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Microbial Load of Perishable Items Sold in Owo Market, Ondo State, Nigeria

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ABSTRACT

Man's food supply consists primarily of plants and animals and products derived from them. Microorganisms are naturally present in the soil, water, and air, and therefore exterior surfaces of plants and animals are contaminated with a variety of microorganisms. There is little specificity to this microflora since it reflects that of the environment in which the plants were grown and the animals were raised. Interior tissues of plants and animals usually contain few, if any, microorganisms. The gastrointestinal tracts of animals, however, contain large numbers of organisms. But if proper slaughtering-dressing procedures are used, contamination of interior muscle tissue can be avoided. The research was carried out using a cross sectional study of Fifty (50) food samples selected randomly and added to the study. The samples were homogenized, spun for about 1min and were serially diluted for culture. Also wet preparation technique was first conducted on each of the samples and discovered that *Taenia saginata* was found in both beef and cow tripe. The culture was then carried after microscopy analysis and it was discovered that the most implicated organisms isolated were *Klebsiella oxytoca* (21.2%), *Escherichia coli* (21.2%), *Klebsiella pneumoniae* (11.5%), other *Pseudomonas spp* except *P. aeuroginosa* had prevalence of 9.6% followed by *Staphylococcus aureus* and other spieces of genus *Staphylococcus* with prevalence of 7.7% while *Pseudomonas aeruginosa* had the least prevalence of 5.7%. The overall prevalence of bacteria isolated from perishable food items in Owo Markets (both Oja oba and Oja koko was 84.6%. The most implicated parasite was *Taenia saginata* with a prevalence of 7.7%, followed by *Ascaris lumbricoides, Strongyloides stercoralis* and other *Teania* spieces having a prevalence of 1.9% respectively. The Overall prevalence of parasites isolated from perishable food items in Owo Markets (both Oja oba and Oja koko) was 15.4%. It was concluded that the growth of the organisms isolated and identified was a result of poor sanitation when handling of these foods and improper human and animal waste disposal.

Keywords: Microbial Load, Perishable Items, market, Owo

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1. INTRODUCTION

Perishable foods on the other hand have a finite shelf-life and if not consumed, will spoil at some time during storage. The exact time of spoilage depends upon a great number of variables. Though various processing procedures, additives, packaging methods, and storage conditions may be applied to increase shelf-life, microorganisms capable of growth survive and ultimately grow. When such growth proceeds to the extent that undesirable changes are perceptible to the processor, preparer, or consumer, the food is deemed of inferior quality or spoiled and is rejected. The distinguishing feature of perishable foods, in contrast to shelf-stable foods, is that microbiological spoilage is an expected event. It will ultimately occur even if the food has been prepared from wholesome raw materials and has been properly processed, packaged, and stored (Baker, 2016**).** Man's food supply consists primarily of plants and animals and products derived from them.

Microorganisms are naturally present in the soil, water, and air, and therefore exterior surfaces of plants and animals are contaminated with a variety of microorganisms. There is little specificity to this microflora since it reflects that of the environment in which the plants were grown and the animals were raised. Interior tissues of plants and animals usually contain few, if any, microorganisms. The gastrointestinal tracts of animals however contain large numbers of organisms but if proper slaughtering-dressing procedures are used, contamination of interior muscle tissue can be avoided (Kautter, 2016). From the time of slaughter, catch, or harvest, the surface and interior tissues of animals and plants are subject to contamination. This is due in part to the breakdown of normal defense mechanisms, particularly in animals. Each processing step subjects the raw material to additional opportunities for contamination. Sources of contamination include surfaces of the harvested plant or slaughtered animal, water, equipment, utensils, workers, and the processing environment (APHA, 2015).

The microorganisms (although invisible) are present in soil, water, air and even in and on our bodies. Therefore, they can enter the food and grow rapidly if conditions are suitable for their growth and multiplication. This can lead to food spoilage that brings a disagreeable alteration in normal state of food making it unsuitable for human consumption or industrial uses. Spoilage of food can also cause wastage of food due to deterioration and can reduce the nutritive value of food. The food spoilage can be broadly classified on the basis of food item (APHA, 2015). Stable or non-perishable foods like flour and sugar. Also semi- perishable foods like apple that remain unspoiled if handled and stored properly. Perishable foods like milk that spoil easily without special preservative methods. The spoilage microbes can cause a variety of changes in the food items (NRC, 2016; US, 2017; US Congress, 2018; Food Microbiology 2019).

For many decades it has been known that microorganisms display varying degrees of sensitivity to oxidation / reduction potential of their growth medium. The oxidation /reduction potential or (Ph.), of a food may be defined generally as the ease with which a substrate –or food – loses or gains electrons. It is said to be oxidized when it loses electrons it, while the one that gains electrons becomes reduced. Food cultivation, transport, processing, retailing, preservation and handling when coupled with those diversities could aggravate the hygienic situation of food (Basset, 2015; Frazier, 2015 and Banwart, 2018).

Extrinsic or environmental parameters as temperature, relative humidity, gaseous content and radiations are known factors to have direct effects on microbial quality of food (Wehr, 2018; Mukartini *et al*., 2019). The intrinsic parameters of the food e.g. hydrogen ion concentration (pH), water activity (aw), nutrient content, oxidation / reduction potential (O/R.P), presence of inhibitory substances and physical characteristics of food, are basic media which inhibit or enhance microbial growth in food. The microorganisms (although invisible) are present in soil, water, air and even in and on our bodies. Microorganisms are naturally present in the soil, water, and air, and therefore exterior surfaces of plants and animals are contaminated with a variety of microorganisms. This study assessed and evaluated the microbial quality of some of perishable foods sold in Owo Market. The main objective is to determine the microbiological quality and the microbial load present in perishable food items sold.

