International Journal of Sciences, Engineering & Environmental Technology (IJOSEET), 7(5): 50-55, 2022
ISSN 0794-9650
www.repcomseet.org

Proximate and Organoleptic Evaluation of Milk Blends Produced from Coconut (Cocos nucifera) and Tiger Nut (Cyperus exculentus. L.)

[1*]Akinyele Adijat Adeola; [2]Akinyele AbdulMuiz Akindamola; [1]Abata Gbenga Daniel; [1]Oyinloye Olaitan Daniel and Mosimabale [1]Margaret Meka

[1]Department of Nutrition and Dietetics, Federal Polytechnic, Ede Osun State, Nigeria
[2]Department of Science Laboratory Technology, Federal Polytechnic, Ayede, Oyo State, Nigeria

*Corresponding Author email Address: akinyeledeola@gmail.com

Abstract: The proximate composition of cow-tigernut-coconut milk blend was conducted. This aimed to evaluate proximate and organoleptic of coconut (Cocos nucifera) and tiger nut (Cyperus esculentus –L.) milk blends. Five blends of milk were formulated using different ratios of C100: (100% cow milk), C75T0CC25: (75% cow milk +25% coconut milk), C75T25CC0 (75% cow milk+ 25% tigernut milk), C50T25CC25 (50% cow milk +25% coconut milk + 25% tigernut milk), C25T50CC25 (25% cow milk +50% coconut milk + 25% tigernut milk), and C25T25CC50 (25% cow milk +25% coconut milk + 50% tigernut milk) respectively. One control sample was made from 100 cow milk. The samples were subjected to proximate analysis using standard assay method. The milk blends samples were evaluated for sensory. Attributes of colour, taste, flavor, mouth feel (texture) and general acceptability. The blends and compare with standards. The results showed that the values of moisture content range between 53.93-59.66, crude protein with the value range from 14.59-18.77. crude, fat, ash content and carbohydrate range from 12.90-21.49, 1.47-3.03, and 2.81-10.72 respectively. In terms of colour, taste, flavor and general acceptability, the panelist preference decreased with increased addition of tiger nut milk in the blends. The texture of the control sample had the highest value while (cow milk 100) had the least score for texture with a mean value starch. This work showed that the acceptable blend milk could be produced by substituting cow milk with tiger nut and coconut milk with good sensory properties preferably, substitution of cow milk with tigernut milk and coconut milk. In addition there is improved nutritional content with respect to the percentage protein content which will go a long way to alleviate protein malnutrition.
Keywords: colour, carbohydrate, protein, cow milk, texture

Introduction

The Codex Alimentarius standards defined milk as the normal mammary secretion of milking animals obtained from one or more milking without either addition to it or extraction from it, intended for consumption as liquid milk or for further processing. This definition thereby precludes non-animal products which may resemble milk in anyway and from any source in color and texture (milk substitutes) such as soy milk, tigernut milk, rice milk almond milk and coconut milk (Codex, 1999). Milk consumption became common in Asia, America and Australia comparatively recently, as a consequence of European colonialism and political domination over much of the world in the last 500 years. In the middle ages, milk was called the “virtuous white liquor” because alcoholic beverages were safer to consume than water (Pecanac *et al.*,2013, Valenze, 2011). Variations exist in the composition of milk for the various species. The composition of cow milk varies for a number of reasons which includes the individuality of the cow , the breed and age, stage of lactation, health of the cow, climatic conditions and herd management which includes feeding and general care. The composition of milk differs widely among species. Factors such as the type of protein; the proportion of protein, fat and sugar; the levels of various vitamins and minerals; and the size of the butterfat globules, and the strength of the curd are among those that may vary. On the average, it contains 3.4% protein, 3.6% fat and 4.6% lactose, 0.7% minerals and supplies 66 kcal of energy per 100 grams. These compositions vary by breed, animal, and point in the lactation period. The protein ranges for the four breeds of Jersey, Zebu, Brown swiss and Holstein-Friesian is 3.3% to 3.9%, while the lactose range is 4.7% to 4.9% (Goff *et al.*, 2014). Milk is an extremely nutritious food. It is an aqueous colloidal suspension of proteins, fats and carbohydrates that contains numerous vitamins and minerals. Many of the pathogenic bacteria encountered do not grow well in milk but remain viable for undesirable lengths of time. Processing and utilization of diary products in African countries is not well developed (Oladipo and Jadesimi, 2012).

