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An Evaluation of the Nutritional and Physicochemical Properties of Candies from Imitation Milks

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Introduction

Candy is a type of confectionary which describes a spectrum of sweet goods and takes on different meanings from one country to the other. Among several definitions, candy is defined as a highly cooked coloured and flavoured sugar mass formed into desired shapes (Barnett, 1978). A more or less solid article of confectionery made by boiling sugar or molasses to the desired consistency, and then crystallizing, molding, or working in the required shape. It is often flavored or colored, and sometimes contains fruit, nuts, etc. The interesting colours and shapes, confectionaries create games opportunity for children and they can also be shared as a sign of affection amongst people although the consumption of confectionary is mostly seen as degrading to human diet. Technically, milk or chocolate can be added to sugars mixtures in candy processing depending on the variety. The utilization of animal milk in candy production results in their unavailability in most African markets and the high price of purchase.

Imitations milks from plants can be investigated in the production of confectionaries especially candy. These milks can be manufactured from soybean, coconut and groundnut, which are commonly cultivated crops anywhere in the world.

The Soybean is often called the miracle crop (IITA, 1990) having its existence and survival to China. Soybeans can be processed in a variety of ways. Common forms of soy (or soya) include soy meal, soy flour, "soy milk", tofu, textured vegetable protein (TVP, which is made into a wide variety of vegetarian foods, (some of them intended to imitate meat), tempeh, soy lecithin and soybean oil. Soybeans are also the primary ingredient involved in the production of soy sauce (or *shoyu*) (FAO, 1982). Groundnut (*Arachis hypogea*) can be processed as groundnut butter, roasted nuts etc. while coconut (*Cocos nucifera*) is commonly processed to coconut oil.

Thus, consumption of candies is being regarded as luxury. The under-utilization of some tropical crops motivated the investigation on a way of utilizing soybeans, groundnuts and coconut in the production of a product such as candy. This will reduce the cost of production thus consumers' can buy at affordable prices and also creation of jobs can be made possible.

Materials and Methods

Production of milk from soybeans, groundnuts and coconuts was done as described by Sunny-Roberts et al. (2004). Thereafter candies were from these milks as described below (Fig. 1). The candies were cut into different sizes and packaged. For each sample, crude protein, crude fibre, fat, ash and moisture contents were determined by standard AOAC procedures (AOAC, 1990). Carbohydrate contents were determined by difference (AOAC, 1990). Total solids, insoluble and soluble solids were also determined by AOAC methods (AOAC, 1990). All chemical determinations were done in at least duplicates and the mean value recorded in each case. The

sensory attributes were evaluated by a panel of ten judges consisting mainly of students and staff of the Department of Food Science and Engineering, Ladoko Akintola University of Technology, Ogbomoso, Nigeria, who were very familiar with candies made from cow milk. The panellists were asked to score each sample on a 9-point Hedonic scale, where 1 and 9 represent dislike extremely and like extremely respectively. Data obtained were subject to appropriate statistical analysis (Duncan, 1955; Larmond, 1980).

Results and Discussion

The physicochemical properties of crops, milk and candies are as shown in Table 1.

The moisture content recorded in candy samples, which are low, ranged between $4.3\pm 0.06\%$ and $5.93\pm 0.25\%$. Most chemical and biological processes that cause deterioration of food and spoilage, which are water-dependent, would be reduced. There was also a decrease in the fat content of the candies. This is an advantage for the keeping quality of the product as chances of rancidity would be greatly reduced (Sunny-Roberts et al., 2004). There was an increase in the protein content of the candies except coconut-candy and also the ash content increased. It should be noted that the variations in the chemical composition of the crops, milks and candies are the effects of processing conditions such as dehulling of the seeds, wet milling, and wet sieving which must have contributed to losses of nutrients at the initial stages.

A reduction in the fat contents of candies was also observed. Although the higher the fat contents of foods, the higher the energy value of the food, however, the fact that fat can become rancid due to oxidation or enzymatic actions cannot be overlooked. Therefore these candies, with low fat contents are less prone to rancidity.

Table 1: The physicochemical properties of crops, milk samples and produced candies.