2. MATERIALS AND METHODS

2.1 Study Area

This Study was conducted at two main markets named Oja Oba and Oja koko in Owo, Ondo state. Owo is a city in Ondo state situated at the South-Western part of Nigeria with latitude 7.2oNorth (7.196200) and longitude 5.59oEast (5.586810) and 348 meters elevation above the sea level. The city has a current population of about 276,574 making it the second biggest city in Ondo State (World Atlas).

Figure 1: Map of Ondo State showing the location of Oja Oba and Oja Koko Markets

2.2 Study Methodology

2.2.1 Experimental Design

The research was a cross sectional study, where samples like Scent leave, Cabbage, Arowojeja, Tomatoes, Green apple, Red apple, Beef, Cow tripe, Herring fish, Water leave, Dried fish, Cow liver and Spinach was picked randomly and enrolled.

2.2.2 Sample Size Determination

The sample size (N) was determined using sample size determination formula for health studies The prevalence of microbial exposure to unprocessed food is 4.4% (Allan, 2017).

$$N = \frac{Z^2P\ (1 - P)}{D^2}$$

N = sample size required
Z = confidence level at 95% (standard value of 1.96)
P = estimated prevalence of exposure in Nigeria is 4.5% (0.11)
D = margin of error at 5% (standard value = 0.05)

$$N = \frac{1.96^2 \text{ X } 0.045\ (1\text{-}0.044)}{0.05^2} \quad (1)$$

$$\frac{3.8416 \text{ X } 0.045\ (0.956)}{0.0025} \quad (2)$$

N = 52 samples

2.3 Sample Analysis

2.3.1 Sample Collection and Processing

Ten grams of each sample was homogenized in 90ml of sterile distilled water and stomached using a stomacher at 360rpm for 1min, after which the homogenized samples was serially diluted to 10-5. The samples were left in a sterile environment at room temperature while the agar was prepared. Usually, the agar is prepared using the Manufacturer's instructions. The Agar was measured using a weighing balance and was poured into a conical flask containing 1000ml of distilled water. The conical flask was then be corked tightly, homogenized and placed into the autoclave for 15 minutes and at a temperature of 121^{o}C for sterilization to take place. After the sterilization 20ml of the Agar was poured into each plate and left to gel and cool down.

2.3.2 Isolation of the Microorganism

After the plates both Chocolate agar and MacConkey (for coliform) had gelled in a sterile environment. The plates were prepared in duplicates and incubated under aerobic condition at 37°C for 24 - 48 hours.

2.3.3 Gram Staining

To carry out the gram staining, a bunsen burner was lighted and a drop of normal saline was placed on a clean grease free slide. Then a wire loop was heated (to sterilize and kill any bacteria on the loop) and allowed to cool down. A colony of the growth from the plate was taken and emulsified on the slide containing the normal saline. The slide was then left to air dry and then heat fixed. The slide was stained with Crystal Violet (60 seconds), Lugol's Iodine (30 Seconds), Decolorized/Differentiated with Acetone (Briefly), Safranin/Methyl Red (30 seconds). After the Gram staining, slide was viewed using x100 Objective lens with immersion oil to focus and view.

2.4 Biochemical Characterization

Before biochemical characterization was carried out the working bench was sterilized and disinfected. Biochemical characterization of the isolates was carried out depending on the organism isolated after Gram Staining. If the organism is Gram Positive Cocci, Coagulase test was carried out. If the organism is Gram Negative Bacilli, the following tests were carried out as follows; Catalase test, Citrate test, Urea, Indole, TSI (to check for the acidity and alkalinity, gas production and sulphur production), motility and sugars (to identify the organism to the specie level).

2.5 Antibiotic Sensitivity Testing Pattern

There are two known method of antibiotics sensitivity testing which includes; the Kirby-Bauer Disc Method used to determine which antibiotic is the most effective against a certain pathogen. The second one is Minimum Inhibitory Concentration (MIC) which is used to determine the lowest concentration that is needed to kill the pathogen at the site of infection. The antibiotic sensitivity testing method used for this work is the Kirby-Bauer Disc Method/ Disk Diffusion Method**.** In this method, a filter disk which has been impregnated with a particular antibiotics will be applied to the surface of the agar (Mueller-Hinton Agar) containing the organisms to be tested.

The plate is then incubated for 24-48 hours. As the antibiotics diffuses from the filter paper into the agar, the concentration decreases as a function of the square of the distance of diffusion. At some particular distance from each disk, the antibiotic is diluted to the point that it no longer inhibits microbial growth. The effectiveness of a particular antibiotic is shown by the presence of growth-inhibition zones. These zones of inhibition (ZOIs) appear as clear areas surrounding the disk from which the substances with antimicrobial activity diffused. The diameter of the ZOI can be measured with a ruler and the results of such an experiment constitute an antibiogram.

2.6 Microscopic Examination of Parasites

A drop of homogenized water placed on a clean grease free slide, covered with a cover slip and examined with a microscope using x10 and x40 to focus, view and examined for the presence of parasitic egg, cyst, or adult parasite. The slides were also viewed using iodine, methylene blue and trichome stain (for the identification of the eggs).

