

## **SHORT COMMUNICATIONS**

### **The role of livestock keeping in human brucellosis trends in livestock keeping communities in Tanzania**

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**Abstract:** A cross-sectional survey was carried out in Karatu and Ngorongoro districts in Arusha region and Babati, Hanang and Mbulu districts in Manyara region involving 20 agro-pastoral and 9 pastoral villages, to establish the magnitude of human brucellosis in relation to livestock brucellosis. A multistage random sampling was used to select villages, sub-village administrative units, ten cell leadership units and animal keeping households. A total of 460 humans from 90 families (19 pastoral and 71 agro-pastoral families) and 2723 domestic ruminants from 90 livestock households were sampled and bled to obtain serum samples for analysis. A competitive enzyme linked-immunosorbent assay (c-ELISA) was used to analyse these samples to detect brucella circulating antibodies. The overall livestock seroprevalence was 5.7% with 32.2% of livestock households being seropositive whereas, human seropositivity was 8.3% with 28% family households being seropositive. The highest proportion of seropositive families was observed in Ngorongoro district (46%) and the lowest in Babati district with no seropositive family household. Family members in seropositive livestock households were 3.3 (OR) times more likely to be seropositive than those with seronegative livestock households. However; 25% of seronegative family households had seropositive livestock households and 48% seropositive family households had seronegative livestock households. Therefore, *Brucella* infection is widespread in the human populations and their livestock in the northern Tanzania and thus humans may acquire infection from their own animals or from other sources thus prompted public health awareness creation in such communities.

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**Keywords:** undulant fever, brucellosis, pastoralists, Tanzania

Animal and human health in livestock keeping communities is inextricably linked. Pastoralists and agropastoralists depend on animals for nutrition and their socio-economic development, yet these animals can transmit many diseases to humans including brucellosis. Brucellosis is a major zoonotic disease widely distributed in both humans and animals especially in the developing countries (WHO, 1997). The disease is transmitted to humans through ingestion of contaminated animal products such as cheese, and unpasteurised milk and by direct contact with infected animals through handling abortions, dystocia and parturitions. Brucellosis in humans is characterised by intermittent fever with a marked effect on the musculoskeletal

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system evidenced by generalised pains (WHO, 1997). However, these clinical signs are non-specific and the disease can be misdiagnosed and confused with typhoid fever, malaria, relapsing fever and rheumatic fever.

Although, several countries especially the Middle East region have carried out studies on human brucellosis (Refai, 2002), only few and limited studies have been conducted in Tanzania. The first report of human brucellosis in Tanzania was in 1935 (Wilson, 1936). Further reports of human brucellosis in the country were from the Lake and Western Regions in 1959, 1960 and 1961 where three cases were confirmed (Mahlau & Hamond, 1962). Recent reports from several hospitals in the Northern zone have shown that the incidence of the disease is on the increase (G.M. Shirima *unpubl.*). Minja (2002) conducted a random survey in two districts of the Northern zone and found a seroprevalence of 0.7% among livestock keepers with no infection in other occupational groups.

Although the geographical distribution of human brucellosis is closely related to the endemicity of animal infection, husbandry methods, eating habits and hygienic standards; screening for animal brucellosis did not go in hand with human screening in Tanzania. Therefore, this study examined the trend of human brucellosis in livestock keeping districts where human brucellosis cases were frequently reported in hospitals.

The objectives of the study were to establish the magnitude of co-existence of human and livestock brucellosis in order to raise awareness about the scale of the problem by: (i) establish the magnitude of human brucellosis in livestock keeping communities of the Northern zone of Tanzania; (ii) establish the magnitude of livestock brucellosis at household (herd/flock) level; and (iii) establish the role of keeping livestock on the trend of human brucellosis.

This study was conducted in the Arusha and Manyara regions in northern Tanzania from 2002 to 2003. The regions lie between 34.6 to 38.0°E and 1.8 to 6.0°S. The regions have potential for agriculture, food and cash crops, livestock, wildlife and mining. Livestock-keeping households were selected by a process of multistage random sampling. The sampling frame comprised of all villages in the study area (n=285), which was made available at district livestock offices. A random sample of 29 villages was selected using a table of random numbers. Among these 20 were agro-pastoral and 9 pastoral villages. In each village two sub-village administrative units were randomly selected. A ten-cell leader, (a leader of ten or more households) was selected at random from each sub-village and all livestock-keeping households were identified. Finally, two livestock-keeping households were selected from each ten-cell leader. This achieved a wide geographic coverage but was considered to be too time-consuming and other resources and the sampling procedure was therefore revised to include two households from each of ten-cell leaders.

