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Hygiene Conditions of Porridge (Hausa-Koko) Vendors in Akwapem North Municipal, Ghana

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Abstract

Improving the hygienic condition of "Hausa koko" is an effective means of reducing the burden of diarrheal diseases, stomach ulceration etc. among the citizenry. The study was conducted to examine the physicochemical, microbial quality of "Hausa koko" and the level of food hygiene knowledge of its vendors in the Akuapem North Municipality. Sample B recorded the highest T.S. S. value with 3.11±0.01°Brix and Sample D with least value of 1.61±0.01°Brix, Sample A recorded also recorded the highest pH value 4.17±0.00 and Sample B and Sample D recording the least also with 3.11±0.01. Also, sample D had 0.43±0.01% as the highest acidity value whiles Sample A and Sample B recording the least also with 0.27±0.01% as their respective mean values. Sample C recorded the highest Total viable count of 1.6×10^3 cfu/ml with sample A 2.9×10^1 cfu/ml. The total coliform count assay recorded results was satisfactory with some all recording no count except Sample C (1.0×10^1cfu/ml) and Sample E (3.9×10^1 cfu/ml). Analysis of Variance conducted revealed that there was significant difference ($P< 0.05$) in *Staphylococcus. Aureus* count in the samples with Sample C (1.6×10^2 cfu/ml) and Sample E (3.3×10^1cfu/ml) respectively. The yeast and mould count also ranged between 5.5×10^1cfu/ml, 3.8×10^2 cfu/ml, 3.0×10^2 cfu/ml, 1.1×10^2 cfu/ml and 6.9×10^3 cfu/ml in Sample A to Sample E respectively. All the samples recorded low levels of contamination within the acceptable values but more work needs to be done by Food and Drug Authority and other bodies to ensure the safety of vended food.

Keywords: Hygiene, Hausa Koko, Physico-chemical, Microbial, Akropong North Municipal

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1.0 Introduction

1.1 Background

The informal division is subjected by economic activities like street hawking which has become common in city areas of developing countries due to inadequate job prospects and high unemployment rates (Chirag et al., 2013). Street foods offer masses of people with regular diversity of foods that are relatively inexpensive and easily available (Muinde and Kuria, 2005; Mensah et al., 2002). According to Food and Agriculture Organization (FAO) of the United Nation (UN), 2020, street foods are complete foods and beverages prepared and sold by vendors or hawkers in streets and other public places. They contribute meaningful to the diet of many people in the emerging world (FAO 2010; Sunitha et al., 2011). According to Afele (2006) these foods provide a source of cheap, suitable and often nutritious food for both the city and rural poor as well as attractive and varied food for tourists.

FAO, (2011) data confirmed that, 2.5 billion people eat hawked food every day. Chukuezi (2010) explains that street food patronage has become part of the way of life and survival approach by many regardless of age, cultural or socio-economic status. The chief reasons for low hygiene and safety practices among a large section of street food vendors include their poor facts on personal hygiene, inadequate training, illiteracy or uneducated background and perhaps lack of information and or appreciation of hygienic and safe food handling, low skills levels, and poverty (Olang'o et al., 2012). These compromise the possible barriers to food contamination.

According to Ackah et al., (2011), road food prosperous in Ghana gained grounds after the post-independence era following advancement of industrial growth where new working surroundings gradually pushed people away from their homes. In Ghana, the street food industry is a multi-million-dollar sector. In 2002, the division was estimated to employ about 60,000 street food vendors in the city of Accra with an annual turnover of about $100million (Tomlins, 2002). This nevertheless is the fact that the process of fast-food joints, restaurants and chop bars has improved in the Ghanaian community, especially in the urban areas (Ayeh-Kumi, 2009).

However, some people view the variation towards eating food outside the home as a mark of prosperity (Afele, 2006). It is faster and time-saving to get meals from food retailers than to prepare them at home, and there are often more mixed choices available than at the household level. One of such foods is Hausa koko prepared and sold on the streets of Ghana. This food is frequently found in West African nations and it is attributed to the Northern people. It is believed to have been first made by the Hausa amid whom millet is a nutritional essential. Hausa koko is a very popular Ghanaian breakfast that is likely to be found in every corner of the streets. It is believed to have originated from the people from the Northern part of the country where millet, sorghum and rice are mostly grown.

