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A SURVEY ON KNOWLEDGE AND PRACTICES OF BRUCELLOSIS AMONG OCCUPATIONALLY EXPOSED LIVESTOCK WORKERS IN NAMIBE PROVINCE, ANGOLA.

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Abstract

The aim of the study was to characterize the level of knowledge and practices among slaughterhouse and small municipal abattoirs workers and breeders in the Namibe province of Angola. A cross sectional questionnaire based survey was conducted during 2012 on 323 livestock workers working with cattle, including 131 slaughterhouse and butchers workers and 192 breeders. The chi-square test for independence, the non-parametric Mann–Whitney test, and logistics regression models were used. Only 11.5% of the livestock workers had heard of brucellosis, being that slaughterhouse and butcher workers (16%) were better-informed than breeders (8.3%). In livestock workers knowledge was very poor (16.1%), with correct answers being more frequent among slaughterhouse and butchers workers (20.2%) than between breeders (13.8%), although this was not statistically different (p=0.170). As to the knowledge of practices, most values were below 50% with a high discrepancy between sampled groups. This study observed the knowledge of brucellosis among livestock workers with high contact with cattle is insufficient, although slightly higher in slaughterhouse and butchers workers probably due to a higher education. Increasing the level of information and education on brucellosis is necessary to implement specific interventions.

Keywords: *Human brucellosis; knowledge; working practices; livestock workers; survey.*

INTRODUCTION

Brucellosis is still one of the most neglected zoonosis to economic and human health impact (WHO, 2006). It is an infectious disease caused by a bacteria belonging to the *Brucella* genus, capable of infecting humans as well as cattle, sheep, goats, pigs and other animals such as rats, dogs and whales (Cunha et al., 2003; Pessegueiro et al., 2003; OIE, 2009). The global prevalence in humans is not entirely known (Corbel, 1997). Stockpersons, other livestock workers handling cattle or carcasses, and consumers of raw milk and non-pasteurized milk products' are the main risk groups (WHO, 2006; Young, 1995; FAO, 2002; Office of Public Health, 2008; Karadzinska-Bislimovska et al., 2010).

A study performed in Namibe in 2009 on the level of knowledge of risk factors and of brucellosis prevention measures by livestock workers handling cattle, revealed that 60.8% of all those in close contact with livestock (breeders and slaughterhouse workers) had never heard of brucellosis (Mufinda and Klein, 2011). Statistically significant differences on the knowledge of risk factors among livestock workers (slaughterhouse workers *vs* breeders) were found but not on the level of prevention measures applied. The same study concluded that there was no association between the knowledge of risk factors and implementing measures to prevent human brucellosis which might favour dissemination of infection (Mufinda, 2010; Mufinda and Klein, 2011). In Namibe, information about Brucellosis is insufficient, may justify the endemic status of them (Mufinda, 2010). Another important outcome of this study was the characterization of the responder´s working practices. For example, this province had only one large slaughterhouse that displayed very poor individual and group protection means. Similar conditions were found in butchers and small municipal abattoirs. In Namibe, slaughterhouse and butcheries present insufficient hygienic sanitary conditions (Mufinda, 2010). The FAO´s review study on prevalence and the risk factors for animal brucellosis in Sub Saharan Africa clearly pointed out some of these factors such as: leaving aborted foetus and afterbirth in grazing areas, absence of veterinary meat inspection, transhumance grazing, common grazing areas and production, consumption and selling of buttermilk/sour milk (FAO, 2002). Therefore it is clear that the control of this disease calls for a multidisciplinary intervention that should include other sectors such as Agriculture, Education and Public Health officials (Mufinda, 2010).

Published literature (Corbel, 1997; Young, 1995; FAO, 2002; Falagas and Bliziotis, 2006, Brito, 2007) pointed out several issues that could be associated with the difficulties in the implementation of solid brucellosis prophylaxis and control plan. These have to do with the nature of the infectious agent, infection sources and the routes of spreading of the pathogen. Equally important are all issues related to the lack of knowledge of the disease by those working with livestock, the traditional husbandry systems, herd management characteristics and traditions/rituals such as consumption of raw milk and performing animal sacrifices at farmers' funeral ceremonies after which animal carcasses are left to rot in the graveyard.

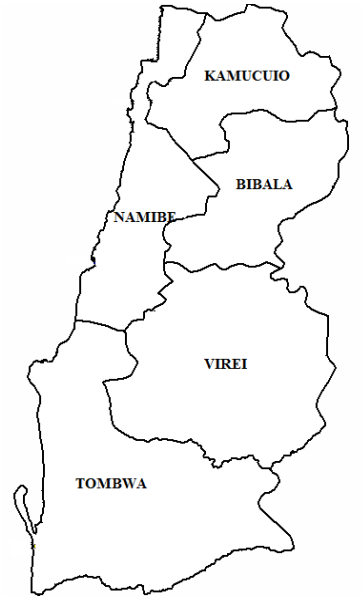
Human brucellosis prevention should include consumption of raw contaminated dairy products; unprotected contact with infected animals, aborted foetus, afterbirths and carcasses. Others measures regard: unprotected assistance in abortions and calvings; and handling of bovine or small ruminant anti-brucellosis vaccine (WHO, 2006; Cunha et al., 2003; Pessegueiro et al., 2003; FAO, 2002; Mufinda, 2010; Al-Nassir et al., 2009; WHO, 2005; Elberg, 1981). Public health educational programmes, especially planned for risk group livestock workers, are of crucial importance (Martinez, 1981; Brito, 2007; Swai et al., 2010).

