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Factors Affecting Morbidity, Mortality, and Growth Rates in Suckling Calves under Conditions of Nile Delta, Egypt

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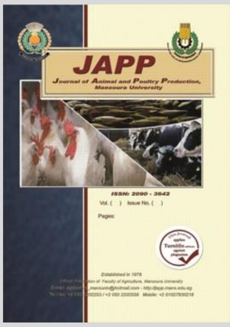

ABSTRACT

The aim of this study was to estimate morbidity, mortality risk, and growth rates during period from birth to weaning in calves under the conditions of Nile Delta. Data were collected during the period from January 2009 until December 2018. Data were collected from 1727 newborn calves from 3 breeds (869 Friesian, 488 Baladi and 370 their Crossbred). The overall rates of calf morbidity and mortality during the period of pre-weaning reached 74.35% and 12.16%, respectively. The majority of cases occurred within the period from 8 to 30 days of calf age (44.93% and 6.20%, respectively). Morbidity and mortality rates were the lowest for Crossbred calves. The means of calf weight at birth and weaning, amount of milk used for suckling and the average daily gain were significantly greater for Friesian calves. Furthermore, morbidity, mortality and growth rates were affected by calf birth season, dam parity, calf gender, calf weight at birth and cause of disease. Incidence and mortality rates due to enteric diseases alone during the pre-weaning period were higher (71.18% and 36.67%, respectively). Calves affected by the diseases had significantly decreased weight at weaning compared with healthy calves. It is clear from this study that elevated calf mortality was associated with low weight at birth. Accordingly, we recommend more attention must be given to proper management and improved health conditions of the calves. It must be obtained ideal weights at birth, alleviate heat stress during the summer, and care for primiparous cows.

Keywords: calf, morbidity, mortality, growth rate

INTRODUCTION

In Egypt, three main breeds of cows are the Friesian, Baladi and their Crossbred. Many of cattle farms in Egypt suffer from a high incidence of diseases during the period from birth to weaning, which affects the increase of mortality rate and decrease growth rate. This leads to increased health care costs and lower financial return of production during this period. The information in Egypt about incidence calf morbidity, mortality and their association with management factors might be scanty. There is increasing interest in identifying the incidence and risk factors associated with calf morbidity and mortality to develop reduction strategies (Cuttance *et al.,* 2017). This period represents a time of high risk for calves; the results indicate that large numbers of live-born calves die during this period (Jorgensen *et al.,* 2017). Calf mortality acts as one of the major obstacles to develop the dairy and beef industry in Egypt. 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. Infectious diseases are particularly high risk for calves, with enteric and respiratory infections being the most common causes of disease-related death (Svensson *et al.,* 2006), and these diseases influence economic efficiency and productive performance over the long-term in the dairy industry (Heinrichs *et al.,* 2005), where calf mortality by 20% reduces net profit to approximately 40% (Singh *et al.,* 2009). The incidence of calf mortality varies from 2 to 20% in exotic dairy breeds under temperate climate (Radostits *et al.,* 2000). Though, calf morbidity and mortality occurs due to multifactorial causes, management of pregnant dam, calving management as well as care and management of the newborn calf significantly affect calf morbidity and mortality (Lorenz *et al.,* 2011). Murray *et al.* (2016) indicated that, several studies in United States have shown that, an average morbidity rate of 5.8% before weaning in beef herds was recorded. Also, pre-weaning calf diarrhea may occur between 2.4% and 36% of beef calves, and bovine respiratory disease may occur between 3% and 11%. Morbidity in calves has a significant effect on average daily gain and production efficiency of the animal.

To develop strategies to reduce calf morbidity and mortality on cattle farms in Egypt, it is imperative to identify the inevitable risk factors and understanding the reasons for mortality that are an important under these conditions for focus and taking specific prevention measures. The proper care and management of calves, particularly for the replacement heifers is very crucial to grow and prosper the dairy and beef industry in Egypt. Therefore, the aim of the present study was to describe herd condition with morbidity, mortality risk, and growth rates during the period from birth to weaning of calves under the Egyptian conditions, and to evaluate if those risks are associated with other herd-level management variables.

MATERIALS AND METHODS

This study was carried out at two experimental stations belonged to Animal Production Research Institute, Ministry of Agriculture, Egypt, one of them in the east of the Nile Delta (El-Serw Station) and the other west of the Nile Delta (El-Qarada Station). These stations are characterized by recording system all data related to animals. These areas are considered to be densely populated in cattle breeding. Both stations are similar in air temperature, relative humidity and temperature-humidity index as shown in Table 1. The following equation of the

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National Research Council (NRC, 1971) was used to determine the temperature-humidity index (THI):

$$THI = (1.8 \times Ta + 32) - [(0.55 - 0.0055 \times RH) \times (1.8 \times Ta - 26.8)]$$

Where: Ta is air temperature (ºC) and RH is relative humidity (%).

Data collection

Data were collected during the period from January 2009 until December 2018. Data were collected from 1727 records concerning newborn calves from 3 breeds (869 Friesian, 488 Baladi and 370 their Crossbred). The collected data included the data related to birth (breed of calf, date of birth, calf weight at birth, calf gender, and dam parity), the data related to weaning (date of weaning, calf weight at weaning and amount of whole milk used to feed calves) and the data related to health status for calves during suckling period (date of disease occurrence, name of disease, date of death occurrence and cause of death).

