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Original research

Public health assessment of consumers on knowledge of food-borne zoonoses in Umuahia, Abia State: A pilot study

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ABSTRACT

Emerging and re-emerging pathogens emanating from food-borne zoonoses are becoming triggering factors to global health threats causing diseases of increased human cases and deaths annually. The knowledge of foodborne zoonotic sources, types, preventive methods and health risks were assessed in this study. Umuahia North, Umuahia South and Ikwuano Local Government Areas (LGAs) were purposively selected being active urban areas. A validated well-structured questionnaire was administered to consenting respondents randomly selected from the study site. Data generated were analysed with statistical significance at $p \leq 0.05$. One hundred and sixty nine (169) respondents participated in the study and most (52%) of the respondents were females, 53% married, 57% aged 24-29 years and 53% had tertiary education. Seventy five percent (75%) of the respondents had good knowledge of zoonoses but 62% knew the types of zoonoses. Seventy seven percent (77%) of the respondents had good knowledge of food-borne zoonoses, 96% on preventive methods, 90% on associated health risks but poor knowledge on types of foodborne zoonoses. Gender ($\chi 2$ =5.161, df=1, p = 0.023), educational status ($\chi 2$ =15.882, df=3, p = 0.001) and occupation ($\chi 2$ =15.945, df=7, p = 0.026) were statistically associated with level of knowledge of food-borne zoonoses. Respondents with tertiary education (OR= 2.909, CI =1.27-6.66, p = 0.011) and animal handlers (OR= 1.428, CI =1.07-1.90, p = 0.015) were more knowledgeable than others within the same category. More surveillance efforts by way of increased research, adequate education and public awareness campaign are recommended on a larger scale in Abia State.

KeyWords: Foodborne zoonoses, knowledge assessment, preventive measures, Umuahia

INTRODUCTION

Food-borne zoonoses are human infections transmitted through ingested food and caused by pathogens whose natural reservoirs are vertebrate animal species (Rahman *et al*., 2020). Worldwide, the consumption of animal products like meat, milk, and egg is increasing due to rapid human population growth, urbanization, per capita income raise, globalization, and the changes on consumer habits such as preference of high-protein diet (Henchion *et al*., 2017; Cockx *et al*., 2019). In situations of meeting the high demands of animal proteins, there may be defective processing practices at any point of the farm to fork chain which increase the chances of contamination and spread of food-borne pathogens (Dhama *et al*., 2013; Heredia & Garcia, 2018). Food products may become contaminated at different stages along the food chain especially during production, processing, distribution, preparation, and/or final consumption (Balali *et al*., 2020). According to World Health Organization (WHO), foodborne diseases are defined as diseases of infectious or toxic nature which are caused by the consumption of food or water by man or animals (WHO, 2022). Global prevalence is quite high with about 6oo million cases annually (WHO, 2015), the fatality reaching up to 420, 000 deaths world wide and 200,000 deaths annually in Nigeria (Ibirogba, 2021). Largely, 60% of human diseases are originated from animals, and approximately 75% of new emerging human infectious diseases are transmitted from vertebrate animals to humans (Rahman, 2020). Food-borne pathogens can be microorganisms from bacterial, viral, and fungal as well as a number of parasitic origins and they are the primary causes of food spoilage and food-borne diseases (Bintsis 2017; Tao *et al*., 2020). The epidemiologic triad of pathogen-host-environment inter-relationship for food-borne zoonoses could be expressed on the basis of chains of processes (van Seventer & Hochberg, 2017). From the zoonotic pathogens originating from the environment/lower organisms are transmitted to asymptomatic animal hosts or reservoirs which are predominantly wild animals (Ellwanger & Chies, 2021). These pathogens undergo gene recombination, mutation, morphology alterations and amplifications leading to zoonotic overflow and spill-overs of the pathogens as re-emerging drivers (Tazerji *et al*., 2022). Human or domestic animal population through contacts or activities get exposed leading to geographical spread and emerging disorders that cause symptomatic host illnesses in their populations (Baker *et al*., 2022). It has been reported that food-producing animals are the major reservoirs for many foodborne pathogens (Heredia & Garcia, 2018). Increasing urbanization and attendant anthropogenic activities are gradually eroding the forest reserves, dislodging wildlife, and increasing human/animal interface (Friant *et al*., 2015). Several reports have attributed sources of food-borne zoonoses to live animal markets as was the speculation for the origin of some infectious diseases of importance such as SARS, Avian influenza and recent COVID 19 pandemic (Haider et al., 2020; Galindo-González, 2022; Leal *et al*., 2022)

To tackle foodborne zoonoses, food safety knowledge of food handlers/consumers is very important and must be ensured mainly through associated proper handling, storage of food and preparation (Todd, 2020; Oduori e*t al*., 2021; Putri & Susanna 2021). Gaining food safety knowledge is essential as it could potentially minimize the outbreak of foodborne diseases (Onyeneho *et al*., 2013). Considering the global burden of foodborne zoonoses and hypothesized low level of awareness, it is expedient to initiate the process of determining the knowledge level of foodborne zoonoses from our immediate locality. This study was proposed to establish the demographics of participants within the study location and assess their level of knowledge on general zoonotic diseases, foodborne zoonotic diseases, types, preventive measures and associated risks. Our findings will position the population to gain increased knowledge on foodborne zoonoses equipping them on ways to avoid risks of contracting diseases especially those from foodborne origin.

