INTERNATIONAL JOURNAL OF SOCIAL Sciences and Information Technology
ISSN 2412-0294 www.ijssit.com
http://www.ijssit.com

EDUCATIONAL RISK FACTORS CONTRIBUTING TO HUMAN BRUCELLOSIS INFECTION AMONG HOUSEHOLD MEMBERS HANDLING LIVESTOCK PRODUCTS IN KISII COUNTY, KENYA

[1*] **Jecton Otieno Aloo**

[2**] **Charles Angira**

[3***] **Portas Olwande**

[1, 2] Department of Public and Community Health and Development, School of Health Sciences, Jaramogi Oginga Odinga University of Science and Technology, Kenya

[3] School of Agriculture and Food Security, Maseno University, Kenya

Corresponding author email: jectonaloo@gmail.com

Abstract: Human brucellosis is a neglected zoonotic disease that remains a major public health and economic burden in Kisii County, Kenya, where reported cases are frequently misdiagnosed as malaria or typhoid before the correct diagnosis is made. This paper reports findings on the educational risk factors contributing to human brucellosis infection among household members handling livestock products in Kitutu Chache South Sub-County, Kisii County. A cross-sectional descriptive design combining qualitative and quantitative approaches was used. A sample of 384 household heads (or their representatives) was drawn using stratified random sampling, of whom 375 questionnaires were fully completed and analyzed; the qualitative component comprised key informant interviews and focus group discussions. Data were analyzed using descriptive statistics, Pearson correlation, and thematic analysis. Slightly more than half of the respondents (52.3%) had attained secondary-level education, 45.6% primary level, and 2.1% college education. Educational attainment was not clearly protective: 19.5% of respondents with primary education or below had never tested positive for brucellosis compared with 13.1% who had, while comparable near-even splits were observed among respondents with secondary (20.8% negative vs 15.7% positive) and tertiary (14.7% negative vs 16.3% positive) education. Across all education levels, protective practices were poor — 80.3% of respondents did not use protective gear while milking, 72.5% did not use protective materials when assisting animals to deliver, and 34.9% of respondents were entirely unaware of brucellosis. Radio (57.6%) was the leading source of brucellosis-related information, followed by national television (19.2%) and daily newspapers (7.5%). Educational risk factors showed a positive but weak and statistically non-significant correlation with human brucellosis infection ($r = .041$, $p = .310$, $p > 0.01$). The study concludes that formal educational attainment alone does not translate into adequate brucellosis awareness or protective behaviour among household members handling livestock products, and recommends intensified, disease-specific public health education

delivered through radio and community platforms, alongside deliberate promotion of protective equipment use during milking, calving assistance, and handling of animal by-products.

Keywords: human brucellosis; educational risk factors; livestock handlers; zoonotic disease; protective behaviour; Kisii County; Kenya

1. Introduction

Human brucellosis is a zoonotic disease caused by bacteria of the genus Brucella, principally Brucella melitensis, Brucella abortus, Brucella suis and Brucella canis, with B. melitensis recognized as the most virulent and invasive species. Globally, brucellosis imposes substantial economic losses through livestock abortion, infertility, reduced milk yield, stillbirths and the birth of weak offspring, in addition to the direct costs of human treatment and lost productive time. In Kenya, and in Kisii County in particular, brucellosis remains under-recognized: medical reports indicate that the great majority of confirmed cases were initially misdiagnosed as malaria or typhoid, delaying appropriate treatment.

Education is widely theorized to play a protective role in the control of zoonotic diseases such as brucellosis. A literate, educated individual is generally better placed to read and interpret public health information about brucellosis, whereas an uneducated person may depend on others to relay such information, or may miss it altogether. Poverty-driven school dropout has also been linked to increased occupational exposure: children and teenagers who cannot access education are often engaged as herders or as caretakers of young livestock in wealthier households, placing them in frequent contact with animals that may be infected. Similarly, uneducated women in low-income households often take up informal work caring for dairy cattle belonging to better-off neighbours, a role that involves frequent milking and feeding of animals and therefore repeated exposure. Conversely, education does not uniformly protect against exposure: well-educated professionals working within the livestock value chain — including veterinary clinicians, meat inspectors, and hides-and-skins inspectors — face elevated occupational risk of brucellosis by virtue of their work.

