



# Conventional technology adoption and its impact on physicochemical properties and proximate composition of cocoa fudge

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## ABSTRACT

Fudge is a traditional type of confectionary which is usually very sweet and extremely rich, prepared using sugar, butter, milk and flavor. In the present study, the investigator developed cocoa fudge adopting conventional technology and processing techniques involved roasting, grinding and heating. The developed cocoa fudge samples were analyzed for their physicochemical properties and proximate composition and were compared to those of commercially available fudge samples. The results revealed that there was significant difference in the proximate composition between the developed cocoa fudge samples and the standard fudge samples at  $p \leq 0.05$ . No significant difference was observed in most of the determined physicochemical properties of the developed sample. Hence the study ascertain that the sensory qualities may be similar as there was no change in the physicochemical characteristic and would be acceptable by everyone. For wider supply and optimum utilization of cocoa, this conventional technology technique can be adopted. Further it may bring great income to the cultivars and in turn add the economy of our country.

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## Introduction

Cocoa tree is usually planted in hot and humid areas of the world with annual rainfall of above 2000mm. The tree is delicate when young and must be shaded from hot sun. Cocoa tree matures at a height of between 6 and 12 meter with flowers and fruits developing directly on the trunk and the branches. The fruits ripen throughout the year and it must be broken open to extract the beans while the mucilage covering the beans must be removed (Belewu and Azeez., 2008).

Cocoa beans contain flavanoids which is a natural plant occurring compound found also in tea, red wine and apples. The compound (Flavanoids) has heart disease inhibiting properties. The compound also helps in maintaining a healthy vascular system, reduces blood clotting, reduces oxidative damage and also improves blood flow. The production process of cocoa beans to cocoa liquor which gives the characteristic odour and flavor is the basis of all cocoa products (cocoa drink, cocoa combined with ice creams and others). Chocolate transformed from the closely packed seeds of the fruit of an exotic tree to a wide variety of carefully manufactured cocoa and chocolate products which is now a commercial and social life drink (American Dietetic Association., 2005).

Fudge is a soft rich candy made of sugar, milk, butter and flavoring. It is a type of western confectionary which is usually very sweet, extremely rich and frequently flavored with cocoa. It is made by mixing the ingredients and heating it to the soft ball stage at 240° F (116°C) and then beating the mixture while it cools so that it acquires a smooth, creamy consistence. Chocolate can also be mixed in it make chocolate fudge; many other flavors and ingredients are possible like maple syrup, vanilla, butterscotch, etc. the principles of making fudge do not differ from those of making fondant. Butter and milk used in this case as ingredients, interfere with crystallization. Corn sugar and acid may also be used in addition (Manay S.N and Shadaksharaswamy., 2005). Chocolates and fudges are the major

products of cocoa beans in the Western world are also tagged as a symbol of pleasure which has contributed greatly to their economy. However, the reverse is the case in most cocoa producing countries like Nigeria where most of the cocoa beans are exported to western countries where it is processed into chocolates and other confectioneries with high turn over.

In order to enhance the local utilization and consumption of cocoa beans like other tropical crops it has to be incorporated into the recipes to develop some chocolate products like kola chocolate, coffee chocolate, milk chocolate and cashew chocolate.

Additionally chocolate manufacturers are making increasing use of pilot plants in conjunction with their laboratory research programmes to develop interesting new ways of improving an old way by using different spices and ingredients (Akinwale and Aina, 2003).

Considering the above facts the present study was carried out with the aim to promote the optimum utilization of cocoa beans which are cultivated locally in Salem district by developing cocoa fudge samples, adopting conventional technologies and processing techniques and to analyze its proximate composition and physicochemical characteristics and compare it with the standard cocoa fudge samples prepared using modern techniques.

## Materials and methods

The materials and methods used in this present study are as follows.

### Selection of ingredients

In the present study cocoa fudge samples were developed with the ingredients like cocoa seeds, cocoa butter, sugar and lecithin Cocoa seeds were procured from the cocoa farm at Mangalapuram near Vzhapaddi, Salem District.

Cocoa butter, sugar and standard cocoa fudge samples were purchased from local supermarkets in Salem District. Lecithin was purchased from Fruits and Nuts at Chennai city.

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### Development of cocoa fudge

The cocoa fudge samples were developed using the conventional technology and processing techniques involving roasting, winnowing, grinding and heating. Fermented dried whole cocoa seeds were first cleaned for impurities and they were roasted at 110°C for 10 minutes in an open kadai (Thilagavathi et al., 2010). The roasted beans were deshelled and winnowed to obtain the cocoa nibs. The obtained cocoa nibs were ground to fine paste in a mixie to obtain cocoa liquor. Secondly sugar was caramelized and to which cocoa butter was added. When it starts boiling cocoa liquor and lecithin was added and heated to a soft ball stage to 116°C. The mixture was gently stirred to obtain a uniform creamy consistency. When ready the prepared cocoa fudge was transferred to a mould and refrigerated after cooling.

### Chemical analysis

The chemical analysis of the developed cocoa fudge and standard fudge samples were analyzed for the proximate compositions with the parameters like carbohydrate (Anthrone method), protein (Lowry's method), fat (Soxhlet method), crude fiber and physicochemical properties with the parameters like moisture, total ash, soluble ash, insoluble ash, pH, acid value and saponification value using standard procedures given by Sadasivam and Manickam, (2005).

