

Nutritional and Phytochemical Composition of Homemade Chocolates

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Abstract

Cocoa has polyphenolic compounds, such as procyanidin monomers, that includes catechin and epicatechin. In the present study fatty acid composition and unique phytochemicals in cocoa based homemade chocolate were assessed in the highly accepted developed product and standard product. The nutrients like carbohydrate, fat and calcium content of standard homemade chocolate has shown reduction as the proportion of cocoa liquor increases viz. 50% (52.2 g, 42.6 g, 38.2 mg) 60% (16.2 g, 15.9 g, 15.4 mg) and 70% (7 g, 5.4 g, 4 mg) respectively. The other nutrients like protein, fiber, iron, potassium and magnesium contents increased as the proportion of cocoa powder/liquor increases than the standard homemade chocolate. Fatty acids like stearic acid, palmitic acid and oleic acids were present in the developed products. The phytochemical, catechin content in Standard Home Made Chocolates (SHMC) was 5.2 mg whereas the (Developed Home Made Chocolate) DHMC had 7.1 mg. Hence the developed product is proven to be rich in phytochemicals as well as various essential nutrients and can be recommended in regular diets.

Keywords: Homemade Chocolates, Macronutrients in Chocolates

1. Introduction

Due to the high concentration of stearic acid and some flavonoid compounds in dark chocolates, it has the capability to reduce the risks of cardiovascular disease¹.

Chocolate added in a number of raw and processed foods is produced from the seeds of the tropical *Theobroma cocoa* tree. Chocolate has become one of the most popular food types and flavors in the world. It is a moderate source of iron. A 50 g bar of plain chocolate provides about 8% of the Reference Nutrient Intake (RNI) of iron for women and 14% of the RNI for a man². Chocolate found to possess different compounds such as saturated

fat, polyphenolic compounds. Also it is rich in polyphenols, particularly in flavan-3-ols such as epicatechins, catechins and procyanidins³. Cocoa in chocolate contains a large amount of antioxidants (flavonoids) that may keep high blood pressure down and reduce the blood's ability to clot, thus reducing the risk of stroke and heart attacks. Hence it is said that darker chocolate has most concentrated cocoa and might be most beneficial. The quality attributes of homemade chocolate has not been well documented. Therefore, the objective of this study was to evaluate and compare the nutritional and phytochemical quality of homemade chocolates produced in Salem district.

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2. Materials and Methods

2.1 Development of Chocolates

Standard Homemade Chocolates (SHMC) were developed based on the procedure of Belitz, (2004)⁴ and the same with slight modifications were used for making DHMC. The steps include roasting, crushing seeds, removing cocoa nibs, grinding seeds, mixing of ingredients, heating and moulding. Homemade chocolates were prepared incorporating varied proportion of cocoa liquor i.e. 50%, 60% and 70% except standard. They were subjected to nutritional and phytochemical qualities.

2.2 Nutrient Assay of Homemade Chocolate

The standard and developed homemade chocolates were tested for their selected macro and micro nutrients and the methods adopted are given in Table 1.

3. Results and Discussion

3.1 Nutrient Composition of the Homemade Chocolate

Homemade chocolates prepared from varied proportions of cocoa powder varied with nutrients and chemical compositions.

Table 2 depicts the energy and other nutrient content of both the standard and 50%, 60% and 70% cocoa liquor incorporated homemade chocolates which are represented in Figures 1 and 2. The standard homemade chocolate has 246.4 k cal and developed product has 208.8, 170.4 and 152.8 k cal for 50%, 60% and 70% cocoa incorporation respectively. The calorie, fiber and iron content of chocolate is relatively high for the size of the food. However SHMC had higher concentration of carbohydrate than the DHMC's which implies that cocoa was a fair source of carbohydrate. In SHMC, carbohydrate content was

Table 1. Methods adopted for nutrients analysis

Nutrients	Methods
Carbohydrates	Anthrone method*
Protein	Kjeldahl method*
Fat	Soxhlet method*
Potassium	Titration method**
Magnesium	Colorimetric method**
Iron	Wongs method*
Calcium	Titration method*
Fibre	AOAC method *

Source^{5and6}

Table 2. Nutrient composition of the Standard Homemade Chocolate and Developed Homemade Chocolate