2.7 Statistical Analysis

Data obtained was analyzed and represented as a mean + or – negative standard deviation and the results of the test groups was compared with students T-test using the IBM statistical software SPSS. Statistical significance was set at $P<0.05$.

3. RESULTS

The overall prevalence of bacteria isolated from perishable food items in Owo Markets (both Oja oba and Oja koko) was 84.6%. *Escherichia coli* and *Klebsiella Oxytoca* had the highest prevalence of 21.2 % respectively, followed by *Klebsiella pneumoniae* which is 11.5% other *Pseudomonas spp* except *P. aeuroginosa* had prevalence of 9.6% followed by *Staphylococcus aureus* and other spieces of *Staphylococcus* with prevalence of 7.7% while *Pseudomonas aeruginosa* had the least prevalence of 5.7% (Table 1). According to Table 2, the overall prevalence of parasites isolated from perishable food items in Owo Markets (both Oja oba and Oja Koko) was 15.4%, *with Taenia saginata* having the highest prevalence of 7.7%, followed by *Ascaris lumbricoides, Strongyloides stercoralis* and other *Taenia* spieces having a prevalence of 1.9% respectively. Table 3 shows that bacteria had the highest prevalence of 84.6% compared with parasites 15.4% and the prevalence was statistically significant $P< 0.05$. The sensitivity reaction of different isoates to various antibiotics as shown in Table 4 and in Table 5, Gentamycin had the highest sensitivity rate of 96% compared to Rocephin, Septrin, Amoxicillin and Augmentin that had the lowest sensitivity rate of 14%, 11%, 17.9% and 9.4% respectively. Zinnacef had the highest resistance rate of 100% making it the least sensitive antibiotics in the study.

The distribution of bacteria in Oja Oba as shown in figure 2; *Klebsiella oxytoca* (26.92%) had the highest prevalence followed by *Escherichia coli* (23.08%), *Psuedomonas aeuroginosa* and *Staphylococcus aureus* (7.69% respectively), with other spieces of *Staphylococcus* and *Pseudomonas* (3.84%) having the least prevalence. Figure 3 shows the distribution of parasites isolate from food samples obtained from Oja oba, *Taenia saginata* (7.69) had the highest prevalence and *Ascaris lumbricoides, Enterobius vermicularis, Strongyloides stercoralis* and other spieces of *Teania* all have a prevalence of 3.84% respectively. According to the figure 4 distribution of bacteria isolated from food samples obtained from Oja koko, *Escherichia coli* had the highest prevalence with a prevalence of 19.23%, followed by *Klebsiella oxytoca* and other spieces of *Pseudomonas* have a prevalence of 15.38% respectively, followed by *Staphylococcus* spp and *Staphylococcus aureus* with a prevalence of 7.69% respectively followed by *Psuedomonas aeuroginosa, Klebsiella* spp and *Klebsiella pneumoniae* with a prevalence of 3.84% respectively.

As shown in figure 5 in Oja Koko, *Taenia saginata* was the only parasite isolated from the food items. Figure 6 shows that *Escherichia coli* and *Klebsiella oxytoca* had the highest prevalence rate of about 21.50% respectively and *Pseudomonas aeuroginosa* with the least prevalence rate of about 5.77%. *Staphylococcus aureus and Staphylococcus* spp have a prevalence of 7.65% respectively. According to the figure 7, *Taenia saginata* had the highest prevalence rate of 5.77% followed by *Ascaris lumbricoides, Entrobius vermicularis, Taenia spp* and *Strongyloides stercoralis* with a prevalence of 1.92% respectively. In Figure 8, Gentamycin had the highest sensitivity rate of over 80% compared to Rocephin, Septrin, Amoxicillin, Zinnacef and Augmentin that had the lowest sensitivity rate which is lower than 20%.

Table 1: Prevalence of Bacteria in Perishable items sold in Owo Markets

Samples	No Examined	*K. pneumoniae*	*K. oxytoca*	*Pseudomonas spp*	*P. aeuroginosa*	*Staphylococcus spp*	*S. aureus*	*E. coli*	**Total**
		No. Pos (%)	No. Pos (%)	No. Pos (%)	No. Pos (%)	No. Pos (%)	No. Pos (%)	No. Pos (%)	No. Pos (%)
Scent leave	4	1 (1.9)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (1.9)	**2 (3.8)**
Cabbage	4	0 (0.0)	2 (3.9)	1 (1.9)	0 (0.0)	1 (1.9)	0 (0.0)	0 (0.0)	4 (7.7)
Arowojeja	4	0 (0.0)	1 (1.9)	1 (1.9)	0 (0.0)	0 (0.0)	1 (1.9)	1 (1.9)	4 (7.7)
Tomatoes	4	1 (1.9)	0 (0.0)	1 (1.9)	0 (0.0)	1 (1.9)	0 (0.0)	0 (0.0)	3 (5.7)
Green apple	4	0 (0.0)	0 (0.0)	1 (1.9)	0 (0.0)	0 (0.0)	1 (1.9)	0 (0.0)	2 (3.8)
Red apple	4	0 (0.0)	0 (0.0)	0 (0.0)	1 (1.9)	0 (0.0)	1 (1.9)	1 (1.9)	3 (5.7)
Beef	4	0 (0.0)	2 (3.9)	0 (0.0)	0 (0.0)	0 (0.0)	1 (1.9)	1 (1.9)	4 (7.7)
Cow tripe	4	0 (0.0)	1 (1.9)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	3 (5.8)	4 (7.7)
Herring fish	4	0 (0.0)	2 (3.9)	1 (1.9)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	3 (5.7)
Water leave	4	1 (1.9)	0 (0.0)	0 (0.0)	0 (0.0)	1 (1.9)	0 (0.0)	1 (1.9)	3 (5.7)
Dried fish	4	2 (3.9)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (3.9)	4 (7.7)
Cow liver	4	1 (1.9)	1 (1.9)	0 (0.0)	0 (0.0)	1 (1.9)	0 (0.0)	1 (1.9)	4 (7.7)
Spinach	4	0 (0.0)	2 (3.9)	0 (0.0)	2 (3.8)	0 (0.0)	0 (0.0)	0 (0.0)	4 (7.7)
Total	52	6 (11.5)	11 (21.2)	5 (9.6)	3 (5.7)	4 (7.7)	4 (7.7)	11 (21.2)	44 (84.6

