Mortality Of Pre-Weaned Calves In Kuwait's Dairy Herds, Its Causes And Impact Of Interventions

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Citation

M Razzaque, S Abbas, M Bedair. *Mortality Of Pre-Weaned Calves In Kuwait's Dairy Herds, Its Causes And Impact Of Interventions*. The Internet Journal of Veterinary Medicine. 2008 Volume 5 Number 2.

Abstract

The objectives were to investigate the causes of high calf mortality and the impacts of intervention measures on calf performance. In the first calving season 1,280 calves were used for the survey work. Risk rate (RR) for morbidity and mortality were 0.59±0.35 and 0.38±0.28 respectively without intervention. Main calf-hood diseases were diarrhea and pneumonia. Diarrhea was caused by E. coli, Rotavirus, Salmonella and Cryptosporidia spp. and that of pneumonia by Pasteurella and Streptococcus spp. Six serotypes and 3 strains of Salmonella spp. were isolated.
RR for mortality was reduced to 0.17±0.12 due to intervention measures in second calving season in 665 calves. Mortality and morbidity rates were significantly influenced by the level of serum proteins. There were Linear correlations between level of housing/management scores and morbidity (r2=0.69 P≤ 0.03) and mortality rates (r2 = 0.78≤ 0.81). A significant improvement of calf performance was achieved due to intervention in Kuwait's commercial in farms.

Source of supports : Kuwait Foundation for Advancement of Sciences and Kuwait's Dairy Companies

INTRODUCTION

It was observed that some dairy farms in Kuwait had lost 90% of their total pre-weaned calves (PAAFR, 1998, unpublished). In the dairy operations of the USA, the mortality rate in pre-weaned calves ranged from 8 to 11% with a mean morbidity rate of 37% (USDA, 2006). In African and Asian countries, where farm management is inadequate, the calf mortality rates ranged from 20 to 46% (Kudi et al, 1998; Khan and Khan, 1991). Due to the high mortality and morbidity rates of calves in Kuwait, dairy producers are compelled to import pregnant heifers from abroad. They are unable to adapt themselves to an extremely high during summer (45-500C) environmental temperature in Kuwait.

Hafez and Hafez (1998) observed that 75% of the total losses in calves occurred in Saudi Arabia during the first month of life. Faith et al., (1996) and Crouch et al., (2001) observed septicemia and enteric disorders in calves caused by Escherichia coli, Coronavirus, Cryptosporidium and Salmonella spp. were the main causes of high morbidity and mortality rates. Past studies on calf hood diseases in Kuwait are scanty. Objectives of the study were to assess the magnitude of calf mortality, investigate its causes and impacts interventions on calf morbidity and mortality rates.

MATERIALS AND METHODS

SURVEY OF FARMS : WITHOUT INTERVENTION

During the first calving season, 13 out of total 29 commercial farms were randomly selected and surveyed. These farms represented 56% of the total 11,760 cattle population. Total of 1,280 Holstein Friesian newborn calves were identified at birth, weighed and had their health performances monitored until they were weaned at 90 days old.

CAUSES OF CALF MORTALITY

Clinical histories, symptoms, duration of sickness and treatments provided were monitored. Fecal samples and nasal swabs from sick and dead calves were used for disease diagnosis and identification of casual pathogens. Nasal swabs and blood samples were screened for Pasteurella spp. (OIE, 1996). Serum proteins were determined using Refractometer (Refractometer SPR-NE, scale: 0-12 g/100mL, Atago Co. Ltd.) and IgG by the radial immuno-diffusion method (Hopkins and Quigley, 1997)

INTERVENTION MEASURES

Intervention measures were applied to 6 farms during the second calving season using 665 new born calves. They were provided with hygienic environment and fed colostrum.

Baseline data of survey work of first calving season and the results obtained from intervention measures of second calving season were compared.

HOUSING AND MANAGEMENT

Seventeen parameters for calf housing and management practices during the second calving season were used to judge the quality of calf rearing (Razzaque, 2005). These included observing the presence of physical facilities and use of improved management practices. Calves were provided with fresh or frozen colostrum within 8 h after delivery. Sick and weak calves were isolated and treated with electrolytes. Mortality, morbidity, disease incidence, risk and case fatality rates were calculated using the formula of Putt et al., (1987).