Table 1. Means ± SE of air temperature (Ta), relative humidity (RH) and temperature-humidity index (THI) during the four seasons of El-Serw and El-Qarada stations

Season	El-Serw station	El-Qarada station
Winter		
Ta (°C)	14.13±1.37	13.72±1.49
RH (%)	67.43±4.53	78.93±6.09
THI	57.64±2.02	56.88±2.40
Spring		
Ta (°C)	21.97±3.07	21.90±3.09
RH (%)	70.03±4.31	65.83±2.04
THI	69.53±4.90	69.05±4.56
Summer		
Ta (°C)	25.93±0.78	25.73±0.88
RH (%)	78.43±2.44[a]	72.63±1.32[b]
THI	76.33±1.38	75.39±1.48
Autumn		
Ta (°C)	19.32±4.21	18.78±3.96
RH (%)	71.10±3.48	74.10±6.10
THI	65.41±6.26	64.65±5.89

[a, b] **Means in the same row within the same factor with different superscripts are significantly different (p<0.05).**

Calf management practices

New born calves were allowed for suckling colostrum within 1 to 2 hours after birth. After that, all calves were fed individually on milk at a rate of 10% of body weight given in two meals for six weeks. The milk allowances were reduced gradually until weaning at about 15 weeks of age. Calf starter and hay (high quality) were available in front of calves from the beginning of the third week of age. While fresh and clean drinking water was available in front of them from the third day of age. Calves were housed in groups inside open sheds, whereas they were separated individually during feeding time on milk only. Body weights were measured at birth and weaning.

The daily gain of each calf was calculated from the following equation:

Daily gain = (Weight at weaning - Weight at birth) / (Age at weaning)

Disease incidence was recorded by veterinarians, who treated the calves until recovery or death. The morbidity was defined with recognizable clinical findings and mortality as death of calves. Common diseases and causes of death were enteric and respiratory diseases, while uncommon diseases and causes of death were generalized weakness, anorexia, navel ill, urinary retention, traumatic injury, imperforate anus, foot-and-mouth disease, lumpy skin and eye diseases.

Statistical Analysis

The data were entered in Microsoft excel worksheet and descriptive statistics were performed. The diseases and death occurrence rates in different analysis were expressed as percentage. Statistics was performed to calculate the percentages of different variables like breed, birth season, dam parity, calf gender, calf weight at birth and cause of disease or death. These variables included morbidity or mortality occurring during the first week (days 1-7), until end of the first month (days 8-30) or from day 31 until weaning. The growth data were statistically analyzed using the General Linear Model (GLM) procedure, SAS (2002).

The significant differences among means were tested using Duncan's Multiple Range Test (Duncan, 1955). Probability values ≤ 5% were considered significant. Categorical variables included calf breed (three levels: Friesian, Baladi and Crossbred), categorized birth season (four levels: winter, spring, summer and autumn), dam parity (three levels: first, second and third and greater than three parities), calf gender (two levels: males and females), calf weight at birth (three levels: <25, 25-35 and >35 kg) and causes of disease and death (four levels: enteric, respiratory, enteric and respiratory together and other causes of diseases).

RESULTS AND DISCUSSION

1. Factors affecting calf morbidity

Figure 1.A showed that, the overall rate of calf morbidity was 74.35% (1284 calves) from total number of 1727 calves born. This result agrees with that reported by Hulbert and Moisá (2016) who indicated that in United States dairy calves 7 out of 10 calves were exposed to disease transmission in the pre-weaning stage. The percentage of morbidity that occurred within the first week was 19.75% (341/1727), but the majority (44.93%, 776/1727) of all calf morbidity occurred during the period from 8 to 30 days of calf age. After 30 days of age, there was a dramatic reduction in calf morbidity rate (9.67%, 167/1727). Hulbert and Moisá (2016) indicated that, the antibodies from passive transfer are low during period from 3 to 4 weeks of age, and the calf begins to have its own antibody responses to environmental microbiota during this period. There were differences in the rates of calf morbidity in the three breeds (Figure 1.B), where rate of morbidity was higher in Friesian calves (86.65%, 753/869) than in Baladi (68.44%, 334/488) while the Crossbred calves were the least (53.24%, 197/370). The high incidence of morbidity in Friesian calves may be due to poor adaptation of this breed to the prevailing Egyptian environment and endemic diseases. The birth season affected the rates of calf morbidity (Figure 1.C), where the rate of morbidity was higher during summer (83.42%, 327/392) compared to spring (76.35%, 268/351) and autumn (74.50%, 371/498) while in the winter it was the least rate (65.43%, 318/486). This observation agrees with the findings of Hoque and Samad (1996) who recorded diseases occurrence in rainy season (41.3%), summer (33.3%) and winter (25.2%). As the condition was seen higher during the summer months, it is may be related to high ambient temperature, dust and flies which act as predisposing factors. Dam parity affected the rates of calf morbidity (Figure 1.D), where rates of morbidity were during second and third parity or higher (78.13%, 268/343 and 75.14%, 650/865, respectively) than first parity (70.52%, 366/519). Calf gender affected the rates of calf morbidity (Figure 1.E), where rate of morbidity was higher in females (75.26%, 587/779) than the males (73.60%, 697/948). Figure 1.F shows that, rates of morbidity were higher for calves weights at birth were 25-35 kg (76.24%, 892/1170) compared to calves weights at birth heavier than 35 kg (61.29%, 38/62) and calves weights at birth were less than 25 kg (71.52%, 354/495).

Figure (1.G) shows that, the incidence rate of enteric diseases only during pre-weaning period was highest (71.18%, 914/1284) than the incidence rate of respiratory diseases only (12.15%, 156/1284) or enteric and respiratory diseases together (9.50%, 122/1284) or other causes of diseases (7.17%, 92/1284). This result agrees with Megersa *et al.* (2009) who found that, diarrhea was the most frequently observed clinical disorder (34%) followed by septicemia (21%) in smallholder dairy farms in Southern Ethiopia. Moreover, diarrhea was the most common condition associated with calf deaths. In another study in Bangladesh, Islam *et al.* (2015) found that, the overall incidence risk of morbidity was 56.17% in dairy farms. The most frequent disease syndrome was diarrhea with incidence risk of 34.82% and pneumonia (6.29%).

