

ASSESSMENT OF REPRODUCTIVE PROBLEMS OF DAIRY CATTLE IN KHARTOUM NORTH- SUDAN

Ibrahim Elrashied A. Ibrahim*¹, Hatim A. Zainalabein² and Adil M. A. Salman³

^{1,2}Department of Obstetric and Gynecology, College of Veterinary Medicine. University of Bahri.

³Department of Food Safety and Veterinary Public Health, College of Veterinary Medicine University of Bahri.

Received on: 10/03/2020

Revised on: 30/03/2021

Accepted on: 20/04/2021

*Corresponding Author

Ibrahim Elrashied A.

Ibrahim

Department of Obstetric and

Gynecology, College of

Veterinary Medicine.

University of Bahri.

ABSTRACT

To assessed the reproductive problems and their association with reproductive failure in dairy Cattle two questionnaires were designed for this study, the first one for individual cows with infertility problem (207cow) and second one for the randomly selected farms (93farms), in Khartoum North (Bahri North and East Nile localities), Khartoum State, Sudan. The study revealed that the major reproductive Problems were repeat breeding 132(63.8%), retained placenta 47(22.7%), reproductive infection which includes (pyometra, metritis, vaginitis and anoestrus) 18(8.7%) and abortion 10(4.8%). The risk factors such as breed, age, parity and mating system, were assessed and their associations with reproductive problems were evaluated in this study. There was association between age of cows and repeat breeding problem, increase in cows' age followed by increase in the repeat breeding problem, there was association between the presence of Mineral block (any source of mineral and vitamins) in farms and cows with repeat breeding problem, the repeat breeding was higher in the farms that not using any source of minerals and vitamins. There was association between origin of cows and the reproductive infection, the reproductive infection in cows purchased from other farms was higher than in cows that born in the farm, and the relative risk of reproductive infection in cows purchased from other farms to be with reproductive infection was almost two time to that for cows born in farm.

KEYWORDS: Sudan, reproductive problem, reproductive failure, dairy Cattle.

INTRODUCTION

The major reproductive problems that have most important influence on reproductive performance of dairy cows are include abortion, dystocia, retained of fetal membrane, metritis, prolapse (uterine and vagina), mastitis, anoestrus, bovine brucellosis and repeated breeding. These reproductive problems could be categorized as prepartum and postpartum reproductive problems, (Dinka, 2013 and Benti and Zewdie, 2014). The presence of the reproductive problems result in considerable economic loss to the dairy industry due to lesser number of calves crop, slower uterine involution, prolonged inter-conception and calving interval, early depreciation of potentially used cows, decreased milk yield per lactation as well as overall lifetime production, and increased costs due to veterinary services and earlier culling of cows, (Lobago *et al.*, 2006; FAWC, 2009).

Repeat breeding in cattle has been recognized as one of the most serious reproductive problems, it is the main reason of infertility and lead to prolonged time at first calving age, prolonged inter-calving interval and economic losses due to loss of one calf per year per cow and milk loss, (Parkinson, 2008, and Kumar *et al.*, 2014).

Abortion is the most common problem of dairy cows which limit the cow's ability to produce a calf yearly and can largely affects the profit of the dairy farm, (Rafati *et al.*, 2010), reported that the early pregnancy abortions could result in increased days open and extended calving intervals which may result in reduction of the herd's potential calf production. The infectious agents have been incriminated in 20-30% of abortion cases submitted to diagnostic laboratories, (Augustine, 2000). The prevalence rate of abortion in Central Ethiopia was 14.6% as reported by (Hunduma, 2013), in Switzerland abortion rate of 2 to 4% reported by (Reitt *et al.*, 2007) and in South east Ethiopia 13.0% reported by (Molalegne and Shiv, 2011). Elfadil, (2012), reported the occurrence of abortion 2.35% in Nile East in Khartoum state, Sudan.

In the retained fetal membrane (RFM) the uterus becomes contaminated with bacteria which have a negative impact on reproductive performance in cattle including delayed uterine involution, a prolonged interval to first service, an increased number of services per conception, a decreased conception rate and a prolonged interval of days open, (Dubuc *et al.*, 2010). Furthermore, RFM have been associated with increased risk for endometritis, metritis, and mastitis, (McDougall, 2001). These diseases can in turn lead to decreased

fertility and potential losses in milk production, (Goshen, 2006). Han and Kim, (2005), they reported that the retained placenta lead to increase the interval from calving to first service and conception.

