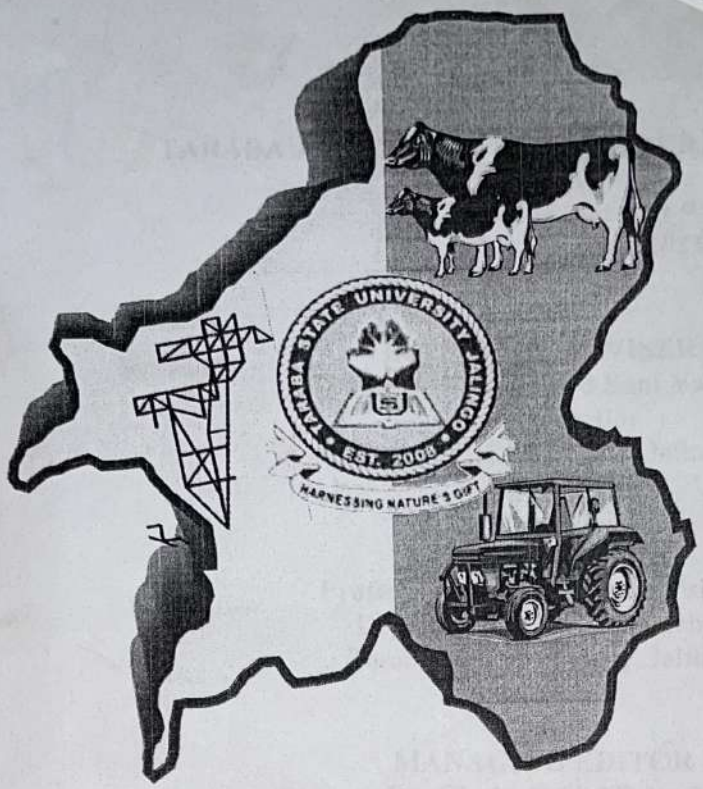
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HUNTERS AND BUSHMEAT PROCESSORS AS POTENTIAL PATH-WAYS FOR THE TRANSMISSION OF ZOONOTIC DISEASES: A CASE STUDY OF KWARA STATE, NIGERIA

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Abstract
The unlimited contact of wildlife hunters and bushmeat processors with wild animals could serve as a potential path-way for the transmission of zoonosis to the unsuspecting members of the public. A survey was carried out on the socioeconomic characteristics of wildlife hunters and bushmeat processors, their perceived knowledge on zoonosis as well as the preventive measures adopted during hunting and bushmeat processing. The study was carried out in Kwara State, Nigeria. A sample size of 120 respondents was randomly obtained with the use of structured questionnaire to elicit relevant information. Descriptive and inferential statistics were employed for data analysis. Result of survey revealed 37.9 years as the mean age of the respondents with an average monthly income of ₦34,308 (USD 214.4), married (81.7%) with average household size of 7 persons and only 5.0% of the respondents had tertiary education. Low awareness level on zoonosis was observed among wildlife hunters (31.1%) and bushmeat processors (26.7%). Majority (90.8%) of the respondents indicated radio as their most preferred source of information and only 3.3% of them had listened to radio discussion on zoonosis transmission. Respondents' perception on the possible transmission of diseases from animals to humans was generally low with "Zoonotic diseases cannot cause any negative impact on man" ranking 1st. Poor usage of preventive measures were also observed among hunters and bushmeat processors in the area. Pearson product moment correlation showed that respondents' age, educational level, hunting/processing experience and average monthly income were positively and significantly related to the use of preventive measures during hunting and processing of bushmeat. The study concluded that respondents were ignorant of the dangers inherent in having contact with wild animals particularly as a source of zoonotic disease transmission. It is therefore recommended that concerted effort be made by the various levels of Government Institutions and Non-Governmental Organizations to train and encourage hunters and bushmeat processors on the use of appropriate preventive measures and sanitary practices to guide against the transmission and spread of zoonosis.
Keywords: Hunters, Bushmeat processors, Path-ways, Transmission, Zoonotic diseases