MATERIALS AND METHODS

THE STUDY AREA

Umuahia is the capital city of Abia State and represents the urban area of the State. The capital metropolis is basically made up of two LGAs; Umuahia North and Umuahia South. The study area consideration comprised of the two LGAs and Ikwuano LGA making it three LGAs in Abia State, Nigeria. Umuahia has the geographical grid reference of Longitude $7^0$29'E, Latitude $5^0$32N in the map of Nigeria (Figure 3.1) and has a total population of 359,230 as at 2006 census. Umuahia is bordered by Aba, Okigwe, Abiriba, Ohafia and Owerri and traditionally owned by the Ibekus (Chidiebere *et al*., 2018). Ikwuano LGA is in close proximity with Umuahia and represents an urban center where many State and Federal establishments are located in Abia State, Nigeria. Its headquarters is in Isiala Oboro. Ikwuano LGA was among the new local government areas that were created in 1991. It has a land mass area of 281km^2 and a population of 137,993 as at the 2006 census (Mark *et al*, 2018). It is made up of about 52 villages and communities and is bounded by Ini LGA of AkwaIbom State by the west and Umuahia South to the North. It lies between the latitude $5^0$24N and $5^0$30N and between the longitude of $7^0$32E and $7^0$3E. In Ikwuano, the Michael Okpara University of Agriculture Umudike, the National Root Crops Research Institute as well as the prestigious Government College Umuahia are located. This part of Abia State is predominantly known for agricultural activities (farming) with much concentration on palm oil/kernel, cocoa, cassava, yam, broom, basket, etc (Njoku *et al*., 2013)

SURVEY TOOL

A well-structured questionnaire was used for this study.

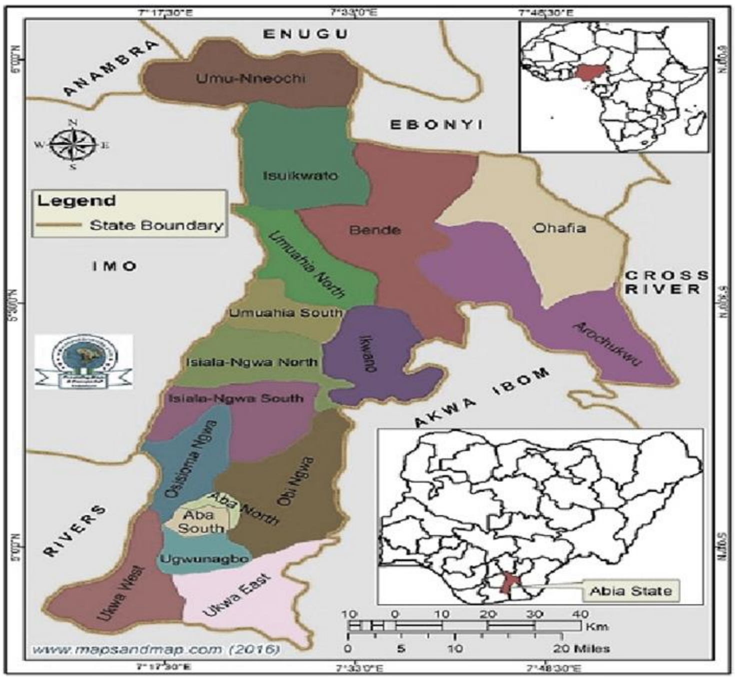

Figure 1: Map of the study area (Odikamnoro *et al*., 2017)

QUESTIONNAIRE CONSTRUCT

The construct of the questionnaire included different sections which were systematically arranged to have a free flow and easy comprehension by the participants. This comprised of the demographics and questions of knowledge of respondents on Zoonoses generally, Food-borne Zoonoses in particular, types of food-borne zoonoses, methods of prevention foodborne zoonoses and health risks associated with food-borne zoonoses. These were presented in sections of the questionnaire.