The occurrence of Retained fetal membranes 8.2% in Nile East locality in Khartoum state (Sudan), recorded by (Elfadil, 2012). Goff, (2006), LeBlanc, (2008) and Hemayatul, *et al.*, (2012), they detected a prevalence rate of retained placenta ranging from 7.1% to 8.6%.

The risk of uterine infection usually increases in cows with, abortion, dystocia or retained fetal membranes, (LeBlanc, 2008). Ahmed and Elsheikh (2013), revealed that the dairy cows were diagnosed with and treated for postpartum uterine bacterial infection was associated with prolonged day open, lowered rate of service per conception lowered breeding and increased calving interval. Moghaddam and Mamoei (2004), Azawi *et al.*, (2008c) and Gilbert (2005), They recorded an incidence of reproductive problems including endometritis and metritis in Iranian local breed buffalo cows were 29.4%, 17% and 3.4% to 40% respectively.

The objectives of this study:

- ▶ To determine the main reproductive problems that cause reproductive failure in dairy cows in Bahri locality.
- ▶ To evaluate the effect of certain risk factors on reproductive problems associated with reproductive failure in dairy cattle.

MATERIALS AND METHODS

Study area: This study was carried out at Khartoum North; all farms were located in the region of Bahri North and Nile East localities in Khartoum State.

Study design: For the purpose of the study a stratified random samples was undertaken. Large dairy farms and small dairy units around Khartoum North were randomly

selected, farm owners, workers and/or managers were interviewed. In all farms selected, animals with known reproductive problems at the time of the survey were investigated.

Questionnaire survey: There was two type of questionnaire in this study, the first one for individual cows with infertility problem and second one for the general conditions of the selected farms.

1. Individual cows with infertility problem

questionnaire: In this part the data was collected from 207 cows with reproductive problem, data were collected from cases with abortion, retained placenta, repeat breeding and reproductive infection. information on reproductive health problems as well as management system and particulars related to individual cows such as age, location, and breed were collected.

2. Farms questionnaire: A total of 93 farmers were interviewed face-to-face using close-ended questions Direct interview with the farmers beside the supervisor observation were used to determine prevalence and types of infertility problems.

Data management and analysis

The data obtained from questionnaire were analyzed using Statistical Package for Social Sciences version 20 (SPSS). Descriptive statistics, association using X² (Chi-square) technique with $p \leq 0.05$ considered as significant and relative risk was estimated.

RESULT

The questionnaire result revealed that the prevalence of the major infertility problems were, repeat breeding cows (RB) (63.8%), retained placenta (RP) (22.7%), reproductive infection (RI) (8.7%) which includes (pyometra, metritis, vaginitis and anoestrus) and abortion (Ab) (4.8%), figure No (1).

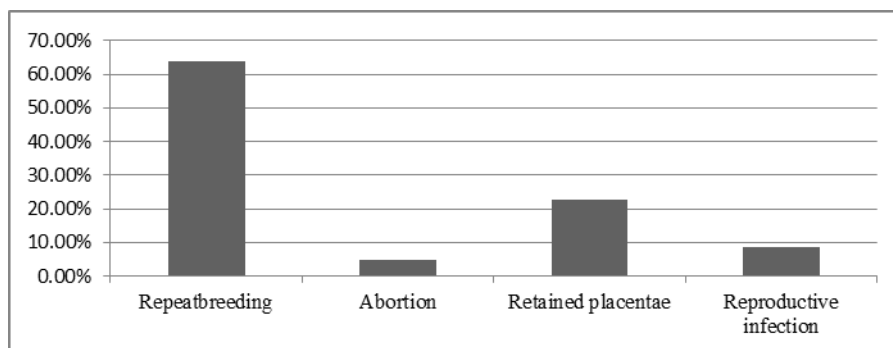


Figure NO. (1): Illustrate Overall Prevalence of Major Reproductive Problems of Dairy Cattle in this Study.

The risk factors such as breed, age, parity, mating system, herd size, location, origin of cows, owner education, records keeping, feeding system, vaccination, veterinary service, presence of bulls, housing system and sanitation were assessed and their association with reproductive problems were evaluated.