Introduction

Wildlife hunting is a global practice but the dimension it assumes varies from country to country. In civilized countries like United States of America, hunting is carried out in the form of sporting activity and only licensed hunters who are rich enough to purchase hunting kits which could cost as much as $1,896 could participate in the expedition. However, in developing countries (Nigeria inclusive) hunting is carried out in order to satisfy some cultural intent in addition to fulfilling the economic needs of the people. The quest for bushmeat by the city-elites in the recent past, had led to an increased operation of bushmeat processors who were hitherto found only at the fringes of the major towns. The fact that bushmeat hunting is now believed to be driven by the increasing demand for the meat in the cities and towns was earlier recognized (Adefalu *et al.*, 2014) and the consequences of this scenario could be located in the pressure on the local hunters to hunt as many animals and as many times as possible in order to meet the bushmeat demand.

The word bushmeat emanated from Africa where forest is referred to as bush and animal meat from the bush is called Bushmeat (DEFRA, 2006). Most of the rural community hunting is done in group and is either done during the day or in the night. Some hunters prefer to hunt in the night because the higher success rate (Lahm, 1993). According to (Afolayan, 1980; Martin, 1983), the methods of hunting in Nigeria include the use of home-made

muzzle-loaders, setting traps and snares, use of dogs and use of fire to drive animals out. Wildlife hunting in Nigeria is predominantly men dominated activity due to the rigorous nature of the exercise, while processing, storage and marketing of the meat from wild animals (bushmeat) are done by women.

However, it is important to note that both hunting and processing of bushmeat in which men and women are involved provide a potential pathway for the transmission of diseases from animals to man which is called Zoonosis. This could be so due to the fact that hunters and processors of bushmeat are the frontline or primary contact to the wild animals. World Health Organization (WHO, 2012) defined zoonoses as naturally transmitted diseases and infections between animals and humans, the zoonotic agent may be bacterium, a virus, a fungus or other communicable disease agent. It has also been established that most of the emerging diseases from animals to man are rooted in wildlife (Jones *et al.,* 2008). A number of these animals are either vectors or carriers of zoonotic diseases. For example rodents are known carriers of lassa virus (Richmond and Baglole, 2003), primate such as chimpanzee had been reported to be responsible for the transmission of SIV (Simian Immunodeficiency Virus) to man before it generated to what is now known as HIV/AIDS (Donald and McNeil, 2010).

Moreover, cross-species transmission of microbes during hunting, butchering, processing and cooking has been linked to human outbreaks of monkey pox, Ebola (Leroy *et al.,* 2004; Jezek *et al.,* 1986)) and infections with simian foamy virus (Wolfe *et al.,* 2004) and primate T-cell lymphotropic virus (PTLV) (Wolfe *et al.,* 2005). When animals are hunted using certain hunting methods such as trapping, the trapped animal (bushmeat) could drag the hunting trap to an unknown destination and may be difficult for the hunter to locate, when the animal is eventually located, the tendency is that the animal has decomposed but because of the desperation of hunters to go back home with a bag filled with animals he is tempted to carry home such decomposed animal for consumption or for sale. This situation could lead to the transmission of Ebola disease as reported in Gabon some years ago (Georges *et al.,* 1999). Hunters are at risk of contracting zoonotic diseases from bushmeat during hunting, through animal blood entering the blood stream if the hunter has open wounds. Bushmeat processors also are predisposed to contracting zoonotic diseases through spillage of animal blood or body fluids during butchering, degutting and processing. The transmission of zoonotic diseases from animal to man has a far reaching consequence. In the recent time, the transmission of ebola virus now takes a different dimension as the virus is now mostly transmitted from infected human being to other people through body contact. West African sub-region is the worst hit with countries like Democrtic Republic of Congo, Gabon, Serialon, Liberia and now Nigeria, having cases of mortality resulting from ebola infection. Several studies have been carried out on the transmission of zoonotic diseases and its effect on humans (Le Breton *et al.*, 2006; Leroy *et al.* 2004 and Wolfe *et al.,* 2005). However, not much effort has been deployed to x-ray the knowledge level and poor preventive measures often employed by hunters and bushmeat processors as well as their vulnerability potentials in terms of transmission of zoonotic diseases.

