Full Length Research Paper

Major causes and risk factors associated with calf mortality in dairy farms in Khartoum State, Sudan

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This study was conducted in dairy farms in Khartoum state in order to determine the major causes and risk factors associated with calves' mortality. The main results revealed that out of 2,310 animals a highest mortality rate was in Hilat kuku 2.16% (n = 50), followed by Alrudwan and Alseleit 1.73% (n = 24) and 1.04% (n = 40), respectively. Application of analytical statistic using one way analysis of variance (ANOVA) showed a significant difference between the mean of the three sites. The most dominant clinical signs in calves was pneumonia, with prevalence rate of 1.08% (n = 25), 1.08% (n = 25) and 0.079% (n = 18) in Alseleit, Hilat kuku and Alrudwan, respectively. In contrast, diarrhea was not observed in two sites. The difference was statistically significant (X^2 = 95.265, P-value = 0.00). Most of the respondents (owner) of the questionnaire survey had a primary level regarding education; Hilat kuku 29.3% (n = 22) and Alseleit 26.7% (n = 20). Further more, most of them had experience of more than 3 years in dairy farms; Hilat kuku 33.3% (n = 25) and 29.3% (n = 22) for the rest of the sites. Education level and experience were found to be statistically significant (X^2 = 8.067 and 3.261, P-value = 0.089 and 0.089, respectively). Some risk factors associated with calves' mortality rate with regard to management were observed in dairy farms in Khartoum state. For instance, a high significant level (X^2 = 17.910, P-value = 0.00) was obtained for feeding of the calves which mainly depended on milk; 33.3% (n = 25) for Alseleit and Hilat kuku and 22.7% (n = 17) for Alrudwan. Moreover, dealing with dead calves was also found to be highly significant (X^2 = 11.949, P-value = 0.003) and most of the respondents did nothing regarding this point; Alseleit 25.3% (n = 19) and Hilat kuku 14.7% (n = 11). In contrast, there no significant level (P > 0.05) was recorded for hygiene, quarantine and presence of veterinary services.

Key words: Risk factors, calves mortality, dairy farms, Sudan.

INTRODUCTION

Calf diseases that cause morbidity and mortality are the results of complex interaction of the management practices

and environment, infectious agents and the calf itself (Wudu et al., 2008). Different managemental and environmental factors were reported to affect significantly, calf morbidity and mortality, these include: colostral feeding, housing, calving assistance, production system, herd size, season and hygiene of micro-environment (Shiferaw et al., 2002). The mode of passive transfer in neonates varies with the type of placentation and in the case of neonatal calves; it is based on an immediate postpartum ingestion of antibody rich colostrum (Tizard, 1995). The age of the calf is the most important factor affecting morbidity and mortality, approximately 75% of the mortality in dairy animals under one year of age occurs in the first month of their life (Heinrichs and Radostits, 2001).

Common causes of calf diseases and deaths were diarrhoea, pneumonia, joint problems, umbilical diseases, trauma, congenital abnormalities, nutritional deficiencies, dystocia and other infections (Svensson et al., 2003; Singla et al., 2013). Calf losses were significantly reduced by introducing new techniques of management including on-time colostrum feeding, housing, feeding and nutrition (Razzaque et al., 2009). In the present study, the situation of calf mortality in dairy farms at Khartoum State was investigated, with the objectives of describing the prevalence and cause of calf mortality, along with identifying the management risk factors associated with calf mortality.

MATERIALS AND METHODS

Study area

This study was carried out during May to December, 2012 in Khartoum State dairy farms from Alrudwan, Alseleit and Hilat Kuku camps.

