ORIGINAL ARTICLE

AFRICAN JOURNAL OF CLINICAL AND EXPERIMENTAL MICROBIOLOGY JANUARY 2017 ISBN 1595-689X VOL18 No. 1
AJCEM/1705 http://www.ajol.info/journals/ajcem

AFR. J. CLN. EXPER. MICROBIOL. 18 (1): 35-41

PUBLIC HEALTH PRACTICES AT MEAT PIE RETAIL POINTS IN MAKURDI, BENUE STATE AND ITS POTENTIAL EFFECT ON CONSUMER'S HEALTH

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ABSTRACT

Observance of public health best practices at point of sales by meat pie retailers in Makurdi, Benue State was evaluated by studying three (3) retail sources namely eateries, supermarkets and street hawkers. Observations were carried out ninety (90) times between March to July 2013. The neatness of the vendor, sales environment, and state of the product storage containers were assessed. Microbiological analysis revealed the presence of *Staphylococcus aureus*, *Escherichia coli*, *Staphylococcus* spp, *Enterobacter* spp, *Proteus* spp, *Pseudomonas* spp, *Citrobacter* spp, *Edwardsiella* spp, *Bacillus* spp, *Klebsiella* spp and *Shigella* spp. There was a positive relationship between multiple bacterial contamination and the constituents of the meat pie fillings. A total of 64 (35.6%) fillings had between 3 – 7 bacterial contaminants, 57 (31.7%) had at least 2 bacterial contaminants, 58 (32.2%) had at least 1 contaminant while only 1 (0.6%) was without any bacterial contaminant. Only 5(5.6 %) of the vendors and 10(11.1%) of the sales environment were very neat, while 23(25.6%) and 22(24.4%) of the storage containers were observed to be partially accessible to air/dust and insects respectively. None of the vendors (90:100%) used hand gloves, none (90:100%) used an apron, 89 (98.9%) used no cutlery and 89 (98%) had uncovered hair while serving the product. The paper submits that the health of consumers is endangered by this negligence. Hence, the need for regulatory authorities to create awareness on, as well as enforce the observance of established point of sales practices for the sake of the public health.

Keywords: Public, health, meat pie, fillings, negligence, contamination.

LES PRATIQUES DE SANTE PUBLIQUE AUX POINTS DE VENTE DE TARTES A LA VIANDE A MAKURDI, ETAT DE BENUE ET SON EFFET POTENTIEL SUR LA SANTE DES CONSOMMATEURS.

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RESUME

L'observance des meilleures pratiques en matière de santé publique par les détaillants de tartes à la viande à Makurdi, état de Benue a été évalué en observant trois (3) sources de détail, à savoir les entrées, les supermarchés et les colporteurs. Les observations ont été effectuées quatre – vingt – dix – neuf (90) fois entre mars et juillet 2013. La propreté du vendeur, l'environnement des ventes et l'état des conteneurs de stockage du produit ont été évalué. L'analyse microbiologique a révélé la présence de *Staphylococcus aureus*, *Escherichia coli*, *Staphylococcus* spp, *Enterobacter*spp, *Proteus*spp, *Pseudomonas* spp, *Citrobacter*spp, *Edwardsiella*spp *Bacillus* spp, *Klebsiella* spp *et Shigella*spp. Il y avaitune relation positive entre la contamination bactérienne multiple et les constituants des garnitures de tartes de viande. Un totale de 64 (35,6%) garnitures ont eu entre 3 – 7 des contaminants bactériens, 57 (31,7%) ont eu au moins 2 contaminants bactériens, 58 (32,2%) ont eu au moins 1 contaminant tandis qu'une (0,65) seule était dépourvue de contaminants bactériens. Seulement 5 (5,6%) des vendeurs et 10 (11,1%) de l'environnement de vente étaienttrès propres, tandis que 23 (25,6%) et 22 (24,4%) de conteneurs de stockage ont été observés d'être partiellement accessibles respectivement à l'air / a la poussière et aux insectes. Aucun des vendeurs (90 :100%)a utilisé les gants, aucun (90 :100%) a utilisé un tablier, 89 (98,9%) n'utilisaient pas de couverts et 89 (98%) ont eu les cheveux découverts tout en servant le produit. L'article soutient que la santé de consommateurs est menacée par cette négligence. Il est nécessaire, donc, pour les autorités de réglementation de sensibiliser et de faire respecter des pratiques établies de point de vente pour le bien de la santé publique.