DATA RECORDING AND ANALYSIS

A record of each calf for both first and second calving season was kept in an epidemiology database, Panacea (Pan Livestock Services Ltd., University of Reading, UK, 1987), with information on calf birth date, health and birth and weaning weights. The data were analyzed for differences in mortality and morbidity rates, serum protein levels and growth rates using one way analysis of variance. Mortality, morbidity and growth rates data were used to evaluate effectiveness of the interventions by regression analysis (Pan Livestock Services Ltd., University of Reading, UK, 1987).

RESULTS

The results of calf mortality rates and the causes of calf-hood diseases of two scenarios i.e. without and with interventions were compared.

WITHOUT INTERVENTION

Individual farm data and the risk rate for morbidity mortality of calves of first caving season are shown in Table 1. Risk rates (RR, cumulative incidence) in first calving season were 0.65 and 0.37 for morbidity and mortality respectively. The variations in the RR for morbidity of individual farms ranged from 0.06 to 1.00. The risk of morbidity and mortality in calves was highest during the first two weeks. The calf-hood diseases and their causes are presented in Tables 2 and 3 respectively. Most common disease was diarrhea, affecting 52.97% of total affected calves. The proportional morbidity and mortality rates of calves were 90.52% in calves affected once or twice by diseases and 87.77% respectively, with a case fatality rate of 48.67%.

Pre-natal calf loss due to abortion births, and stillbirths was 3.69% (49/1329 – at risk 1280 + 49). E. coli and Salmonella spp. mixed infections of both were frequently isolated bacteria (Table 3). Rotavirus was recovered in fecal samples of calves suffered from diarrhea in all farms. For diarrhea cases, 76.19% (16/21) of the E. coli isolates occurred in calves between birth and 10 days of age while Salmonella isolates (100%) occurred over a wider range of ages between birth and 26 days of age. Fecal samples showed no evidence of parasites and mean growth rate for all calves was 460 g ± 11.3 SE g/day during survey work.

Figure 1

Table 1: Morbidity and mortality risk rates (RR) of calves during first calving season

Farm ID	Calves	Withdrawn	Deaths	Sick	RR (0-1 Scale)	
	→	Nos.	→	→		
	(1,280)	(253)	(376)	(749)	Morbidity	Mortality
1	386	200	96	293	1.00	0.34
2	215	0	52	140	0.65	0.24
4	25	1	5	10	0.40	0.20
5	106	13	7	9	0.09	0.07
6	133	27	5	7	0.06	0.04
7	29	4	8	9	0.33	0.30
8	65	8	10	13	0.20	0.15
9	77	0	54	62	0.81	0.70
10	35	0	11	31	0.89	0.31
11	57	0	29	36	0.63	0.51
12	27	0	27	27	1.00	1.00
13	125	0	72	112	0.90	0.58
Mean ± SD	-	-	-	-	0.58 ± 0.35	0.37 ± 0.28
( ) Numbers in brackets represent total calves in all farms.						

Figure 2

Table 2: Diseases, risk and proportional morbidity, mortality and case fatality rates in all 13 dairy farms during first calving season

Diseases	Cases (1280)	Death (376)	Total	Proportional Rate for Morbidity	Proportional Rate for Mortality	Case Fatality Rate	RR (0 to 1 scale) Mortality	Morbidity
Unspecified	540	9	1	N/A	N/A	N/A	N/A	N/A
Foot and Mouth	4	4	100	0.53	1.06	100	0.004	0.003
Diarrhoea	678	330	48	90.52	87.77	48.67	0.286	0.588
Entero/ pneumonia	12	8	66	1.6	2.13	66.67	0.007	0.01
Injury	1	1	100	0.13	0.27	100	0.001	0.001
Navel/joint ill	8	1	12	1.07	0.27	12.5	0.001	0.007
Pneumonia	24	12	50	3.2	3.19	50	0.01	0.021
Septicaemia	13	11	84	1.74	3.19	85.71	0.01	0.011
Mean ± SD	–	–	57.62 ± 37.41	14.11 ± 33.71	13.98 ± 32.56	66.22 ± 31.93	0.05 ± 0.12	0.09 ± 0.22
( ) Numbers in brackets represent total calves in all farms								