Żychlińska-Buczek *et al.* (2015) confirmed that, 80% of cases of disease from birth to weaning are disorders of a diarrhea and respiratory syndrome which were the main cause of business failure and economic losses. Tesfaye (2019) indicated that, in the assessing of age as a risk factor for the morbidity of the diarrheic dairy calves, the highest incidence of diarrhea (68.4%) among the diarrheic dairy calves occurred at the age of less than two months, followed by 26.3% at the age of 2–4 months, and 5.3% at the age of 4–6 months. Also, Hulbert and Moisá (2016) indicated that, in the United States dairy calves, one out of 3 calves experience enteric diseases in the pre-weaning stage; therefore, 7 out of 10 calves are penned individually to minimize physical contact and avoid disease transmission. Where, individual housing systems are commonly used in the United States to reduce the risk of pathogen exposure, while group housing systems are commonly used in Egypt, this leads to increase the risk of pathogen exposure. Individual housing reduces the risk of disease transmission among hand-fed calves.

Also, individual housing facilitates customized care and feeding. Nevertheless, individual housing requires more materials and space than group housing. In this study may be calves were not allowed to get enough of the colostrum, to increase the immunity of the calves. Thus it causes an increased incidence of morbidity in early age.

Also, general hygiene and calf housing conditions seem to be one of the main factors for diseases incidences.

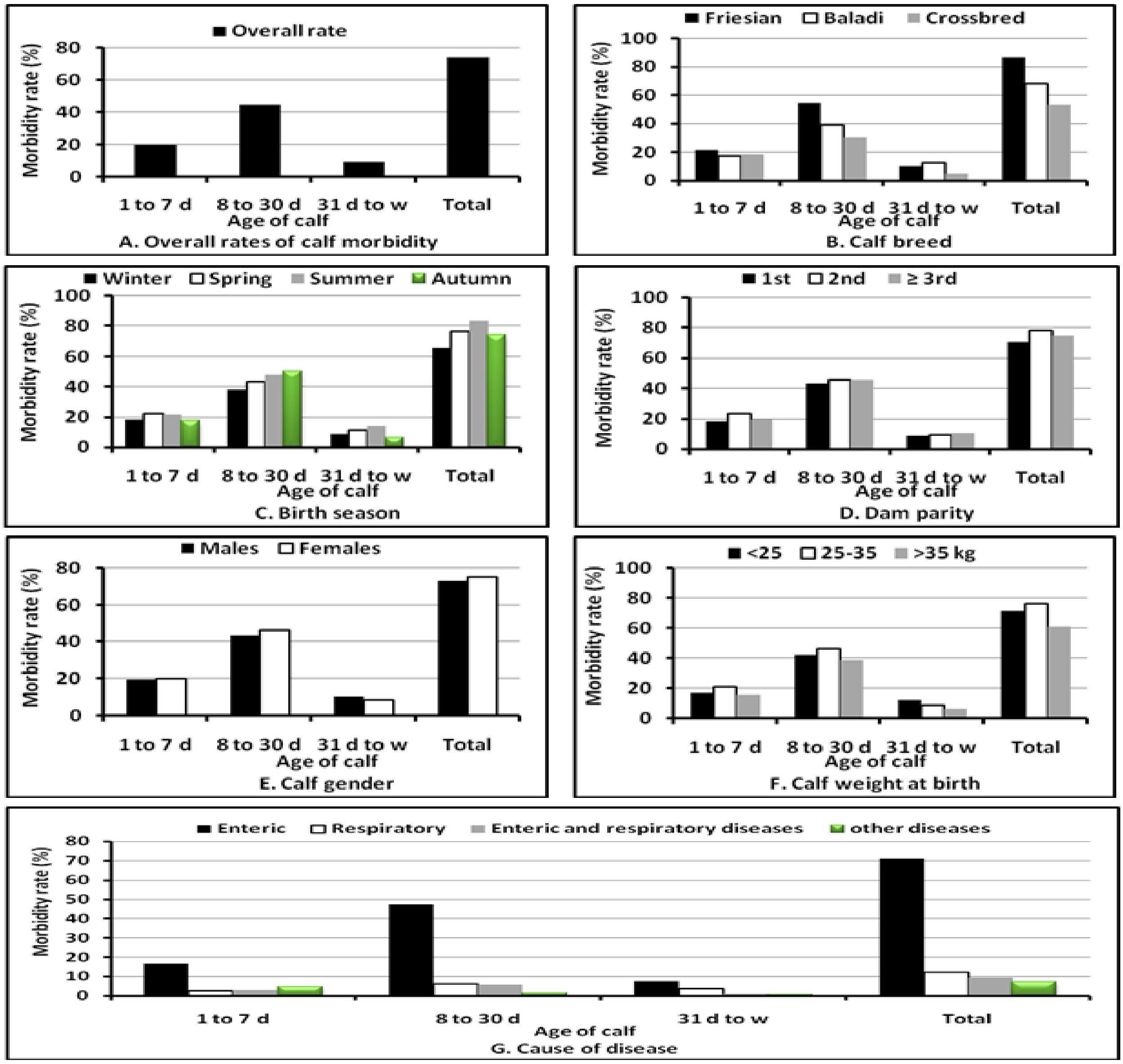

Figure 1. Overall rates of calf morbidity (A) from birth to weaning and their distribution depending on calf breed (B), birth season (C), dam parity (D), calf gender (E), calf weight at birth (F) and cause of disease (G) under the conditions of Nile Delta of Egypt.

2. Factors affecting calf mortality

Figure 2.A shows that, the overall rate of calf mortality during the period of pre-weaning reached 12.16% (210/1727). This result agreed with that reported by Radostits *et al.* (2000) who noticed that, incidence of calf mortality varies from 2 to 20% in dairy breeds under temperate climate. Also, Hulbert and Moisá (2016) reported that, mortality rate among United States calves was 10% before weaning, Bunter *et al.* (2014) and Patbandha *et al.* (2017) found that, incidence of calf mortality under field conditions in Australia and India were 9.50 and 16.03%, respectively.

In the present study, the majority of all calf deaths occurred within the first month of calf age (7.53%, 130/1727), where the percentages of deaths that occurred within the first week and during the period from 8 to 30 days of calf age were 1.33 and 6.20%, respectively. After 30 days of age, there was a reduction in calf mortality rate (4.63%). Similar values were reported by Tesfaye (2019) who indicated that, approximately 60-75% of the mortality in calves occurred in the first month of their life in dairy calves.