Tigernut (*Cyperus esculentus*) is often used in various ways in traditional Nigerian cuisine, but tigernut milk is particularly well loved. Tigernuts are not nuts, they are tiny tubers (root vegetable) with a nut-like flavor and nut-like texture. Tigernut milk is naturally sweet, creamy and offers a luxurious, rich and nutty flavour. The milk is rich in monosaturated fat (oleic acid) as well as minerals (like Calcium, iron, magnesium, potassium, and phosphorus) and Vitamins C and E. Tigernuts are also good source of probiotics (that is, food for the good beneficial bacteria) like fermented starchy products. Tigernut milk can be made simply by soaking the tubers in water, blending and filtering. However, the addition of spice like cinnamon as well as sweetener is good. In Nigeria, tigernut is not only flavored from time to time with sweet spices, but also with alligator pepper.

Coconut (*Cocos nucifers*) grows extensively in Nigeria and is eaten as a snack usually for pleasure. It is a fruit rich in fibre (aids digestibility), iron, and other minerals. It also serves as an excellent source of raw materials for the development of dairy-like products. Coconut milk is the liquid that comes from the grated meat of a brown coconut (it is different from coconut water). The colour and rich taste of coconut milk can be attributed to the high oil content. Most of the fat is saturated fat. Coconut milk has the following nutritional properties; protein (3%), fat (17-24%), and carbohydrate (2%). It has no cholesterol and it contains many vitamins, minerals, and electrolytes, including potassium, calcium, and chloride (Balogun *et al*., 2016).

Coconut milk is being used in confectioneries, bakeries, biscuits and ice cream industries worldwide to enhance flavour and taste of various products. Coconut milk was found to be rich in calcium. The milk was reported to be high in minerals and vitamin content, while total saturated fat was 10% of the total energy (Adejuyitan *et al*., 2014).

Coconut plays a significant role in the economic, cultural and social life of 80 tropical countries (Oyoo *et al.*, 2015). It is a major source of income for rural families and plays an important role in wealth generation and improving the quality of life in many tropical countries. Sustainable yields can be increased by providing high quality planting materials along with improved management of the coconut plant. At the small scale farming level, coconut is an important contributor to food security. At the industrial level, value-added products of coconut are important sources of employment and income in rural communities (Singh *et al.,* 2008).

It has a total fat content of 24%, most of which (89%) is saturated fat, with lauric acid as a major fatty acid. The milk can be used to produce virgin coconut oil by controlled heating and removal of the oil fraction. A protein-rich powder can be processed from coconut milk following centrifugation, separation, and spray drying (Naik *et al.*, 2012).

Statement of the Problem

It is noteworthy, that the diary sub sector in Africa is thus relegated to the category of subsistence system of production due to minor and peripheral status accorded the sector by various government policies. Allied with the above, are poor nutrition and genetic constitution of the Africa breed of ruminants. Because of the above stated facts, milk from the diary sources in Nigeria has been low in quantity and it is expensive to purchase. Poor and local people may not be able to afford it. Therefore, producing coconut and tigernut milk blend may be a promising means of value addition and to further promote the utilization of tigernut milk and coconut milk beyond traditional usage.

MATERIALS AND METHODS

Production of tigernut milk

Tigernut milk was produced by modified procedure described by Belewu and Belewu (2007). The tigernut was selected and sorted, washed and blended to extract the juice from the tigernut The tigernut milk was then stored (it is important if it is not going to be consumed same day to keep it in constant movement using mixer at low temperature or frozen). The flow chat of the production is as stated below.