Alrudwan dairy camp

Alrudwan dairy camp, located in Western Omdurman, was established in 1993. The camp total area is 75 Fadden, with estimated total dairy units (Heyazat) of 430 Heyaza, including over 12,000 heads of dairy cows (average 27 cow/heyaza raised in an area of 700 to 1000 sq m). The housing system adopted at Alrudwan camp is variable, most of the dairy units (Heyazat) have shades above ground level of about 3 to 3.5 m, roofed by bamboo, with an extended yard in front of the shade. Each heyaza is provided by a feed manger either built of concrete or portable manger made of steel. Clean water is available all day in water troughs. Fifty percent of Alrudwan dairy farms house the young calves of different ages together, while only 5% keep calves separately (young suckling, weaned calves and heifers). Natural mating is the only way to access reproductive activity in Alrudwan farms. Vaccination against hemorrhagic septicemia (HS), black quarter (BQ), contagious bovine pleuropneumonia (CBPP) and anthrax is carried on annually by the governmental veterinary services. The area of study is characterized by high temperature (40 to 45°C) in summer during May to August and lacks shades and

trees.

Alseleit dairy camp

The project was established in 2001. The majority of Alseleit dairy farms keep the young calves of different ages together in the same house. The camp is surrounded by trees, with a tree-planting, in the areas of internal roads, among the barns and veterinary service sites.

Hilat Kuku dairy camp

The Kuku project was started in 1960, which was considered to be the largest milk producing and marketing area in Khartoum State and also regarded as a semi-intensive system (small holders) of milk production. The farms previously belonged to Hillat Kuku dairy project, which consist of 3 barns distributed in vast space; each barn composed of small units containing a few number of cows to large, which may reach hundreds.

Questionnaire survey

Questionnaire survey and field observations were used in order to obtain information on major causes and risk factors associated with calf mortality in dairy farms in Khartoum state. Collected information was related to education and experience of the owner, herd structure and size, management and husbandry and veterinary services and bio-security in dairy farms.

Target population and respondents

The target population under investigation was calves with different age group and sex, while the target respondents were the owners of the dairy farms in different sites of Khartoum state.

Production system and sample size

The study was conducted either in intensive production system with large herd size or in semi-intensive production system. It was difficult to use epidemiological formula for calculation of sample size because there was no previous study in respect of calves' mortality. A total of 2,310 calves from 75 dairy farms in different sites of Khartoum state were investigated.

Sampling methods

It is difficult to give all dairy farms under production system in Khartoum state the same chance for being selected. Hence, selection was done according to willingness and support of the owners as described by Thrusfield (2007).

Data management and analysis

Data related to the major causes and risk factors regarding calves mortality were analyzed using International business machine Statistical package for social sciences (IBM SPSS) version 20. Descriptive statistic such as count and percentage was used for

Table 1. Description of the target population in dairy farms in Khartoum state.

Unit	Frequency (%)			X^2	df	P-value
	Alseleit	Kuku	Alrudwan			
Presence of other livestock						
Yes	11 (14.7)	7 (9.3)	6 (8.0)	81.711	6	0.000*
No	14 (18.7)	18 (24.0)	19 (25.3)			
Herd size						
Small (10-70)	13 (17.3)	0 (0.0)	0 (0.0)			
Medium(70-120)	9 (12.0)	1 (1.3)	4 (5.3)	130.745	9	0.000*
Large(>120)	3 (4.0)	24 (32.0)	21 (28.0)			
Bull exist						
Yes	3 (4.0)	0 (0.0)	0 (0.0)	94.149	15	0.000*
No	22 (29.3)	25 (33.3)	21 (28.0)			
Breed						
Local	2 (2.7)	0 (0.0)	5 (6.7)	5.987	2	0.05
Exotic	23 (30.7)	25 (33.3)	20 (26.7)			
Sex						
Male	15 (20.0)	12 (16.0)	15 (20.0)	80.026	6	0.000*
Female	10 (13.3)	13 (17.3)	10 (13.3)			

* = Highly significant (P > 0.001)

different variables and presented as tables and figures, while analytical statistical using one way ANOVA was used for comparison of means of calves' mortality rate between three sites. Chi- square was also used for getting significant level between variable for the same purpose. However, it was difficult to estimate or quantify the risk because the odds ratio can be calculated only for 2 × 2 tables.

RESULTS

This study was conducted in dairy farms in Khartoum state in order to determine the major causes and risk factors associated with calves' mortality. The main results out of 2,310 calves investigated revealed that a high mortality rate in Hilat kuku 2.16% (n=50) was recorded, followed by Alrudwan and Alseleit 1.73% (n=24) and 1.04% (n = 40), respectively. Application of analytical statistic using one way ANOVA showed a significant difference between the mean of the three sites (F=29.214, P-value= 0.000). The results are presented in Figure 1.