There was an effect of the calf breed on the mortality rate (Figure 2.B), where the Baladi calves were the highest in mortality rate (12.93%, 107/488) compared to Friesian calves (9.67%, 84/869), while the Crossbred calves recorded the lowest rate (5.14%, 19/370). The breed effects on calf mortality might be primarily a result of breed differences in calf weight at birth. This result agreed with that reported by Bunter *et al.* (2014) who found that, Brahman calves were more likely to die before weaning than were other calves breeds, where Brahman cows had higher percentages of calves with low birthweights. They found a relationship between birth weight and survival and both low and high calf birth weights are problematical for calf survival. In our study, the average birth weight of Baladi calves was very low (21.80 kg) compared to Friesian (29.29 kg) and Crossbred (28.70 kg) calves. This implies that management and selection should be targeted towards reducing the incidence of low birth weight while maintaining calving ease. Also, results present some interesting trends, where the Crossbred calves recorded the lowest morbidity and mortality rates may be due to hybrid vigor as they were distinguished by the high weight at birth obtained from the Friesian breed and its resistance to the diseases obtained from the Baladi breed.

There was an effect of the birth season on the calf mortality rate (Figure 2.C). Calves were born during the summer season had the highest rate of mortality (14.80%, 58/392) than other seasons, while the winter season was the best, where the calves recorded the lowest rate (9.88%, 48/486). These results disagree with those obtained by Murray *et al.* (2016) who found that, herds that began their calving season in January or February had a greater incidence of calf mortality from day 7 to weaning, compared with those that began calving in the warmer conditions. Because the weather in Canada is very cold in the winter, born calves had an increased risk of experiencing bovine respiratory disease, diarrhea or death compared with calves born in the summer or spring. This association may be due to the adverse effect of cold weather on calf vitality and the transfer of passive immunity. While in Egypt the weather is quite different where winter is warm and the summer is very hot, as calves born in the summer have an increased risk of experiencing heat stress and diarrhea compared with calves born in the winter.

The dam parity had an effect on rate of calf mortality (Figure 2.D). Calves born to dams of the first season had the highest mortality rate (13.29%, 69/519) from calves born to dams of the second season (12.83%, 44/343) or the other seasons (11.21%, 97/865). These results agreed with those reported by Raboisson *et al.* (2014) and Mee (2013) who observed positive association between the proportion of primiparous cows and mortality in day 3 to one month old calves. This might be due to the higher probability of dystocia for primiparous cows, which frequently requires assistance at calving. Also, Bunter *et al.* (2014) reported that, young cows have lower-birth weight calves more frequently and calves born to cows ≤4 years old had a risk of mortality about two to six times higher than that of calves born to mature 5–7-year-old cows. Tesfaye (2019) reported that colostrum of primiparous cows is lower in immunoglobulin (Ig) content than older cows and colostrum deprived calves are highly susceptible for colisepticemia. Furthermore older cows tend to have more IgG than primiparous cows, as they have been exposed to a greater number of pathogens during their lifetimes. Therefore, more intensive management of primiparous cows might be imperative to improve calf survival rates.

Calf gender had an effect on the calf mortality rate (Figure 2.E), where male calves were higher (13.50%, 128/948) than female calves (10.53%, 82/779). Although female calves had a higher rate of morbidity (75.35%) than male calves (73.52%), but they were able to overcome the causes of diseases. These results agreed with those reported by Bunter *et al.* (2014) who found that, gender of the beef calves were significantly associated with calf mortality, where the mortality rate in males was significantly higher (11.4%) than females (7.4%). Also, Cuttance *et al.* (2017) found that, calf mortality was greater for male relative to female calves (odds ratio 1.39; 95% confidence interval 1.22 to 1.59).

There was a high effect of the calf weight at birth on the calf mortality rate (Figure 2.F), where the mortality rate of calves weights at birth were lighter than 25 kg were higher (18.59%, 92/495) than calves weights at birth were than 25-35 kg (9.74%, 114/1170) and heavier than 35 kg (6.45%, 4/62). Although, the morbidity rates were higher of the calves with a birth weight of 25-30 kg (76.24%) than the calves with a birth weight of lighter than 25 kg (71.52%), but they were able to overcome the causes of diseases and the mortality rate were less than the calves with a birth weight of lighter than 25 kg. These results agreed with those reported by Bunter *et al.* (2014) who found that, low weight at birth was associated with increased calf mortality rates, particularly within the first week and one month after birth. They noticed that, calves with birth weights of 32 kg or below had a significantly increased mortality rate compared with calves weighing between 32 and 38.5 kg at birth.

During the pre-weaning period, enteric and respiratory diseases were the main causes of death (78.10%, 164/210). Deaths from enteric diseases only (36.67%, 77/210) were more markedly increased in calves compared to the respiratory diseases only (18.10%, 38/210), enteric and respiratory diseases together (23.33%, 49/210) or other causes of diseases (21.90%, 46/210). It is observed from this study that mortality due to respiratory diseases was associated with enteric diseases at a large rate (23.33%, 49/210). This is consistent with Murray *et al.* (2016) who observed that, disease such as pre-weaning calf diarrhea may predispose calves to bovine respiratory disease during the period from birth to weaning. These results agreed with those reported by Hulbert and Moisá (2016) who pointed out that, mortality rates were high among United States calves (1 in 10), and more than half of these deaths were caused by scours. Also, Żychlińska-Buczek *et al.* (2015) indicated that, overall mortality throughout the first 90 days of age was due to diarrhea, which increased the risk of death among calves. Also respiratory system disorders were the next common cause of loss of calves. In addition, Hulbert and Moisá (2016) reported that, calves that survived from dystocia were susceptible to a higher risk of morbidity and mortality during the pre-weaning stage. Due to the inflammatory response might not be well controlled tissue damage caused a difficult calving, even without any microbial exposure. These factors may contribute to low calf vitality. Murray *et al.* (2016) indicated that, dystocia had been associated with an increased risk of morbidity and mortality in calves, which were likely a result of the detrimental effects on the calf such as reduced vitality and increased failure of transfer of passive immunity.