	Moisture content (%)	Protein content (%)	Fat content (%)	Ash content (%)
A	5.93 ± 0.25	1.10 ± 0.14	0.10 ± 0.02	1.04 ± 0.09
B	4.44 ± 0.00	3.96 ± 0.16	0.06 ± 0.00	0.23 ± 0.01
C	4.37 ± 0.06	6.43 ± 0.08	0.08 ± 0.01	0.94 ± 0.02
D	5.89 ± 0.03	1.29 ± 0.17	0.11 ± 0.02	0.85 ± 0.01
E	82.26 ± 0.34	1.38 ± 0.02	7.86 ± 0.01	0.04 ± 0.01
F	79.17 ± 0.11	0.64 ± 0.01	2.81 ± 0.01	0.05 ± 0.01
G	81.36 ± 0.39	1.69 ± 0.01	0.15 ± 0.01	0.04 ± 0.01
H	38.09 ± 0.09	3.40 ± 0.16	35.07 ± 0.01	1.83 ± 0.09
I	10.10 ± 0.03	22.61 ± 0.16	48.07 ± 0.01	2.32 ± 0.02
J	6.41 ± 0.12	38.70 ± 0.14	22.04 ± 0.03	3.33 ± 0.02

Sample codes represent: coconut candy (A); groundnut candy(B); soy candy(C); cow milk candy (D); coconut milk(E); groundnut milk(F); soymilk (G); coconut (H); groundnut (I) and soybean (J). Values are means of triplicate experiments.

The total solid content of the milk samples (Table 2) indicated that no artificial fillings were needed to increase the solid content of the end products. Potter (1987) reported the total solid content of animal milk to be 12.9%. The insoluble solid content of the candies indicated the fibre content and other contents which contributed to their bulkiness. The soluble solid, measured as the brix content of the candies help in binding the available water thus reducing microbial attacks. These soluble solids also react with other food constituents such as amino acids of proteins to form compounds that affect the colour, flavour and other properties of foods.

Table 2: Insoluble solids, soluble solids and total solids of crops, milk samples and produced candies.

Sample codes	Insoluble solids (%)	Soluble solids (%)	Total solids (%)
A	0.16±0.00	34.75±0.35	-
B	0.07±0.01	26.50±0.17	-
C	0.17±0.00	27.50±0.71	-
D	0.18±0.03	31.25±0.35	-
E	0.23±0.00	-	9.10±0.01
F	0.15±0.01	-	8.68±0.30
G	0.19±0.00	-	11.17±0.16
H	2.24±0.03	-	-
I	3.27±0.01	-	-
J	2.85±0.03	-	-

Sample codes are as explained in Table 1. Values are means of triplicate experiments.

The soluble solids content of coconut candy was the highest amongst the samples. These were responsible for the brown colour of these candies and the intensity of brownness was dictated by the level of soluble solids in the samples.

Evaluation of the sensory characteristics of the samples (Table 3) indicated that only soy candy was significantly different from other samples in terms of taste and appearance. All the samples were given an overall acceptance except soy candy, in which the unpleasant flavour of soybeans was expressed.

Table 3: Mean sensory scores of produced candies from imitation milks.

Qualitative attributes	Coconut candy	Groundnut candy	Soy candy	Cow milk candy
Taste	6.8a	6.3ab	5.5b	6.3ab
Colour	6.6a	6.2a	5.7a	6.8a
Texture	6.0a	6.1a	5.4a	6.3a
Flavour	6.2a	6.0a	5.7a	6.2a
Appearance	6.3a	6.5a	5.5a	6.4a
Overall acceptability	6.6a	6.5a	6.1ab	6.6a

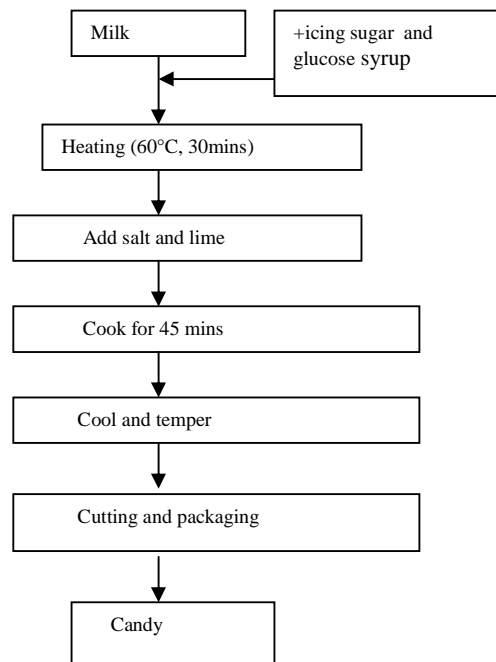
Data in same column with same subscripts are not significantly different at 5% level.
Each value is a mean of the scores of ten panellists.

Conclusions ad Recommendations

These results revealed the possibility of candies production, from imitation milks, which had comparable nutritional values with candy which was made of animal milk. This means the production of such candies on a large scale would be a wise way of utilizing these crops. This would also give an opportunity of purchasing these products, at affordable prices, to the consumers.

These candies can be fortified with vitamin sources like natural fruits. A prior roasting of soybeans can be used to overcome the unpleasant flavour in its candy.

Figure 1: Flowchart for the preparation of candies from imitation milks.



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