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A STUDY ON THE PHYSIO CHEMICAL, MICROBIAL AND SENSORY PROPERTIES OF MILK PEDA BY INCORPORATION OF NATURAL SWEETNER (PALM SUGAR)

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Abstract

Peda is a highly nutritious indigenous milk product containing almost all milk solids plus added sugar and other additives. Palm sugar, a traditional organic sweetener is used to replace the sugar at the level of 25 percent, 50 percent, 75 percent, and 100 percent in the preparation of peda. There was no significant difference in output yield of peda samples between control and treatments, as compared with yield, T3 has best output yield. Analysis of the data for moisture, total solids and ash contents revealed highly significant difference between control and to increase in the minerals and vitamin content of palm sugar. An increasing trend in titratable acidity and pH value of peda samples were observed when replacement level of palm sugar increases due to higher citric acid content and pH level. But there is no significant difference between control and treatments in fat and protein content of peda samples. The textural analysis of various combinations of peda samples for firmness, Consistency and cohesiveness showed significant difference between control and treatments whereas no significant difference observed in index of Viscosity (g. sec) between peda samples. Analysis of data showed highly significant difference between control and treatments indicating that addition of palm sugar at different level produce significant change in the standard plate count and coliform count due to minimal processing of palm sugars during preparation and contain other ingredients rather than sugars. There was no growth of yeast and mold in control and treatments indicating that addition of palm sugar at various level dose not promote the yeast and mold growth because all the samples were analyzed for the count immediately after preparation may be the reason for the absence of growth. The organoleptic quality revealed 75 percent replacement (T3) of cane sugar with palm sugar scored better result than control and other treatments. In economy of production study, when replacement level increased the cost of the finished product also increased due to higher price of the palm sugar.

I. INTRODUCTION

India continues to be the largest producer of milk in world with 133.7 million tones in the year 2012-13. A considerable share of total milk production is utilized for production of milk based sweets as they have been an inseparable part of socio-cultural life of Indian subcontinent. It has also been reported that from the total milk production, 50-55% was utilized for production of indigenous milk products using processes such as heat and acid coagulation, heat desiccation and fermentation by the traditional sector (Dairy India, 2007). Indian milk sweets have played a significant role in the economic, social, religious and nutritional wellbeing of our people since ancient period. The market for Indian milk products is estimated to be more than sixty-five thousand crores. This value underlines the significance of Indian milk sweets in the national economy, out of total milk produced in India, buffalo milk contributes 55 per cent and cow milk 40.5 per cent.

Khoa, a heat desiccated traditional Indian milk product prepared by heat concentration of milk in an open pan with continuous stirring and scrapping, is a major intermediate base for a variety of sweets like burfi, peda, kalakand, gulabjamun etc. (Acharya and Sapkota, 2008, Sowmya *et al*. 2015). Peda is highly nutritious product as it contains almost all milk solids plus added sugar and other additives. Peda is indigenous milk sweet prepared by heating a mixture of khoa and sugar until the desiccated or concentrated whole milk (Anonymous,2011). The production of peda far surpasses other traditional milk sweets produced in India (Narwade and Bhosale, 2007) by its desired granular, hard texture and flavor.

Palm sugar is produced from sap derived from the tropical coconut tree (Cocos nucrfem) or a palm tree called *Arenga pinnam* (Apriyantono *et. al.* 2002 and Panyakul, 2001). Palm sugar has been used as a traditional sweetener for thousands of years in Asia. Its flavor is similar to a combination of brown sugar and molasses. It is now gaining popularity globally because of its natural, minimal processed and healthy. One of the major health claims is its low glycemic index (GI) which plays an important role in the dietary management of diabetes, weight reduction, peak sport performance and reduction of risks associated with heart disease and hypertension (Jenkins *et. al.*, 2002).

In general, natural foods and natural flavours found preference among people rather than those based on chemical or artificial agents due to health consciousness.

Palm sugar is a natural product having nutritive as well as medicinal value. So far scanty research work had been conducted on utilization of palm sugar in peda. The present study envisages the use of palm sugar as substitute for sugar at different level in peda preparation.

