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Short Communication

Effects of Boiling and Fermentation on the Nutrient Composition of Cow Milk in Kaduna Metropolis

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Abstract

The effects of boiling and fermentation on the nutrient composition cow milk was investigated using proximate analysis. The results for boiled milk showed that boiling reduced nutrient contents of the milk as follows : protein content (3.73%),fats (2.85%), total solids (9.67%), calcium(0.06%), magnesium (0.41%) contents and bacteriological count significantly ($p<0.05$), suggesting that boiling has negative effects on fresh milk. The result also reveals that fermentation has no significant ($p>0.05$) effects on protein (3.81%), total solids (12.21%) and Iron (0.0014%),but has significant effects on carbohydrates and bacteriological count ($2.5x10^1$). Our findings show that fresh milk sample has the highest nutritive values when compared to fermented and boiled milk.

Key words: Milk, nutrients, cow and bacterial count.

Introduction

Since the beginning of history, human beings have used the milk of other mammals as food source because it was recognized that the milk of some of the domesticated mammal was equally as satisfying in meeting the physiological demands for energy and nutrients as the human milk[1]. Before urbanization, evidence showed that each family depend on animals particularly cow for milk which has been the primary and traditional source of milk over the years[2]. Milk and milk products are excellent high quality foods, providing nutritional values[3]. Milk and milk products have an important place in the human diet; it has been described as being almost a complete food for man. It contains carbohydrates, protein, fats, vitamins, mineral elements and water. Milk also serves as carrier of microbial agents of certain diseases of mammals[4]. It was reported in 2007 that with increased worldwide prosperity and the competition of bio-fuel production for feed stocks, both the demand for and the price of milk had substantially increased worldwide, particularly was the rapid increase of consumption of milk in China and the rise of the price of milk in the United States above the government subsidized price[5]. Milk is a translucent white liquid produced by the mammary_glands of mammals[6]. It has been reported that milk is a non cellular, almost complete food with no waste and ready to be consumed, it is derived from human breast, cow, goat, camel, sheep and buffaloes[7].

With the technological advancement there are few people these days pay attention to the traditional raw cow milk having healing properties. It has been reported that few people are aware that clean, raw milk from grass-fed cows was actually used as a medicine in the early part of the last century[8]. Milk straight from the udder, a sort of "stem cell" of foods, was used as medicine to treat, and frequently cure some serious chronic diseases[9]. Raw cow's milk has all 8 essential amino acids in varying amounts, depending on stage of lactation , about 80% of the proteins in milk are caseins- reasonably heat stable and easy to digest. People with lactose intolerance for one reason or another no longer make the enzyme lactase and so can't digest milk sugar. This leads to some unsavory symptoms. Raw milk, with its lactose-digesting *Lactobacilli* bacteria, may allow people who traditionally have avoided milk to give it trial.

Approximately two thirds of the fats in milk is saturated. Saturated fats play a number of key roles in our bodies, from manufacture of cell membranes and key hormones to providing energy storage and padding for delicate organs, to serving as a vehicle for important fat-soluble vitamins. It has been revealed that Milk appears to be effective at promoting muscle growth[10]. One study has shown that for women desiring to have a child, those who consume full fat dairy products may slightly increase their fertility, while those consuming low fat dairy products may slightly reduce their fertility[11]. In fact the whole raw milk has all the nutrients and they're completely available for your body to use. Milk is a valuable source of riboflavin. It also contains useful amounts of thiamin and folic acid and a small amount of niacin. In addition, raw milk also contains a broad selection of completely available minerals ranging from the familiar calcium and phosphorus on down to trace elements. The objectives of this study were to investigate the effects of

boiling and fermenting on the nutritional values of cow milk contents.

Material and Methods

Sampling: samples of fresh milk were collected in the month of June 2010 near national eye centre Kaduna from Fulani settlers. Immediately after milking in a sterile containers and transported to the laboratory for analysis. The milk sample was divided in three portion each of 100ml, the first portion was boiled at a temperature of 108°C, the second potion was kept for 24 hours for fermentation to take place by natural micro – organism present in the milk, the third portion was analyses as fresh samples and the analysis commenced from the third samples immediately.

Proximate analysis: Samples of the milk were analyzed for their proximate composition, according to AOAC[12] methods as given below.

