International Journal of
Dairy Science

ISSN 1811-9743

Academic
Journals Inc.

www.academicjournals.com

International Journal of Dairy Science 8 (2): 58-64, 2013
ISSN 1811-9743 / DOI: 10.3923/ijds.2013.58.64

Sero-prevalence of Brucellosis in Milk of Sheep and Goats in Kaduna North Senatorial District of Kaduna State, Nigeria

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ABSTRACT

Most brucellosis related studies in Nigeria is mainly in the cattle population. Brucellosis in small ruminants may be of greater public health concern in view of the socio-economic role of small ruminants in Nigeria. This study was carried out to generate a base-line data of brucellosis in sheep and goats in Kaduna North Senatorial District of Kaduna State, Nigeria. In this study, 72 and 122 milk samples were collected from apparently healthy sheep and goats, respectively within the months of April- May. Milk samples were collected from lactating sheep and goats and subjected to the Milk Ring Test (MRT). From the milk samples collected 13(18.1%) and 32(26.2%) were positive for *Brucella* antibodies. Though the prevalence in goats was higher compared to sheep but this was not statistically significant ($p>0.05$). A high prevalence of *Brucella* antibodies in the milk of sheep and goats necessitates government intervention for an effective and holistic control of brucellosis in Nigeria. High risk groups and the general public should further be enlightened on the health hazards of the disease and the risk of interspecies transmission of brucellosis.

Key words: *Brucella,* antibodies, sheep, goats, milk ring test, Nigeria

INTRODUCTION

Brucellosis is a contagious bacterial disease mainly of domestic animals and man which could culminate in serious economic losses (Cadmus *et al*., 2008). Seleem *et al*. (2010) and Hahn (1991) reported that zoonoses are diseases of public health importance transmissible through direct infection or consumption of contaminated animal products indicating an occupational hazard.

Infected animals can shed *Brucella* organism in milk and in reproductive tract discharges after abortion or birth. Infection in humans could result from consumption of unpasteurized milk and other dairy products that have been contaminated with the *Brucella* organisms.

The fact that there is an unhindered movement of domestic and some wild animals between pastoral and rural populations and that there is an increase in the prevalence of the disease in cattle (Ocholi *et al*., 2004), the occurrence of brucellosis among sheep and goats could be expected.

Presently, small ruminants make up the bulk of the population of food animals in Nigeria with about 28 million goats and 23 million sheep, whereas 15.2 million represent cattle population (FAO, 2006). Kaduna state has an estimated population of 1,144,000 cattle, 832,000 sheep and 988,000 goats (KDSG, 2008). The major occupation of the people of Kaduna state constitutes crop and livestock farming (KDSG, 2008). Man seizes the advantage of the size of small ruminants as

it favors minimal investment in terms of cash and land. Furthermore, there is less risk bearing in terms of loss and they are rewarding in terms of reproductive efficiency (Ademosun, 1988; Omoike, 2006). Small ruminants also feature prominently in socio-cultural activities like ceremonies and religious festivals where they are either loaned, exchanged among relatives and friends or slaughtered for such occasions (Bale, 1980). However, there is a paucity of data on the occurrence and impact of zoonotic infections, including brucellosis in many developing countries (Perry *et al*., 2002; Mcdermott and Arimi, 2002).

The upsurge in the demand for milk and milk derived products could lead to an increase in the spread of milk-borne diseases one of which is brucellosis and this could lead to a very serious health hazard in man (FAO/WHO, 1986; Olsen and Tatum, 2010). Five million cases of human brucellosis are estimated to occur worldwide every year. The prevalence rate of brucellosis is particularly high in developing countries, this could be ascribed to the close association between animals and man and also due to the traditional way of food consumption such as consumption of unpasteurized milk and milk derived products (Nicoletti, 1984).

However, Omeke (1988) reported that diseases have been the major limiting factor in small ruminant production in the tropics as is in the case of Kaduna State.

This study was therefore aimed at generating a base-line data of *Brucella* antibodies in milk of in sheep and goats in Kaduna North Senatorial District of Kaduna State, Nigeria, with the possibility of using them in brucellosis control and eradication programs.

MATERIALS AND METHODS

Study area: This study was conducted in Kaduna North Senatorial District of Kaduna State which comprises of seven Local Government Areas (LGAs). Kaduna State is located in the Northwest Geopolitical zone of Nigeria. It lies between latitudes 6° and 11° North and longitude 7° and 44° East and is 608 m above sea level. It has distinct wet and dry seasons within the Guinea Savannah zone and part of the Sudan Savannah in Nigeria. Kaduna State is made up of 23 Local Government Areas (LGAs) and occupies about 48,473.25 km^2. It has a human population of over 6,066,562 people according to the census figures of 2006 (KDSG, 2008).