The number of cows with repeat breeding problem were 52 (39.4%) and 80 (60.6%) from East Nile and Bahri North respectively, this difference between the two locations was found to be statistically insignificant. $p \leq 0.05$ table (1).

Table NO. (1): Distribution of cows with RB problem in different farms location.

Location	Repeat breeding		Total	Chi\ S	Sig
	Positive	Negative			
East Nile	52(68.4%)	24 (31.6%)	76(100%)	1.4	0.23
Bahri North	80 (61.0%)	51(38.9%)	131(100%)		
Total	132(63.8%)	75(36.2%)	207(100%)		

The open period in this study was ranging between 2 to 48 month; the association between the RB problem and open period was highly significant, $p \leq 0.05$, table (2).

Table (2): Differences between the RB problem and open period.

	Mean \pm SD	No. of cows	T.	D.F	Sig
Repeat breeder	1.3 \pm 0.45	132	- 12.27	206	0.000
Open period	8.6 \pm 8.26				
Repeat breeder - Open period	-7.3 \pm 8.56				

In this study there was association between RB in farms and number of culled cows, this association was found to be highly significant, $p \leq 0.05$, table (3).

Table NO. (3): The association between RB in farms and NO. of culled cows.

RB in farms	No of culled cows							
	00	1	2	3	4	5	7	10
Positive RB	12(14.6%)	16(19.5%)	16(19.5%)	13(15.9%)	10(12.2%)	11(13.4%)	2(2.4%)	2(2.4%)
Negative RB	9(81.8%)	00	2(18.2%)	00	00	00	00	00
Total	21(96.4%)	16(19.5%)	18(37.7%)	13(15.9%)	10(12.2%)	11(13.4%)	2(2.4%)	2(2.4%)
Total	Chi\ S	Sig						
82(100%)	26.6	0.000						
11(100%)								
93(100%)								

The number of RB was significantly associated with the age with ($p \leq 0.05$), in cows over seven years the RB problem was detected in 58(43.9%) of cows, in the age

group of 2-5-year the percentage of repeat breeder cows were 42(31.8%), table (4).

Table (4): The association between ages of cows with RB problem.

Presence of repeat breeding cows	Cows age			Total	Chi\ S	Sig
	2-5year	5-7 year	7-...year			
Positive RB	32(24.3%)	42(31.8%)	58(43.9%)	132(100%)	8.8	0.03
Negative RB	36(48.0%)	20(26.7%)	19(25.3%)	75(100%)		
Total	68(72.3%)	62(58.5%)	77(69.2%)	207(100%)		

Also in this study there was association between the presence of Mineral block (any source of mineral and

vitamins) in farms and cows with RB problem, this association was significant ($p \leq 0.05$), table (5).

Table (5): Association between the presence of Mineral block and cows with RB problem.

Mineral block	Repeat breeding problem		Total	Chi\ S	Sig	Risk value
	Positive	Negative				
Present	37(97.3%)	1(2.7%)	38(100%)	5.21	0.02	1.19
Not Present	45(81.8%)	10(18.2%)	55(100%)			
Total	82(88.2%)	11(11.8%)	93(100%)			

Abortion was detected in 75(80.6%) farms from 93 farms, figure (2). The number of aborted cows was 10 (4.8%) from the total cows with reproductive problem

207 (100%). The number of aborted cows was 2 (2.6%) and 8 (6.1) in East Nile and Bahri North respectively.

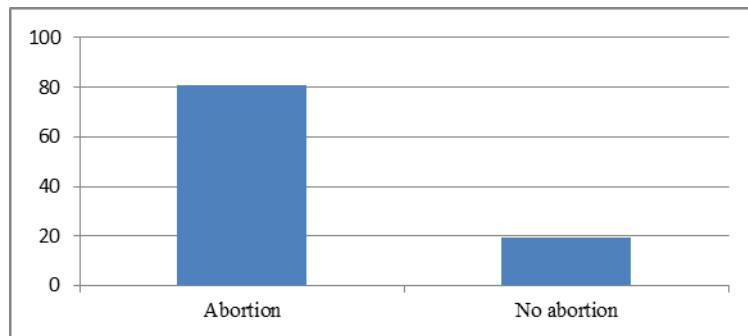


Figure (2): Illustrate the prevalence of abortion in farms.

