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To Study Chemical Properties Of Developed Peanut Butter

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Abstract: The study of development of nutritious butter from peanut was undertaken considering its importance for human health. To increase the consumption of peanut butter flavors are added which enhances the test of peanut butter. The ingredients used to prepare flavored peanut butter are peanut, sugar, oil, flavors, essence. Three treatments were studied in which sugar content varied for 15gm, 25gm and 35gm. For each treatment three replications are considered. Laboratory tests performed to check the chemical composition of developed peanut butter. The replications were prepared and considered for chemical analysis. The ANOVA method is used to optimize the quality parameters of the treatments. The treatment T2 was found to be the best treatment in both sensory and laboratory treatments. In test, parameters like moisture, total ash, total fat, protein, acid value of fat, total carbohydrates, energy, reducing sugar, non-reducing sugar, total sugar and salt were calculated in Chocolate flavor 3.89%, 1.96%, 41.44%, 20.84%, 0.52%, 37.87%, 583.80kcal, 0.22%, 19.53%,18.34%, 0.34% respectively. And in Pineapple flavor 4.37%, 1.81%, 40.29%, 20.23%, 0.47%, 33.30%, 576.73kcal, 0.16%, 19.27%, 18.15%, 0.36% respectively.

Key words: **Peanut butter, Sugar, Chemical Properties, ANOVA.**

I. INTRODUCTION

Peanut butter is a beloved and versatile spread, enjoyed by people across the globe. Its deliciousness is matched only by its nutritional value, making it a top choice for sandwiches, snacks, and even recipes. And the magic behind this creamy delight. Among peanut-based products, peanut butter stands out as a particularly promising choice. The commercial production of peanut butter has flourished worldwide, making it staple food enjoyed by all age groups, from infants to the elderly. Peanut butter shows its beneficial health impact on malnourished infants when included in their diet

The Indian Peanut butter production is mostly concentrated in the peanut growing states, of which, Gujarat is leader in its manufacturing. The existing peanut manufacturing units are concentrated in this region and cater to the export to USA, Canada, Japan, Middle East, South East Asian and African countries. Although the popularity of the peanut butter is variable around the world, most of which is consolidated in American and European countries, however, the trend of consumption has seen massive jump in developing nations as well. Most of this is mainly focused on urban population in countries like India. The global butter market currently is estimated to about 21.6 billion USD, and has grown at 3.3% CAGR during the decade (2010-20) as against the global oil and fat market that has grown by 2.6% CAGR. The Indian butter market has even shown a bigger leap with growth at the rate 8.6% CAGR from 2010 to 2020, while the Indian fats and oil market has grown at

the rate of 6.7% CAGR, during the same period. Peanut butter is a dynamic product now piercing this butter market, owing to various growth drivers. (PMFMP - processing of peanut butter)

The primary reason for the increase in demand for peanut butter could be attributed to many factors like favourable demographic and lifestyle change. As the working population of India is increasing by 64% by current year (2021) and increasing purchasing capacity per capita, along with increasing urbanization. Worldwide consumers are becoming wary of the various health issues associated with the junk food consumption. The consumer population are looking of healthy alternative to the junk that would taste and feel just like the junk commodities. Moreover, the day to day activities of people are becoming strenuous and requirement of energy on the other hand have gone up. Peanut butter is healthy alternative to the junk food providing required energy and other beneficial nutrients. With recent estimates India will become worlds 5th largest consumer market by 2025, with the Indian middle class increasing by 583 million by this year. Other reasons include the improvement in the retail structure in India, with the industry becoming more organized. Big players like Reliance Fresh, Big Bazar, Easyday etc. coming into picture availability of variety of consumer food products has grown. The retail market is expected to grow by 10%. Further the e-grocery segment in India has grown by 26% CAGR, owing to improved connectivity (GAIC 2017).

II. MATERIAL AND METHODS

The details of experimental material used, and methods adopted during the present study are described in detail.

Experimental details

The ingredients used for flavored peanut butter were Peanut, Sugar, Oil, Essence and Flavors (Chocolate & Pineapple). The quantity of these ingredients had impact on acceptability of peanut butter. The quantity of ingredients was captured in following table 3.1 where sugar had varied for 15gm , 25gm and 35gm.

Evaluation of Chemical properties of peanut butter-

Proximate composition of peanut butter (Chemical characteristic):

Prepared chocolate and pineapple peanut butter were analyzed for moisture, total ash, total fat, protein, acid value, carbohydrates, energy by the methods of AOAC (2003). This analysis was conducted at SHREE FDT LAB, Kolhapur.

Estimation of moisture:

Samples weighing 100 g were taken and dried in oven at 60 C, Then the dried samples were weighted and this value was subtracted from the fresh weight of the sample to obtain moisture. The percent moisture was calculated by following formula:

$$\% \text{ Moisture} = ((W1-W2))/W1 \times 100 \quad (1)$$

Where,

W1 = Weight of sample before drying (g)

W2 = Weight of sample after drying (g)

Note: Moisture free samples were used for further analysis.