Mots clés: Publique, santé, tartes é la viande, garnitures, négligence, contamination.

INTRODUCTION

Meat pies and other pies are popular the world over and belong to the class of ready-to-eat foods known as pastries (1). A pie refers to any food or dish that consists of a crust with a filling. Examples are fruit pies, cream pies, custard pies and meat pies (2). Their popularity owes to the fact that they are convenient to stock, sell and consume (3). Meat pie like other ready to eat foods, is common and can be found on many streets, supermarkets, motor parks and food outlets, thereby providing a ready source of nutrition for the teaming populace who now have little or no time to make their own food.

Studies have indicated that producers and retailers of ready-to-eat foods are either ignorant of accepted hygienic and sanitary practices or overlook them (4, 5, 6, 7, 8). Individuals and families are thus, left with no other option than to eat just what they buy. From recent findings, food mixtures such as pastries, salads, sauces and soups have been frequently incriminated in food poison outbreaks (10, 11, 12, 13). Food-borne infections have caused the death of many children in the developing world and have also affected their growth, as well as physical and cognitive development (4). Bacteria such as *Pseudomonas* spp, *Enterococcus* spp, *Klebsiella* spp, *Clostridium perfringens*, *Salmonella* spp, *Escherichia coli*, *Staphylococcus aureus* and *Proteus* spp have been isolated from meat pie and other locally prepared ready-to-eat foods (8, 14, 15).

Microorganisms enter foods from both internal and external sources. Their number and type depend on the care used during production, processing and storage (16). Some sources of food contamination have been identified as unhygienic practices by food handlers, untidy preparation or service environment, contaminated water, utensils and ingredients used for preparation of the food (4, 8, 17, 18). Point of sale practices by vendors has also been reported as a major source of food contamination. It is required that food safe for human consumption should be displayed in a clean environment and in containers that are insect and dust proof. Serving of food at retail points should also be done with sanitized utensils (19). Unfortunately, vendors of meat pie often use bare hands to serve, wear no aprons and leave their hair uncovered. As a result, the same hands used for collecting money are used to package the food for buyers (17, 20). Bacteria are also introduced into food through aerosols released during vendor–client communication at the point of sale (18). Bacteria in the released aerosol from saliva settle on the food and are carried away by the buyer unknowingly. Sometimes, flies and insects are not totally prevented from making contact with the food. This could lead to cross contamination (8). This study was therefore aimed at investigating observance or otherwise, of point of sale best practices by vendors of meat pie in Makurdi and to highlight their potential effect on consumer health. Information generated from this study will reveal the extent of adherence to accepted point of sales best practices. It will also aid in laying emphasis on the need for health, environmental and regulatory agencies to further strengthen the implementation of existing food hygiene laws and enforce acceptable point of sale practices.

METHODOLOGY

Study area

The research was carried out in Makurdi Benue State. Makurdi is the capital of Benue State and is located on latitude 7°38' and 7°50′ N and longitude 8°24' and 8°38′ E (21). Makurdi is situated in the middle-belt region of Nigeria, thereby serving as a link town between the North and the East, as well as other local government areas of the state, and hence has a large number of parks and fast food outlets which witness a high number of travelers on a daily basis.

Study design

A descriptive cross-sectional study design was used for this study and was carried out between March and July 2013. Inclusion and exclusion criteria were also adopted in the selection of the study sites. The inclusion criteria were outlets that either prepared meat pie themselves or were first level retailers who receive stock directly from a producer. Second level retailers and outlets were excluded.