Four out of the seven LGAs in Kaduna North Senatorial District of Kaduna State were selected using simple random sampling without replacement. These were Ikara, Makarfi, Sabon Gari and Soba LGAs. Three wards were further selected from each of the selected LGAs using the same method. The location of the flock, animal species, breed and age of each animal sampled were recorded. Ten animals were sampled per flock. A total of 194 lactating animals from both sheep and goats were sampled.

Study animals: Pastoral and village level sheep and goats were used in the study. Flock selection was done based on random selection following farmers' consent to allow their flocks to be used for the study.

Sample collection: Lactating animals earmarked for sampling were properly restrained by an assistant. The teats of the udder were disinfected using 70% alcohol and dried using clean gauze bandage. The fore milk was stripped off to reduce contamination and about 5 mL of fresh milk was then expressed from the udder into a clean sterile bottle which was properly labeled. All samples were then transported in ice box to the laboratory where they were stored in the refrigerator at 4°C and analyzed after at least 12 h post collection.

Laboratory investigation: The MRT was performed as described by Alton *et al.* (1975) using MRT antigen sourced from Onderstepoort Biological Products Ltd, South Africa. The antigen and milk samples were placed on the work table for 1 h to attain room temperature. A series of test tubes of a size to contain 1 mL of milk in a column 2 cm high were labeled to correspond with those on the milk samples. A drop (0.03 mL) of the antigen was then placed in each test tube to which 1 mL of the milk sample in the corresponding tube was added. The test tubes were then covered and the mixture was incubated in a water bath (KOTTERMANN) at 37°C for 1 h after which the results were read. Positive reaction by identically deeply colored milk and cream, or colorless milk and deeply colored cream forming a distinct ring while negative reaction was indicated by colored milk, colorless cream.

Statistical analysis: Data obtained were subjected to statistical analysis using Chi square (χ^2) (Snedecor and Cochran, 1980). Values of $p<0.05$ were considered significant.

RESULTS

The results obtained on the sero-prevalence of *Brucella* antibodies present in the milk samples of sheep and goats used in the study indicated that the highest sero-prevalence rate for *Brucella* antibodies in the milk of the sampled sheep was 8 (40.0%) from Ikara LGA, followed by sheep from Makarfi LGA with 1 (25.0%), 1 (5.0%) from Soba LGA and 3 (10.7%) from Sabon Gari LGA (Table 1). Similarly, the highest sero-prevalence rate for *Brucella* antibodies in milk of goats determined by the MRT was in Sabon Gari LGA with 8 (42.1%) followed by goats from Ikara, Makarfi and Soba LGAs with 10 (40.0%), 7 (24.1%) and 7 (14.3%) respectively (Table 2).

The results obtained from this study showed that 45 out of the 194 milk samples tested were positive for *Brucella* antibodies indicating an overall sero-prevalence of 23% (Table 3).

Table 1: Sero-prevalence of *Brucella* antibodies in milk of Sheep in four LGAs in Kaduna North Senatorial District of Kaduna State

		Positive	
Local government area	No. of samples tested	No.	%
Ikara	20	8	40.0
Makarfi	4	1	25.0
Sabon Gari	28	3	10.7
Soba	20	1	5.0
Total	72	13	18.1

Table 2: Sero-prevalence of *Brucella* antibodies in milk of Goats in four LGAs in Kaduna North Senatorial District of Kaduna State

		Positive	
Local government area	No. of samples tested	No.	%
Ikara	25	10	40.0
Makarfi	29	7	24.1
Sabon Gari	19	8	42.1
Soba	49	7	14.3
Total	122	32	26.2

Table 3: Sero-prevalence of *Brucella* antibodies in milk of sheep and goats in four LGAs in Kaduna North Senatorial District of Kaduna State

		Positive		Overall sero-prevalence	
Species	No. of samples tested	No.	%	No.	%
Sheep	72	13	18.1	45	23.2
Goats	122	32	26.2		

Table 4: Sero-prevalence of *Brucella* antibodies in milk of sheep and goats per different age groups in Kaduna North Senatorial District of Kaduna State, Nigeria

Local government area	No. of samples tested	1-3 (year)	No. of samples tested	>3 (Age)
Ikara	21	5 (23.8)	24	13 (54.2)
Makarfi	13	3 (23.1)	20	5 (25.0)
Sabon Gari	22	5 (22.7)	25	6 (24.0)
Soba	30	7 (23.3)	39	1 (2.6)
Total	86	20 (23.3)	108	25 (23.2)

Values in brackets are percentage

There was no statistically significant difference ($p = 0.1925$, $\chi^2 = 1.698$) in the prevalence rates of *Brucella* antibodies present in the milk sampled from sheep and goat.