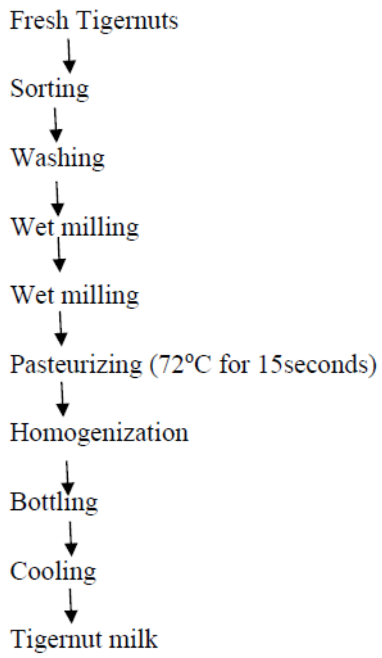

Fig. 1: Flowchat of the production of Tigernut milk

Production of Coconut milk

A whole coconut was purchased, shelled and shredded using a traditional coconut grater. Coconut milk was produced by mixing the shredded pulp with an equal volume of warm distilled water (60°C) in a blender, filtered through a double-layered cheese cloth, and manually squeezed with a twisting motion to extract most of the milk. The extracted emulsion was pasteurized and stored at 30°C before the production of cheese and used within 24 hours of production (Balogun *et al*., 2016). The flowchat is as shown below

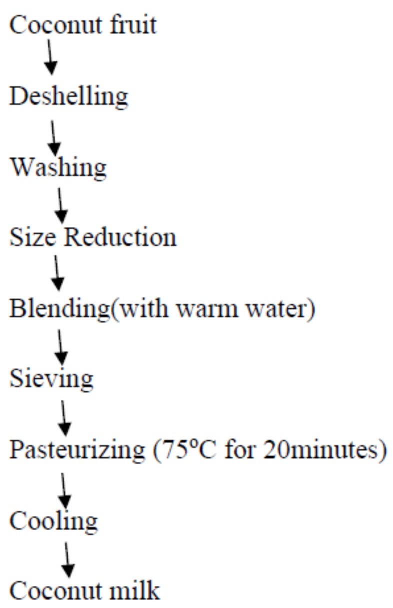

Fig. 2: Flowchat of the production of the Coconut milk

RESULTS AND DISCUSSION

Proximate composition of Blend Produced from Cow-Tigernut-Coconut Milk

The results of proximate composition of milk produced from cow-tigernut-coconut milk blends is presented in table 1. There were significant ($p<0.05$) differences in all the parameters evaluated. These differences could be attributed to the addition of coconut milk and tigernut milk at different levels and the resultant difference in the proportion of milk present in the samples. The moisture content of samples ranged from 53.92% to 59.66% with samples containing $C_{75}T_0CC_{25}$ having the lowest moisture content while sample $C_{25}T_{25}CC_{50}$ contains the highest moisture content and no significant difference was observed between samples $C_{25}T_{25}CC_{50}$ and $C_{50}T_{25}CC_{25}$. The observed result in this study is in conformity with earlier work of other researchers (Balogun *et al.*, 2016). It was reported that there was an increase in moisture content as the level of coconut increases (66.69% and 71.86% for cheese produced from 100% cow milk and 70:30% cow-coconut milk respectively).

The protein content ranged from 14.59% to 18.77% with sample $C_{25}T_{25}CC_{50}$ having the lowest protein content and this may be due to the high amount of coconut milk in the blend since coconut milk contains the least amount of protein as well as high moisture of all the three milk used, while $C_{75}T_{25}CC_0$ had the highest protein content. Sample $C_{75}T_0CC_{25}$ has the second highest protein content and is significantly different to the control sample C_{100}. This result is similar to the findings by Balogun *et al.,* (2016) who reported that sample with 75:25% of cow-coconut cheese has the highest protein content of her samples. Hussein *et al.,* (2016) also reported increase in the crude protein as the proportion of tigernut milk is increased in the blend for the cow-tigernut cheese production. (25:75% cow- tigernut milk had the highest value of 18.50% followed by 50:50% cow- tigernut milk with 16.50% and 75:25% cow- tigernut milk with 15.60% had the lowest value). The differences in the findings may be due to nutrient composition of the tigernut and coconut as well as the amount of protein available in the cow milk.