QUESTIONNAIRE VALIDATION

The process of validation of the questionnaire was carried out following the documented and acceptable guidelines on survey-based empirical research (Aithal and Aithal 2020). For the validation process reliability and validity were assessed. Using the face validity method, the Cohen's Kappa index value was 0.8 indicating acceptability in inter-rater agreement in the questionnaire. The expert assessment inter-rater reliability was 0.83 which showed that there was excellent agreement. The reliability and validity outcomes provided validation for the questionnaire to be used in the field.

STUDY PARTICIPANTS AND SURVEY

In this study, a cross-sectional epidemiological design was adopted. This involves observational descriptive research to understudy the selected study area and pilot it to assess the knowledge of people concerning food-borne zoonoses. Fifty participants were purposively to be selected from each of the three LGAs for this study making a total of 150 respondents with attrition rate estimated at greater than or equal to 10%. Finally, 170 participants were estimated for this study. The questionnaire was administered to consenting respondents by the survey team.

ETHICAL CONSIDERATIONS

Approval of the College of Veterinary Medicine, Michael Okpara University of Agriculture, Umudike Research Ethics Committee was obtained before conducting the study (MOUAU/CVM/REC/202302.). The respondents provided informed consent that appeared on the first page of the survey by answering a "Yes or No" question before the interview/ self-reporting questionnaire was commenced. The team of our surveyors ensured that confidentiality of the respondents was protected.

DATA ANALYSIS

Data analysis was carried using the Statistical Package for Social Science (SPSS) software. Demographic variables were presented using descriptive statistics. Inferential analysis; Chi square was used to test for associations and logistic regression to measured associations of the variables. Significant difference was measured at P value ≤ 0.05

RESULTS

SOCIO-DEMOGRAPHIC CHARACTERISTICS

In this study a total number of one hundred and sixty nine respondents (n=169) consented to participate in the survey while one person declined making the responsive percentage for this study to be 99.4%. More than half of the respondents were females (52%) and majority of family sizes are within the range of 5-9 people. Most of the respondents were still single 53% and within the age bracket of 24-29 years. Ninety six (57%) of respondents had tertiary education. Most respondents 90 (53%) were self-employed while 48 (28%) were students (Table I).

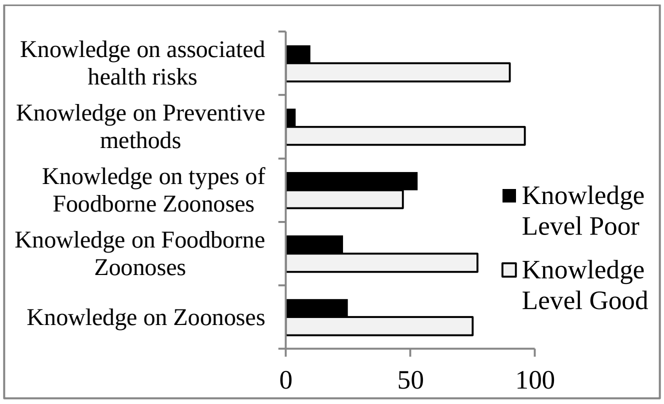

Figure II: Summary of Knowledge Level analysis of the respondents on Foodborne Zoonoses

GENERAL KNOWLEDGE LEVEL ON ZOONOSES

About 138 (82%) have heard about zoonoses and 99 (59%) of the respondents knew what the term zoonosis meant. Only 58% of the respondents knew how zoonoses are transmitted and 38% of respondents knew the different types of zoonoses. One hundred and twenty seven respondents (75%) were aware that zoonoses are preventable. More respondents 131(78%) knew that poor food storage is a potential source of zoonoses. (Table II).

KNOWLEDGE LEVEL ON FOOD-BORNE ZOONOSES

The result of this section shows that 78 (46%) respondents strongly agreed that food-borne zoonoses can be transmitted by contact with food materials. The respondents that strongly agreed that food-borne zoonoses can be transmitted through eating of raw meat were 119 (70%), 69 (41%) respondents disagreed that food-borne zoonoses are usually contagious, while 57 (34%) of the respondents strongly agreed that food-borne zoonoses are usually contagious. The result of this section showed that about 112 66% of the respondents (112) strongly agreed that meat borne zoonoses are a type of food-borne zoonoses. Seventy two respondent (43%) believed that meat, eggs, fish are sources of food-borne zoonoses, while 66 (39%) disagreed with the fact that meat, eggs and fish are sources of food-borne zoonoses (Table III).