Data collection

The three major sources of retail meat pie in Makurdi identified as eateries, supermarkets and hawkers were sampled. Sample sites were randomly selected from across the five major areas of the town namely Ankpa ward, Wadata, High Level, Wurukum and North Bank. A total of ninety (90) observations in all, were made at the outlets. Structured questionnaire and observational checklist designed to obtain information about the vendors' personal hygiene and behavior during food vending were used for the study. Outlets at major business and work areas with high human activity and patronage were carefully noted and selected. Point of sale practices were assessed based on the use of hand gloves, use of apron, use of service cutlery, use of hair covering and talking while serving. The neatness of the service environment and vendor was made by visual observation. The show glasses were also assessed based on their accessibility to dust, air and insects judging from the presence and size of openings found on them. Show glasses that were wholly enclosed were judge to be inaccessible to dust and insects.

Sample collection

Meat pie samples were obtained from the three main sources of meat pie sold in Makurdi identified as

eateries, supermarkets and street hawkers spread across the five major areas of the town namely Ankpa ward, Wadata, High Level, Wurukum and North Bank. Thirty (30) samples were obtained from each source, making a total of ninety (90) meat pie samples. The filling and crust of each sample were analyzed separately owing to the difference in their composition and preparation.

Isolation and identification of isolates

Ten (10) grams of the sample (filling or crust) were weighed into 90 ml of sterile normal saline and homogenized in a sterilized electric blender. A loop full of the stock preparation was streaked on the surface of Nutrient agar (Titan Biotech Ltd.), Mannitol salt agar (Oxoid), Eosin methylene blue agar (Titan Biotech Ltd.) and MacConkey agar (Titan Biotech Ltd.) and incubated at 37^{o}C for at least 18 hours. The morphological and cultural characteristics of colonies on the various media used were recorded. Colonies with similar morphological characteristics where selected, sub-cultured, and discrete colonies obtained were used for identification tests. The Gram reaction of each isolate was determined. Biochemical identification was achieved by performing catalase, coagulase, indole, citrate utilization, oxidase, lysine decarboxylase, sugar fermentation, motility and hydrogen sulfide production tests on the various isolates.

Statistical analysis

Statistical analyses were done with Statistical Package for the Social Sciences (SPSS 17, 2008) software, using descriptive statistics such as frequencies and percentages. Chi-square test was used to determine associations.

RESULT

Eleven different bacterial genera were isolated from the meat pie samples collected (Table 1). *Staphylococcus aureus*, *Bacillus* spp, *Pseudomonas* spp, *Klebsiella* spp, *Escherichia coli*, *Enterobacter* spp and *Proteus* spp were found as contaminants in both fillings and crusts of all samples collected from all the locations. *Staphylococcus* spp was isolated from samples obtained from hawkers and supermarket, while *Edwardsiella* spp was isolated from eateries samples only. *Shigella* spp was not isolated from the fillings of hawked samples and those collected from eateries. *Citrobacter* spp was isolated from all sample sources except those from supermarket.

TABLE 1: PRESENCE OF BACTERIAL CONTAMINANTS IN FRESH MEAT PIE SAMPLES FROM HAWKERS, SUPERMARKETS AND EATERIES

	Hawkers		Supermarket		Eateries	
Bacterial isolates	**Filling**	**Crust**	**Filling**	**Crust**	**Filling**	**Crust**
Staphylococcus aureus	+	+	+	+	+	+
Bacillus Spp	+	+	+	+	+	+
Staphylococcus Spp	+	+	+	+	-	-
Pseudomonas Spp	+	+	+	+	+	+
Citrobacter Spp	+	+	-	-	+	-
Klebsiella Spp	+	+	+	+	+	+
Shigella Spp	-	+	+	+	-	+
Escherichia coli	+	+	+	+	+	+
Enterobacter Spp	+	+	+	+	+	+
Proteus Spp	+	+	+	+	+	+
Edwardsiella Spp	-	-	-	-	+	+