### Statistical analysis

All the data collected were analyzed statistically using mean, standard deviation and two sample t-tests with unequal variance.

### Results and Discussions

The obtained results are tabulated in table 1 and 2.

**Table 1: Proximate composition of the developed cocoa fudge samples and the standard cocoa fudge samples**

S.No	Proximate composition	Standard cocoa fudge sample (Mean±SD)	Developed cocoa fudge samples (Mean±SD)	t-test value
1.	Carbohydrate	64±0.00	25±0.23	337.7*
2.	Protein	13±2.00	22±1.63	6.97*
3.	Fat	25.25±2.24	16.63±0.48	7.26*
4.	Fiber	0.02±0.01	0.08±0.05	NS

\* - significant difference at  $p \leq 0.05$

NS- No significant difference between the samples at  $p \leq 0.05$

Table 1 shows the proximate composition and table 2 shows the physicochemical properties of both the developed cocoa fudge samples and the standard fudge samples respectively. Vast significant difference was observed at  $p \leq 0.05$  for the carbohydrate content of the developed sample and the standard sample. The carbohydrate content of the developed cocoa fudge was lesser than the standard fudge samples with the value of 25g%. This reduced carbohydrate content infers the developed sample to be a low glycemic food. Peters, 1956 recorded a similar level of carbohydrate content with 29.33g%. Higher protein content with 22g% was recorded by the investigator for the developed sample. Whereas the protein content of the standard sample was 13g%. Fat content of the developed cocoa fudge was comparatively lesser than that of the standard cocoa fudge samples with 16.63g% for each 100g of the sample. Reduced fat content of the developed sample suggest it as a hypolipidemic food. No significant difference was observed between the crude fiber content of the developed sample and the standard sample at  $p \leq 0.05$ .

Regarding the physicochemical properties, the developed sample had reduced moisture content than the standard sample.

This may be because of the increased duration of roasting. Reduced moisture content of the developed sample would enhance the shelf life of the product.

**Table 2: Physicochemical properties of the developed cocoa fudge samples and the standard cocoa fudge samples**

S.No	Properties	Standard cocoa fudge sample (Mean±SD)	Developed cocoa fudge samples (Mean±SD)	t-test value
1.	Moisture	0.03±0.01	0.02±0.01	3.27*
2.	Total ash	1.97±0.01	1.98±0.01	NS
3.	Soluble ash	1.96±0.08	1.97±0.01	NS
4.	Insoluble ash	0.013±0.01	0.02±0.01	NS
5.	pH	5.52±0.21	4.18±0.01	13.07*
6.	Acid value	2.97±0.05	3.49±0.05	15.95*
7.	Saponification value	68.20±0.88	96.95±1.45	33.91*

\* - significant difference at  $p \leq 0.05$

NS- No significant difference between the samples at  $p \leq 0.05$

The total ash content of the developed sample was 1.98g% whereas the standard sample has 1.97g%. Not much difference was observed between the samples at  $p \leq 0.05$ . The developed product was slightly acidic with the pH of 4.18±0.01 when compared to the standard sample which was 5.52±0.21. The acid value and saponification value of the developed samples were 3.49±0.05 and 96.95±1.45, whereas for the standard sample it was 2.97±0.05 and 68.20±0.88 respectively. Samples with the above values are reported to have better flavor, taste and therapeutic benefits also.

### Conclusion

The developed cocoa fudge sample has significant difference in the proximate composition except crude fiber at  $p \leq 0.05$ . Significant difference was observed for the physicochemical properties, except total ash, soluble ash and insoluble ash at  $p \leq 0.05$ . The results conclude that the samples prepared adopting conventional technology is a low caloric food and may be an anti-cariogenic. The sensory qualities may not have any change as there was no change in the physicochemical properties of the developed samples. For wider supply and optimum utilization of cocoa, this conventional technique can be adopted provided proper standardized temperature and hygienic practices need to be adopted. Further it may bring great income to the cultivars and in turn add the economy of our country.

### References

1. Belewu and Azeez. (2008). Coconut Chocolate Preparation: Compositional and Organoleptic qualities. European Journal of Scientific Research. Vol.22. No.1. Pp. 144-152.
2. American Dietetic Association. 2005.
3. Akinwale, T.O and Aina, J.O. (2003). The physicochemical and sensory evaluation of some non-conventional products for the tropics. Cocoa Research Institute of Nigeria. Ibadan, Nigeria.
4. Peters, F.E. (1956). Techn. Rept. No.6 South Pacific Commission Numbers New Caledonia.
5. Zubaida Faridi, Valentine Yanchou Njike, Suparna Dutta, Ather Ali and David L Katz. (2008). Acute dark chocolate and cocoa ingestion and endothelial function: a randomized controlled crossover trial. American Journal of Clinical Nutrition. 88:58-63.
6. Thilagavathi.S, Deepa.M and Nisha.S.M. (2010). Role of roasting on the physicochemical and sensory properties of the developed cocoa fudge samples. Asian journal of Science and Technology.
7. Manay S, N. and Shadaksharaswamy, (2005). "Foods Facts and Principles", New Age International publishers, pg. 617.