FEACAL CARRIAGE RATE OF EXTENDED SPECTRUM BETA LACTAMASE PRODUCING ENTEROBACTERIACEAE AMONG FOOD VENDORS IN DAR ES SALAAM, TANZANIA

Lutengano William Mwanginde (BSc. HLS)

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Muhimbili University of Health and Allied Sciences
Department of Microbioogy and Immunology

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By

Lutengano William Mwanginde (BSc. HLS)

A dissertation Submitted in (Partial) Fulfillment of the requirements for the Degree of Master of Sciences (Microbiology and Immunology) of

Muhimbili University of Health and Allied Sciences
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CERTIFICATION

The undersigned certify that they have read and hereby recommend for acceptance by Muhimbili University of Health and Allied Sciences a dissertation entitled ***"Carriage rate of Extended Spectrum Beta-Lactamase producing enterobacteriaceae among food vendors in Dar es Salaam, Tanzania"***, in (partial) fulfillment of the requirements for the degree of Master of Science (Microbiology and Immunology) of the Muhimbili University of Health and allied Sciences.

…….

Dr. Agricola Joachim
(Supervisor)

…….....

Date

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DEDICATION

This dissertation is dedicated to my lovely wife, my daughter Vivian, my two sons Bill and Jordan for tolerating my absence all this time we haven’t been together.

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LIST OF ABBREVIATIONS

AMC	-	Amoxicilline-clavulanic acid
AMR	-	Antimicrobial Resistance
BSc	-	Bachelor of Science
CAZ	-	Ceftazidime
CLSI	-	Clinical and Laboratory Standards Institute
CTX	-	Cefotaxime
ESBL	-	Extended Spectrum Beta Lactamase
FAO	-	Food and Agriculture Organization
Fig	-	Figure
HLS	-	Health Laboratory Sciences
ID	-	Identification
KIA	-	Kligler Iron Agar
MUHAS	-	Muhimbili Univrsity of Health and Allied Sciences
MCA	-	MacConkey Agar
MHA	-	Mueller Hinton Agar
MNH	-	Muhimbili National Hospital
NA	-	Nutrient Agar
NO	-	Number
SIM	-	Sulfur Indole Motility
SOP	-	Standard Operating Procedure
SPSS	-	Statistical Package for Social Sciences
Tsh	-	Tanzanian shillings
WHO	-	World Health Organization

DEFINITION OF TERMS

Food vendor is the person who sells and is contaminated with poutry meat.

One Health refers to the inter relationship in health between animal, enviroment and human.

Extended Spetrum Beta-Lactamases are Gram-negative bacteria that produce an enzyme, beta-lactamase that has ability to break down commonly used antibiotics such as penicillin and cephalosporins and render them ineffective for treatment.

Poultry meat food vendor is someone who sells raw or cooked poultry meat at market place or in the street.

ABSTRACT

Background: Extended-Spectrum Beta-Lactamase (ESBL)-producing bacteria are Gram-negative bacteria that produce an enzyme, beta-lactamase that has ability to break down commonly used antibiotics such as penicillin and cephalosporins and render them ineffective for treatment. The ESBL producing bacteria are a common cause of nosacomial and community acquired infection worldwide. Poultry meat food vendors are at high risk of contacting ESBL due contamination with infected animal products when handling them. Most of food vendors do not wear hand protective gears when handling meat; therefore they get direct contamination with the contaminated poultry meat.

Aim: To determine the feacal carriage rate of ESBL producing Enterobacteriaceae among poutry meat food vendors in Dar es Salaam, Tanzania.

Method: A cross sectional study conducted among poultry meat food vendor in Dar es Salaam, Tanzania. The study included consented poultry meat food vendors from slaughterhouses and sellers of poultry meat in the streets and markets. Social-demographic data and associated factors were collected using standard structured questionnaires. Rectal swab samples were collected in transport media and processed at within 24hrs of collection. Specimen were cultured in MacConkey Agar supplemented with Ceftazidime. Identification of bacterial isolates were based on colonial characteristics, Gram stain and biochemical tests. ESBL producing enterobacteriaceae were confirmed by Double Disk Synergy method. Data were analysed using the Statistical Package for Social Sciences version 23. Association between ESBL and associated factors were analysed by logistic regression modeling. *P* value of < 0.05 were considered statistically significant.

Results: Among 300 studied poultry meat food vendors, 107 (35.7%) were ESBL carriers. Majority of ESBL producing enterobacteriaceae were *E. coli* (78.5%) were and *Klebsiella pneumoniae* (21.5%).

Conclusion: The study demonstrates feacal carriage rate of ESBL producing enterobacteriaceae among poultry meat food vendors. *Escherichia coli* and *Klebsiella pneumoniae* were the ESBL producing enterobacteriaceae associated with food vendors in Dar es Salaam, Tanzania.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Back ground

Extended-Spectrum Beta-Lactamase (ESBL)-producing bacteria are Gram-negative bacteria that produce an enzyme, beta-lactamase that has ability to break down commonly used antibiotics such as penicillin and cephalosporins and render them ineffective for treatment, like *Escherichia Coli* and *Klebsiella pneumoniae* (1). ESBL are common cause of nosocomial and community acquired infections, confer an increased resistance to commonly used antibiotics, and infections caused are associated with high morbidity and mortality worldwide (2). Of concern is the spreading of ESBL to human through foods substances particularly animal producing food or animal food products like meat, milk, fish, chicken meat and from the environment. Variety of foods production chain from farm to consumers, health individuals including those who directly contact with food animal pose a great danger for contamination (3). Increased irrational use of antimicrobial agents in animal farming may lead to emerging of antibiotic resistant strain. These resistant strains are transfered to human by direct contact with animal food products or through the consumption of contaminated food or water (4). ESBL producing enterobacteriaceae reduce the efficacy of the mordern expanded spectrum of beta lactam drugs based on plasmid mediated production of enzyme that innactivate these compounds by hydrolysing the beta lactum ring causing the emergency of antimicrobial resistance in human and verterinary medicine (5).