The objective of this study is to characterize the level of knowledge of brucellosis and of practices among livestock workers in Namibe.

STUDY AREA

Namibe is a province in the Southwest of Angola and is divided in five municipalities: Namibe, Tombwa, Bibala, Kamucuio and Virei (Figure 1). It occupies an area of 57,097 km^2 and has an estimated human population of 1,195,779. The rural population is mainly engaged in farming activities, with an estimated cattle population of 500,500. The majority of the herds belong to farmers from the Vakuval (Mucubal) ethnic group. Most farms involve cattle trading which takes place throughout most farms (*sambos*) in Angola as well as in the neighbouring country (Republic of Namibia). The province has one large slaughterhouse, five smaller municipal abattoirs and twelve butchers. There are 131 officially registered slaughterhouse workers on these facilities and 1,204 breeders across the whole region (Angola, 2013).

The livestock sector has a production system, associated with the traditional practice, extremely dependent on watering points and the availability of grazing.



Fig(1)Map of the Namibe province.

METHODOLOGY

Study type

A cross sectional study was developed to characterize the level of knowledge and of practices regarding brucellosis. The subject of the study was the livestock worker in contact with cattle working in Namibe, divided into two groups: slaughterhouse or butcher workers (1st group) and breeders (2nd group) or those working directly with cattle.

In the Namibe province the breeders work with live animals and slaughterhouse and butcher workers come into contact with carcasses. The number of veterinarians tends to be reduced, which leads to a large portion of livestock workers taking on the activities of the veterinarian.

Population and sampling

Due to a relative small number of slaughterhouse workers (N=131) of Namibe province all participated in the study.

For breeders and given the size of the population (N=1204), it was decided to apply a proportional stratified random sampling process. This method ensures that the polling rate is the same in all group (Coelho et al., 2009). In this type of sampling, the population study is divided into homogeneous subgroups (strata) and the final sample consisted of using a simple random sampling of the elements belonging to each of them (Marôco, 2010; Toma et al., 2004).

The breeders are distributed on the entire province and registered by municipal livestock services, being strata defined by municipalities. The population of breeders in the study (N = 1204) were distributed considering the following values: 61 (5.1%) Namibe, 41 (3.4%) Tombwa, 708 (58.8%) Bibala, 276 (22.9%) Kamucuio and 118 (9.8%) Virei.

In this study, we used 5% human brucellosis prevalence estimated in 2001 in the municipalities of Bibala and Kamucuio (Médicos Sem Fronteiras, 2001) and an error admitted, 3%, indicating a sample size of 174 observations (breeders).

The selection of subjects was made using a table of random numbers generated by Openepi program version 2.3.1 (Dean et al., 2012).
By the author's knowledge on this population was not expected to be a significant number of non-adherence to the study or difficulties contact for geographical access, however to safeguard this possibility was decided to increase the calculation of the sample size of the breeders by 10%, giving n_{total} = 192 = [10 + 174% (174)].

Having regard to the proportions in the population identified, their dimensions by strata (municipalities) in the sample were Namibe (9), Tômbwa (7), Bibala (113), Kamucuio (44) and Virei (19).

The livestock workers (323) were 77 workers of butchers (68 for Namibe municipality and 9 for Tombwa) and 54 workers for slaughterhouse and small municipal abattoirs (35 for Namibe municipality, 8 to Bibala, 5 to Kamucuio and 6 to Virei). For breeders (192): 9 for Namibe, 113 to Bibala, 44 to Kamucuio, 19 to Virei and 7 to Tombwa.

Questionnaire

In 2009, a questionnaire on the level of knowledge and prevention measures implemented for brucellosis was published (Mufinda, 2010). This questionnaire was adapted and in 2012, complemented by the Brucellosis Epidemiological Inquiry from the Portuguese Direcção Geral de Veterinária (Portugal, 2011) and later translated into a local dialect (Nhaneca-Umbi) by a traditional leader and health promoter. This questionnaire was applied to all 131 slaughterhouses and butchers workers and 192 breeders, by 15 health delegates previously instructed by the author, in September and December 2012.

This assessment tool addresses the socio demographic characteristics, practices and knowledge of brucellosis.

The socio-demographic variables were (Table 1): gender, age (for methodological reasons divided into two groups: ≤ 30 and > 30 years), place of birth (Namibe or other Angolan provinces), instruction level (no instruction or basic level), age at onset of work (minor<18 years, adult>18 years), reason for starting the cattle-raising activity (inheritance, investment or employment) and place of work.