S. No	Parameters	*SHMC	*DHMC		
			50%	60%	70%
0	Energy (k cal)	246.4	208.8	170.4	152.8
1	Carbohydrate (g)	61.6	52.2	42.6	38.2
2	Protein (g)	12.8	13.6	13.9	14.1
3	Fat (g)	28	16.2	15.9	15.4
4	Fibre (g)	1.5	1	2.5	3
5	Iron (mg)	1.35	1.43	1.50	1.55
6	Calcium (mg)	8.5	7	5.4	4
7	Potassium (mg)	140	137	141	146
8	Magnesium (mg)	43	39	42	46

*SHMC-Standard Home Made Chocolate *DHMC- Developed Home Made Chocolate

61.6 g whereas the DHMC with 50%, 60% and 70% cocoa incorporated chocolates has 52.2 g, 42.6 g and 38.2 g of carbohydrates respectively.

The protein content of the SHMC was about 12.8 g and the DHMC of 50%, 60% and 70% incorporation of cocoa liquor were about 13.6 g, 13.9 g and 14.1 g respectively, which was higher than the standard. Kinsella (1970)⁷ reported that the protein content of the chocolate samples depend on the initial protein content of different milk sources that influences the nutritional qualities of chocolate. Additionally, protein and fat in milk improves the textural qualities and properties and characterization of cocoa solids.

The amount of fat present in Standard Home Made Chocolate was higher (28 g) than DHMC. Cocoa beans contain approximately 50% fat. Evidence have been pro-

vided that cocoa administered to rats decreased visceral adipose tissue, thus changing the expression of genes which are involved in the generation of enzymes and molecules for the occurrence of fatty acid synthesis and thermogenesis in liver and white adipose tissue⁸.

With regard to fibre content, DHMC with 70% incorporation had high fiber content of 3 g. Studies revealed that 100 g of homemade chocolate contains 3.14 g of fiber⁹. The amount of iron present in Standard Home Made Chocolate is relatively lower than Developed Home Made Chocolate. The calcium content of standard Home Made Chocolate was 8.5 mg which was greater when compared to 50%, 60% and 70% of Cocoa liquor incorporated developed Home Made Chocolate bar and their calcium content were found to be 7 mg, 5.4 mg and 4 mg respectively.

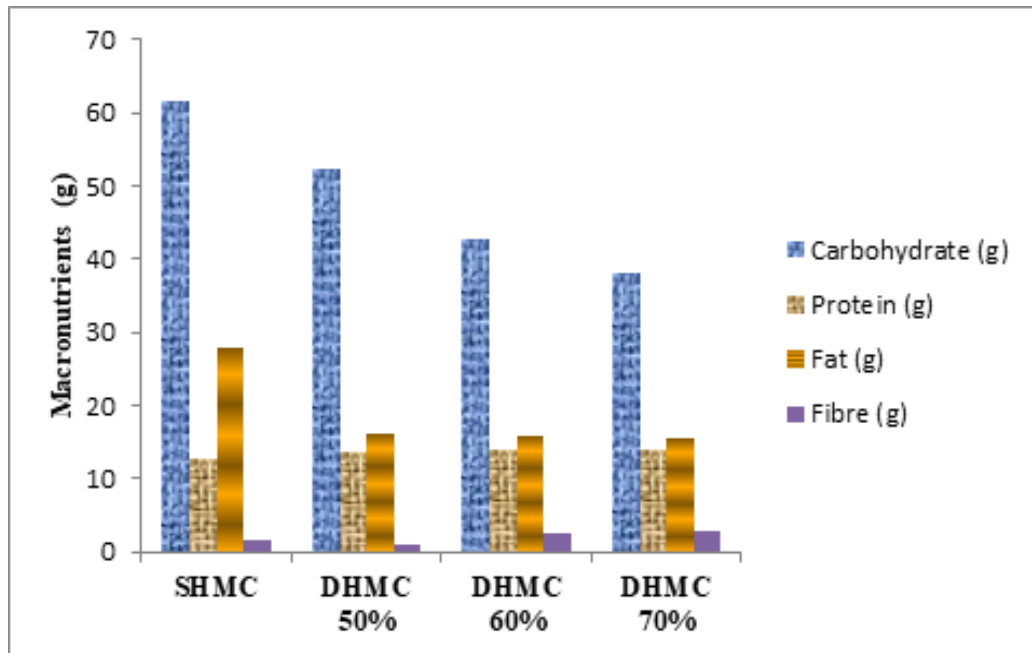


Figure 1. Macronutrient content of the Home Made Chocolate.

