Journal of
Veterinary Medicine and Animal Health

ACADEMIC JOURNALS
expand your knowledge

ABOUT JVMAH

The Journal of Veterinary Medicine and Animal Health (JVMAH) is published monthly (one volume per year) by Academic Journals.

The Journal of Veterinary Medicine and Animal Health (JVMAH) is an open access journal that provides rapid publication (monthly) of articles in all areas of the subject like the application of medical, surgical, public health, dental, diagnostic and therapeutic principles to non-human animals.

The Journal welcomes the submission of manuscripts that meet the general criteria of significance and scientific excellence. Papers will be published shortly after acceptance. All articles published in JVMAH are peer-reviewed.

Contact Us

Editors

Dr. Lachhman Das Singla
Department of Veterinary Parasitology
College of Veterinary Science
Guru Angad Dev Veterinary and Animal Sciences
University
Ludhiana-141004
Punjab
India

Dr. Viktor Jurkovich
Szent István University,
Faculty of Veterinary Science,
István utca 2. H-1078 Budapest
Hungary

Editorial Board Members

Journal of Veterinary Medicine and Animal Health

Table of Contents: **Volume 10   Number 10   October   2018**

ARTICLES

AJ ACADEMIC JOURNALS
expand your knowledge

Journal of Veterinary Medicine and Animal Health

Full Length Research Paper

Challenges with the implementation and adoption of assisted reproductive technologies under communal farming system

Thinawanga Joseph Mugwabana[1,2*], Voster Muchenje[2], Nkhanedzeni Baldwin Nengovhela[3], Khathutshelo Agree Nephawe[4] and Tshimangadzo Lucky Nedambale[4]

[1]Department of Agricultural Economics and Animal Production, University of Limpopo, Private Bag x 1106, Sovenga, 0727, South Africa.
[2]Department of Livestock and Pasture Science, University of Fort Hare, Private Bag x 1314, Alice, 5700, South Africa.
[3]Department of Agriculture, Forestry and Fisheries, Delpn Building, Corner Annie Botha and Union Street, Riviera, Pretoria, 0084, South Africa.
[4]Department of Animal Science, Tshwane University of Technology, Private Bag x 680, Pretoria, 0001, South Africa.

This study aimed to assess the perception of cattle farmers regarding the challenges affecting implementation and adoption of Assisted Reproductive Technologies (ARTs) such as oestrous synchronisation and artificial insemination under communal and emerging farming systems in South Africa. The study was conducted in Limpopo, Mpumalanga and KwaZulu-Natal provinces. A total of 27 cattle farmers who participated in the ARTs project were randomly selected, nine (9) from each province. The data were collected through in-depth interviews using semi-structured questionnaire. The collected data were managed and coded into themes using Nvivo Version 11 software programme. A total of 31 perceived sub-themes emerged that could compromise the implementation and adoption of Assisted Reproductive Technologies in the study area. Sub-themes were clustered into three major themes by the researcher, namely; those that arose from human interference, those that emanated from lack of resources and those that were the result of natural causes. The most prominent of the challenges that emerged during the interviews across the three provinces as mentioned were: drought and dry seasons (22), stock theft (21), diseases (21), inadequate infrastructure (19), lack of access to the market (16) and expansion of dwelling areas (13). Interviewed cattle farmers strongly agreed that the removal of these challenges would make the implementation and adoption of ARTs and any other livestock related technology easier for them.

Key words: Artificial insemination, cattle farmers, oestrous synchronisation

INTRODUCTION

Agriculture, and cattle farming in particular, form part of the traditional survival strategy of many rural farming communities in South Africa. The productivity of cattle in those farming areas is low due to many reasons including

*Corresponding author. E-mail: Mugwabanatj@gmail.com.

those farming areas is low due to many reasons including the poor or non-adoption of best practices, new researched information and technologies advances. This challenge arises from human factors and not from the animal or lack of technologies. Assisted Reproductive Technologies (ARTs) mainly oestrous synchronisation and artificial insemination can be used to enhance genetic gains in breeding programmes. Additionally, ARTs can minimise the cost associated with buying and managing a bull, time and labour essential for heat detection in cow that graze in those areas with physical barriers such as mountains and bushes (Maqhashu, 2013; Nqeno et al., 2010). The adoption and use of these technologies by commercial dairy farmers is highly advanced. Communal and emerging cattle farmers in rural areas can adopt and use these technologies to address the shortage of bulls and the low calving rate that has become the norm.

The Agricultural Research Council – Animal Production Institute (ARC-API) in partnership with Technology Innovation Agency (TIA) and Provincial Departments of Agriculture (PDAs) rolled out the Livestock Improvement Programme throughout South Africa between 2012 and 2016. The project involved the application of ARTs such oestrous synchronisation and artificial insemination of beef cattle in communal and emerging farming areas.

The decision to accept and adopt a particular technology by rural cattle farmers is dependent on how the technology is perceived. Those technologies that are perceived negatively will have a low to zero adoption level (Adesina and Baidu-Forson, 1995; Tatlidil et al., 2009). Furthermore, the socio-economic attributes of the intended beneficiaries will influence the adoption process (Muzari et al., 2012; Tatlidil et al. 2009). Mphinyane and Terblanchè (2005) and Shields et al. (1993) found that the rate of technology adoption is directly associated to the level of education as well as information-seeking behaviour of the farmers. The high illiteracy level among rural livestock farmers can become a stumbling block to technology adoption (Kunene and Fossey, 2006).

In South Africa, the agricultural extension service is offered by the government at no cost to communal and emerging farmers. Development agencies that are agricultural based also play a part although on a limited scale. Gwala (2013) reported on the poor quality of extension services offered by the South African government agencies. According to Liebenberg (2015), 8 out of 10 extension officers in South Africa are insufficiently qualified to carry out their responsibilities. Additionally, there is a high extension personnel shortfall in South Africa taking into account the number of resource-poor farmers as well as projects emerging from land reform programmes as well as other initiatives. Despite the challenges, extension services still remain a major source of information and knowledge to rural farmers, and largely influence the acceptance and adoption of technologies, these in addition to technology attributes. There is a generally low level of technology implementation and adoption in rural communities worldwide. This study was conducted to determine challenges that affect the implementation and adoption of assisted reproductive technologies under communal farming systems in South Africa.

## MATERIALS AND METHODS

Study site

The study was conducted in three provinces of South Africa, namely; Limpopo, Mpumalanga and KwaZulu-Natal. The provinces were chosen because of their rural nature and abundance of cattle under communal and emerging farming systems, in addition to the availability of cattle handling facilities and previous working relations with farmers. Limpopo is mainly rural and temperatures in the province average between 27°C in summer months and 15°C in winter months with an average range of 12.5 to 37.1°C. Rainfall in the province ranges from 346 to 1560 mm per annum with an average of 550 mm per annum (Nengovhela, 2011). Mpumalanga has a sub-tropical climate with hot summers and mild to cold winters where the average daily temperature in summer is 24 and 14.8°C in winter (Mpumalanga Department of Agriculture, Rural Development and Land and Environmental Affairs, 2012; Molefi et al., 2017). Furthermore, the province has an average rainfall of 767 mm per annum. The rainfall increases from West to East at 600 to 1600 mm or more annually (Mpumalanga Department of Agriculture, Rural Development and Land and Environmental Affairs, 2012). KwaZulu-Natal province is sub-tropical characterised by high humidity, warm wet summers and cool dry winters (Fairbanks and Benn, 2000). Summer temperatures average at 28°C and winter temperatures seldom fall below 17°C even in mid-winter (Census, 2011). The province collects an average of 1000 mm rainfall per annum with more rainfall towards the coastal areas (Fairbanks and Benn, 2000).