+ = Present, - = Absent

TABLE 2: MULTIPLE BACTERIAL CONTAMINATION IN NINETY MEAT PIE SAMPLES COLLECTED FROM HAWKERS, SUPERMARKET AND EATERIES

No. of Contaminants	Eatery (%)	Supermarket (%)	Hawkers (%)	Total (%)
0	0 (0)	0 (0.0)	0 (0.0)	0 (0.0)
1	0 (0)	1 (3.3)	0 (0)	1 (1.1)
2	10 (33.3)	9 (30.0)	6 (20.0)	25 (27.8)
3	1 (3.3)	3 (10.0)	3 (10.0)	7 (7.8)
4	8 (26.7)	5 (16.7)	8 (26.7)	21 (23.3)
5	11 (36.7)	12 (40.0)	13 (43.3)	36 (40)
Total (%)	30 (33.3)	30 (33.3)	30 (33.3)	90 (100)

$\chi^2 = 5.207$, $p = 0.735$ ($p<0.05$)

Bacteriological analysis (Table 2) showed that only one sample obtained from the supermarket was contaminated with only one bacterial genera (1: 1.1%). Multiple bacterial contamination with two different

bacterial genera was observed in 25 (27.8%) of the samples, three genera in 7 (7.8%) and four genera in 21 (23.5%) respectively. Multiple contamination of five bacterial genera and above was observed in 36 (40.0%) samples with the highest in this category coming from hawked samples (43.3%). All the samples were contaminated by at least one bacterial genera. The differences in multiple bacterial contamination between the three retail outlets were not statistically significant (p>.05).

TABLE 3: LEVEL OF MULTIPLE BACTERIAL CONTAMINATION IN CONSTITUENTS OF MEAT PIE FILLINGS FROM EATERIES, SUPERMARKETS AND HAWKERS

	Number of contaminants (%)			
Constituents of fillings	**Zero**	**1**	**2**	**3 – 7**
Carrot, meat and irish potato	0 (0)	17 (9.4)	15 (8.3)	16 (8.9)
Meat, onion and pepper	0 (0)	4 (2.2)	4 (2.2)	4 (2.2)
Meat and irish potato	1 (0.6)	22 (12.2)	17 (9.4)	20 (11.1)
Irish potato only	0 (0)	15 (8.3)	21 (11.7)	24 (13.3)
Total (%)	**1 (0.6)**	**58 (32.2)**	**57 (31.7)**	**64 (35.6)**

$\chi^2 = 4.430$, p = 0.881 (p>0.05)

The level of contamination in the various constituents of meat pie sample fillings was as shown in Table 3. Fillings of meat pie samples containing meat, onion and pepper were the least contaminated, whereas fillings made up of only irish potato where the most contaminated. Multiple contaminations involving three to seven (3 - 7) contaminants was the most observed. Chi-square results showed no statistically significant difference in the contamination levels in relation to the various filling constituents examined.

Most of the meat pie vendors at the sampled outlets ignored accepted point of sale practices. None of the vendors (90: 100%) used any covering such as hand gloves while selling the products and only 1 (1.11%) vendor used a cutlery and hair covering while serving. No vendor (0: 0%) used a service apron while serving. The least compliance with the accepted point of sale practices assessed was observed with the hawkers (Table 4).

TABLE 4: ASSESSMENT OF OBSERVANCE OF POINT OF SALE HYGIENIC PRACTICES BY MEAT PIE VENDORS

Point of sale practice assessed	Hawkers (n = 30)	Supermarkets (n = 30)	Eateries (n = 30)	Total (N = 90)
No hand gloves	**30 (100)**	**30 (100)**	**30 (100)**	**90 (100)**
No apron	**30 (100)**	**30 (100)**	**30 (100)**	**90 (100)**
Used cutlery	**0 (0.0)**	**1 (3.3)**	**0 (0.0)**	**1 (1.11)**
No cutlery	**30 (100)**	**29(96.7)**	**30 (100)**	**89 (98.9)**
Covered hair	**0 (0.0)**	**0(0.0)**	**1 (3.3)**	**1 (1.11)**
Uncovered hair	**30 (100)**	**30 (100)**	**29(96.7)**	**89 (98.9)**
Not talking while serving	**30 (100)**	**30 (100)**	**30 (100)**	**90 (100)**

Following assessment of some indicators of environmental hygiene, it was observed that only 5.6% (N = 90) of the vendors were assessed to be very neat, while only 11.1% (N = 90) of the vending sites were very neat. Altogether, 25.6% (N = 90) of the containers used for display of the product were observed to be partially open to air and dust while 24.4% (N = 90) were observed to be partially accessible to insects.

