academicJournals

Vol. 9(13), pp. 929-933, 1 April, 2015
DOI: 10.5897/AJMR2015.7418
Article Number: 131B7B052149
ISSN 1996-0808

http://www.academicjournals.org/AJMR

African Journal of Microbiology Research

Full Length Research Paper

Comparative study of ready-to-eat foods from road-side and eateries in Benin City, Nigeria

Akinnibosun, F. I.[1]* and Ojo, K. N.[2]

[1]Department of Microbiology, Faculty of Life Sciences, University of Benin, P.M.B 1154, Benin City, Edo State, Nigeria.
[2]Department of Science Laboratory Technology, Faculty of Life Sciences, University of Benin, P.M.B. 1154, Benin City, Edo State, Nigeria.

Received 10 February, 2015; Accepted 20 March, 2015

The microbiological qualities of ready to eat foods sold in road-side and eateries were studied using the standard microbiological methods. The mean viable bacterial counts in food samples obtained from eateries ranged from 2.4 x10^3±0.23 to 4.8 x10^4±0.23 cfu/g, while the mean viable bacterial counts in food samples obtained from road side canteen ranged from 9.0 x10^4±0.43 to 2.20 x 10^5±0.40 cfu/g. The fungal counts in the food samples obtained from eateries ranged from 3.0 x 10^3±0.15 to 3.5 x 10^4±0.18 cfu/g while the fungal counts in food samples obtained from road side ranged from 2.5 x 10^4±0.33 to 5.3 x 10^4±0.22 cfu/g. The microorganisms isolated were identified based on their cultural characteristics, Gram staining and biochemical tests. A total of eight bacterial isolates were obtained from the salad samples which included *Staphylococcus aureus*, *Bacillus subtilis*, *Enterobacter aerogenes*, *Pseudomonas aeruginosa*, *Micrococcus* sp., *Escherichia coli, Bacillus licheniformis* and *Klebsiella* sp. The fungi isolated were: *Saccharomyces cerevisiae*, *Mucor mucedo*, *Aspergillus flavus*, *Fusarium* sp., *Aspergillus niger, Penicillium* sp. and *Rhizopus* sp. Therefore, good personal hygiene, proper sanitation practice and the use of clean utensils during the preparation of ready to eat foods are recommended to avoid food poisoning and spoilage associated with the isolated microorganisms.

Key words: Ready-to-eat foods, hygiene, microbial analysis, food poisoning, canteen.

INTRODUCTION

Ready-to-eat foods can be described as foods ready for immediate consumption at the point of sale. They could be raw or cooked, hot or chilled and can be consumed without further heat treatment (Clarence et al., 2009; Tsang, 2002; Oranusi and Braide, 2012; Mahakarnchanakul et al., 2010). There are certain factors that make street foods popular. These include familiarity, taste, low cost and convenience (Mahakarnchanakul et al., 2010). Our society shows a social pattern characterized by increased mobility, large number of itinerary workers and less family or home centered activities. This situation, however, has resulted in more ready-to-eat foods taken outside the home. Thus, food vendor services are on the increase and the responsibility of good manufacturing practices of food including good sanitary measures and proper handling have been transferred from individuals/families

*Corresponding author. E-mail: fakinnibosun@yahoo.co.uk.

to the food vendors who rarely enforce such practices (Musa and Akande, 2002; Clarence et al., 2009).

Food consumption is an important pathway for bacteria to infect humans, hence the presence of antimicrobial resistant bacteria in foods warrants particular attention. Antimicrobial resistant bacteria have been recovered from both healthy humans (Okeke et al., 2000) and a wide variety of foods, which include vegetables (Osterblad et al., 1999), confectionary (Pinegar and Cooke, 1985) meat and meat products and poultry (Schoeder et al., 2004). Hence food contaminated by faecal material from healthy humans may be an important source of antibiotic resistant organisms that later cause human infections (Teuber, 1999; Schoeder et al., 2004).