Therefore, timely intervention should be encouraged to minimize such negative effects, for the sake of calf survival.

In this study, it is noted that the colostrum was fed directly to the calves from their dams during the first two hours of birth only. Calves may not be received enough colostrum during this critical neo-natal period. Hulbert and Moisá (2016) reported that, the first meal for bovine species must provide an adequate amount of colostrum within the first 24 h. (critical period). Although the presence of the dam helps with Ig absorption from colostrum, calves that were allowed to suckle from the dam ingested inadequate volumes of colostrum and increased their risk of colostrum-borne pathogens. Calves that not received colostrum were more likely to die in the first 3 weeks of life. Also, failure of passive transfer of maternal antibodies to calves accounted for almost 40% of the deaths. Murray *et al.* (2016) reported that, intervening with colostrum intake if the calving was assisted, reduced the incidence of death from day 7 until weaning, ensuring that calves consumed adequate colostrum after a difficult birth reduced the risk of failed transfer of passive immunity. If low vitality calves are identified, perhaps more colostrum gavage is needed to decrease their risk of death. Żychlińska-Buczek *et al.* (2015) indicated that, the steady intensification of livestock farming lead to a high concentration of animals in a small habitat area. This phenomenon leads to the spread of infectious diseases, particularly in calves. Therefore, calves are commonly advised to be housed individually in the first week of age, because it may lead to a decreased pathogen load. Moreover, grouping relatively late in the calves' life (median of 6 weeks) could have positively influenced morbidity, because the risk for diarrhea is the highest in the first three weeks of their life. Mortality of calf could be reduced and improved survival rate by improving management and care like adequate colostrum feeding soon after birth, proper hygiene and housing to reduce disease transfer and proper feeding protocols to enhance rumen growth (Zucali *et al.*, 2013; Seppä-Lassila *et al.*, 2016 and Patbandha *et al.*, 2017).

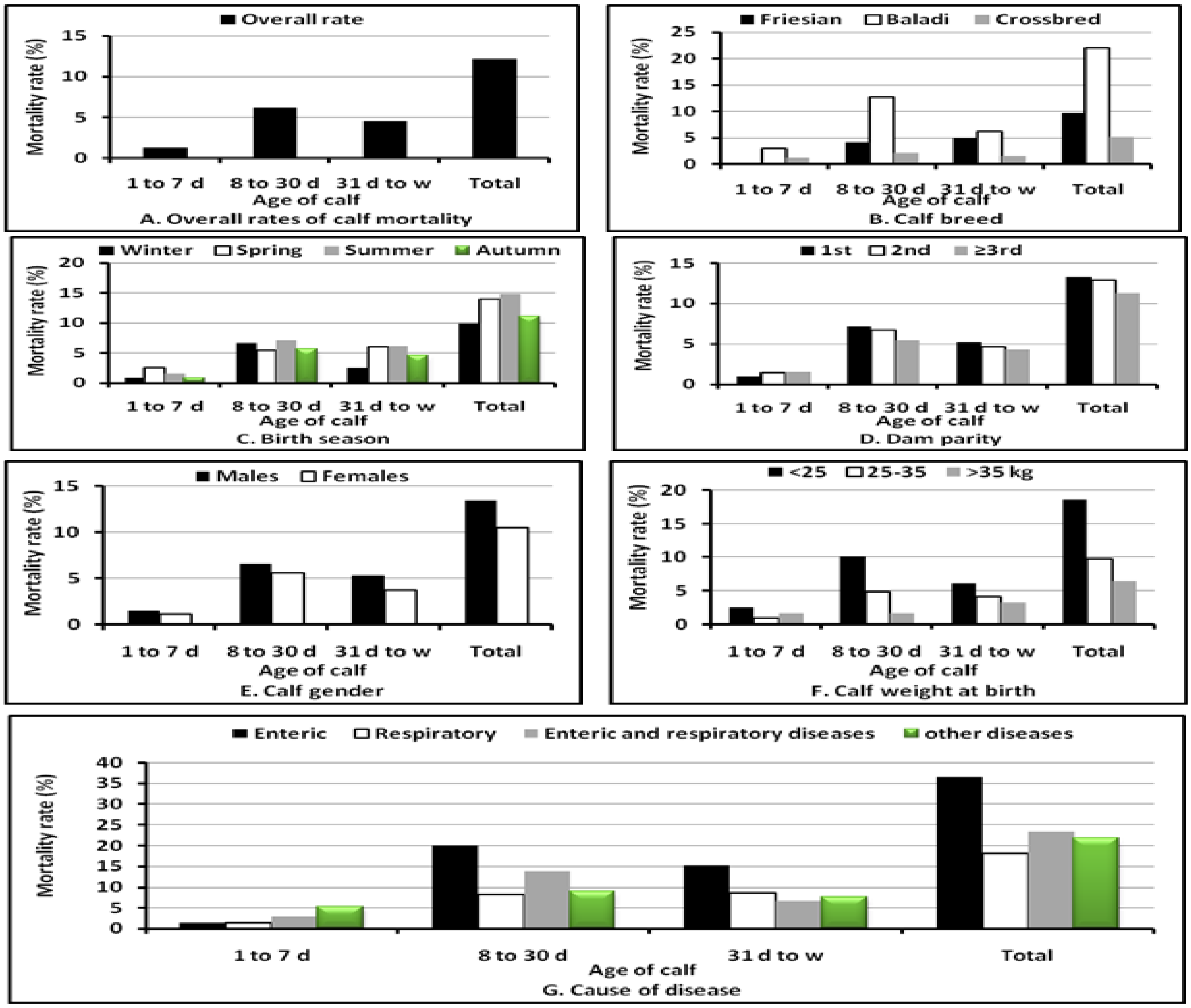

Figure 2. Overall rates of calf mortality (A) from birth to weaning and their distribution depending on calf breed (B), birth season (C), dam parity (D), calf gender (E), calf weight at birth (F) and cause of disease (G) under the conditions of Nile Delta of Egypt.

