

## Bacteriological Analysis and Hygiene Level of Food Outlets within Rufus Giwa Polytechnic, Owo, Ondo State, Nigeria.

Ibrahim TA<sup>1\*</sup>, Akenroye OM<sup>1</sup>, and Osabiya OJ<sup>2</sup>

<sup>1</sup>Department of Food Science and Technology, Rufus Giwa Polytechnic, P.M.B 1019, Owo, Ondo State, Nigeria.

<sup>2</sup> Department of Laboratory Technology, Rufus Giwa Polytechnic, P.M.B 1019, Owo, Ondo State, Nigeria.

### Research Article

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#### \*For Correspondence

Department of Food Science and Technology, Rufus Giwa Polytechnic, P.M.B 1019, Owo, Ondo State, Nigeria.

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#### ABSTRACT

The bacteriological quality of three major food outlets in Rufus Giwa Polytechnic, Owo, was assessed using standard bacteriological methods. Swabs of hands of food vendors, table and plates in these outlets were assessed for total bacterial count, total coliform count and total *E. coli* count. A total of 789 bacterial colonies were isolated from hands of food handlers, tables and plates used for eating in the outlets. Eleven genera of bacteria were isolated and identified, they were; *klebsiella* sp, *Enterobacter* sp, *Staphylococcus* sp, *Proteus* sp, *E. coli* *Salmonella* sp, *Micrococcus* sp, *Bacillus* sp, *Pseudomonas* sp, *Streptococcus* sp and *Serratia* sp when their morphology and biochemical characteristics were compared with standard reference organisms. The presence of these bacterial isolates has been attributed to ineffective washing technique, rare changing of water used for washing plates and poor personal hygiene of the food handlers which could be enhanced by regular monitoring and supervision of the canteens by the authorities on food safety practices and regular education on food and personal hygiene.

#### INTRODUCTION

An adequate supply of safe, wholesome and health food is essential to the health and well-being of humans [1]. However, at the time, food itself can pose a health threat. The consumption of contaminated or unsafe foods may result in illness, also referred to as food borne disease [2,3]. Food safety is a growing concern for consumers and professionals in the food and food service industry [4]. Food safety is defined as the conditions and measures that are necessary during production, processing, storage, distribution and preparation of food to ensure that it is safe, sound, wholesome and fit for human consumption [5]. Food hygiene is essentially aimed at producing food which is safe for human consumption and of good keeping quality [6].

Biological contaminants such as bacteria, viruses, fungi, protozoa and helminthes constitute the major cause of severity ranging from mild indisposition to chronic or life-threatening illness or both. In developing countries such contaminants are responsible for food borne disease such as cholera, campylobacteriosis, *E. coli* gastroenteritis, salmonellosis, shigellosis, typhoid fever, brucellosis, amoebiasis and poliomyelitis [7]. Aerobic colony counts, coli form and enterococci enumeration are useful and most often used means of assessing overall sanitation in the environment of food service establishments [8]. Rufus Giwa Polytechnic Owo canteens are commercial catering establishments that service the campus populace both the students and lecturers. Incidence of diarrhoea and abdominal pains are mostly prevalent at the school clinic following eating at the school canteen, such cases are presumed to be "microbial food poisoning" even though, no clinic or laboratory findings are provided. Therefore, the hygiene standard of the food preparation areas, utensils as well as the personal hygiene practice of some of the kitchen personal is questionable.

Lacking personal hygiene amongst food handlers is one of the most commonly reported practices contributing to food-borne illness and poor hand and surface hygiene is also a significant contributory factor [2,3]. Contamination of

food premises has been shown to be associated with poor hygiene standards [9]. In most countries, food – borne disease remain a public health predicament in spite of the improvement in hygiene standards, improved food processing practices, education of food handlers and consumer awareness [10]. The hands of food handlers can be pivotal as vector in the spread food – borne disease due to poor personal hygiene or cross – contamination. Hand washing, a simple and effective way to cut down on cross – contamination, is too often forgotten. It was reported that 42% of food borne disease outbreaks which took place from 1975 – 1998 in the United States of America has been caused by the hands of food handlers [11]. The risk of food borne illness due to contact with hands or surface depends on both the level of contamination as well as the probability of transfer and the importance of contaminated surface in relation to potential transmission of pathogens to food is apparent in food processing [12]. This study was carried out to appraise the bacteriological quality and hygiene level of major food outlets with in Rufus Giwa polytechnic, Owo, Ondo State, Nigeria.

## MATERIALS AND METHODS

### Collection of Samples

Swab sticks were used to swab tables, plates and hands of the food handlers in two major canteens (NASU, and Arise & Shine restaurant) within the polytechnic .The swab sticks were brought to the microbiology Laboratory of Food Science and Technology Department of the institution for the bacteriological analysis.