Determination of crude protein in milk: Five milliliters of each sample was weighed into separate digestion flask 10g of catalyst Na_2SO_4. The protein nitrogen was converted to ammonium sulphate by digestion with concentrated sulphuric acid, followed by liberation of ammonia. It was titrated with standard 0.55m NaOH sodium hydroxide solution according to AOAC[12] method. The conversion factor 6.38 was use to get the % protein in all the samples.

Determination of crude fat: Fat in milk exist in the form of an emulsion which is stabilized by phospholipids and proteins. The crude fat content was determined according to AOAC[12] method.

The milk sample was brought to a temperature of 20^0C and it was then allowed to stand for a few minute to discharge any air bubbles. Ten mililitres of surphuric acid was pipetted into three butyrometer tubes. Then, 10.94ml of each of the milk samples were pitted into each of the butyromter tubes and 1ml of amyl alcohol was dispensed into each tubes, the butyromter was tighten with a dry stopper. The mixture was shake and then the butyrometer tube was inverted until all the milk has been absorbed by the acid.

The butyrometer tubes were placed in a water bath at 65^0C for 5 minutes. The tubes ware subjected to centrifugation for 4 minutes at 1000rpm. After centrifugation, the butyrometer tube were returned to the water bath for 5 minutes. The percentage fat can be read by bringing the butyrmeter graduation mark to eye level, each graduation on the tube represent 1% which is then estimate as the percentage crude fat in milk.

Determintion of total solid: A clean crucible that has been oven dried was weighed and the weight taken as (W1) 1g of each samples were added to each of the crucible and the weight taken as (W2) the samples were oven dried at 105^0C for 24 hours. The crucibles were transferred from the oven to the desiccators to cool and the weight taken as (W3) and percentage % total solid was calculated according to AOAC[12] method.

Determination of total ash: Three empty dried crucibles were weighed and the weights taken as (W1) 1g of each of the milk samples were added into the crucible and the weight of crucible and sample taken as (W2). The crucibles were then placed in a muffled furnace and the temperature was increased slowly from 150°C – 550°C for 3 hours. The samples were remove from the furnace to desiccators and were allowed to cool to room temperature. The crucibles and content were reweighed as (W3) and the percentage ash was calculated.

Determination of the mineral elements: The mineral content of the milk samples were determined using the wet digestion and analysis procedure and the Atomic Absorption Spectroscopy(AAS) .This procedure was used for analysis of calcium, magnesium and iron. Briefly 5g of milk samples were weighed into (3) three digestion flask of 250ml capacity and 25ml of digestion acid was added. The flask was fixed to a clamp and kept overnight. When the initial reaction subsided, the temperature of the micro – digestion bench was increased slowly from 180°C - 200°C. The digestion was continued at this temperature until no visible particles observed. The temperature was raise up to 240°C and the digestion acid was evaporated until dense white were formed with in the digestion flask. After the digestion was completed, the content of flask was then filtered through acid washed filter paper in a 100ml capacity volumetric flask using de ionised water, at the end suitable aliquot of digested materials were kept in a dust proof glass chamber. The sample was digested with the disappearance of brown fumes, the samples were diluted to a known volume (100ml), which is then put in a cell and ready for AAS. Analyses each of the element in the sample are identified using a corresponding suitable lamp of the AAS Instrument.

Microbiological assessment of samples: Preparation of nutrient agar mediawas done using normal routine procedure,and the broth plated on the agar according to the method described by Okpowasili and Ogbulie[(13)].

The fresh, boiled and fermented samples were inoculated. The petri dishes were all conveyed into the incubator for 24hours at 37°C.

Identification of micro-organism : The colonies formed on each plate was taken and Gram stained on a microscope slide, the microscopic examination of morphological characteristic was carried out by observing the different slides with the microscope according to the method described by Onyeagba[14].