Table 2: Prevalence of Parasites in Perishable items sold in Owo Markets

Samples	No Examined	*A. lumbricoides*	*E. vermicularis*	*Teania spp*	*S. stercoralis*	*T. saginata*	**Total**
		No. Pos (%)	No. Pos (%)	No. Pos (%)	No. Pos (%)	No. Pos (%)	No. Pos (%)
Scent leave	4	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Cabbage	4	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Arowojeja	4	1 (1.9)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (1.9)
Tomatoes	4	0 (0.0)	1 (1.9)	0 (0.0)	0 (0.0)	0 (0.0)	1 (1.9)
Green apple	4	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Red apple	4	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Beef	4	0 (0.0)	0 (0.0)	1(1.9)	0 (0.0)	2 (0.0)	3 (5.7)
Cow tripe	4	0 (0.0)	0 (0.0)	0 (0.0)	1(1.9)	1 (0.0)	2 (3.8)
Herring fish	4	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Water leave	4	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Dried fish	4	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Cow liver	4	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.0)	0 (0.0)
Spinach	4	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Total	52	1 (1.9)	0 (0.0)	1 (1.9)	1 (1.9)	4 (7.7)	7 (15.4)

Table 3: Prevalence of microorganisms in relation to bacteria and parasites isolated and identified among perishable items in Owo markets.

Microorganisms	No. Examined	No. Positive (%)	Mean ± SD	SEM	95% CI (Confidence Interval of difference)	t	Df	p-value
Bacteria	52	44 (84.6)	2.7±4.45	0.87	0.93-4.53	3.13	25	0.004
Parasites	52	7 (15.4)	5.4±4.40	0.86	3.61-7.16	6.24	25	0.000

Table 4: Antibiogram of the bacteria isolated from food samples obtained from Oja oba and Oja koko.

ISOLATES	ANTIBIOTICS													
	S	SXT	CH	SP	CPX	AM	AU	CN	PEF	OFX	APX	Z	R	E
K. pneumoniae	R	R	R	-	S	-	R	S	S	S	-	-	-	-
K. pneumoniae	R	R	S	-	-	R	S	S	R	R	-	-	-	-
K. pneumoniae	-	R	R	R	S	R	R	S	S	S	-	-	-	-
K. pneumoniae	R	R	R	R	S	R	R	S	S	S	-	-	-	-
K. pneumoniae	R	-	S	-	R	S	R	R	S	S	-	-	-	-
K. pneumoniae	R	-	S	-	R	R	R	S	S	S	-	-	-	-
K. Oxytoca	S	S	S	S	S	S	R	-	S	S	-	-	-	-
K. Oxytoca	S	S	-	-	S	R	R	S	S	R	-	-	-	-
K. Oxytoca	-	R	R	S	S	R	R	S	S	S	-	-	-	-
K. Oxytoca	S	R	R	R	S	R	R	S	S	S	-	-	-	-
K. Oxytoca	-	R	R	S	S	R	R	S	S	S	-	-	-	-
K. Oxytoca	-	R	S	R	S	R	R	-	S	S	-	-	-	-
K. Oxytoca	-	R	-	-	S	R	R	S	S	-	-	-	-	-
K. Oxytoca	R	R	S	R	S	R	R	S	S	S	-	-	-	-
K. Oxytoca	R	R	-	S	S	R	R	-	S	-	-	-	-	-
Pseudomonas spp	R	R	R	R	S	R	R	-	S	S	-	-	-	-
Pseudomonas spp	R	R	-	-	S	R	R	S	S	-	R	-	-	-
Pseudomonas spp	R	R	R	-	S	S	-	-	S	S	-	-	-	-
Pseudomonas spp	R	R	S	R	S	R	R	-	R	S	-	-	-	-