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The food chain industry is seen as an important part of the economy of many countries especially the developing countries by providing employment and readily accessible cooked meal at relatively cheaper prices. This nevertheless, there have been major apprehensions over the quality and safety of street foods (Wuliyeng, 2013). Street food is often perceived unhygienic and of low quality, sometimes owing to the poor environmental conditions under which food is prepared or sold, and also due to inadequate information in food safety regarding food preparation and handling by food vendors (Annan-Prah et al., 2011).

In low- and middle-income nations, about 70% of cases of diarrheal disease are linked to the eating of unwholesome food. This is largely attributed to the fact that food handlers in developing countries to a large extent lack knowledge and basic education on food safety issues. This results in a situation where street foods become more vulnerable to contamination and or poisoning (Zeru et al., 2007). This was attributed to the general unhygienic condition in the country. Even though this cannot solely be attributed to food vendors, it is believed that their actions and inactions cannot be underestimated in this circumstance. Knowledge gathering from the outbreak of the corona virus (covid-19) indicates it is transmitted through coming in contact with droplets of saliva from an infected person (Liu et al., 2020). Touching the nose, mouth or eyes while selling can put the food, serving equipment and other materials in danger and thereby exposing patrons of ready to-eat food like Hausa Koko in danger. Safety of publicly sold food is of great concern because food vendors represent a point source of possible contamination, infection and poisoning of the masses.

Various factors have been said to be associated with unhygienic practice among street food vendors which include inefficient or lack of effective education, training of food vendors on health and hygiene, non-provision of needed infrastructure as well as non-regulation and enforcement of by-laws governing street food vending by local authorities. It has also been contended that weak institutional control encourages poor food vending practices, including the selection of poor location, usage of low-grade food inputs, and other poor food handling practices. In some cases, there are already established laws regulating the activities of these food vendors.

Vending Hausa koko does not come without its associated challenges that are likely to cause serious health issues. In the Akwapem North Municipal, there are numerous towns and villages with each having Hausa koko vendor(s) in them. They go through similar processes in handling and selling the koko. It is imperative to note that people in this part of the country also enjoy this delicacy mostly as a breakfast, however none has really on these Hausa koko vendors within the Municipality. Giving this gap, this research was conducted to address the phenomenon.

The main objective of this study was to assess hygiene conditions of Hausa koko vendors in some selected areas in the Akwapem North Municipality.

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The specific objectives

- To determine the hygienic and safety practices of Hausa koko vendors.
- To determine the microbial safety of the Hausa koko sample.
- To determine the physiochemical properties of Hausa koko sample.

People queue in the streets for Hausa koko everyday notably in the morning. It is a clear indication of the fact that this food is eaten at the same period by lot of people. This can even be a whole community in the case of smaller settlements. In view of this, safety and hygiene practices observed in the preparation and selling of the food should be of great essence to all stakeholders. The study will contribute to the academic literature on Hausa koko and food vending in general and may also instigate further interest and research into other single-vended meal sold on the street.

Again, this study will help policy makers determine the training needs of the Hausa koko vendors. Many are the issues that may arise with data information in the municipality with respect to food vendors, these findings available will serve as basic data in the municipality that will help them to education the vendors on food hygiene and practices in order to ensure optimum safety of consuming the Hausa koko in the municipality.

This research again will serve as a baseline study and a source of reference in future studies. Future researchers into this area of study will have a benefit referencing from this document to better come out with appropriate corroborations or contradictions.

2.0 Methodology

The study adopted for the research was cross-sectional descriptive type which involved field survey and laboratory analysis. The varied technique plan was employed to allow for in-depth and impartial assessment of the situation under consideration. A total of 26 Hausa koko vendors from Akropong (4), Mamfe (4), Amonokrom (4), Aburiw (4), Kwamoso (4) and Mampong (4) filled the structured questionnaire. The sample was taken from five major areas in the towns above except Mamfe. Organised surveys were developed and directed by qualified enumerators to ensure that data obtained was accurate and genuine. Face-to-face interviews were also conducted to allow for in-depth analysis of the situation and also because respondents usually provide honest and clear feedback about the subject in-hand. For the laboratory analysis, the Association of Official Analytical Chemist (AOAC) and International Standard (ISO) methods were used to analyze the samples in the Laboratory. Data were examined using the SPSS (version 16.0) and Graph pad prism version 9.1.0 software for the survey and the laboratory analysis respectively. All experiments were made in triplicate and the outcomes expressed as mean ± standard deviation. The obtained data were subjected to numerical analysis using GraphPad Prism 5.01. A One-way ANOVA was used to compare mean values among the various

treatments. P-values less than 0.05 ($P < 0.05$) were considered statistically significant using Tukey's Multiple Comparison Test.

