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Knowledge, Attitudes, Risk Factors and Practices (KARP) that Favor *Leptospira* Infection among Abattoir Workers in North Central Nigeria

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ABSTRACT

Zoonoses are common infections when there is close contact between humans and animals. In Nigeria, where safety at work is poorly regulated and enforced, most workers do whatever they consider appropriate safe work place practices. Thus, 263 abattoir workers across five North Central (NC) states in Nigeria were evaluated on their knowledge of leptospirosis, work place attitudinal practices and other risks that could favor spread of *Leptospira* among them. Findings showed that most workers 252 (95.8%) were ignorant of leptospirosis. Other identified risk factors for infection included age of workers, occupation, illiteracy and risks within, such as inadequate protective gear and outside the workplace, such as rodents in homes. All these factors gave a prevalence of 226 (89.7%) *Leptospira* antibodies in the abattoir workers which they probably contracted through un-mindful handling of infected animal fluids and tissues. Surveys of Knowledge, Attitudes, Risk Factors and Practices (KARP) is a common strategy for collecting information to assess safe work environments among high risk populations and is a good starting point for prevention and control programs for individuals at risk of infection by zoonotic agents, especially Nigerian abattoir workers.

Key words: *Leptospira*, abattoir, knowledge, practices, workers, Nigeria

INTRODUCTION

Zoonotic diseases are an important threat to public health worldwide and constitute about 70% of emerging infectious diseases in recent times (Cutler *et al.*, 2010).

Occupational zoonoses are diseases that result from exposure of humans to animal diseases during work related activity. An estimated 320,000 occupationally related deaths from infectious diseases are reported yearly worldwide (Haagsma *et al.*, 2012). In Nigeria, abattoir workers constitute a major group at risk of contracting occupational zoonoses, due to the close contact that exists between them and animals/tissues during slaughter and processing (Ngbede *et al.*, 2012).

Leptospirosis is a contagious, re-emerging zoonotic disease of worldwide occurrence, caused by *Leptospira interrogans*. These are thin, highly mobile, slow-growing, obligate aerobic bacteria, with an optimal growth temperature of 30°C. These spirochetes belong to the genus *Leptospira* and family Leptospiraceae, measure about 6-20 µm in length by 0.1-0.15 µm in diameter and possess unique hook or question mark-shaped ends (Li *et al.*, 2000).

Leptospirosis has a significant health impact in many parts of the world, particularly the Americas and Asia. Outbreaks have been reported in some countries such as Brazil, India, Southern Asia, Malaysia, Japan, California and the United States (WHO., 2000; Meites *et al.*, 2004). It is transmitted to man via direct or indirect contact with water, food or soil containing blood, urine and tissue from infected animals, when the spirochaetes enter the body through mucous membrane of the eyes, nose and mouth or abraded skin, during bathing or accidental immersion in fresh water, lakes, rivers or canals contaminated with the urine of the infected livestock (Vijayachari *et al.*, 2008).

The disease can present life-threatening forms such as weil's disease and severe pulmonary hemorrhagic syndrome. The majority of reported cases have severe manifestations, for which mortality is greater than 10%. Studies in Thailand have shown that leptospirosis may represent up to 20% of febrile illness of unknown origin (Ko *et al.*, 2009).

While some infected persons may not have symptoms, leptospirosis in humans causes a wide range of symptoms. It is a biphasic disease that begins with flu like symptoms, from subclinical or mild infections to severe multi-organ failure associated with high mortality and morbidity in different countries (Ahmed *et al.*, 2006; El Jalii, 2008). In adult humans, symptoms appear after 4-14 day incubation period and include high fever, chills, myalgia, intense headache, anorexia, conjunctivitis, muscle pain, abdominal pain and constipation. Complications include meningitis, azotemia, extreme fatigue, hearing loss, respiratory distress, liver failure, cardiovascular problems and renal interstitial tubular necrosis which results in renal failure. Cardiovascular involvement is also possible. Children show symptoms such as fever, vomiting, headache, diarrhea, rash, abdominal and generalized muscle pain (Ramakrishna *et al.*, 2008; Patil *et al.*, 2011; DebMandal *et al.*, 2011).