3. Factors affecting calf growth

Table 2 showed that, the overall mean of calf weight at birth was 27.27±5.35 kg, the mean of calf weight at weaning was 88.25±9.13 kg, mean of the milk amount used during the suckling period for each calf was 338.3±52.0 kg, mean of calf age at weaning was 113.46±12.45 days and the average daily gain was 544±93 g.

Table 2. Factors associated with calves growth rate from birth to weaning under the conditions of Nile Delta of Egypt

Variable	No.	Calf weight at birth (kg)	Calf weight at weaning (kg)	Milk used to feed each calf (kg)	Calf age at weaning (day)	Average daily gain (g)
Overall rate	1517	27.27±5.35	88.25±9.13	338.3±52.0	113.46±12.45	544±93
Calf breed:						
Friesian	785	29.29±3.76^{A}	93.60±8.69^{A}	385.82±3.23^{A}	107.63±2.87^{C}	598±78^{A}
Baladi	381	21.80±3.52^{C}	80.35±4.99^{C}	280.20±22.01^{C}	126.46±14.12^{A}	468±63^{C}
Crossbred	351	28.70±5.92^{B}	84.85±4.63^{B}	295.05±23.84^{B}	112.39±13.22^{B}	505±72^{B}
Birth season:						
Winter	438	27.25±5.45^{AB}	88.31±9.99^{AB}	329.88±54.04^{B}	113.31±13.77	545±96^{A}
Spring	302	27.89±5.04^{A}	89.04±8.09^{A}	343.62±50.66^{A}	112.94±11.35	547±87^{A}
Summer	334	27.17±5.38^{AB}	87.25±8.82^{B}	341.42±50.40^{A}	114.36±12.17	532±92^{B}
Autumn	443	26.94±5.40^{B}	88.40±9.11^{AB}	340.62±51.37^{A}	113.28±12.00	549±95^{A}
Dam parity:						
1st	450	25.57±4.84^{C}	87.96±8.77	338.45±54.55	113.90±12.46^{A}	554±87^{A}
2nd	299	27.18±5.40^{B}	88.11±9.76	339.43±53.70	112.13±12.17^{B}	549±89^{A}
≥3rd	768	28.30±5.36^{A}	88.46±9.10	337.76±49.91	113.71±12.53^{AB}	536±97^{B}
Calf gender:						
Males	820	27.95±5.45^{A}	88.84±9.29^{A}	338.96±50.97	113.02±12.13	545±95
Females	697	26.47±5.12^{B}	87.55±8.90^{B}	337.51±53.31	113.97±12.80	542±91
Calf weight at birth (kg):						
<25 kg	414	20.39±2.28^{C}	81.70±6.53^{B}	294.58±43.00^{C}	123.29±14.87^{A}	505±85^{B}
25 – 35 kg	1046	29.41±3.10^{B}	90.76±8.80^{A}	355.30±45.66^{A}	110.00±8.88^{B}	562±91^{A}
>35 kg	57	38.07±1.75^{A}	89.60±7.90^{A}	343.66±35.15^{B}	105.60±9.56^{C}	491±80^{B}
Morbidity:						
Healthy	443	27.85±5.37^{A}	91.37±9.73^{A}	330.48±50.58^{B}	112.11±11.41^{B}	572±99^{A}
Enteric diseases	837	26.92±5.33^{A}	87.24±9.08^{B}	338.96±53.02^{B}	114.13±12.87^{B}	535±91^{B}
Respiratory diseases	118	27.99±5.01^{A}	87.44±7.04^{B}	363.33±43.18^{A}	111.38±10.87^{B}	539±78^{B}
Enteric and respiratory diseases	73	28.18±4.89^{A}	84.47±5.77^{C}	358.96±45.95^{A}	111.51±10.60^{B}	509±64^{C}
Other diseases	46	24.85±5.84^{B}	84.46±3.70^{C}	304.39±39.49^{C}	122.72±15.65^{A}	492±62^{C}

^{A,B,C} **Means in the same column within the same factor with different superscripts are significantly different (*P*<0.05).**

Effect of breed: The means of calf weight at birth, calf weight at weaning, amount of milk used during the suckling period for each calf and the average daily gain were significantly (P<0.05) greater for Friesian calves (29.29, 93.60, 385.82 and 0.598 kg, respectively) followed by Crossbred calves (28.70, 84.85, 295.05 and 0.505 kg, respectively), while Baladi calves recorded the lowest values (21.80, 80.35, 280.20 and 0.468 kg, respectively). These results are in harmony with those obtained by Ali (2001) who found that, means of calf weight at birth and the average daily gain were significantly greater in the Crossbred calves (31.25 and 0.539 kg) compared with Baladi calves (23.50 and 0.481 kg), respectively. He indicated also that, dam genotype exerted an effect on calf weight at birth. The mean calf age at weaning was longer for Baladi calves (126.46 days) than Crossbred calves (112.39 days) and Friesian calves (107.63 days), this is might be to Baladi calves need more time to reach the appropriate weight at weaning (80.35 kg).

Effect of birth season: Calves born in the spring were the best where calf weight at birth (27.89 kg) and at weaning (89.04 kg) were heavier, also they needed less time (112.94 day) to reach the appropriate weight at weaning, but they used amount of milk (343.62 kg) greater than calves born in other seasons. Calves born in the summer were the lighter at weaning (87.25 kg) and the average daily gain was significantly less (532 g) than calves born in other seasons. While calves born in the autumn were lighter at birth (26.94 kg) but they were insignificantly greater in the average daily gain (549 g). Calves born in the winter significantly used least milk for scuckling (329.88 kg). Lower weights at weaning in summer were mainly because of the increasing morbidity rate, flies and mosquitoes together with increasing ambient temperature, also high temperature decreases feed consumption of Holstein calves (Yaylak *et al.,* 2015).