Estimation of Total ash:

The Ash content of sample was obtained by dry ashing the samples completely by heating it over a flame, This was expressed as gram/100 g of the samples. Total ash was calculated by following formula:

$$\% \text{ Total ash} = (\text{Weight of ash})/(\text{Weight of sample}) \times 100 \quad (2)$$

Estimation of fat:

Fat was estimated as crude ether extracted using moisture free samples. The solvent was removed by evaporation and residue of fat was weighted. Fat content was calculated by following formula:

$$\text{Fat content} = (\text{Weight of ether extract})/(\text{Weight of sample taken}) \times 100 \quad (3)$$

Estimation of Protein:

The protein content of the dried samples was estimated as percent total nitrogen by micro kjeldhal procedure. Protein percent was calculated by multiplying the per cent nitrogen by the factor 6.25. Protein was calculated by following formula:

Per cent Protein = (Titre value x Normality of HCL x 14.001 x 6.25)/(Sample weight (g)) x 100 (4)

Estimation of Carbohydrates:

Carbohydrate content was calculated by differential method.

Carbohydrate (g/100g) = 100-[{Protein (g)+ Fat (g)+Ash (g)+Moisture (%)}] (5)

Estimation of Energy:

Energy was calculated by differential method.

Energy (k.cal) = Protein (g) x 4 + Fat (g) x 9 + Carbohydrates (g) x 4 (6)

III. Statistical Analysis

Analysis of variance (ANOVA) is a statistical technique that splits the observed aggregate variability found within a data set into two parts: systematic factors and random factors. Systematic factors have a statistical influence on the given data set, while random factors do not. Analysts use the ANOVA test to determine the influence that independent variables have on the dependent variable in a regression study.

While the t- and z-test methods were developed in the 20th century, their widespread use predates 1918. The term "ANOVA" became well-known in 1925 after appearing in Fisher's book, "Statistical Methods for Research Workers." Initially employed in experimental psychology, ANOVA has since expanded to more complex subjects

IV. Result and Discussion

Chemical properties of developed peanut butter

4.1 Moisture Content:

The moisture content observed in control sample was (4.42%) which was significantly more than the remaining treatments (T1, T2 & T3). The minimum moisture content in chocolate flavor was (3.21%) and in Pineapple flavor it was (3.69%). In both flavors, minimum moisture content was observed in treatment T2 which was significantly less than all other treatment. Moisture content of peanut butter samples in present research varied between (3.21% to 4.23%) which is in accordance with results of Navnitkumar et al. (2012) and Shibli et al. (2019). Lesser moisture contents of peanut butter helps to get the longer shelf life and microbial stability of peanut butter.

4.2 Total Ash:

The Ash content observed in control sample was (1.55%) whereas it varies between (0.99% to 1.87 %) in chocolate peanut butter and (1.62% to 1.85%) in pineapple peanut butter for treatments T1, T2 and T3. For treatment T2 the total ash% observed is lower than treatment T1 and T3. Ash percentage of peanut butter samples in present study fluctuated between (0.99% to 1.87%) that corresponded with the range mentioned by Shibli et al. (2019).

4.3 Total Fat:

The fat content of the control and treatments ranged between (39.20% to 42.43%) though there was no significant difference among the samples. The control sample (42.43%) and treatment T1 (41.39%) of chocolate peanut butter and treatment T3 (41.24%) of pineapple flavor butter had the highest fat content while treatment T2 (39.20%) of chocolate peanut butter and treatment T2 (39.71%) of pineapple flavor butter had the least amount. This result is similar with the results of Mulindhwa et al. (2019).

4.4 Protein:

Protein is essential for muscle repair, growth and various body functions. Treatment T2 has highest level of protein content in both chocolate and pineapple peanut butter. The protein content significantly ranged from (18.19% to 20.72%), with Treatment T2 (20.72%) of chocolate flavor and again treatment T2 (20.22%) of pineapple flavor peanut butter having the highest protein content, followed by treatment T3 & T1. Control sample has protein level of (20.47%).

4.5 Acid value of Fat:

The maximum acid value of fat was observed in control sample (0.81%) which was significantly more than remaining treatments. The minimum acid value of fat (0.27%) was found in treatment T2 of chocolate peanut butter and in treatment T2 of pineapple peanut butter it was (0.37%) which was significantly less than the control sample. There is slight difference in acid value of fat between all the treatments.

4.6 Total Carbohydrates:

Carbohydrate percentage of peanut butter samples in present study varied between (33.63% to 38.37%) which was little higher than control sample carbohydrate percentage (31.76%). The carbohydrate percentage found in the study done by Shibli et al. (2019) was lesser (24% to 32%) compared to the present study. This variation could be due to the difference in the peanut variety selected for the study.