Figure 3

Table 3: Rotavirus and Bacteria isolations during first calving season

Farm ID	Samples examined	Positive Cases (Nos.)					
		Rotavirus	%	*E.coli / Klebsiella*	%	*Salmonella*	%
	(172)	(20)		(63)		(30)	
1	5	2	40.00	2	40.00	2	40.00
2	17	1	5.88	4	23.52	3	17.64
4	16	2	12.50	6	37.50	1	6.25
5	16	3	18.75	2	12.50	1	6.25
6	23	2	8.69	10	43.47	1	4.34
7	3	_	_	2	66.66	1	33.33
8	5	2	40.00	1	20.00	1	20.00
9	28	3	10.71	14	50.00	5	17.85
10	3	1	33.33	1	33.33	1	33.33
11	20	_	_	9	45.00	2	10.00
12	6	1	16.66	4	66.66	2	33.33
13	30	3	10.00	8	26.66	10	33.33
() Total number of cases in all farms							

WITH INTERVENTIONS

During the second calving season, all six commercial farms agreed to adopt an improved calf management practices. Table 4 shows that mortality RR of the six farms on the intervention program in second calving season were lower (0.17) than that (0.37) was observed in the same farms in first calving season. Case fatality rate with intervention program was lower at 0.12 compared with 0.58 without interventions (Table 1). The standard of calf housing management was a significant cause for the differences between farm morbidity and mortality (P<0.05), with 69% of the variation in morbidity (r2=0.692) and 79% of the mortality (r2 = 0.788) due to calf housing management score.

Figure 4

Table 4: Calf numbers, mortality and morbidity risk rates during second calving season

Farm	Calves	Withdrawn	Deaths	Disease events	RR 0-1 Scale		Case fatality rate
					Morality	Morbidity	
	(665)	(9)	(138)	(1005)			
2	151	0	27	245	0.17	0.99	0.11
4	67	0	2	110	0.02	0.92	0.02
6	75	9	3	58	0.04	0.56	0.05
9	143	0	47	221	0.32	0.92	0.21
11	94	0	20	157	0.21	0.98	0.13
13	135	0	39	214	0.28	0.92	0.18
Mean ± SD		_	_	_	0.17 ± 0.12	0.88 ± 0.16	0.12 ± 0.07
() Total number of calves in six farms							

During the second calving season, a practice of quick diagnosis of diseases and identification of pathogens was introduced for taking intervention measures on time. Table 5 shows that the most prevalent pathogen in diarrhea cases was E coli, followed by Salmonella, rotavirus and Cryptosporidium as well as mixed infection of all species of above pathogens. In pneumonia cases, Pasteurella spp and Streptococcus spp were isolated in 70% of the sick calves.

There was a significant difference (P<0.05) between serum protein ((no table presented) of calves that died 4.72 g/dL (SE 0.106) and the calves that survived 5.00 g/dL (SE 0.050). A significant difference was observed (P<0.05) between calves that contracted septicemia /diarrhea 4.92 g/dL (SE 0.046) and those that did not (5.22 g/dL SE 0.143). The correlations between serum protein and mortality (r2 = 0.555, P = 0.08) RR and case fatality rate (r2 =0.562, P = 0.086) were significant. Fifty percent of the calves had acceptable levels, 25% partial failure of passive transfer and 25% failure of passive transfer of IgG in serum despite forced feeding of colostrum.Salmonella trains were types B 10%, C 23% and E 67% of the 30 Salmonella spp isolated.

Growth rates: Growth rates were generally lower in most farms, apart from farm 11, than the target of 700 g/day and it ranged from 400 to 855 g/day (table not presented). The effect of pneumonia, which occurred on all farms from late January to February in second calving season, appeared to be a contributing factor to the significant difference (P?0.1) between weight gain means of calves that contracted pneumonia (gain 498 g/day) and those that did not (gain 532 g/day). The calves treated for scours and respiratory diseases responded positively and the post-recovery growth was good. There was no relationship between daily weight gain and calf serum protein (r2 =2.85, P=0.782).