Contamination of food may occur during and after processing of such food. Contamination of ready-to-eat food is of primary concern because such organisms may be pathogenic thereby leading to outbreak of food-borne illness. Food-borne illnesses may occur when food sources that contain pathogenic microorganisms are consumed raw or improperly cooked (Sangoyomi et al., 2012). The health implications cannot be over-emphasized. *E. coli* for instance can induce gastroenteritis (Olowe et al., 2008); *Staphylococcus aureus* isolates have been implicated in a number of clinical cases (Adegoke and Komolafe, 2009; Serrano et al., 2004; Adegoke et al., 2010). Ready-to-eat foods have been reported to be easily available, affordable, provide diverse/variable food source, employment and with a potential for improving food security and nutritional status and general social security (Draper, 1996). It is, however, a variable source of food-borne pathogen (Abdussalam and Kaferstein, 1993; Arambulo et al., 1994; Mensah, 2002; Patricia and Azanza, 2005). Moreover, non-pathogenic organisms that may contaminate man's food chain from time to time may serve as reservoir of genes for antimicrobial resistance in organisms. These genes are encoded by integrons that occur on plasmids or that are integrated into the bacterial chromosome. Antimicrobial resistant strains of animal or human commensals that do not produce disease may transmit their resistance genes to pathogenic organisms whenever they occur in humans.

In Nigeria, most of these products are stored under unhygienic conditions. They are often displayed in open trays or container in the market or are hawked along the street and major runways. Contamination of food can occur at any point in the production chain (from the raw materials, processing, packing, transportation, storage or marketing) to consumption. Because of improper processing, handling and storage of these foods could be subject to contamination by microorganism (Musa and Akande, 2002).

In Nigeria, there is little or no knowledge of transmission of foodborne diseases among food handlers working in ready-to-eat food centers. Most proprietors of ready-to-eat food centers are not duly licensed and their staff properly selected. Therefore, this work was designed to examine the microbiological quality of ready-to-eat foods from road-side and eateries in Benin City, to reduce the risk of food poisoning.

MATERIALS AND METHODS

Sample collection

A total of 18 ready-to-eat food samples were purchased from road-side local food centers and high class eateries within Benin metropolis. All samples were collected in sterile containers and were taken under aseptic condition to the laboratory for microbiology analysis.

Sample preparation

Ten grams of each sample were weighed and mashed in a sterile laboratory mortar and pestle and aseptically introduced into 90 ml of sterile distilled water, properly shaken before a 10 fold serial dilution was prepared.

Preparation of culture media

All media were prepared accordingly to manufacturer's instruction. The media used in this study were nutrient agar (used for hetero-trophic bacterial count) and potato dextrose agar (used for fungal count).

Isolation and enumeration of microorganisms

One milliliter from appropriate dilutions was plated out by pour plate method on nutrient agar and potato dextrose agar. The nutrient agar plates were incubated at 37°C for 24 h while the potato dextrose agar plates were incubated at room temperature 28°C for 72 h. After incubation, discrete colonies of culture on nutrient agar and potato dextrose agar plates were counted and expressed in cfu/ml.

Characterization and identification of bacterial isolates

Bacterial isolates were identified on the basis of cultural morphological and biochemical tests according to Jolt et al. (1994) and Cheesbrough (2006). The fungal colonies were identified as described by Harrigan (1998).

Total coliform count

From the homogenate, 1 ml of serially diluted (1:10, 1:100 and 1:1000) sample was transferred into 9 ml sterilized lauryl sulphate tryptose (LST) broth in triplicate. For each dilution, the tubes were incubated at 35°C for 48±2 h to evaluate tryptose broth used as a pre enrichment medium. After primary incubation, one (0.3 mm) loopful of positive tube (gas formation by the action of chloroform bacterial in fermenting lactose medium tube) was transferred to Brilliant Green Lactose Bile (BGLB) broth, further incubated at 35°C for 48 ± 2 h for total coliforms count. Inverted Durham fermentation tubes were added into test tubes before the addition of BLGB broth to allow easy identification of gas production. Then, the number of tubes with positive gas production was counted. Most probable number (MPN) of coliform bacteria per gram sample was calculated from MPN table based on number of tubes of BGLB broth producing

Table 1. Total viable bacterial counts (cfu/g) in the ready-to-eat food samples.

Samples	Eateries	Road side canteen
	Mean±SD	Mean ±SD
Egusi soup	8.0 x10^3±0.10	7.2 x10^5±2.92
Salad	4.9 x10^4±1.37	1.22 x10^5±0.40
Pounded yam	0.0	7.4 x10^4±0.63
Vegetable soup	1.29 x10^4±0.16	2.20 x10^5±0.40
Moimoi	6.1 x10^3 ±0.39	1.58 x10^3±0.70
Beans	8.2 x10^3 ±0.13	2.13 x10^5±0.63
Porridge yam	4.8 x10^4±0.23	1.43 x10^5±0.23
Jollof rice	2.4 x10^3±0.23	1.03 x10^5±0.43
Amala	3.1 x10^3±0.40	9.0 x10^4±0.43

Table 2. Total fungal counts (cfu/g) in the ready-to-eat food samples.

