in everyday life and this aspect appears in food industry. There seems to be major transition in nutrition in India, due to the impact of globalization. This often results in increased consumption of calories from carbohydrates and saturated fats. Thereby it may lead to other micro nutrient deficiencies. The present research was conducted to formulate sunflower meal fortified cookies as influenced by different levels of sunflower meal flour such as 10%, 20% and 30%. Sunflower meal fortified cookies were formulated by fortifying sunflower meal flour in different levels to the cookies flour, whereas cookies prepared out of without adding sunflower meal flour were kept as control. The colour and texture profile analysis of the sunflower meal incorporated cookies and control cookies were analysized. The instrumental results for colour analysis in the present study shows that the L, a, b values of 20 % proportions were much similar to that of control cookies among the three different proportions. The texture profile parameters such as hardness, springiness, cohesiveness, gumminess, chewiness and resilience were significant at p<0.001 level for 20 % incorporation of sunflower meal flour. The Texture Profile Analysis (TPA) of the cookies revealed that as the increased level of sunflower meal resulted in increased force.***

Keywords: Sunflower meal; Colour analysis; Texture profile analysis; Cookies

1. Introduction

SunFlower Meal (SFM) is primarily used as ruminant feed but it can be potentially used in human's food because of its nutritional and functional properties. SFM is one of the major protein meals used for livestock feeding and particularly for ruminant diets. It is generally a valuable and safe product, whose protein, fibre and oil contents are highly variable and driven by variations of the oil extraction process. Its protein content ranges from 23 per cent for some non-dehulled, mechanically-extracted meals, to more than 40 per cent for highly decorticated, solvent-extracted meals. However, usual ranges for protein are 29 to 33 per cent for non-dehulled meals and 35 to 39 per cent for dehulled and partially dehulled meals. The fibre content is directly linked to the presence of hulls: crude fibre range is 27 to 31 per cent for non-dehulled meals and 20 to 26 per cent for dehulled meals. The lignin content is important, in the 9 to 12 per cent range, even in dehulled meals. Solvent extracted sunflower meals contain about 2 to 3 per cent of residual oil, but mechanically-extracted meals may contain up 30 per cent oil depending on the amount of pressing. This oil content gives expeller meals a higher gross energy, but these meals contain less protein than solvent extracted ones (Mc Nab 2002).

Anti nutritional factors is absent in sunflower meal, unlike it is present in other meals like soybean, rapeseed or cotton; it does not require heating or special attention before being fed. Its amino acid profile is richer in sulfur amino acids and particularly methionine than other protein sources (Poncet et al., 2003, Steen 1989 and Villamide et al., 1998). SFM also contains significant amount of calcium, phosphorous and B vitamins (Grompone, 2005). The bland flavor, light color and absence of antinutritional or allergenic compounds has prompted the utilization of the oil cake for human consumption (Diaa El - Din and Farag, 1999) which is otherwise traditionally used as an animal feed.

2. Materials and Methods

Selection of sunflower meal

Sunflower meal is the by-product after extraction oil from sunflower seeds. In this present research, sunflower meal was purchased from the crop cultivator at Tiruchirappalli district, Tamilnadu, India. Sunflower meal was obtained after extraction of oil from the whole sunflower seeds. Sunflower seed in India are harvested usually in the month of June and December and the seed is available almost throughout the year.

Preparation of sunflower meal flour.

The sunflower meal were cleaned by a method of winnowing and hygienically powdered separately with the aid of an electric mixer and finally passed through a 1mm mesh sieve to obtain flour. Quick and uniform grinding was ensured without causing undue heating to avoid possible contact with outside air. The obtained flour was stored in clean, dry airtight polypropylene bags of 38 microns for further studies.

Analysis of nutrient parameters of sunflower meal flour

The sunflower meal flour were analysized for its proximate analysis such as moisture, protein, fat, fiber, carbohydrate, energy and ash content as per their respective methods described (AOAC, 2012) at Indian Institute of Crop Processing Technology, Ministry of Food Processing Industries, Government of India, Thanjavur, Tamilnadu,

Licensed Under Creative Commons Attribution CC BY

India. All the analyses were performed in triplicates and the results were averaged.