ISOLATES	ANTIBIOTICS													
	S	SXT	CH	SP	CPX	AM	AU	CN	PEF	OFX	APX	Z	R	E
Pseudomonas spp	R	R	-	R	S	R	R	S	-	-	-	-	-	-
Pseudomonas spp	R	R	-	-	S	R	R	-	S	S	-	-	-	-
Pseudomonas aeruginosa	R	R	R	S	S	R	R	S	S	S	-	-	-	-
Staphylococcus spp	S	R	-	-	S	R	-	S	S	-	S	R	R	R
Staphylococcus spp	R	R	-	-	S	R	-	S	S	-	S	R	-	S
Staphylococcus spp	R	-	-	-	S	R	-	S	-	-	R	R	R	S
Staphylococcus aureus	-	R	-	-	S	R	-	S	R	-	R	-	-	R
Staphylococcus aureus	-	S	-	-	S	R	-	S	S	-	R	R	R	S
Staphylococcus aureus	-	-	-	-	R	R	-	S	S	-	S	R	R	S
Staphylococcus aureus	R	R	-	-	S	-	-	S	S	-	S	R	S	R
Staphylococcus aureus	-	R	-	-	-	S	-	S	-	-	S	R	R	S
Staphylococcus aureus	R	R	-	-	-	R	-	S	S	-	S	R	R	S
E. coli	R	R	S	R	S	R	S	S	S	S	-	-	-	-
E. coli	-	R	S	R	R	S	R	-	S	S	-	-	-	-
E. coli	S	R	R	R	S	R	R	S	S	S	-	-	-	-
E. coli	-	R	R	R	S	-	R	S	S	-	-	-	-	-
E. coli	R	-	S	R	S	S	R	S	R	-	-	-	-	-
E. coli	R	R	R	S	S	R	R	S	S	-	-	-	-	-
E. coli	R	R	R	R	-	R	R	S	S	S	-	-	-	-
E. coli	-	R	R	-	S	R	R	S	S	-	-	-	-	-
E. coli	S	R	-	R	S	R	R	-	S	S	-	-	-	-
E. coli	R	R	S	-	-	R	S	S	R	-	-	-	-	-
E. coli	R	-	R	S	S	R	R	S	-	S	-	-	-	-

S = Sensitive
R = Resistance

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Table 5: Distribution of the efficacy of the antibiotics used against bacteria isolated from food sample obtained from Oja oba and Oja koko.

S/N	ABBREV	ANTIBIOTICS	SENSITIVE	%	RESISTANCE	%	TOTAL	%
1	S	STREPTOMYCIN	7	22.6	24	77.4	31	100.0
2	SXT	SEPTRIN	4	11.1	32	88.9	36	100.0
3	CH	CHLORAMPHENICOL	11	42.3	15	57.7	26	100.0
4	SP	SPARFLOXACIN	8	36.4	14	63.6	22	100.0
5	CPX	CIPPROFLOXACIN	32	86.5	5	13.5	37	100.0
6	AM	AMOXICILLIN	7	17.9	32	82.1	39	100.0
7	AU	AUGMENTIN	3	9.4	29	90.6	32	100.0
8	CN	GENTAMYCIN	31	96.9	1	3.1	32	100.0
9	PEF	PEFLOXACIN	33	86.8	5	13.2	38	100.0
10	OFX	OFLOXACIN	21	87.5	3	12.5	24	100.0
11	APX	AMPICLOX	7	63.6	4	36.4	11	100.0
12	Z	ZINNACEF	0	0.0	7	100.0	7	100.0
13	R	ROCEPHIN	1	14.3	6	85.7	7	100.0
14	E	ERYTHROMYCIN	6	66.7	3	33.3	9	100.0
	TOTAL		**171**	**48.7**	**180**	**51.3**	**351**	**100.0**

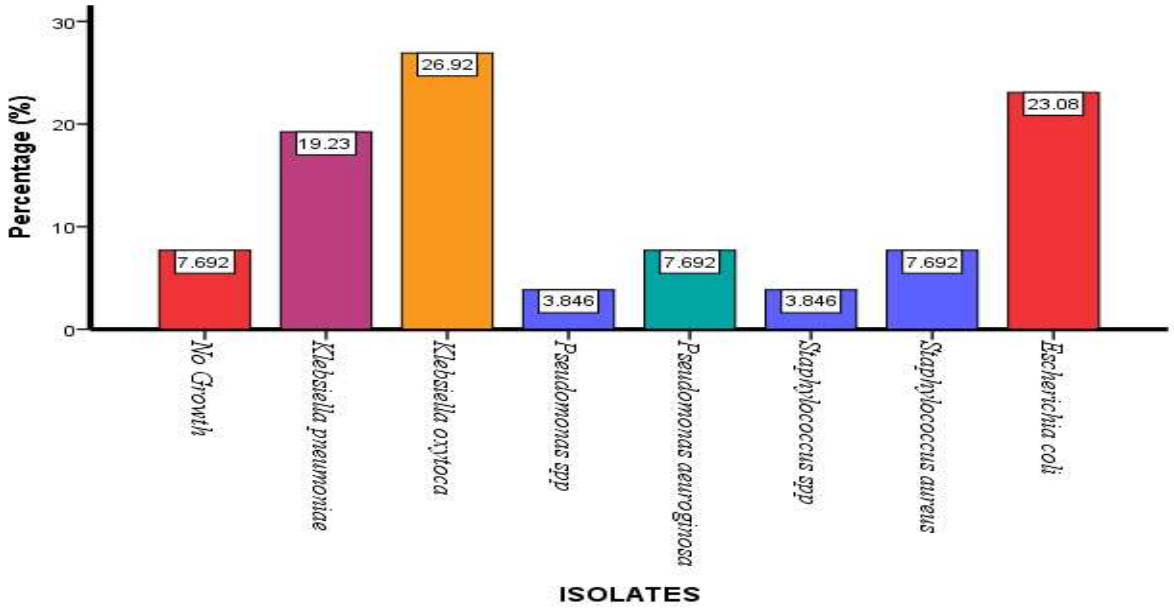

Figure 2: Distribution of bacteria isolated from food samples obtained from Oja oba.