Samples	Eateries	Road side canteen
	Mean±SD	Mean±SD
Egusi soup	8.0 x10^3±0.01	5.3 x10^4±0.22
Salad	3.0 x10^3±0.15	4.3 x10^4±0.29
Pounded yam	9.0 x10^3±0.10	2.5 x10^4±0.33
Vegetable soup	3.5 x10^4±0.18	9.5 x10^4±0.20
Moimoi	6.6 x10^3±0.05	3.2 x10^4±0.27
Beans	1.4 x10^4±0.10	4.7 x10^4±0.21
Porridge yam	4.0 x10^3±0.08	3.5 x10^4±0.19
Jollof rice	3.0 x10^3±0.15	2.1 x10^4±0.30
Amala	1.5 x10^3±0.04	7.0 x10^4±0.15

Table 3. Microbial isolates from food samples.

Bacterial isolates	Fungal isolates
Staphylococcus aureus	*Mucor mucedo*
Bacillus subtilis	*Aspergillus flavus*
Enterobacter aerogenes	*Saccharomyces*
Pseudomonas aeruginosa	*Penicillium* sp.
Micrococcus sp.	*Aspergillus niger*
Escherichia coli	*Fusarium* sp.
Bacillus licheniformis	*Rhizopus* sp.
Klebsiella sp.	

gas at the end of incubation period.

RESULTS AND DISCUSSION

The mean viable bacterial counts in food samples obtained from eateries ranged from 2.4 x10^3±0.23 to 4.8 x10^4±0.23 cfu/g while the mean viable bacterial counts in food samples obtained from road side canteen ranged from 9.0 x10^4±0.43 to 2.20 x10^5±0.40 cfu/g (Table 1). The highest bacterial counts was recorded in vegetable soup obtained from road side canteen while the lowest bacterial counts was recorded in *jollof* rice obtained from eateries. The fungal counts in the food samples obtained from eateries ranged from 3.0 x10^3±0.15 to 3.5 x10^4±0.18 cfu/g while the fungal counts in food samples obtained from road side ranged from 2.5 x10^4±0.33 to 5.3 x10^4±0.22 cfu/g (Table 2). The salad samples obtained from eateries had the lowest fungal counts while *egusi* soup obtained from road side canteen had the highest fungal counts. The microbial counts in the food samples obtained from road side were comparably higher than the microbial loads of food samples obtained from eateries. The microorganisms isolated from the ready to eat food samples analyzed included eight bacterial isolates and seven fungal isolates. The bacterial isolates were *Staphylococcus aureus*, *Bacillus subtilis*, *Enterobacter aerogenes*, *Pseudomonas aeruginosa*, *Micrococcus* sp., *Escherichia coli, Bacillus licheniformis* and *Klebsiella* sp. The fungal isolates include *Saccharomyces cerevisiae*, *Mucor mucedo*, *Aspergillus flavus*, *Fusarium* sp., *Aspergillus niger* and *Rhizopus* sp., this is seen in Table 3. The occurrence of the microorganisms isolated from the ready to eat food samples is presented in Tables 4 and 5.

Despite the high level of contamination of the ready-to eat foods in this study, most of the sampled foods contained total aerobic plate counts of 10^3 to 10^5 cfu/g. These foods are therefore considered fit for human consumption (ICMSF, 1974; FAO/WHO, 2005). The ICSMF (1974) identified foods with counts >10^6 cfu/g as unacceptable for consumption. The high microbial load recorded for food samples obtained from road side canteen could be associated with the poor hygienic practices and handling of the product by the sellers. Lack of storage facilities could have heightened the chances of contamination (Baro et al., 2007). The ready-to-eat foods are maintained throughout the day under room temperature, this encourages proliferation of contaminants. The micro-organisms isolated from the ready to eat food samples analyzed included eight bacterial isolates and seven fungal isolates. Our results revealed that the bacterial isolates were *S. aureus*, *B. subtilis*, *E. aerogenes*, *P. aeruginosa*, *Micrococcus* sp., *E. coli, B. licheniformis, Klebsiella* sp. This finding is similar to previous reports by Desmarchelier et al. (1994), Nichols et al. (1999) and Mensah et al. (2002). The fungal isolates include *S. cerevisiae*, *M. mucedo*, *A. flavus*, *Fusarium* sp., *A. niger* and *Rhizopus* sp. This result was in agreement to that reported by Wogu et al. (2011), who isolated similar fungi from ready-to-eat foods, although few data are available on the occurrence of fungi in ready-to-eat food. Some of the microorganisms isolated from the ready to eat have been reported to be associated with food spoilage and food poisoning (Jay, 1996). Organisms implicated in

Table 4. Distribution of the bacterial isolates in the food samples.

