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Full Length Research Paper

Bacteriological Quality of Street Vending Potato Chips In Gondar Town, North West Ethiopia

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Street vended foods are those sold in the street by street vendors mostly for snack times. Potato chips are one of the popular snacks which are sold in streets. Bacterial count in prepared food like potato chips is a key factor during assessing the quality and safety of food. In the present study an attempt was made to assess the bacteriological quality of street vended potato chips. The objective of the study is to determine the bacteriological quality of the street vended potato chips collected from Azezo and kebele 18. Samples from the street vended chips were collected in Azezo and Kebele18. Ten gram of potato chips was added to 90 ml of buffered peptone water and mixed well, and serial dilution up to $10^{-5}$was prepared for each samples. From a tube containing 10^{-5}, 0.1 ml of suspension was transferred and spread on to Plate count agar, MacConkey agar, Mannitol salt agar and *Salmonella-shigella* agar plate and incubated at 37^{o}C for 24 hours. Then colonies were counted and morphologically different colonies were selected for further study. The selected isolates were characterized based on morphological, biochemical and physiological characteristics. The total plate count, total *Enterobacteriaceae* count, *Staphylococcal* count and *Salmonella Shigella* count result showed that 95% (38), 22.5% (9), 62.5% (25) and 15% (7) samples were contaminated by microorganisms, respectively. Based on morphological, biochemical and physiological characterization, genus *Escherichia*, *Staphylococcus, Salmonella* and *Shigella* were identified from potato chips collected from Azezo and Kebele 18. Based on the result the standard quality and safety levels of the potato chips are not acceptable. Therefore, the utilization of such contaminated foods poses a series health problem to the consumers. This can provide information for responsible organization to make trainings and awareness creation to street venders and consumers to solve health problems and outbreak caused by food borne pathogens.

Keywords: Bacteriological quality, Contamination, Gondar town, potato chips, street venders

INTRODUCTION

Street vended foods and beverages are prepared and sold by vendors on streets or public places for fast consumption (Chandi and Sonali, 2012). The street food is a growing sector in many developing countries in the last decades with linked to urbanization. It is now widely recognized by food and health agencies to possess a huge socio-economic power. The sector therefore, has an immense employment and income generating potential (Thilde, 2006).

Most street vended foods are snack items (foods that are consumed especially between lunch and dinner). One of the more popular snacks is potato chips. Potato chips are piece of potato which have been sliced extremely thin and then fired or baked until they become crisp and ready to eat (Tambeker et al., 2011). Hygienic and quality potato chips preparation is vary from processor to processor (EAS747, 2010; Jackson and Berga, 2003; Ndungu, 2007). Food hygiene requires clean environment at every stage of the food preparation process because microbes can be found in every where (Peter and Martin, 2011).

Since potato chips can be found easily with cheap cost and sours of income, it has important role in snack times. But the biological safety of street vended foods are always in doubt and most of ready to eat foods do not fulfill bacteriological quality standards (Mirriam et al.,

2012). This is as a result of the traditional processing methods that are used in the preparation, packaging and personal hygiene of food handlers (Felglo and Sakyi, 2012). Because most of street venders have poor knowledge about quality food preparation, basic food safety measures, epidemiological significances of foods, the causes and effects of food borne disease (Garode and Waghodo, 2012).

Food borne diseases are diseases caused by ingestion of bacteria, toxins and cells produced by microorganisms present in food. Potential health risks are associated with contamination of food by *E. coli, Salmonella thyphi, Pseudomonas species*, *Staphylococcus aureus* and *Proteus species*. They have originated from the vendors food preparation, the quality of the materials they use, even their hand and cloth, cross contamination between dish water, food preparation surfaces and the food itself (Garode and Waghodo, 2012).

However, there is no scientific report about the bacteriological quality of street vended potato chips in Ethiopia particularly in Gondar town. Therefore, this study is necessary to reveal the information about bacteriological quality of street vended potato chips in this particular area. As a result, it provides background information for interested researchers, people those use street vended potato chips to take care of their health, and for health organization.