This study therefore sought to describe the socio-economic characteristics of the respondents, examine the perceived knowledge of respondents on zoonotic diseases, identify the sources of information and identify the preventive measures been used by the respondents against the transmission of zoonotic disease.

Methodology

The study was carried out in Kwara State, and its capital is Ilorin. It is located between latitude 8° 30′N and longitude 5° 0′E. The State has an area of 36,825 square kilometers with a population of 2.59 million which made up of four main ethnic groups namely, Yoruba, Nupe, Fulani and Baruba (NPC, 2006). The State comprises of 16 Local Government which are Asa, Baruteen, Edu, Ekiti, Ilorin East, Ilorin South, Ilorin West, Ifelodun, Irepodun, Isin, Kaiama, Moro, Offa, Oke-Ero, Oyun and Pategi. The population of the study comprised all wildlife hunters and bushmeat processors in Kwara State. Two (2) sets of respondents were captured (wildlife

hunters and bushmeat processors). A multi stage sampling technique was used for the selection of respondents for the study. The first stage involved the selection of Kwara State. Kwara state is known to have large number of hunter's take-off points and restaurants where bushmeat are sold. For the selection of wildlife hunters, five (5) major hunter's take-off points located at Ilorin, Oro, Ganmo, Moro and Ilesha-baruba were purposively selected. The next stage involved the random selection of eighteen (18) hunters from each of the selected take-off points given a sub-sample size of hundred (90) respondents. The second aspects of the selection involved purposive selection of ten (10) restaurants where bushmeat are processed and sold. Three (3) women (bushmeat processors) were randomly selected from each of the identified restaurants to give another sub-sample size of thirty (30) respondents. The addition of the two (2) selected sub-samples gave a sample size of one hundred and twenty (120) respondents. Data obtained from the field survey was subjected to both descriptive (frequency distribution, percentage, mean score and ranking order) and inferential (Pearson product moments correlation) statistics for analysis.

Results and Discussion

Socio economic Characteristics

Table 1 show thata little above half (56.7%) of the respondents were youth who fell within the age bracket of 21-40 years. This may be due to the ability of youth to trek long distance and run after animals as observed in a study carried out on exploratory study of hunter's perception of forest bush burning in Kwara State, Nigeria (Adefalu *et al.*, 2009). The mean age of the respondents was 37.95 years, the minimum age was 11 years (7.5%) and the maximum was 61 years (4.2%). The results reveal that 75% of the respondents were male and 25% were female. This indicates that men involved in hunting activities while women involved in processing activities.The information collected from the respondents shows that 81.7% were married while 18.3% were single. This shows that a larger percentage of the respondents were married. This implies that majority of the hunters/processors depends on proceeds from hunting/processing for family upkeep and home maintenance.

The data in table 1 also reveal that 21.7% of the respondents had no formal education, while 3.3% had Quranic education; 27.5% had primary education, 42.5% had secondary school certificate and only 5% had tertiary education certificate. This indicates that most of the respondents had secondary school certificate as in accordance with the study carried out by Adefalu *et al* (2009) that high literacy level among the respondents may place an advantage in terms of adoption of new innovations.Majority (86.7%) of the respondents were Muslims and 13.3% were Christian.Table 1 reflects that 17.5% of the respondents were full time hunters/processors while majority (82.5%) of the respondents operate as hunters/processors in part time basis. This implies that majority of the respondents still have other occupations aside from hunting/processing activity.