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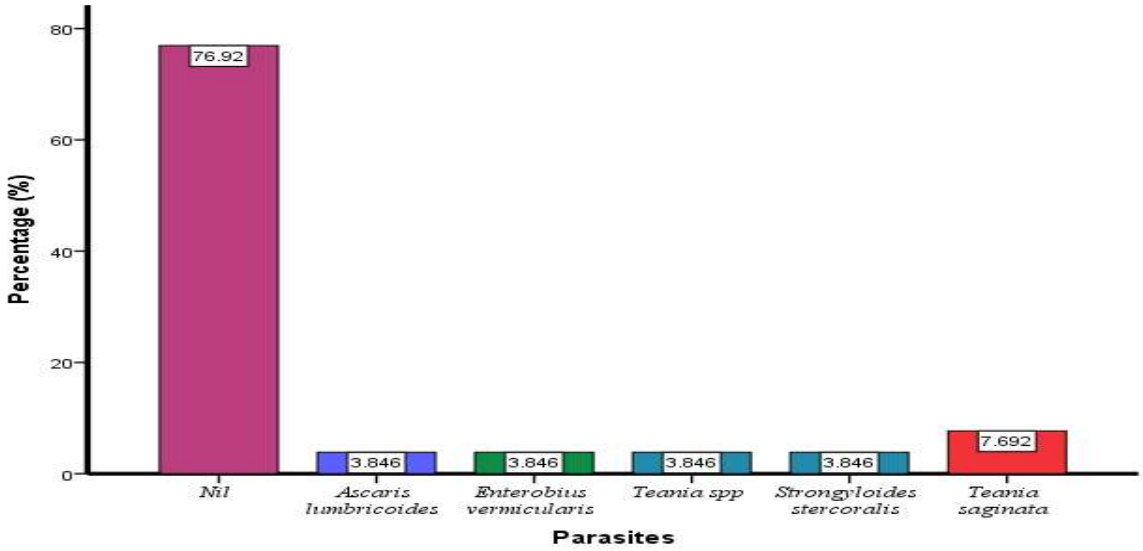

Figure 3: Distribution of parasites isolate from food samples obtained from Oja oba.

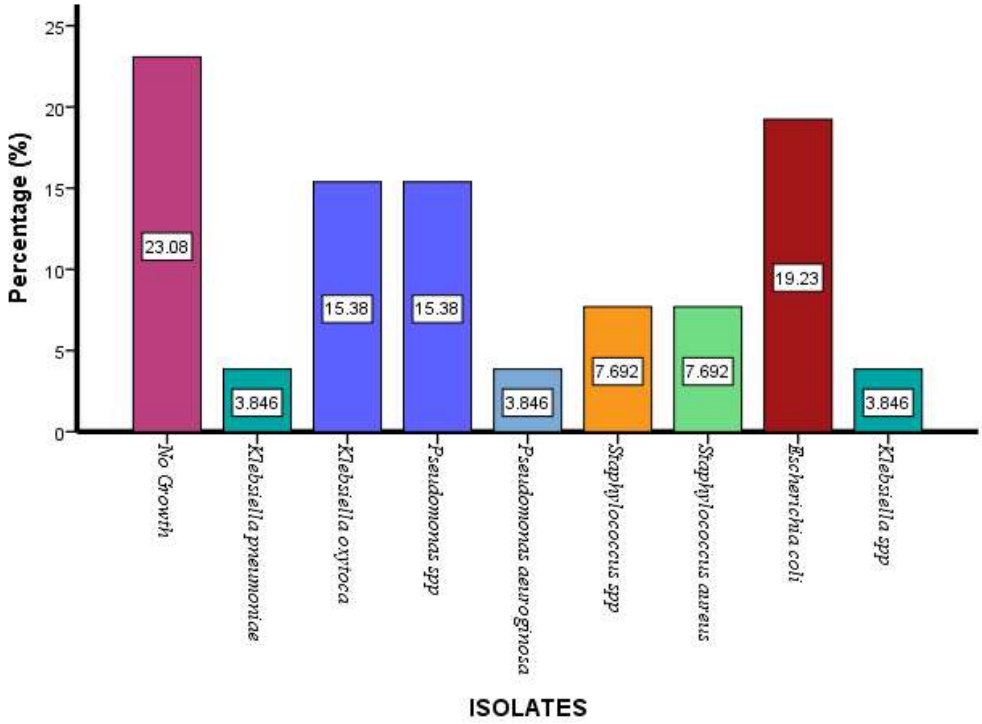

Figure 4: Distribution of bacteria isolated from food samples obtained from Oja koko.

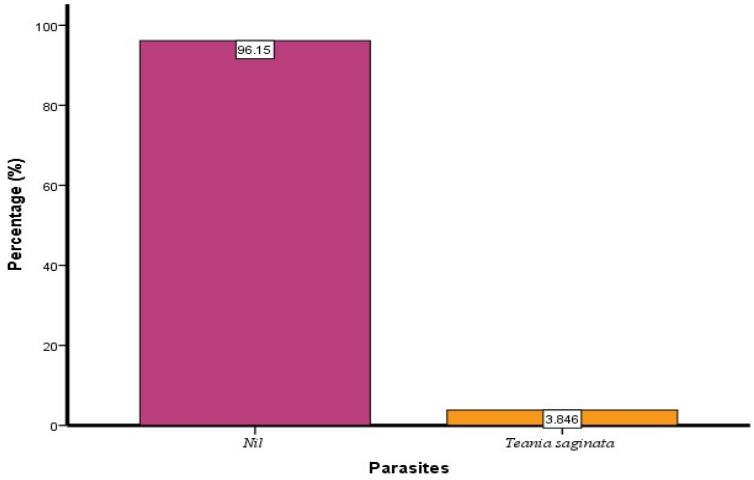

Figure 5: Distribution of parasites isolated from food samples obtained from Oja koko.