There are significant differences in the fat content of milk produced from cow-tigernut-coconut milk blends with samples $C_{75}T_{25}CC_0$ and $C_{25}T_{25}CC_{50}$ of cow- tigernut- coconut milk having a value of 12.90% and 21.49% respectively. The value of control sample (C_{100}) was 19.51% which is close to the highest fat content although significantly ($p<0.05$) different. The fat content of the samples can be seen to be dependent on the proportion of cow milk and coconut milk in the samples as Balogun *et al.,*(2016) reported that the fat content increases with increase in the coconut milk and this is as a result of the high fat content of the milk and supporting this was that coconut milk is rich in saturated fatty acids, particularly lauric acid and fat is important as a source of energy in the human body. Hussein *et al.,* (2016) reported that the fat content of the 'warankashi' decreases as the percentage composition of tigernut milk increases suggesting that the fat content is dependent largely on the cow milk. Similar results were reported by Okorie and Adedokun (2013) for the blending of cow-bambara nut milk, Adejuyitan *et al.,* (2014) for tigernut-coconut and Chikpah *et al.,* (2016) for cow-tigernut milk. The value of fat found in this study was closely related to 13.4% fat recorded by Uaboi-Egbenni *et al.,* (2010) and 20% reported by Mustafa *et al.,* (2013). This result implies that cow-tigernut-coconut milk blended with up to 25% tigernut milk and 50% of coconut milk will be a good source of energy in human diet due to its high protein content.

The ash content in foodstuffs is a measure of mineral element in food. The ash content of products varied significantly ($p<0.05$) as sample $C_{75}T_{25}CC_0$ had a value of 3.03% closely followed by sample $C_{50}T_{25}CC_{25}$. Thus it can be deduced that increase in the percentage cow milk (i.e above 50%) leads to increase in the ash content. This is supported by the findings of Balogun *et al.,* (2016) who reported that there is decrease in the ash content as there is increase in the 100% cow-milk (1.02%) while in the milk with added coconut milk, it decreased from 0.88%-0.32% with 5% and 30% proportions of added coconut milk respectively. The increase in ash content with the addition of 25% of tigernut milk and coconut milk implies that it is a good source of minerals. The crude fibre serve functions like increasing digestibility, lowering of plasma cholesterol levels, decreasing the incidence of colon cancer and others (Adejuyitan *et al.,* 2014). No noticeable value of crude fibre was detected. Total carbohydrate content of the milk samples ranged from 2.81% to 10.72% as seen in samples $C_{25}T_{25}CC_{50}$ and $C_{75}T_{25}CC_0$ (Table 1) showing that there are no significant differences between the samples ($p<0.05$). Sample $C_{25}T_{50}CC_{25}$ is not significantly different to the sample with the highest carbohydrate content ($C_{75}T_{25}CC_0$) ($p<0.05$). The control sample (C_{100}) has a carbohydrate content of 6.06% and differed significantly to the other samples. This result indicates that the total carbohydrate content is dependent on the tigernut milk level and this view has also been reported by Oladele *et al.,* (2007).

The mean sensory scores for milk samples with varying proportions of added tigernut milk and coconut milk are in table 2. There was no significant difference in the taste of all the samples of milk provided thus the taste was very palatable and acceptable by the consumers. There was significant ($p< 0.05$) difference in colour, texture, aroma and overall acceptability where the colour of sample $C_{75}T_{25}CC_0$ is not significantly different to C_{100} having similar value of 7.00 respectively.

The sample with highest percentage of tigernut milk in the blend was rated the lowest in colour with a value of 5.80. This is similar to the findings of Igor *et al*. (2006) and Hussein, (2016) who reported that in terms of appearance, 100% Cow milk was rated the best 6.43 followed by 75:25 cow-tigernut milk 5.57 and also that the cow-tigernut milk with higher percentage of tigernut milk was rated the least 5.00. This was reported to be due to the discolouration impacted by tigernut.