Standardization and preparation of cookies

Cookies are made in a wide variety of styles, using an array of ingredients including sugars, chocolate, butter, peanut, butter, nuts, dried fruits and spices. The softness of the cookie may depend on how long it is baked. The traditional method of one stage mixing method adopted in many countries, where all the ingredients are measured accurately and mixed together until uniform blending takes place. It was found to be cumbersome and incorporation of sunflower meal in this method of preparation led to a product that was not satisfactory in terms of colour, texture and overall acceptability of cookies. Therefore, the creaming method was employed in the preparation of cookies. This method was found to be relatively simple, cost effective and less strenuous. The entire process of preparing could be handled by a single person, which was helpful in minimizing the labor cost.

Cookie, a bakery product was prepared with the incorporation of sunflower meal flour separately and compared with control cookies prepared without the incorporation of sunflower meal flour. Cookies were prepared by the incorporation of sunflower meal flour separately using three different proportions such as l0 per cent, 20 per cent and 30 per cent respectively.

In the present research, cookies were also formulated at 5 per cent and 40 per cent level of incorporation of sunflower meal flour separately, but the nutrient quality were found to be very minimal for the former level of incorporation and for the latter, the cookies in terms of texture and over all acceptability of the product was found to be not satisfactory. Hence the blends of refined flour and sunflower meal flour separately were processed into cookies in the following ratios 100:0, 90:10, 80:20 and 70:30 were formulated in the present research.

The treatments for preparation of sunflower meal fortified cookies were as follows.
Treatment details
T1 - Cookies flour (Control)
T2 -Cookies flour + 10% sunflower meal flour
T3 - Cookies flour + 20% sunflower meal flour
T4 - Cookies flour + 30% sunflower meal flour.

The sunflower meal fortified cookies were prepared by mixing the cookies flour with specified amount of sunflower meal flour as mentioned treatments. All the ingredients such as butter, granulated sugar, water, whole egg, maida, baking flour, vanilla essence and salt were used. Butter and granulated sugar were mixed together in a planetary mixture for creaming of 15 minutes, and then water and whole egg were added. Weigh and sieve the maida flour, baking powder, vanilla essence, salt and sunflower meal flour were added together in desired quantities and baked to a temperature of 180°c for 15 minutes.

Colour analysis of cookies

The colour of the cookies was determined by the color hunter colorimeter. The colour of the cookies was evaluated by measuring the L (100 = white and 0 = black), a {red (+) and green (-)} and b {yellow (+) and blue (-)} value with a standard white tile (ISO 11037, 1999). The colour and texture profile analysis was replicated for three times. In cookie production, visual quality is of very high importance. To ensure that the quality is constantly in accordance with the specifications, it is inspected regularly throughout the production day, so that the process can be adjusted immediately if needed. Traditionally, such control and quality checking is done by human expert operators. Even though it can be advantageous to have expert human operators placed directly at the production line, there are also some disadvantages. Besides being labor intensive, manual inspectors might evaluate the products slightly different, they are also by nature subjective, and their evaluations may be inconsistent so that they vary over time, even for the same expert.

In the present research, the cookies formulated at three different proportions along with the control cookies were baked at uniform temperature and baking time, therefore the browning index was not determined for colour measures and the colour of the cookies was determined instrumentally by color hunter colorimeter. Hunter Lab is the safe bet and reliable choice by food manufacturers. In fact, majority of the food industry rely on Hunter Lab for their colour measurement needs.

Texture Profile analysis of cookies

Texture analysis of sunflower meal incorporated cookies was done by Texture Analyzer (Make Stable Micro System, U.K, Model TA –XT2). The colour and texture profile analyses were replicated for three times. Texture analysis of cookies was done by two methods such as Texture Analysis (TA) and Texture Profile Analysis (TPA) test. TA test was done for measuring cutting force of cookies and TPA test for hardness, cohesiveness, gumminess, chewiness, resilience and springiness (ISO 11036, 1994). From the texture profile analysis, the parameters such as hardness, cohesiveness, gumminess, chewiness, resilience, and springiness were determined. The texture profile analysis of cookies were triplicated and carried out at Indian Institute of Crop Processing Technology, Ministry of Food Processing Industries, Government of India, Thanjavur, Tamilnadu, India.

Statistical analysis

The data obtained through the sensory evaluation questionnaire were coded, classified and tabulated for further statistical analysis. A scoring method was developed and the scores were used for analyzing the data. Descriptive and inferential statistics was computed. The tests such as standard deviation, t- test, ANOVA and post hoc tests- Duncan's table were used.

3. Results and Discussion

Proximate analysis of Sunflower meal flour

The analysis of proximate principles of sunflower meal flour was triplicated and the results are depicted in Table I.