Antimicrobial drugs have been used in animal producing food to prevent, control and treat diseases. In some areas the drugs are used to increase the animal weight and even using the medications which are not approved for poultry or animal production (6). Such antibiotics abuse poses a great threat for emergency of antibiotic resistance strain including ESBL producing Enterobacteriaceae (7). Handling of contaminated animal food products increase the risk of contacting ESBL strains. Food producing animals including poultry meat may be save as source of spread of ESBL strains due to direct contact during slaughtering and selling, if proper hygience is not maintained (8).

Food vendors particulary those who handle chicken meat are more exposed during slaughtering, food preparation and even selling food animal products with bear hands. Also their working environments are not clean and safe for selling food (9). This study investigated the fecal carriage rate of ESBL producing enterobacteriaceae among the poultry food vendors in Dar es salaam, Tanzania.

1.2 Statement of the problem

Antimicrobial resistance has become a worldwide problem causing serious consequences on the treatment of infectious diseases. Irrational use of antibiotics in food chain production particularly poultry farming for growth promotion or improving feeding efficiency and treatment, posses a great risk of development of resistant strains such as ESBL. The ESBLstrain are transmitted to humanbeing when handling contaminated animal products (10). Study done in Vietnam reported higher prevalence of ESBL isolates in chicken meat (92.7%) compared to beef (34.3%) and fish (29.3%) (11). Handling or consumption of contaminated animal food products have been reported to have a potential risk of spreading ESBL strains by human via the food chain (12). Food vendors during processing poultry meat from slaughtering, washing guts and selling raw and/or cooked poultry meat come in contact with ESBL producing enterobacteriaceae (13).

The association between poultry meat and human health has become an important issue in poultry industry versus food safety (14). Studies conducted in Tanzania on ESBL carrige rate focused much in hospital settings, community and enviroment. There is limited data on the carriage rate of ESBL producing bacteria among food vendors in Dar es salaam (15). Poor hygiene and inappropriate food handling increases the risk of transmission of ESBL producing enterobacteriaceae from food vendors to customers and the community at large as results of food contamination (16). The ESBL carriage rate among food vendors in the community and their consequences toward AMR have not been extensively studied in Tanzania. There is little information about food vendors as potential carriers on the spreading ESBL producing bacteria to the community during serving their customers in Dar es salaam (17).

1.3 Rationale

There is an alarming increase of antibiotic resistance in bacteria that cause either community acquired infections or hospital acquired infections. In this case, the study help to provide information on the magnitude of carriage rate of ESBL among food vendors in Dar es Salaam. The prevalence which obtained from food vendors with that of hospital setting, community and enviroment is not ignored. It provides recommendations on the necessary steps to manage the situation including better surveillance to assess accurately the extent of the problems.

The study provides baseline information to improve the hygienic condition and their working environment. In addition, ONE HEALTH approach advocate the importance of ensuring the control of the transmission of pathogens from animals to human as this is crucial for prevention of spread of antimicrobial resistant strain to the community. It is important for public health authorities and poultry meat vendors processing outlet to collaborate in ensuring adherence to set out principles of processing and handling of chicken meat in order to reduce potential risks of infection.

1.4 Research Question

1. What are the common bacterial isolates of ESBL producing enterobacteriaceae associated with food vendors in Dar es Salaam?
2. What is the carriage rate of ESBL producing enterobacteriaceae among food vendors in Dar es Salaam?
3. What are the associated factors of ESBL producing enterobacteriaceae among food vendors in Dar es Salaam?

1.5 Objectives

1.5.1 Broad objective

To determine the feacal carriage rate and associated factors of ESBL producing enterobacteriaceae among poultry food vendors in Dar es Salaam.

1.5.2 Specific objectives

1. To determine the feacal carriage rate of ESBL producing enterobacteriaceae among poultry meat food vendors in Dar es Salaam.
2. To determine the associated factors of ESBL producing enterobacteriaceae among poultry meat food vendors in dar es Salaam.

CHAPTER TWO

2.0 LITERATURE REVIEW

Reports from WHO have shown that, the intestinal flora of animals can provide a reservior of antimicrobial-resistant bacteria that can be transimited to humans via handling of contaminated animal food (18). Studies conducted in Sub-Sahara Africa showed that, chickens can be reservor for several food-borne pathogens as well as antimicrobial resistance strains (19). Studies have showed that, ESBL producing bacteria isolated from poultry are frequently resistant to a broad spectrum antibiotics than those from beef or pork due to irrational antibiotics use (20). It is reported in Rwanda that, antimicrobial use in poultry farming was pointed out as one of the sources of antibiotic resistant bacteria that can be transfered to human through contamination when handling meat (21).