MATERIALS AND METHODS

Description of the study area

The study area is Gondar town, North West Ethiopia which is 737 km away from Addis Ababa, Capital city of Ethiopia. Gondar is located in the north Gondar zone of the Amhara region, North of Lake Tana and South West of the Simien Mountains. The town has 12°36′N latitude and 37°28′E longitude with an elevation of 2133 meters above sea level. And has 231,977 total populations according to 2008 Ethiopian statistical agency report. The study was carried out from January –June 2013.

Sample collection and analysis

The street vending potato chips were purchased at two different areas of Gondar town (Azezo and kebele 18) between 11am-2pm when most potato chips were prepared and ready to sell for consumers. The samples were collected aseptically in sterilized plastic bags, transferred and preserved in microbiology laboratory at 4^0C refrigerator for further analysis.

Ten grams of potato chips were added in to sterile stomacher bag containing 90 ml of buffered peptone water (13g/l peptone, 3.56g/l KH_2PO_4, 7.23g/l Na_2HPO_4, 4.3g/l NaCl) and mixed together using stomacher blander. One milliliter of each sample was taken and added into test tube containing 9ml of normal saline (0.85%w/v) and was mixed well using vortex. Then, the serial dilution was made up to 10^{-5} using test tubes. After mixing each tube, 0.1 ml suspension was transferred and spread on to a sterile plate count agar (PCA), MacConkey agar (MA), Mannitol salt agar (MSA) and *Salmonella-Shigella* agar (SSA) in duplicate for total viable count, total *Enterobacteriaceae* count, S*taphylococcal* count and *Salmonella-Shigella* count, respectively. The plates were incubated at 37^oC for 24 hrs for bacteria. After the incubation period completed, the results of each plate having colonies were recorded and pure colonies having different morphology were subculture to test tubes containing nutrient agar slant. All the test tubes containing selected cultures were incubated for 24hrs in 37^oC and after incubation; slants were preserved at 4 ^{0}C for further analysis (Feglo and Sakgi, 2012).

Characterization of isolates

Selected isolates were then sub cultured to nutrient broth and was incubated to make our sample refresh for gram staining and different biochemical tests (catalase, coagulase, TSI test, indole, citrate utilization, urease production) (Odu and Imaku, 2013). Gram staining was prepared for selected isolates and results were recorded. Catalase and coagulate tests were done for those gram positive isolates. Citrate utilization test, Urease test, TSI test, MR/VP test and indole tests were prepared for those gram negative isolates. The antibiotic susceptibility test for such isolates were done by disc diffusion method (Feglo and Sakgi, 2012) using different standard antibiotic discs such as Erythromycin (ERY), Ciprofloxacin (CIP), Amoxicillin (AMC), Ampicillin (AMP), Vancomycin (VA) and Chloramphenicol (C).Then, results were recorded.

Data analysis

The collected and recorded data were analyzed using Excel office 2007 to determine the average CFU/g of the sample and to make tables.

RESULTS

Sample collection, enumeration and isolation of microorganisms

Forty samples (16 from Azezo and 24 from Kebele 18) were collected from ten randomly selected sites of Gondar town in four different successive weeks. From a

total of 40 samples, 50 % (20) of the samples were TMTC, 45% (18) were between 1X10^5 to 5.1 X10^{7}CFU/g and5 % (2) were not shown growth of microorganisms on the total plate count agar. As the mean CFU/g of the sample result indicates, 100 % (16) of the samples collected from Azezo and 91.7 % (22) samples from Kebele 18 were shown more than 1X10^5 CFU/g.

As total *Enterobacteriaceae* count indicated that Out of 40 collected samples, 22.5% (9) of the samples were shown growth of microorganisms from genus *Enterobacteriaceae* (17.5 % (7) of samples were contaminated by both lactose fermenters and non-lactose fermenters, and 2.5% (1) sample was contaminated by lactose fermenters only and 2.5% (1) was contaminated by non-lactose fermenters only).