In the East Nile locality abortion rate was 38(92.7%), while in Bahri North it was 37(71.2%) farms, there was

statistical significant association in the abortion rate between farm location, with ($P \leq 0.05$), table (6).

Table NO. (6): Abortion in farms and farm location.

Farms location	Abortion		Total	Chi\ S	Sig	Risk factor
	Positive	Negative				
East Nile	38(92.7%)	3(7.9%)	41(100%)	6.8	0.009	1.3
Bahri North	37(71.2%)	15(28.8%)	52(100%)			
Total	75(80.6%)	18(19.4%)	93(100%)			

The prevalence of the abortion rate in the farms was divided to three categories low (1% of cows aborted every year), medium (2- 4% of cows aborted every year)

and high (≥ 5 of cows aborted every year); the abortion rate was high in 54.7% of farms, medium in 32% of farms and low in 11% of the farms, figure (3).

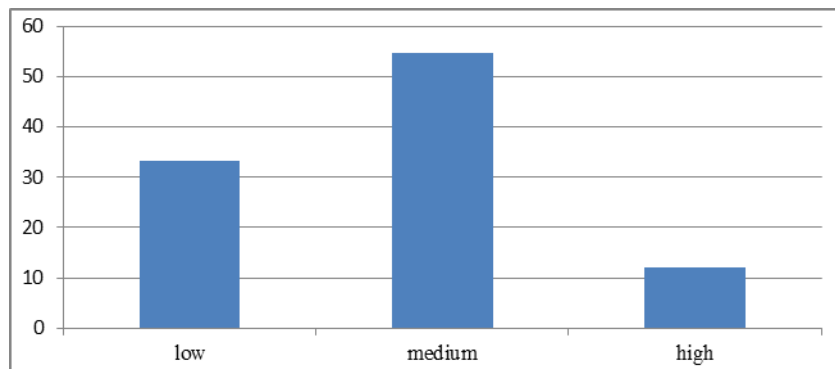


Figure (3): The prevalence of the AB in the farm.

The causes of the abortion of in this study was divided in to four group, disease causes (infectious) 2 (29.3%), high temperature 210 (13.3%), unknown causes 32 (42.7%) and mixer of (high temperature and disease causes);

11(14.7%) farms respectively, and the differences between the abortion causes was highly significant ($P \leq 0.01$), Table (7).

Table (7): The association between the abortion in the farm and the causes of abortion.

Presence of abortion in farm	Causes of abortion				Total	Chi\ S	Sig
	Disease (infectious)	High temperature	Unknown causes	Mixer causes			
Aborted cows	22(29.3%)	10(13.3%)	32(42.7%)	11(14.7%)	75(100%)	86.7	0.00
No abortion					18(100%)		
Total					93(100%)		

Retained placenta was the second major reproductive problem in this study, it was detected in 55(59.1%) farms from 93 farms. 47 (22.7%) cows had RP from 207(100%) cows with reproductive problem in this

study. The number of cows with RP in East Nile was 14 (29.8%) while that in Bahri North was 33 (70.2%), figure (4).

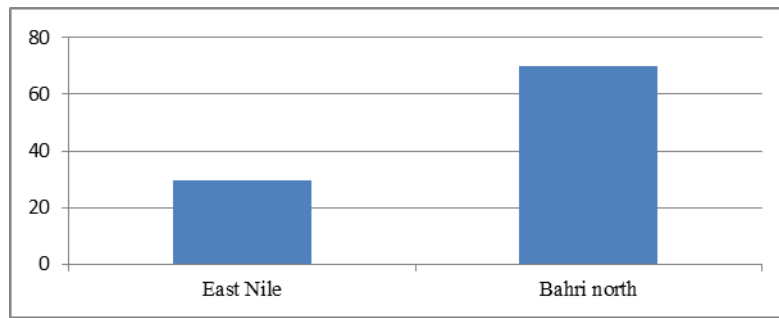


Figure (4): The frequency of cows with retained placenta according to localities.

The occurrence of the RP in the farm in this study was ranging between 1.8% to 12.7% per farm per year. In the East Nile locality the prevalence of RP was 25(61.0%) farms from total 41(100%) farms visited in this area,

while in Bahri north it was 30(57.7%) farms. There was insignificant association between RP in farm and farms location, table (8).

Table (8): Association between RP in farm and farms location.