Regarding the practices, the subjects were offered three possible answers (yes, rarely, no) for the following issues: consumption of raw

milk and unpasteurized milk products; boiling milk; contact with cattle afterbirth; contact with carcasses and remains; and contact with aerosols spray at work (in the case of no use of individual protection equipment) (Table 2).

Regarding knowledge assessment the following groups of variables were separated accordingly with the number of possible answers: 1) with two possible answers (yes, no): “Have you ever heard of brucellosis?”, “Have you heard of a vaccine against animal brucellosis?”; “Are you aware of the need to use individual protection gear (mask, gloves, cap)?” and “Were you ever tested for human brucellosis?”; 2) With three possible answers (yes, no, don´t know); Does cattle afterbirth transmit brucellosis?”; 3) Questions with a specific answer. “Is brucellosis an animal, a human or a zoonotic disease?” (animals only; humans and animals; humans only; don´t know). “Ways for brucellosis transmission?” (raw milk; contact with afterbirth; raw milk and contact with afterbirth; don´t know). “Ways of preventing brucellosis?” (biosecurity; animal vaccination; biosecurity and animal vaccination; don´t know) (Table 2).

The question “Have you ever heard of brucellosis?” was considered a keystone question for the multivariate analysis on the level of knowledge (Table 3).

Additionally, the levels of knowledge and practices were calculated based on the percentages of correct answers (13 questions also considering the two dimensions (practices - questions 1-6 and knowledge - questions 7-13) and the 2 different groups of workers (Table 4) analyzed. After the values of these correct answers percentages expected were pooled and plotted by "practical" and "knowledge " , and using the Mann-Whitney test were calculated the means of livestock workers and each group to compare the differences (p- values) . For example: - practice in % (question 1) = livestock workers (13.3) , slaughterhouse and butchers workers (32.8) and breeders (0.0) - knowledge in % (question 7) = livestock workers (35.5) , slaughterhouse and butchers workers (52.7) and breeders (23.4). The classification scale of the percentages obtained from the correct answers was defined as : very good (81-100 %) , good (61-80 %) , average (41-60 %) , insufficient (21-40 %) and very poor (0 to 20 %).

Statistical analysis

All data were analysed using SPSS© Version 18.0 (SPSS, 2010). After descriptive approach, the chi square test was used to test independency between the nominal qualitative variables (or Fisher exact test in case of small samples), focus on the two different groups of workers. After this, logistic regression models were applied to model the event “Have you ever heard of Brucellosis?” and crude and adjusted odds ratios were computed (method: enter). Finally a multivariate model was fitted, using previous identified statistical significant variables. Additionally, Mann-Whitney Tests were used to compare distributions of two independent samples (Slaughterhouse and butchers workers versus breeders and working practices versus knowledge). A significant level of 5% was defined for inferential analysis (Marôco, 2010).

Ethical considerations

The objectives and methods of this study were clearly explained to the livestock workers before filling in the questionnaire. Ethics issues related with informed consent, anonymity and possibility of leaving at any time were ensured, according to the Helsinki and CIOMS guidelines for research in humans (Council for International Organization of Medical Sciences, 2002).

The study was approved by the Angola´s National Institute for Public Health Ethical Committee from the Angola´s Republic Health Ministry.

ANALYSIS AND RESULTS

Table(1)shows the socio-demographic characteristics of the livestock workers involved in the study.

Of the 131 slaughterhouse and butchers workers, 103 (78.6%) performed their activity in the central slaughterhouse or in butcher shops in the Namibe Municipality and 28 (21.4%) in smaller local abattoirs, while cattle breeders come from several municipalities but mainly from the Bibala region (58.9%). Overall average age was 36.2 years (CI 95%, 22-49.4) (minimum age 16 and maximum 71 years). The slaughterhouse and butchers workers average age was 33.3 years (CI 95%, 22.5-43.3) and a minimum and maximum age of 17 and 66 years, respectively. The livestock workers age distribution was similar (aprox. 50%) for the two age groups (<30 and > 30 years). Overall the livestock workers male gender prevailed with 64.9% (85/131). The breeders’ average age was 38.18 years (CI 95%: 27.43-48.93) (minimum age 16 and maximum 71 years).

Table (2) shows the results for the overall level of knowledge and working practices assessment in slaughterhouse workers and breeders.

Of all livestock workers (answered yes and rarely) were different and stated that raw milk and unpasteurized dairy products (cheese and butter) were a part of their diet (p=0.001).

Regarding the contact with carcasses and remains (considering yes and rarely answers) the groups were not different (p= 0.027) (Table 2).

All livestock workers affirmed that they were no subject to a human brucellosis test (Table 2).