Sex was found to be statistically significant (X^2 = 27.245, P-value = 0.00) with regard to mortality rate. The rest of the results are shown in Figure 2. The most dominant clinical signs in calves was pneumonia, with a prevalence rate of 1.08% (n = 25), 1.08% (n = 25) and 0.079% (n = 18) in Alseleit, Hilat kuku and Alrudwan, respectively. In contrast, diarrhea was not observed in two sites. The difference was statistically significant (X^2 = 95.265, P-value = 0.00) (Figure 3). Description of the target population is summarized in Table 1. For instance, the exotic breed is dominant in three sites, giving a percentage of 33.3% (n = 25), 30.7% (n = 23) and 26.7% (n = 20) in Hilat kuku, Alseleit and Alrudwan, respectively. The large herd size (>120) was found in Hilat kuku and Alrudwan 32.0% (n = 24) and 28.0% (n = 21), respectively. Moreover, the existence of bulls was only found in Alseleit 4.0% (n = 3).

Herd size and existence of bulls were statistically significant (X^2 = 130.745, 94.149, P-value = 0.00). Most of the respondents (owner) of the questionnaire survey had a primary level regarding education: Hilat kuku 29.3% (n = 22) and Alseleit 26.7% (n = 20). Furthermore, most of them had experience of more than 3 years in dairy farms: Hilat kuku 33.3% (n = 25) and 29.3% (n = 22) for the rest of the sites. Education level and experience were found to be statistically significant (X^2 = 8.067 and 3.261, P-value = 0.089 and 0.089, respectively). Both education level and experience are presented in Figures 4 and 5, respectively.

Table 2. Questionnaire survey respondents by the owners of the dairy farms in Khartoum state with regard to the effect of management on calves' mortality.

Unit	Frequency (%)			X^2	df	P-value
	Alseleit	Kuku	Alrudwan			
Quarantine new cows						
Yes	2 (2.7)	0 (0.0)	1 (1.3)	2.083	2	0.353
No	23 (30.7)	25 (33.3)	24 (32.0)			
Mineral salt blocks						
Yes	11 (14.7)	11 (14.7)	12 (16.0)	0.108	2	0.948
No	14 (18.7)	14 (18.7)	13 (17.3)			
Disinfection of umbilical cord						
Yes	11 (14.7)	11 (14.7)	12 (16.0)	0.108	2	0.948
No	14 (18.7)	14 (18.7)	13 (17.3)			
Mark new calves						
Yes	15 (20.0)	12 (16.0)	15 (20.0)	0.974	2	0.614
No	10 (13.3)	13 (17.3)	10 (13.3)			
Calves feeding						
Milk	25 (33.3)	25 (33.3)	17 (22.7)	17.910	2	0.000*
Milk replacer	0 (25.0)	0 (25.0)	10.7 (25.0)			
Weaning age						
Before 6 months	0 (0.0)	0 (0.0)	0 (0.0)	0.125	2	0.939
After 6 months	25 (33.3)	25 (33.3)	25 (33.3)			
Hygiene						
Yes	2 (2.7)	1 (1.3)	4 (5.3)	2.206	2	0.332
No	23 (30.7)	24 (32.0)	21 (28.0)			
Vet. Sup. In the farm						
Yes	13 (17.3)	7 (9.3)	9 (12.0)	3.148	2	0.207
No	12 (16.0)	18 (24.0)	16 (21.3)			
After calf dead						
Do nothing	19 (25.3)	11 (14.7)	7 (9.3)	11.949	2	0.003*
Burry	6 (8.0)	14 (18.7)	18 (24.0)			
Burn	0 (0.0)	0 (0.0)	0 (0.0)			

* = Highly significant (P>0.001).