It was reported in Denmark that, there were great decline in antimicrobial resistance to the population after the descontinuations of using antimicrobial agents to animals (22). Reports from South Africa, indicated that out of 1500 diseases that affect people, almost two-thirds can pass between animal and human (23). In Ghana, agriculture consumes more than 80% of all antibiotics produced for which some are used in poultry industry for growth promotion (24). Studies conducted in United States of America showed that, antimicrobial agents has been used in livestock and poultry, which resulted in the emergence of ESBL producing bacteria and microbial resistant to human from animal food products through contamination (25). In Spain, it has been reported that the ESBL bacteria isolates *Escherichia Coli and Klebsiella pneumoniae* from chicken meat can lead to human infections with highly drug resistant bacteria strains (26). In Netherlands, it was found that the retail meat samples contained ESBL producing bacteria which were also present in human in contact with animal food products. This findings are suggestive of the contamination of ESBL from poultry to human (27).

The distribution of ESBL producing *Escherichia coli* in livestock and companion animals indicates that poultry account for 30 – 33% (28). ESBL producing *Escherichia coli* in poultry and chicken meat has been reported as a source of ESBL in human population (29). In Germany, studies indicated that ESBL producing *Escherichia coli* in pig, cattle and broiler farms emphasizing the impact of livestock animals as a resevour for resistant strains that can be transmitted to human through handling of contaminated animal food products (30).

It has bee reported in Tunisia that chicken husbandry was identified as a main food sector contributing development of antibiotic resistant genes resevours in animals that may be acquired by human through handling or consumption of contaminated meat (31). The use of chicken dropings in farming is another source of contamination as indicated by isolation of *Compylobacter spp* and *Escherichia coli* from cloacal cotents of live chicken (32).

The resistant genes /plasmid can be tranfered from broilers to human via the consumption of contaminated poultry meat (33). Studies in Vietnam, showed that ESBL producing E.coli was more frequently detected in the samples obatined from sloughterhouses (100%) than those collected in supermarkets (85%) (11). In aonther study done in Germany, showed that the rate of ESBL positive was high and identified health floaks as reseviour of antimicrobial reistant bacteria (34).

Studies in France indicated the prevalence of 10.7% of ESBL producing *Escherichia coli* in human that were related in part to contamination during sloughtering and in contact with food animal products including poultry meat (35). ESBL producing enterobacteriaceae derived from poutry meat and hospitalized patients showed a high degree of similarity of resistance gene patterns (36). Study done in Dutch, showed the carriage rate of 18% in human with ESBL producing bacteria from broilers and spread of these resistant bacteria to humans in tha genaral population (37). In a study done in Mwanza from the community found 16.5% of the individuals were colonized with ESBL producing enterobacteriaceae (38).

Studies in Tanzania reported the faecal carriage rate of 24.3% of ESBL faecal carriage in the community in Dar es salaam, shared latrines may serve as reservoir for transimission in Urban community settings (39). The prevalence of ESBL producing enterobacteriaceae *Escherichia coli* and *Klebsiella pneumoniae* among hospitalized children in Tanzania is 50.4%, compared to children from the community with 11.69% (40). Studies done in Tanzania reported the prevalence of 28% of ESBL bacteria in the hospital settings and the commoly ESBL producing bacteria isolated were *Escherichia coli* and *Klebsiella pneumoniae.*

CHAPTER THREE

3.0 METHODOLOGY

3.1 Study design and setting

This was cross sectional study conducted in Dar es salaam, Tanzania. This study included poultry meat food vendors selling raw and cooked meat in streets and markets.

3.2 Study duration

The study was conducted between June and July, 2018

3.3 Study population

This included all sellers of raw and cooked poutry meat in the streets and markets.

3.4 Inclusion criteria

1. All poultry meat food vendors who have been in the field for more than three months
2. Health individual with no complain of illness.
3. Provided writen informed consent to participate in the research.

3.5 Exclusion criteria

1. Those with history of antibiotics use within two weeks before the commenciment of study.
2. History of previous hospital admission one month before commenciment of study.
3. Refused to provide written informed consent.

3.6 Sampling method

Multistage sampling were done from district to the ward level. Dar es Salaam has five districts namely Ilala with 25 wards, Kinondoni (34 wards) Temeke (30 wards), Kigamboni (9 wards) and Ubungo (14 wards). Of 107 wards, 23 wards were picked randomly and be included in the study. This was subjected to proportion to size (number of wards per district), for which Ilala were 5 wards, Kinondoni 7 wards, Temeke 6 wards, Ubungo 3 wards and Kigamboni 2 wards were included.

At the ward level, participants were obtained by simple random sampling (subject to proportion to size). Number of participants from picked wards were 80 participants from Kinondoni, 70 participants from Temeke, 60 participants from Ilala, 50 participants from Ubungo and 40 participants from Kigamboni district.

3.7 Sample size

The sample size was calculated using Fisher's formula

$n=Z^2P(1-P)/E^2$

Where: n= sample size,

Z = (1.96)

P = prevalence (24.3%). This was the prevalence of ESBL producing isolates among people using private and shared latrines for all adult incuding vendors in an informal urban settlement in Dar es Salaam (39).

95% confidence interval were used.

E = margin error 5%

Therefore $n= (1.96)^2 \times 0.243 (1 - 0.243)/ (0.05)^2 =283$

We sampled an extra 5% to account for possible non-response

n=297

Thus the sample size in this study were 300.