II. MATERIALS AND METHODS

PREPARATION OF PALM SUGAR PEDA

Fresh pooled cow milk was collected from the SNP dairy industry, Ayyankottai, Vadipatti, Madurai and good quality palm sugar purchased from Khadi kraft, Madurai were ~~was~~ used in the preparation of peda samples. In the present study, cane sugar was replaced by incorporation of natural sweetener - palm sugar at different levels (25 percent, 50 percent, 75 percent, and 100 percent) in the preparation of peda. The formulations were coded as T_o (control), T1, T2, T3 and T4 (Table 1). The flow chart for the preparation of peda is given in Figure 1.

Flow Chart for Preparation Of Peda With Palm Sugar

Receiving of Cow Milk
↓
Preheating [38-40 ^{0}C]
↓
Standardization [3.5% Fat and 8.5% SNF]
↓
Boiling of milk in karahi (stirring and scrapping)
↓
Khoa leaving sides of pan
↓
Pat formation stage (stop heating)
↓
Addition of sugar / palm sugar
↓
Stirring and scrapping for mixing
↓
Spreading the mass to the sides of pan
↓
Packaging
↓
Storage (4^{0}C)

Table- 1 DIFFERENT FORMULATIONS OF PEDA

Trial	Milk (Ltrs)	Percentage of palm sugar added	Sugar (gms)	Palm sugar(gms)
T0- Control	2	0	200	-
T1	2	25	150	50
T2	2	50	100	100
T3	2	75	50	150
T4	2	100	-	200

III. COMPOSITIONAL ANALYSIS OF THE PRODUCT

pH of peda samples was measured by Electronic digital type Hana pH meter No. H_1 8416 according to method No.981.12 of AOAC (1990).Titratable acidity of peda was determined as per the method given in IS:4883 (1980).Fat content in milk was estimated by Gerber's method as per the procedure given in IS: 1224, (part II) (1977). The protein content of peda were determined by micro Kjeldhal method as per the procedure described in IS : 7219 (1973). The method described in AOAC (1975) was followed for the estimation of percentage of moisture and ash in peda. The total solids percentage of peda were estimated by gravimetric method IS: 1479 part II (1961). The rheological characteristics of peda was analyzed by using the texture analyzer (model: TA HD plus, Stable Microsystems).

MICROBIAL ANALYSIS

All the samples were subjected to microbiological analysis for Standard Plate Count (SPC), Coliform Count and Yeast and Mould Count (YMC). The standard plate count of the samples was analyzed as per the method followed in IS: 5402 (1969).The Coliform count of the samples was enumerated by using Violet Red Bile Agar (IS 5401, 1969). Yeast and mould count were determined using Potato Dextrose Agar medium as per the procedure of IS: 5403(1969).

SENSORY EVALUATION

The samples of the milk peda were subjected to sensory evaluations by a panel of 6 semi trained judges using the score card adopted by Puranik *et al.*,(1998). The score card for the evaluation of milk peda considering the factors like flavour (45), body and texture (35) and appearance and finish (20)

COST ESTIMATION

The cost of 100 g of control and treatment peda was calculated from the linear programming model based on the market price of the ingredients. The cost of ingredients per kilogram based on market price of each product was milk Rs. 40, sugar Rs. 40 and palm sugar Rs 100. The further calculations were made based on this price.

DATA ANALYSIS

The experimental trials were replicated for four times and the observations obtained from all four replications were analyzed statistically by using completely randomized design (CRD) as per Panse and Sukhatme (1985).

IV. RESULTS AND DISCUSSION

The different formulations of palm sugar peda were subjected to physio chemical and cost analysis were exhibited in table 2 and figure 1 to 9 .The output yield (g) of peda samples were 556.26, 562.27, 564.22, 577.21 and 557.26 for control and treatments T1, T2, T3 and T4, respectively. The results of the samples–ranged from to 556.26 to 577.21. The output yields in percent were 25.69, 25.55, 25.65, 26.24 and 25.33 for control and treatments with a range of 25.24 to

