Study of knowledge about bovine brucellosis among people involved in the cattle supply chain in the province of Manabí, Ecuador

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Summary

A cross-sectional study was conducted to determine the level of knowledge about brucellosis among livestock farmers and their families, veterinary personnel, food processors and other people involved in the cattle supply chain in the province of Manabí. A voluntary, open-ended survey of participants was conducted in seven cantons in Manabí province selected at random: Bolívar, Chone, El Carmen, Jama, Junín, Sucre and Tosagua. Of the 500 people who responded to the survey, only 30% said they knew the disease. Greater knowledge about the disease was observed among people with a higher educational level, veterinarians, livestock farmers/traders and men. For all the aspects surveyed, only a small percentage of respondents (ranging from 0.6% to 30.2%) indicated that they had knowledge of that aspect of the disease. Only 29.8% of the respondents stated that they knew the clinical signs of the disease in cattle, which could jeopardise the brucellosis surveillance system.

Only 7.6% of respondents knew the measures for reducing the risk of contracting brucellosis, leading to widespread high-risk practices when working with animals. The conclusion is that there is a low level of knowledge about the disease among people involved in the cattle supply chain in the province under study.

Keywords

Brucella spp. – Cattle – Humans – Knowledge – Zoonosis.

Introduction

Brucellosis is a zoonotic disease that is transmitted to humans either directly, through exposure to infected animals, or indirectly, through exposure to animal waste or the consumption of contaminated food (1).

Lack of knowledge among livestock farmers about the importance of preventing this zoonosis is not confined to developing countries, as the same problem − relating to health education − is also seen in developed countries (2). Livestock farmers' decisions regarding their herd can have a great impact on society at large, especially on public health (3).

As a result of poverty and lack of awareness of what a zoonosis actually is, many people, especially in rural areas, consume high-risk foods, such as unpasteurised milk or uninspected meat, obtained in informal food markets (4). In developing countries, a large proportion of the rural population is engaged in livestock production, which leads to a high level of contact with animals and an increased risk of contracting this zoonotic infection. Therefore, adequate knowledge about the epidemiology of bovine brucellosis is of great importance for public health, especially among workers in the different links of the cattle supply chain (1).

Control of this disease should not rely solely on programmes based on the investigation, vaccination and killing of animals; better outcomes are achieved when livestock producers also ensure that they implement effective biosecurity measures (5).

Studies have shown that the lower the level of knowledge about the disease, the greater the number of herds infected (5), hence the importance of achieving an adequate level of knowledge on the part of all people involved in the different links of the cattle supply chain.

As many factors impact on the eradication of bovine brucellosis, a national eradication programme should not be based solely on the health management of infected herds because, for eradication programmes to succeed, they must include adequate training for livestock farmers, covering biosecurity, compliance of the national programme and important veterinary public health aspects of the disease (5).

Therefore, the objective of this study was to determine the level of knowledge about brucellosis among livestock farmers and their families, veterinary personnel, food processors and other people involved in the cattle supply chain in the province of Manabí, Ecuador.

Material and methods

Study area

The study area is located in the province of Manabí, with an area of 18,893.7 km^2, accounting for 7.36% of Ecuador's total area. The province lies between 0 and 500 metres above sea level (6) and hosts the country's largest livestock population (977,140 head) (7).

The study was conducted in seven cantons in Manabí province selected at random: Bolívar, Chone, El Carmen, Jama, Junín, Sucre and Tosagua (Fig. 1).

Study design

A cross-sectional study was conducted using a voluntary, open-ended survey. As a preliminary step, a census was carried out to ascertain the total number of cattle herds, industrial and artisanal milk-processing units and slaughterhouses in the cantons studied, as well as the total number of people involved in them. To this end, interviews were held

with relevant officials from Ecuador's Ministry of Agriculture, Livestock, Aquaculture and Fisheries (MAGAP), the Ecuadorian Agency for Agriculture Quality Assurance (AGROCALIDAD), livestock associations, and municipal and provincial councils.