The mean experience of the respondents was 21.28 years, 39.2% of the respondents had between 11-20 years of hunting/processing experience while 1-10 years and 21-30 years had 21.7% and 21.7% respectively. Experience of 31-40 years, 41-50 years and above 50 years had 10%, 6.7% and 0.8% respectively. This implies that people intend to withdraw from active hunting/processing leaving the trade to the hand of relatively young people (Adefalu *et al.*, 2009). The mean household size of the respondents was 6.76 persons per household. Table 1 also shows that 45.8% of the respondents had household size of between 5-8 people. On the other hand, 30% of the respondents had household size of 1-4 people. Similarly, 19.2% constitute household size of 9-12 people, 3.3% and 0.8% constitute 13-16 and 21 people and above respectively.Also, the mean monthly income is ₦34, 308.33 and 35% of the total respondents earn between the range ₦20,001- ₦35,000 per month, 30.8% of the respondents earn between ₦35,001- ₦50,000 per month, 23.3%, 5.8%, 1.7%, 0.8% and 0.8% earn ₦ 5,001- ₦20,000, ₦50,001- ₦65,000, ₦65,001 - ₦80,000, ₦95,001 - ₦110,000 and ₦125,001 or more per month respectively. Also 1.7% earns less than ₦5000 per month.

Table 1: Socio economic Characteristics of Respondents

Variables	Hunters frequency (Percentage %)	Mean	Bush meat processors frequency (Percentage %)	Mean	Pooled frequency (Percentage %)	Mean
Age						
11-20	7 (7.80)		2 (6.70)		9 (7.50)	
21-30	33 (36.7)		3 (10.0)		36 (30.0)	
31-40	24 (26.7)	36.5	8 (26.70)	42.3	32 (26.7)	37.95
41-50	8 (8.90)		10 (33.30)		18 (15.0)	
51-60	13 (14.4)		7 (23.3)		20 (16.7)	
≥61	5 (5.6)		0 (0.0)		5 (4.2)	
Total	90 (100)		30 (100)		120 (100)	
Sex						
Male	90 (100)		0 (0.0)		90 (75.0)	
Female	0 (0.0)		30 (100)		30 (25.0)	
Total	90 (100)		30 (100)		120 (100)	
Marital status						
Single	20 (22.2)		2 (6.7)		22 (18.3)	
Married	70 (77.8)		28 (93.3)		98 (81.7)	
Total	90 (100)		30 (100)		120 (100)	
Educational Attainment						
No formal	15 (16.7)		11 (36.7)		26 (21.7)	
Quranic	4 (4.4)		0 (0.0)		4 (3.3)	
Primary	25 (27.8)		8 (26.7)		33 (27.5)	
Secondary	42 (46.7)		9 (30.0)		51 (42.5)	
Tertiary	4 (4.4)		2 (6.7)		6 (5.0)	
Total	90 (100)		30 (100)		120 (100)	
Primary occupation						
Hunting/Processing	6 (6.7)		15 (50)		21 (17.5)	
Artisan	38 (42.2)		7 (23.3)		45 (37.5)	
Security	9 (10.0)		0 (0.0)		9 (7.5)	
Civil servant	7 (7.8)		3 (10)		10 (8.3)	
Trading	7 (7.8)		2 (6.7)		9 (7.5)	
Others	23 (25.6)		3 (10)		26 (21.7)	
Total	90 (100)		30 (100)		12 (100)	
Secondary occupation						
Hunting/Processing	84 (93.3)		15 (50)		99 (82.5)	
Artisan	2 (2.2)		1 (3.3)		3 (2.5)	
Civil servant	1 (1.1)		1 (3.3)		2 (1.7)	
No secondary occupation	3 (3.3)		13 (43.3)		16 (13.3)	
Total	90 (100)		30 (100)		120 (100)	
Religion						
Islam	76 (84.4)		28 (93.3)		104 (86.7)	
Christianity	14 (15.6)		2 (6.7)		16 (13.3)	
Total	90 (100)		30 (100)		120 (100)	
Experience						
1-10	20 (22.2)		6 (20)		26 (21.7)	
11-20	38 (42.2)		9 (30.0)		47 (39.2)	
21-30	18 (20)		8 (26)		26 (21.7)	
31-40	6 (6.7)	20.7	6 (20.0)	23.0	12 (10)	21.28
41-50	7 (7.8)		1 (3.3)		8 (6.7)	
≥51	1 (1.1)		0 (0.0)		1 (0.8)	
Total	90 (100)		30 (100)		120 (100)	
Household size						
1-4	33 (36.7)		4 (13.3)		37 (30.8)	
5-8	40 (44.4)		15 (50)		55 (45.8)	
9-12	14 (15.6)	6.27	9 (30)	8.23	23 (19.2)	6.76
13-16	2 (2.2)		2 (6.7)		4 (3.3)	
17-20	0 (0)		0 (0)		0 (0)	
>21	1 (1.1)		0 (0)		1 (0.8)	
Total	90 (100)		30 (100)		120 (100)	
Monthly income (₦)						
≤5000	1 (1.1)		1 (3.3)		2 (1.7)	
5001-20000	19 (21.1)		9 (30)		28 (23.3)	
20001-35000	30 (33.3)		12 (40)		42 (35)	
35001-50000	29 (32.2)	₦36,500	8 (26.7)	₦27,733	37 (30.8)	₦34,308
50001-65000	7 (7.8)		0 (0)		7 (5.8)	
65001-80000	2 (2.2)		0 (0)		2 (1.7)	
80001-95000	0 (0)		0 (0)		0 (0)	
95001-110000	1 (1.1)		0 (0)		1 (0.8)	
110001-125000	0 (0)		0 (0)		0 (0)	
≥125001	1 (1.1)		0 (0)		1 (0.8)	
Total	90 (100)		30 (100)		120 (100)	