According to *Staphylococcal* count result in this study, 62.5% (25) of the samples were contaminated by *Staphylococcus* species. From these, 57.5 % (23) ranging from 1x10^5 (minimum) to 3.15x10^7 (maximum) CFU/g and 5 % (2) of samples were too many to count. Although no fermentation occurs in all, microorganisms grow well in mannitol salt agar. This is enough to say those species are not *Staphylococcus aureus* since there is no mannitol fermentation at all in mannitol salt agar media.

In case of *Salmonella shigella* count, from a total of 40 samples, 15% (6) samples were contaminated by the genus *Salmonella* and *shigella* and the recorded result was ranged from 1x10^5 to 4.9x10^6 CFU/g (Table 1).

Characterization of isolates

Fourteen morphologically distinct isolates were selected for further characterization. Out of 14 isolates, 57% (8) of them were gram negative (D13, D14, D18, D19, D20, A7) and the rest 43% (6) were gram positive (D4, D12, D17, A3, A4, A6, A10, A13) isolates.

The whole gram positive isolates were catalase positive and coagulate negative. A6 were the only isolate which is negative for citrate utilization from all the gram negatives and D12 were the only isolate which is positive for indole test. D17 and A6 were negative for urease test and the rest were positive. Three isolates (D12, D17 and A10) were shown positive result for gas production. There was no H_2S production and MR/VP positive result in all isolates. Isolate A3 and A4 were resistant against three (Ampicillin, Amoxicillin and Vancomycin) and two (Ampicillin and Amoxicillin) standard antibiotics, respectively (Table2).

Based on these morphological, biochemical and physiological characterization microorganisms are grouped under genus S*taphylococcus, Escherichia*, *Salmonella* and *Shigella.*

DISCUSSION

The study was carried out to determine whether the street vended potato chips sold by those street venders in Gondar town for consumption were hygienic or not. All potato chips samples selected for examination were obtained from street vendors in Azezo and Kebele 18 streets. As a result, their hygiene and bacteriological quality of potato chips were assessed.

The study showed that 95% (38) of samples have a minimum of 1 x10^5 CFU/g and maximum of too many to count (TMTC) microorganisms were recorded in the total plate count. In case of total *Enterobacteriaceae* count, 22.5% (9) of the samples were showing growth of microorganisms from genus *Enterobacteriaceae*. According to East African standard (EAS747, 2010), a maximum result of total plate count and total *Enterobacteriaceae* count should be 1x10^4 and zero, respectively. These showed that the quality of street vended potato chips collected from Azezo and Kebele18 didn't have acceptable sanitation.

In case of *Staphylococcal* count, more than half (62.5% (25)) of sample collected from sites were shown growth of *Staphylococcus* species (except *Staphylococcus aureus*) having more than 1x10^5 CFU/g.

During the present study in *salmonella shigella* count, 15% (6) of the samples were shown growth of microorganisms. According to East African standards of the quality of potato chips, any microorganism growth should not observed in *salmonella shigella* agar. A number of studies which are conducted on street vending foods showed that the samples are contaminated by *Shigella* or/and S*almonella* species although most studies of street vended foods had not isolate *Shigella* and *Salmonella* species. In the study of bacteriological quality assessment of street foods, the samples were showed growth of *Shigella* and *Salmonella* species (Chandi & Sonali, 2012).

As the result showed that, most of street vended potato chips samples were contaminated by one or more microorganisms from different genera. Based on different morphological, biochemical characterization, 4 genera (S*taphylococcus, Escherichia*, *Salmonella* and *Shigella*) were identified.