The sample size was calculated as described by Martin *et al.*, (1987) based on the previous seroprevalence of 5% (a figure that was considered likely on the basis of previous published studies) with 80% power and 95% confidence to obtain the total number of animals to be screened from each household. Blood samples were collected from the jugular vein using a sterile needle and a plain vacutainer (Becton and Dickson, UK) and the metal tag was fitted to each animal for subsequent identification. Sampling of animals at herd level was difficult due to lack of

systematic method of restraint such as crush or race. Therefore, at herd level animals were restrained on convenience.

Permission to collect human serum samples was obtained from the Ministry of Health, Tanzania. In each household selected, family members were approached for blood sampling. Where members gave consent, blood samples were collected from the brachial vein after disinfection using cotton wool soaked in methylated spirit (Bell chemicals Co. Ltd. Dar es Salaam). Blood was collected using sterile disposable 5ml syringe and later transferred into a plain vacutainer. The vacutainer was assigned an identification number and kept in a tray for serum separation.

Serum samples were sent to VLA Weybridge-UK for c-ELISA analysis as a confirmatory test. Therefore, a livestock household (herd and or flock) and a family household was considered c-ELISA seropositive, if at least one individual was seropositive. Data were entered using Microsoft Excel spreadsheet 97 (1993). The Chi-square test was used to compare two or more proportions and to determine associations. The strength of the association between risk factor and brucellosis status was examined by odds ratio (OR) and 95% confidence intervals (95%CI) values.

A total of 2723 domestic ruminants (cattle, goats and sheep) were bled and subjected to c-ELISA analysis from 90 households. Of these, 155 samples (5.7%) were seropositive. Seropositivity was detected in all species although the difference between cattle (4.9%) and small ruminants (6.5%) was not statistically significant ( $\chi^2 = 3.1$ ,  $df=1$ ,  $95\%CI=0.0017, 0.0331$ ,  $P>0.05$ ). For both herds and flocks, c-ELISA seropositivity was significantly higher in pastoral than in agro-pastoral herds ( $\chi^2=31.9$ ,  $df = 1$ ,  $95\%CI = 0.379, 0.818$ ,  $P<0.01$ ) and flocks ( $\chi^2= 18.28$ ,  $df=1$ ,  $95\%CI= 0.250, 0.731$ ,  $P<0.01$ ).

During the cross-sectional survey, 104 families were visited. Fourteen families were not bled due to non-compliance. Therefore, 90 families with a total of 460 family members were screened. Within these families however, young children who were afraid and those individuals failing to comply were not bled. Seventy four percent of the families had family members ranging from 1-6 who complied for bleeding.

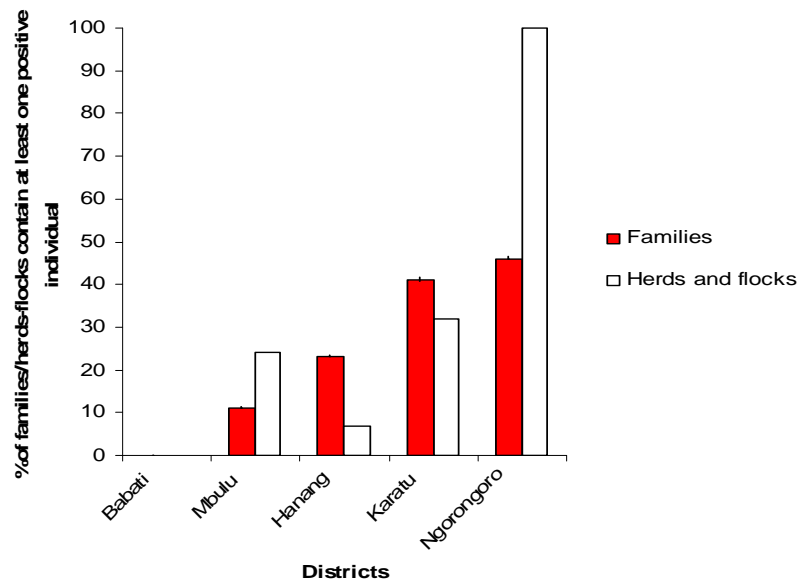
Out of 460 sera that were tested using c-ELISA, 38 (8.3%) turned to be seropositive. There was no statistical difference between seropositivity in males and females ( $P=0.663$ ). A higher proportion of human c-ELISA seropositivity was observed in the agro-pastoral farming system (8.7%) than in the pastoral system (7.4%) though the difference was not statistically significant ( $P = 0.631$ ). However, the difference between pastoral and agro-pastoral families seropositivity was statistically significant ( $\chi^2 = 14.98$ ,  $P<0.05$ ) with high proportion of seropositivity observed in agro-pastoral families (29%) compared to pastoral families (25%).

Forty four percent (11/25) of the families that were c-ELISA seropositive had more than one person that was seropositive. Also among families that were seropositive, three families had brucella seropositive human cases diagnosed in health facilities prior to this study. Furthermore, the highest proportion of human c-ELISA positive families was observed in Ngorongoro district (46%) and lowest in Babati district (0%). All family members ( $n = 56$ ) from 12 families sampled in Babati district were seronegative (Table 1).