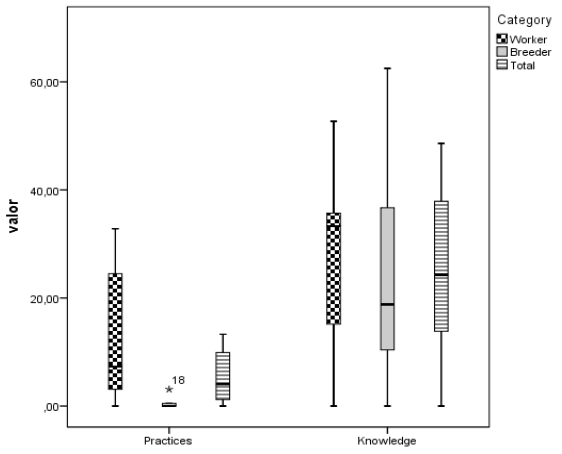
For the question “Have you ever heard of brucellosis?” Livestock workers (11.5%, 37/323) with a high level of contact with cattle answered yes, slaughterhouse and butchers workers (16.0%, 21/131) were not different to breeders (8.3%, 16/192) (p= 0.049) (Table 2).

Slaughterhouse and butchers workers (33.3%, 7/21) and breeders (12.5%, 2/16), were not different and concurred that only animal afterbirth could transmit brucellosis (p=0.248) (Table 2).

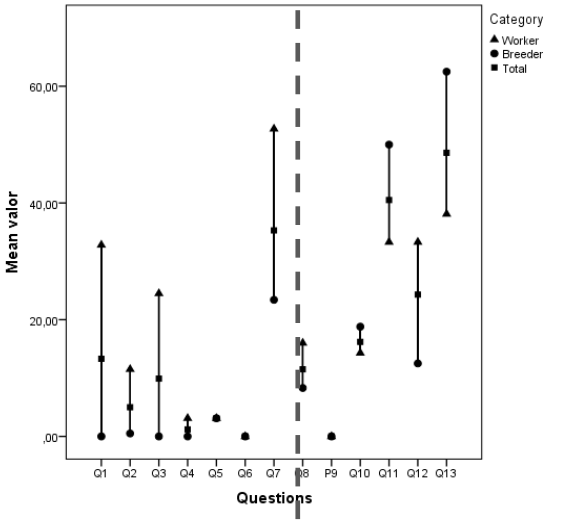
In multivariate analyse, only gender (p=0.511), place of birth (p=0.699) and age group (p=0.363) are not statistically associated with the knowledge about brucellosis. The positive associations were found between place of work (p=0.010), reason for starting the activity (p=0.002) and professional group (p =0.036) (Table 3).

The level of practices was very poor and different between the groups (0.6% *versus* 12.5%, p= 0.030). The average level of knowledge was considered insufficient and not different between the groups (Table 4).

Figure(2) shows the distributions of the two indicators (practices and knowledge) by livestock workers groups: the majority of proportions of correct answers were below 50%, associated in some cases with huge dispersions.



a)



b)

Fig(2) Characterization of the practices and knowledge on brucellosis by livestock workers groups a) overall; b) by questions – Working practices (Q1 to Q6) and knowledge (Q7 to Q13)

In contrast with the 30% found in Tanzania (Swai et al., 2010) our results showed that only 3.1% of the livestock workers boiled the milk before consumption as a brucellosis prevention measure. Also striking was the proportion of professional livestock workers that stated that they never had contact with cattle foetal remains (approximately 10%) or were never tested for human brucellosis (100%) probably because this test was not part of the routines programmes in Namibe and medical consultations were rarely required. It is also known that livestock workers do not go through screening tests (Rose Bengal Test and Serum Agglutination Test).

Our study also showed that the majority (90%) of Namibe livestock workers frequently handled with animal carcasses and remains and more than 72% were subjected to potential infectious aerosols spray in their working environment. The magnitude of exposure to these risk are powerfully and extensively referred in the scientific literature (Cunha et al., 2003; Pessegueiro et al., 2003; Corbel, 1997; Karadzinska-Bislimovska et al., 2010, Al-Nassir, 2009, WHO, 2005), reveals a very serious and disturbing reality with an enormous potential impact in Namibe province, to implicate the brucellosis`s risk for livestock workers.

In our survey on practices, slaughterhouse and butchers workers showed a higher awareness for the need to use protective equipment when compared with breeders (p=0.001). For zoonosis prevention, many authors consider indispensable the use of protective equipment frequently disinfected with appropriate disinfectants (Pessegueiro et al., 2003; Corbel, 1997; Office of Public Health, 2008; Elberg, 1981; Brito, 2007; Swai and Schoonman, 2009). In Namibe province the biggest issue is the availability of personal protective equipment, little education on health and safety and reduced number of inspections.

The results achieved in this study, were important because it identified even fewer livestock workers working closely with cattle being aware of the existence of brucellosis (11.5%), when compared with the 39% in 2009 (Mufinda and Klein, 2011). However, these numbers were similar to the 17% found in Arusha and Tanga in Tanzania (Swai et al., 2010). Compared with our numbers (8%) a very different level of knowledge was found between breeders in Ghana (Addo et al., 2011) with 76% having heard of brucellosis through regular professional training and has access to information on the disease.

However, when comparing the 2009 study in Namibe (Mufinda and Klein, 2011) with the current one, we have to remember that the questionnaires were not the same nor were the target populations. In 2009, the survey was applied to 40 slaughterhouse workers and 130 breeders and in the present study we had 131 slaughterhouse workers and 192 breeders, although all were included in the same Namibe Livestock Department list.