Table- 2 PHYSIO - CHEMICAL CHARACTERS OF PALM SUGAR PEDA

Parameters	T0	T1	T2	T3	T4	MEAN	SEd (0.05)
Output Yield (gm)	556.26	556.26	556.26	556.26	556.26	563.444	17.2156
Output Yield (%)	25.69	25.55	25.65	25.24	25.33	25.69	0.7843
Moisture (%)	21.33	21.33	21.33	21.33	21.33	20.80	0.6683
Total solids (%)	78.67	78.67	78.67	78.67	78.67	79.20	0.6683
Titratable Acidity(as %LA)	0.56	0.56	0.56	0.56	0.56	0.59	0.0172
pH	6.8	6.8	6.8	6.8	6.8	0.59	0.0172
Fat (%)	21.84	21.84	21.84	21.84	21.84	22.69	0.6927
Protein (%)	19.10	19.10	19.10	19.10	19.10	22.69	0.6927
Firmness gm%	392.327	231.797	229.903	440.983	780.839	415.169	14.0976
Consistency(g.sec)	2606.682	2299.527	2365.848	4026.142	4045.432	3068.726	148.1214
Cohesiveness (g)	-229.666	-203.622	-229.666	-339.633	-318.810	-264.280	11.0804
Index of Viscosity(g.sec)	-2.808	-29.361	-19.164	-13.336	-0.705	-13.074	10.2433

25.69. There is no significant difference between control and treatments, as compared with yield, T3 has best output yield. In the present study, the output yield of peda for control and treatments were in close agreement with the result of De, (1980) and Sindhu, (1996).

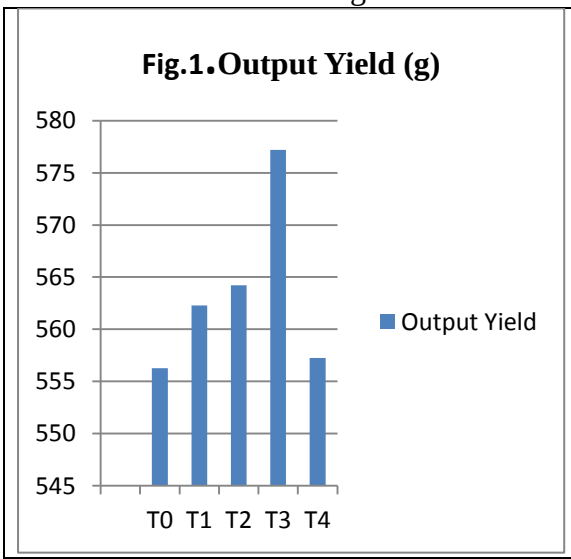


Fig.1.Output Yield (g)

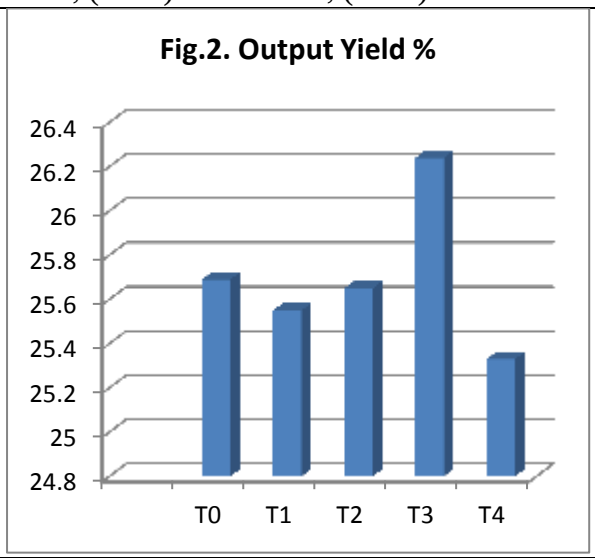
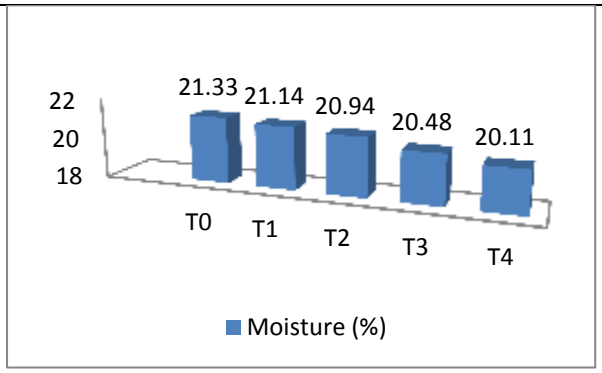