CONCLUSION

The present Study was conducted on street vending potato chips that sold on the streets of Azezo and Kebele 18 in Gondar town and revealed that almost all the samples are in unacceptable sanitation. As the result indicated that the required quality and safety levels of the potato chips is not acceptable. The situation calls for formulation of strict public-health regulations regarding to the sale of potato chips in these particular area. Therefore, the consumption of such contaminated street vended potato chips poses a series problem to the community health. These provide information for responsible organizations to take an action for providing regular training and to make awareness creation on food

Table 1. Comparison of mean CFU/g between districts and along with in districts

District	Sample code	Week (w)	Mean of colony forming unit per gram (CFU/g)x10^5					
			TPC	TEC		SC		SSC
				LF	NLF	SAC	OSC	
Azezo	S_1	w_1	35	0	0	0	6	0
		w_2	2	0	0	0	0	0
		w_3	TMTC	0	0	0	7	0
		w_4	TMTC	0	0	0	1	0
	S_2	w_1	43	0	0	0	0	49
		w_2	TMTC	0	0	0	0	1
		w_3	151	0	0	0	1	1
		w_4	TMTC	0	0	0	4	0
	S_3	w_1	3	0	0	0	0	0
		w_2	TMTC	TMTC	0	0	0	0
		w_3	TMTC	10	11	0	188	0
		w_4	TMTC	0	149	0	5	0
	S_4	w_1	4	0	0	0	2	0
		w_2	4	0	0	0	0	27
		w_3	TMTC	TMTC	49	0	TMTC	0
		w_4	TMTC	0	0	0	7	0
K18	S_5	w_1	0	0	0	0	0	0
		w_2	110	0	0	0	10	0
		w_3	80	6	52	0	7	9
		w_4	TMTC	0	0	0	1	0
	S_6	w_1	80	0	0	0	21	0
		w_2	TMTC	0	0	0	14	0
		w_3	509	103	25	0	315	0
		w_4	TMTC	0	0	0	0	0
	S_7	w_1	1	0	0	0	0	0
		w_2	2	0	0	0	3	0
		w_3	TMTC	0	0	0	3	0
		w_4	TMTC	0	0	0	0	0
	S_8	w_1	TMTC	0	0	0	0	0
		w_2	TMTC	0	0	0	6	0
		w_3	185	5	33	0	17	0
		w_4	TMTC	0	0	0	3	0
	S_9	w_1	0	0	0	0	0	0
		w_2	11	0	0	0	0	0
		w_3	TMTC	2	13	0	TMTC	5
		w_4	TMTC	0	0	0	3	0
	S_{10}	w_1	3	0	0	0	0	0
		w_2	3	0	0	0	3	0
		w_3	126	2	1	0	8	0
		w_4	TMTC	0	0	0	0	0

Key: TMTC (Too many to count), TPC (total plate count), TEC (Total *Enterobacteriaceae* count), LF (Lactose fermenter), NLF (Non lactose fermenter), SAC (*Staphylococcus aureus* count), OSC (Other *Staphylococcal* count), SSC (*Salmonella -shigella* count)

Table 2. Morphological, biochemical and physiological characterization of isolates

Characteristics		Isolates													
		D13	D14	D18	D19	D20	A7	D4	D12	D17	A3	A4	A6	A10	A13
Colony shape		C	C	C	C	T	C	C	C	C	C	C	C	C	C
Gram reaction		+	+	+	+	+	+	-	-	-	-	-	-	-	-
Cell shape		Co	Rod	Rod	Co	Co	Rod	Rod	Rod	Co	Rod	Rod	Co	Co	Co
Catalase		+	+	+	+	+	+								
Coagulase		-	-	-	-	-	-								
Citrate utilization								+	+	+	+	+	-	+	+
Indole test								-	+	-	-	-	-	-	-
TSI test								K/A	K/K*	A/A*	K/K	K/K	K/K	K/A*	K/K
Urease test								+	+	-	+	+	-	+	+
MR/VP								-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-
Antibiotics Resistance	AMP	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	R	R	**S**	**S**	**S**
	AMC	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	R	R	**S**	**S**	**S**
	VA	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	R	**S**	**S**	**S**	**S**
	CH	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
	CIP	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
	ERY	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**

Key: C (circular), co (cocci), T (tree), +(positive), -(negative), K/K (base/base), K/A (base/acid), A/A (acid/acid), * (Gas production), R (Resistance), S (Susceptible)

and personal hygiene among street food venders as well as consumers.

Conflict of interest statement

We declare that we have no conflict of interest.

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