Sampling process

Eighteen smallholder cattle farmers who participated in the Livestock Improvement Programme conducted by the Agricultural Research Council – Animal Production Institute were selected as model farmers for interview purpose. The model farmers were identified with the help of other cattle farmers and as well as project implementation co-ordinators in the respective provinces. According to Kundhlande et al. (2014), a model farmer is an experienced farmer who demonstrates improved farming and management skills. Other farmers look up to that farmer in terms of new knowledge and improved management skills. When in-depth interviews are to be conducted with targeted respondents, the sample size will have little bearing on the outcome of the studies (Crouch and McKenzie, 2006; Marshall et al., 2013; Small, 2009).

Data collection and analysis

A semi-structured questionnaire was developed with open ended questions. The approach was aimed at eliciting inner views of the participants by probing their responses to get a better understanding of their reasoning. Data collected was fully transcribed and translated into English. Nvivo Version 11 designed and developed by QSR International Ltd was used to manage the final English transcripts. Whole sentences and paragraphs were coded as outlined by Straus and Corbin (2014) and categorised
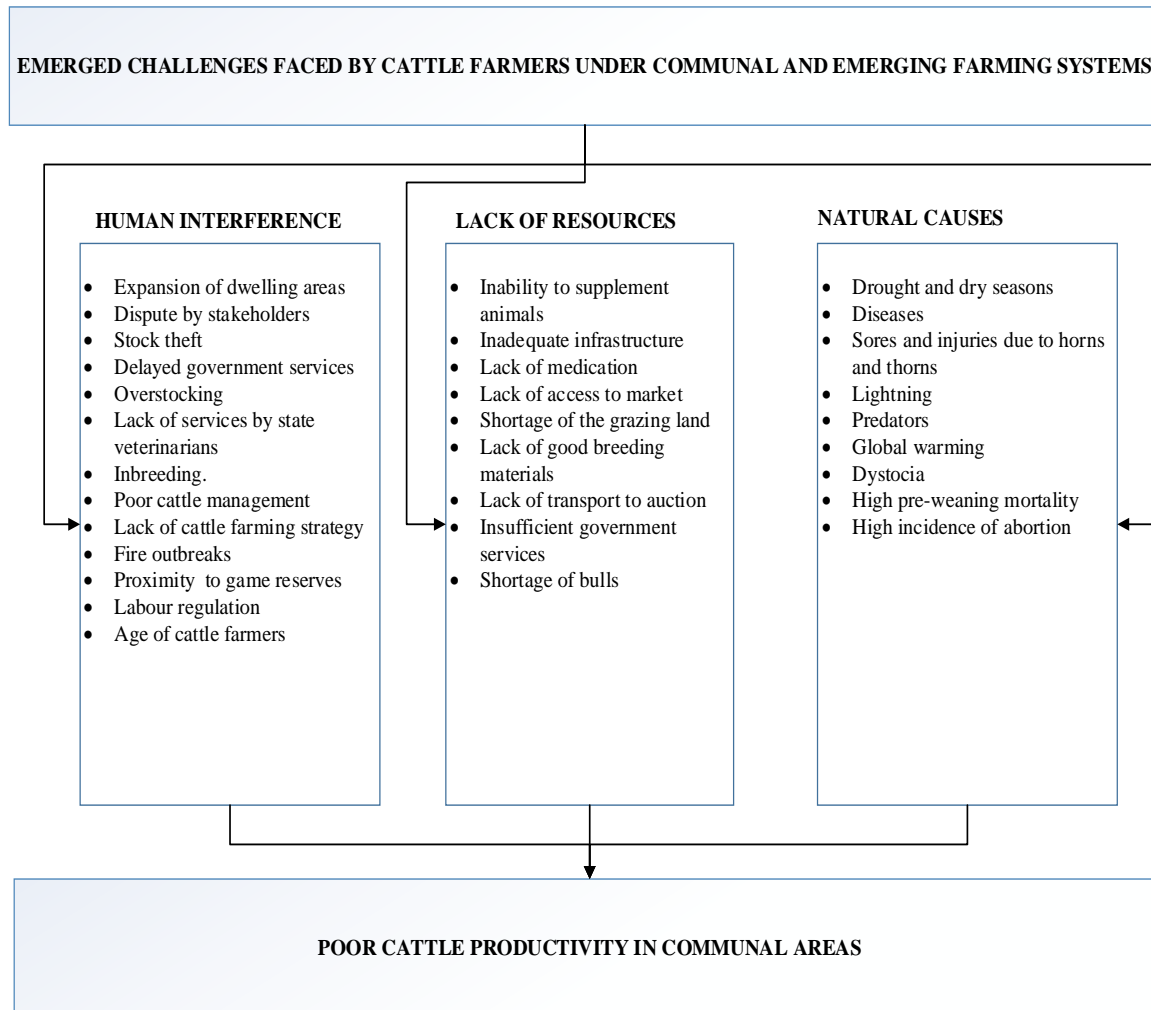
Figure 1. Challenges that emerged faced by communal and emerging cattle farmers in Limpopo, Mpumalanga and KwaZulu-Natal provinces.

into themes.

RESULTS AND DISCUSSION

A total of 31 sub-themes emerged on the perceived challenges that could compromise or prevent the implementation of the Livestock Development Project under communal and emerging farming systems. The sub-themes were clustered into three major themes as reported crosscutting through provinces, namely: those that arose from human interference, those that emanated from lack of resources and those that were the result of natural causes (Figure 1).