Licensed Under Creative Commons Attribution CC BY

Table 1: Analysis of Proximate Principles Of Sunflower Meal Flour(Sfm) Per 100 Grams

Proximate principles	SFM	Mean ± S.D	t- value	Significance
Moisture (%)	Meal	8.10±0.10	14.13	p<0.001
Protein(g)	Meal	2.20±0.10	243.35	p<0.001
Fat(g)	Meal	16.70±0.1	520.82	p<0.001
Fiber (g)	Meal	3.00±0.10	0.34	NS
Carbohydrate (g)	Meal	64.00±0.10	699.55	p<0.001
Energy (Kcals)	Meal	415.20±0.10	2858.52	p<0.001
Ash (%)	Meal	6.10±0.10	52.39	p<0.001

NS-Not Significant
Mean ± SD of triplicates determination

Colour analysis of sunflower meal flour cookies

From the below Table II, the mean value for "L" was found to be 52.33 ±0.58 for control cookies, 10 per cent of SFM cookies had 55.43 ±0.55, 20 per cent had 51.84 ±0.15 and 30 per cent had 48.60 ±0.35. The mean value for "a" of 20 per cent proportion found to be closer to that of control cookies. The mean value for "b" was 5.48 ±0.04 for control cookies, 5.67 ±0.04 for 10 per cent proportion, 20 per cent had 5.46 ±0.02 and 30 per cent had 1.47 ±0.01. It can be also seen in the Table II that all the samples except the 30 % proportion cookies, stand in the clear zone, with values of brightness (L) above 50.

In all cases the values of "a" are positive, thus indicating the predominance of the colour red over the green. The co ordinate "b" assumes also positive and relatively high values, Indicate a strong predominance of the yellow coloration, in disfavor of the blue. From the L^*, a^*, and b^* values among three proportions, it can be observed that 20% incorporation of sunflower meal had a similar parameters to that of control cookies. The results of present research found to be similar with the findings of Yamunadevi and Sabitha, 2014 who found that 20 % incorporation of sunflower meal into cookies resulted in higher the sensory scores.

Table 2: Colour Analysis of Sunflower Meal Cookies

Variables	Sample	Mean ± S.D	t- value			Significance		
			Control Vs 10 %	Control Vs 20 %	ControlVs 30 %	Control Vs 10 %	Control Vs 20 %	ControlVs 30 %
L	Control 10% 20% 30%	52.33± 0.58 55.43±0.55 51.84±0.15 48.60±0.35	6.67	1.40	9.43	0.003 p<0.001	0.23 NS	0.001 p<0.001
a	Control 10% 20% 30%	5.23±0.01 4.35±0.10 5.32±0.10 2.43±0.45	15.16	1.50	10.74	0.000 p<0.001	0.207 NS	0.000 p<0.001
b	Control 10% 20% 30%	5.48±0.04 5.67±0.04 5.46±0.02 1.47±0.01	4.93	0.64	139.84	0.008 p<0.001	0.55 NS	0.000 p<0.001

NS-Not Significant

Texture profile analysis of cookies

The Table III depicts the mean value of force for control cookies which was found to be 6009.23±0.001, 10 per cent level of proportion had 6031.38 ± 0.00, 20 per cent level of proportion had 5927.08 ± 0.001 and 30 per cent level of proportion had 5953.98 ± 0.001. It can be observed from the Table IV that increases in incorporation of SFM leads to decrease in mean value of force (g). These lower values of hardness (N) among the three variations can be somehow justified by high moisture content present in sunflower meal, while in control cookies, it is its high fat content that increases brittleness and those results from migration of moisture from the centre to the surface.

Table 3: Texture Profile Analysis Of Sunflower Meal Cookies

Variables	Sample	Mean ± S.D	t- value			Significance		
			Control Vs 10 %	Control Vs 20 %	Control Vs 30 %	Control Vs 10 %	Control Vs 20 %	Control Vs 30 %
Force(g)	Control 10% 20% 30%	6009.23±0.001 6031.38±0.00 5927.08±0.001 5953.98±0.001	27393.38	77935.50	67668.10	0.0000 p< 0.001	0.000 p< 0.001	0.000 p< 0.001
Area	Control 10% 20% 30%	412.19±0.001 327.30±0.00 412.60±0.001 285.53±0.001	99078.17	19706.23	191207.04	0.0000 p< 0.001	0.000 p< 0.001	0.000 p< 0.001
Time difference (Sec)	Control 10% 20% 30%	1.81±0.001 1.51±0.01 1.74±0.00 1.48±0.00	45.23	70.83	496.00	0.0000 p< 0.001	0.0000 p< 0.001	0.0000 p< 0.001
Hardness (N)	Control 10% 20% 30%	6009.23±0.001 6031.38±0.001 5927.08±0.001 5953.98±0.001	27122.70	71145.34	67668.10	0.0000 p< 0.001	0.0000 p< 0.001	0.0000 p< 0.001