Figure 5

Table 5: Number of different pathogens isolated from diarrhea cases during second calving season

Farm ID	Calves sampled (No)	*E.Coli*	*Salmonella* (Positive cases)	*Rotavirus* (Positive cases)	*Cryptosporidia*	Mixed pathogens
2	36	15	5	4	8	8
4	22	11	6	9	7	11
6	8	4	1	3	4	4
9	43	20	15	5	7	18
11	34	15	7	11	5	9
13	25	16	5	9	3	8

DISCUSSION

MORBIDITY AND MORTALITY RISK RATE

A very high range of RR for both morbidity and mortality (0.06 to 1.00 for morbidity) and (0.04 to 1.00 for mortality), suggesting that management variables could be the main reason (Frank and Kaneene, 1992). All of the common enteric pathogens E. coli, Rotavirus and Salmonella spp. These results are consistent with the earlier findings

(Razzaque et al., 2005; Hafez and Hafez, 2000, Hill et al., 2001). The cause of pneumonia outbreaks during second calving season was not clear. IBR and other respiratory virus antibody titers were found in 30 days and older calves with pneumonia; therefore, interpretation was difficult as similar titers found in one week old calves.

Deaths in young calves (<1 week) were remarkably high reflecting the persistence of the disease problems requiring intervention measures. Vaccination of dams during the last 2 months of gestation was of major importance to obtain colostrum with high antibodies. In addition, the laboratory results highlight the importance of mixed infection of calves (e.g., Salmonella spp. + E. coli + Rotavirus or Salmonella spp. + E. coli). Dairy cattle in Kuwait are subjected to a harsh climate as well as other clinical cases of pneumonia caused by agents, like IBR, BVD, PI-3 and BRSV. Crouch et al., (2001) found that the vaccination of dam was very effective in reducing the neonatal calf diarrhoea.

COLOSTRUM FEEDING, HOUSING AND MANAGEMENT

In our work, forced tube feeding of fresh or frozen colostrum to calves at birth was followed. A comprehensive review carried out by LeBlance et al., (2006) has focused on prenatal calf health. The authors recommended a key strategy of tube feeding of 4 L of colostrum to calves at birth and a measurement of serum protein levels. Use of individual hutches (LeBlance et al., 2006) for calves in our subsequent studies in second calving reduced calf mortality and morbidity in Kuwait (Razzaque, 2005). Calf housing/management scores (table not shown) were linearly correlated to morbidity ($r^2=0.69$ $P<0.03$) and mortality ($r^2=0.78$ $P<0.01$) rates. It was presumed that the high incidence of diarrhea and pneumonia was a consequence of inadequate calf house hygiene. The overall problems observed during the interventions in six farms were in housing, feeding, farm hygiene and isolation facilities.

SERUM PROTEIN AND IGG

In three out of six farms, the young calves suffered from severe diarrhea associated with low levels of IgG in serum. Serum protein levels were often low (<5.00 mg/dL), and a high incidence of diarrhea and pneumonia. Serum protein and IgG levels were found to influence calf survival (Tyler et al., 1999). Diarrhea with pneumonia as a sequel was the most important diseases on individual farm (Table 3) with the incidence of diarrhea over a range of 49% to 95%. Treatment of sick calves was an important tool in reducing mortality, whereas colostrum feeding aimed at preventing disease/death by increasing disease resistance and reducing the threat of infection (hygiene and housing) found beneficial. Generally, growth rates of calves over the milk feeding period did not reach the target of 700 g/day (Tyler et al., 1999) and were reduced by the effects of pneumonia.

IMPLICATIONS

Findings of the first calving season served as the basis for applying intervention measures for improving the calf survival rates. Quick diagnosis of diseases was the important step for taking immediate intervention measures. Improved feeding, housing, hygiene and treatment of dehydrated calves were the main interventions leading to a significant positive impact on calf survivals. The above investigation is the first of its kind in Kuwait indicating a need for undertaking intervention measures to reduce the incidence of calf hood diseases and deaths.

ACKNOWLEDGEMENTS

Kuwait Foundation for the Advancement of Sciences (KFAS), Dairy Producers and KISR supported the project. The authors are grateful to Dr. David Scharp, GRM, Australia, Dr. S. El-Sawy, Dr. Senousi and Ms. Farida Al-Mulla of PAAFR for their scientific assistance.

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