In parts of Kisii County characterized by high poverty, such as Kisii South and Kitutu Chache South sub-counties, children unable to attend school due to lack of school fees frequently take up herding or animal-care work at neighbouring homesteads, increasing their exposure to potentially infected livestock. Low educational attainment in these areas has also been associated with poor health-seeking behaviour, including the practice of purchasing and consuming raw blood from slaughterhouses mixed with vegetables, and testing the freshness of unboiled milk churn (locally, "ochuri") by taste — both practices that carry a documented risk of brucellosis transmission.

Against this background, this study set out to identify the educational risk factors contributing to human brucellosis infection among household members handling livestock products in Kisii County, Kenya, as one of the specific objectives of a broader study on risk factors for human brucellosis in the County.

2. Materials and Methods

2.1 Study area

The study was conducted in Kitutu Chache South Sub-County, one of nine sub-counties of Kisii County in the southern part of Kenya. The sub-county comprises seven locations — Nyakoe, Nyatieko, Nyanguru, Bogeka, Nyamache Mange, Etora and Township — with a population of 132,131 people in 29,930 households across an area of 104.4 km². Livestock production (cattle, goats, sheep and poultry) alongside crop farming are the major economic activities in the area.

2.2 Study design and population

A descriptive, cross-sectional study design combining qualitative and quantitative methods was adopted, conducted over a two-month period. The qualitative phase used key informant interviews (KIIs) with the head of veterinary services and head of health services in each sub-county, and focus group discussions (FGDs) — one per sub-county — comprising household heads who had not participated in the quantitative survey. The quantitative phase involved administration of structured questionnaires to sampled households actively engaged in handling livestock products. The study population comprised 132,131 people practicing livestock-related agricultural activities within the study area.

2.3 Sample size and sampling

Sample size was determined using the Krejcie and Morgan (1970) sample size determination table, yielding a sample of 384 respondents. Stratified random sampling was used to proportionately allocate the 384 households among the four sampled locations (Bogeka, Etora, Nyakoe and Nyamache Mange) based on population size, with sampled household heads or their representatives interviewed at their homes. For the qualitative component, eight KIIs and four FGDs (8–13 discussants each) were purposively and randomly sampled respectively. Of the 384 questionnaires administered, 375 were fully completed, returned and analyzed (response rate of approximately 97.7%).

2.4 Data collection and measurement of educational risk factors

Quantitative data were collected using a structured and semi-structured questionnaire administered by trained research assistants. Educational risk factors were operationalized through: respondents' level of formal education (primary, secondary, or college/tertiary); brucellosis awareness; source of information about brucellosis; use of protective gear while milking; assistance rendered to animals during delivery and associated use of protective materials; occurrence of animal illness or abortion in the preceding six months; and disease positivity status. Qualitative data on community knowledge and awareness were collected through KII and FGD guides.

2.5 Data management and analysis

Quantitative data were cleaned, coded and entered into SPSS version 26 for analysis. Descriptive statistics (frequencies, percentages, means and standard deviation) were generated and presented in tables. Bivariate and correlation analyses, including Pearson's correlation coefficient, were used to assess the association between educational risk factors and human brucellosis positivity, alongside chi-square tests of independence and cross-tabulation. Qualitative data from KIIs and FGDs were analyzed thematically.

2.6 Ethical considerations

Ethical approval was obtained through the JOOUST Board of Postgraduate Studies and the JOOUST Ethical Review Committee, followed by registration and licensing from the National Commission for Science, Technology and Innovation (NACOSTI) and permission from the Kisii County Government departments of Health and of Agriculture and Livestock Development. Written informed consent was obtained from all participants, who were assured of voluntary participation, anonymity, and confidentiality of their data.

3. Results

3.1 Level of education of respondents

Table 1 shows that more than half of the respondents (52.3%) had attained secondary-level education, 45.6% had primary-level education, while only 2.1% had attained college-level education. Respondents with secondary education were the largest group among those handling livestock products in the study area.

