Incidence and Resistant Pattern of Bacteria Associated with Street Foods in Ogun state, Nigeria.

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Abstract: A laboratory based cross sectional study, was carried out, on 120 samples of street foods circulating in Ogun State, Nigeria, using standard microbiological method while the antibiotics profiling of the isolated organisms were determined using agar disc diffusion method. This study, indicated *Bacillus* species 37 (33.3%) as the most predominant followed by *Staphylococcus aureus* 33(30.3%) and then *Escherichia coli* 16 (14.7%). With reference to sensitivity/resistance pattern, it was concluded, that the front line antibiotics, that should be considered for treating street foods associated food poisioning include Aminoglycosides and fluoroquinolones.

1.   Introduction

The food and Agricultural Organization define street foods as ready-to-eat foods and beverages prepared and/or sold by vendors and hawkers, especially in streets and other similar public places (Simopoulos, 2000). These foods provide ready-to-eat and fairly inexpensive priced snacks and meals for a wide variety of people (Arambulo *et al.*, 1995; Taylor *et al*., 2000).With a population of over 4 million people in Ogun State and a well established and growing middle class, there is a ready demand for convenient foods. One of the frequent problem in the sale of street foods is the potential hazard caused by bacterial contamination (Munoz de Chavez *et al*., 2000). Some of these bacterial contaminants may eventually survive and grow in the foods (Thomas *et al*., 2012) thereby causing food poisioning diseases especially when the bacterial pathogens or its toxins are consumed (Tauxe,2002). Generally, research indicates that food safety is not a factor, which influences the public's choice when selecting an eating establishment (Leach *et al*.,2001) but the psychological interpretation of product properties than the physical properties of product themselves (Rozin *et al*., 1986). This is because, consumers often use their senses in the descriptions of safe foods and feel that food that looks or smells bad should not be eaten (Seward, 2003). They cannot tell the risk of incurring a food-borne illness at the time of purchase or consumption of a food item, because the extent of microbial contamination or the level of chemical residues cannot be observed (Roberts *et al*.,2003). Consumers need to be informed on the potential hazard caused by these street foods. Therefore, the objectives of this study were to determine the bacterial flora of street foods in Ogun State and to study their susceptibilities patterns to some selected antibiotics.

2. Material and Methods
2.1 Study Areas

The Study area "Ogun State" is a State in South Western Nigeria. It borders Lagos State to the South, Oyo and Osun State to the North, Ondo State to the east and the Republic of Benin to the West. The State is made up of twenty local government areas and it have a total area of 16, 762Km^2 with over Four Million people (Thomas *et al.,*2012b).

2.2 Sample Collections

A total of 120 street foods including Doughnut, Meatpie, Moin-Moin, Egg roll and Suya (roasted meat) were purchased between October, 2011 and February, 2012. These samples were collected from the four geographical zones of Ogun State, Nigeria as follows using presterlized aluminum pan.

2.3 Microbiological Examination
2.3.1 Preparation of Initial Suspension

This was prepared using the method described by ISO 68877-1 (1999) with slight modification. Each of the food samples were homogenized in a presterilised blender (Shaisho, Japan) and 10g of each samples were added separately to 90ml of 0.1% (w/v) peptone water and swirled at medium speed.. Serial decimal 10 fold dilution were prepared by transfer of one millimeter of initial suspension into a tube containing 9ml of 0.1% (w/v) peptone water. These operations were repeated using a new sterile pipette to obtain 10^{-2} through 10^{-10} dilutions.

2.3.2 Isolation and Identification of Bacterial isolates of Street foods

The suspension of the samples prepared above were inoculated onto Nutrient Agar and MacConkey Agar. The plates were incubated at 37°C for 24 hour. The identification of the isolated bacteria were based on morphological and biochemical methods (Cheesborough, 2005).

2.4 Antibiotic Susceptibility Testing

The antibiotic susceptibility test was carried out as described by Bauer *et al*.,(1996) while the zones of inhibition were interpreted as described by NCCLS (2002).