In 1991, Huila province, almost half the respondents (48.6%) said that they knew of a vaccine against cattle brucellosis, which shows some knowledge of the disease. In Angola, before the country's independency (1975), the literature reports two sanitary campaigns in which cattle were vaccinated against brucellosis with the S-19 vaccine (Baptista, 1991). These campaigns were in 1965 (10,720 doses) and in 1966 (8,828 doses) (Baptista, 1991), but since then no vaccination programmes have been launched in Angola.

Unlike the results obtained in this study that showed insufficient knowledge among livestock workers, in Egypt (Holt et al., 2011) found 83.2% of all livestock workers claimed to have heard about the disease, 96.3% knew it was a zoonosis and 100% said it could be transmitted by contaminated afterbirth. The frequent training meetings and talks given across Egypt, explained the large difference in level of knowledge when compared with this present study. In Arusha and Tanga regions in Tanzania, study (Swai et al., 2010) found 70% of livestock workers drinking un-pasteurized milk. These values are very similar to the ones in our study (77%) showing that in many ways eating habits are similar throughout Austral Africa.

In our study there was a surprisingly difference between the number of livestock workers that state having heard about cattle vaccination (48.6%) and those considering it an effective prevention method (16.2%). This can be attributed to the low educational level or even illiteracy or to the low divulgation and communication about the disease from the Namibe health and veterinary services. The reduce number of veterinary inspections in Namibe province difficult the education for livestock workers about the more common zoonosis preventive measures for animal sanitary interventions (OIE, 2009; Corbel, 1997; Young, 1995; FAO, 2002; WHO, 2005).

Considering the main question "have you ever heard of brucellosis?" several socio-demographic factors were identified as

significant: work location, reason for starting the activity, level of education, age and professional category. It is worth mentioning that all these factors are interrelated. The multivariate analysis found a positive and statistical significance between having heard about the existence of brucellosis (knowledge of the disease) and the working place, and the way livestock workers started their activity with a special emphasis on being hired. In other words, the livestock workers working in the Kamucuio and Virei municipalities, and the ones that had an employment contract, showed a better knowledge of brucellosis when compared to the ones working in the main SOFRIO slaughterhouse and Namibe butchers, or those who went into activity by inheriting livestock. The explanation for this can be the fact that research on brucellosis and health education activities for farmers has been conducted in these two municipalities. For example, Kamucuio was the first to start investigations on brucellosis in 2000, followed by Bibala and Virei (Médicos Sem Fronteiras, 2001). On the other hand, the contracted employees seem be more keen to learning the basics of zoonotic diseases, possibly with the purpose of better protecting their health and that of the animals they are responsible for.

Overall, the livestock workers showed a superior level of knowledge of brucellosis (25.4%, insufficient) when compared to the practices (5.4%, very poor). A previous study in 2009 (Mufinda 2010) on the level of knowledge of brucellosis risk factors and prevention measures by livestock workers working in Namibe, had already found that a very low level of knowledge and no correlation between these two types of knowledge (risk factors and prophylaxis) – 56% of the livestock workers had moderate information about risk factors but almost none on prevention (Mufinda and Klein, 2011; Mufinda, 2010). Comparing the 2009 study with the current one it is shown that the knowledge level decreased due to absence of job training, but the practices increased 5.4%.

When comparing levels of practices by livestock workers group, slaughterhouse and butchers workers had better results than breeders. On the other hand, the level of knowledge expressed by this last group was scarce with average values between slaughterhouse and butchers workers. The variation of education between the two livestock workers categories can eventually explain this difference of knowledge.

It is mainly on these two key elements (knowledge of the disease and of prevention measures) that future actions should focus. Protection of livestock workers groups at risk (slaughterhouse workers, butchers and breeders), mandatory boiling of milk, health and epidemiological surveillance (including working places) and most of all health training , are the main topics for the successful management and control of brucellosis, as mentioned in several studies (Karadzinska-Bislimovska et al., 2010; Falagas and Bliziotis, 2006; WHO, 2005; Brito, 2007).

CONCLUSION

This study observed the knowledge of brucellosis among livestock workers in Namibe province with high contact to cattle is insufficient and practices very poor. Slaughterhouse workers and butchers demonstrated better knowledge and practices than breeders, probably due to a higher education.

The livestock workers of the farms in Kamucuio and Virei municipalities compared to the Namibe SOFRIO slaughterhouse workers showed a better knowledge of brucellosis. In addition, the livestock workers employees showed the better knowledge of brucellosis than inherited the profession.

The overall assessment displays a very concerning reality, worsened by the fact that already some educational meetings had been held in the Namibe province. It was demonstrated that there is a strong and urgent need to inform and educate people about brucellosis. This should be based on very specific training sessions (courses, workshops or simple talks) adjusted to the local context, dealing with the key issues pointed out in this study (use of protection equipment, handling carcasses and milk pasteurization) and always bearing in mind the instruction level of the target population.