### Sample Preparation and Isolation of Bacteria Isolates

Each piece of the swab sticks were dipped into a test tube containing distilled water for 2hours. 1ml of the original sample solutions were serially diluted to  $10^3$  dilution factors which were then used for the various bacteriological analyses. The total heterotropic and coliform count were done according to the methods described by ICMSF [15] and Cheesebrough [16]. 1ml of appropriate dilution  $10^{-3}$  of the samples were pipette into Petri dishes containing 20ml of molten nutrient agar and MacConkey agar cooled at  $45^{\circ}\text{C}$  . There were mixed thoroughly and allow to set .The plate were incubated at  $37^{\circ}\text{C}$  for 24hrs for total heterotropic and coliform count respectively.

### Identification of Bacterial Isolates

After 24 hours of incubation, the bacterial populations were counted; the morphological characteristics of the isolates were examined. Pure culture of the bacteria species were obtained on bjoe bottles before been subjected to gram staining reaction and biochemical tests such as oxidase, catalase, coagulase, citrate, sugar utilization as described by Speck [17] and Cheesebrough [16].The dichotomous key results were compared with the standard characterized bacteria s expressed in the Berger's Manual of Systemic Bacteriology [18].

## RESULTS AND DISCUSSION

The bacteriological quality of hand of food vendor, table and plates used in two major restaurant (NASU and ARISE & SHINE) were examined using standard bacteriological method on the aseptically swabbed surface of plates, tables and hands. The total bacteria count were done on nutrient agar, MacConkey and Eosine methylene Blue (EMB) agar respectively. In NASU, the total bacteria count were 88, 132 and 34 on the hands of the food vendor, table and plates respectively while the total coliform count were 8cfu/ml on the hands of the food vendor and 23cfu/ml on the tables and none on the plates. The total *E.coli* count was only viable on the table with 8 colonies. In ARISE & SHINE restaurant, the total bacteria count were 76, 184 and 92cfu for hands of the food vendor, tables and plates respectively. The total coliform were 12, 38 and 8 cfu/ml colonies for hands of food vendor, tables and plates while the total count were 12, 16 and 4 colonies for hands of food vendor, tables and plates respectively.

A total of 789 bacteria colonies were isolated from the hands of vendor, tables and plates used for eating in the two analyzed restaurants for total bacterial, total coliform and total *E. coli* count. Eleven genera of bacteria were isolated and identified. They were identified as *klebsiella* sp, *Entrobacteria* sp, *Citrobacter* sp, *Micrococcus* sp, *Proteus* sp, *Staphylococcus* sp, *Streptococcus* sp, *Pseudomonas* sp, *Bacillus* sp, *Serratia* sp, *Salmonella* sp by comparing their morphology and Biochemical characteristic with standard reference organisms. In this work, the palm swabs, tables and plates used for eating in the NASU restaurant and ARISE & SHINE restaurant harboured bacteria species such as coliform, *Staphylococcus* sp, *Pseudomonas* sp, *Klebsiella* sp, *Entrobacter* sp, *Proteus* sp, *Streptococcus* sp, *Salmonella* sp, *Micrococcus* sp, as shown by the biochemical analysis on the isolated bacteria. The total bacteria count was used to measure the general bacteria load of the food and the result may reflect the hygiene level of food handling and retail storage as observed by Collins et al [19] and Brown [20] . However, the bacteria pathogens isolated in the