2.1 Materials

The reagents used for this work were of analytical grade and were obtained from Food chemistry laboratory of Food/Postharvest Technology Department, Koforidua Technical University and Microbiology laboratory of Food science and Nutrition Department of University of Ghana, Accra respectively. Their preparation was carried out according to specified standard.

2.2 Physicochemical Analysis

The pH, brix (total soluble solids) and the Titratable acidity of the different koko samples were measured using standardized instrumental methods (AOAC, 1990).

2.3 Microbiological Analysis

The determination of microbial contamination in the koko samples was performed by using plate count Agar (Vm72974462 7023) for Total Viable Count **(**ISO 4833-1:2013), Baired Parker Agar (Oxoid Cm0275) for Staphylococcus aureus counts(ISO 6888-1, 1999A1:2003), Violet Red Bile Glucose Agar (Oxoid Cm0485) for Total Coliform Count (ISO 4832:2006) and Potato Dextrose Agar (Oxoid 0139) for yeast and mould count **(**ISO 21527:2008), as outlined in Thermo scientific Microbiological products, making food safer according to ISO methods with some modifications. The colonies were counted using a colony counter and the results expressed as colony forming unit per ml (cfu/ml).

3.0 Results and Discussions

3.1 Survey Results and Discussions

This chapter deals with the data analysis and presentation of findings. It looks at the socio-demographic characteristics of the respondents, personal hygiene of vendors, observation of personal hygiene and use of protective clothing, observation on cleanliness and hygiene of premises, hygiene during packaging and storage of Hausa koko, hygienic condition of processing and or service equipment of koko. It also looks at the analysis of microbial as well as physiochemical analysis the Hausa koko sampled from the respondents.

Table 1: Socio- demographic characteristic of food vendors

Features	Frequency	Percentage (%)
Gender		
Male	2	7.7
Female	24	92.3
Age		
Below 20 years	2	7.7
21-30 years	4	15.4
31-40 years	8	30.8
41 years and above	12	46.2
Marital status		
Single	11	42.3
Married	15	57.7
Level of Education		
No formal education	11	42.3
Primary education	8	30.8
Secondary education	7	26.9

Source: Field work, (2020)

The total sample size of food vendors observed during the study was 26. Out of the 26 food vendors sampled, 7.7 per cent were males while females constituted 92.3 per cent. This is exhibited in Table **1**. The study also revealed that, 2(7.7%) of the vendors were below 20 years, 4(15.4%) between the age limit of 21-30 years, 8(30.8%) also between 31-40 years and 41 years above were 12(46.2%) respectively. With respect to their marital status, 11 of the Hausa koko vendors were single representing 42.3 percent whiles 15 of them were married also representing 57.7%.

The educational attainment of the respondents was also explored, given that some studies found that educational level of vendors is a significant determinant of the hygienic practices in food. These are people who never stepped in the classroom or were drop out before completing basic or primary education. Respondents with primary or basic education constituted 30.8 per cent and that of senior high or secondary education forming 26.9 per cent.

Table 2: Occupational characteristics of koko vendors

Characteristics	Frequency	Percentage (%)
Health certificate		
Municipal assembly	11	42.3
No certificate	15	57.7

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Period of certificate		
Below six months	1	9.1
Exactly six months	4	36.7
Seven months – one year	6	54.4
Training		
Yes	10	38.5
No	16	61.5
Trainer		
Municipal health directorate	7	87.5
Ghana Education Service	1	12.5
Length of training		
One day	8	100.0
Two days	0	0.0

Source: Field work, (2020)

The study explored the occupational characteristics of Hausa koko vendors. This includes whether or not the vendors operate with a certificate, the length of period of the acquisition of the certificate, whether or not the vendor has ever undertaken any training program, the training organization and the length of training of the vendors.

The results show that only 11 vendors representing 42.3 percent of the sample operated with a certificate. The rest of the vendors (15) representing 57.7 percent operated without certificate. This picture painted indicates that over 50 per cent of respondents sell koko to the public without coming under any regulation. It is either there is no check and balances of these vendors of in the municipal or these vendors are recalcitrant and refuse to obey the any regulation put out by the municipal assembly. Out of this percentage that hold vending certificate, 54.4 percent have held it for seven months to one year while 9.1 percent have had it for less than six months. The rest of the number representing 36.7 has had theirs for exactly six months.