Some risk factors associated with calves' mortality rate with regard to management were observed in dairy farms in Khartoum state. For instance, a high significant level (X^2= 17.910, P-value = 0.00) was obtained for feeding of the calves which mainly depended on milk: 33.3% (n = 25) for Alseleit and Hilat kuku and 22.7% (n = 17) for Alrudwan. Moreover, dealing with dead calves was also found to be highly significant (X^2 = 11.949, P-value = 0.003) and most of the respondents did nothing regarding this point: Alseleit 25.3% (n = 19) and Hilat kuku 14.7% (n = 11). In contrast, there was no significant level (P > 0.05) recorded for hygiene, quarantine and presence of veterinary services. All results regarding management in dairy farms are summarized in Table 2.
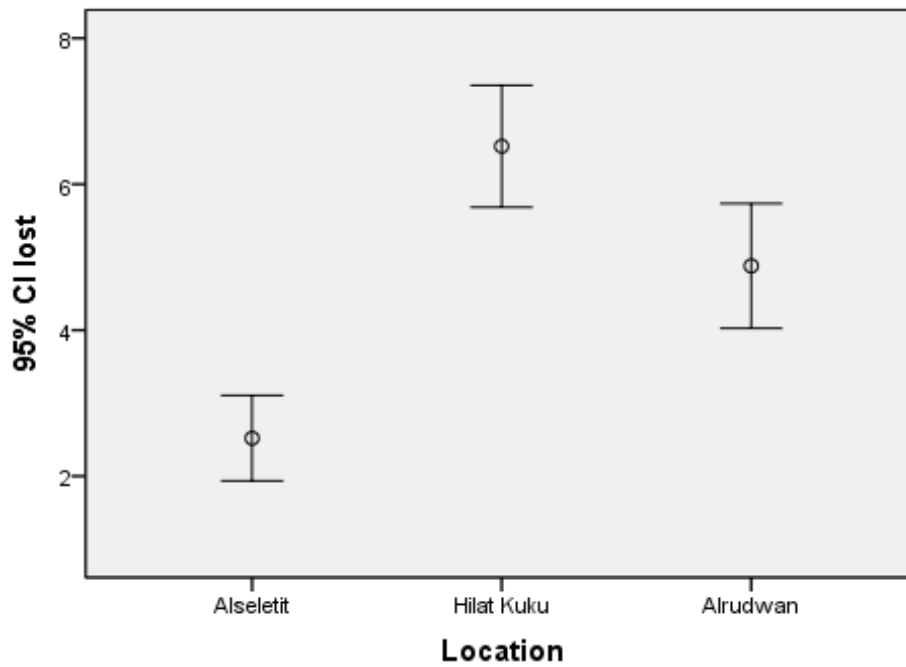
Figure 1. Comparison of means calf mortality rate in dairy farms of Khartoum state (F = 29.214, P- value = 0.000).
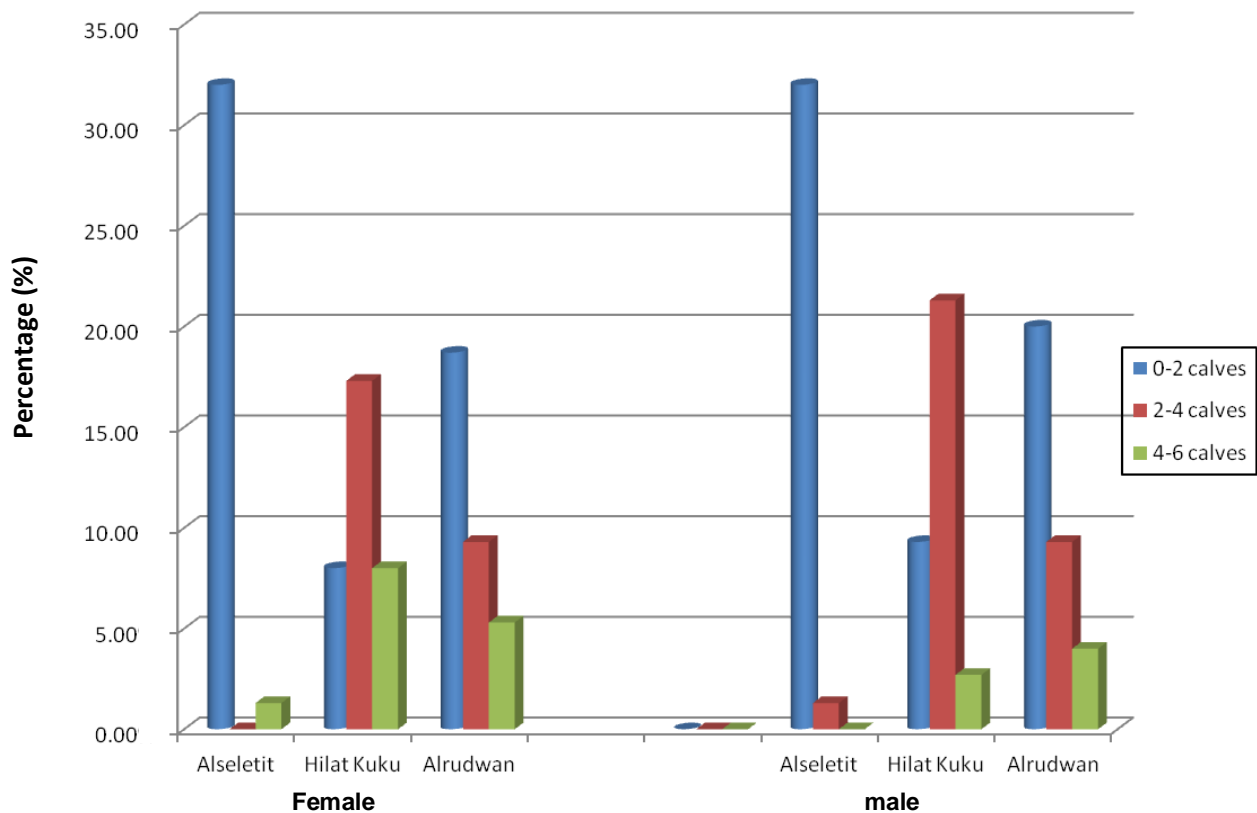