Table 1: Respondents' level of education

Level of education	Frequency	Percent
Primary level	171	45.6
Secondary level	196	52.3
College	8	2.1
Total	375	100.0

3.2 Education level and brucellosis positivity

Table 2 presents brucellosis positivity by education level. Among respondents with CPE/KCPE education or below, 19.5% had never tested positive for brucellosis compared with 13.1% who had tested positive. Among respondents with secondary (KCSE) education, 20.8% had never tested positive compared with 15.7% who had. Among respondents with tertiary education, the pattern reversed slightly, with 16.3% testing positive compared with 14.7% who had not. Overall, 55% of respondents who handled livestock products were not positive for brucellosis regardless of education level, while 45% tested positive.

Table 2: Educational characteristics and brucellosis positivity

Level of education	Positivity	Frequency	Percent
CPE/KCPE or below	Positive	49	13.1
	Not positive	73	19.5
KCSE (secondary)	Positive	59	15.7
	Not positive	78	20.8

Level of education	Positivity	Frequency	Percent
Tertiary	Positive	61	16.3
	Not positive	55	14.7
Total		375	100.0

3.3 Use of protective gear while milking

The majority of respondents (80.3%) who milked their cows themselves did not use any protective gear while milking, while only 19.7% reported using protective gear such as gloves, head gear or gumboots (Table 3).

Table 3: Use of protective gear while milking

Use of protective gear	Frequency	Percent
Yes	74	19.7
No	301	80.3
Total	375	100.0

3.4 Assisting animals to deliver and use of protective materials

Slightly over half of respondents (52.8%) did not personally assist their animals during delivery, while 47.2% did (Table 4). Among all respondents, 72.5% did not use protective materials when assisting animals to deliver, compared with only 27.5% who did (Table 5), indicating that non-use of protective material during calving assistance is common and increases exposure to zoonotic transmission.

Table 4: Assisted animals to deliver

Response	Frequency	Percent
Yes	177	47.2
No	198	52.8
Total	375	100.0

Table 5: Use of protective materials while helping animals deliver

Response	Frequency	Percent
Yes	103	27.5
No	272	72.5
Total	375	100.0

3.5 Animal illness and abortion

Regarding animal health, 76.3% of respondents reported that their animals had not fallen sick in the preceding six months, while 23.7% reported illness, with clinical signs such as udder swelling, reduced milk yield and blood-stained milk noted among affected animals. On abortion, 73.3% of respondents had never experienced a case of pregnant-animal abortion, while 26.7% had; among those reporting abortions, 19.7% had experienced between one and five aborted pregnancies.

3.6 Awareness of brucellosis and sources of information

Table 6 shows that 65.1% of respondents were aware of brucellosis, while 34.9% were not aware at all. Among sources of information (Table 7), radio was the dominant channel (57.6%), followed by national television (19.2%), extension personnel (15.7%) and daily newspapers (7.5%).

Table 6: Household awareness of brucellosis

Response	Frequency	Percent
Yes	244	65.1
No	131	34.9
Total	375	100.0

Table 7: Source of information about brucellosis

Source	Frequency	Percent
Extension personnel	59	15.7
Radio	216	57.6
National TV	72	19.2
Daily newspapers	28	7.5
Total	375	100.0

3.7 Correlation between educational risk factors and human brucellosis

Pearson correlation analysis showed that educational risk factors had a positive but weak and statistically non-significant correlation with human brucellosis among household members handling livestock products ($r = .041$, $p = .310$, $p > 0.01$). This indicates that, unlike socio-economic factors ($r = .131$, $p = .002$), demographic factors ($r = .129$, $p = .011$) and cultural factors ($r = .210$, $p = .100$), variation in educational risk factors was not a strong independent driver of brucellosis positivity in this study population.

3.8 Qualitative findings

Focus group discussions corroborated the survey findings, indicating that community-level knowledge of brucellosis was generally very low, with most residents only becoming aware of the disease once

diagnosed or placed under treatment. Participants attributed the low level of knowledge to limited government and agency effort to raise awareness through radio and other communication channels, reinforcing the survey finding that radio was nonetheless the most-used, if underexploited, information channel.

4. Discussion

This study found that awareness and protective practice against brucellosis were low across all levels of education, and that education level alone was not a significant correlate of brucellosis positivity. Few of even the tertiary-educated respondents who handled livestock products demonstrated strong awareness of the disease, and the majority of respondents overall were not positive for brucellosis irrespective of educational attainment. A key finding was that most respondents who milked their own cows did not use protective gear, consistent with the World Health Organization and American Public Health Association's (WHO & APHA, 2005) description of animal-to-animal and animal-to-human transmission pathways, whereby cattle, sheep, goats, pigs and camels serve as principal reservoirs shedding Brucella organisms in urine, faeces, milk and other body fluids.