Human interference

The five most common constraints as perceived by respondents in order of rankings were: stock theft,

expansion of dwelling areas, fire outbreak, delayed government services and poor cattle management; however, only the first two will be discussed (Figure 2). Stock theft emerged as the number one challenge arising from human interference. Stock theft crime is a common feature in rural areas of South Africa and had been going on for years. Crime statistics reports and surveys in South Africa indicate that rural livestock farmers are mostly affected by stock theft (Maluleke et al., 2016). Hangara (2011) and Malekano (2000) reported about stock theft as a challenge facing communal cattle farmers in Namibia and Malawi, respectively. Stock theft takes place more often than other forms of criminality and it is a much more serious threat in South African regions bordering other countries, such as the Eastern Cape, Mpumalanga, Free State, KwaZulu-Natal, North West and Limpopo (South African Police Service, 2012). Nengovhela (2011) reported that most farmers felt that there was better maintenance of the rule of law during
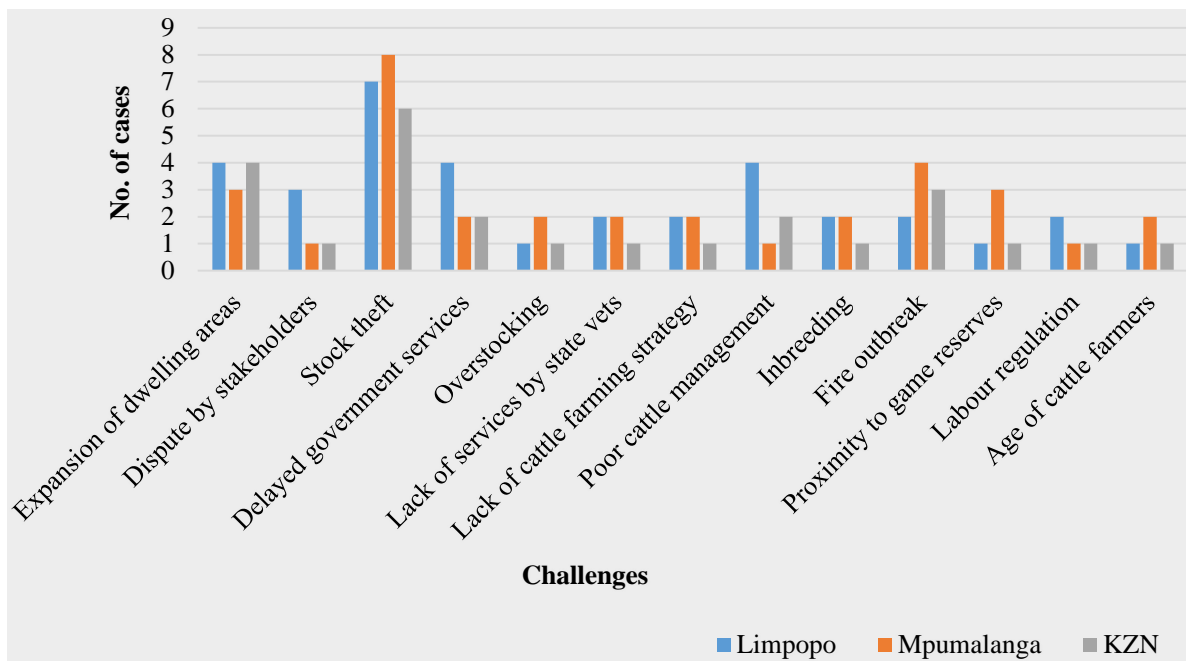
Figure 2. Perceived challenges arising from human interference as given by respondents.

apartheid than it is now. The costs paid by these farmers to boost safety in the vicinities of their livestock roughly preceded the fiscal planning destined for production. To restore order and trust in the cattle farming sector, the government needs to seriously increase the penalties that are associated with stock theft. Furthermore, the Animal Identification Act (Act no. 6 of 2002) which makes provision for a permanent identification mark to be put on the animal for identification purposes need to be enforced.

The expansion of the dwelling areas was mentioned as a challenge that reduces the land originally available for cattle grazing. Ever since the fall of apartheid, there has been a rapid expansion of villages and dwellings. Many small, medium and large enterprises, along with tourist attraction businesses such as overnight accommodation and holiday resorts have also been on the rise. These mushrooming businesses are all at the expense of land originally allocated for grazing and field crops. Local governance was also not spared as they were accused of expanding industrial and residential areas in order to generate more income through rates and taxes. Management committees at the chief's kraal that manage applications for the development process are seen as dysfunctional entities often open for manipulation by ambitious traditional leaders who feel that they have more power over land and people (Buthelezi and Yeni, 2016). This is augmented by a raft of laws such as the Traditional Leadership and Governance Framework Act of 2003 that still fails to define the functions and powers of chiefs. The government needs to intervene and provide leadership to ensure the rule of law and accountability before the situation gets even worse.