Fig.2. Output Yield %

Fig.3. Moisture Percentage Of Peda

Fig.4 .Total Solids Percentage Of Peda



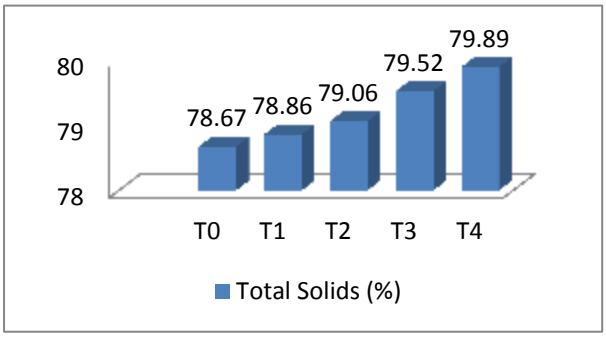


Fig 5 Ash (mg)

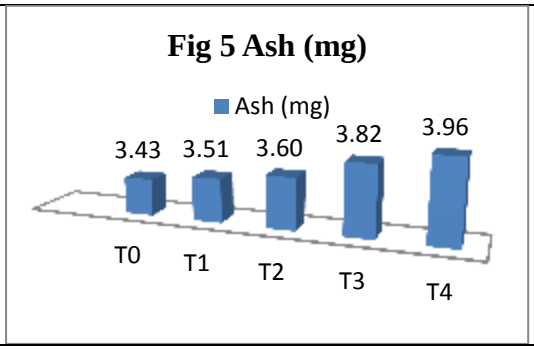


Fig 6 Titratable acidity

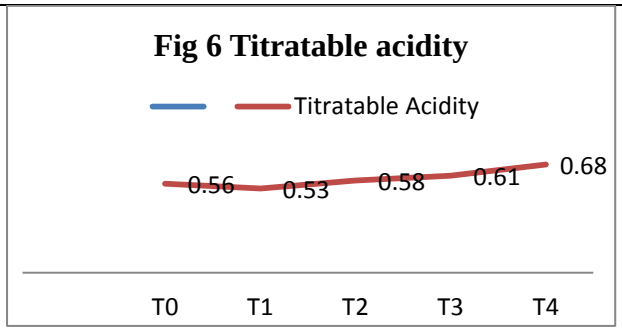


Fig 7 pH

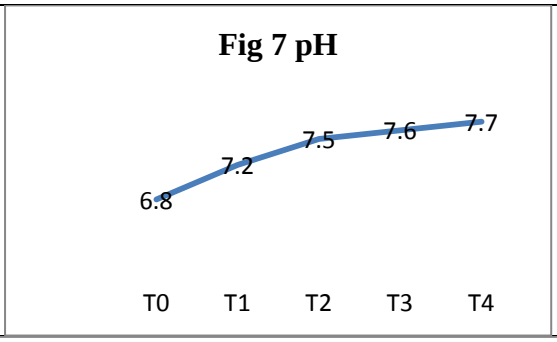


Fig 8 Fat (%)

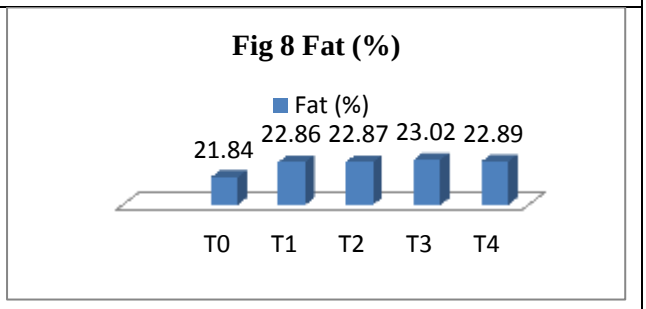
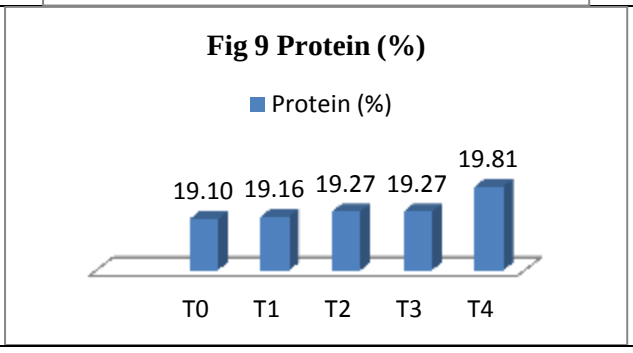