The finding that most respondents did not personally assist their animals to deliver suggests some inadvertent reduction in exposure during calving, one of the highest-risk transmission events; however, among those who did assist deliveries, the low uptake of protective material (72.5% non-use) meant that this risk-reduction was undermined for a substantial subgroup. This is consistent with the observation of Mantur et al. (2007) and Young et al. (2000) that brucellosis is common where close, unprotected contact with animals and their reproductive discharges occurs. Similarly, low disease awareness (34.9% entirely unaware) mirrors the broader literature suggesting that health-seeking behaviour, rather than education level per se, is the more proximate driver of exposure — an educated individual is theoretically better placed to interpret health information, but this advantage did not clearly translate into safer practice in this study population.

The weak, non-significant correlation between educational risk factors and brucellosis positivity ($r = .041$, $p = .310$) suggests that formal schooling alone is an insufficient lever for brucellosis control in this setting, and that other factors — occupational exposure, cultural food practices, and the low reach of targeted disease-specific messaging — may better explain observed positivity patterns. This is consistent with the observation that even well-educated professionals in the livestock sector, such as veterinary clinicians and meat inspectors, remain occupationally exposed to brucellosis by virtue of their work rather than being protected by their education. The heavy reliance on radio (57.6%) as an information source, despite persistently low awareness, further points to a gap between information availability and its translation into protective knowledge and behaviour, an issue also noted by McDermott et al. (2002), who observed that continued endemicity of brucellosis in animal reservoirs poses an ongoing risk of human infection regardless of general educational context.

5. Conclusion

The study concludes that most household members handling livestock products in Kisii County were not positive for brucellosis regardless of their level of formal education, and that education level alone did not

translate into meaningfully better protective practice. Majority of respondents who milked their own animals, or who assisted them during delivery, did not use protective gear or materials, which represents a leading, education-independent pathway for zoonotic transmission from animals to humans. Awareness of brucellosis, while moderate overall (65.1%), remains insufficiently disease-specific, and radio — the dominant information channel — is not yet being fully leveraged to close this gap.

6. Recommendations

1. The Kisii County Government should intensify public education and awareness campaigns on the safe handling of livestock products, targeting all education levels rather than assuming higher education confers adequate protection.
2. Radio-based health communication, already the most widely used information channel, should be strengthened and made more disease-specific to close the gap between general awareness and protective practice.
3. Extension and veterinary services should actively promote and, where feasible, facilitate access to protective equipment (gloves, gumboots, head gear) for household members who milk animals or assist with calving.
4. Community health education programs should specifically target the practices of assisting animal deliveries and handling of animal by-products, since these remain high-risk activities regardless of respondents' educational attainment.

References

FAO. (2013). Children's work in the livestock sector: Herding and beyond. Gender, Equity and Rural Employment Division, Economic and Social Development Department, Rome, Italy.

IFAD. (2013). Women livestock managers in the third world: Focus on technical (Women's role in livestock production). Retrieved from http://www.ifad.org/gender/thematic/livestock/live_2.htm

Mantur, B.G., Amarnath, S.K., & Shinde, R.S. (2007). Review of clinical and laboratory features of human brucellosis. Indian Journal of Medical Microbiology, 25, 188–202.

McDermott, J.J., & Arimi, S.M. (2002). Brucellosis in Sub-Saharan Africa: epidemiology, control and impact. Veterinary Microbiology, 90(1–4), 111–134.

Nicoletti, P. (1992). The control of brucellosis: a veterinary responsibility. Saudi Medical Journal, 13, 10–133.

Nyamongo, I.K. et al. (2003). [Cited in Aloo, J.O. (2026), risk factors of human brucellosis, JOOUST].

Tepilit, S., & Carol, B. (1986). Maasai. Elm Tree Books, London.

WHO & APHA. (2005). Brucellosis in humans and animals: WHO guidance. Geneva: World Health Organization, in collaboration with FAO and OIE.

Young, E.J. (2000). Brucella species. In G.L. Mandell, J.E. Bennett, & R. Dolin (Eds.), Principles and practice of infectious diseases (5th ed.). New York: Churchill Livingstone.