The sample size for the study was determined by the method established for this type of study by Lwanga and Lemeshow (8), based on the following formula:

Study of the level of knowledge about brucellosis

$n = Z^2 * p * (1 - p)/d^2$

where:

Z = 1.96 (with a 95% confidence interval)

p = 0.25 (anticipated population proportion that knows about brucellosis)

1 - p = 0.75

d = 0.04 (absolute precision required on either side of the proportion).

In this case, it was determined that a minimum sample size of 450 people was required.

The survey was printed, sent electronically and, in the case of illiterate people, conducted orally. It was sent to a total of 1,209 people (previously identified by the census) who were distributed into the groups shown in Table I.

The objective of the survey was to determine the level of knowledge about the disease. The questionnaire contained a total of 30 questions divided into the following five key aspects:

– socio-demographic data on respondents (sex, educational level, age and role in the supply chain)

– knowledge about the agent, the species it affects and the main clinical signs

– knowledge about modes of transmission

– knowledge about prevention and control measures

– knowledge about the epidemiological status of the disease.

The answer to each question was evaluated and the answers were divided into 'had knowledge' or 'had no knowledge'.

Data processing and statistical analysis

The level of knowledge among people in the different population groups was determined and XLSTAT statistical analysis software (version 7.5) was used to make a comparison of proportions to ascertain any differences between them, with a confidence interval of 95%.

Results

Of all those asked to participate, a total of 500 responded to the survey (41.36%). Table II shows the socio-demographic characteristics of respondents.

Figure 2 shows the level of knowledge about the disease among respondents. The level was very low, with only 30% of respondents saying that they knew about the disease.

An analysis to correlate the level of knowledge about the disease with the level of education of respondents (Table III) revealed that people with a university education had the greatest knowledge about the disease ($p \leq 0.05$), followed by those with pre-university education. A difference can be seen between these two groups, as well as between the two groups and the other educational levels.

When these results are plotted, they show that the level of knowledge about the disease increases as the educational level increases (Fig. 3). However, at no educational level does the level of knowledge exceed 60%, which points to serious shortcomings in this area.

The respondents' level in the milk supply chain also influences their knowledge about bovine brucellosis. For instance, 100% of veterinary personnel and 100% of livestock farmers who also engage in trade said they knew about the disease. These percentages differ ($p \leq 0.05$) from those observed in respondents at other levels in the supply chain, whose knowledge was found to be low, with the percentage of respondents indicating that they knew about the disease ranging from 14% to 36% (Table IV).

No differences were found in the level of knowledge about the disease among people in the different age groups (under 20 years, 21–40 years and over 40 years), demonstrating that age has no bearing on the level of knowledge (Table V).

An analysis of the level of knowledge according to respondents' sex revealed that more men than women ($p \leq 0.05$) knew about the disease (Table VI).

In the case of the 151 respondents who claimed knowledge about the disease (Table VII), the results were mixed, meaning that there were also shortcomings in knowledge about certain aspects, such as identification of the causal agent, control measures to be used or knowledge about the situation in the region and in their own herd, with less than 30% of respondents proving to have such knowledge.

Discussion

A precise knowledge about bovine brucellosis among all people involved in the cattle supply chain is vital to the development of measures for preventing and controlling this disease (1, 9).

The current study found that 70% of respondents across the different links of the cattle supply chain lacked basic knowledge about the disease, which could affect the bovine brucellosis control strategy established in the country and the province (10).

This situation is common in developing countries, with a study in Mexico (11) demonstrating a low level of knowledge about bovine

brucellosis (45%). In Tajikistan (12), the majority (85%) of livestock farmers surveyed were found to have no knowledge of the disease.

People surveyed in Uganda showed poor knowledge about brucellosis and vaccination in animals; community members felt that it was both important and feasible to provide education on the disease (13).

In a study in Senegal to ascertain cattle-farmer awareness of zoonotic diseases, farmers failed to mention brucellosis as belonging to this group, showing that knowledge about the disease is virtually non-existent (14). The situation was similar in Tanzania (15), where livestock farmers were found to have little knowledge of brucellosis. In Zimbabwe (16), only 21.2% of those surveyed were familiar with the disease.