3.8 Data collection

Food vendors were visited at their working station. Detail explanation about the study and its importance were given and requested to participate in the study. Those that who consented were recruited into the study. Instructions on how to collect rectal swab by themselves were provided. Data were collected using a structured questionnaire which were filled by study investigator. Socio-demographics and associated factors including use of shared toilets, history of use antibiotics with self medication, hygienic behaviour, duration being in the business and use of clean water.

3.9 Sample collection, bacterial isolation and identification

Rectal swab samples were collected by participants themselves and then inserted onto Carry Blair transport media. The sample was transported in a cool box with ice packs to Microbiology and Immunology laboratory at MUHAS. Sample was inoculated in MacConkey Agar No.3 supplemented with Ceftazidime, within 24 hrs after collection. The culture media was incubated at 37 ± 2^{o}C for 18 to 24 hours. Bacterial isolates were identified based on colonial characteristics, Gram stain reaction and biochemical tests. Biochemical tests included Kliglers Iron Agar (KIA), Sulfide Indole Motility (SIM), Citrate, Oxidase and Indole (Kovacs's reagent).

ESBL producing isolates were confirmed by Double Disc Synergy method as per CLSI (41). Initially, colonial suspension equals to 0.5 McFarland standard were prepared in a falcon tube, then the suspension was inoculated in MHA in three different overlapping directions each at 60˚(42). Three disks were used; ceftazidime (CAZ) 30µg, cefotaxime (CTX) 30µg and amoxicillin-clavulanic acid (AMC) 30µg. The AMC was placed at the center of the CTX and CAZ at a distance of 20mm apart from one disc to another. The media was incubated at 37 ± 2 C^{o} incubator for 18 to 24 hours, then the results were observed such that the zone of inhibition induced of either CAZ or CTX or both towards AMC indicated ESBL positive, otherwise were interpreted as ESBL negative (43).

Escherichia coli ATCC 25922 and *Klebsiella pneumoniae* ATCC 700603 were used as standard quality control organism.

3.10 Data analysis

Dependent variables; were the presence or absence of ESBL among food vendors. Independent variables included the categorical data: sex, age and residence. The associated factors: use of hand protective, use of latrine, self medication and source of water.

Data was entered and analysed using the Statistical Packages for the Social Sciences (SPSS) version 23.0. Categorical variables were summarized using proportions while continuous variables was summarized by calculating means and standard deviations. Chi-square test was used to compare differences between proportions and T-test for comparison between means. Logistic regression modeling were done to determine the associated

factors of ESBL carriage among poultry meat food vendors. Both crude and adjusted Odds ratio were calculated and presented with corresponding 95% confidence intervals. All the analysis were two-tailed and significance level set at 5%.

3.11 Ethical clearance and consideration

Ethical approval to conduct the study was obtained from MUHAS Institution Research Board and Publication Committee. Permision to conduct the study was also sought from the District and Municipal authorities. Information about the study were given to all study participants. Written informed consent were obtained from each participant before recruitment. The interview was conducted in privacy. All the information collected and findings were confidential. Data were handled confidentially and stored in a secured place.

CHAPTER FOUR

4.0 RESULTS

4.1 Demographic characteristics of study participants

A total of 300 poultry food vendors were enrolled in this study. Majority of the study population were male 202 (67.3%). Many study participants 138 (46.0%) were aged between 19 and 24 years. More that quarter 80 (26.7%) of the participants enrolled in this study were from Kinondoni district followed by participants from Temeke district 70 (23.3%). Majority of the participants 224 (74.7%) have been working as food vendors for more than one year (Table 1). All (100%) of study participants do not use hand protective when handling poultry meat. Also, all participant use shared public latrines while at work, they use those from near by restaurant or hotels. The study participants had no access to running tape water close at their working areas for hand washing after handling poultry meat or after visiting the toilet. Half of the study participants 151 (50.3%) reported history of self medication with antibiotics for more than three months before commencement of study (Table 1).

Table 1: Demographic distribution of study participants.

Variables	Frequency (n)	Percentage (%)
Age group		
19 – 24	138	46
25 – 30	85	28.3
31 – 36	43	14.3
≥ 37	34	11.3
Sex		
Male	202	67.3
Female	98	32.7
Residence (districts)		
Ubungo	50	16.7
Ilala	60	20.0
Temeke	70	23.3
Kigamboni	40	13.3
Kinondoni	80	26.7
Duration in business of food vendor		
≥ 3 months to 1year	76	25.3
> 1year	224	74.7
Use of latrine		
Shared	300	100
Not shared	0	0.0
Source of running tape water		
No	300	100
Use of hands protective		
No	300	100
Self medication with antibiotics > 3 months		
Yes	151	50.3
No	149	49.7

4.2 Distribution of ESBL isolates

A total of 130 bacteria were isolated from 300 rectal swab samples of which 101 (77.7%) were *Escherichia coli* and 29 (22.3%) were *Klebsiella pneumonia*. Of 130 bacteria isolated, 107 (82.3) were confirmed ESBL positive and the rest 23 (17.7%) tested ESBL negative. Out of 107 ESBL producer, 84 (78.5%) were *Escherichia coli* isolates and 23 (21.5%) were *K. pneumoniae* (Figure 1).