In Nigeria, as in other countries, there is likelihood that majority of the animals brought for slaughter may harbor chronic or subclinical zoonotic diseases which may increase the risk of infection among abattoir workers (Swai *et al.*, 2010). Leptospirosis has been reported in Northern Nigeria, Enugu, Ibadan, Bauchi and Plateau States in cattle, sheep, abattoir workers and volunteer blood donors (Ezeh *et al.*, 1990; Abiayi *et al.*, 2011; Agunloye, 2002; Ngbede *et al.*, 2012).

The attitudes, knowledge and practices among livestock workers especially those in the abattoirs are major factors that influence the risk of infection and spread of zoonotic diseases. Knowledge and awareness of disease existence creates a platform for behavioral changes that help in diseases prevention, as well as prioritization and dedication of resources to their prevention and control by the government, while its absence increases the threat of a disease.

Thus, data generated by this study will help in the provision of baseline information and establish possible risk factors for sero-positivity with pathogenic *Leptospira* and assist in control and prevention of the disease in abattoir workers.

MATERIALS AND METHODS

Study area: Nigeria, in the West African sub-region has an area of 923,768 sq km, inhabited by a population of about 150 million, a population density of 152 pers km⁻²; 48% urban and 52% rural population distribution respectively (NPC., 2006). The country is divided into six geopolitical zones: North-West, North-East, North-Central, South-East, South-West and South-South. The North-Central zone consists of Benue State, Kogi State, Kwara State, Nasarawa State, Niger State and Plateau State. These six states cluster round Abuja, the Federal Capital Territory (FCT) of Nigeria (Fig. 1).

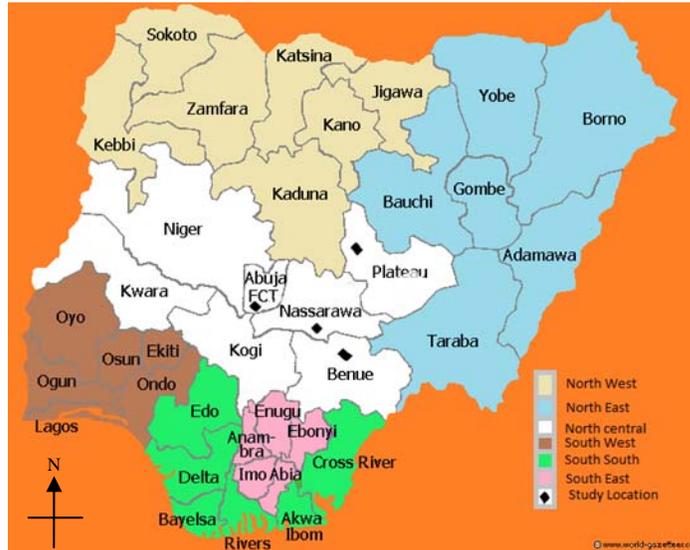


Fig. 1: Map of Nigeria showing the six geo-political zones and study locations

The North-Central zone is home to 18,971,965 Nigerians, making up 13.46% of national population (NPC., 2006). The inhabitants are mainly engaged in agriculture-pastoral and livestock farming, fishing and petty trading as major occupations.

The climate in the zone is generally moderate in humidity and with mean temperature of more than 35°C in low areas near the Rivers Benue and Niger where altitudes are less than 750 m Above Sea Level (ASL), to the cold mean temperature of less than 25°C in Jos, the capital of Plateau State, with altitudes of more than 1750 m ASL.

Data collection tools: Structured interviewer administered questionnaires were used to gather necessary information from abattoir workers, which included demographic factors such as sex, age, level of education, occupation, work duration, marital status as well as knowledge, attitudes and practices, including factors within and outside the abattoirs that could pose health risks to the workers.

Before questionnaire administration, the purpose of the study was explained to each respondent, consent obtained and confidentiality of the information assured.

Blood samples were collected at the time of the interview and sent for serologic analysis for presence of *Leptospira* antibodies.