Fig 9 Protein (%)

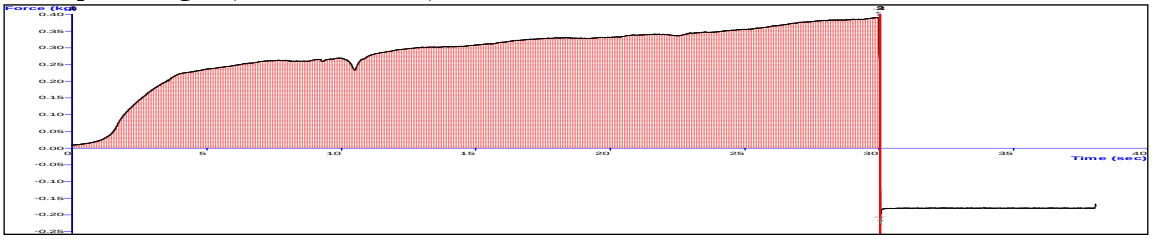


Moisture percentages of peda samples were recorded as 21.33, 21.14, 20.94, 20.48, and 20.11 for control and treatments T1, T2, T3, and T4, respectively. The result of samples was ranged from to 20.11 to 21.33. Analysis of the data revealed highly significant difference in the moisture of peda samples between control and treatments. Kavita Banjare *et.al.* (2015) reported that moisture percentage of market peda sample were ranged from 12.21 to 23.34 and for laboratory made samples 12.96.

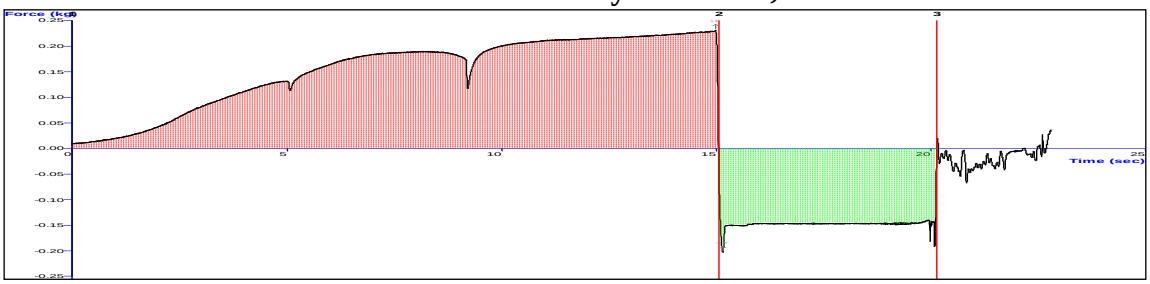
Total solids (g) percentage of peda samples were78.67, 78.86, 79.06, 79.52, and 79.89 for T0, T1, T2, T3 and T4, respectively. Analysis of data revealed highly significant difference between control and treatments indicating that addition of palm sugar at any percentage increases the total solids content of treatments due to increase in the minerals and vitamin content of palm sugar (MI Secretaria, 2003).

Ash (mg) percentage of peda samples were 3.43, 3.51, 3.60, 3.82, and 3.96 for T0, T1, T2, T3, and T4, respectively. Increasing trend in the ash content was observed with higher replacement of sugar with palm sugar may be due to higher concentration of minerals especially calcium and potassium (Aider *et al.*, 2007). Best result obtained in treatments T3 and T4respectively.