With regard to training programmes of respondents, the study show that a greater percentage (61.5%) have had no training programme in the course of their operation. On the other hand, only 38.5 per

cent of the respondents have undergone one training program or the other. This training according to the vendors came from two different sources. A greater percentage of 87.5 came from the municipal health directorate, a body at the assembly as part of their duties responsible for regulating the activities of these vendors. Only 1 respondent representing 12.5 percent indicates he had had a training program from teachers. All the respondents (100%) indicated that all training program lasted for just a day.

Table 3: Personal hygiene of koko vendor

Attribute	Frequency	Percentage
Number of baths per day		
Once a day	1	3.8
Twice a day	25	96.2
None	0	0
Hand washing before handling koko		
Yes	26	100
No	0	0
Means of hand washing		
Cold water	8	38.8
Cold soapy water and rinsing	18	69.2
Hand washing after visiting toilet		
Yes	26	100
No	0	0
Means of hands washing after visiting the toilet		
Cold water	4	15.4
Cold water and soap	20	76.9
Warm water and soap	2	7.7

Source: Field work, (2020)

It is extremely important to analyse the personal hygiene of koko vendors. This is so because the personal hygiene observed by these vendors can affect the safety of the food as contamination can take place even with their unclean body. The study explored this by looking at number of baths done by vendors in a day, their hand washing practices before handling food. From the results in table 3, it is seen that 25 respondents representing 96.2 percent responded they had two baths per day. This may be in the morning and the evening putting them in good body odour. On the other hand, 1 respondent

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representing 3.8 percent took just a bath a day. This practice has a potential leaving offensive body smell on the vendor thereby affecting the hygiene of the food. From the study, it is observed that all the respondent (26, 100%) washed their hands before handling koko. Of this number, 38.8 percent responded that they do that with just cold water while 69.2 percent washed with cold soapy water and rinsing it afterwards. It is also noted from the study that the percentage that cleaned their hands with cold soapy water after visiting toilet is 76.9. Seven (7) percentage point increase of those who was their hands before handling koko. It is further observed from the study that 7.7 percent even washed their hands with warm water and soap.

3.1 Observation of hygienic condition of processing/ service equipment

Hygienic condition of service equipment is as equally important as the main meal (Hausa koko). It is therefore important to see that this equipment is clean and fit for purpose in order not to contaminate the food. There is multiple use of these equipment as these bowls are not disposable. They are made for reuse. The study looked at the serving bowls (calabash) for serving, knives for cutting bread and "koose" and napkins for cleaning hands. The results of the study show that vendors mainly use cold water for washing this equipment. Warm water was not mentioned in their responds. It is seen that equal percentage were arrived at in both means of cleaning bowls and knives. A percentage of 19 representing 5 respondents used only cold water to clean their equipment when selling. As to whether only cold water has the potential to clean bowls and knives well to get rid of contaminants is a question to ask.

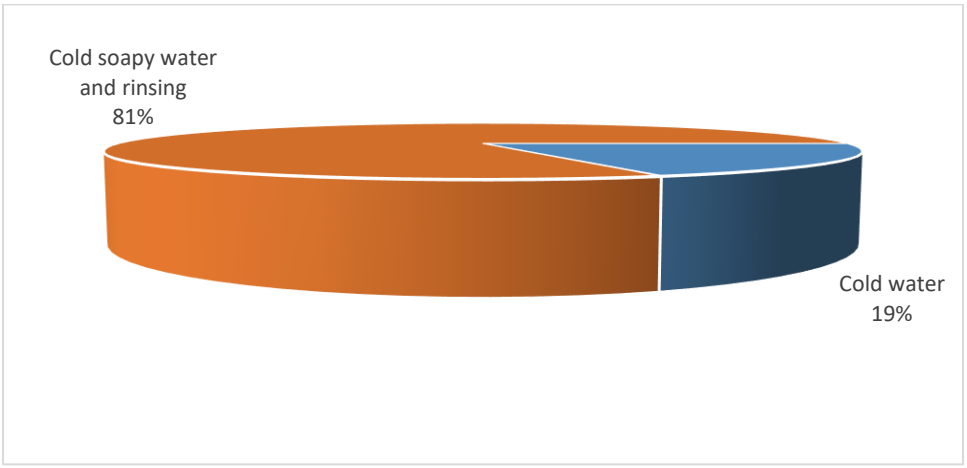

Figure 1: hygienic condition of washing bowls

Source: Field work, (2020)

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The rest of the percentage, 81% of the respondents did wash their bowls and knives with cold soapy water and rinsing. This is a considerable percentage and it is a step further of the percentage that wash with only cold water. The hygienic status of these two-equipment arrived at equal percentages because they are washed in same bowl or container of water.