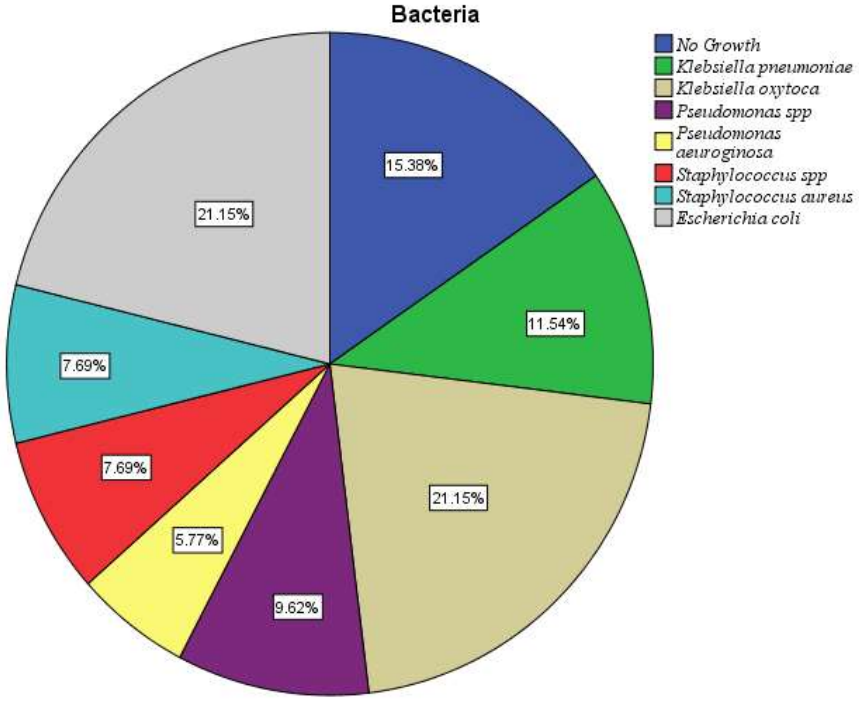

Figure 6: Prevalence rate of bacteria isolated from food samples obtained from Owo Markets

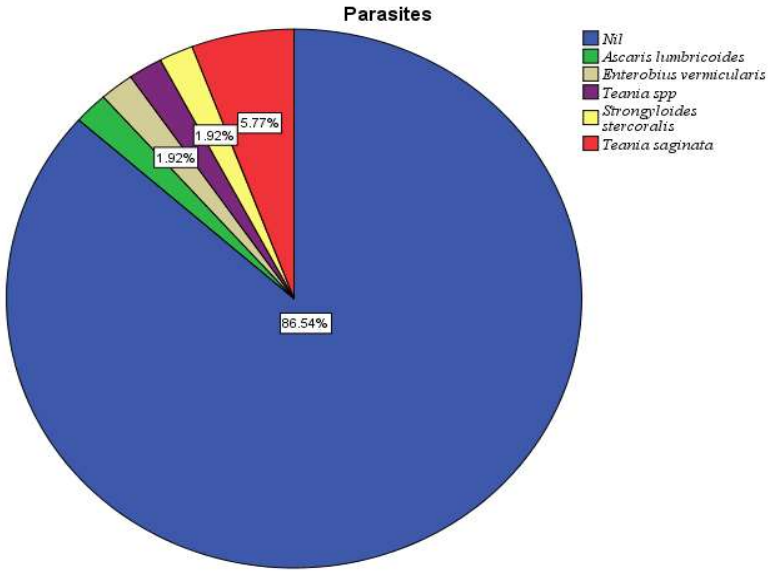

Figure 7: Prevalence rate of parasites isolated from food samples obtained from Owo Markets