Bacterial isolates	Egusi soup	Salad	Pounded yam	Vegetable soup	Moimoi	Beans	Porridge yam	Rice	Amala
S. aureus	-	+	+	+	+	+	-	+	+
B. subtilis	+	+	+	-	+	+	-	+	+
E. aerogenes	+	-	-	+	-	-	+	-	-
P. aeruginosa	+	+	-	+	-	-	+	-	-
Micrococcus sp	-	-	-	-	+	+	+	-	+
E. coli	-	+	-	-	-	-	-	-	-
B. licheniformis	-	-	+	-	+	+	-	+	-
Klebsiella sp	+	+	+	+	-	-	+	-	-

+ = Present; - = Absent.

Table 5. Distribution of the fungal isolates in the food samples.

Fungal isolates	Egusi soup	Salad	Pounded yam	Vegetable soup	Moimoi	Beans	Porridge yam	Rice	Amala
Mucor mucedo	+	+	-	+	-	+	+	-	+
Aspergillus flavus	+	-	+	+	+	+	-	-	+
Saccharomyces cerevisiae	-	+	-	-	-	-	-	-	+
Penicillium sp	+	+	+	-	+	-	+	+	-
Aspergillus niger	+	+	+	+	+	+	-	+	-
Fusarium sp	+	+	+	+	-	-	+	-	-
Rhizopus sp	-	-	-	-	-	-	-	+	-

+ = Present; - = Absent.

food-borne diseases are numerous and diverse bacteria, fungi, viruses and parasites (Jay, 1996; Chukwu et al., 2010; De Rover, 1998). *E. coli, S. aureus, Bacillus* species and *Pseudomonas* sp. were isolated from the ready to eat foods indicating poor sanitary control and practices. These organisms are known food borne pathogens and opportunistic pathogens that have been implicated in food-borne disease outbreaks (Oranusi and Braide, 2012; Mudgil et al., 2004; Oranusi et al., 2006, 2007; Yadav et al., 2011; Tambeker et al., 2008).

Fungi are common environmental contaminants due to their ability to produce spores; this could explain their presence in ready to eat food. They have been implicated in ready to eat foods. Species of *Aspergillus, Penicillium* and *Fusarium* are known to produce deleterious mycotoxins under favourable conditions (Oranusi and Braide, 2012), their presence in ready to eat food must therefore be treated with caution. *Aspergillus* species which were the most predominant in this study are among the most abundant and widely distributed organisms on earth. Members of this genus are saprophytic moulds. Most live in the environment without causing disease. Virtually, all the common *Aspergillus* species have been recovered at some time from agricultural products. *A. niger* and *A. flavus* were isolated from the ready to eat food samples analyzed.

The occurrence of *S. cerevisiae* may be due to its role in fermentation of agricultural products. *S. cerevisiae* is well known for converting carbohydrates into alcohol and other aroma compounds such as esters, organic acids and carbonyl compounds. Their presences in food sometimes represent assimilation of glucose, galactose and lactic acid by them. Examination for the presence of pathogens in ready-to-eat food contributes to food safety (Roberts and Greenwood, 2003; Elviss et al., 2009; Willis et al., 2009). Although low numbers of food pathogens probably represent a low risk, their presence can suggest fault(s) in the production and/or subsequent handling which, if not controlled, could lead to an unacceptable increase in risk (Health Protection Agency, 2009). The presence of *Bacillus* sp. in these foods indicate the possibility that spices such as pepper have been added after the main cooking process (Health Protection Agency, 2009). Evidence show that food can be a reservoir of extra-intestinal infections caused by epidemic strains of *E. coli* causing uncomplicated urinary tract infections (Manges et al., 2008) and other severe infections (Johnson et al., 2002; Manges et al., 2006).