Table 1: Socio-demographic Characteristics

CHARACTERISTICS	FREQUENCY N = 169	PERCENTAGE (%)
GENDER		
Male	82	48
Female	87	52
ARITAL STATUS		
Married	73	43
Single	89	53
Divorced/separated	7	4
AGE (YEARS)		
18 – 23	30	18
24 – 29	58	34
30 – 35	29	17
> 36	52	31
EDUCATIONAL STATUS		
No formal education	1	1
Primary	10	6
Secondary	62	37
Tertiary	96	57
EMPLOYMENT STATUS		
Employed	39	23
Unemployed	39	23
Self-employed	90	53
OCCUPATION		
Government worker	21	12
Private	16	10
Student	48	28
Trader	30	18
Food vendor	20	12
Butcher	18	11
Meat seller	2	1
Animal handler	14	8
FAMILY SIZE		
0 – 4	48	28
5 – 9	103	61
> 10	18	11

KNOWLEDGE LEVEL ON TYPES OF FOODBORNE ZOONOSES

Respondents that selected cholera as one of the types of food-borne zoonoses were about 97 (57%). Greater number of the respondents; 101 (60%) respondents were aware of tuberculosis as a food-borne zoonoses while 116 (69%) respondents identified typhoid fever as a food-borne zoonotic disease. For tapeworm infestation, 99 (59%) said yes while only 38% knew that Ebola disease was a foodborne zoonosis. Furthermore, respondents identified Corona virus (18%), Leptospirosis (37%), toxoplasmosis (47%), brucellosis (37%), and Lassa fever (43%), as food-borne zoonotic diseases (Table IV).

Table II: General Knowledge level on Zoonoses

CHARACTERISTICS	FREQUENCY (N=169))	PERCENTAGE (%)
Have you heard about zoonoses?		
Yes	138	82
No	31	18
Do you know what zoonoses means?		
Yes	99	59
No	70	41
Do you know how zoonoses are transmitted?		
Yes	98	58
No	71	42
Are zoonoses preventable?		
Yes	127	75
No	42	25
Do you know about types of zoonoses?		
Yes	64	38
No	105	62
Can inadequate food storage cause zoonoses?		
Yes	131	78
No	38	22
Can zoonoses cause threat to public health?		
Yes	121	72
No	48	28

KNOWLEDGE LEVEL ON METHODS OF PREVENTING FOOD-BORNE ZOONOSES

One hundred and sixty three respondents (97%), accepted that proper cooking of food prevents foodborne zoonoses. Subsequently, 95% of the respondent knew about proper refrigeration as means of preventing food borne zoonosis. By using safety wears and not handling meat with bare hands are further preventive measures accepted by 113 (67%) and 135(70%) of respondents respectively (Table V).

KNOWLEDGE LEVEL ON HEALTH RISKS OF FOOD-BORNE ZOONOSES

Assessment of this variable using five signs of possible outcome of health risks associated with foodborne zoonoses, only 11%, 12%, 8%, 33%, and 40% of the respondents indicated that fever, diarrhoea, vomiting poisoning and death were not risks respectively (Table VI).

The knowledge level summary based on binary categorization of "poor knowledge" and "good knowledge" of the five variables and data collected from the survey were analysed presented in Figure II. Comparing the socio-demographic variables and knowledge level on foodborne zoonoses of the respondents, the breakdown summary of the analyses is shown in Table VII.

SOCIO-DEMOGRAPHIC PREDICTORS OF KNOWLEDGE LEVEL OF FOODBORNE ZOONOSES AND THEIR MEASUREMENT

Gender (χ^2 =5.161, df =1, p = 0.023), education status (χ^2 = 15.882, df=3, p-value =0.001) and occupation (χ^2 =15.945, df =7, p = 0.026) of the respondents were statistically significant (Table 8). Further subjecting the result of association of the socio-demographic variables of the respondents to their knowledge level on food-borne zoonoses using logistic regression analyses, education status; tertiary (OR =2.909, CI =1.27-6.66, p=0.011) and occupation; Animal handler (OR = 1.428, CI =1.07-1.90, p=0.015) remained statistically significant (Table IX). The logistic regression model was statistically significant

Table III: Knowledge Level on Foodborne Zoonoses

Characteristic	Frequency n = 169	Percentage (%)
Foodborne zoonoses can be transmitted by contact with food materials		
Disagree	47	28
Agree	44	26
Strongly agree	78	46
Foodborne zoonoses can be transmitted through eating of raw meat		
Disagree	10	6
Agree	40	24
Strongly agree	119	70
Foodborne zoonoses is usually contagious		
Disagree	69	41
Agree	43	25
Strongly agree	57	34
Meat borne zoonoses is a type of foodborne zoonoses		
Disagree	20	12
Agree	37	22
Strongly agree	112	66
Meat, egg, fish are sources of foodborne zoonoses		
Disagree	**66**	**39**
Agree	**31**	**18**
Strongly agree	**72**	**43**