RESULTS

Table 1 shows the socio-demographic characteristics of abattoir workers in North Central Nigeria. The ages ranged from 18-45 years (31 years median). Two hundred and twenty five (85.4%) were male. Two hundred and twenty (83.7%) were currently unmarried. One hundred and five (40%) had no formal education, 63 (23.9%) were meat vendors, 192 (73.0%) lived in rural settlements and 84 (31.9%) were from FCT.

Table 2 shows risk factors associated with the observed seroprevalence of leptospirosis among the workers. Factors found to be associated with the seroprevalence of leptospirosis among abattoir

Table 1: Socio-demographic characteristics of abattoir workers in States of North Central Nigeria

Variable	No. examined (n = 263)	No. positive	Seroprevalence (%)
Age group (Years)			
18-25	71	69	97.2
26-25	68	56	82.4
36-45	87	77	88.5
>45	37	29	78.4
Median age (31 years) (Range 18-55)			
Gender			
Male	213	188	88.3
Female	50	43	86.0
Occupation			
Animal handlers	47	43	91.5
Butchers	45	43	95.5
Cleaners	47	42	91.3
Meat inspectors	27	23	86.0
Meat vendors	63	59	92.6
Veterinarians	11	10	91.9
*Others	23	16	69.6
Location of abattoir			
Federal capital territory	84	74	88.1
Benue	62	54	87.1
Nasarawa	53	50	94.3
Plateau state	64	53	82.8

[§]Median age: 31 years, Range: 18-55 years, *Other: Errand men and women (n = 263)

Table 2: Risk factors associated with seroprevalence of leptospirosis in abattoir workers in States of North Central Nigeria

Variable	Seropositive (%)	χ^2	OR	95% CI	p-value
Age (years)					
18-25	69(97.2)	10.851	7.40	1.47-50.63 [#]	0.013 [#]
26-35	56(82.4)		1.00	Referent	
36-45	77(88.5)		1.65	0.61-4.46	
>45	29(78.4)		0.78	0.26-2.37	
Working duration (years)					
< = 10	39(86.7)	0.541	0.78	0.26-2.45	0.763
11-20	75(86.2)		0.75	0.31-1.84	
>20	117(89.3)		1.00	Referent	
Job description					
Animal handler	43(91.5)	3.785	11.42	1.21-18.25 [#]	0.688 [#]
Butcher	43(95.5)		9.4	1.77-50.11 [#]	
Cleaner	42(91.3)		4.6	1.18-17.84 [#]	
Meat inspector	23(86)		2.3	0.87-8.31	
Meat vendor	59(92.6)		5.5	1.01-29.23 [#]	
Veterinarian	10(91.9)		4.4	0.47-14.06	
*Others	16(69.6)		1.00	Referent	
Exposure factors (in abattoir)					
Accidental cut	46.8	66.534	2	0.87-4.83	0.00 [#]
Injury	44.9		0.95	0.41-2.22	
Personal protection	26.23		0.5	0.24-1.13	
Personal hygiene	26.23		0.68	0.31-1.52	
Exposure factors					
Keep livestock	245(93.2)	17.802	5.3	1.67-30.40 [#]	0.00 [#]
Rat in workers homes	251(95.4)		9.4	1.77-50.11 [#]	

*Others: Comprise of errand women and men working at the abattoir, [#]: Statistically significant values

workers were age group 18-25 years (OR = 7.40; 95% CI: 1.47-50.63). Occupation or job description, e.g. being an animal handler (OR = 11.42; 95% CI: 1.21-18.25), butchers (OR = 9.4; 95% CI: 1.77-50.11), cleaners (OR = 4.6; 95% CI: 1.183-17.84) and meat vendors (OR = 5.5; 95% CI: 1.01-29.23). Figure 2 and 3 show some risky work place practices that are engaged in by abattoir workers, such as contact with animal fluids and no protective gear worn during work.