DISCUSSION

The results of this study demonstrate that both fillings and crusts of meat pie sold in Makurdi are contaminated with different bacterial types. Investigations revealed that addition of the fillings into the pastry before baking is a manual process and this practice may have contributed to bacterial contamination. Similar studies (8, 14, 15, 22, 23) have implicated most of the bacteria isolated in this study in meat pie and other ready-to-eat foods. *Bacillus* spp in meat pie raises an issue of concern since some species are known to cause food poisoning by preformed toxins in food or by the production of enterotoxins in the small intestine (24). The presence of *Escherichia coli* in food poses a threat to the health of consumers since it has been associated with traveler's diarrheoa and hemorrhagic colitis. Its presence is an indication of gross contamination and could be due to faecal contamination of the water sources and raw materials used during the production (8, 15, 18, 25). *Staphylococcus aureus* occurring in meat pie also requires attention because

of its enterotoxigenic ability even at a toxin dose of less than 1 microgram (26). The incidence of *Staphylococcus aureus* suggests excessive human handling, since the bacteria occurs as a normal flora of the human and animal skin (15).

The presence of bacterial contamination in all samples analyzed is indicative of high contamination rate in meat pie. Samples collected from hawkers registered the highest rate of multiple bacterial contamination. This is not surprising because of the sort of treatment they receive. In the process of vending, the hawkers expose the product to contaminated air and dust through the continuous opening of their show glasses in both clean and dirty environments. Some of the hawkers are found stationed around and within motor parks where the environment is often times, not clean and the air significantly contaminated.

TABLE 5: ASSESSMENT OF CONDITIONS AT POINTS OF SALE OF MEAT PIE

Indicators	Assessment	Hawkers (n = 30)	Supermarkets (n = 30)	Eateries (n = 30)	Total (N = 90)
Vendor assessment:	Very Neat	0(0)	0(0)	5(16.7)	5(5.6)
	Neat	5(16.7)	27(90.0)	25(83.3)	57(63.3)
	Fairly neat	25(83.3)	3(10.0)	0(0.0)	25(27.8)
	Dirty	0(0.0)	0(0.0)	0(0.0)	0(0.0)
	Very dirty	0(0.0)	0(0.0)	0(0.0)	0(0.0)
Site assessment:					
	Very Neat	0(0.0)	0(0.0)	10(33.3)	10(11.1)
	Neat	21(70.0)	28(93.3)	20(66.7)	69(76.7)
	Fairly neat	9(30.0)	1(3.3)	0(0.0)	10(11.1)
	Dirty	0(0.0)	1(3.3)	0(0.0)	1(1.1)
	Very dirty	0(0.0)	0(0.0)	0(0.0)	0(0.0)
Container state:	Not open to air	19(63.3)	18(60.0)	30(100)	67(70.3)
	Partially open to air	11(36.7)	12(40.0)	0(0.0)	23(25.6)
	Not open to dust	19(63.3)	18(60.0)	30(100)	67(70.3)
	Partially open to dust	11(36.7)	12(40.0)	0(0.0)	23(25.6)
	Not accessible to insects	19(63.3)	19(63.3)	30(100)	68(75.6)
	Partially accessible to insects	11(36.7)	11(36.7)	0(0.0)	22(24.4)