Table IV: Knowledge Level on types of Foodborne Zoonoses

Characteristics	Frequency n=169	Percentage (%)
Cholera		
Yes	97	57
No	72	48
Brucellosis		
Yes	63	37
No	106	63
Tuberculosis		
Yes	101	60
No	68	40
Ebola		
Yes	64	38
No	105	62
Corona virus		
Yes	30	18
No	139	62
Malaria		
Yes	73	43
No	96	57
Leptospirosis		
Yes	63	37
No	106	63
Typhoid fever		
Yes	116	69
No	53	31
Tapeworm infestation		
Yes	99	59
No	70	41
Lassa fever		
Yes	80	47
No	89	53

Table V: Knowledge level on methods of preventing foodborne zoonoses

Characteristics	Frequency n=169	Percentage (%)
Proper food cooking		
Disagree	6	4
Strongly agree	131	78
Agree	32	19
Proper Refrigeration		
Disagree	12	7
Strongly agree	120	71
Agree	37	22
Personal hygiene		
Disagree	10	6
Strongly agree	131	78
Agree	28	17
Use of safety wears		
Disagree	56	33
Strongly agree	72	43
Agree	41	24
Avoid handling of meat with bare hands		
Disagree	34	20
Strongly agree	116	69
Agree	19	11

Table VI: Knowledge level on health risk associated with foodborne zoonoses

Characteristics	Frequency n=169	Percentage (%)
Fever		
True	151	89
False	18	11
Diarrhoea		
True	149	88
False	20	12
Vomiting		
True	156	92
False	13	8
Poisoning		
True	131	67
False	56	33
Death		
True	101	60
False	68	40

Table VII: Summary of Socio-demographics and Knowledge level on Foodborne Zoonoses

Variables	Knowledge level (N)	
	Good (%)	Poor (%)
Gender		
Male	68 (40%)	14 (8%)
Female	59(35%)	28(17%)
Marital status		
Married	56(33%)	17(10%)
Single	68(40%)	21(12%)
Divorced	3(1%)	4(2%)
Age		
18 – 23	21(12%)	9(5%)
24 – 29	49(29%)	9(5%)
30 – 35	23(14%)	6(4%)
> **36**	34(20%)	18(11%)
Educational status		
No formal education	0(0%)	1(1%)
Primary	3(2%)	7(4%)
Secondary	46(27%)	16(9%)
Tertiary	78(46%)	18(11%)
Employment status		
Employed	31(18%)	8(5%)
Unemployed	27(16%)	12(7%)
Self-employed	68(40%)	22(13%)
Occupation		
Government worker	13(8%)	8(5%)
Private	13(8%)	8(5%)
Student	36(21%)	12(7%)
Trader	17(10%)	13(8%)
Food vendor	17(10%)	3(2%)
Butcher	16(9%)	2(1%)
Meat seller	1(1%)	1(1%)
Animal handler	14(8%)	0(0%)
Family size		
0 – 4	38(22%)	10(6%)
5 – 9	77(46%)	26(15%)
> **10**	12(7%)	6(4%)

Table VIII: Socio-demographic predictors of Knowledge level of foodborne zoonoses

	Knowledge Level				
Variables	**Good**	**Poor**	χ^2	**Df**	**p-value**
Gender					
Male	68	14	5.161	1	0.023*
Female	59	28			
Marital status					
Married	56	17			
Single	68	21	4.079	2	0.130
Divorced	3	4			
Age					
18 – 23	21	9			
24 – 29	49	9	6.055	3	0.109
30 – 35	23	6			
> 36	34	18			
Educational status					
No formal education	0	1			
Primary	3	7	15.882	3	0.001*
Secondary	46	16			
Tertiary	78	18			
Employment status					
Employed	31	8			
Unemployed	27	12	1.463	3	0.691
Self-employed	68	22			
Occupation					
Government worker	13	8			
Private	13	8			
Student	36	12			
Trader	17	13	15.945	7	0.026*
Food vendor	17	3			
Butcher	16	2			
Meat seller	1	1			
Animal handler	14	0			
Family size					
0 – 4	38	10			
5 – 9	77	26	1.117	2	0.572
> 10	12	6			

(χ^2 = 20.354, $p < 0.000$). Another measure of goodness of fit used in logistic regression analysis is the Nagelkerke R^2, which indicates that the model explained 17.3% of the variations in general knowledge assessment on zoonoses in Umuahia metropolis and correctly classified 77.5% of the cases. An increase in no formal education leads to an increase in the odds (2.909) of having knowledge of food-borne zoonoses in Umuahia metropolis when compared with the tertiary level of education baseline comparison. On the other hand, a respondent who has no formal education level has 191% increases in the odds of not being aware of food-borne zoonoses in Umuahia metropolis. As an individual moves to other occupation other than animal handling, the odds (1.428) occurring on knowing about food-borne zoonoses tends to be higher (50%) than the odds of knowing about general knowledge on zoonoses in the baseline comparison variable (animal handling occupation). Gender, age, employment status and family size all had *p*-values of 0.535, 0.277, 0.181 and 0.292, respectively, implying that the male respondents, highest age range, self-employed, unemployed and other family sizes other than the largest range, all had no statistic differences ($p > 0.05$) in the knowledge of food-borne zoonoses than the baseline categories (female, 36 years and above, employed status and above 10 persons in a household, respectively) in Umuahia metropolis which included knowledge level on zoonoses, food-borne zoonoses, types of food-borne zoonoses, methods of preventing food-borne zoonoses and health risks of food-borne zoonoses.