References

1)Addo K.K., Mensah G.I., Nartey N., Nipah G.K., Mensah D., Aning K.G. (2011). Knowledge, attitudes and practices (KAP) of herdsmen in Ghana with respect to milk-borne zoonotic diseases and the safe handling of milk. Journal of Basic and Applied Scientific Research. 1: (10) 1556 – 1562.

2)Al-Nassir W., Lisgaris M.V. and Salata A.R. (2009). Brucellosis. Medscape from WebMD: Drugs & Diseases. http://tinyurl.com/lcl5wfw.

3)Angola. Governo provincial do Namibe (2013). Plano de Desenvolvimento Económico e Social da Província do Namibe para o Período 2013-2017. Governo Provincial do Namibe, Namibe. http://tinyurl.com/ptqtf86

4)Baptista F. (1991). Brucelose e leptospirose bovinas nas explorações pecuárias tradicional e empresarial da província da Huila (Angola) [dissertation]. Universidade Federal de Minas, Belo Horizonte.

5)Brito I.S. (2007). Intervenção de conscientização para prevenção da brucelose em área endémica [thesis]. Universidade do Porto, Instituto de Ciências Biomédicas Abel Salazar, Porto.

6.)Coelho P.S., Pinheiro J.A. and Xufre P. (2009). Method of random [Course of Master in Statistics]. Universidade Nova de Lisboa, Instituto Superior de Estatística e Gestão de Informação, Lisboa.

7)Corbel M.J. (1997). Brucellosis: an overview. Emerging Infectious Diseases. 3: (2) 213 – 221.

8)Council for International Organizations of Medical Sciences (2002). International ethical guidelines for biomedical research involving human subjects. CIOMS, Geneva. http://tinyurl.com/q4vgtqc.

9)Cunha M., Miguel N. and Manso A.J. (2003). Revista Portuguesa de Clínica Geral. 19:84-8.

10)Dean A.G., Sullivan K.M., Soe M.M. (2012). OpenEpi: open source epidemiologic statistics for Public Health version 2.3.1. Emory University, Rollins School of Public Health, Atlanta. http://tinyurl.com/nr8xwrl.

11)Elberg S.S. (1981). A guide to the diagnosis, treatment and prevention of human brucellosis. *Word Health Organization*, Geneva. http://tinyurl.com/osbr3dw.

12)Falagas E.M. and Bliziotis A.I. (2006). Quinolones for treatment of human brucellosis: critical review of the evidence from microbiological and clinical studies. Antimicrobial Agents and Chemotherapy. 50: (1) 22 – 33.

13)FAO (2002). Bovine brucellosis in sub-Saharan Africa: estimation of sero-prevalence and impact on meat and milk offtake potential. *Food and Agriculture Organization, Livestock Information and Policy Branch*, Rome. http://tinyurl.com/p2v55oe.

14)Holt H.R., Eltholth M.M., Hegazy Y.M., El-Tras W.F., Tayel A.A. and Guitian J. (2011). *Brucella* spp. infection in large ruminants in an

endemic area of Egypt: cross-sectional study investigating seroprevalence, risk factors and livestock owner's knowledge, attitudes and practices (KAPs). BMC Public Health. 341:11.
15)Karadzinska-Bislimovska J., Minov J., Mijakoski D., Stoleski S. and Todorov S. (2010). Brucellosis as an occupational disease in the Republic of Macedonia. Macedonian Journal of Medical Science. 3: (3) 251 – 256.
16)Marôco J. (2010). Análise estatística com utilização do SPSS. 3rd edition. Sílabo, Lisboa.
17)Martinez C. (1984). Guia del inspector veterinário. 2nd edition. Biblioteca Agrícola, Barcelona.
18)Médicos Sem Fronteiras (2001). Estudo de brucelose humana e animal nos municipios de Bibala e Kamucuio, provincia do Namibe. Médicos sem Fronteiras-Suiça, Namibe. (unpublished data)
19)Mufinda F.C., Klein C.H. (2011). Conhecimento de factores de risco e de profilaxia na transmissão da brucelose humana nos profissionais da pecuária na província do Namibe, Angola, 2009. Revista Portuguesa de Saúde Pública. 29: (1) 88 – 95.
20)Mufinda F.C. (2010). Conhecimento de factores de risco e de profilaxia na transmissão da brucelose humana nos profissionais da pecuária na província do Namibe, Angola, 2009 [dissertation]. *Fundação Oswaldo Cruz (FIOCRUZ), Escola Nacional de Saúde Pública*, Rio de Janeiro.
21)Office of Public Health (2008). Brucellosis. *Infectious Disease Epidemiology Section*, New Orleans, LA. http://tinyurl.com/orzmh9l.
22)OIE (2009). Bovine brucellosis: version adopted by the World Assembly of Delegates of the OIE. *Organisation Mondiale de la Santé Animale*, Paris. http://tinyurl.com/cvby6ao.
23)Pessegueiro P., Barata C. and Correia J. (2003). Brucelose – uma revisão sistematizada. Medicina Interna. 10: (2) 91 – 100.
24)Portugal. Ministério da Agricultura, do Desenvolvimento e das Pescas. DGV (2011). Brucelose bovina: Inquérito MOD794/DGV. Ministério da Agricultura, do Desenvolvimento e das Pescas, Direcção Geral de Veterinária, Lisboa. http://tinyurl.com/ms2gpzr.
25)SPSS (2010). SPSS version 18.0. IBM, Chicago, IL.
26)Swai E.S., Schoonman L. (2009). Human brucellosis: seroprevalence and risk factors related to high risk occupational groups in Tanga municipality, Tanzania. Zoonoses Public Health. 54: (4) 183 – 187.
27)Swai E.S., Schoonman L. and Daborn C.J. (2010). Knowledge and attitude towards zoonoses among animal health workers and livestock keepers in Arusha and Tanga, Tanzania. Tanzania Journal of Health Research. 12: (4) 282 – 288.
28)Toma B., Dufour B., Sanaa M., Benet J.J., Shaw A. and Mouton F. (2004). Epidemiologia aplicada: à luta colectiva contra as principais doenças animais transmissíveis. Fundação Calouste Gulbenkian, Lisboa 2004.
29)WHO (2005). Brucellosis (human). *World Health Organization*, Geneva. http://tinyurl.com/mq2ws6m.
30)WHO (2006). The control of neglected zoonotic diseases: A route to poverty alleviation. *World Health Organization*, Geneva. http://tinyurl.com/nwjrnmo.
31)Young E.J. (1995). An overview of human brucellosis. Clinical Infectious Diseases. 21:283 – 290.