Street Foods
N = 120 Street Foods

Yewa Zone
N = 30
6 Moin Moin Samples
6 Egg Roll samples
6 Suya (roated meat)   **Remo Zone**
6 Meat pie   N = 30
6 dougnut   6 Moin Moin Samples

            6 Egg Roll samples
            6 Suya (roated meat)
            6 Meat pie
            6 dougnut
            6 Meat pie

Egba Zone
N = 30
6 Moin Moin Samples
6 Egg Roll samples
6 Suya (roated meat)   **Ijebu Zone**
6 Meat pie
6 dougnut   N = 30
                6 Moin Moin Samples
                6 Egg Roll samples

            6 Suya (roated meat)

3.0 RESULTS AND DISCUSSION

Table 1: Bacterial Flora of Street Foods in Ogun State, Nigeria.

Bacterial isolates	N	n	%
Staphylococcus aureus	109	33	30.3
Bacillus species	109	37	30.9
Escherichia coli	109	16	14.7
Proteus vulgaris	109	10	9.2
Klebsiella species	109	5	4.6
Salmonella species	109	8	7.3

N = total number of bacteria isolated
n = number of specific bacteria isolated

$$(\%) = \frac{n}{N} \times \frac{100}{1}$$

Table 2: Resistance pattern of Bacterial flora of Street foods in Ogun State, Nigeria

Resistance pattern of Bacteria flora of street foods

Antibiotics	SA	BS	EC	PV	KS	SS
	number of specific organisms(percentage of resistant organisms)					
Ampicillin	28(85)	34(92)	16(100)	10(100)	5(100)	8(100)
Cefuroxime	13(40)	17(47)	13(80)	3(30)	3(60)	6(75)
Ceftriaxone	17(52)	4(10)	6(40)	2(20)	4(80)	6(75)
Ceftazidime	14(43)	9(25)	19(52)	2(20)	3(60)	4(50)
Gentamicin	11(33)	6(15)	6(38)	0(0)	1(20)	2(25)
Ciprofloxacin	10(30)	0(0)	8(50)	0(0)	0(0)	2(25)
Ofloxacin	9(28)	0(0)	8(50)	0(0)	0(0)	4(50)
Erythromycin	9(28)	4(10)	13(80)	10(100)	3(60)	8(100)
Tetracycline	3(100)	30(80)	16(100)	10(100)	5(100)	8(100)
Cloxacillin	26(80)	34(92)	16(100)	10(100)	5(100)	8(100)

SA = *Staphylococcus aureus*, BS = *Bacillus species*, EC = *Escherichia coli*
PV = *Proteus vulgaris*, KS = *Klebsiella* species, SS = *Salmonella* species

Results of the bacteriological analysis as summarized in table 1 showed that the street foods under investigation recorded a total number of 109 bacterial strains. The presence of considerable high numbers of different bacterial strains in this food established it as a good culture media for bacterial growth. This observation may be due to improper preparation and handling of foods in food vendors establishment (Jay, 1993) or low level of contamination that occurs on the surface of products from equipment and food handlers during packaging or serving of the food (Johnston and Tompkin,1992), Majority of the bacteria isolated from street foods in our study are known to be pathogenic and are capable of causing gastroenteritis (Ojo, 2009). *Bacillus* species which were the most predominant in our study are generally known to be saprophytic organisms (Brooks *et al*.,2001) and they include large aerobic gram positive rods occurring in chains (Sobowale *et al*., 2007). The ability of this organisms to resist the beta lactams antibiotics and tetracycline may be due to their spore forming potential (Okonwwo *et al*., 2010) or widespread use of these antibiotics (Chikwendu *et al*.,2008,Fey *et al*.,2004).An alarming trend of associated resistance to beta lactam and extended spectrum beta lactam antibiotics by *Staphylococcus aureus* in this study may be due to the presence of an extended spectrum beta lactamases enzyme in this organisms (Efuntoye and Amuzat, 2007). *Escherichia coli,* which was also isolated from the street foods represent an unhygienic mode of preparation of the foods (Oshoma *et al*.,2009). The multi drug resistant behaviour of the *Escherichia coli* observed in this study, is not surprising, as this may be due to the presence of multi drug resistance gene on their plasmids (Rooney *et al.,* 2009). According to Johnson *et al*. (2007), the presence of multi drug resistant *Escherichia coli* in food may be an indication, that, such *Escherichia coli* have originated from poultry or from susceptible poultry source precursors. The results of this study, further disclosed, a waning susceptibility and an elevated multi drug resistant patterns of *Klebsiella, Proteus* and Salmonella species to Beta lactam, macrolides and tetracycline antibiotics tested. This findings may not be unconnected to the presence of an extended spectrum beta lactamases enzymes which has been found to confer a cross class resistance potential to non beta lactams antimicrobial (Thomas *et al*., 2012). In conclusion, the outcome of this study, has established the presence of pathogenic and antibiotic resistant bacteria in street foods circulating in Ogun State, Nigeria. It is therefore, important, to educate the vendors of these food on the ways to preventing cross contamination so that their food would not serve as a vehicle for the transmission of food borne illness.