Farms location	Retained placenta in farm		Total	Chi\ S	Sig	Risk factor
	Positive	Negative				
East Nile	25(61.0%)	16(39.0%)	41(100%)	0.102	0.75	0.9
Bahri North	30(57.7%)	22(42.3%)	52(100%)			
Total	55(59.1%)	38(40.9%)	93(100%)			

There was association between the presence of RP and abortion, this association was statistically significant ($p \leq 0.05$), table (9).

Table (9): The association between the prevalence of RP in farms and abortion.

Retained placenta in farm	Abortion in farm		Total	Chi\ S	Sig	Risk factor
	Positive	Negative				
Positive Retained placenta	48(87.3%)	7(12.7%)	55(100%)	2.79	0.05	1.2
No Retained placenta	27(71.1%)	11(28.9%)	38(100%)			
Total	75(80.6%)	18(19.4%)	93(100%)			

There was statistical significant association between the RI and location of farm, RI in Bahri North 14(10.7%) and in East Nile 4(5.3%), with ($p \leq 0.05$) and the relative

risk of detecting cows in Bahri North to be with RI was 1.4 time to East Nile cows, table (10).

Table (10): Association between the RI and farm location.

Location	reproductive infection		Total	Chi\ S	Sig	Risk value
	Positive	Negative				
East Nile	4(5.3%)	72(94.7%)	76(100%)	3.8	0.05	1.4
Bahri North	14(10.7%)	117(89.3%)	131(100%)			
Total	18(8.7%)	189(91.3%)	207(100%)			

The RI in cows purchased and introduced to the farm was 12(13.3%) and in cows that born in farm was 6(5.1%), The association between origin of cows and the

RI was significant ($p \leq 0.05$), and the relative risk of purchased cows to be with RI was 1.9 time to that cows born in farm, table (11).

Table NO. (11): Association between RI and origin of sampled cows.

Origin	reproductive infection		Total	Chi\ S	Sig	Risk value
	Positive	Negative				
Born in farm	6(5.1%)	111(94.9%)	117(100%)	4.04	0.04	1.9
Imported from out site farm	12(13.3%)	78(86.7%)	90(100%)			
Total	18(8.7%)	189(91.3%)	207(100%)			

DISCUSSION

The present study revealed the occurrence of the major reproductive problems which were mainly repeat breeding, retained placenta, reproductive infection which includes (pyometra, metritis, vaginitis and anestrus) and abortion. This was in partial agreement to result recorded by, (Dinka, 2013 and Benti and Zewdie, 2014), they reported that the major reproductive problems that have most important influence on reproductive performance of dairy cows include abortion, dystocia, retained of fetal membrane, metritis, prolapse (uterine and vagina), mastitis, anoestrus, bovine brucellosis and repeated breeding.

Repeat breeding was the major infertility problem in this study, which lead to increase the open period (from the first estrus cycle to conception) that lead to increase in calving interval, this finding was similar to results reported by (Parkinson, 2008 and Kumar *et al.*, 2014), they stated that the repeat breeding of bovine has been recognized as one of the most serious reproductive problems, It is the main reason of infertility and lead to prolonged time at first calving age, prolonged inter-calving interval and economic losses due to loss of one calf per year per cow and milk loss.

The prevalence of the abortion in the farms was put in three categories 1% per farm per year, 2- 4% farm per year and $\geq 5\%$ per farm per year; it was found that the range 2- 4% farm per year was the highest one, this results similar to result reported by (Shiferaw *et al.*, 2005, Gizaw *et al.*, 2007 and Oumer, 2003), who reported 5.33%, 2.23% and 3.19% respectively in in different areas in Ethiopia. Also agreement with result obtained by (Reitt *et al.*, 2007) they reported abortion rate of 2 to 4% annually in Switzerland. And also match with (Elfadil, 2012), who reported the occurrence of abortion 2.35% in Nile East in Khartoum state, Sudan. But this result was lower than other results reported by (Hunduma, 2013), who found the prevalence of abortion 14.6 % in and around Asella town in central Ethiopia, and 13.0% reported by (Molalegne and Shiv, 2011) in and around Bedelle in South Ethiopia. In this study the abortion rate due to infectious causes was 22 (29.3%), this result was in line with, (Augustine, 2000), who found the infectious agents have been incriminated in 20-30% of abortion cases submitted to diagnostic laboratories.