Conclusion

The results of this present study indicated that the ready-to-eat food samples sold in road side canteen and eateries had microbial contaminants. Hence, it is recommended that a more close supervision of ready-to-eat

food should be carried out by relevant authorities.

Conflict of interests

The author(s) did not declare any conflict of interest.

ACKNOWLEDGEMENT

The authors would like to thank the Department of Microbiology, University of Benin, Benin City for the provision of materials for this work.

REFERENCES

Adegoke AA, Adebayo-Tayo CB, Inyang UC, Aiyegoro AO, Komolafe OA (2010). Snails as meat source: Epidermiology and nutritional perspective. J. Microbiol. Antimicrob. 2(1):1-5.

Adegoke AA, Komolafe AO (2009). Multidrug resistant Staphylococcus uareus in clinical cases in Ile-Ife, South Western Nigeria. Int. J. Med. Sc. 1(3):68-72.

Baro N, Bello AR, Itsiembou Y, Savadogo A, Ouattara CAT (2007). Street-vended foods improvement: Contamination mechanisms and application of food safety objective strategy. Crit. Rev. 6:01-10.

Cheesbrough M (2006). District laboratory practice in tropical countries. Cambridge University Press. 434pp.

Chukwu COC, Chukwu ID, Onyimba IA, Umoh EG, OLarubofin F, Olabode AO (2010). Microbiological quality of pre-cut fruits on sale in retail outlets in Nigeria. Afr. J. Agric. Res. 5(17):2272-2275.

Clarence SY, Obinna CN, Shalom NC (2009). Assessment of bacteriological quality of ready to eat food (meatpie) in Benin City Metropolis, Nigeria. Afr. J. Microbiol. Res. 3(6):390-395.

De Rover C (1998). Microbiology safety evaluations and recommendation on fresh produce. Food Control 9(6):321-347.

Desmarchelier PM, Apiwathnasorn C, Vilainerun D, Watson C, Johari MR, Ahmed Z, Barnes A (1994). Evaluation of the safety of domestic food prepared in Malaysia. Bull. World Health Organ. 72(6): 877-884.

Draper A (1996). Street foods in developing countries: The potential for micronutrient fortification. John Snow, INC/OMNI Project London School of Hygiene and Tropical Medicine.

Elviss NC, Little CL, Hucklesby L, Sagoo S, Surman-Lee S, de Pinna E, Threlfall J (2009). Microbiological study of fresh herbs from retail premises uncovers an international outbreak of salmonellosis. Int. J. Food Microbiol. 134:83-88.

FAO/WHO (2005). Reginoal conference on food safety for Africa Harare, Zimbabwe. 22 pp.

Harrigan WF (1998). Laboratory methods in food microbiology. 3rd ed. Academic Press. London. UK.

Health Protection Agency (2009). Guidelines for assessing the microbiological safety of ready-to-eat foods. London: Health Protection Agency.

ICMSF (International Commission on Microbiological Specification for Food) (1974). Sampling for microbiological analysis. Principles and specific application. University of Toronto press, Toronto. pp. 1-18.

Jay JM (1996). Modern Food Microbiology, 6th Ed. Gailthersburg (MD), Aspen, London. pp. 679-680.

Johnson JR, Manges AR, O'Bryan TT, Riley LW (2006). A disseminated multidrug-resistant clonal group of uropathogenic *Escherichia coli* in pyelonephritics. Lancet 359:2249-2251.

Jolt JG, Krieg NR, Sneath PHA, Stanley JT, Williams ST (1994). Bergey's Manual of Systematic bacteriology. Williams and Wilkins Co. Baltimore, Maryland, Yunchalard. 9th edn. p. 786.

Mahakarnchanakul W, Ontoun W, Stonasaovapak S, Pirapatrungsuriya N, Choo-in P, Borisuit T (2010). Risk evaluation of popular ready-to-eat food sold in Bangkok. Asian J. Food Agro-Industry 3(1):75-81.

Manges AR, Perdreau-Remington F, Solberg O. Riley LW (2006). Multidrug-resistant *Escherichia coli* clonal groups causing community acquired bloodstream infections. J. Infect. 53:25-29.

Manges AR, Tabor H, Tellis P, Vincent C, Tellier PP (2008). Endemic and epidermic lineages of *Escherichia coli* that cause urinary tract infections. Emerg. Infect. Dis. 14:1575-1583.