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REFERENCES
1. Arambulo P, Cuellar J, Estupinia J, Ruiz A (1995). Street Foods: A Latin American perspective. In: Trends in Food Science and technology, Nataryan CP and Ranganna S. (Eds), Mysore Association of Food Science and Technologist (India). Central Food technological Research Institute, Association of Food Scienctists and Technologists Mysore, India. 760 – 770.
2. Bauer AW, Kirby WMM, Sherris JC, Turck M(1966). Antibiotic susceptibility testing by a standardized. Single disk method. Am. J. Clin, Pathol., **45** : 493 – 496.
3. Brooks GF, Bute JA, Morse SA (2002). Jawetz, Melnick and Adelberg's Medical microbiology, McGraw Hill Professional publishers UK, **22** (180): 222 – 233.
4. Cheesborough LM (2005). Identification of bacteria. Medical Microbiolgy Laboratory Manual for tropical countries, Butter worth and Co. Publishers. London, UK,**2**: 63 – 69.
5. Chikwendu CI, Nwabueze RN and Anyanwu BN (2008). Antibiotic Resistance profile of *Escherichia coli* from clinically healthy Pigs and their commercial farm environments. *African Journal of Microbiology Research* **2** : 021 – 017.
6. Efuntoye MO, Ayodele AE, Thomas BT and Ajayi TO (2010). Does host plant affect the antibacterial activity of *Tapinanthus bangwensis* (Engl. And k.krause) Danser (horanthaceae)? *J. Medicinal Plants Res.***4** (13): 1281 – 1284.
7. Fey FD, Safranek TJ, Rupp ME, Dunne EF, Ribot E, Iwen PC, Bradford PA, Angulo FT, Hinrichs SH (2000).Ceftriaxone resistant Salmonella infection acquired by a child from cattle. *N. Engl. J. Med.* **342** : 1242 – 1249.
8. Jay JM (1992). Food poisioning caused by Gram positive spore forming bacteria. Modern food Microbiology. 3rd edition, Delhi India: CBS Publishers and distributors. 459 – 488.
9. Johnson JR, Sannes MR, Croy C, Johnston B, Clabots C, Kuskowski MA, Bender J, Smith KE, Winiokur PL, Belongin EA (2007).

Antimicrobial drug resistant *Escherichia coli* from human and poultry products. *Emerging infectious disease.* **13**(6): 838 – 846.

10. Johnston RW, Tompkin RBC (1992). Meat and poultry products. In compendium of Methods for the Microbilogical Examination of Foods, C. Vanderzant and D.F. Splittstoesser (Eds.), 821 – 835.American Public Health Association, Washinton, D.C.

11. International Organization for Standardization (1999) Microbiology of Food and Animal Feeding Stuffs. Preparation of test samples, initial suspension and decimal dilutions for Microbiological examination Part 1. general rules for the preparation of the Switzerland.

12. Leach J, Mercer H, Stew G, Denyer S (2001). Improving food hygiene standards – a customer focused approach. *British Food J.*, **103** (4): 238 – 252.