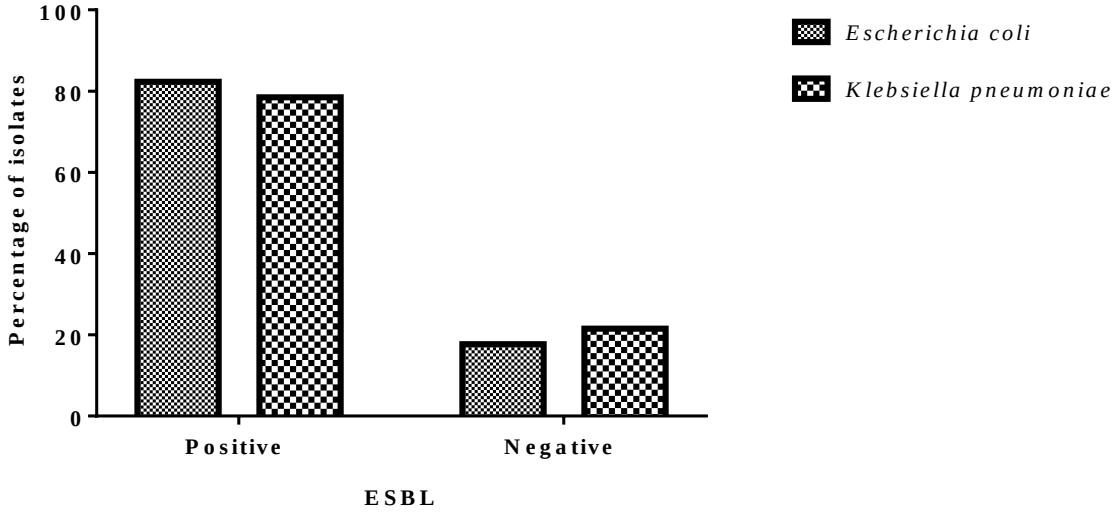


Figure 1. **Distribution of ESBL isolates**

4.3 Distribution of ESBL producing bacteria among study participants.

The frequency of ESBL carriage were high 53 (38.4%) among participants aged 19-24 years. At the district level, the carriage were 24 (48.0%) Ubungo and 15 (21.4%) Temeke. This difference from the district level was statistically significant, (P = 0.030) as in Table 2. ESBL colonization among female participants were higher (37.8%) than male participants (34.7%), but this difference was not statistically significant (P = 0.599). The carriage of ESBL among participants who worked as poultry food vendor for more than three months were 36.8% (Table 2).

Table 2: Distribution of ESBL producing enterobacteriaceae among study participants

Variable	Total N=300	ESBL positive n (%)	*P*- value
Age group			
19 – 24	138	53 (38.4)	
25 – 30	85	26 (30.6)	
31 – 36	43	14 (32.6)	
≥ 37	34	14 (32.6)	0.565
Sex			
Male	202	70 (34.7)	
Female	98	37 (37.8)	0.599
Residence (Districts)			
Ubungo	50	24 (48.0)	
Ilala	60	25 (41.7)	
Temeke	70	15 (21.4)	
Kigamboni	40	13 (32.5)	
Kinondoni	80	30 (37.5)	0.030
Duration in business of food vendor			
≥ 3 months to 1year	76	28 (36.8)	
> 1year	224	79 (35.3)	0.804

4.4 Factors associated with ESBL producing enterobacteriaceae among study participants.

Study participants from Ubungo, Ilala, Kigamboni had significant high feacal carriage of ESBL producing enterobacterieceae compared to participants from Temeke district p = 0.003, OR= 3.3, CI 95%; (1.53 – 7.50), p = 0.014, OR = 2.619, CI 95%; (1.22 – 5.64), p = 0.034, OR = 2.200, CI 95%; (1.06 – 4.56) and p = 0.035 respectively. There were association observed between ESBL carriage and the residences $p > 0.05$ (Table 3). Other associated factors were not included in the logistic regression because all study participants had the same characteristics as; did not use hand protectives, had no running tape water for wshing hands and shared latrines.

Table 4. Univariate and Multivariate analysis of associated factors for ESBL producing enterobacteriaceae among study participants.

			Univariate			Multivariate		
Variable	Total N	ESBL Positive n (%)	cOR	95% CI	P-value	aOR	95% CI	P-value
Age	300	107 (35.7)	1.008	(0.97 – 1.04)	0.66			
Sex								
Male	202	70 (34.7)	0.874	(0.53 – 1.44)	0.59			
Female	98	34 (37.8)	1[a]					
Residence								
Ubungo	50	24 (48.0)	3.385	(1.53 – 7.50)	0.003	3.464	(1.54 – 7.79)	0.003
Ilala	60	25 (41.7)	2.619	(1.22 – 5.64)	0.014	2.702	(1.25 –5.87)	0.012
Kigamboni	40	13 (32.5)	1.765	(0.74 – 4.23)	0.202	1.761	(0.73 – 4.23)	0.206
Kinondoni	80	30 (37.5)	2.200	(1.06 – 4.56)	0.034	2.232	(1.08 - 4.63)	0.031
Temeke	70	15 (21.4)	1[a]		0.035	1[a]		0.033
Duration in the business								
Above 3 months	76	28 (36.8)	1[a]					
Above 1 year	224	79 (35.3)	0.934	(0.54 – 1.60)	0.804			
Self-medication								
Yes	151	53 (35.1)	1[a]					
No	149	54 (36.2)	1.051	(0.66 – 1.69)	0.836			

N: Total number of poultry meat food vendors subjected to ESBL confirmatory test, n: number of food vendors confirmed to carry ESBL producing enterobacteriaceae, 1[a]: Refference category, cOR: crude odds ratio, aOR adjusted odds ratio.