Figure 2. Calf mortality rate by sex in dairy farms in Khartoum state (X^2 =27.245, df = 4, P-value = 0.000).
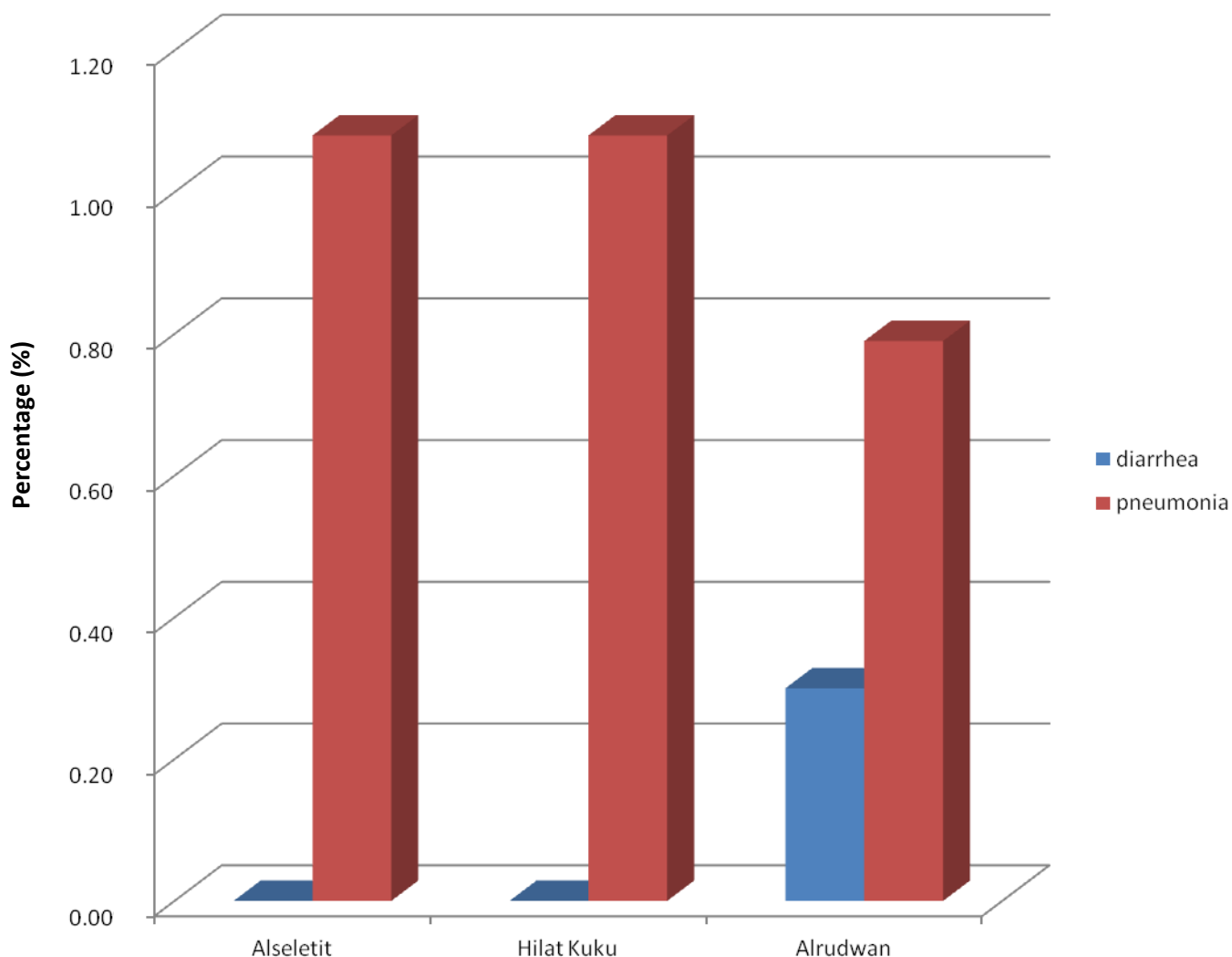
Figure 3. The most dominant clinical signs that associated with calves mortality in dairy farms in Khartoum state (X^2 = 95.265, df = 6, P-value = 0.000).