Lack of resources

The five most common constraints that emerged as perceived by respondents in order of ranking were: inadequate infrastructure, lack of access to the market, shortage of grazing land, a shortage of bulls and inability to supplement animals, again, discussion will be limited to the first two (Figure 3). Challenges associated with inadequate infrastructure dominated this category. Inadequate infrastructure merely takes away the limited incentives that are available to rural farmers (Nkosi and Kirsten, 1993). Gwala (2013) reported about the poor state of access roads and lack of transport facilities in rural Eastern Cape Province. Almost all the cattle infrastructure currently in existence in the Eastern Cape province was built by the Department of Agriculture (Tada, 2012). According to Frisch (1999), in communities that have facilities, they are either in a poor state or non-functional because they were erected some 50-60 years ago and farmers do not have the cash to maintain them. The facilities make it easy for farmers to carry out the basic animal husbandry activities such as castration, animal identification, vaccination, animal treatment, artificial insemination, pregnancy diagnosis and live-weight measurements. The lack of infrastructure can seriously hinder development initiatives such as the implementation of ART in rural farming communities.
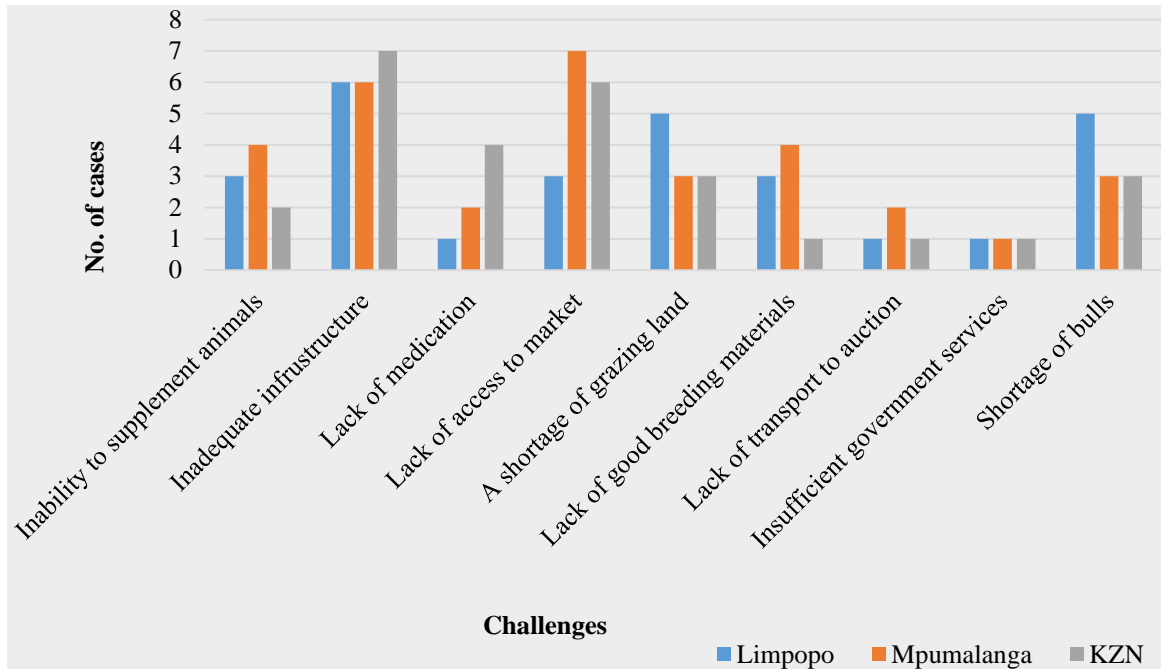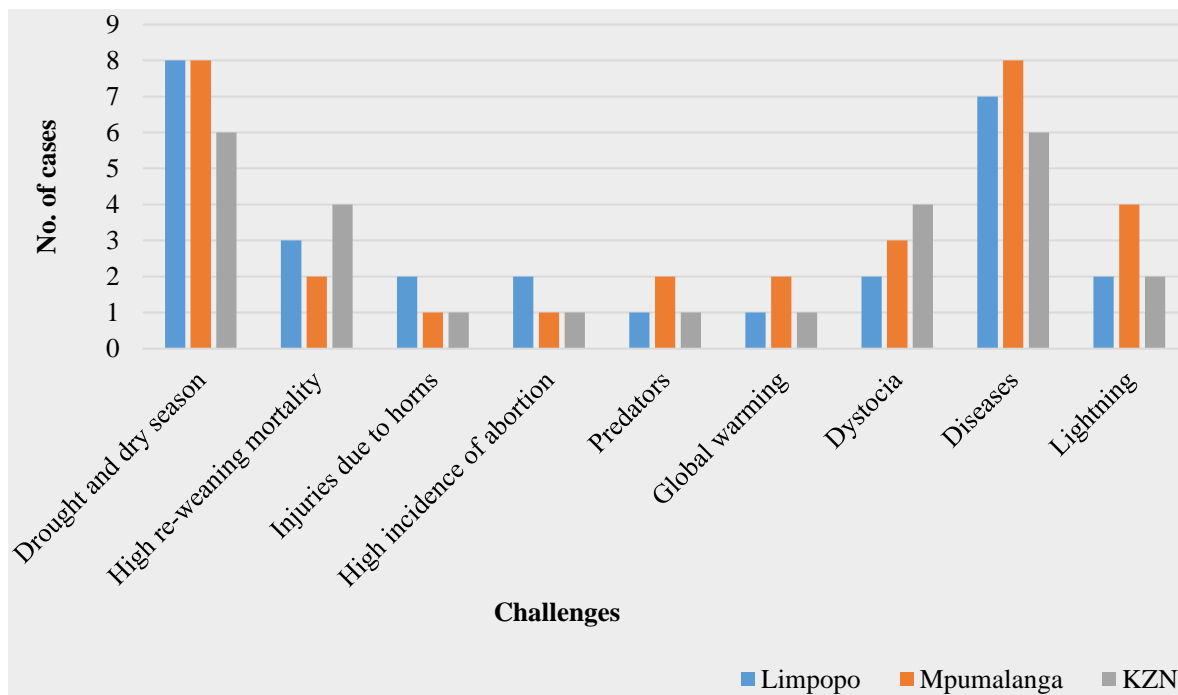
Figure 3. Perceived challenges arising from lack of resources as given by respondents.

Because of competing and limited available resources, the government is unable to provide adequate services such as the repairs of crush pens necessary for cattle handling. Farming communities need to organise themselves into functional groups so that they can carry out their own repairs. Interviewed cattle farmers complained about the lack of market and high transactional costs when they take their animals to the auction. Nkosi and Kirsten (1993) found that farmers prefer informal markets with no transaction cost, with poor market information pertaining to price and lack quality requirement. This finding is also supported by a study conducted by National Emergent Red Meat Producer's Organisation (2005) for the National Department of Agriculture. Montshwe (2006) and Musenwa et al. (2007) identified poor market infrastructure, increasing market price variability, high transaction costs and low purchasing power of buyers as major problems resulting in limited market participation. Ainslie et al. (2002) identified cultural values and poor production practices rather than market failures as major causes of limited market participation. The challenge for most rural cattle farmers is that sometimes they cannot sell their animals on any specific day they want because of a lack of buyers. Furthermore, most of their animals are in poor body conditions due to poor nutrition for the most part of the year except during the rainy seasons and this result in lower farm gate prices especially during the dry spells (Makhura, 2001); also, more often producers will refuse to sell their livestock. Animals under rural farming are often too old when farmers sell them and this

contributes a great deal to low prices (Nkhori, 2004). Respondents felt that any technology that would increase cattle productivity with no access to formal markets was less likely to be adopted since farmers were able to meet the demand of the rural market.

Natural causes

The five most common challenges that emerged as given by respondents in order of ranking were: drought and dry season, diseases, lighting, dystocia and high pre-weaning mortality; again, our discussion will be limited to the first two (Figure 4). Interviewed stakeholders reported drought as one of the key challenges to livestock productivity and could impact negatively on the implementation of the ART project under communal and emerging farming systems. Drought and dry seasons are regular and recurrent features of the South African climate (Mathieu and Yves, 2003). The results of drought are severe water and feed shortages, and the death of animals. These in turn will affect the body condition score and the ability of animals to cycle and conceive, negatively impacting on the implementation of the ART. South Africa experienced severe drought in 2015 through to 2016, and a large number of cattle died during this period. Motiang and Webb (2016) found that farmers do not dispose-of their animals even when there is an anticipation of drought. Though this challenge is recurrent, communal and emerging cattle farmers had no strategy at all to deal with the challenge. Cattle farmers

Figure 4. Perceived challenges arising from natural causes as given by respondents.

need to devise strategies that will ensure their herd survival during drought and winter (May to July) season. Parasites and diseases were among the constraints faced by communal and emerging cattle farmers as raised by respondents during the interview. The most problematic diseases listed by respondents were tick-borne diseases such as heartwater and redwater, lumpy skin disease, Foot and Mouth Disease and sores resulting from abscesses. This is comparable with many authors (Mapiye et al., 2009; Rajput et al., 2006; Swai et al., 2010) who reported tick-borne diseases as the main cause of substantial losses in cattle production, reduced productivity, the decline in fertility and often death. High incidences of diseases in developing countries are due to a number of reasons including the unavailability and high cost of drugs and medicines (Ndebele et al., 2007). Some drugs and vaccines such as the Teramycin and Lumpy skin disease vaccine can be purchased from farmer's co-operatives and NTK stores throughout South Africa. Respondents were aware that indigenous cattle breed such as the Ngunis are tick and disease resistant, and that they should be promoted since they will fit the low-input, low-output production system common in rural setups. Again, respondents also indicated that in the past, during the apartheid era, they were provided with all vaccines free of charge and questioned the motives of the current government as being too corrupt and selfish. Not all cattle farmers vaccinate their animals and unvaccinated herds become the source of reinfection due to poor control of movement under communal setups.

Diseases, especially reproductive diseases can impact negatively on the implementation and adoption of ART under communal and emerging farming systems. It is important for cattle farmers to know and understand their role and that of the government in cattle farming.