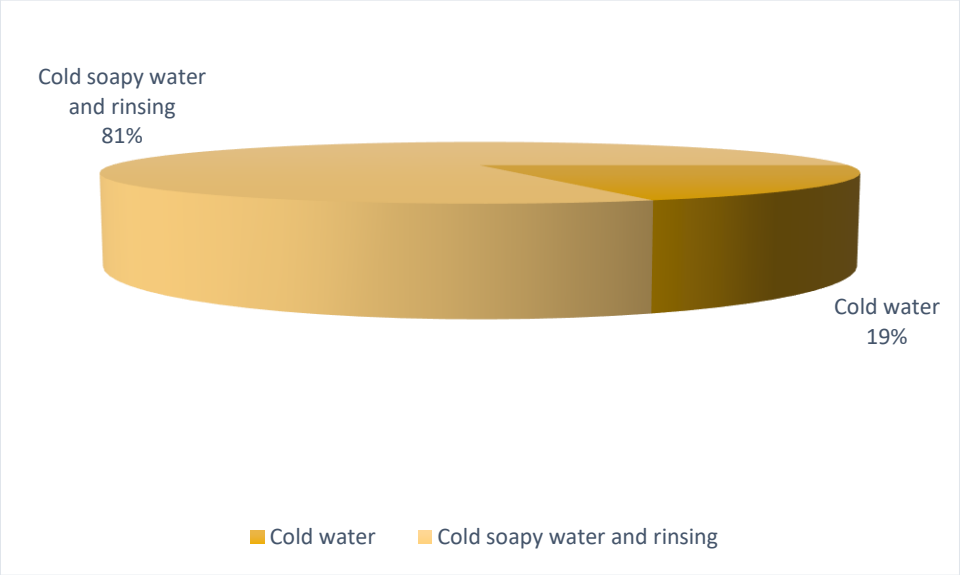

Figure 2: Hygienic condition of knives

Source: Field work, (2020)

Equally important equipment that this study looked at was the napkins. It looked at the frequency and the urgency at which the napkins were washed. The study revealed that 5 respondents representing 1 percent washed their napkins once a day. This means the researcher did not observe them wash them when dirty in the course of selling the koko. This percentage means they were used till the food was sold out. Again, 11.5 percent of the respondents were observed to wash their napkins twice a day. It was observed that this percentage of the respondents wash their napkins, dry them for a short time and put them to use again. Whether they were adequately and properly dried was immaterial here. A considerable percentage of 88.5 washed theirs as soon as observed were dirty. The napkins here were replaced with new dry ones while the washed ones were left to dry.

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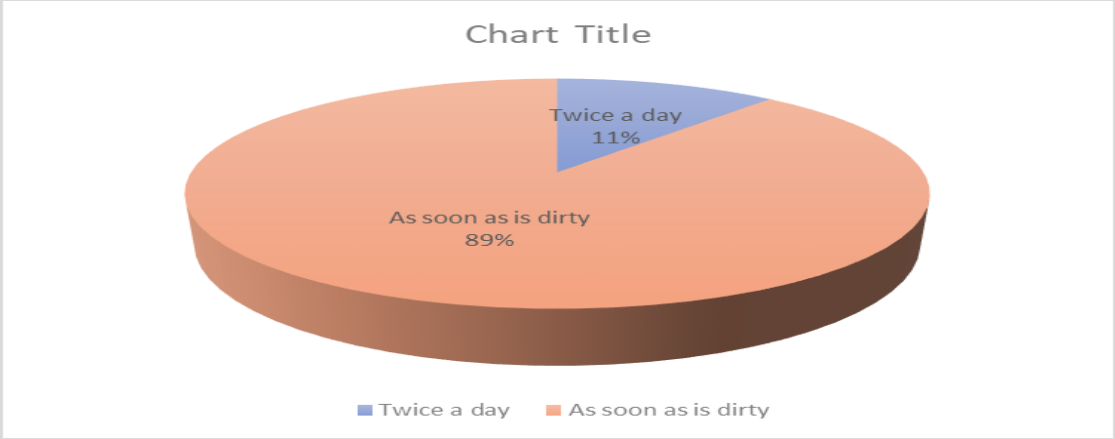

Figure 3: Hygienic condition of napkins

Source: Field work, (2020).