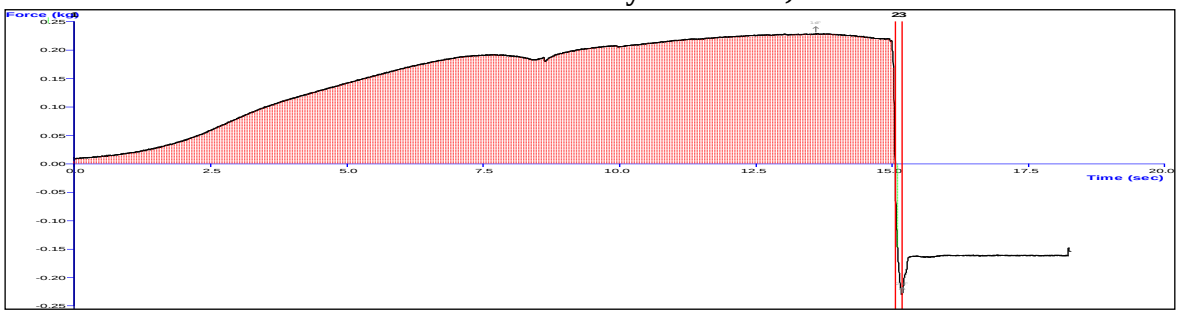
Titratable Acidity (as percentage lactic acid) of peda samples were 0.56, 0.53, 0.58, 0.61 and 0.68 for control treatments T1, T2, T3, T4, respectively. The result of the samples ranged from 0.53 to 0.68. Significant difference between control and treatments indicating that addition of palm sugar at different levels produce significant change in the titratable acidity of the product due to the presence of citric acid in palm sugar (Srikaeo and Thongta., 2015). The pH Value of peda samples were 6.8, 7.2, 7.5, 7.6, and 7.7 for control and treatments T1, T2, T3, T4, respectively. An increasing trend in pH value was observed when addition of palm sugar at 25 per cent, 50 per cent, 75 per cent and 100 percent replacement level produce significant change in the pH of peda due to higher pH level of the palm sugar (Ho *et al*., 2008).