13. Lewis RC (1981). Restaurant advertising: appeals and consumer itentions. J Advertising Research., 21(5): 67 – 74. National Committee for clinical Laboratory Standards (NCCIS) (2002). Performance Standard for Antimicrobial Susceptibility testing; Eleventh Informational Supplement. M100 – S11. Villanova, PA 21 : 1.

14. Rozin P, Pelchat ML, Fallon AE (1986). Psychological factors influencing food choice. In: Food Safety Handbook, R.H. Schmit and G.E. Rodrick, (Eds), Johnson Wiley and Sons, Inc., New Jersey, 3 – 9.

15. Roberts T, Buzby J, Lichtenberg E (2003). Economic consequences of Food borne hazards. In: Food Safety Handbook. R.H. Schmit and G.E. Rodrick (Eds), John Willey and Sons, Inc., New Jersey. 89 – 124.

16. Seward RTA (2003). Definition of Food Safety. In: Food Safety Handbook, R.A. Schmidt and G.E. Redick (eds), John Wiley and Sons Inc. New Jersey 3 – 9.

17. Ojo MO (2009). Food and Animal borne diseases, microbes human and animals. Darting Ventures, Ibadan, Nigeria, 1 – 4.

18. Okonkwo IO, Donbraye – Emmanuel O.B, Ijandipe L.A (2009). Antibiotic Sensitivity and Resistant patterns of uropathogens to Nitrofurantion and Nalidixic acid in Pregnant women with Urinary tract infections in Ibadan, Nigeria. *Middle East Journal of Scientific Research.* **4** (2): 105 – 109.

19. Oshoma CE, Aghimen MO, Bello ZO (2009). Growth and Survival of *Escherichia coli* in Kunun zaki during storage.*World Journal of Agriculture Sciences* **5** (4) : 447 – 497.

20. Simopoulous AP (2000) Preface. In: Street Foods, AP. Simipoulous and R.V. Bhat, (Eds), Karger, Basel, Switzerland. VII – X.

21. Taulor MA, Warren KV, Hunt AF(2000). Ready to eat food in Nigeria. *Journal of Agric Sci.* **2** (3): 3/9 – 323.

22. Rooney PJ, O' leary M, Loughhary AC, McMacmaont M, Smith B, Donaghy P, Badri M, Word Ford N, Karisik E, Livermore DM (2009). Nursing homes as a reservoir of extended spectrum beta lactamase (ESBL) producing ciprofloxacin resistant *Escherichia coli*. *J. Antimicrobial. Chemother*.**64**: 635 – 641.

23. Sobowale AA, Efuntoye MO, Babalola OO, Mabekoje OO, Owolabi AO (2007). Probable pathogenic bacteria resident on cowpea (*Vigna unguiculata*) Walp cultiva, Ife Brown. *African Journal of Pure and Applied Science*. **1**(1): 193 – 197.

24. Munoz de Chavez M, Chavez-villa sana A, Chavez muinoz A, Eichin vuskovic_I (2000). Sale of Street Food in Latin America. The Mexican case: Joy or Jeorpardy? In: Street Foods A.P. Simopoulous and Bhat, R.V. (Eds), Kager, Basel, Switzerland. 138 – 154.

25. Thomas BT, Agu GC, Musa OS, Adeyemi MT, Odunsi OD, Adesoga KO, Ogueri OC (2012). Cross class resistance to non betalactams antimicobials in extended Spectrum beta lactamases producing *Esherichia coli* – a concern to health care practitioners. *International Research Journal of Microbiology*.**3**(2): 056 – 054.

26. Thomas BT, Effedua HI, Musa OS, Afolabi O (2012). Growth and Survival of Gastroenteritis Pathogens in Dried Cassava Powder (garri). *New York Science Journal* **5**(2): 9 – 14.

27. Thomas BT, Effedua HI, Agu G, Musa OS, Odunsi OO, Ogueri OC, Raheem-Ademola, R, Afolabi O (2012). Prevalence of Antibiotic Resistant Bacteria in Dried Cassava Powder (garri) Circulating in Ogun State, Nigeria. *Academic Arena* **4** (1) : 9 – 13.

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