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The bacteriological quality of Hamburger patties from fast-food restaurants in Umuahia, Nigeria

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***Abstract*:** *Bacteriological analysis was conducted on sixteen samples of Hamburger patties from eight (A-H) f ast-food restaurants in Umuahia. Eight of the samples were made of ground chicken (A_1-H_1) and the other eight samples were made of ground beef (A_2-H_2). Both C1 and E1 samples gave the highest Escherichia coli count of 3.9 Log_{10} cfu/g while sample E_2 gave the highest count of 3.7 Log_{10} cfu/g amongst the beef samples. Samples C_1 and C_2 gave the highest Staphylococcal count of 3.95 Log_{10} cfu/g and 3.7 Log_{10} cfu/g respectively. The Salmonella count of 2.4 Log_{10} cfu/g was recorded by samples C_1 and E_2. The highest total aerobic plate count was 4.29 Log_{10} cfu/g from sample E2 while the lowest was recorded by sample D_1 with a count of 3.3 Log_{10} cfu/g. Bacterial species isolated includes; S.aureus, E.coli, Bacillus spp, Proteus spp, Micrococcus spp, Pseudomonas spp and Salmonella spp. The presence of food-borne pathogens beyond the acceptable limit is of public health importance.*

***Keywords*-** *Bacteriological quality, Fast-food, Hamburger patties, Umuahia*

I. Introduction

From its birth in the 1940's in Southern California, the growth of fast food industry has been nothing less than astonishing. It has become so routine and so thoroughly mundane, that it is now taken for granted like brushing of teeth. In Nigeria, the fast food industry has grown tremendously in the 21st century. Every major city in Nigeria is flooded with fast food restaurant. Worldwide, more money are now spent on fast food than on newspapers, magazines, books, movies, videos and recorded music combined.

Hamburger is one of the most popular fast foods, which carries considerable amount of meat all over the world. After production, Hamburger patties are mainly being kept cold or frozen until they were used in many restaurants (Ciftcioglu *et al*., 2008). The main raw material is minced beef, though fat and other ingredients may be included. (Fortuna *et al*., 2012; USDA/FSIS, 2012).

Microbial pathogen control in hamburger patty production poses several challenges. Ground meats are a troublesome source of food borne infection. Intensive handling and complex preservation issues in preparation promote pathogen growth and transmission (Fortuna *et al*., 2012). Grinding operations typically take raw beef trimmings from multiple sources and mix these inputs together to make patties. Meat trimmings may carry high pathogenic loads because of how they are being handled and because they have multiple exposed surfaces. The grinding operation itself disperses pathogens present on the trimmings throughout the ground product and there is opportunity for those pathogens to multiply in the subsequent supply chain.

The primary method of destroying pathogens in hamburger patties is to cook them to a proper internal temperature (Nester *et al*., 2008). USDA recommend slowest heating points for hamburger patties of 71.1^0C /160^0F (Clavero *et al*.,1998; USDA/FSIS, 2012) or 70^0C for 2min (FDA, 2007). Ground poultry should be cooked to an internal temperature of 74^0C (165^0C). According to USDA/FSIS (2012), re-heated patties should be cooked to an internal temperature of 73.9^0C (165^0F). Premature browning is a food safety issue; because hamburger patties appear fully cooked (brown), even though they have not reached an internal temperature sufficient to kill pathogens (Hague *et al*., 1994).

Although research indicates that food safety is not a factor which influences the public's choice when selecting an eating establishment (Leach *et al*., 2001), the detection and characterization of pathogens in food is very important in the control and prevention of food poisoning outbreaks. This work is therefore aimed at determining the microbiological quality of Hamburger patties from fast food restaurants in Umuahia, Nigeria.

II. Materials And Methods

Sample collection:

Sixteen Hamburger patties {eight of chicken (A_1-H_1) and {eight of beef (A_2-H_2)} were bought from eight fast food restaurants in Umuahia, the samples were immediately transported to the laboratory in well wrapped, clean, sterile aluminum foil.

Isolation and enumeration of microorganisms

Nutrient agar, Salmonella shigella agar, Mannitol Salt agar, Eosin Methylene blue agar, were prepared according to manufacturer's instruction and sterilized by autoclaving at 121^{o}C for 15mins. Hamburger patties were analyzed after aseptic removal of the bread/bun component of the hamburgers. 10grams of each patty was blended in a sterile blender with 90mls of normal saline for two minutes. 10 fold serial dilutions were prepared and 1ml of the relevant dilutions was inoculated onto duplicate plates of the already prepared media using the pour plate technique. The plates were then incubated at 37^{o}C for 24-48h and examined for colony formation.
After incubation, colonies were counted using a colony counter (Gallencamp) and then the colonial counts recorded as cfu/g were converted to log 10 cfu/g. Pure cultures of isolates were obtained by sub-culturing in fresh medium using the streak plate method.

Identification of isolates

Bacterial isolates were identified based on standard microbiological cultural, morphological and biochemical characteristics as described by Cowan and Steel, (1965), Prescott *et al*. (1996) and Cheesebrough, (2006). The characteristics and biochemical tests include; Gram reaction, endospore staining, catalase, urease, coagulase, citrate, oxidase, sugar fermentation, methyl red-Voges proskauer and indole tests.