Conclusion

Respondents were aware of the many challenges facing cattle production under communal and emerging farming systems. The general feeling amongst cattle farmers is that government should address these challenges. However, due to limited resources, government programmes should target cattle farmers who are serious about farming, and those who are willing to change their traditional farming methods. The dependency syndrome will not advance cattle farming, and government cannot initiate and support all aspects of cattle farming in rural areas. Cattle farmers with the help of Provincial Department of Agriculture officials need to devise strategies to survive drought and dry winter periods in order to keep their animals in shape. There is also a need for the development and maintenance of infrastructure such as cattle handling facilities in rural areas by all cattle stakeholders involved.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interest..

ACKNOWLEDGEMENTS

REFERENCES

Adesina AA, Baidu-Forson J **(**1995). Farmers' perceptions and adoption of new agricultural technology: evidence from analysis in Burkina Faso and Guinea, West Africa. Agricultural Economics 13**(**1):1-9.

Ainslie A, Kepe T, Ntsebeza L, Ntshona Z, Turner S (2002). Cattle ownership and production in the communal areas of the Eastern Cape, South Africa. Research Report No.10. University of the Western Cape, Cape Town, South Africa.

Buthelezi M, Yeni S (2016). Op-Ed: Rural South Africa is on precipice. Daily Maverick, www.dailymaverick.co.za/article/2016-07-06-op-ed-rural-south-africa-is-on-a-precipice/

Census (2011). Census Report by the Statistics South Africa, August, 2011, Pretoria, South Africa.

Crouch M, McKenzie H (2006). The logic of small samples in interview-based qualitative research. Social Science Information 45(4):483-499.

Fairbanks DHK, Benn GA (2000). Identifying regional landscapes for conservation planning: a case study from KwaZulu-Natal, South Africa. Landscape and Urban Planning 50(4):237-257.

Frisch JE (1999). Towards a permanent solution for controlling cattle ticks. International Journal for Parasitology 29(1):57-71.

Gwala L (2013). Effect of Agricultural Extension Services on beneficiaries of the Nguni Cattle Project: The case of Ncera and Kwezana villages, Eastern Cape Province. Published MAgric dissertation. Department of Agricultural Economics and Extension, Faculty of Science and Agriculture, University of Fort Hare, Alice, South Africa.

Hangara GN (2011). Challenges facing communal farmers to improve cattle production and marketing systems in Namibia: Case study from Omaheke region. Published PhD thesis. Centre of Sustainable Agriculture, Faculty of Natural Science and Agricultural Sciences, University of Free State, Bloemfontein, South Africa.

Kundhlande G, Franzel S, Simpson B, Gausi E (2014). Farmer-to-farmer extension approach in Malawi: A survey of organizations using the approach ICRAF Working Paper No.183. Nairobi, World Agroforestry Centre. DOI: http://dx.doi.org/10.5716/WP14384.PDF

Kunene NW, Fossey A (2006). A survey on livestock production in some traditional areas of Northern KwaZulu-Natal in South Africa. Livestock Research for Rural Development. 18:113

Liebenberg F (2015). Agricultural Advisory Services in South Africa. A discussion paper. Department of Agricultural Economics, Extension and Rural Development, Faculty of Natural and Agricultural Sciences, University of Pretoria.

Makhura MT (2001). Overcoming transaction costs barriers to market participation of smallholder farmers in the Northern Province of South Africa. Published PhD Thesis. Department of Agricultural Economics, Extension and Rural Development, University of Pretoria, South Africa.

Malekano L (2000). The socio-economic impact of stock-theft and disease in the lower Shire district of Malawi. A paper presented at the International Conference on Historical and Social Sciences Research in Malawi, Blantyre, June 26-29.

Maluleke W, Mokwena RJ, Motsepa LL (2016). Rural farmers' perspectives on stock theft: police crime statistics. South African Journal of Agricultural Extension 44:2413-3221.

Mapiye C, Chimonyo M, Dzama K, Raats JG, Mapekula M (2009).

Opportunities for improving Nguni cattle production in the smallholder farming systems of South Africa. Livestock Science 124(1):196-204.

Maqhashu A (2013). Application of assisted reproductive technologies on the indigenous Nguni cows and heifers. Published MSc dissertation. Department of livestock and pasture Science, University of Fort Hare, Alice, South Africa.

Marshall B, Cardon P, Poddar A, Fontenot R (2013). Does sample size matter in qualititative research? A review of qualitative interviews in IS research. Journal of Computer Information Systems 54(1):1-22.

Mathieu R. Yves R (2003). Intensity and spatial extension of drought in South Africa at different times scales. Water SA - African 29(4):489-500.

Molefi SH, Mbajiorgu CA, Antwi MA (2017). Management practices and constraints of beef cattle production in communal areas of Mpumalanga Province, South Africa. Indian Journal of Animal Research 51(1):187-192.

Montshwe BD (2006). Factors affecting participation in mainstream cattle markets by small-scale cattle farmers in South Africa. Published MSc Mini-Dissertation. Department of Agricultural Economics, University of Free State, Bloemfontein, South Africa.

Motiang DM, Webb EC (2016). Herd mortality and cattle off-take rates among smallholder producers in the North West Province of South Africa. African Journal of Agricultural Research 11(11):930-934.

Mphinyane MS, Terblanché S (2005). Personal and socio-economic variables affecting the adoption of maize production intervention in the Vuwani District, Limpopo Province. South Africa Journal of Agricultural Extension 35(2):221-241.

Mpumalanga Department of Agriculture, Rural Development, Land and Environmental Affairs (2012). Terms of Reference for Strategic Partnerships/Investors for the GIBA Community Land Reform Project (DARDLEA: Nelspruit, South Africa).

Mpumalanga Department of. Agriculture, Conservation and Environment (2003). Mpumalanga State of the Environment Report, (DACE: Nelspruit, South Africa).

Musemwa L, Chagwiza C, Sikuka W, Fraser G, Chimonyo M, Mzileni N (2007). Analysis of Cattle Marketing Channels Used by Small-holder Farmers in the Eastern Cape Province, South Africa. Livestock Research for Rural Development 19(9):131

Muzari W, Gatsi W, Muvhunzi S (2012). The Impacts of technology Adoption on Smallholder Agricultural Productivity in Sub-Saharan Africa: A review. Journal of Sustainable Development 5(8):69-77.

National Emergent Red Meat Producers' Organisation (2005). Emerging red meat industry analysis in South Africa. A study commissioned by the Department of Agriculture, Pretoria, South Africa.

Ndebele JJ, Muchenje V, Mapiye C, Chimonyo M, Musemwa L, Ndlovu T (2007). Cattle breeding management practices in the Gwayi smallholder farming area of South-Western Zimbabwe. Livestock Research for Rural Development. 19(12):1-9.

Nengovhela NB (2011). Improving the wellbeing of people dependent on the low-income beef industry in South Africa. Published PhD Thesis. School of Integrative Systems, University of Queensland, Queensland, Australia.