4.7 Total Energy:

In Chocolate peanut butter, the maximum energy (585.15 Kcal) was noticed in treatment T2 whereas the minimum energy (507.28 Kcal) was observed in the control sample. Similarly, for Pineapple peanut butter, the maximum energy (572.92 Kcal) was noticed in treatment T2.

4.8 Reducing Sugar:

It is observed that the highest reducing sugar content (0.37%) is in control sample whereas the lowest reducing sugar content (0.15%) was observed in treatment T2 of chocolate peanut butter and treatment T2 (0.16%) of Pineapple flavor peanut butter.

4.9 Non reducing Sugar:

The highest non reducing sugar was found in control sample (21.19%) and in chocolate flavor peanut butter, the lowest non reducing sugar content was found in treatment T2 (17.93%). Similarly, in pineapple flavor peanut butter, the lowest non reducing sugar content was found in treatment T2 (18.27%), Hence the treatment T2 is best for non-reducing sugar in developed product.

4.10 Total Sugar:

It is seen that highest total sugar content was observed in control sample (22.01%) whereas in chocolate flavor peanut butter, the lowest total sugar content was found in treatment T2 (17.21%). In pineapple flavor peanut butter, the lowest total sugar content was found in treatment T2 (17.59%), the Sample T2 was significantly better than all other treatments (T1, T2 & T3).

4.11 Salt:

In chocolate flavor peanut butter, the lowest salt content observed in treatment T2 (0.19%) and in pineapple flavor peanut butter lowest salt content observed in treatment T2 (0.21%). For control sample, salt content is (0.42%) which is significantly higher compared to the treatments studied in chocolate and pineapple flavor peanut butter.

Table 1: Chemical properties of developed peanut butter

Treatments	Chocolate flavour Peanut butter					Pineapple flavour Peanut butter				
	Moisture	Total Ash	Total Fat	Protein	Acid Value of Fat	Moisture	Total Ash	Total Fat	Protein	Acid Value of Fat
T1	3.85	1.87	41.39	18.19	0.50	4.23	1.73	40.16	19.63	0.29
T2	3.21	0.99	39.20	20.72	0.27	3.69	1.62	39.17	20.22	0.37
T3	4.21	1.06	39.80	19.78	0.38	4.07	1.85	41.24	20.21	0.46
T0	4.42	1.55	42.43	19.21	0.81	4.42	1.55	42.43	19.21	0.81
SE	0.052	0.039	0.278	0.316	0.050	0.0547	0.647	0.261	0.314	0.100
CD	0.247	0.188	1.320	1.504	0.239	0.259	NS	1.243	NS	NS

NS: Non-Significant

Table 2: Chemical properties of developed Chocolate flavour peanut butter

Treatments	Chocolate flavour Peanut butter					
	Carbohydrate	Energy	Reducing sugar	Non-Reducing Sugar	Total sugar	Salt
T1	34.11	570.55	0.20	19.20	18.20	0.35
T2	38.37	585.15	0.15	17.93	17.21	0.19
T3	35.12	583.64	0.19	20.21	18.29	0.26
T0	31.76	507.28	0.37	21.19	22.01	0.42
SE	1.039	1.962	0.027	0.300	0.396	0.021
CD	NS	9.313	0.130	1.428	1.879	0.101

Table 3: Chemical properties of developed Pineapple flavour peanut butter

Treatments	Pineapple flavour Peanut butter					
	Carbohydrate	Energy	Reducing sugar	Non-Reducing Sugar	Total sugar	Salt
T1	33.51	560.31	0.31	19.23	18.13	0.35
T2	35.89	572.62	0.16	18.27	17.59	0.21
T3	32.63	566.25	0.19	20.17	20.04	0.40
T0	31.76	507.28	0.37	21.19	22.01	0.42
SE	0.484	6.221	0.100	0.194	0.400	0.028
CD	2.299	29.524	NS	0.921	1.899	0.135

V. CONCLUSION

Proximate composition revealed that Treatment T2 of chocolate peanut butter contains moisture 3.89 %, total ash 1.96 %, total fat 41.44 %, protein 20.84 %, acid value of fat 0.52 %, total carbohydrates 37.87 %, energy 583.80 kcal, reducing sugar 0.22 %, non-reducing sugar 19.53 %, total sugar 18.34 % and Salt 0.38 %

Also, the proximate composition of Treatment T2 of pineapple peanut butter contains moisture 4.37 %, total ash 1.81 %, total fat 40.29 %, protein 20.23 %, acid value of fat 0.47 %, total carbohydrates 33.30 %, energy 576.73 kcal, reducing sugar 0.16 %, non-reducing sugar 19.27 %, total sugar 18.15 % and Salt 0.36 %
From the investigation it is concluded that flavored nutritional peanut butter is more acceptable compared to existing plain peanut butter and provides health benefits

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