By contrast, studies conducted in Egypt involving goats (17) and sheep (18) found that livestock farmers had general knowledge about brucellosis, but they engaged in high-risk activities that could contribute to the high seroprevalence detected in the area. A study in Uganda (19) found that 53.1% of survey participants had a moderate level of knowledge about bovine brucellosis.

The current study correlated ($p \leq 0.05$) the educational level with level of knowledge about the disease: it found that people with the lowest educational level knew the least about the disease. Similar results are reported in other studies, which found that a low educational level was associated with poor knowledge about bovine brucellosis (12).

A relationship was demonstrated between respondents' level in the supply chain and their level of knowledge ($p \leq 0.05$) about the disease: 100% of veterinarians and 100% of livestock farmers/traders knew about the disease. This is of great importance, given the role veterinarians play in developing training programmes for livestock producers and the community (13) and in involving producers in brucellosis surveillance activities (20). Lindahl *et al.* (12) report that knowledge about the disease is greater among people in charge of herds that receive regular visits from veterinarians than among those responsible for herds not receiving visits.

This study found a higher level of knowledge among men than among women. As other authors report different results (19), such as similar levels of knowledge in both sexes, the authors believe that future studies should further examine the reasons for this.

An analysis of the level of knowledge about the different aspects of importance in bovine brucellosis showed that only 29.8% of respondents said they knew the clinical signs of the disease in cattle. Another study (13) found that awareness of the clinical signs was the area where knowledge about the disease was most lacking (only 19% of respondents said that they knew the signs). These results are of great importance because, in Ecuador, bovine brucellosis is a notifiable disease (21), meaning that lack of awareness of the clinical signs caused by the disease could not only affect compliance with this measure but could also impact on the surveillance system in general.

The mode of transmission among animals was known by 27.6% of respondents and that from animals to humans was known by 26%. Similar results were reported in Argentina (22), where insufficient knowledge about the disease was found, especially about modes of transmission. It was reported that only 46% of respondents in India knew about the disease and its mode of transmission (23).

Poor knowledge was also found regarding the other aspects on which survey questions were asked, with levels ranging from 0.6% to 30.2%. A point of note is that only 7.6% of the people surveyed knew the measures for reducing the risk of contracting brucellosis. Other authors have found similar results (24), reporting considerably lower percentages of respondents who were aware of the risk of infection through direct contact with fetal membranes (19%) and via physical contact with infected livestock (13%). These knowledge gaps lead to widespread high-risk practices, such as providing unprotected assistance in animal parturition (62%), disposing of aborted fetuses without using protective gloves (71.2%) or masks (65%), or failing to boil milk before it is consumed or used to make dairy products (60%).

The identification of brucellosis as a priority problem for both livestock and producers is vital for successfully controlling and eradicating the disease (25).

Educating producers in on-farm methods for controlling milk-borne zoonoses and in ways to minimise human exposure to animals and animal products reduces the incidence of such zoonoses among livestock farmers and people involved in other links in the cattle supply chain (16).

If producers are not made aware of the social and economic impact of the disease, it will continue to be common practice to disregard basic hygiene practices when brucellosis is suspected and to trade suspect animals freely, causing the disease to remain endemic in herds (24).

The results reveal that health education needs to be improved because, in the absence of producer awareness of the basic epidemiology of the disease and of the measures required to control and eradicate it, it will be impossible to eradicate bovine brucellosis in either cattle or humans. Other authors (26) point out that, for a bovine brucellosis control and/or eradication programme to be viable, it should include health education activities to raise awareness of the economic and social benefits of implementing the programme.

Efforts are needed to educate the rural population about the disease, its modes of transmission, clinical symptoms, risk factors and preventive measures for reducing the incidence of the disease in animals, which can help to reduce the incidence of human brucellosis (27).