Nkhori PA (2004). The impact of transaction cost on the choice of cattle markets in Mahalapye district, Botswana. Published MSc Dissertation. Department of Agricultural Economics and Extension, University of Pretoria, Pretoria, South Africa.

Nkosi SA, Kirsten JF (1993). The marketing of livestock in South Africa's developing areas: a case study of the role of speculators, auctioneers, butchers and private buyers in Lebowa. Agrekon 32(3): 200-237.

Nqeno N, Chomonyo M, Mapiye C, Marufu MC (2010). Ovarian activity, conception and pregnancy patterns of cows in the semiarid communal rangelands in the Eastern Cape Province of South Africa. Animal Reproduction Science 118(2):140-147.

Rajput ZI, Hu SH, Chen, WJ, Arijo AG, Xiao CW (2006). Importance of Ticks and Their Chemical and Immunological Control in Livestock Journal of Zhejiang University SCIENCE B 7(11):912-921.

Shields ML, Rannigar GP, Goode FM (1993). A longitudinal analysis of factors influencing technology adoption in Swaziland, 1985-1991. Journal Of Developing Areas 27(4):469-484.

Small M (2009). How many cases do I need? On science and the logic of case selection in field based research. Ethnography 10(1):5-38.

South African Police Service (2012). Remarks by the Minister of Police, E.N. Mthethwa, MP, on the occasion of the release of the 2011/12 SAPS National Crime Statistics, Parliament, Cape Town – 20 September 2012 – Full text of crime statistics speech, Independent Online [Online], available from :http://www.iol.co.za/news/crime-courts/full-text-of-crime-statistics-speech-1.1387332

Straus AL, Corbin J (2014). Basics of Qualitative Research. Techniques and Procedures for Developing Grounded Theory, 4th Edition. SAGE Publication, London, United Kingdom.

Swai ES, Karimuribo E, Kambarage DM (2010). Risk factors for smallholder dairy cattle mortality in Tanzania. Journal of the South African Veterinary Association 81(40):241-246.

Tada O (2012). Breeding objectives for *in-situ* conservation of indigenous Nguni cattle under low-input production systems in South Africa. Published PhD dissertation. Department of Livestock and Pasture Science, Faculty of Science and Agriculture, University of Fort Hare, Alice, South Africa.

Tatlidil FF, Boz Í, Tatlidil H (2009). Farmers, perception of sustainable agriculture and its determinants: a case study in Kahramanmaras province of TurkeyEnvironment, Development and Sustainability 11(6):1091-1106.

AJ ACADEMIC JOURNALS
expand your knowledge

Journal of Veterinary Medicine and Animal Health

Full Length Research Paper

Prevalence and risk analysis of bovine brucellosis in Asella organized dairy farm, Oromia Regional State, South East Ethiopia

Eyob Eticha[1*], Hani Solomon[2], Diriba Iemma[1] and Birhanu Abera[1]

[1]Asella Regional Veterinary Laboratory, Asella, Ethiopia.
[2]Arsi University School of Agricultural and Environmental Science, Asella, Ethiopia.

A cross-sectional study was conducted on organized Dairy Farm at Asella, Oromia Regional State of Ethiopia to determine seroprevalence and risk analysis of bovine brucellosis in May, 2016. A total of 304 samples were collected; all were tested and confirmed serologically using Rose Bengal plate test (RBPT) and complement fixation test (CFT). Out of 304 samples tested, overall seroprevalence of RBPT and CFT results was12.48% (38) and 9.87% (30) respectively, which was higher in animals above two years age than younger one. History of abortion and retained fetal membrane were found to be significantly (p<0.05) associated with occurrence of bovine brucellosis. A statistically not significant difference (p >0.05) was observed between cross and local dairy cattle. The result showed the high prevalence of bovine brucellosis in the farm. Hence, culling of the positive dairy cattle and practicing good management should result in a control and prevent of the brucellosis.

Key words: Asella, brucellosis, dairy cattle, seroprevalence, risk factors.

INTRODUCTION

Brucellosis is a highly contagious, zoonotic, and economically important bacterial disease of animals worldwide (OIE, 2009). It is endemic in many developing countries and caused by *Brucella* species that affect man, domestic and some wild animals, and marine mammals (Seleem et al., 2010). It is primary reproductive disease clinically characterized by abortion in the last trimester and retained placenta in the female whereas orchitis and epididymitis with frequent and sterility occur in male (Radostits et al., 2007). Sources of infection for isolation of bacterial include aborted fetuses, fetal membranes, vaginal discharges and milk from infected cows. The most common route of transmission in cattle is through direct contact with an aborting cow and the aborted foetus or by indirect contact with contaminated fomites. Ingestion of contaminated pasture, feed, fodder and water may also play a secondary role (Godfroid et al., 2010). Susceptibility of animals to brucellosis depends on their natural resistance, level of immunity and environmental stress (Radostits et al., 2007). Mature animals are much more susceptible to infection, regardless of sex. In female animals, pregnancy has

positive contribution to the degree of susceptibility than their age. Bulls are relatively resistant than sexually mature heifers and less resistant than sexually immature heifers (Godfroid et al., 2010). A precise diagnosis of *Brucella* spp. infection is important for the control of the disease in animals and consequently in man. Clinical diagnosis is based usually on the history of reproductive failures in livestock, but it is a presumptive diagnosis that must be confirmed by laboratory methods (Poester et al., 2010). Laboratory methods also help to differentiate from other infectious causes of abortions (Juyal et al., 2011). No single test is appropriate in all epidemiological situations; all have their own limitations. The first serological test for brucellosis was used by Wright and Smith (OIE, 2009). Compliment fixation test is a standard method for the epidemiological surveillance of brucellosis (Köppel et al., 2007). Antibodies anti-*Brucella* have been demonstrated by the Rose Bengal plate test (RBPT), standard tube agglutination test (STAT), coombs test, complement fixation test (CFT), 2- mercaptoethanol test and enzyme-linked immunosorbentassay (ELISA)(OIE, 2009). In Ethiopia, the prevalence of bovine brucellosis has been intensively investigated in state owned dairy farms (Bekele et al., 2000). In smallholder farms in some parts of the country (Berhe et al., 2007) and in the central highlands of Ethiopia (Kebede et al., 2008). Thus, this study was carried out to determine the seroprevalence of bovine brucellosis and its associated risk factors in Asella organized dairy farm.