Fig. 2: Submerged unprotected legs of butcher in pool of blood at Abattoir



Fig. 3: Handling animal tissue with no protective gear worn

Table 3: Distribution of *Leptospira* serovars among seropositive abattoir workers in selected states in North central Nigeria

<i>Leptospira</i> sero group	High risk groups							Total (%)
	Meant vendor	Vet	Cleaner	Butcher	Inspector	Animal handlers	other	
<i>Icterohaemarrhagia</i>	14 (6.1)	1 (0.4)	6 (2.6)	4 (1.7)	3 (1.3)	5 (2.2)	0 (0.0)	33 (14.3)
<i>Tarassovi</i>	1 (0.4)	0 (0.0)	1 (0.4)	2 (0.9)	1 (0.4)	3 (1.3)	0 (0.0)	8 (3.5)
<i>Pomona</i>	7 (3.0)	2 (0.9)	3 (1.3)	6 (2.6)	2 (0.9)	2 (0.9)	5 (2.2)	27 (11.7)
<i>Grippityphosa</i>	12 (5.2)	4 (1.7)	6 (2.6)	9 (3.9)	5 (2.2)	11 (4.8)	3 (1.3)	50 (21.7)
<i>Australis</i>	7 (3.0)	0 (0.0)	3 (1.3)	6 (2.6)	3 (1.3)	5 (2.2)	3 (1.3)	27 (11.7)
<i>Canicola</i>	2 (0.9)	1 (0.4)	6 (2.6)	4 (1.7)	1 (0.4)	3 (1.3)	2 (0.9)	19 (8.2)
<i>Hardjo</i>	11 (4.8)	2 (0.9)	18 (7.8)	12 (5.2)	7 (3.0)	14 (6.1)	3 (1.3)	67 (29.0)
Total (%)	54 (23.4)	10 (4.3)	42 (18.2)	43 (18.6)	23 (10.0)	43 (18.6)	16 (6.9)	231 (100)

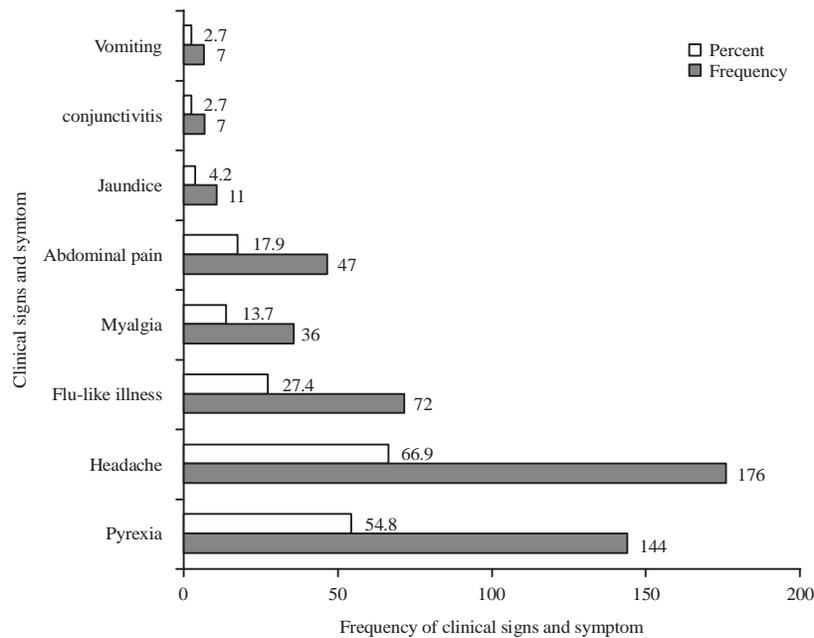


Fig. 4: Clinical signs and symptom among abattoir workers in some States in North Central Nigeria

Exposure factors outside the workplace found to be associated with the seroprevalence of leptospirosis among abattoir workers were keeping of livestock (OR = 5.3; 95% CI: 1.67-30.40) and presence of rodents like rats in workers' homes (OR = 9.4; 95% CI: 1.77-50.11).

Distribution of serovar prevalence in the workers was as follows; Meat vendors showed the following respective prevalence rates; *Icterohaemarrhagia* 14 (6.1%), *Pomona* 7 (3.0%), *Grippityphosa* 12(5.2%) and *Australis* 7(3.0). *Tarassovi* was most prevalent in animal handlers at 3(1.3%), while serovar *Canicola* 6 (2.6) and *Hardjo* 18(7.8) were prevalent in cleaners (Table 3).