CHAPTER FIVE

5.0 DISCUSSION

The present study demontrate a high feacal carriage rate of 35.7% for ESBL producing enterobateriaceae among poultry food vendors in Dar es Salaam. Although there is no similar study done in Tanzania this finding is higher than the previous reported ESBL feacal carriage (24.3%) from the study conducted in the community among people sharing latrines in Dar es salaam (39). The high prevalence may be due to direct contact with poultry meat that may be carrying or contaminated with ESBL strain, poor hygiene practices on their working enviroment as well as as lack safe and enough water for washing hands and other uses.

In this study *Escherichia coli* was the most common ESBL isolated among food vendors. The results are inline with findings from other study conducted in Tanzania where *Escherichia coli* and *Klebsiella pneumoniae* were reported as the most common causes of community acquired infection, contributing up to 47.0% (45). Furthermore, studies done in Mwanza on companion and domestic animals carrying ESBL producing bacteria reported a rate of 21.7 % (7) lower than the finding from the current study. This suggests that handling poultry meat may increase the chance of acquiring ESBL compared with domestic animals meat. In another study from Sub-Saharan Africa reported the rate of contamination of chicken with ESBL producing *Escherichia coli* were 23.0% (47).

Irrational use of antibiotics among human and animals have been reported to increase the risk of development of resistance strains particularly ESBL. This study found that 50.3% of the participants interviewed, practice self antibiotic medication which might have contributed to the high carriage rate observed. There were no water tapes close or near the working area for all food vendors. None of the food vendor in this study use running water for hand washing instead they used water in the buckets or tins for washing hands and cleaning tables. Washing from same bucket may also increase the contamination rate thus spreading the ESBL strains. Studies in France reported the prevalence of 10.7% of ESBL producing *E. coli* in human that were related with contamination during sloughtering and/or in contact with food animal products including poultry meat. The lower prevalence compared to Tanzania, could be due to the fact that France is the developed country and

personal hygienic practice or handling of poutry meat (35) is quite different. Study done in Dutch, reported the carriage rate of 18% in human with ESBL producing bacteria from broilers and spread of these resistant bacteria to humans in tha genaral population (37).

There was association between ESBL fecal carriage rate and sex, age or duration of one being in the poutry meat bussiness. The study report carriage rate of ESBL from study population in five districts with differences which were statistically significant. Handling contaminated animal food products increase the risk of transmission of ESBL strains (8, 9). In this study, all food vendors were not using hand protectives gears like cloves when processing and serving the customers and hence had direct contact with poultry meat.

This study reports most of food vendors were young age between 19 – 24. This observations would probably suggest that many young men prefer this business as the self emmployed. This study enrolled study population from five districts in Dar es Salaam, from these, the carriage of ESBL showed the differences which were statistically significant. This indicates that there is strong asssociation between the districts having a high chance of getting carriage of ESBL when exposed in the business.ESBL producing enterobacteriaceae were commmon among *C. coli* compared to the *Klebsiella pneumoniae* isolates which is in agreement with the study reported in Spain (26). This study isolated 130 organisms from the screening media but only 107 were confirmed ESBL positive. The ESBL negative could be due to presence of other resistance genes other than ESBL suggesting that ther is a need to test for other resistance genes like carbanepenemes in the fututre. In this study we found an association of ESBL producers and residence. The reason may be due to the difference in hygienic practice.

In our settings screening for ESBL production among bacteria isolates is not routinely done in many clinical settings and the evidence of treatment failure of most antibiotics is not well documented. Thus, the detection of ESBLs among food vendors indicates that there is a problem in the community as these poultry meat food vendors are part of the community. Whenever diagnosed, use of appropriate antibacterial agents is of critical important, therefore, routine ESBL detection in laboratories recommended (49).

There are limited data from surveillance studies on feacal carriage of ESBL producing enterobacteriaceae among food vendors in Tanzania. To the best of our knowledge this is the first report from the region with focus on investigating the prevalence of ESBL producing isolates from this specified group. Therefore, our study presents the baseline information on the ESBL prevalence among poultry meat food vendors and its associated factors. This present study suggests that clinical microbiology laboratories should take into account the diagnosis of ESBL producers coming from the community whic include this specific group of poultry food vendors. Also, the government should have a policy that will direct screening of food vendors before they start selling poultry meat in order to avoid the spread of ESBL to the customers. This will help in defining the degree of the problem in the community so as to establish a proper methods for controlling the spread of ESBL and comprehensive hygiene protocol.

The limitation of this study was lack of funds to perform molecular analysis inorder to determine the resistant genes associated with ESBL among food vendors.

Conclusion:

The study demonstrates high feacal carriage rate of ESBL producing enterobacteriaceae among poultry meat food vendors. *Escherichia coli* and *Klebsiella pneumoniae* were the ESBL producing enterobacteriaceae associated with food vendors in Dar es Salaam, Tanzania. Direct contact with poultry meat without hand protective and poor hygienic behavior were associated with high carriage of ESBL.