Conclusions

There is a low level of general knowledge about bovine brucellosis among people involved in the different links of the cattle supply chain in the province of Manabí, Ecuador.

The level of knowledge about the disease increases with educational level and is higher among men.

No differences were found among the different age groups in the level of knowledge about the disease.

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Table I
Number of surveys sent to each population group involved in the cattle supply chain

Population group studied	No. of surveys sent
Cattle herd owners and workers	491
Workers in food processing centres	133
– Slaughterhouse workers	50
– Collection centres	10
– Dairy producers	73
Milk transporters	34
Dealers	370
Livestock farmers/traders	11
Veterinary professionals	7
Consumers living close to livestock farms	163
Total	1,209

Table II
Socio-demographic characteristics of respondents (*n* = 500)

Characteristic	*n*	Percentage of all those who replied to the survey
Sex		
Male	339	67.8
Female	161	32.2
Educational level		
No schooling	38	7.6
Primary	125	25.0
Secondary	155	31.0
Pre-university	79	15.8
University	103	20.6
Age		
Under 20 years	39	7.8
21-40 years	232	46.4
Over 40 years	229	45.8
Occupation		
Cattle herd owners and workers	156	31.2
Slaughterhouse workers	20	4.0
Workers in milk-processing plants	42	8.4
Collection centres	3	0.6
Dairy producers	39	7.8
Milk transporters	22	4.4
Dealers	109	21.8
Livestock farmers/traders	7	1.4
Veterinary professionals	3	0.6
Consumers living close to livestock farms	141	28.2
Total	500	

Table III

Analysis of knowledge about bovine brucellosis according to respondents' educational level

Educational level	Had knowledge	Had no knowledge	Total	Percentage who had knowledge	95% confidence interval
No schooling	4	34	38	10.53[c]	4.17–24.13
Primary	27	98	125	21.60[c]	15.29–29.60
Secondary	35	120	155	22.58[c]	16.71–29.78
Pre-university	28	51	79	35.44[b]	25.80–46.44
University	57	46	103	55.34[a]	45.72–64.58
Total	151	349	500		

Values with different letters are significantly ($p \leq 0.05$) different

Table IV

Analysis of knowledge about bovine brucellosis according to respondents' level in the cattle supply chain

Level in the supply chain	Had knowledge	Had no knowledge	Total	Percentage who had knowledge	95% confidence interval
Cattle herd owners and workers	39	117	156	25.00[b]	18.86–32.34
Slaughterhouse workers	6	14	20	30.00[b]	14.55–51.90
Workers in milk-processing plants	6	36	42	14.29[b]	6.72–27.84
Milk transporters	8	14	22	36.36[b]	19.73–57.05
Dealers	33	76	109	30.28[b]	22.44–39.45
Livestock farmers/traders	7	0	7	100.00[a]	64.57–100.0
Veterinary professionals	3	0	3	100.00[a]	43.85–100.0
Consumers living close to livestock farms	49	92	141	34.75[b]	27.39–42.92
Total	151	349	500		

Values with different letters are significantly ($p \leq 0.05$) different

Table V
Analysis of knowledge about bovine brucellosis according to respondents' age

Age (years)	Had knowledge	Had no knowledge	Total	Percentage who had knowledge	95% confidence interval
Under 20	10	29	39	25.64	14.57–41.08
21–40	61	171	232	26.29	21.05–32.31
Over 40	80	149	229	34.93	29.05–41.31
Total	151	349	500		

There are no significant differences

Table VI
Analysis of knowledge about bovine brucellosis by respondents' sex

Sex	Had knowledge	Had no knowledge	Total	Percentage who had knowledge	95% confidence interval
Male	114	225	339	33.63[a]	44.18–57.13
Female	37	124	161	22.98[b]	22.48–38.40
Total	151	349	500		

Values with different letters are significantly ($p \leq 0.05$) different

Table VII
Level of knowledge about the different aspects of bovine brucellosis (*n* = 151)