Table 1: Microbial counts for organisms of public health interest in burger patties

Samples	Microbial counts (Log_{10} cfu/g)			
	Total aerobic plate count	*E.coli*	*Staphylococcus*	*Salmonella*
A1	4.10	3.58	3.50	0
B1	3.60	2.80	2.84	0
C1	4.20	3.90	3.95	2.40
D_1	3.30	2.70	2.80	0
E_1	4.50	3.90	3.60	2.30
F_1	3.60	2.78	2.80	0
G_1	3.40	2.90	2.84	0
H_1	3.70	2.80	2.97	0
A_2	4.00	3.52	3.43	0
B_2	3.75	2.90	2.97	0
C_2	3.75	3.50	3.70	0
D_2	3.50	2.87	2.90	0
E_2	4.29	3.70	3.60	2.40
F_2	3.50	2.85	2.90	0
G_2	3.60	2.70	2.80	0
H_2	3.50	2.78	2.70	0
APHA acceptable limit	□5.00 Log_{10} cfu/g	□2.00 log10 cfu/g	□2.00 log10 cfu/g	0/25g

Key:A1-H1=Chicken Burger, A2-H2=Beef Burger, APHA=American Public Health Association

Table 2: Percentage occurrence of bacterial isolates in burger patties

Isolates Samples	*Bacillus*	*Staphylococcus*	*Pseudomonas*	*Proteus*	*Micrococcus*	*Salmonella*	*E.coli*	percentage
A1	_	+	+	+	_	_	+	57%
B1	_	+	_	_	_	_	+	29%
C1	+	+	+	+	+	+	+	100%
D_1	_	+	_	_	_	_	+	29%
E_1	+	+	+	+	+	+	+	100%
F_1	_	+	_	+	+	_	+	57%
G_1	_	+	_	+	+	_	+	57%
H_1	_	+	_	+	_	_	+	43%
A_2	+	+	_	+	_	_	+	57%
B_2	_	+	_	+	_	_	+	43%
C_2	+	+	_	_	+	_	+	57%
D_2	_	+	_	_	_	_	+	29%
E_2	_	+	+	+	+	+	+	86%
F_2	+	+	_	_	+	_	+	57%
G_2	_	+	_	+	+	_	+	57%
H_2	+	+	+	_	_	_	+	57%
%	38%	100%	31%	63%	50%	19%	100%	

Key: + = present, _ = absent

III. Discussion

Most of the burger patties analyzed posed zero to low microbial risks i.e they were within acceptable limits (5.0 Log_{10} cfu/g for total aerobic plate counts, 2.0 Log_{10} cfu/g for *S.aureus* and *E. coli* count and 0/25g for *Salmonella* (APHA, 2004). However, the bacterial quality of the samples also varied with the fast – food restaurants, with high microbial load from two of the fast-food restaurants 'C and E' ranging from 3.9 Log10cfu/g -4.5 Log10cfu/g (TABLE1). The high microbial load, though, within acceptable limits in the samples can be attributed to what Johnston and Tompskins (1992) described as some low level of contamination which occurs during handling, packaging or serving of cooked products on surface of the product from equipment's and food handlers.

Growth of *Salmonella* was found in three samples, fast-food restaurants C_1, E_1 and E_2 (TABLE1). E_1 recorded 2.3 Log10cfu/g, while sample E2 and C1 recorded 2.4 Log10cfu/g respectively. Improper preparation and handling of foods at food service establishments are primary factors in *Salmonella* outbreaks (Jay, 1992).
S. aureus recorded a highest count of 3.95Log10cfu/g from fast food C_1, which might be attributed to low level of food hygiene practices (TABLE1). The presence of small number of *S. aureus* is not uncommon (Adams and Moss, 2000). Human contact with cooked food invariably introduces *S. aureus* of levels 10^1 or 10^2 to many sample units, (Surkiewics, *et al*., 1973), such levels are harmless but offer sufficient inoculums for growth.
Sample C_1 and E_1 recorded the highest counts of *E. coli* which was 3.9 Log10cfu/g (TABLE1). Unavoidable contamination usually will add coliforms of level 10^1 or 10^2 per gram to the surface of the product (Johnson and Tompskins, 1992). The presence of coliforms on the surface of properly cooked meat products indicate post process contaminations and warrants investigation of the condition of preparation (Speck, 1976). Also human contacts may sometimes introduce *E. coli*.

Other organisms like, *Proteus, Micrococcus, Pseudomonas and Bacillus*, were found in their small numbers during the course of the research work (TABLE2). These organisms might be associated with the environment According to Killinger *et al.,* (2000), consumers often believe that a brown internal color indicates that a patty is fully cooked. The food safety and inspection service, the food and drug Administration and the centre for disease control and prevention recommend that consumers use a thermometer to cook hamburgers to 160^0F(71^0C) USDA/FSIS (1998a) with no reference to internal color.

IV. Conclusion

From this research it is evident that eating of hamburger patties might pose a health risk even though as yet there have not been any report of any outbreak assigned to its consumption in Nigeria. However, to ensure the safety and health of their customers, fast-food restaurants should inculcate food safety practices and habits in their staff and food processing. The critical control points to preventing food borne illness such as preventing cross – contamination from the raw products to ready to eat foods, using adequate time and temperatures for cooking (160^0F or 71^0C), avoiding recontamination after cooking, by surfaces previously contaminated with the raw meat, and properly chilling and storing meat after mincing should be emphasized. Food handlers should also be trained on hygienic food handling practices and safety.

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