The occurrence of the RP in the farm in this study was ranging between 1.8 % to 12.7% per farm per year, this result was in line with findings represented by (Elfadil, 2012, Goff, 2006, LeBlanc, 2008 and Hemayatul, *et al.*, 2012), they detected prevalence rate of retained placenta, 8.2% 7.8%, 8.6% and 7.1% respectively. Retained placenta for long time lead to transport the bacteria from earth, air, feces and from manipulation with contaminated human hand, with the opening of the physical barriers during partum (vagina, cervix and vaginal vestibule) and in the presence of necrotic tissue

and fluid creating an ideal environment for bacteria like *staphylococcus epidermis*, *streptococcus fecalis* and *E. coli*, leading to metritis or pyometra which result in delayed uterine involution, a prolonged interval to first service, a decreased conception rate and a prolonged interval of days open, that means decreased in fertility, this was in line to that reported by (Beagley *et al.*, 2010, and Dubuc *et al.*, 2010), they reported that following RFM, the uterus becomes contaminated with bacteria which have a negative impact on reproductive performance in cattle including delayed uterine involution, a prolonged interval to first service, an increased number of services per conception, a decreased conception rate and a prolonged interval of days open, Furthermore, RFM have been associated with increased risk for endometritis, metritis, these can in turn lead to decreased fertility and potential losses in milk production.

In this result there was significant association with ($p \leq 0.05$) between the RP and the open period (days open from parturition to first estrus) and increased calving interval, this was similar to the result reported by (Han and Kim, 2005), they detected an increased interval from calving to first service and conception in the retained placenta.

The incidence of RI (which includes pyometra, metritis, vaginitis and anestrus) was 8.7 % from all reproductive problems, this finding was lower than result reported by (Moghaddam and Mamoei, 2004, Azawi *et al.*, 2008c and Gilbert, 2005), they recorded an incidence of 29.4%, 17% and 3.4% to 40% respectively of reproductive problems including endometritis and metritis in Iranian local breed buffalo cows.

In the present study there was an association between RI and increase open period, which lead to prolongation of calving interval and hence economic losses, this result was in line with the result reported by (Ahmed and Elsheikh, 2013), they revealed that the dairy cows which diagnosed with and treated for postpartum uterine infection had a prolonged day open lowered rate of service per conception, lowered breeding and increased calving interval.

In conclusion the current study revealed high prevalence rate of reproductive health problems and the repeat breeding was the major infertility problem in this study.

REFERENCES

1. Ahmed, F.O. and Elshiekh, A. S (2013). Uterine bacterial infection during postpartum delays the recrudescence of the reproductive traits in dairy cows. *J Am Sci*, 9(6): 593-598]. (ISSN: 1545-1003). <http://www.jofamericanscience.org>.
2. Augustine, T. P., (2000). Abortions in Dairy Cows: New Insights and Economic Impact Department of Veterinary Clinical Sciences, School of Veterinary Medicine, Purdue University, West Lafayette, IN