Aspects surveyed (knowledge about)	No. of respondents who claimed knowledge of the disease	Percentage of all those who claimed knowledge of the disease	Percentage of all respondents
Importance of the disease	131	86.8	26.2
The causal agent	45	29.8	9.0
The species it affects	151	100.0	30.2
Clinical signs in cattle	149	98.7	29.8
That the disease affects humans	117	77.5	23.4
Clinical signs in humans	117	77.5	23.4
Mode of transmission to animals	138	91.4	27.6
Mode of transmission to humans	130	86.1	26.0
Measures to be used to control the disease	104	68.9	20.8
Measures for preventing transmission to humans	129	85.4	25.8
Presence of sick individuals in the region	80	53.0	16.0
Presence of sick individuals in the herd	20	13.2	4.0
Existence of a sick relative	10	6.6	2.0
Existence of other sick people	7	4.6	1.4
Situation in one's own herd	3	2.0	0.6
Measures for reducing the risk of infection	38	25.2	7.6

Fig. 1
Map of the study area in the province of Manabí, Ecuador

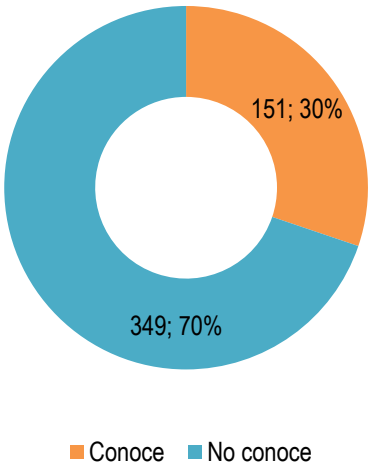

Fig. 2
Respondents' knowledge about bovine brucellosis

151, 30% = 151 (30%); *349, 70%* = 349 (70%); *Conoce* = Had knowledge; *No concoce* = Had no knowledge

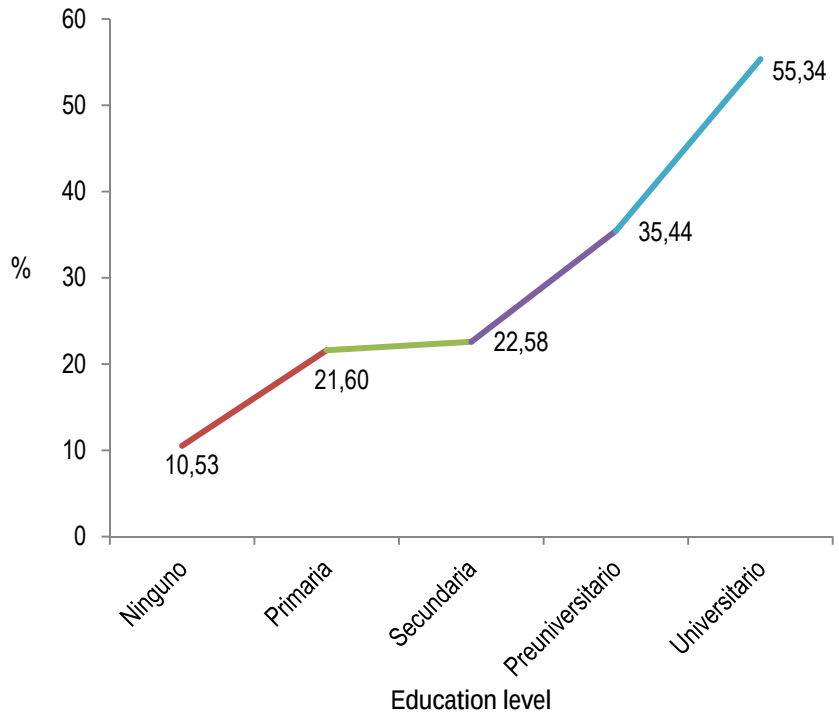

Fig. 3

Level of knowledge about the disease according to respondents' educational level

% = Percentage*; Ninguno* = No schooling; *Primaria* = Primary;

Secundaria = Secondary; *Preuniversitario* = Pre-university;

Universitario = University; *Nivel educacional* = Educational level