The number of sheep and goats tested and the prevalence of *Brucella* antibodies in milk per different age groups are presented in Table 4.

Twenty animals within the age bracket of 1-3 years were tested, the highest seroprevalence rate 5 (23.8%) was recorded in Ikara LGA while the lowest rate 5 (22.7%) was recorded in Sabon Gari LGA, seroprevalence of 3 (23.1%) and 7 (23.3%) were recorded in Sabon Gari and Soba LGAs, respectively. Similarly, 25 sheep and goats above 3 years of age were tested. The highest sero-prevalence rate for this age group 13 (54.2%) was recorded in Ikara LGA while the lowest rate 1 (2.6%) was recorded in Soba LGA, Makarfi and Sabon Gari LGAs recorded prevalence of 5 (25.0%) and 6 (24.0%), respectively.

There was no statistically significant difference ($p = 0.9859$, $\chi^2 = 0.0003115$) in the prevalence rates of *Brucella* antibodies present in the milk sampled from sheep and goat of 1-3 years of age and those above 3 years of age.

DISCUSSION

The high sero-prevalence rate observed using the MRT in this study is of great significance because goat milk is becoming increasingly important as reported by Haenlein (2011) and also due to the fact that, pastoralists use raw goat milk as traditional medicine to cure certain ailments (Anonymous, 2011). Furthermore, brucellosis in humans is usually associated with the consumption of unpasteurized milk and soft cheeses made from the milk of infected animals, primarily goats, infected with *Brucella melitensis* (European Commission, 2001). Also, the fact that goat milk has been reported to have several nutritional advantages over cow milk places it at an advantage over cow milk and makes it a source of public health risk (Anonymous, 2012; Adamu *et al*., 2012). There is a possibility that some of the positive MRT result could have been due to certain factors like end of lactation, mastitis, presence of colostrum, or a hormonal disorder could result in false positive. However, these factors except for hormonal were minimized during the course of this

study, as mastitic, colostrum and end of lactation milk were avoided. It was however, not impossible that some cases would have been included which would give a false positive result as health/parturition records of these animals were not available. The MRT may also be insufficiently sensitive to detect antibodies in milk that contains low concentrations of antibodies specifically IgM and IgA or that lacks the fatclustering factors (Patterson and Deyoe, 1976). Despite these limitations, the MRT remains an important screening test for brucellosis considering the fact that some other tests are more problematic and cumbersome.

There is however, the need to employ other tests for confirmatory diagnosis. This is in agreement with the reports of Morgan (1967), Bercovich and Moerman (1979), who stated that the MRT test should be used in conjunction with established tests and not instead of them.

The milk ELISA could be used as a confirmatory test for *Brucella* status of animals which can be used on pooled milk samples instead of milk from individual animals. However, the test is very expensive (Cadmus *et al*., 2008).

Antibodies detected in the sampled animals could really indicate an exposure to *Brucella* organisms as no vaccination against small ruminant brucellosis is currently being carried out in Nigeria. It is worth noting also that despite the few lactating animals sampled in each flock visited, the prevalence rate was yet high. This implies that brucellosis being contagious and equally transmissible through milk, many young and adult non-lactating animals stood a high risk of exposure and hence the true prevalence of the disease in all the flocks may be multiples of the above figures.

The study also recorded higher prevalence in goats than in sheep, this could be attributed to the fact that more goats were sampled compared to sheep which was due to the much ease of milking the does than ewes which could be due to the fact that milk in goats is produced almost throughout the year since there is little or no photoperiod effect on their conception (Adamu *et al*., 2012).

The study revealed a high seroprevalence rate 23.3 and 23.2% in sheep and goats of 1-3 years and those above 3 years, respectively. Although the difference in the seroprevalence rate between these age groups was not statistically significant. This could be due to the fact that since these animals are herded together they have equal exposure potentials.

However, the presence of antibodies to *Brucella* in these animals is of serious public health concern as these age group are more likely to be sold out to other potential herd owners or to farmers who wish to increase their flock size which could lead to spread of the disease to the young.

The government should institute a stringent measure for the control of brucellosis. High risk groups and the general public should be given health education on the nature of the disease and how to minimize the risk of transmission of the disease through animal contact and milk products produced from unpasteurized milk.

CONCLUSION

This study has established a high prevalence of *Brucella* antibodies in milk of sheep and goats in the study area which is of serious public health significance. Therefore, more detailed studies should be carried out in this region and in Nigeria as a whole to make proper and effective control measures.

ACKNOWLEDGMENT

The authors wish to express their appreciation to the farmers, Veterinary personnel from the LGAs involved in this study, Head of Department and Laboratory staff, Department of Public Health and Preventive Medicine, Faculty of Veterinary Medicine, ABU, Zaria and Ahmadu Bello University, Zaria.

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