DISCUSSION

Epidemiological information gathering from the populace encourages improved public health by ensuring that areas of vital outcome are given the necessary attention by the government. This study has therefore provided an insight into the level of knowledge of the participants on foodborne zoonotic diseases which causes devastating public health concerns. Our findings revealed that the respondents had adequate knowledge on four out of the five assessed variables which includes knowledge on zoonoses, food-borne zoonoses, and preventive measures and associated health risk of food-borne zoonoses. However, there was poor knowledge of 47% on types of food-borne zoonoses.

Although females responded more during the survey, they had less knowledge on food-borne zoonoses more than the males. It was reported by Strassle *et al*., 2019 that males were likely to consume high risk foods; unpasteurized milk, raw shellfish, egg and other high risk food in the public places, thus increasing exposure to such zoonoses and this might have accounted for their more awareness on food-borne zoonoses. This is in contrast with a study which reported more females having higher knowledge level on zoonoses when compared to males (Akil, 2021). The result obtained from this study showed a statistical significant association between education and knowledge of food-borne zoonoses. This showed that respondents with tertiary education had more knowledge about food-borne zoonoses

Table IX: Logistic regression analyses of socio-demographic associations of knowledge level on foodborne diseases

Demographic variables	**Odd ratio**	**C.I**	***p*-value**
Gender (female as reference)	0.758	0.32-1.82	0.535
Age	0.771	0.48-1.23	0.277
Education level (Tertiary as reference)	2.909	1.27-6.66	0.011*
Occupation (Animal handler as reference)	1.428	1.07-1.90	0.015*
Employment	1.498	0.82-2.71	0.181
Family size	0.701	0.36-1.35	0.292
Model summary			
N = 169			
Log likelihood function = 159.794			
Nagelkerke (R^2) = 0.173			
Model Chi-square = 20.354*			
Overall percentage = 77.50			

and this agrees with the finding of (Akuiyibo *et al*., 2021) who opined that educated individuals make the awareness and control programs more effective and easier in the community. Lack of knowledge on food-borne and zoonotic diseases could be as a result of poor communication between veterinarians, human health-care professionals and individuals with no formal or primary education status (Lopes *et al*., 2021). Awareness and education on food-borne zoonoses impact will reduce the significant economic and public health burden (Mekonnen *et al*., 2021). According to Bertoni, 2021, the interface among people, animal and surrounding environment is very close in many developing and developed countries, where animals act as a companion and provide draught power, transportation, clothing, fuel and source of protein in the form of milk, meat and eggs. In the absence of proper care and lack of awareness, this linkage can lead to serious risk to public health with huge economic losses especially due to food-borne diseases. Respondents between 24 – 29 years and above 36 years recorded the highest good knowledge status of food-borne zoonoses contrary to a report on knowledge assessment of a neglected tropical disease where 30% of respondents within the age bracket of 30-39 displayed the poorest knowledge on Buruli ulcer disease (Otuh *et al*., 2018). Findings from Strassle *et al*. (2019) showed that the distribution of food-borne zoonoses and health related illnesses might result from related food preferences among age ranges of respondents, where red meats, dairy products, snacks e.t.c are associated with younger individuals, while fish, fruits, nuts-seeds, grains-beans were more likely to involve older people. Additionally, Augustin *et al*. (2013) opined that foods consumed by individuals of different age range can be associated with specific foodborne disease, pathogens and infections. The knowledge on the type of food-borne zoonoses such as cholera, tuberculosis, toxoplasmosis, typhoid fever, tape worm infestation and Lassa fever in this study was low, in contrast with the knowledge level on other outcome variables assessed. The reason might be attributed to the technical/medical nomenclatures of many of the types of diseases outlined in the questionnaire which are quite different from the common diseases which names are frequently used. The result obtained from this study showed respondents who worked as animal handlers knew more about foodborne zoonosis when compared with other occupation. This could be attributed to the fact that close contact with animals is crucial for zoonotic disease transmission which makes animal handlers more knowledgeable of such diseases. This finding is in agreement with the result of Klous *et al*., 2016, who reported that more exposure of people to livestock will lead to more occurrence of food-borne zoonoses transmission.