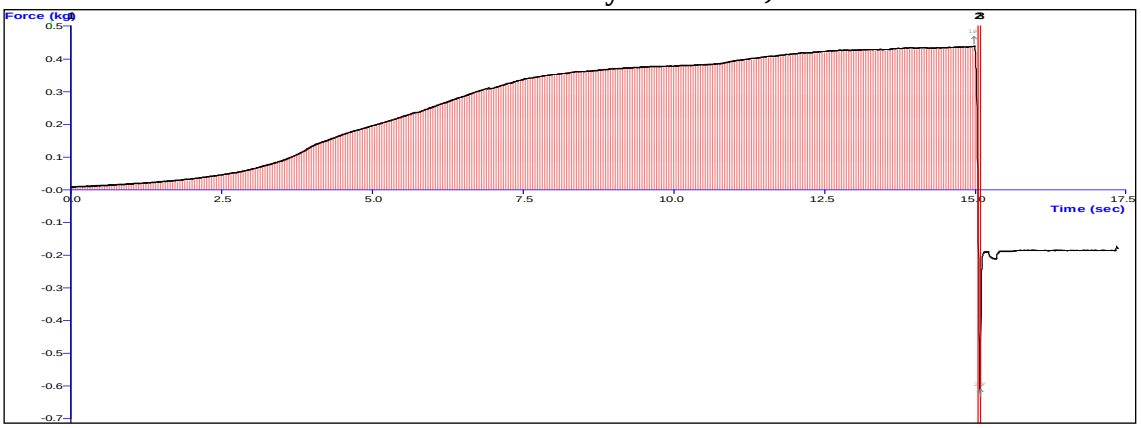
Textural Profile Analysis of Peda, T1



Textural Profile Analysis of Peda, T2



Textural Profile Analysis of Peda, T3



Textural Profile Analysis of Peda, T4

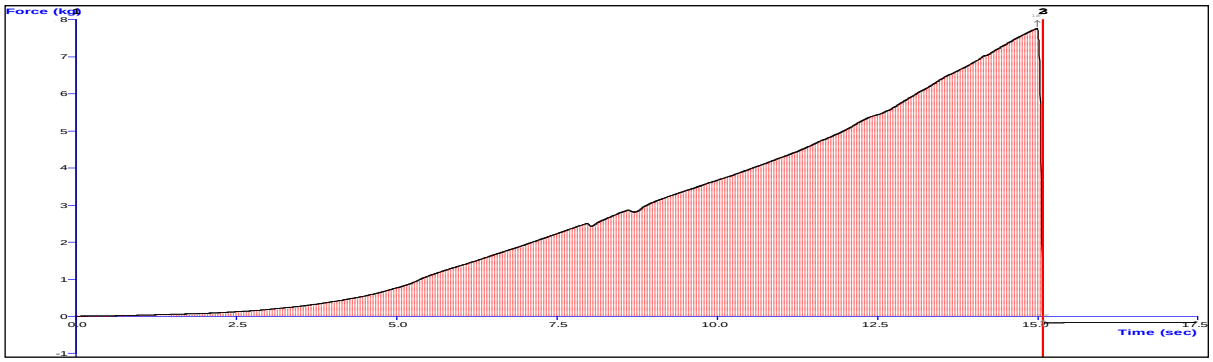


Fig 10 Textural Profile Analysis of Peda, T0-Control

Fat percentage of peda samples ranged from to 21.84 to 23.02 per cent. The samples T3 and T4 showed were higher fat content 23.02 and 22.89, respectively. The analysis of samples showed no significant difference between control and treatments indicating that addition of palm sugar at different level does not produce any significant change in the fat percentage of the product. The protein percentage for control and treatments were ranged from 19.10 to 19.81 per cent. An increasing trend in protein percentage was observed when palm sugar was added in peda. This may be due to presence of protein in the palm sugar (MI Secretaria, 2003 and Aider, *et al.*, 2007).

The textural analysis of the various combination of peda samples were recorded in table 2 and exhibited in Fig 10. Firmness of the peda samples (gms) were ranged between 229.903 to 780.839. Analysis of data revealed highly significant difference between control and treatments and among treatments due presence of various type of minerals and caramelization nature of palm sugar(Trinidad *et al*. 2010).Consistency of the peda samples (g. sec) ranged between 2299.527 to 4045.432, increase in consistency level in treatments were due to presence of significant amount of dietary fiber in palm sugar (Larmond, 1976). The cohesiveness (g) of peda samples ranged between -203.622 to -339.33per cent. Analysis of the data revealed significant difference between control and treatments indicating that addition of palm at each level will affect the cohesiveness of the product.

Index of Viscosity (g. sec) of peda samples ranged from - 0.705 to -29.361 per cent. No significant difference in the index of viscosity values between control and treatments and among treatments indicating that addition of palm sugar at different level does not affect the viscosity due to non-sticky nature of palm sugar (Srikaeo and Thongta., 2015)

The samples were subjected to various microbial analysis like standard plate count, Coliform count and yeast and mould count and also sensory evaluation of the products were tabulated in table 3.

Table-3 Microbial and Sensory analysis of Palm sugar Peda

Sample	Standard Plate Count(cfu/ gm)	Coliform Count (cfu/ gm)	Yeast And Mould Count (cfu/gm)	Sensory Evaluation			
				Flavor (45)	Body and Texture (35)	Appearance and Finish (20)	Total (100)
T0-Control	5.9×10^4	1.1×10^2	Nil	38	29	16	83
T1	5.6×10^4	1.3×10^2	-	36	30	18	84
T2	5.7×10^4	1.4×10^2	-	40	32	16	88
T3	5.5×10^4	1.4×10^2	-	43	32	18	93

T4	5.1 $\times 10^4$	1.3×10^2	-	25	20	10	55
Mean	5.6	1.3	-	36	28	15	80
Range	5.1-5.9 x 10^4	1.1-1.4 x 10^2	-	25-43	20-32	10-18	55-93
SEd (0.05)	0.1599	0.0540	-	1.1583	0.9309	0.5401	-
CD(0.05)	0.3409	0.1151	-	2.4689	1.9843	1.1511	-