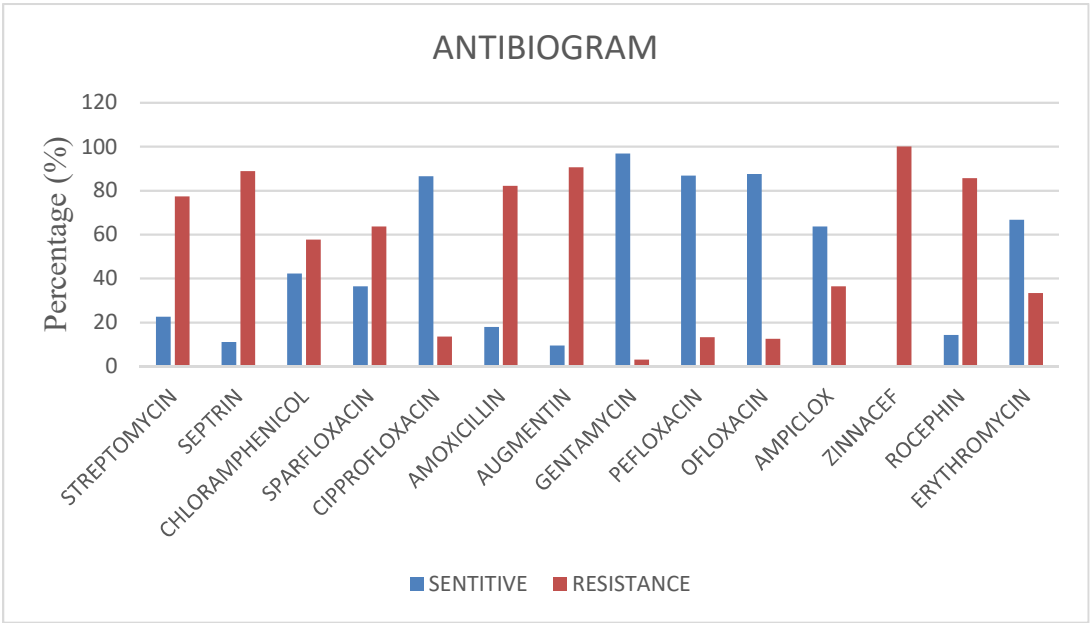

Figure 8: Antibiogram of bacteria isolated from food samples from obtained from Oja oba and oja koko.

4. DISCUSSION

The recovery of helminthes eggs and larvae, also with the isolation of bacteria from fruits and vegetables is indeed of great public health importance. Some of the vegetables and fruits may be eaten raw and could leadto infection and disease. Also the distribution of samples (Scent leave, cabbage, Arowojeja, Tomatoes, Green apple, Red apple, Beef, Cow tripe, Herrring fish, water leave, Dried fish, cow liver, spinach) gotten from both Oja Oba and Ojakoko and the number of isolates gotten from each food sample. The prevalence of Bacteria isolated from the samples gotten from Oja Oba and Oja Koko was seen in Table 4.1 and it revealed that the overall prevalence of Bacteria isolated from perishable food items in Owo Markets was 84.6%. This showed that fruits and vegetables in Owo market were more contaminated with bacteria than parasite (15.4%). The study reports a significant higher contamination by bacteria than parasite of the perishable items ($p< 0.05$).

Escherichia coli and *Klebsiella Oxytoca* been the highest prevalence of 21.2 % respectively was followed by *Klebsiella pneumoniae* which had a prevalence of 11.5%. Other *Pseudomonas spp* except *P. aeuroginosa* had prevalence of 9.6% and were followed by *Staphylococcus aureus* and other spieces of *Staphylococcus* with prevalence of 7.7% while *Pseudomonas aeruginosa* had the least prevalence of 5.7%. The table showed that *Klebsiella Oxytoca* and *Escherichia coli* were implicated with the highest occurrence in Microbial contamination and this could be as a result of poor hygiene when handling the food and another reason for the high rate of isolation could also be as a result of cross contamination from a previously infected food or the pH of the food. According to Table 2, the overall percentage of parasites isolated from perishable food items in Owo Markets (both Oja oba and Oja Koko) was 15.4% *with Teania saginata* having the highest percentage of 7.7% respectively, followed by *Ascaris lumbricoides, Strongyloides stercoralis* and other *Teania* spieces having a prevalence of 1.9% respectively. The table shows the distribution of the samples Scent leave, cabbage, Arowojeja, Tomatoes, Green apple, Red apple, Beef, Cow tripe, Herrring fish, water leave, Dried fish, cow liver, spinach) gotten from both Oja Oba and Ojakoko and the amount of parasites gotten from each food sample.

According to the Table, *T. saginata* was the highest isolated and it was found both the Beef and Cow tripe this is because the life cycle of *T. saginata. T. saginata* undergoes about 6 steps in the life cycle. The Life cycle begins with an Adult tapeworm residing in the small intestine of human where it lays its eggs (that are produced in it's Proglottids). The Gravid proglotids (containing the eggs) is released into the environment. Once the eggs are released into the environment through the feces, an intermediate host which is usually a grazing animal like cattle ingests the grass containing the eggs. The eggs then hatch (Oncospheres) in the animal's digestive system and is released into the intestinal wall of the cattle the Cysticerus then develops in the hosts tissue. Humans then get infected when he eats an improperly cooked or uncooked meat containing the cysticerus. The cysticerus was isolated from the cow and cow stripe because the cattle ate a grass that has been infected with the eggs of the *T. saginata* so if this meat is improperly uncooked and it is consumed the person could be infected. *T. saginata* was isolated as the highest with prevalence of 7.7% and this could be a result of improper sanitation or disposal of faeces. Antibiogram and efficacy of the antibiotics used against the bacteria isolated from the food samples obtained from both Oja Oba and Oja koko and according to the tables,

Gentamycin was sensitive with a percentage of 96.9% and resistance of about 3.1% and Zinnacef is the least effective isolates making it the most effective antibiotics against the bacteria isolated.

5. CONCLUSION

According to the study, the bacteria organism isolated the most is *Klebsiella oxytoca* and *Escherichia coli* and *Teania Saginata* was the highest isolated parasite from the food samples isolated from Oja Oba and Oja koko market, this is as a result of improper sanitation and handling of the food samples sold in both markets. Conclusively, the results of the present study had revealed that food items sold in Owo Markets are mainly contaminated by the bacteria than the parasite. Presence of these bacteria and parasites can pose a serious threat to the health of consumers and sellers because these organisms produce mycotoxins which can be very lethal when consumed by the sellers and the consumers that purchase these food items from these markets.

6. RECOMMENDATION

This study therefore recommends that proper storage and handling of food should be ensured. It is also recommended that the traders in the markets should be sensitized on the existence of these organisms and their effects on the health. It is also recommended that food like meats and cow tripe should be properly cooked before consumption. Farmers and sellers should also take necessary and appropriate precautions in preventing contamination and eating of contaminated food items.

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