Table 2 shows the animals killed and processed by the respondents. Majority (97.5%) of the respondents killed/processed Rabbit, while 88.3% killed/processed Bush fowl, 75.8%, 73.3% and 72.5% killed/processed Guinea fowl, Ground squirrel and Cane rat respectively. This implies that smaller animals are killed/processed most and this in line with the study carried out by Cowlishaw *et al.*, in 2005.

Table 2: Animal Killed/Processed Most*

Animals	Hunters frequency	Percentage (%)	Bushmeat processors frequency	Percentage (%)	Pooled frequency	Percentage (%)
Rabbit	88	97.8	29	96.7	117	97.5
Cane rat	58	64.4	29	96.7	87	72.5
Bush fowl	77	85.6	29	96.7	106	88.3
Guinea fowl	66	73.3	25	83.3	91	75.8
Ground squirrel	64	71.1	24	80.0	88	73.3
Warthog	44	48.9	3	10	47	39.2
Giant rat	15	16.7	22	73.3	37	30.8
Pangolin	9	10.0	18	60.0	27	22.5
Snakes	11	12.2	15	50.0	26	21.7
Alligator	13	14.4	19	63.3	32	26.7
Monkey	20	22.2	1	3.3	21	17.5
Common duiker	21	23.3	5	16.7	26	21.7

*Multiple responses Source: Field survey, 2014

Table 3 shows the source of information of the respondents. Majority (90.8%) of the respondents use radio as their source of information, while 37.1% obtain information from their colleagues. Newspaper (2.5%) and customers (2.5%) also serves as source of information for the respondents. The result implies that radio was the most frequently used media by the respondents.