Mensah P, Yeboah MD, Owusu DK, Ablordey A (2002). Street foods in Accra, Ghana: how safe are they? Bull. World Health Organ. 80 (7): 546-554.

Mudgil S, Argawal DG, Anguli A (2004). Microbiological analysis of street vended fresh squeezed carrot and Kinnow Mandarin juice in Patiala City, India. Int. J. Food Saf. 3:1-3.

Musa OI, Akande TM (2002). Effect of Health Education Intervention on food safety practice among food vendors in Illorin. J. Med. 5:120-124.

Nichols GL, Little CL, Mithani V, De Louvois J (1999). The microbiological quality of cooked rice from restaurants and take-away premises in the United Kingdom. J. Food Prot. 62:877-882.

Okeke IN, Lamikanra A, Steinrück H, Kaper JB (2000). Characterization of Escherichia coli strains from cases of childhood diarrhea in provincial southwest Nigeria. J. Clin. Microbiol. 38:7-12.

Olowe OA, Okanlawon BM, Olowe RA (2009). Antimicrobial resistance pattern of Escherichia coli from human clinical samples in Oshogbo, South Western Nigeria. Afr. J. Microbiol. Res. 2:8-11.

Oranusi S, Galadinma M, Umoh VJ (2006). Phage typing and toxigenicity test of *S. aureus* strains from food contact surfaces and foods prepared in boarding schools in Zaria, Nigeria. Nig. J. Microbiol. 20(2):1011-1017.

Oranusi S, Galadinma M, Umoh VJ, Nwanze PI (2007). Food safety evaluation in boarding schools in Zaria, Nigeria, using the HACCP system. Sci. Res. Essays 2(10):426-433.

Oranusi US, Braide W (2012). A study of microbial safety of ready-to-eat foods vended on highways: Onitsha-Owerri, south east Nigeria. Int. Res. J. Microbiol. 3(2): 66-71.

Osterblad M, Posala O, Peterzens M, Heleniusc H, Huovien P (1999). Antimicrobial susceptibility of Enterobacteriaceae isolated from vegetables. J. Antimicrob. Chemother. 43:503-559.

Patricia MA, Azanza V. (2005). Aerobic plate counts of Philippine ready-to-eat foods from take away premises. J. Food Safe. 25(5):80-97.

Pinegar JA, Cooke EM (1985). *Escherichia coli* in retail processed food. J. Hyg. 95:39-46.

Roberts D, Greenwood M (2003). Isolation and enrichment of microorganisms, In: Roberts, D. and Greenwood, M. (eds). Practical Food Microbiology. Blackwell Publishing Ltd. Oxford, UK. pp. 131-192.

Sangoyomi TE, Bello-Olusoji, OA, Ajani F, Owoseni AA, Odeniyi O. (2012). Bacterial contamination in vended animal food products around motor parks in Ibadan, South West, Nigeria. J. Med. Appl. Biosci. 4:59-66.

Schoeder CM, White DG, Meng J (2004). Retail meat and poultry as a reservoir of antimicrobial-resistant *Escherichia coli.* Food Microbiol. 21:244-255.

Serrano S, Medina LM, Jurado, M. Jodral M (2004). Microbiological quality of terrestrial gastropods prepared for human consumption. J. Food Prot. 67:1779-1781.

Tambeker DH, Jaiswal VJ, Dharnokar DV, Gulhane PB, Dudhane MN (2008). Identification of microbiological hazards and safety of ready-to-eat food vended in streets of Amravati City, India. J. Appl. Biosci. 7:195-201.

Teuber M (1999). Spread of antibiotic resistance with food-borne pathogens. Cell. Mol. Life Sci. 56:755-763.

Tsang D (2002). Microbiological guidelines for ready to eat food. Road and Environmental Hygiene Department, Hongkong. pp.115-116.

Willis C, Little CL, Sagoo S, de Pinna E, Threlfall J (2009). Assessment of the microbiology safety of edible dried seeds from retail premisesin the United Kingdom with a focus on *Salmonella* spp. Food Microbiol. 26(8):847-852.

Wogu MD, Omoruyi MI, Odeh HO, Guobadia JN (2011). Microbial load in ready-to-eat rice sold in Benin City. J. Microbiol. Antimicrob. 3(2):29-33.

Yadav N, Saini P, Kaur D, Srivastava N, Pandey D (2011). Microbial quality and safety of ready-to-serve street foods vended in Allanhabad City, India. J. Food Saf. 13:6-10.