Table 1: Livestock workers' socio-demographic characterization

Variable	Total	Slaughterhouse and butchers workers	Breeder	*p-values*
	n (%)	n (%)	n (%)	
Gender	323			0.001*
Gender	(100)			
Male	248 (76.8)	85 (64.9)	163 (84.9)	
Female	75 (23.2)	46 (35.1)	29 (15.1)	
Age (groups)	323 (100.0)			0.013*
Age Group				
≤ 30 years	136 (42.1)	66 (50.4)	70 (36.5)	
> 30 years	187 (57.9)	65 (49.6)	122 (63.5)	
Place of Birth	323 (100.0)			0.001*
Namibe	209 (64.7)	66 (50.4)	143 (74.5)	
Other provinces	114 (35.3)	65 (49.6)	49 (25.5)	
Education level	323 (100.0)			0.001*
No instruction	189 (58.5)	41 (31.3)	148 (77.1)	
Basic Instruction	134 (41.5)	90 (68.7)	44 (22.9)	
Onset of Activity	323 (100.0)			0.001*
Minor	226 (70.0)	42(32.1)	184 (95.8)	
Adult	97 (30.0)	89 (67.9)	8 (4.2)	
Reason for starting activity	323 (100.0)			0.001*
Livestock inheritance	116 (35.9)	0 (0.0)	116 (60.4)	
Investment	109 (33.8)	55 (42.0)	54 (28.1)	
Employment	98 (30.3)	76 (58.0)	22 (11.5)	
Place ok work	323 (100.0)			0.001**
SOFRIO slaughterhouse and Namibe´s butchers	103 (31.9)	103 (78.6)	0 (0.0)	
Municipal abattoirs	28 (8.7)	28 (21.4)	0 (0.0)	
Namibe´s farms	9 (2.8)	0 (0.0)	9 (4.7)	
Tombwa´s farms	7 (2.2)	0 (0.0)	9 (4.7)	
Bibala`s farms	113 (35.0)	0 (0.0)	113 (58.9)	
Kamucuio`s farms	44 (13.6)	0 (0.0)	44 (22.9)	
Virei`s farms	19 (5.9)	0 (0.0)	19 (9.9)	

*Chi square Independence test ; Chi square test for Independence and Monte Carlo simulation

Table 2: Working practices and knowledge of Brucellosis, overall and by professional groups (slaughterhouse workers and breeders).