Effect of dam parity*:* Calves born to dams of the first parity were the lightest for weight at birth (25.57 kg) and they needed more time (113.90 day) to reach the appropriate weight at weaning compared to calves born to dams of the second parity (27.18 kg and 112.13 day) and the third parity and more (28.30 kg and 113.71 day), respectively. There was no significant effect of the dam parity on calf weight at weaning or the amount of milk used to feed the calves. Raphaka and Dzama (2009) reported that, since primiparous cows were not mature both physically and biologically, the nutrients they consume were not only partitioned into maintenance and gestation, but also channelled towards their own growth. First calving therefore generally gives smaller calves at birth and weaning. Also, they indicated that, mature cows, aged 5 to 8 years, had a greater ability to provide nutrients and an optimal uterine environment for the foetus compared to younger cows which were still developing their body systems.

Effect of calf gender: Weight at birth and weaning of male calves were significantly greater (27.95 and 88.84 kg) compared to females (26.47 and 87.55 kg), respectively. However, the calf gender did not significantly affect the amount of milk used to feed calves and average daily gain. Previous researchers also reported greater weights at birth and weaning of male calves (Manzi *et al.*, 2012 and Yaylak *et al.,* 2015), who indicated that, male calves usually have greater weights at birth and weaning because of longer gestation periods and greater androgen hormone level in male calves serum.

Effect of Calf weight at birth*:* Many growth rate measurements were associated with calf weight at birth. The calf weight at weaning and the milk amount used to feed calves were significantly decreased for lighter calves than 25 kg weights at birth. Also they need more time to reach the appropriate weight at weaning compared to the calves with higher weights.

Effect of disease: Morbidity in calves had a significant effect on weight at weaning, the amount of milk used to feed calves and average daily gain. Whereas calves affected by enteric diseases alone and respiratory diseases alone decreased significantly weight at weaning by 4.13 and 3.93 kg, respectively compared with healthy calves. While calves affected by enteric and respiratory diseases together and other causes of diseases decreased significantly weight at weaning by 6.90 and 6.91 kg, respectively compared with healthy calves. The amount of milk used in feeding calves did not significantly affect the incidence of enteric diseases compared to healthy calves, while it significantly increased for calves affected by respiratory alone and enteric and respiratory together diseases by 32.85 and 28.48 kg, respectively and in contrast it significantly decreased for calves with other diseases by 26.09 kg. Calves affected by other diseases required a longer period for suckling (122.72 day) to reach an appropriate weight at weaning, and this may be due to a low weight at birth. The average daily gain was significantly lower for calves affected by enteric diseases alone and respiratory diseases alone by 37 and 33 g/day, respectively. Also, it significantly decreased for calves affected by enteric and respiratory diseases together and other diseases by 63 and 80 g/day, respectively compared to healthy calves. These results agreed with Virtala *et al.* (1996) who reported that, diseases reduced calf growth. Whereas calves with pneumonia alone, diarrhea alone, and both together decreased daily body weight gain by 1.3, 3.0, and 4.8 g/kg, respectively, during a 44 to 60 days follow-up period. The corresponding relative declines in growth rate were 8, 18, and 29%, respectively.

CONCLUSION

This study identified several risk factors that affecting the morbidity, mortality and growth rates in suckling calves. Current findings revealed that morbidity, mortality and growth rates were affected by calf breed, birth season, dam parity, calf gender, calf weight at birth and cause of disease. It is now established that calf morbidity and mortality are an important limiting factors for the success of modern cattle farms. Accordingly, and to correct pathway in the future, we recommend that attention must be given to proper management and improved health conditions of the calves. It must be obtained ideal weights at birth, alleviate heat stress during the summer, and care for primiparous cows. The focus must be also on disease prevention rather than veterinary treatment to minimize calf morbidity and mortality.

REFERENCES

Ali, M. A. E. (2001). Effect of climatic changes on the physiological and productive performance in cattle under the conditions of north of Nile Delta. M. Sc. Thesis, Faculty of Agriculture, Cairo University, Egypt.

Bunter, K. L., Johnston, D. J., Wolcott, M. L. and Fordyce, G. (2014). Factors associated with calf mortality in tropically adapted beef breeds managed in extensive Australian production systems. Animal Production Science 54(1):25-36.

Cuttance, E. L., Mason, W. A., McDermott, J., Laven, R. A., McDougall, S. and Phyn, C. V. C. (2017). Calf and replacement heifer mortality from birth until weaning in pasture-based dairy herds in New Zealand. J. Dairy Sci. 100:8347-8357.

Duncan, D. B. (1955): Multiple rang and multiple F test. Biometrics 11:1-42.

Heinrichs, A. J., Heinrichs, B. S., Harel, O., Rogers, G. W. and Place, N. T. (2005). A prospective study of calf factors affecting age, body size, and body condition score at first calving of dairy heifers. J. Dairy Sci. 88:2828–2835.

Hoque M.S. and Samad M. A. (1996). Prevalence of clinical diseases in dairy cross-bred cows and calves in the urban areas in Dhaka. Bangladesh Veterinary Journal 30:118-129.

Hulbert, L. E. and Moisá, S. J. (2016). Stress, immunity, and the management of calves. J. Dairy Sci. 99(4):3199-3216.

Islam N. M., Rahman, A. K. M. A., Nahar, M. S., Khair, A., Alam, M. M. (2015). Incidence of calf morbidity and mortality at CIG dairy farms of Muktagacha Upazila in Mymensingh district. Bangladesh Journal of Veterinary Medicine 13(1):37-43.

Jorgensen M. W., Adams-Progar, A., de Passillé, A. M., Rushen, J., Godden, S. M., Chester-Jones, H. and Endres, M. I. (2017). Factors associated with dairy calf health in automated feeding systems in the Upper Midwest United States. J. Dairy Sci. 100 (7):5675–5686.

Lorenz, I., Mee, J. F., Early, B. and More, S. J. (2011). Calf health from birth to weaning. I. General aspects of disease prevention. Irish Veterinary Journal 64:10-17.

Manzi M., Junga J. O., Ebong, C., Mosi, R. O. (2012). Factors affecting pre and post-weaining growth of six cattle breed groups at Songa Research station in Rwanda. Livestock Research for Rural Development 24 (4):11-24.