Figure 4 shows the clinical signs and symptoms of leptospirosis exhibited by abattoir workers. Headache had the highest frequency of 176 (66.9%), followed by pyrexia 144 (54.8%). Vomiting and conjunctivitis had the lowest frequencies of 7 (2.7%) each.

Table 4 shows knowledge of leptospirosis among the 263 abattoir workers interviewed. 252 (95.8%) had no knowledge of the disease at all, though 217 (82.5%) knew about zoonotic diseases, e.g., knowledge of rabies had the highest frequency of 109 (41.4%).

Abattoir workers in North central Nigeria showed various attitudes and work place practices, 225 (85.6%) did not eat while working, none ate meat rare, 139 (52.9%) had cuts while working,

Table 4: Knowledge on leptospirosis among abattoir workers in States in North central Nigeria

Knowledge base	No. examined (n = 263)	No. positive	Prevalence (%)
Ever heard of leptospirosis?			
Yes	11	5	45.5
No	252	226	89.7
Aware of any zoonoses?			
Yes	217	208	96.0
No	46	23	50.0
Know any zoonoses?			
Mange	32	29	90.6
Brucellosis	70	65	93.0
Rabies	109	93	85.3
Tuberculosis	43	38	88.4
Leptospirosis	0	0	0.0
Aspergilloses	9	6	66.7

Table 5: Attitude of Abattoir worker to leptospirosis in North central Nigeria

Variable characteristic	No. examined (N = 263)	No. positive	Seroprevalence (%)
Eat while working?			
Yes	38	15	39.5
No	225	216	96.0
Eat rare meat?			
Yes	0	0	0.0
No	263	231	87.8
Have cuts while working?			
Yes	124	109	87.9
No	139	122	87.8
Can be infected while working?			
Yes	134	118	88.1
No	129	113	87.6
Consult Doctor when sick?			
Yes	146	122	83.6
No	117	109	93.2
Drugs administered			
Anti-malarial	117	105	89.7
Antibiotics	35	28	80.0
Herbal drugs	111	98	88.2

Table 6: Hygienic practices of Abattoir workers in selected states in North central Nigeria

Characteristic	No. examined	No. positive	Seroprevalence (%)
Wear protective clothing at work?			
Yes	73	67	91.8
No	190	164	86.3
Wear protective foot gear like boot?			
Yes	47	23	48.9
No	216	208	81.3
Wear hand gloves?			
Yes	7	2	28.6
No	256	229	89.5
Regular hand washes at work?			
Yes	15	8	53.3
No	248	223	89.9
Bathe with soap and water after work?			
Yes	88	78	88.6
No	175	153	87.4

while 134 (51.0%) knew they could get infected via cuts, 146 (55.5%) visited doctors when ill, while 117 (44.5%) were in the habit of self medication with drugs and herbs (Table 5).

Table 6 shows that 73 (27.8%) wore protective while at work, 216 (82.1%) did not use foot wear, about 88 (33.5%) wore hand gloves when at work while 175 (66.5%) took their bath after work.

Figure 5 shows environmental factors associated with the transmission of leptospirosis in abattoirs. Over grown vegetation had the least frequency of 75%.