3.2 Personal Hygiene Indicators

Table 4 shows the observation results of personal hygiene and use of protective clothing, cleanliness and hygiene of premises, packaging and storage and waste handling. These observations were carried out on all the respondents oblivious of it. These results show the point of view of the researcher concerning the operation the koko vendors.

Table 4: observed hygiene practices indicators

Observation	Response	
	Yes (%)	No (%)
Personal hygiene and use of protective clothing		
Short finger nails	96.2	3.8
Clean finger nails	73.1	26.9
Use of apron	73.1	26.9
Use of hair cover	69.2	30.8
Use of mouth/nose cover	100	0
use of glove	0	100
Cleanliness and hygiene of premises		
Cleanliness of premises	84.6	15.4
Premises enclosed	15.4	84.6
Flies on premises	65.4	34.6
Bareness of floor	34.6	65.4
Packaging and storage		
Finger licking to separate wrappers	3.8	96.2
Air blowing to separate wrappers	0	100.0

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Picking koko with bare hands	100.0	0
If yes, are hands washed	15.4	73.1
Use of gloves for packaging	11.5	88.5
Waste handling		
Presence of waste bin	96.2	3.8
Waste bin covered	65.4	34.6
Waste bin hand operated	84.6	15.4

Source: Field work, (2020)

Table 4 shows that a considerable number of respondents, 96.2 percent 73.1 percent kept their finger nails short and clean respectively. Rane (2011) reported that Salmonella, non-typhi salmonellae, Campylobacter and E. coli can endure on finger tips and other sides for diverse periods of time and in some cases even after hand washing. It therefore befits food sellers always to keep their finger nails short and clean to avoid them from serving as a vehicle for spread of pathogens. With respects to the use of aprons and head cover, the study reported 73.1 percent observed to use aprons while 69.2 percent hair cover. This is to prevent debris of hair from entering into the bulk food to accidentally serve it to a customer.

3.3 Physicochemical Results and Discussion

Table 5: Physicochemical Analysis of "Hausa Koko" In Akropong Municipality

TESTS	Sample A	Sample B	Sample C	Sample D	Sample E	Sig. Level
T.S.S(^{O}Brix) ±SD	2.21 ± 0.01^{a}	3.11 ± 0.01^{b}	1.72 ± 0.00^{c}	1.61 ± 0.00^{d}	1.42 ± 0.00^{e}	***
$_{P}$H ±SD	4.17 ± 0.00^{a}	3.86 ± 0.00^{b}	4.13 ± 0.00^{a}	3.86 ± 0.00^{b}	3.92 ± 0.00^{b}	***
Titratable acidity (% lactic acid)	0.27 ± 0.00^{a}	0.27 ± 0.00^{a}	0.41 ± 0.00^{b}	0.43 ± 0.02^{b}	0.29 ± 0.00^{a}	***

**** = P < 0.05= Extremely significant. Sig. Level, SD = Standard deviation, T.S. S= Total soluble solids, $_{P}$H = Hydrogen ions concentration.* Each value is presented as mean ± standard deviation. Means in a column with the same letter superscripts are not significantly different (P> 0.05, Tukey's test), whereas those with different superscripts are significantly different (P> 0.05, Tukey's test). Sample A=Akropong, Sample B=Amonokrom, Sample C=Aburiw, Sample D=Kwamoso, Sample E=Mampong

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The physicochemical parameters analyzed for the samples are summarized in Table 5. There was significant difference ($P<0.05$) between all the "Hausa koko" samples with Sample B recording the highest mean value and sample with the least mean value respectively. The lower values obtained for the T.S.S was as a result metabolization of sugars in the millet during fermentation process.

The pH of the samples (A- E) was 4.17.3.86, 4.13, 3.86 and 3.92 respectively (Table 5). Mao et al. (2013) reported that at the start of fermentation, microorganism such as lactic acid bacteria decomposed carbohydrates and fat to produce small organic molecules such as lactic acid, acetic decomposed the protein to produce free amino acid, and hence contributes to low pH values of the samples (Hausa koko).