Licensed Under Creative Commons Attribution CC BY

Springiness (%)	Control 10% 20% 30%	0.25±0.001 0.17±0.001 0.25±0.00 0.16±0.00	91.02	1.73	131.98	0.0000 p< 0.001	0.157 NS	0.0000 p< 0.001
Cohesiveness (%)	Control 10% 20% 30%	0.99±0.00 0.99±0.00 0.99±0.00 0.63±0.007	52553.56	44.57	39.83	0.0000 p< 0.001	0.0000 p< 0.001	0.0000 p< 0.001
Gumminess	Control 10% 20% 30%	6008.56±0.001 6030.67±0.001 5926.16±0.008 5953.11±0.009	27066.24	16923.63	9679.27	0.0000 p< 0.001	0.0000 p< 0.001	0.0000 p< 0.001
Chewiness	Control 10% 20% 30%	1528.60±6.24 1037.47±7.07 1037.47±7.07 965.91±3.68	90.14	3.95	134.44	0.0000 p< 0.001	0.017 p<0.01	0.0000 p< 0.001
Resilience (%)	Control 10% 20% 30%	1.27±0.00 1.04±0.00 1.29±0.00 2.13±0.00	164725.9	16256.5	191820.69	0.0000 p< 0.001	0.0000 p< 0.001	0.0000 p< 0.001

4. Conclusions

The present research shows that there exists potential for sunflower meal flour incorporation into baked products. This would be of economic importance in many developing countries such as India in promoting the utilization of sunflower meal. Health concerns related to baked products consumption are often attributed to the higher amount of fat content in the product. Furthermore, fortification of commercial cookies with essential micro nutrients like vitamins and minerals, fiber and other flours which enhance their nutritional attributes can be targeted to ensure better nutrition to the people.

5. Acknowledgements

I am thankful to Indian Institute of Crop Processing Technology, Ministry of Food Processing Industries, Government of India, Thanjavur, Tamilnadu, India for helping me to carry out the research work at the institute.

References

[1] AOAC (Association of Official Analytical Chemist), Official methods of analysis.2012. Washington DC; 19th Edition,pp173.
[2] Diaa El-Din M and Farag H(1999) Effect of radiation and other processes methods on protein quality of sunflower meal. Journal of the Science of Food and Agriculture, 79, 1565- 1570.
[3] Grompone MA(2005) Sunflower oil. In: Bailey's Industrial Oil and Fat Products, Sixth Edition, John Wiley and Sons, Inc.
[4] ISO 11037(1999) Sensory Analysis, General guidance and test method for assessment of the color of food,Westport, CT: AVI Publ. Co, pp121- 136.
[5] ISO11036(1994) Sensory analysis Methodology, Texture profile analysis. In Rheology and Texture in Food Quality, Westport, CT: AVI Publ. Co, pp 142-243.
[6] McNab JM (2002) Poultry Feedstuffs: Supply, Composition and Nutritive Value. CABI Publishing, pp 49.
[7] Poncet C, Remond D, Lepage E Doreau M(2003) Comment mieux valoriser les proteagineux et oleagineux en alimentation des ruminants. Fourrages, 174, 205-229.
[8] Steen RWJ (1989) A comparison of soya-bean, sunflower and fish meals as protein supplements for yearling cattle offered grass silage-based diets. Animal Production, 48, 1, 81-89.
[9] Villamide MJ and San Juan L D(1998) Effect of chemical composition of sunflower seed meal on its true metabolizable energy and amino acid digestibility. Poultry Science, 77, 12, 1884-1892.
[10] Yamunadevi Puraikalan and Dr. Sabitha. N (2014) Development and Sensory Evaluation of Sunflower Meal Fortified Cookies. Journal of Science and Research (IJSR) , 3,8, 1160-63.

Licensed Under Creative Commons Attribution CC BY