- 47907 Email: peterat@vet.purdue.edu Advances in Dairy Technology Volume 12, page 233.
3. Azawi, O.I., A.J. Ali and E.H. Lazim. (2008c). Pathological and anatomical abnormalities affecting buffalo cows reproductive tracts in Mosul. *Iraqi Journal of Veterinary Sciences*, 22: 59-67.
 4. Beagley, J.C, Whitman, K.J, Baptiste, K.E, and Scherzer. J (2010). Physiology and Treatment of Retained Fetal Membranes in Cattle. *J Vet Intern Med*, 24: 261–268.
 5. Benti, A. D. and Zewdie, W. (2014): Major reproductive health problems of indigenous Borena cows in Ethiopia. *Journal of Advanced Veterinary and Animal Research*, 1(4): 182-188.
 6. Dinka, H. (2013). Major reproductive disorders of dairy cows in and around A sella town, Central Ethiopia. *Journal of Veterinary Medicine and Animal Health*, 5(4): 113-117.
 7. Dubuc, J., Duffield, T.F., Leslie, K.E., Walton, J.S., LeBlanc, S.J., (2010). Risk factors for postpartum uterine diseases in dairy cows. *J. Dairy Sci.*, 93: 5764-5771.
 8. Elfadil, M.H.M, (2012). Some infertility problems and their economical impacts in dairy farm in Eastern Nile Locality, A Thesis for Master degree, Sudan University of Science and Technology.
 9. FAWC (2009). Opinion on the welfare of the dairy cow. London, UK.
 10. Gilbert, R.O., Shin, S.T., Guard, C.L., Erb, H.N., Frajblat M., (2005). Prevalence of endometritis and its effects on reproductive performance of dairy cows, *Theriogenology*, 64: 1879-1888.
 11. Gizaw, M., Bekana, M. and Abayneh, T., (2007). Major reproductive health problems in smallholder dairy production in and around Nazareth town, Central Ethiopia. *J. of Vet. Med. and Animal Health*, 5(4): 112-115.
 12. Goff, J.P. (2006). Major advances in our understanding of nutritional influences on bovine health. *J Dairy Sci*, 89: 1292-1301.
 13. Goshen, T. and Shpigel, N.Y., (2006). Evaluation of intrauterine antibiotic treatment of clinical metritis and retained fetal membranes in dairy cows. *Theriogenology*, 66: 2210 -2218.
 14. Han, I.K. and Kim, I.H. (2005). Risk factors for retained placenta and the effect of retained placenta on the occurrence of postpartum diseases and subsequent reproductive performance in dairy cows. *J Vet Sci.*, 2005; 6: 53-59.
 15. Hemayatul. Md. Islam,; Kader, M.A.; Sarder, M.J.U.; Islam, M.A. and Jahan, M.Henk, L.; Smitt, I. and Sally, J. (2012). Contributions of biotechnology to the control and prevention of brucellosis in Africa. *African Journal of Biotechnology*, 3(12): 631-636.
 16. Hunduma, D., (2013). The major reproductive disorders of dairy cows in and around Asella town, Central Ethiopia. *J. of Vet. Med. and Animal Health*, 5(4): 113-117.
 17. Kumar, M., Pant, S.S., Ram, R., Kumar, S. and Gupta, P.K. (2014). Therapeutic efficacy of levofloxacin along with vitamin E for the management of repeat breeding syndrome in cow under field condition. *International Journal of Veterinary Science*, 3(3): 155-157.
 18. LeBlanc, S.J., (2008). Postpartum uterine disease and dairy herd reproductive performance: a review. *Vet J.*, 176: 102-114.
 19. Lobago, F., Bekana, M., Gustafsson, H. and Kindahl, H. (2006). Reproductive performances of dairy cows in smallholder production system in Selalle, Central Ethiopia. *Tropical Animal Health and Production*, 38: 333-342.
 20. McDougall, S., (2001). Effects of periparturient diseases and conditions on the reproductive performance of New Zealand dairy cows. *NZ Vet J.*, 49: 60–68. 167.
 21. Moghaddam, A.A.I. and M. Mamoei, (2004). A survey on some of the reproductive and productive traits of the buffalo in Iran, p. 1910. *In 23rd World Buiatrics Congress*. Qu and Eacute, Canada.
 22. Molalegne, B. and P. Shiv, (2011). Study on major reproductive health problems in indigenous and cross breed cows in and Around Bedelle, South West Ethiopia. *J. Anim. Vet. Adv.*, 10(6): 723-727.
 23. Oumer, I., (2003). Study on major health problems of smallholder dairy farms in and around Kombolcha. DVM thesis. Faculty of Veterinary Medicine, Addis.
 24. Parkinson, T.J. (2008). Infertility, Veterinary Reproduction and Obstetrics. 8th Edition., Saunders Company, USA., 463-464.
 25. Rafati, N., Mehrabani-Yeganeh, Hansonb, T.E. (2010). Risk factors for abortion in dairy cows from commercial Holstein dairy herds in the Tehran region. *Preventive Veterinary Medicine*, 96: 170-178.
 26. Reitt, K., Hilbe M., Voegtlin A., Corboz, L., Haessig, M., Pospischill, A., (2007). Etiology of Bovine Abortion in Switzerland from 1986 to 1995 – A Retrospective Study with Emphasis on Detection of Neospora caninum and Toxoplasma gondii by PCR *J. Vet. Med. A*(54): 15–22.
 27. Shiferaw, Y., Tenhagen, B.A., Bekana, M. and Kassa, T.(2005). Reproductive disorders of crossbred dairy cows in the central highlands of Ethiopia and their effect on reproductive performance. *Tropical Animal Health and Production*, 37: 427-441.