The titratable acidity of the "Hausa koko" samples were found to be 0.27%, 0.27%, 0.41%, 0.43%, 0.29% respectively (Table 5). The acidity in the samples (A-E) was due to the organic acids mainly lactic acid which also abate the unfair of decay bacteria in the samples. (Adams and Nicolaides, 1997) hence making the food safe from bacteria. The contrary proportional trend between pH and titratable acidity observed in this study was comparable to the finding of (Hounhouigan, 1994). It was similarly observed that the variation in the two parameters (i.e., pH and TTA) was very rapid and significant; this signified a good rate of fermentation procedure of the millet used in Hausa koko production (Assohoun et al., 2013). In addition, Odunfa and Adeyele 1985, reported that the incidence of un-dissociated forms of organic acids at low pH could prevent a broad spectrum of pathogens thus improving the microbiological stability of the food product (Blandino et al., 2003; Omar et al., 2006). According to Gadaga et al. (2001), most pathogens are not able to survive at low pH, this is beneficial to the product in terms of storage capacity and shelf life.

3.4 Microbiological Results and Discussion

In all, 5 samples (A-E) were analyzed from 5 Hausa koko vendors in the municipality. Bacterial growth was observed in almost all the samples analyzed. Samples were taken in the morning and afternoons from the 5 vendors selected. The means of the results from the food sample analysis were converted to cfu/ml.

3.5 Total Viable Count

The total aerobic count assay indicated the presence of some aerobic microorganisms in the samples with all exhibiting significant microbial populations though few.

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Table 6: showing results for Total Viable count (ISO 4833:2013)

Sample code	Unit	Results
A	Cfu/ml	$2.9\times10^{1}\pm0.01$
B	Cfu/ml	$1.2\times10^{3}\pm0.00$
C	Cfu/ml	$1.6\times10^{3}\pm0.01$
D	Cfu/ml	$8.8\times10^{2}\pm0.01$
E	Cfu/ml	$6.2\times10^{2}\pm0.00$
LOD: Limit of Detection		$<10^{3}$

Sample A=Akropong, Sample B=Amonokrom, Sample C=Aburiw, Sample D=Kwamoso, Sample E=Mampong

The mean TVC in the "Hausa koko" samples expressed as cfu/ml is shown by Table 6. The mean TVC ranged from 2.9×101 cfu/ml to 1.2×10^{3} cfu/ml. Sample C recorded the highest microbial load with TVC count of 1.6×10^{3} cfu/ml with sample A 2.9×10^{1} cfu/ml. Analysis of variance conducted revealed that there was significant difference ($P< 0.05$) in TVC count in samples collected from "Hausa koko" venders in Akropong municipality. All the samples had levels of contamination lower than the recommended load by Ghana Standard Authority which prescribes values of < 5.0 $\log_{10}\frac{cfu}{g}$ or (100000 cfu/g). (GSA, 2003).

3.6 Total Coliform Count

Coliforms are a class of organisms, which are of prime importance in the area of food safety as they have been implicated in a couple of food poisoning and contamination cases recorded across the globe. Coliform are a yardstick of microbial contamination of cooked foods. High levels of coliform contamination in cooked foods thus indicates poor handling, processing and possible transmission of enteric pathogens (Wood et al., 1983). The total coliform count assay recorded results was satisfactory with some all recording no count except Sample C (1.0×101cfu/ml) and Sample E (3.9×10^{1} cfu/ml) observed on Violet Red Bile Glucose Agar (Oxoid Cm0485) after incubation period for 24 hours at 35 ºC.

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Table 7: Showing results for Total Coliform Count (ISO 4832:2006)

Sample code	Unit	Results
A	Cfu/ml	ND
B	Cfu/ml	ND
C	Cfu/ml	1.0×101
D	Cfu/ml	ND
E	Cfu/ml	3.9×101
LOD: Limit Detection		<102

ND- Not Detected; Sample A=Akropong, Sample B=Amonokrom, Sample C=Aburiw, Sample D=Kwamoso, Sample E=Mampong

The absence of coliform bacteria (TCC) in Sample A, B and D signifies that the samples are free from faecal contamination due to the hygienic conditions employed during preparation Whereas the presences of coliform bacteria (TCC) signify some level of contamination but do not exceed the by Ghana Standard Authority which prescribes values of < 5.0 $\log_{10} \frac{cfu}{g}$ or (100000 cfu/g). (GSA, 2003). The level of contamination was as a result of contaminated utensils used in serving the "Hausa koko".