The texture of the control sample C_{100} with a value of 6.65 was the most acceptable and was significantly ($p< 0.05$) different to the other samples. This was in contrast with the findings of Hussein, (2016) who reported that sample with 100% cow milk has lowest texture 4.56 while the result supports the findings of Balogun *et al*. (2016) who reported that 100% cow has the best texture. In terms of aroma, the sample $C_{75}T_{25}CC_0$ of cow-tigernut-coconut milk has the highest score of 6.45 followed by sample $C_{50}T_{25}CC_{25}$ with 6.00 although not significantly different from the control sample C_{100}. These findings were in contrast with the findings of Hussein. (2016), who reported that the aroma of 25:75 % cow-tigernut-milk was rated lowest.

However, Ekanem and Philippa, (2017) reported sample containing 75:25 % cow-coconut milk blend to have the highest value for aroma (6.85) which may be due to the aroma and flavor of the essential oil in the coconut milk. The sample $C_{75}T_{25}CC_0$ and $C_{75}T_0CC_{25}$ has the highest acceptability which was followed by the control sample C100 and $C_{50}T_{25}CC_{25}$. This denotes that samples with coconut and tigernut milk supplements are generally accepted by the consumers and can be used in the production of milk commercially.

Table 1: Proximate Composition of Cow-Tiger-Coconut

Samples	Moisture	Protein	Fat	Ash	Carbohydrate
C100	$55.18^c±0.25$	$16.75^b±1.58$	$19.51^{b±}±0.74$	$2.52^c±0.02$	$6.06^{bc}±1.06$
$C_{75}T_0CC_{25}$	$53.92^c±0.81$	$17.25^{ab}±0.00$	$20.46^{ab}±0.53$	$2.72^{bc}±0.16$	$5.67^c±0.12$
$C_{75}T_{25}CC_0$	$54.59^c±0.01$	$18.77^a±0.16$	$12.90^d±0.22$	$3.03^a±0.14$	$10.72^a±0.06$
$C_{50}T_{25}CC_{25}$	$59.32^a±1.10$	$16.53^b±0.74$	$13.84^d±1.42$	$2.84^{ab}±0.17$	$7.49^b±0.91$
$C_{25}T_{50}CC_{25}$	$57.49^b±0.00$	$15.48^{bc}±0.43$	$15.71^c±0.01$	$1.92^d±0.15$	$9.42^a±0.29$
$C_{25}T_{25}CC_{50}$	$59.66^a±0.13$	$14.59^c±0.14$	$21.49^a±0.57$	$1.47^c±0.64$	$2.81^d±0.53$

Values are mean ± S. D. means with same superscript across a column are not significantly different ($p< 0.05$)

Table 2: Sensory properties of cow- tigernut- coconut milk

Samples	Appearance	Texture	Taste	Aroma	Overall acceptability
C100	$7.00^a±1.41$	$6.65^a±1.09$	$5.15^a±1.90$	$5.40^{ab}±1.85$	$6.10^{ab}±1.86$
$C_{75}T_0CC_{25}$	$6.80^{ab}±1.28$	$6.50^{ab}±1.70$	$5.35^{ab}±2.13$	$5.20^{ab}±1.96$	$6.30^a±1.75$
$C_{75}T_{25}CC_0$	$7.00^a±1.56$	$6.50^{ab}±1.61$	$6.05^a±1.67$	$6.45^a±1.99$	$7.00^a±1.45$
$C_{50}T_{25}CC_{25}$	$6.25^{ab}±1.48$	$6.45^{ab}±1.57$	$5.85^a±1.95$	$6.00^{ab}±1.89$	$6.10^{ab}±1.77$
$C_{25}T_{50}CC_{25}$	$5.80^b±1.61$	$6.00^{ab}±1.86$	$5.35^a±2.16$	$5.50^{ab}±1.85$	$5.75^{ab}±1.83$
$C_{25}T_{25}CC_{50}$	$5.95^b±1.64$	$5.30^b±2.72$	$4.80^a±2.19$	$5.05^b±2.16$	$5.40^{ab}±1.85$

Values are mean ± S. D. means with same superscript across a column are not significantly different ($p< 0.05$)

References

Adejuyitan J, A., Olanipekun B. F. and Moyinwin O. A. (2014). Production and Evaluation of Cheese-Like Product from the Blend Soy Milk and Coconut Milk. *Archive of Applied Science Research*. 6 (4): 263-266.