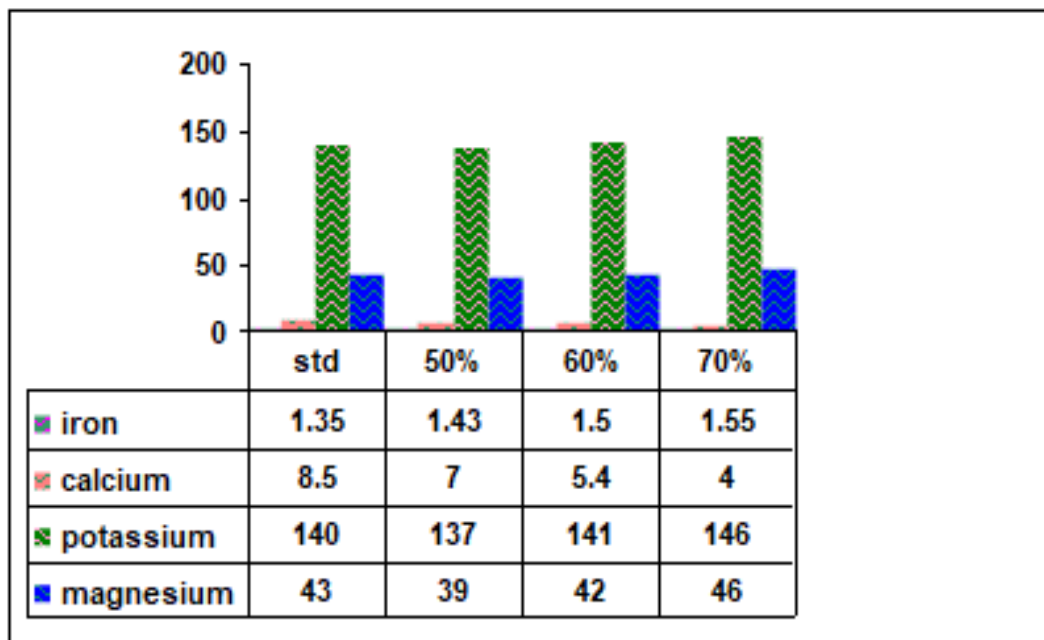


Figure 2. Micronutrient content of the Home Made Chocolate.

Potassium constituted in standard Home Made Chocolate bar was about 140 mg however Developed Home Made Chocolate had 137 mg, 141 mg and 146 mg for 50%, 60% and 70% incorporation respectively. Among these 70%

has greatest value compared to others. Magnesium content of Standard Home Made Chocolate bar was 43 mg, while 50%, 60% and 70% cocoa liquor incorporated DHMC bars had 39 mg, 42 mg and 46 mg of magnesium content respec-

tively. Sharma, (1998) analyzed the amount of potassium and magnesium present in 100 g of Home Made Chocolate bar found to be 153 mg and 170 mg respectively.

3.2 Fatty Acid Composition of Homemade Chocolate Bar

Cocoa butter is unique among natural fats. Its constituent fatty acids are principally the medium-chain saturated fatty acids and the mono unsaturated oleic acid. So it exhibits a remarkable stability against oxidative rancidity. Depending upon the molecule in the fat, they have the tendency to withstand the temperature and remain solid. However it melts below the body temperature.

The Table 3 shows the fatty acids present in Homemade Chocolates. The concentrations of essential fatty acids were found higher in DHMC than the SHMC. According to **Ding, (2006)¹**, “In dark chocolates, the fatty acid from added cocoa butter seem to be around 33% of oleic acid (cis-18:1 mono unsaturated), 25% palmitic acid (16:0 saturated), and 33% of stearic acid”.