The standard plate count of the samples ranged from 5.5×10^4 to 5.10×10^4. Analysis of data showed highly significant difference between control and treatments indicating that addition of palm sugar at different level produce significant change in the standard plate count due to minimal processing of palm sugars during preparation and contain other ingredients rather than sugars. The lower total bacterial count observed when replacement level of palm sugar increased may be due to higher level of minerals especially calcium and phosphorous in the palm sugar, which might have adversely affected the total bacterial count. The Coliform count of the samples were ranged from 1.1×10^2 to 1.4×10^2. Analysis of the data revealed significant difference between control and treatments indicating that addition of palm sugar at different level produces significant change in the coliform count. The presence of Coliform count in the samples may be due to improper handling and minimal processing temperature during preparation of palm sugar (Karthikeyan and Dhanalakshmi, 2010).There was no growth of yeast and mold in control and treatments indicating that addition of palm sugar at various level dose not promote the yeast and mold growth because all the samples were analyzed for the count immediately after preparation may be the reason for the absence of growth and was in close agreement with the report of Pushpa *et al.*(2015).

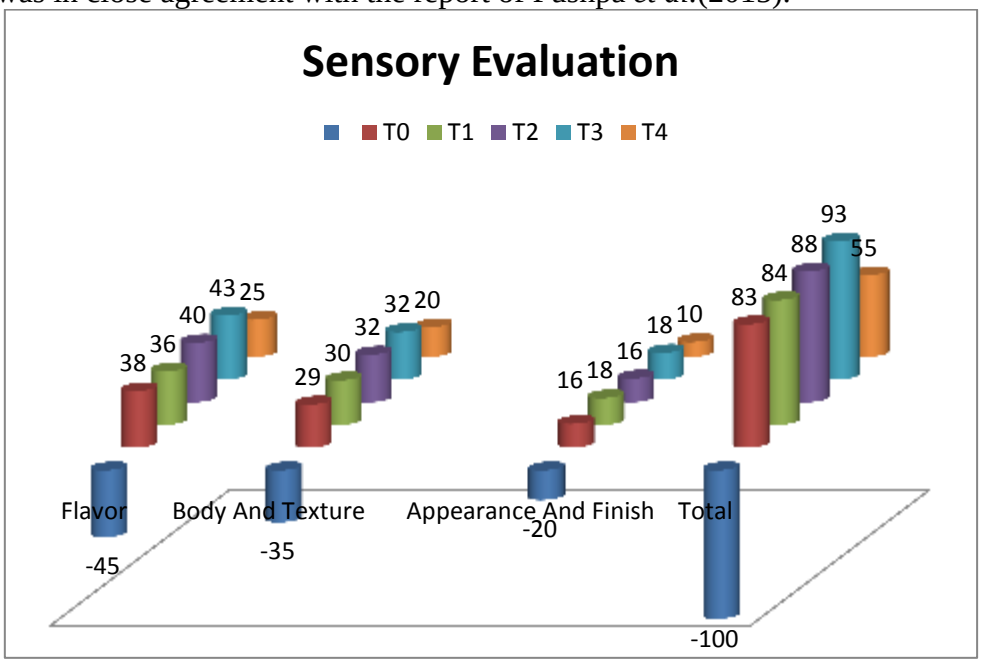


Fig.11 . Sensory Evaluation of Peda

In economy of production study, when replacement level was 25 and 50 per cent, the percentage increase in cost of the product were 3.41 and 6.82 per cent respectively as compared to control. The per cent expenditure increased from 10.23 to 13.64 per cent when replacement level was increased from 75 to 100 per cent. The increase in cost for experimental peda could be attributed to the higher cost of palm sugar as compared to sugar.Palm sugar is a natural one that has nutritive as well as medicinal value. Nowadays people are ready to offer higher price for product with higher degree of confidence in wholesomeness and natural foods and natural flavour than those based on chemical or artificial agents.

V. CONCLUSION

Milk peda prepared by incorporation of 75 percent of palm sugar gave the best result in terms of physio chemical, microbial and sensory properties. Replacing the sugar content by palm sugar alter the nutritive valve of the product by increase in the minerals and vitamins content of the finished product.

To- Control, T1- 25 % replacement of sugar by palm sugar, T2- 50 percent replacement of sugar by palm sugar, T3- 75 percent replacement of sugar by palm sugar, T4- 100 percent replacement of sugar by palm sugar, SEd- standard division.

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