Questions	Livestock workers 323	slaughterhouse workers 131	Breeders 192	*p-values*
Questions on working practices:				
Q1. Are raw milk and unpasteurized dairy products part of your diet?				0.001*
Yes	248 (76.8)	56 (42.7)	192 (100.0)	
Rarely	32 (9.9)	32 (24.4)	0 (0.0)	
No	43 (13.3)	43 (32.8)	0 (0.0)	
Q2. Is raw milk boiled prior to human consumption?				0.001**
Yes	10 (3.1)	9 (6.9)	0 (0.0)	
Rarely	6 (1.9)	6 (4.6)	1 (0.5)	
No	307 (95.0)	116 (88.5)	191 (99.5)	
Q3. Contact with animal afterbirth?				0.001*
Yes	253 (72.8)	51 (38.9)	184 (95.8)	
Rarely	56 (17.3)	48 (36.6)	8 (4.2)	
No	32 (9.9)	32 (24.5)	0 (0.0)	
Q4. Contact with carcasses and remains?				0.027**
Yes	292 (90.4)	119 (90.8)	173 (90.1)	
Rarely	27 (8.4)	8 (6.1)	19 (9.9)	
No	4 (1.2)	4 (3.1)	0 (0.0)	
Q5. Contact with aerosols spray in working place?				0.001**
Yes	235 (72.8)	68 (51.9)	167 (87.0)	
Rarely	78 (24.1)	59 (45.0)	19 (9.9)	
No	10 (3.1)	4 (3.1)	6 (3.1)	
Q6. Were you ever tested for human brucellosis?				NA
No	37 (100.0)	21 (100.0)	16 (100.0)	
Questions on knowledge:				
Q7. Is there a need for protection gear (mask, gloves, boots)? [1]				0.001***
Yes	114 (35.3)	69 (52.7)	45 (23.4)	
No	209 (64.7)	62 (47.3)	147 (76.6)	
Q8. Have you ever heard of Brucellosis?				0.049*
Yes	37 (11.5)	21 (16.0)	16 (8.3)	
No	286 (88.5)	110 (84.0)	176 (91.7)	
Q9. Is brucellosis a disease? [1]				0.063**
Only animals	14 (37.8)	5 (23.8)	9 (56.3)	
Only humans	19 (51.4)	12 (57.2)	7 (43.7)	
Animal and humans	0(0.0)	0(0.0)	0(0.0)	
Does not know	4 (10.8)	4 (19.0)	0 (0.0)	
Q10. How is Brucellosis transmitted to humans? [1]				0.814**
Raw milk	5 (13.5)	2 (9.5)	3 (18.8)	
Contact with dead animals remains	14 (37.8)	9 (42.9)	5 (31.3)	
Raw milk and contact with animals remains	6 (16.2)	3 (14.3)	3 (18.8)	
Other	12 (32.5)	7 (33.3)	5 (32.4)	
Q11. How can you prevent Brucellosis? [1]				0.006**
Biosecurity	9 (24.3)	7 (33.3)	2 (12.5)	
Animal vaccination	6 (16.2)	0 (0.0)	6 (37.5)	
Biosecurity and animal vaccination	0(0.0)	0(0.0)	0(0.0)	
Other	22 (59.5)	14 (66.7)	8 (50.0)	
Q12. Does animal afterbirth transmit Brucellosis? [1]				0.248*
Yes	9 (24.3)	7 (33.3)	2 (12.5)	
No	28 (75.7)	14 (66.7)	14 (87.5)	
Q13. Have you heard of a vaccine against animal brucellosis? [1]				0.191*
Yes	18 (48.6)	8 (38.1)	10 (62.5)	
No	19 (51.4)	13 (61.9)	6 (37.5)	

*Chi square test of Independence; **Chi square test of Independence with Monte Carlo simulation NA: Non applicable; *** Fisher´s test; [1]Questions only to those that stated having heard of brucellosis.

Table 3: Multivariate logistic analysis of the level of knowledge based on the question "Have you ever heard of brucellosis" with relation to the socio demographic variables.

	p	Crude OR	*P*	adjusted OR**
Place of work				
SOFRIO slaughterhouse or butchers*				
Municipal abattoirs	0.310	2.34 (0.78;7.00)	0.318	2.34 (0.44;12.42)
Namibe`farms	0.164	2.77 (0.66;11.62)	0.327	2.60 (0.38;17.52)
Tombwa`s farms	0.264	3.69 (0.37;36.57)	0.172	5.44 (0.48;61.82)
Bibala`s farms	0.593	0.62 (0.10;3.66)	0.939	1.08 (0.17;6.87)
Kamucuio`s farms	**<0.001**	12.58 (3.13;50.48)	**<0.001**	17.10 (4.02;72.62)
Virei`s farms	**0.010**	9.69 (1.74;54.96)	**0.007**	11.53 (1.96;67.75)
Formal way into activity				
Livestock inheritance *				
Investment	0.098	1.91 (0.89;4.09)	0.888	0.89 (0.18;4.30)
Employment	**0.002**	5.00 (1.79;13.98)	**0.007**	4.56 (1.56;13.83)
Gender				
Male*				
Female	0.511	1.34 (0.56;3.18)		
Age group				
≤ 30 years*				
> 30 years	0.363	0.72 (0.35;1.47)		
Place of birth				
Namibe*				
Other provinces	0.699	1.16 (0.56;2.39)		
Instruction level				
No instruction*				
Basic education	**0.048**	0.49 (0.25;0.99)		
Age at onset of activity				
Minor*				
Adult	**0.010**	0.40 (0.20;0.81)		
Professional category				
Breeder*				
Worker	**0.036**	2.10 (1.05;4.19)		

*Reference class; **Final model (forward method)

Table 4: Characterization of the practices and knowledge on brucellosis by livestock workers

	Means (Medians)			p^{*1}
	Slaughterhouse and butchers workers	**Breeders**	**Total (**livestock workers **)**	
Practices	12.5	0.6	5.4	0.030
Knowledge	26.8	25.1	25.2	0.707
Total (livestock workers **)**	20.2	13.8	16.1	0.170
p^{*2}	0.099	0.012	0.024	

*Mann-Whitney test; p^{*1}: Slaughterhouse and butchers workers *versus* breeders; p^{*2}: working practices *versus* knowledge