**Table 1: C-ELISA seropositivity in humans by district, family and individual level**

District	Families screened	Families positive	%positive families	People screened	People positive	%people positive
Babati	12	0	0	56	0	0
Hanang	13	3	23.08	49	3	6.12
Mbulu	18	2	11.11	92	3	3.26
Karatu	34	14	41.18	180	24	13.33
Ngorongoro	13	6	46.15	83	8	9.64
Total	90	25	27.78	460	38	8.26

Fifty two percent (13/25) of families that were c-ELISA seropositive had infected herds and flocks whereas 48% (12/25) of families that were c-ELISA seropositive their herds and flocks were c-ELISA seronegative. In addition 25% (16/65) of families that were c-ELISA seronegative had infected herds and flocks. There was a significant association between c-ELISA seropositivity in families and c-ELISA seropositivity in households (OR = 3.3, 95%CI = 1.26, 8.67,  $P < 0.05$ ) (Figure 1). Family members in the c-ELISA positive households were 3.3 (OR) times more likely to be c-ELISA positive than those in seronegative livestock households.



**Figure 1: C-ELISA seropositivity in families and livestock-keeping households**

The overall c-ELISA seropositivity in humans was 8.3% whereas in livestock was 5.7%. To-date this is the first and highest human figure to be reported in a cross-sectional survey in pastoral and agro-pastoral communities in Tanzania. The cross-sectional study by Minja (2002) found that livestock keepers in agro-pastoral areas were infected (0.7%) among different groups of people who handle livestock and livestock products in the area. Therefore, the current study encompasses both pastoral and agro-pastoral families and had a wider coverage thus resulting to a

higher seroprevalence than the previous studies. Several studies carried in other countries indicated variable seroprevalences based on the rate of infection in animals such as 18-24% in humans and 18% in farms in Uganda (Ndyabahinduka & Chu, 1984), 3.8% in humans and 7% in cattle in Chad (Schelling *et al.*, 2003) and 40 cases/100,000 in humans and 15% in animals in Saudi Arabia (Memish, 2001). The variations of seroprevalence between humans and livestock could be probably due to the extent of spread of the disease in livestock populations and risk factors associated with transmission of brucellosis from animals to humans.

The statistical difference observed between agro-pastoral and pastoral families c-ELISA seropositivity with high proportion of infected families recorded in agro-pastoral families may not reflect the true status of the disease as many family members from pastoral areas were reluctant for screening. It was expected that pastoral families having higher seropositivity than agro-pastoral families to conform to the infection in livestock where high infection was observed in the pastoral herds and flocks compared to agro-pastoral herds and flocks. Another possible explanation could be the fact that families in agro-pastoral areas might acquire infection from other sources apart from their livestock.

Absence of c-ELISA seropositive families in Babati district observed in this study was consistent with the previous studies where the seroprevalence was low compared to Hanang district (Niwael, 2001). This could be explained by the fact that domestic ruminants were also c-ELISA seronegative during cross-sectional screening. This was supported by the fact that human brucellosis occurred when brucellosis was present in livestock populations. Families with the highest c-ELISA seropositivity were observed in Ngorongoro district, which is a pastoral district, followed by other districts which are predominantly agro-pastoralist. This was expected because in all families that were screened in Ngorongoro district their herds and flocks were also c-ELISA positive. Close cohabitation under poor hygiene, eating habits and livestock related activities performed without protective measures could have resulted in high family seroprevalence in the district. Assisting with parturition and handling aborted foeti and retained placenta may be risk factors for human infection. This was further supported by the fact that there was a significant statistical association between families with c-ELISA seropositivity and herd c-ELISA seropositivity.

Furthermore, 48% percent of families were c-ELISA seropositive while their herds and flocks were c-ELISA seronegative. Family members could acquire infection from neighbours through drinking raw milk, assisting parturitions or handling aborted materials and in livestock auction markets where people may have access to raw blood, milk and meat. It was also observed that 25% of families were c-ELISA seronegative yet their livestock were seropositive. One explanation could be the fact that in some families not all members were tested resulting in false negative families. This may mask the real status of the disease at family level. These families were from agro-pastoral farming systems where some households kept high numbers of male rather than female animals for transport and draught purposes. Therefore, risk from infected males is probably minimal as humans acquire infection through consumption of raw milk and handling foetal materials and placentae. Also the practice of boiling milk may be common in these households thus reducing the

risk of human infection. Another possible explanation could be the recent introduction of infected animals into the herd or flock.

Although keeping livestock was observed to be associated with human brucellosis in the area, other sources of infection should be identified and quantified as some families had seronegative herds and flocks.

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