MATERIALS AND METHODS

A cross sectional study was conducted in May, 2016 at Asella organized dairy farm managed under intensive system which is located at 175 km South East of Addis Ababa. In this study a bout 5-10 ml of blood was collected from the jugular vein of 304 cattle which are more than six month of age using plain vacationer tube to collect a serum samples. Information on individual animal such as age, sex, breed and history of abortion was recorded in separate sheet. The collected sera samples were screened for the presence of antibody against *Brucella* using the Rose Bengal Plate Test (RBPT) and Complement Fixation Test (CFT) as a confirmatory test were used in detecting antibody against *Brucella* antigen. RBPT undertaken at Asella regional veterinary laboratory and CFT was undertaken at the National Animal Health Diagnostic and Investigation Center, serology laboratory, sebata, Ethiopia. The procedure and interpretation of results described by OIE (2008) were followed. Finally, the collected data and the results of laboratory tests were analyzed by statistical package for social science (SPSS), to determine those variable that were significantly associated with seropositivity to *Brucella.*

RESULTS

In dairy animals investigated during the study were above six month of age and 76(25%) and 228 (75%) were local Borena and cross-breeds of indigenous zebu and Holstein Friesian, respectively. in addition 95 (31.25%) of the animals were lactating cows, 30(9.87%) were pregnant, 42(13.82%) were bulls and the remaining 137(45.10%) were heifers. From the studied animals there was 45(14.8%) history of retained fetal membrane and 28(9.2%) abortion. Generally, the frequency distribution of breed, age group, and sex were summarized in Table 1. Out of 304 serum samples, 38 (12.5%) were positive for brucellosis using RBPT. The present study attempted to look into the existence of any association between seropositivity and breeds, age and sex of the animals. Thus, the prevalence of local Borena, and to cross breed animals was compared in Table 2. The sera prevalence of local Borena, and cross breed cattle was calculated as 1.32 and 8.55% having not a significant variation with P-value of 0.265, the sera prevalence of age for animals 6 month-3 year, 3-6 year and above 6 year which assess in Table 3 was intended as 2.3, 2.63 and 4.93% respectively which have significant variation with p-value 0.011 the prevalence of male and female which assess in Table 4 was intended as 0.99 and 8.88% have not a significant variation with p-value of 0.523. The association of brucellosis with abortion and retained fetal membrane was tested using Chi-square. It was found that brucellosis was significantly associated with abortion and retained fetal membrane with p-value of 0.000 and 0.002, respectively (Table 5).

DISCUSSION

The present study revealed that the seroprevalence of anti-*Brucella* antibodies determined with CFT and RBPT was 9.87 and 12.48%, respectively. The overall seroprevalence of bovine brucellosis in the study area was 9.87%. This high seroprevalence is an agreement with previous finding of (Kebede et al., 2008) with 11% in central highland, (Hunduma and Regassa, 2009) with 11.2% in east show and (Megersa et al., 2012) with 8% in pastoral region.

On the other hand, there were reports with a relatively higher sero-prevalence of bovine brucellosis in other parts of the country, (Sintaru, 1994) with 22% in a dairy farm in northeastern Ethiopia and (Bekele et al., 2000) with 11-15% in dairy farms and ranches in southwestern Ethiopia. Other investigator 0.14% in selected area of north Gondar (Tadese, 2003), 0.77% in selected site of Jima Zone (Tolosa et al., 2008), 0.45% in central highlands of Ethiopia (Lidia, 2008) and 0.05%, in Arsi Zone (Degefa et al., 2011) indicates lower overall prevalence when compared to our present study. The level of brucellosis infection tends to be relatively high in intensive farm than in extensive farm (Matope et al., 2011).

There is still disagreement between different authors among breed susceptibility to brucellosis. In this study breed has supposed one of the risk factors, consequently seroprevalence was found to be higher in cross breed animals (8.55%) than local (1.32%). Nevertheless, this difference was statistically not significant which is similar

Table 1. Distribution of variables with percent.

Variable	Group	Frequency	Percent
Breed	Local Borena	76	25
	Cross	228	75
Age	6 month -3 years	166	54.6
	3-6 years	86	28.29
	>6 years	52	17.1
Sex	Male	42	13.81
	Female	262	86.18
Rose Bengal Plate Test result	Negative	266	87.5
	+	3	0.98
	++	7	2.3
	+++	28	9.21
Compliment Fixation Test result	Positive	30	9.87
	Negative	274	90.13

Table 2. Breed wise sero prevalence of bovine brucellosis.

Breed	n	CFT positive	Prevalence (%)
Local	76	4	1.32
Cross	228	26	8.55
Total	**304**	**30**	**9.87**

χ^2 =2.66, df=2 p value =0.265.

Table 3. Age wise seroprevalence of bovine brucellosis.

Age	n	CFT positive	Prevalence (%)
6 month-3year	179	7	2.3
3-6year	73	8	2.63
Above 6 year	52	15	4.93
Total	**304**	**30**	**9.87**

χ^2 =9.035, df=2 p value =0.011.

Table 4. Sex wise seroprevalence of bovine brucellosis.

Sex	n	CFT positive	Prevalence (%)
Male	42	3	0.99
Female	262	27	8.88
Total	**304**	**30**	**9.87**

χ^2 =0.407, df=1 p value = 0.523

to reported in GutoGidadistrict (Moti et al., 2012) and in central highland of Ethiopia (Lidia, 2008). On the other hand Minda et al. (2016) and Jergefa et al. (2009) reported significant variation on serological prevalence of

Table 5. Association of brucellosis with abortion and retained fetal membrane.

	History of abortion			history of retained fetal membrane		
Test result	Aborted	Not aborted	Total	Present	Not present	Total
CFT⁻	21(6.9%)	214(70.4%)	235(77.3%)	38(12.5%)	197(64.8%)	235(77.3%)
CFT⁺	7(2.3%)	20(6.6%)	27 (8.9%)	7(2.3%)	20(6.6%)	27(8.9%)
Total	28(9.2%)	234(77%)	262(86.2%)	45(14.8%)	217(71.4%)	262(86.2%)
χ^2 =22.5, df=2, p-value=0.000				χ^2 = 12.86, df= 2, p- value=0.002		

brucellosis with higher prevalence in cross-bred than in local ones. Age have association with occurrence of brucella. This could be explained by sexual maturity and pregnancy due to the influence of sex hormones and placenta *erythritol* on the pathogenesis of brucellosis (Radostits et al., 2007). This result in agreement with report of Lidia (2008) central highland of Ethiopia and Nuraddis et al. (2010) in selected site of Jima Zone. The presences of statistically significant contradict with the previous finding of Minda et al., (2016) and Magona et al. (2009). Even if there is high prevalence in adult animals there was seropositive reactor in less than 3 years of age this is an indication of variations in the management practices (level of intensification and hygienic practices).

Even though sex is not significantly associated with *Brucella* seroposetivity (p> 0.05), high seroprevalence was found among female animals which is 8.88% in female and 0.99% in male animals. This finding was in agreement with the report done by Asfaw et al. (1998) in and around Addis Ababa, Tolosa et al. (2008) in Jima Zone and Desalegn et al. (2011) in Asella dairy farm. The lower prevalence of male reactors in this report could be as a result of smaller number of males tested as compared to female and it was also reported that the serological response of male animal to *Brucella* infection is limited (Mohammed et al., 2009). Female animals are more susceptible to *Brucella* organism in gravid uterus of pregnant animals than in testis due to the presence of erythritol in female reproductive tract which stimulates the growth of the organism (Godfroid et al., 2010).