CONCLUSION

The findings from this study elucidated detailed public health information on foodborne disease within the study locations which has yielded a baseline data to further explorative research on food-borne diseases in Abia state.

This study has contributed in harnessing important information that will be utilized to design contents for awareness campaign into the grass-root communities because most disease outbreaks that cause increased burden on public health do emanate from our localities. If the populaces are adequately knowledgeable on diseases or health challenges, they will be better equipped to report to appropriate quarters promptly.

We recommend; periodic education on zoonoses, meat inspection procedure as a way to communicate with the general public, awareness campaigns focusing on information on the public health implication associated with food-borne zoonoses. Institution of a functional and strong surveillance system in the State to gather timely, necessary, sensitive, geographically spread action-oriented information not only on food borne zoonosis but on other vital public health concerned emerging and re-emerging infectious diseases is equally recommended.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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REFERENCES

Abebe, E., Gugsa, G., & Ahmed M. (2020). Review on Major Food-Borne Zoonotic Bacterial Pathogens. *Journal of Tropical Medicine*, 4674235.

Aithal A. & Aithal S. (2020). Development and validation of survey questionnaire experimental data-A systematical review-based statatistical approach. *Munich Personal RePEc Archive* paper No. 103996

Akil L. (2020). Trends of Foodborne Diseases in Mississippi: Association with Racial and Economic Disparities. *Diseases* 9(4), 83

Akuiyibo S., Anyanti J, Idogho O, Piot S, Amoo B, Nwankwo N, Anosike N (2021). Impact of peer education on sexual health knowledge among adolescents and young persons in two North Western states of Nigeria. *Reproductive Health.* 18(1), 204.

Augustin J-C, Kooh P, Bayeux T, Guillier L, Meyer T, Jourdan-Da Silva N, Villena I, Sanaa M, Cerf O, on Behalf of the Anses Working Group on Consumer Information on Foodborne Biological Risks. Contribution of Foods and Poor Food-Handling Practices to the Burden of Foodborne Infectious Diseases in France. *Foods*. 9(11), 1644

Baker RE, Mahmud AS, Miller IF, Rajeev M, Rasambainarivo F, Rice BL, Takahashi S, Tatem AJ, Wagner CE, Wang LF, Wesolowski A, Metcalf CJE.

Infectious disease in an era of global change. *Nature Review Microbiology* 20(4), 193-205.

Balali GI, Yar DD, AfuaDela VG, Adjei-Kusi P (2020). Microbial Contamination, an Increasing Threat to the Consumption of Fresh Fruits and Vegetables in Today's World. *International Journal of Microbiology*, 3029295.

Bertoni G (2021). Human, Animal and Plant; Health for Complete Sustainability. *Animals*. 11(5), 1301.

Bintsis T. (2017). Foodborne pathogens. *AIMS Microbiology* 3(3), 529-563.

Cockx, L., Colen, L., De Weerdt, J., Gomez Y Paloma, S. (2019), Urbanization as a driver of changing food demand in Africa: Evidence from rural-urban migration in Tanzania, EUR 28756 EN, Publications Office of the European Union, Luxembourg,

Dhama K, Rajagunalan S, Chakraborty S, Verma AK, Kumar A, Tiwari R, Kapoor S. Food-borne pathogens of animal origin-diagnosis, prevention, control and their zoonotic significance: a review. *Pakistan Journal of Biological Scienc* 16(20), 1076-85.

Ellwanger JH, Chies JAB (2021). Zoonotic spillover: Understanding basic aspects for better prevention. *Genetics Molecular Biology* 44(1 Suppl 1.

Friant S, Paige SB, Goldberg TL (2015) Drivers of Bushmeat Hunting and Perceptions of Zoonoses in Nigerian Hunting Communities. *PLOS Neglected Tropical Diseases* 9(5).

Galindo-González J. (2021) Live animal markets: Identifying the origins of emerging infectious diseases. *Current Opinion Environmental Science and Health*. 100310.

Garg S, Bhatnagar N, Gangadharan N.(2020). A Case for Participatory Disease Surveillance of the COVID-19 Pandemic in India. *Journal of Public Health Surveill*ance 6(2).

Haider N, Rothman-Ostrow P, Osman AY, Arruda LB, Macfarlane-Berry L, Elton L, Thomason MJ, Yeboah-Manu D, Ansumana R, Kapata N, Mboera L, Rushton J, McHugh TD, Heymann DL, Zumla A and Kock RA (2020) COVID-19—Zoonosis or Emerging Infectious Disease? *Frontiers in Public Health* 8, 596944

Henchion M, Hayes M, Mullen AM, Fenelon M, Tiwari B. Future Protein Supply and Demand: Strategies and Factors Influencing a Sustainable Equilibrium. *Foods.* 6(7), 53.