Table 3: Sources of Information*

Sources	Hunters frequency	Percentage (%)	Bush meat processors frequency	Percentage (%)	Pooled frequency	Percentage (%)
Radio	81	90	28	93.3	109	90.8
News paper	3	3.3	0	0	3	2.5
Colleagues	24	26.7	14	46.7	38	31.7
Customers	2	2.2	1	3.3	3	2.5

*Multiple responses

Respondents' Knowledge on Zoonotic Diseases

Table 4 shows the knowledge of respondents on zoonotic diseases. Some attitudinal statements were presented to the respondents to test their knowledge using 5 Likert scale. Zoonotic diseases cannot cause any negative impact on man was ranked 1st, Wild animal blood contact with humans fresh wounds cannot cause any negative health situation was ranked 2nd, while zoonotic diseases can be transmitted only from animals to animals was ranked 3rd. These responses to the attitudinal statements indicated that the respondent's knowledge on zoonotic diseases was very poor. Furthermore, zoonotic diseases cannot be contacted from decomposed animals; people are more predisposed to zoonotic diseases from live animals, diseases can be transmitted from animal species to man, bushmeat processors are highly predisposed to zoonotic than hunters, hunters are more predisposed to zoonotic diseases than bushmeat processors, humans are highly predisposed to zoonotic diseases during animal slaughtering and cutting and animal droppings can predispose individuals to zoonotic infections ranked 4th, 5th, 6th, 7th, 8th, 9th and 10th respectively. The general assessment of the respondents to the statements posed to them showed that both the bushmeat hunters and processors are not well informed and have poor knowledge of the pathways through which zoonotic diseases are transmitted to man.

Table 4: Knowledge of Respondents on Zoonotic Diseases

Respondent Knowledge	SA Freq (%)	A Freq (%)	U Freq (%)	D Freq (%)	SD Freq (%)	M	R
Diseases can be transmitted from animal species to man	5 (4.2)	7 (5.8)	3 (2.5)	8 (6.7)	90 (80.8)	1.46	6th
Zoonotic diseases can be transmitted only from animals to animals	6 (5.0)	58 (48.3)	32 (26.7)	18 (15.0)	6 (5.0)	3.33	3rd
Zoonotic diseases cannot cause any negative impact on man	84 (70.0)	28 (23.3)	1 (0.8)	3 (2.5)	4 (3.3)	4.54	1st
Humans are highly predisposed to zoonotic diseases during animal slaughtering and cutting	2 (1.7)	3 (2.5)	2 (1.7)	26 (21.7)	87 (72.5)	1.39	9th
Wild animal blood contact with humans fresh wounds cannot cause any negative health situation	75 (62.5)	31 (25.8)	4 (3.3)	5 (4.2)	5 (4.2)	4.38	2nd
Hunters are highly more predisposed to zoonotic diseases than bushmeat processors	1 (0.8)	0 (0.0)	8 (6.7)	28 (23.3)	83 (69.2)	1.40	8th
Bushmeat processors are highly predisposed to zoonotic diseases than hunters	0 (0.0)	2 (1.7)	12 (10.0)	21 (17.5)	85 (70.8)	1.43	7th
Animal droppings can predispose individuals to zoonotic infections	1 (0.8)	3 (2.5)	4 (3.3)	25 (20.8)	87 (72.5)	1.38	10th
Zoonotic diseases cannot be contacted from decomposed animal	3 (2.5)	32 (26.7)	66 (55.0)	16 (13.3)	3 (2.5)	3.13	4th
People are more predisposed to zoonotic diseases from live animals	0 (0.0)	7 (5.8)	9 (7.5)	28 (23.3)	76 (63.3)	1.56	5th

SA= Strongly Agree, A= Agree, U= Undecided, D=Disagree, SA= Strongly Disagree, M= Mean, R= Rank
Source: Field survey, 2014.

Preventive Measures Used by Respondents

Table 5 shows the preventive measures used by the respondents against the transmission of zoonotic diseases. The results show that washing hands with water only ($\bar{x}$=3.93), intensive cooking of bushmeat ($\bar{x}$=3.57), incantation ($\bar{x}$=3.56) and avoid purchasing non-fresh bushmeat from hunters ($\bar{x}$ =3.08) were the most significant preventive measures used by the respondents against the transmission of zoonotic diseases. Avoid temptation of filling hunting bags ($\bar{x}$=2.98), use of hand gloves ($\bar{x}$ =1.97), wearing of jungle boot ($\bar{x}$=1.66), sterilization of slaughtering/cutting tools ($\bar{x}$ =1.57) and washing hands with ashes and water ($\bar{x}$=1.50) were preventive measures not frequently used by the respondents.