In our study, individual animal sero-prevalence was positively associated with the occurrence of abortion and retained fetal membranes. This indicated that history of abortion or still birth and retained fetal membrane were significantly associated with brucellosis seropositivity. This could be explained by the fact that abortion or still birth and retained fetal membrane are typical outcome of brucellosis (Radostits et al., 2007). This result was in agreement with other investigators Desalegn et al. (2011) in Asella dairy farm and Berhe et al. (2007) in Tigray Region.

Conclusion

The study reflected higher prevalence of bovine

brucellosis about 9.87% in the target dairy farm. The current findings indicated that the age, history of abortion and retained fetal membrane were the risk factors statistically significant associated with Brucella seropositivity for this study. Therefore, considering the economic and public health importance of brucellosis, regular screening of brucellosis for newly introduced and the whole farm animals, and culling of those positive one and practicing good farm management were recommended to reduce the risk incidence of bovine brucellosis in dairy farm and surrounding population.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

REFERENCES

Asfaw YB, Molla HKZ, Tegene A (1998). The epidemiology of bovine brucellosis in intra and peri urban dairy production system in and around Addis Ababa, Bulletin of Animal Health and Production in Africa 46:217-224.

Bekele A, Molla B, AsfawY, Yigezu L (2000). Bovine brucellosis in ranches and farms in southeastern Ethiopia.Bulletin of Animal Health and Production for Africa 48:13-17.

Berhe G, Kelay B, Yilkal A (2007). Seroepidemiological investigation of bovine brucellosis in the extensive production system of Tigray Region of Ethiopia. The International Journal of Applied Research in Veterinary Medicine 5:65-71.

Degefa T, Duressa A, Duguma R (2011). Brucellosis and Some Reproductive Problems of Indigenous Arsi Cattle in Selected ArsiZone's of Oromia Regional State. Ethiopia. Global Veterinaria 7:45-53.

Deselegn TB, Gangwar SK (2011).Seroprevalence study of bovine brucellosis in Assela government dairy farm of Oromia Regional State, Ethiopia. International Journal of Science and Nature 2:692-697.

Godfroid J, Nielsen K, Saegerman C (2010). Diagnosis of brucellosis in

livestock and wildlife. Croatian Medical Journal 51:296-305.

Hunduma D, Regassa C (2009). Seroprevalence study of bovine brucellos is in pastoral and agro-pastoral areas of East Showa Zone, Oromia Regional State, Ethiopia. Am. American-Eurasian Journal of Agricultural & Environmental Sciences 6:508-512.

Jergefa T, Kelay B,.BekanaM,Teshale S, GustafsonH,Kindahl H (2009). Epidemiological study of bovine brucellosis in three agro ecological areas of Central Oromia, Ethiopia.Revue Scientifiqueet Technique 28:933-943.

Juyal PD, Bal MS, Singla LD (2011) Economic impact, diagnostic investigations and management of protozoal abortions in farm animals. In: All India SMVS' Dairy Business Directory 11:39-46.

Kebede T, EjetaG,Ameni G(2008). Seroprevalence of bovine brucellosis in smallholder farms in central Ethiopia ..Revue MédVét 159:3-9.

Köppel C, Knopf L, Ryser MP, Miserez R, Thür B, Stärk KDC (2007). Serosurveillance for selected infectious disease agents in wildboars (*Susscrofa*) and outdoor pigs in Switzerland. European Journal of Wildlife Research 53:212-220.

Lidia B (2008). Seroprevalence study of bovine brucellosis in Central High Land of Ethiopia, DVM Thesis, Jimma University, Jimma, Ethiopia.

Magona JW, Walubengo J, Galiwango T, Etoori A (2009). Seroprevalence and potential risk of bovine brucellosis in zero-grazing and pastoral dairy systems in Uganda. Tropical Animal Health and Production 41:1765-1771.

Matope G, Bhebhe E, John B, Muma JB, Oloya J, Madekurozwaa RL, Lund A, Skjerve E (2011). Seroprevalence of brucellosis and its associated risk factors in cattle from smallholder dairy farms in Zimbabwe. Tropical Animal Health and Production 43:975-979.

Megersa B, Biffa D, Abunna F, Regassa A, Godfroid J, Skjerve E(2012). Seroepidemiological study of livestock brucellosis in a pastoral region. Epidemiology and Infection 140:887-896.

Minda AG, Gobena A, Tesfu k, Getachew T, AngellaA,Gezahegne MK (2016).Seropositivity and risk factors for *Brucella*in dairy cows in Asella and Bishoftu towns, Oromia Regional State, Ethiopia.African Journal of Microbiology.Research 10(7):203-213.

Mohammed H (2009). Seroprevalence of small ruminant brucellosis in and around Jijiga.DVMthesis.School of Veterinary Medicine, Jimma University, Jimma, Ethiopia.

Moti Y, Tesfaye M, Hailu D, Tadele T, Mezene W (2012). Bovine Brucellosis: Serological Survey in Guto-Gida District, East Wollega Zone, Ethiopia.Global Veterinaria 8(2):139-143.

Nuraddis I, .KelayB,FikreL,Merga B(2010). Seroprevalence of bovine brucellosis and its risk factors in Jimma Zone of Oromia region, south western Ethiopia. Tropical Animal Health and Production 42:35-40.

OIE (2008). Bovine Brucellosis. Manual of Diagnostic Tests and Vaccines for Terrestrial Animals.Office international des Epizootics, Paris. Chapter 2.4.3:624-629.

OIE (2009).Bovine brucellosis.Manual of diagnostic Tests and Vaccines for Terrestrial Animals, Office International Des Epizootics. Paris pp. 409-435.

Poester P, Nielsen K, Samartino E (2010).Diagnosis of brucellosis. The Open Veterinary Science Journal 4:46-60.

Radostits OM, Gay CC, Hinchcliff KW, Constable PD (2007). Veterinary Medicine.A text book of diseases of cattle, sheep, pigs, goats and horses.10th edition. London: W.B., Saunders. pp. 963-985.

Seleem MN, Boyle SM, Sriranganathan N (2010). Brucellosis A re-emerging zoonosis. Veterinary Microbiology 140:392-398.

SintaruT(1994). The impact of brucellosis on productivity in improved dairy herd of Chaffa State Farm, Ethiopia.M.Sc Thesis, Frei University, Berlin, Germany.

Tadese Y(2003).A survey of brucellosis in sleeted area of North Gonder Zone, DVM Thesis, Addis Ababa University, DebreZeit, Ethiopia.

Tolosa T, Regassa F Belihu K (2008). Seroprevalence study of bovine brucellosis in extensive management system in selected sites of Jimma Zone, Western Ethiopia. Bulletin of Animal Health and Production in Africa 56:25-37.

Related Journals:

Clinical Reviews and Opinions

Journal of
Medicinal Plant Research

African Journal of
Pharmacy and Pharmacology

Journal of
Dentistry and Oral Hygiene

Journal of
Parasitology and Vector Biology

Journal of
Pharmacognosy and Phytotherapy

Journal of
Medical Laboratory and
Diagnosis

Journal of
Diabetes and Endocrinology

Medical Practice and Reviews