Heredia N, García S. Animals as sources of food-borne pathogens: A review. *Animal Nutrition.* 4(3), 250-255.

Klous G, Huss A, Heederik D.J. J, Coutinho R.A (2016). Human-livestock contacts and their relationship to transmission of zoonotic pathogens, a systematic review of literature. *One Health*. 2, 65-76.

Leal F, Walter, L. T, Sanika A. P, Marina K. and Gustavo J. N. (2022). "Climate Change and Zoonoses: A Review of Concepts, Definitions, and Bibliometrics" *International Journal of Environmental Research and Public Health* 19, 2, 893

Lopes, A. P., Fontes, C., Silvestre, M., Cardoso, L., & Coelho, A. C. (2021).A Cross-Sectional Study of Knowledge on Ownership, Zoonoses and Practices among Pet Owners in Northern Portugal. *Animals* 11(12).

Mekonnen SA, Gezehagn A, Berju A, Haile B, Dejene H, Nigatu S, Molla W, Jemberu WT (2021). Health and economic burden of foodborne zoonotic diseases in Amhara region, Ethiopia. *PLoS One.* 16(12), 0262032

Njoku, J. D. & Amangabara, G and Duru, P. (2013). Spatial assessment of urban flood risks in Aba metropolis using geographic information systems techniques. *Global Advanced Research Journal of Environmental Science and Toxicology.* 2, 086 - 092.

Odikamnoro O.O, Ikeh , I.M, Okoh F.N , Ebiriekwe S.C, Nnadozie, I.A., Nkwuda J.O., Asobie G.C (2017). Incidence of malaria/typhoid co-infection among adult population in unwana community, Afikpo north local government area,Eebonyi State, Southeastern Nigeria. *African Journal of Infectious Diseases*12 (1), 33-38

Oduori DO, Kwoba E, Thomas L, Grace D, Mutua F (2021). Assessment of Foodborne Disease Hazards in Beverages Consumed in Nigeria: A Systematic Literature Review. *Foodborne Pathogens and Diseases* 19(1), 1-18

Onyeneho, Sylvester N., and Craig W. Hedberg. (2013). "An Assessment of Food Safety Needs of Restaurants in Owerri, Imo State, Nigeria" *International Journal of Environmental Research and Public Health* 10, 8, 3296-3309.

Otuh PI, Soyinka FO, Ogunro BN, Akinseye V, Nwezza EE, Iseoluwa-Adelokiki AO, Adeyemo OK. Perception and incidence of Buruli ulcer in Ogun State, South West Nigeria: intensive epidemiological survey and public health intervention recommended. *Pan African Medical J*ournal 29, 166.

Otuh PI, Adeyemo OK, Nwezza EE, Soyinka FO, Daniel OJ (2019). Knowledge, attitude and practices regarding Buruli ulceramong rural inhabitants in Ogun State, Nigeria. *African Journal of Medicine and Medical Science*s 48,101-109

Putri MS, Susanna D. (2021) Food safety knowledge, attitudes, and practices of food handlers at kitchen premises in the Port 'X' area, North Jakarta, Indonesia 2018. *Italian Journal of Food Safety*. 10(4), 9215.

Rahman MT, Sobur MA, Islam MS, Ievy S, Hossain MJ, El Zowalaty ME, Rahman AT, Ashour HM (2020). Zoonotic Diseases: Etiology, Impact, and Control. *Microorganisms*. 8(9), 1405

Strassle PD, Gu W, Bruce BB, Gould LH (2019). Sex and age distributions of persons in foodborne disease outbreaks and associations with food categories. *Epidemiology of Infection* 147, 200.

Tao J, Liu W, Ding W, Han R, Shen Q, Xia Y, Zhang Y, Sun W. (2020). A multiplex PCR assay with a common primer for the detection of eleven foodborne pathogens. *Journal of Food Science*. 85(3), 744-754

Tazerji, S S, Roberto N, Muhammad S, Awad A. S, and Phelipe M D (2022). "An Overview of Anthropogenic Actions as Drivers for Emerging and Re-Emerging Zoonotic Diseases" *Pathogens* 11,11, 1376.

Todd E (2020) Food-Borne Disease Prevention and Risk Assessment. *International Journal of Environmental Research in Public Health.* 17(14), 5129.

vanSeventer JM, Hochberg NS (2017). Principles of Infectious Diseases: Transmission, Diagnosis, Prevention, and Control. *International Encyclopedia of Public Health.* 22–39

World Health Organization (2015).WHO's a first ever global estimate of foodborne diseases find children under 5 account for almost one third of deaths. Assessed on 30th December, 2022 from https://www.who.int/news/item/03-12-2015

World Health Organization (2022) Food safety. Assessed from https://www.who.int/news-room/fact-sheets/detail/food-safety on 20th December, 2022