Findings of this study also show that fillings of meat pie sold in Makurdi are made of different materials, depending on the source. It was observed that fillings of the samples from eateries were made of carrot, Irish potato and minced meat. Some other samples obtained from eateries were made of onion and minced meat with plenty of pepper while samples from supermarkets contained only minced meat and irish potato; hawked samples were made up of Irish potato only. Although the level of contamination in relation to the constituents of the fillings did not differ statistically (χ^2 = 4.430, p = 0.881), it was observed that fillings made of Irish potato only, had a higher multiple bacterial contamination rate of 2 genera (57: 31.7%) and between 3 – 7 genera (64: 35.6%) respectively, compared to the other constituent types, making it the highest contaminated constituent type. Fillings made of minced meat, onion and pepper recorded fewer bacteria than others. Methanol, ethanol and acetone extracts of pepper and onion have been reported to inhibit growth of pathogenic bacteria of clinical origin such as *Escherichia coli, Staphylococcus aureus*, *Klebsiella pneumoniae*, *Pseudomonas aeruginosa* and *Proteus vulgaris* (27); *Escherichia coli* and *Pseudomonas florescence* (28); *Staphylococcus aureus* and *Klebsiella pneumoniae* (29); *Staphylococcus aureus* (30); and *Vibrio cholera* (31). Hence, the reduction in contamination observed with the peppered fillings may not be totally unlinked to the use of onion and pepper in their preparation.

Some vital point-of-sale best practices were observed to be neglected during sales of the product. It was observed that most of the vendors did not use any cutlery, hand covering, or hair cover while serving. The neglect of serving utensils does not conform to

the WHO requirements for point of sale operations. A higher rate of compliance with the use of serving utensils was reported in a study of ready-to-eat salad vegetables where only 31% (n = 1,985) of staff used bare hands to prepare or handle salad vegetables (32). No vendor in all the three retail outlets wore an apron. This finding is similar to the report of (33), though a higher usage of apron (30.8%) and hair covering (82.2%, n = 185) was reported to have been observed among food vendors in Ilorin, Nigeria. Another similar study by (34) reported that only 9(15%) out of 60 food vendors covered their hair, and only 31 (52.0%) wore an apron while serving food. Although wearing of hair covering and apron has more to do with food aesthetics and inspiring consumer confidence than food safety (19), it is the opinion of the researchers that this should be strongly encouraged among food vendors. Poor personal hygiene such as not washing hands and serving of the product without any cutlery by food vendors can lead to contamination of food (32). For instance, *Shigella* spp picked from infected diarrheal stool can be deposited unto food substances which when ingested, could cause the disease. Sweat and aerosols produced by handlers during talking or sneezing can introduce bacteria to the raw materials and may even re-contaminate the finished product (18).

Some of the show glasses used for display of meat pie by supermarkets and hawkers were observed to be accessible to air, dust and insects such as ants and flies. Regrettably, some of these outlets are situated in areas with high human and vehicular activities thereby exposing the product to contaminated air and dust from the environment. These could possibly have served as routes of contamination. Some of the show glasses assessed had openings large enough for insects to freely go through. This could lead to the depositing of bacteria from other sources in the environment onto the internal surfaces of the show glass or directly on meat pie as they are displayed for sale. Exposure of some vended food to flies has also been reported (33, 35). A study by (34) reported that about 55.0% of vendors adequately protected their food from flies and dust whilst 45.0% had no protection, thus exposing their food to flies and dust. The WHO recommends as a requirement at the point of sale, that food should be sold in a clean environment protected from sun, dust, rain, wind and insects (19). Appropriate regulatory authorities should hence step up monitoring of food retail outlets to ensure compliance to accepted point of sale practices. Periodic food safety awareness and education for food vendors will also go a long way to increase observation of acceptable point of sale and good food handling practices.

An assessment of both the vendors and the vending environment showed that vendors and vending environments of eateries were generally neater, followed by those of supermarkets. In a similar study by (35), 259 (90.5%) of the food vending environment assessed were judge to be clean. The high level of compliance with neatness observed in this study is commendable. Only hawkers were observed not to be satisfactorily clean. A deliberate effort at sensitizing meat pie hawkers on the need to dress neatly while vending meat pie could go a long way to encourage neatness among this group.

CONCLUSION

The study has observed that some important and recommended point of sale practices were neglected by some of the vendors at the retail outlets studied and these could contribute to the contamination of the product and endanger the health of consumers. Meat pie vendors and retail outlets should continue to maintain neatness as it is not only suggestive of health consciousness, but also has the ability to boost the confidence of their customers, thereby increasing patronage. Periodic food safety awareness and education for food vendors is also advocated as a possible way to increase observation of acceptable point of sale and good food handling practices.

Conflict of interest: Authors have declared that no competing interests exist.

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