Balogun , M. A., Kolawole F. L. Joseph J. K., Adebisi T. T. and Ogunleye O. T. (2016). Effect of Fortification of Fresh Cow Milk with Coconut Milk of the Proximate Composition and Yield of Warankashi, a Traditional Cheese. *Croatian ournal of Food Science Technology*. 8(1):1-5.

Belewu M. A. and Belewu K. Y. (2007). Comparative-Physio-evaluationof Tigernut and Coconut Milk sources. *International Journal of Agricultural Biology*. 9: 785-787.

Codex Alimentarius Commission. (1999). ``General Standard for the use of Dairy Terms 206``

Ekanem, G. O. and Philippa C. O. (2017). Potential of Coconut Milk as a substitude for Cow Milk in Cheese Making. Journal of Advances in Microbilogy. 4(2): 1-9.

Golf, D. (2014) `Introduction to Dairy Science and Technology: Milk History, Consuption, Production and Composition``. Dairy Science and Technology. University of Guelph.

Hussein, J. B., Suleiman, A. D., Hesanmi, J. Y. o and Sanusi S. A. (2016). Chemical Composition and Sensory Qualities of West African Soft Cheese (Watankashi) produced from Blends of Cow Milk and Soy Milk. *Nigerian Journal of Tropical Agriculture*. 16: 79-89.

Igyor M. A,. Igbian E. K. and Irorbo C. I. (2006). Effect of Soy Milk supplements on the yield and Quality of `Warankashi`. *Nigerian Food Journal*. 24(1): 92-97.

Mustafa W. A., Suleiman A. M. E., Abdelgadir W. S. and Elkhalifa E. A. (2013). Chemical Composition of the white Cheese Produced at Household Level in Dueim Area, While Nile State, Sudan. *Journal of Food Nutrition Disorders*. 2(2):1-5.

Naik A, Raghavendra S. N. and Raghavarao K. S. (2012). Production of Coconut protein powder from coconut wet processing waste and its characterization. *Applied Biochemical and Biotechnology*. 167 (5): 1290-1302.

Okorie S. U. and Adedokun I. I.(2013). Effect of Partial Substitution of Fresh Cow Milk with Bambara nut Milk on Nutritional Characteristics and yield of soft (Unripe) Cheese `Warankashi`. *Advanced Journal of Food Science and Technology*. 5(6): 665-670.

Oladipo I.C. and Jadesimi P.D. (2012). Microbiological Analysis and Nutritional Evaluation of West African soft cheese (wara) produced with different preservatives. *American Journal of Food and Nutrition*. 3(1): 13-21.

Ooyo M. E., Najya M.,. Githiri S. M., Ojwang P. O., Muniu F. K., and Owuoche J. O. (2015). In -Situ morphological characterization of coconut in the Coastal Lowlands of Kenya. *African Journal of Plant Science*. 9(2): 65-74.

Pecanac M., Janjic Z., Komarcevic A., Pajic M., Dobanovacki D and Miskovic S. S.(2013). `*Burnt Treatment in Ancient times*`. Medical Pregl. 66(5-6): 263-7.

Oladele A. K. and Aina J. O. (2007)Chemical composition and functional properties of flour produced from two varieties of tigernut (Cyperus esculentus). *African Journal of Biotechnology*. 6 (21): 2473-2476

Oladipo I.C. and Jadesimi P.D. (2012). Microbiological Analysis and Nutritional Evaluation of West African soft cheese (wara) produced with different preservatives. *American Journal of Food and Nutrition*. 3(1): 13-21.

Uaboi-Egbenni P. O., Okolie P. N., Akintunde T. I., Bisi-Johnson O., Enwe L and Bessong P. O. (2010). Proximate Analysis and Microbial Quality of Cheese Produced from Raw Cow Milk Obtained from Fulani Settlement in Ogun state , Nigeria. Using Lactic Acid Bacteria and Extracted Sodom Apple Leaf (*Caloptropis procera*). *Pakistan Journal of Nutrition*. 9(9): 925.

Valenze D. M. (2011). ``Virtuous White Liquor I the Middle Ages``. Milk: a local and Global history. New Haven: Yale University Press. P. 34.