Recommendations:

(i) We recommend the Government through regional and districts health officers to advice poultry meat food vendors to use hand protective and on proper personal hygiene when handling poultry meat, in order to prevent contamination of meat with ESBL producing bacteria.

(ii) Further studies should be done for swabing the tables and the hands of food vendors while at work in order to find out whether the ESBL is from chicken meat.

(iii) Perform routine screening of ESBL among food vendors

We recommend to desseminate this information obtained to the Dar es Salaam Regional Commissioner, all district commissioners for their attention health officers and community

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APPENDICES

Appendix I: Consent Form (English Version)

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES

DIRECTORATE OF RESEARCH AND PUBLICATIONS, MUHAS

ID-NO…….....

Consent to Participate in a Study

My name is Luengano William Mwanginde; I am conducting study on Carriage rate of ESBL producing enterobacteriaceae among poultry meat food vendors at MNH.

Study Purpose

ESBL are produced by variety of gram negative bacteria which cause increased resiastance to commonly used antibiotics. It is capable of causing infections in human through food, the enviroment and health people. Therfore, this study aims to establish baseline iformation on the carriage rate of ESBL among food vendors and the associated factors, for which the awareness will be made for prevention and those affected will be adviced to go to hosptial for further check up.

Also, this study is conducted as partial fulfillment of the requirements of MSc in Microbiology and immunology at MUHAS.

How to participate

The poultry meat food vendors who agree to participate in this study will be required to sign the consent form, then interviewed after that.

Confidentiality

The information obtained from you will be confidential. No name will appear on any document of this study instead Identification numbers will be used.

Participation and right to Withdraw

Involvement in this study is voluntary. You can participate or refuse to participate from this study. Refusal to participate from this study will not interfere with your management.

Benefits

The information that you provide will help us to obtain findings of the carriage rate of ESBL bacteria among poultry meat food vendors and associated risk factors. Thus the study outcomes will help to bring advocasy for prevention and control the spread of ESBL bacteria and improve hygienic bahavour thus improving quality of life.

Contact Personally

If you ever have questions about this study, you should contact the Principal Investigator, Lutengano William Mwanginde, Muhimbili University of Health and Allied Sciences, P. O. Box 65001, Dar es Salaam. Tel. 0756 094 309**.**

OR in case you have questions about your rights of participation in this study you may contact

Chairperson of the Senate Research and Publications Committee,
P. O. Box 65001 DSM.
Telephone**:** +255 022 2152489

Participant agrees ……..

I ……. have read the contents in this form. My questions have been answered. I am willing to participate in this study.

Signature of participant ……Date…….……

Signature of Researcher ……..Date…….

Appendix II: Consent Form (Toleo la Kiswahili)

CHUO KIKUU CHA SAYANSI ZA AFYA MUHIMBILI

KURUGENZI YA TAFITI NA UCHAPISHAJI

FOMU YA RIDHAA

Namba ya utambulisho .....

Ridhaa ya kushiriki kwenye utafiti

Jina langu ni Lutengano William Mwanginde, nafanya utafiti wenye lengo la kuangalia ESBL kwa wanaochinja, wanaoosha na kuuza nyama za kuku zilizozalishwa nchini Tanzania katika Hopitali ya Taifa Muhimbili.

Madhumuni ya Utafiti huu ni pamoja na kutimiza sehemu ya matakwa ya shahada ya uzamili

ya matibabu kitengo cha vipimo vya mionzi Chuo Kikuu cha Afya na Sayansi ya Tiba Muhimbili. Hali kadhalika kupata vipimo ambavyo vinaweza kutumika kwenye kutoa elimu ya tiba na jinsi ya matumizi ya dawa za antibiotic kwa kuku na binadamu.

Jinsi ya kushiriki

Ukikubali mtoto kushiriki katika utafiti huu, utasailiwa alafu utatakiwa kujibu maswali kutoka

kwenye dodoso lililoandaliwa alafu mtoto ataendelea na kipimo kama kawaida.

Usiri

Taarifa zote zitakazokusanywa kupitia dodoso hili zitakuwa ni siri. Jina lako halitatumika badala yake tutatumia namba ya utambulisho.

Uhuru wa kushiriki na haki ya kujitoa

Kushiriki kwenye utafiti huu ni hiari. Unaweza kushiriki au kukataa kushiriki na hii haitakuondolea haki ya kupata matibabu yako.

Nani wa kuwasiliana naye

Kama una maswali kuhusiana na utafiti huu, wasiliana na mtafiti mkuu, Lutengano William,

Chuo Kikuu cha Afya na Sayansi ya Tiba Muhimbili, S. L. P. 65001, Dar es Salaam.

Simu 0756 094 309.

Mwenyekiti wa kamati ya Utafiti na Uchapishaji, S.L.P 65001,

Dar es Salaam. Simu +255 022 2152489**.**

Kama umekubali kushiriki weka sahihi

Mshiriki nimekubali …….....

Mimi..... nimesoma maelezo ya fomu hii nimeyaelewa na nimekubali kushiriki katika utafiti huu.

Sahihi ya mshiriki…… Tarehe ya kutia sahihi…….....

Sahihi ya mtafiti……

Tarehe ya kutia sahihi…….

Appendix III: Questionnaire –English Version

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES

SCHOOL OF MEDICINE,

DEPARTMENT OF MICROBIOLOGY AND IMMUNOLOGY.