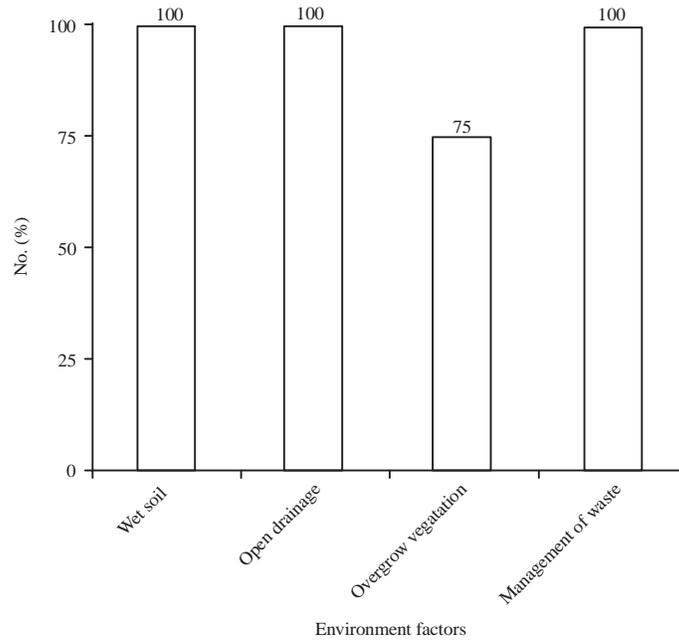


Fig. 5: Environmental factors associated with transmission of leptospirosis at the abattoirs

DISCUSSION

Survey of KARP is a common strategy for collecting information to assess safe work practices among populations at risk (Rahim *et al.*, 2012).

It was noted that majority of the abattoir workers had basic literacy (primary education), which means it might be easier for them to appreciate relevant health information when it is provided by health authorities (Ngbede *et al.*, 2012).

However, ages of the abattoir workers has been reported as a risk factor for Leptospirosis. Thus, age 18-25 years were significantly associated with leptospirosis, in this study being seven times more likely to become infected with leptospirosis than other age group. This is similar to the age reported by Ferro *et al.* (2006). This age group constituted a majority of the abattoir work force, as most of the workers were below the age of 40 years.

The implications of occupational exposure to a preventable and potentially debilitating disease to Nigeria's economy and workforce cannot be overemphasized, especially as risk factors identified in this study included occupation or job description as follows: Animal handlers compared with other occupation groups were eleven times more likely to come down with leptospirosis than others, butchers were nine times more likely to come down with leptospirosis. Cleaners were four times more likely to come down with leptospirosis than others, while meat vendors were five times more likely to come down with leptospirosis than others.

Other risk factors that were also identified in this study included exposure outside the workplace, such as keeping livestock, which groups showed statistically significant association with leptospirosis, being five times more likely to come down with leptospirosis. Rodents like rats in workers homes showed statistically significant association with leptospirosis. These groups were nine times more likely to come down with leptospirosis than others, as rodents and other animals could harbor and spread the disease.

For accidental cuts, personal protection and hygiene the result could be due to recall bias or respondent bias.

The survey provides a suitable format to evaluate existing programs and to identify effective strategies for behavior change. Indeed a good KARP among workers at risk is essential in assuring successful prevention and control of the disease. A large majority of respondents had never heard of leptospirosis. This is in agreement with the work of Rahim *et al.* (2012) who in a study also obtained a low percentage of 12.8% who had never heard of leptospirosis.

In contrast, a study among Canoeists in North Wales in 1991 revealed a very high 95% of respondents who had heard of the disease (Philipp *et al.*, 1992). This was probably because the study was either carried out among active leptospirosis cases or the subjects were exposed to intensive information because they were exposed to a good health promotion program. In contrast, this study was focused on asymptomatic subjects who were exposed to information on leptospirosis on ad-hoc and voluntary bases, which is in agreement with the work of Sharma *et al.* (2003).

Concerning attitude towards leptospirosis, majority of the workers in this study showed unsatisfactory and high risk work place practices, in contrast to Rahim *et al.* (2012), who got 64% respondents with positive attitudes.

Johnson *et al.* (2004) demonstrated that attitudes, practices and knowledge are important and remain the main predictors of *Leptospira* infection. Thus in agreement with his assertion, the finding of this work is a good starting point for prevention and control programs for leptospirosis. Of course difficulties still exist in convincing people to take all necessary safety precautions even though they may be aware of the disease. Similar to smoking, people may know the consequence but still choose to smoke, probably because they fail to see the benefits of altering long term behaviors they've indulged in.

CONCLUSION

Leptospirosis is preventable when the risk factors are appropriately identified and interventions are targeted at individuals and community levels. The risk factors responsible for leptospirosis in North Central Nigeria have been established in this study. This survey has also provided knowledge on the attitudes and practices among abattoir workers to identify effective strategies for behavior change and successful prevention and control of leptospirosis.

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