3.7 Staphylococcus Aureus

In general, *S. aureus* was present in almost all the food sampled in various levels of contamination but the values were below the international limit (3.0 log10 cfu/g in ready-to-eat foods) ICMSF 1996, with Sample C recording the highest mean value and Sample E recording the least value respectively,

Table 8: Results Staphylococcus aureus Count (ISO 6888-1:2003)

Sample code	Unit	Results
A	Cfu/ml	5.9×10^1
B	Cfu/ml	5.4×10^1
C	Cfu/ml	1.6×10^2
D	Cfu/ml	3.9×10^1
E	Cfu/ml	3.3×10^1
LOD: Limit Detection		Absence in 1mL

Sample A=Akropong, Sample B=Amonokrom, Sample C=Aburiw, Sample D=Kwamoso, Sample E=Mampong

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Analysis of variance conducted revealed that there was significant difference ($P< 0.05$) in *S. aureus* count in the samples collected from "Hausa koko" venders in Akropong municipality. Koneman et al. (1988) identified that the growth of *S. aureus* in foods produces heat stable toxin capable of causing foodborne illnesses. The bacteria count in this study is quite consistent with a study on cooked food in Accra that showed that main meals (salads, macaroni, shito and fried fish) had high counts of pathogenic bacteria including *S. aureus* (Mensah et al., 2002). Since *S. aureus* is largely found in man's respiratory passages, skin and superficial wounds (Burt et al., 2003), their presence in cooked foods implies non-adherence to standard hygienic practices during food preparation and handling (Ghana Standard Authority, 2003) and the contaminated nature of water used in preparing the food (Muleta, 2001).

3.7 Yeast and Mould

Yeast and mould usually produce mycotoxins which are not totally destroyed through processing. In this study yeast counts in the food samples were generally low except Sample E (6.9×10^3) compared to the international reference standards value of 2.7 log10 cfu/g (New Zealand Food Safety Authority, 1995).

Table 9: Results for Yeast and Mould Count (ISO 21527:2008)

Sample code	Unit	Results
A	Cfu/ml	5.5×10^1
B	Cfu/ml	3.8×10^2
C	Cfu/ml	3.0×10^2
D	Cfu/ml	1.1×10^2
E	Cfu/ml	6.9×10^3
LOD: Limit of Detection		$<10^3$

Sample A=Akropong, Sample B=Amonokrom, Sample C=Aburiw, Sample D=Kwamoso, Sample E=Mampong

The mean yeast and mould count ranged between 5.5×10^1cfu/ml, 3.8×10^2 cfu/ml, 3.0×10^2 cfu/ml, 1.1×10^2 cfu/ml and 6.9×10^3 cfu/ml in Sample A to Sample E respectively with Sample E highest values and Sample A with the least. These values were quite lower than the international reference standard for cooked foods except sample E with a value of (6.9×10^3) which is above the acceptable limit. Although yeast in lower doses may not cause health hazard, FDA (2012) reported in a study that their metabolic activities may shift the pH of the cooked food and permit the multiplication of other harmful bacteria. The spores of yeast are ever present in the environment and they get into foods through infected equipment and air. Their presence in cooked foods therefore indicates poor hygienic practices of food handlers (not covering foods) and undercooking.

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4.0 Conclusion

From the study, it was realized that most of the "Hausa koko" samples analysed had low pH and T.S.S levels with appreciable acidity level. Though all the samples recorded contamination lower than the acceptable values of Ghana Standard, the presence of high pH levels, Coliform, *S. aureus* and yeast and mould in the food samples suggest the likelihood of residents being exposed to the risks and consequences of eating contaminated "Hausa koko". Majority of the vendors in the study area had no formal education and this was exhibited in some of the practices and the unsanitary conditions under which the vendors operated as well as some levels of contamination of the "Hausa koko".

5.0 Recommendations

The finding of this study implies the training of "Hausa koko" vendors on food hygiene in the study area. Again, there should be awareness creation and regular sanitary inspection of vending sites by the regulatory agencies and authorities in study area. Further studies should investigate the strain of molds in the "Hausa koko" as some molds directly associated with "Hausa koko " can be harmful for human consumption. Finally, vendors should enhance their hygiene practices at both preparations and vending sites.

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