DISCUSSION

Education level and experience were found to be statistically significant. Similarly, low calf mortality was seen in herds owned by older and more experienced managers which were in accordance with Heinrichs and Radostits (2001). Sex was found to be statistically significant, which agreed with Debnath et al. (1995) who found lower mortality rate for females compared to males. The most dominant clinical signs in calves were pneumonia and diarrhea. These findings are in agreement with many studies which reported diarrhea and pneumonia as the first and second important diseases complexes affecting calf health (Olsson et al., 1993; Debanth et al., 1995; Bhat et al., 2012). Herd size

was one of the risk factors significantly affecting the rate of mortality. This finding agreed with Nielsen et al. (2008) who found that mortality risk increased with herd size in Danish herds. The breed of calf showed no significant varriations in calf mortality rate. This could be because the majority of the farms studied included exotic breed (cross breed). In addition, the tropical environment for which temperate breeds are not well adapted might have been an additional stress to increase the risks of health problems.

The majority of farms investigated (69.3%) had no record, which supported El Zubeir and Mahala (2011) who reported that lack of records was among management factors that need correction. Mohamed (2011) found that only 36.33% of farms had poorly designed
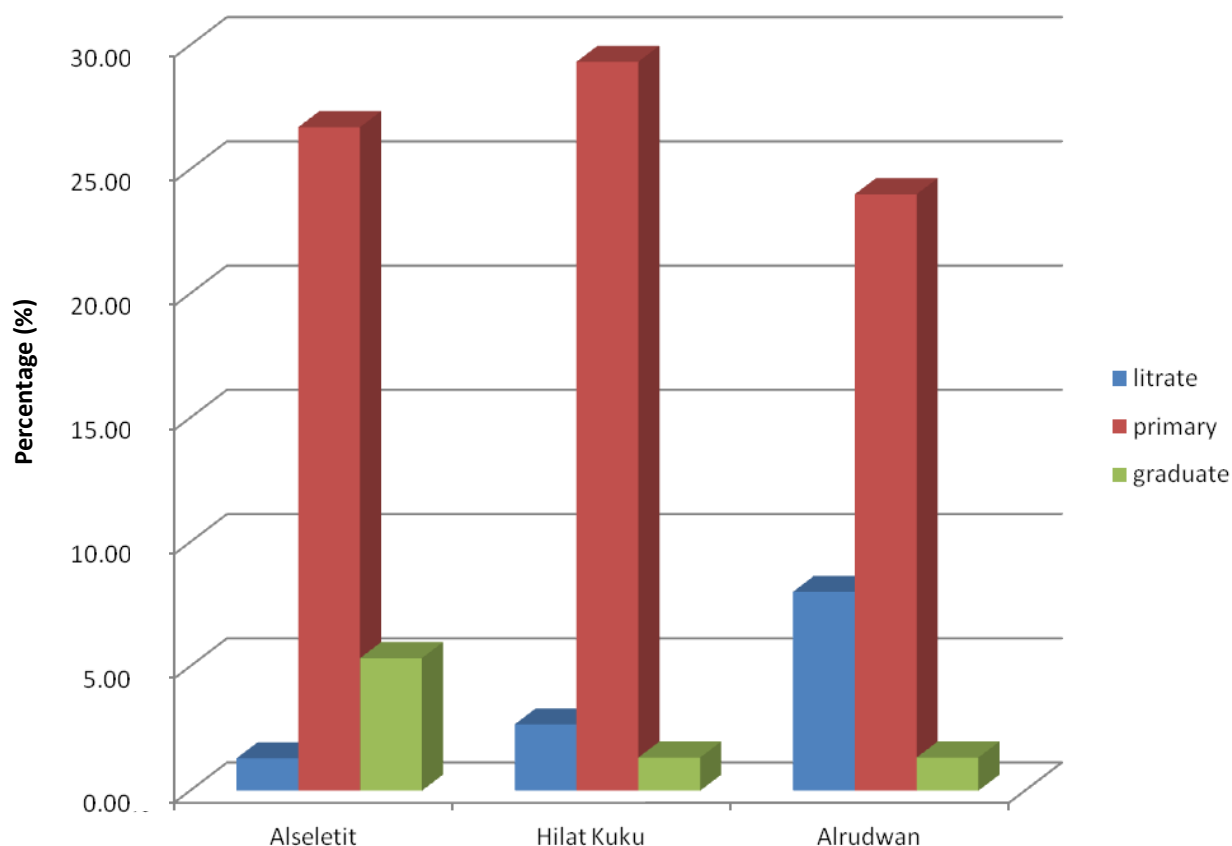
Figure 4. Education level of the respondents of the questionnaire in dairy farms in Khartoum state (X^2= 8.067, df = 4, P-value = 0.089)**.**

records.Bayemi et al. (2005) reported that one area needing much attention in dairy farms is record keeping and farmers need intensive training and follow up. Yousif and Fadl El Mula (2006) reported that farmers do not pay much attention to the importance of keeping records, thus the recording system is poor. The veterinary services did not contribute significantly to calf mortality rate. According to Karib (1962), dairy farms must be under supervision of veterinarians; however in this study 29% of the farms were under veterinary supervision, which agreed with El-Nazeir (2005) and El Zubeir and Mahala (2011) reported that most of the workers give the treatment without consultation of the veterinarians.

Most of the farms under investigation did not quarantine the newly introduced cows and 75% of the farms did not apply correct disposal of dead calves which might be risky for dairy farms and public health. The higher risk of mortality associated with dirtiness of calf house seen in this study agreed with Shiferaw et al. (2002) who reported the effect of hygiene of the micro-environment of calves in the occurrence of calf mortality. However, 61.4% of farms were found unclean. This

agreed with El Zubeir and Ahmed (2007) who reported that the health services, preventive measures and disease control were not satisfactory. El Zubeir (2007) reported that general hygiene and sanitation measures such as dung removal, disinfection, cleaning program and maintaining minimal contamination during milking process could not be observed in the majority of dairy farms in Khartoum State.