present study are similar to microorganism reported by [21,22,23]. Bryan [3] had stated that the general state of inadequate hygiene and poor sanitary practices could account for high counts in the samples. Abdullahi *et al* ; [21] reported that the presence of microbial population in some of the foods may be due to unhygienic practice by food handlers in a similar study where all palms of food vendor and hotel operators harboured *Staphylococcus* sp, *E. coli*, *Pseudomonas* sp, *klebsiella* sp [18]. The presence of organism such as *E. coli*, *Enterobacter* sp and other organisms in this study is of special concern and perhaps the greatest danger associated with the water for food processing and drinking purpose [12,15]. Qualitative hand swab results showed that a high fraction of the personnel's hand were contaminated by coliform, *E. coli*, *Enterobacter* sp even though the source of those contaminants was not determined they are highly indicative of inadequate hand sanitation [19,26]. The *Staphylococcus* sp and *Streptococcus* sp isolated although they are normal commensal on human which reflect improper hygiene practice such as pocking nose with fingers [10]. It was observed that there was no hand sanitizer at each of the hand wash basins for personnel to wash their hand with after using the toilet or handling food or handling raw foods. A common practice is to dry their hands after washing their apron, garment which could probably serve as source of further contamination, this was also reported in a similar study by Moyo and Baudi [8]. From these assessments, the food handlers personal hygiene standard and food handling practices were unsatisfactory, the tables and plates used for eating could be a source of spread of food borne diseases unless corrective sanitary measures are put in place. It is imperative for the school authority to have regular monitoring and control of these eateries which could have a positive influence on the personal hygiene and food handling practices of food handlers. The presence of *Staphylococcus* sp, coliform, *E. coli*, *Pseudomonas* sp, *Klebsiella* sp in the plates shows the existing poor sanitary qualities of food utensils. In this study, the bacteria indicator showed the unhygienic condition of food utensil, ineffective washing techniques, improper handling and storage of clean utensils, rare changing of water used for washing plates and used of dirty cloths/ towels to wipe and dry plates are some of the factors that could contribute to the gross contamination. The handlers and the utensils used in these 2 major food outlets were obviously unclean judging by the respective counts obtained from respective swabs. Adesiyun and Kwaga [27] identified the cafeteria environment and their workers as likely sources of food contamination. Food handlers with skin lesion, respiratory infection, eyes and nose discharge could have served as the source point for the presence of *Staphylococcus aureus* on plate. As *Staphylococcus aureus* lives and flourishes in the human nose, skin and throat, the likely hood of recontamination of cleaned plate by infected food handlers is quite high. It is not worthy that, total bacterial count were detected on the palm of the food handlers. According to the Health Regulation [28] a working surface or any surface which comes into direct contact with food shall contain no more than 100 viable microorganism/gram upon analysis. The total Bacteria count of hands could be regarded as negligible. According to Gibbon *et al* [29] the hands of food handlers well as their protective cloth should be kept clean and food handlers avoid contact with food whenever possible. For many foods especially those that are ready to eat, the cleanliness of food contact surface [30]. It should be kept in mind, however, that it is virtually impossible to exclude all microbiota from food related surface except if such surfaces are sterilized. The table surface in the 2 outlets did not meet the specification of the ICMSF [15] setting a maximum count of  $1.5 \times 10^2$  cfu/cm<sup>2</sup> of bacteria on food working surfaces. The level of bacterial count on the service tables points to the level of hygiene in these outlets.

### CONCLUSION

In general, it can be concluded that the level of personal hygiene of the food handlers in eating establishments were found to be unsatisfactory due to poor sanitation. The bacteriological swab test of food utensils, palms of food handler and tables confirmed the gross unhygienic condition of food establishments, thereby increasing the risk of food contamination considerable. Good personal hygiene is also expected among the cleaning and dish washing staff, food hygiene can be best promoted by educating the food handlers about personal hygiene and training in hygiene and sanitation for all employees working in food establishment which is an essential step towards ensuring food safe.

**Table 1 : Bacteria density of Hands of vendors, tables and Plates from NASU and Arise & Shine Restaurant in Rufus Giwa Polytechnic, Owo, Ondo State.**

RESTAURANTS	BACTERIOLOGICAL ANALYSIS	SAMPLING POINTS		
		HANDS	TABLES	PLATES
NASU	TOTAL BACTERIAL COUNT	88	132	34
	TOTAL COLIFORM COUNT	08	32	Nil
	TOTAL E.COLI COUNT	Nil	08	Nil
ARISE & SHINE	TOTAL BACTERIAL COUNT	76	184	92
	TOTAL COLIFORM COUNT	12	38	08
	TOTAL E.COLI COUNT	12	16	04

**Table 2: Gram staining reaction and biochemical test of pure culture of the bacterial isolates**

Parameters	A	B	C	D	E	F	G	H	I	J	K
Gram reaction	+cocci	+cocci	-rod	-rod	-rod	-rod	-rod	-rod	+cocci	+rod	-rod
Catalase test	-ve	+ve	-ve	-ve	+ve	-ve	+ve	-ve	-ve	-ve	-ve
Citrate test	-ve	-ve	-ve	-ve	+ve	-ve	+ve	-ve	-ve	-ve	-ve
Oxidase test	-ve	-ve	-ve	-ve	+ve	-ve	-ve	-ve	-ve	-ve	-ve
Coagulase test	-ve	+ve	-ve	-ve	-ve						
Indole test	-ve	-ve	-ve	-ve	-ve	+ve	-ve	-ve	-ve	-ve	+ve
Urease test	-ve	-ve	-ve	-ve	-ve	-ve	+ve	-ve	-ve	-ve	-ve
Glucose test	+ve	+ve	-ve	-ve	+ve	-ve	-ve	-ve	+ve	-ve	+ve
Lactose test	-ve	-ve	-ve	-ve	-ve	+ve	+ve	+ve	-ve	-ve	-ve
Sucrose test	-ve	-ve	-ve	-ve	-ve	+ve	+ve	-ve	-ve	-ve	+ve
Manitol test	+ve	+ve	+ve	-ve	+ve	+ve	+ve	+ve	+ve	+ve	-ve
Motility	+ve	+ve	+ve	-ve	+ve	+ve	-ve	+ve	+ve	+ve	+ve

**Probable bacteria**

A = Streptococcus sp, B = Staphylococcus sp , C= Salmonella sp , D = Serratia sp , E = Pseudomonas sp , F= E. coli , G = klebsiella sp , H= Enterobacter sp , I = Micrococcus sp , J= Bacillus sp , K = Proteus sp.

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