Table 5: Preventive Measures Used Against Transmission of Zoonotic Diseases

Preventive measures	Always Freq (%)	Sometimes Freq (%)	Undecided Freq (%)	Never Freq (%)	Mean
Hand glove	18 (15.0)	30 (25.0)	2 (1.7)	70 (58.3)	1.97
Intensive cooking of bushmeat	56 (46.7)	31 (25.8)	0 (0.0)	3 (2.5)	3.56
Wearing of jungle boot	8 (6.7)	18 (15.0)	19 (15.8)	75 (62.5)	1.66
Sterilization of slaughtering/cutting tools	3 (2.5)	11 (9.2)	37 (30.8)	69 (57.5)	1.57
Incantation	86 (71.7)	22 (18.3)	6 (5.0)	6 (5.0)	3.57
Avoid purchasing of non-fresh bushmeat from hunters	44 (36.7)	51 (42.5)	16 (13.3)	9 (7.5)	3.08
Avoid temptation of filling hunting bags	16 (13.3)	60 (50.0)	10 (8.3)	4 (3.3)	2.98
Washing hands with water only	115 (95.8)	2 (1.7)	3 (2.5)	0 (0.0)	3.93
Washing hands with ashes and water	4 (3.3)	15 (12.5)	18 (150.)	83 (69.2)	1.50

Source: Field survey, 2014

Relationship between Respondents' Socio-economic Characteristics and the Frequency of use of Preventive Measures against the Transmission of Zoonotic Diseases

Table 6 shows the relationship between respondent's socioeconomic characteristics and the frequency use of preventive measures against the transmission of zoonotic diseases. The results in table 6 shows that age (p= 0.002), educational level (p= 0.000), average monthly income (p= 0.004) and hunting/processing experience (0.000) were positively and significantly related to the respondents frequency of usage of preventive measures during bushmeat hunting/processing. This implies that the older the respondents, the higher the preventive measures used, the higher the level of education, the higher the use of preventive measures, the higher the average monthly income earned, the higher the chances of buying preventive kits and the higher the experience, the higher the preventive measures used during bushmeat hunting/processing. However, other socio-economic variables of the respondents such as sex (p= 0.260), religion (0.721) and household size (0.060) were not significant and not related to the respondents frequency of usage of preventive measures and this means that the use of preventive measures by the respondents are not determined by the respondents sex, religion and household size.

Table 6: Relationship between some Socio-economic Characteristics of the Respondents and the Frequency Use of Preventive Measures against the Transmission of Zoonotic Diseases

Variables	Coefficient –r	P-value	Remarks
Age	0.340	0.002	Significant
Sex	0.056	0.260	Not significant
Religion	0.041	0.721	Not significant
Educational level	0.532	0.000	Significant
Monthly income	0.320	0.004	Significant
Household size	0.230	0.060	Not significant
Hunting/processing experience	0.879	0.000	Significant

P > 0.05 Source: Field survey, 2014

Conclusion and Recommendations

The findings of the study have shown that there is low awareness and knowledge on zoonotic disease and usage of preventive measures among the respondents in the study area. The study also revealed that the respondents were of low educational status and access information essentially from radio. The study concluded that respondents were ignorant of the dangers inherent in having contact with wild animals particularly as a source of zoonotic disease transmission. There is need for Government and other relevant Non-Governmental Agencies to design programmes towards filling this gap in awareness and knowledge of Zoonotic Disease as revealed by the study. This is especially important given the

ravaging scourge of the Ebola virus disease in the West-African region.

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