3.3 Phytochemical-Catechin Content of Homemade Chocolate Bar

Cocoa beans contain polyphenols with antioxidant properties such as catechins, epicatechins and procyanidins. The antioxidant flavonoids are found in the non fat portions of

Table 3. Percentage of fatty acid composition in SHMC and DHMC

S.No	Name of the Component	SHMC	DHMC
1.	Dodecanoic acid (Lauric acid)	1.50	34.9
2.	Tetradecanoic acid (myristic acid)	0.45	10.6
3.	n-Hexadecanoic acid (Palmitic acid)	1.73	1.80
4.	Oleic acid	2.07	2.59
5.	Octadecanoic acid (Stearic acid)	0.95	1.16
6.	1,2-Benzenedicarbolic acid (Phthalic acid)	92.9	32.7
7.	Benzene 1,3,5 trimethyl	0.09	-
8.	Butyl octyl ester (Oxiraneoctanoic acid)	0.28	-
9.	Octanoic acid (Caprylic acid)	-	0.19
10.	Triacetin	-	0.88

Table 4. Catechin content of SHMC and DHMC

Foods	Catechin content mg/g
SHMC	5.2
DHMC	7.1

SHMC-Standard Home Made Chocolate: DHMC- Developed Home Made Chocolate

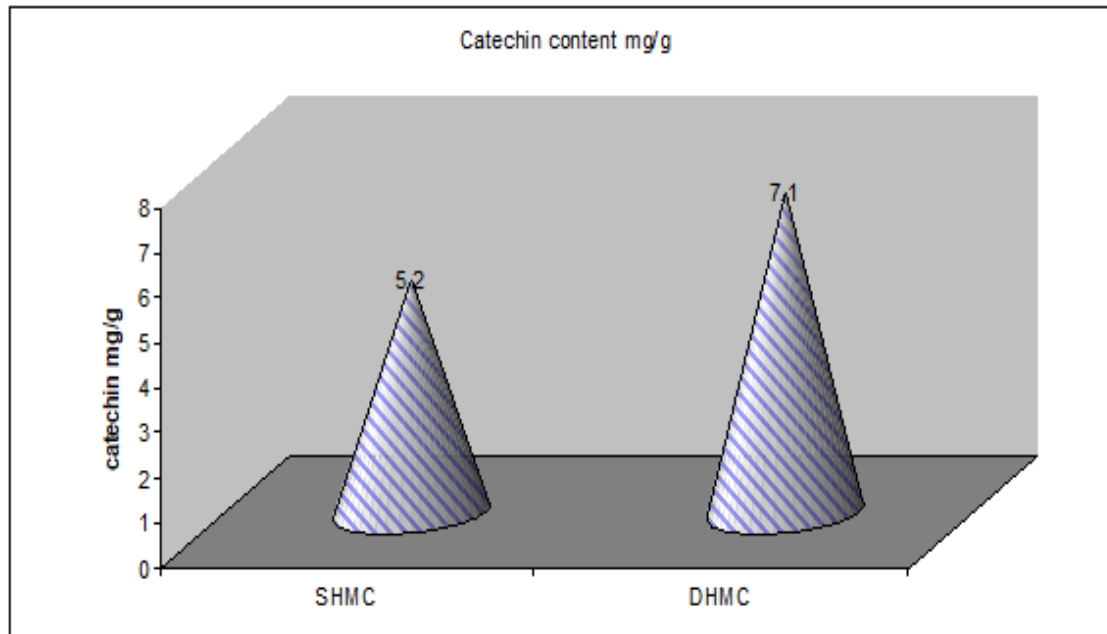


Figure 3. Catechin contents in SHMC and DHMC.

the cocoa bean. The phytochemical-catechin content of the standard and developed Homemade Chocolate bar is given in Table 3 and in Figure 3.

SHMC-Standard Home Made Chocolate; DHMC-Developed Home Made Chocolate

The Table 4 shows that “SHMC contains 5.2 mg of catechin and the DHMC contains 7.1 mg. of catechin clonal variation, growing location, seasonal, light variation and altitude determines the catechin content of the product”¹⁰. “The type of microbial colonization and length of fermentation phase will also likely to affect flavanol content and breakdown. Indeed significant variations in the flavanol content of cocoa is noted among different batches and growing areas”¹¹. Changes in the flavonoid biochemistry would be expected during the roasting process. Catechin antioxidants are thermally labile to some degree as noted in some studies of thermal stability in tea”¹². “Naturally, the concentration of all of these components can vary considerably depending on the origin and processing of the cocoa”¹³. Antioxidant flavanols are significantly reduced during the dutching process, neutralization of acetic acid with base which is undesirable for maintaining the flavanol activity in chocolate products”¹⁴.

4. Conclusion

The Developed Homemade Chocolate has low calorie, low fat and high catechin content. However, chocolate which is always referred as a pleasure food has been proved from the present study as a nutritious and healthy food for inclusion in regular diets.

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