Mee, J. F. (2013). Why do so many calves die on modern dairy farms and what can we do about calf welfare in the future?. Animals 3:1036-1057.

Megersa B., Yacob, A., Regassa, A., Abuna, F., Asmare, K. and Amenu, K. (2009). Prevalence and incidence rates of calf morbidity and mortality and associated risk factors in smallholder dairy farms in Hawassa, Southern Ethiopia. Ethiopian Veterinary Journal 13:59-68.

Murray C. F., Fick, L. J., Pajor, E. A., Barkema, H. W., Jelinski, M. D. and Windeyer, M. C. (2016). Calf management practices and associations with herd-level morbidity and mortality on beef cow-calf operations. Animal 10 (3):468–477.

NRC. (1971). A Guide to Environmental Research on Animals. Natl. Acad. Sci., Washington DC.

Patbandha, T. K., Garg, D. D., Maharana, B. R., Chavda, M. R., Rupal Pathak and Gamit, V. V. (2017). Factors associated with calf mortality under field condition in Saurashtra region of Gujarat, India. Int. J. Curr. Microbiol. App. Sci. 6(7):4184-4192.

Raboisson D., Maigne, E., Sans, P., Allaire, G. and Cahuzac, E. (2014). Factors influencing dairy calf and replacement heifer mortality in France. J. Dairy Sci. 97 (1):202–211.

Radostits, O. M., Gay, C. C., Blood, D. C. and Hinchcliff, K. W. (2000). Veterinary Medicine- A textbook of the diseases of cattle, sheep, pigs, goats and horses. 9th Ed. W. B. Saunders, Philadelphia, USA. pp. 117.

Raphaka, K. and Dzama, K. (2009). Sex of calf and age of dam adjustment factor for birth weight in Tswana and Composite beef cattle in Botswana. South African Journal of Animal Science 39(4):296-300.

SAS, (2002): User's Guide: Statistics, Version 9.0 Edition. SAS Institute Inc., Cary, NC, USA.

Seppä-Lassila, L., Sarjokari, K., Hovinen, M., Soveri, T. and Norring, M. (2016). Management factors associated with mortality of dairy calves in Finland: A cross sectional study. The Veterinary Journal 216:164-167.

Singh, D. D., Kumar, M., Choudhary, P. K. and Singh, H. N. (2009). Neonatal calf mortality - An overview. Intas Polivet 10(11):165-169.

Svensson, C., Linder, A. and Olsson, S. O. (2006). Mortality in Swedish dairy calves and replacement heifers. J. Dairy Sci. 89:4769–4777.

Tesfaye, N. (2019). Review on the major causes and associated risk factors of calf morbidity and mortality in dairy farms of Ethiopia. J. Dairy Vet. Anim. Res. 8(2):83–92.

Virtala, A.-M. K., Mechor, G. D., Gröhn, Y. T. and Erb, H. N. (1996). The effect of calfhood diseases on growth of female dairy calves during the first 3 mo of life in New York State. J. Dairy Sci. 79(6):1040-1049.

Yaylak, E., Orhan, H. and Daşkaya, A. (2015). Some environmental factors affecting birth weight, weaning weight and daily live weight gain of Holstein calves. Turkish Journal of Agriculture-Food Science and Technology 3(7):617–622.

Zucali, M., Bava, L., Tamburini, A., Guerci, M. and Sandrucci, A. (2013). Management risk factors for calf mortality in intensive Italian dairy farms. Italian J. Anim. Sci. 12(e26):162-166.

Żychlińska-Buczek, J., Bauer, E., Kania-Gierdziewicz, J. and Wrońska, A. (2015). The main causes of calf mortality in dairy farms in Poland. Journal of Agricultural Science and Technology A 5:363-369.

العوامل المُؤثرة علي مُعدلات الإصابة بالأمراض والنفوق والنمو في العجول الرضيعة تحت ظروف دلتا النيل ـ مصر

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الهدف من هذه الدراسة هو تقدير مُعدلات الإصابة بالأمراض ومخاطر النفوق ومُعدلات النمو خلال الفترة من الميلاد وحتى الفطام في العجول تحت ظروف دلتا النيل. تم جمع البيانات خلال الفترة من يناير 2009 وحتي ديسمبر 2018. البيانات المُجمعة كانت لـ 1727 عجل حديث الولادة من 3 سلالات (869 فريزيان ، 488 بلدي و370 خليطهما). بلغ المُعدل الإجمالي لإصابة العجول بالأمراض والنفوق خلال فترة ما قبل الفطام 74.35% و12.16% علي الترتيب. حدثت غالبية الحالات خلال الفترة من 8 إلي 30 يوم من عمر العجل (44.93% و 6.20% علي الترتيب). كانت مُعدلات الإصابة بالأمراض والنفوق هي الأقل بالنسبة للعجول الخليط. كانت متوسطات وزن العجول عند الميلاد والفطام وكمية اللبن المستخدمة في الرضاعة ومُعدل النمو اليومي أعلي وبشكل معنوي للعجول الفريزيان. علاوة علي ذلك تأثرت مُعدلات الاصابة بالأمراض والنفوق والنمو بكل من موسم ميلاد العجول وترتيب موسم ولادة الأم وجنس العجل ووزن العجل عند الميلاد وسبب المرض. كانت مُعدلات الإصابة والنفوق الناجمة عن الأمراض المعوية فقط خلال فترة ما قبل الفطام هي الأعلي (71.18% و36.67% علي الترتيب). انخفض بشكل معنوي الوزن عند الفطام للعجول المصابة بالأمراض مقارنة بالعجول غير المصابة. يتضح من هذه الدراسة أن مُعدل النفوق المرتفع في العجل ارتبط بإنخفاض الوزن عند الميلاد. وفقًا لذلك ، نوصي بإيلاء الإهتمام بتقديم الرعاية الجيدة وتحسين الظروف الصحية للعجول ، العمل علي الحصول على أوزان مثالية عند الميلاد ، وتخفيف الإجهاد الحراري خلال فصل الصيف ، والإهتمام برعاية الأبقار البكرية.