TITLE:

CARRIAGE RATE OF EXTENDED SPECTRUM BETA-LACTAMASE PRODUCING ENTEROBACTERIACEAE AMONG FOOD VENDORS IN DARE ES SALAAM

Identity number ……. Age …… Sex F/M ..... Location .....

A. Duration in the field of being food vendor

(1). How long are you in this bussiness in month (s)? 3. ☐ I year. ☐ Above ☐ year ☐

B. Clinical information:

(2). Are you in medical treatment with antibiotics? 1.Yes. ☐ 2.No. ☐

(3). When was your your last medication with antibiotics?

1. Three weeks ago ☐ 2.one month ago ☐ 3. None ☐

(4). Have you had any diarrhea or stomachache before? 1. Yes. ☐ 2. No. ☐

(5). If Yes, didi you go to the hospital for check up? 1. Yes. ☐ 2. No. ☐

ASSESS ON RISK FACTORS

C. Personal hygiene:

(6). Is clean water available for washing hands? 1. Yes. ☐ 2. No. ☐

(7). Do you use of hand protective? 1. Yes. ☐ 2. No. ☐

(8). Do you have a history with prolonged cough? 1. Yes. ☐ 2. No. ☐

(9). Do you have a history with diarrhea? 1. Yes. ☐ 2. No. ☐

D. Use of latrines:

(10). Do you share toilets? 1. Yes ☐ 2. No ☐

(11). Do you use of safe and clean water? 1. Yes. ☐ 2. No. ☐

(12). Do you use of toilet papers? 1. Yes. ☐ 2. No. ☐

(13). Is latrine available at the working area? 1.Yes. ☐ 2. No. ☐

E. Working environments:

(14). Is the table clean? 1. Yes. ☐ 2.No. ☐

(15). Do you clean knives, bowels and plates? 1. Yes. ☐ 2. No. ☐

(16). Are water channels available? 1. Yes. ☐ 2. No. ☐

(17). Is self medication your choice without going to the hospital? 1. Yes ☐ 2. No ☐

Appendix III: Questionnaire. (Toleo la Kiswahili)

CHUO KIKUU CHA AFYA NA TIBA MUHIMBILI,

SHULE YA MEDICINE,

IDARA YA MAIKROBAIOLOJIA NA IMMUNOLOJIA.

TOPIKI:

UWEPO WA BACTERIA WANAOBEBA NA KUSAMBAZA VIMELEA VYA USUGU WA DAWA ZA ATIBIOTICS MIONGONI MWA WAUZAJI WA NYAMA ZA KUKU MKOANI DARE ES SALAAM, TANZANIA.

Namba ya utambulisho ……. Umri…… Jinsia Ke/Me ..... Eneo .....

A. Muda ambao upo ndani ya hii biashara ya kuuza nyama za kuku:

(1). Je, unafanya biashara hii kwa muda gani sasa? (Mwezi au miezi)

3. ☐ mwaka 1. ☐ Zaidi ya mwaka ☐

B. Taarifa binafsi kuhusu afya:

(2). Je, upo kwenye matibabu na dawa za antibiotics? 1. Ndiyo 2. Hapana ☐

(3). Ni lini mara ya mwisho kutibiwa na dawa za antibiotics?

1. Wiki tatu zilizopita ☐ 2. Mwezi ulopita ☐ 3. Ziaidi ya mwezi ☐ ulopita

(4). Je, uliugua ugonjwa wa tumbo au kuharisha? 1. Ndiyo ☐ 2. Hapana ☐

(5). Kama ni Ndiyo, je, ulitibiwa hospitali? 1. Ndiyo ☐ 2. Hapana ☐

KUHUSU VIASHIRIA VYA KUPATA MAAMBUKIZI:

C. Usafi binafsi:

(6). Je, kuna maji safi ya kuosha mikono? 1. Ndiyo ☐ 2. Hapana ☐

(7). Je, unatumia vifaa kinga vya mikononi? 1. Ndiyo ☐ 2. Hapana ☐

(8). Je, unakikohozi cha mara kwa mara? 1. Ndiyo ☐ 2. Hapana ☐

(9). Je, una magonjwa ya kuharisha ya mara kwa mara? 1. Ndiyo ☐ 2. Hapana ☐

D. Matumizi ya choo/vyoo:

(10). Je, unatumia choo cha pamoja? 1. Ndiyo ☐ 2. Hapana ☐

(11). Je, unatumia maji safi chooni kwa kunawa mikono? 1. Ndiyo ☐ Hapana ☐

(12). Je, unatumia toilet paper? 1. Ndiyo ☐ 2. Hapana ☐

(13). Je, Choo kipo jirani na eneo la biashara? 1. Ndiyo ☐ 2. Hapana ☐

E. Eneo la kufanyia biashara:

(14). Je, meza ya kuuzia nyama ya kuku ni safi? 1. Ndiyo ☐ 2. Hapana ☐

(15). Je, unaosha meza kwa maji safi ya bomba? 1. Ndiyo ☐ 2. Hapana ☐

(16). Je, unaosha vifaa vya kukatia nyama za kuku? 1. Ndiyo ☐ 2. Hapana ☐

(17). Je, huwa unajitibia mwenyewe kwa kununua dawa za antibiotics bila kwenda hospitalini kupima afya?

1. Ndiyo ☐ 2. Hapana ☐