Results and Discussion

Table 1
Proximate composition of fresh, boiled and fermented cow milk

S/No	Sample	% Crude protein	Carbohydrate%	Fats %	Ash %	Total solids%
1	Fresh milk	3.81±0.007	5.27±0.014	3.91±0.01	0.73±0.04	12.1 ±0.14
2	Boiled milk	3.73±0.04[a]	5.24±0.06	2.85±0.07[a]	0.64±0.001[a]	9.67 ±0.04[a]
3	Fermented milk	3.82±0.04	3.85±0.07[b]	3.61±0.01[b]	0.72±0.02	12.21± 0.14

Mean ± SD for 2 determinations. The values b dna a are significantly different from control group at (P<0.05)

Table 2
Mineral elements composition in cow milk

S/No	SAMPLE	Ca %	Mg %	Fe %
1	Fresh milk	0.11±0.007	0.61±0.01	0.0014
2	Boiled milk	0.065±0.006[c]	0.42±0.015[c]	0.0014
3	Fermented milk	0.075±0.007[d]	0.41±0.015[d]	0.0014

Mean ± SD for 2 determinations. The values with c and d are significantly different from the control group at (P<0.05) level

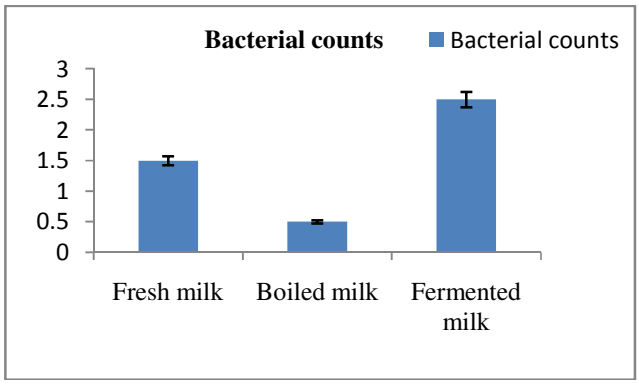

Figure 1
Effects of boiling and fermenting on the nutritive value of cow milk. Bars represent the mean ±SD for two determinations, and are significantly different P<0.05

The proximate analysis results for fresh milk, boiled and fermented cow milk are shown in tables 1 and 2. The results reveals that fermentation has no significant effects on protein content with value 3.82% when compared to fresh milk 3.81%. On the other hand boiling has significant effects on milk (3.73%). In a related development The immunoglobulin's, an extremely complex class of milk proteins also known as *antibodies*, provide resistance to many viruses, and bacterial toxins and may help reduce the severity of asthma symptoms. Studies have shown significant loss of these important disease fighters when milk is heated to normal processing temperatures[15]. It is also interesting to note that fermentation has significant effect (P<0.05) on carbohydrate content of the milk 3.85%. The analysis also shows that fats content for fresh milk is 3.91%, boiled milk is 2.85% and fermented milk is 3.61%. suggesting that boiling and fermenting has significant negative effects on fats contents of cow milk. Recent research conducted by Orhevba[16] revealed that there is remarkable decrease in % lipid as soya milk was cooked at its boiling temperature, % lipid content in the soya milk decreased from 12 to 6% between 10 and 30 min of cooking. This could be as a result

of the removal of a film which is rich in protein and oil called yuba. Lipids seeped up and were removed as yuba as the soya milk was boiled over the period of time. The results in table 1 reveals that the percentage Ash content for cow milk are 0.73%, 0.64%,and 0.72% for fresh , boiled and fermented milk respectively, indicating that milk has low level of inorganic substances. The percentage total solid of cow milk shows that boiling has effect on total solids (9.67%) as against fresh milk (12.1%), this suggest that boiling reduces the total solid content of the milk. The mineral elements investigation reveals that boiling and fermenting has effect on Calcium and Magnesium contents significantly as shown in table 2 and has no effect on Iron (0.0014%). In a related development Hindu[17] reported that Cow milk contains, on average, 3.4% protein, 3.6% fat, and 4.6% lactose, 0.7% minerals The result for microbial count shown in figure 1 reveals that boiling decreases the bacterial count ($0.5x10^{1)}$ significantly $p<0.05$.Conversely fermentation increases the bacterial count (2.5×10^{1}) significantly $p<0.05$, All this values indicates that each of the sample is bacteriological safe for consumption because C.F.U colony forming unit was less than the (WHO) standard.

Conclusion and Recommendation: It is evident that fresh cow milk has the highest nutritive values and we should be encouraged to use row cow milk in order to obtain its health benefits.

In view of the result obtained from this study, the following recommendations were made.

(a) Cow milk should be consumed in its raw state.
(b) If no proximity to consuming fresh milk, milk bought should be boiled before consumption to avoid disease causing organisms

The government should enlighten the public on the proper and hygienic way to handle fresh cow milk. Through an enlightenment campaign program.

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