The survey done in this study showed that calf mortality was high and a lot of malpractices in the investigated dairy farms in the three camps in Khartoum State influenced calf mortality. They include low level of veterinary supervision, lack of attention to the cleanliness of the calves houses and ignorance to provide farm with salt blocks as source of minerals and trace elements.

RECOMMENDATIONS

1. Efforts should be made to increase calving supervision, improve management of newborn calves, and prevent respiratory diseases and diarrhea.
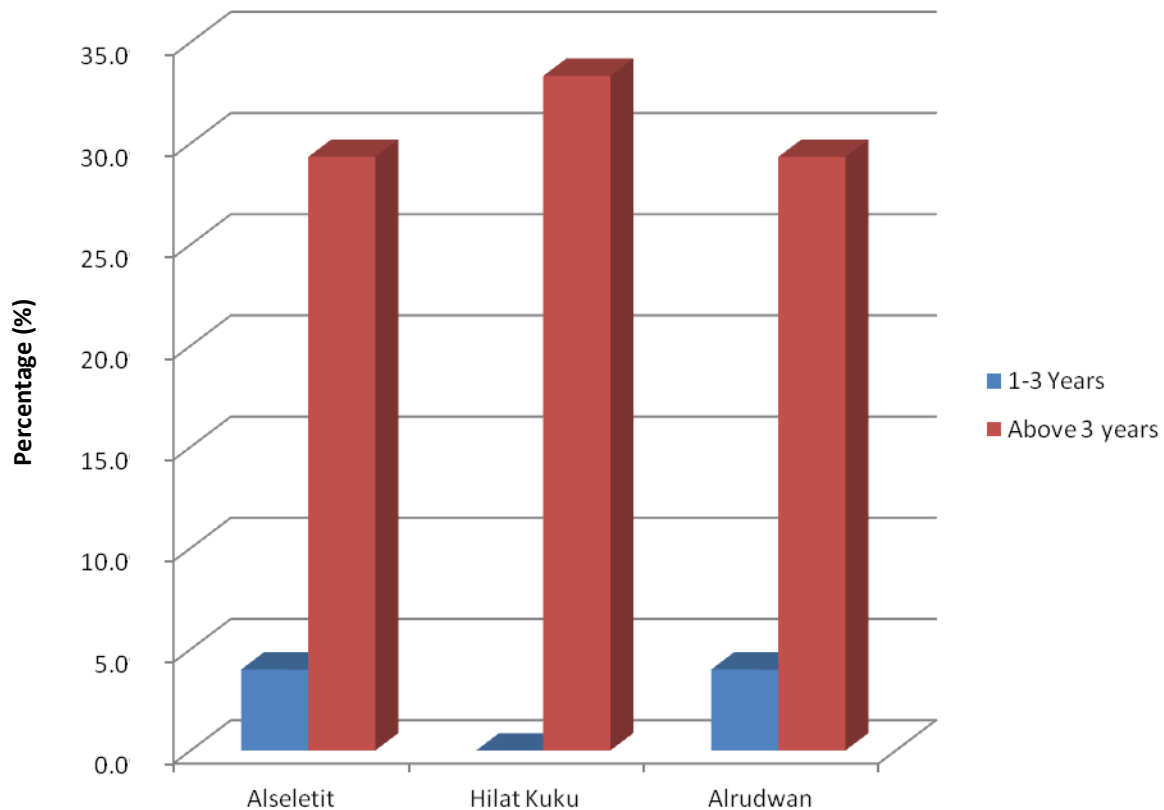
Figure 5. Experience of the respondents of the questionnaire survey in dairy farms in Khartoum state (F = 3.261, df = 2, P-value = 0.089).

2. Implementation of calves' vaccination programs is required to protect calf diarrhea caused by viruses.
3. Activating health laws aimed at reducing the spread of diseases through proper disposal of dead calves and employing of veterinarians at dairy farms.
4. Extension services among dairy farms owners and labors are urgently needed on proper dairy farm practices such as record keeping, sanitary practices and cleaning programs.
5. Research must focus on the causative agents of calf diarrhea and calf pneumonia in order to control and prevent losses due to these diseases.

Conflict of Interests

The author(s) have not declared any conflict of interests.

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