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NON-GENETIC FACTORS AFFECTING INCIDENCE OF ABORTION, STILLBIRTH AND POST–NATAL MORTALITY OF EGYPTIAN BUFFALOES

El-Regalaty, H. A and H.B. Aboul-Ela.
Animal Production Research Institute, Agricultural Research Center, Ministry of Agriculture.

ABSTRACT

Prenatal mortality is one of the most important causes of production losses in the livestock industry. This study shed lights on the prevalence of abortion and stillbirth, and postnatal mortality up to six months in five buffalo herds (6169 pregnancy cases) to determine the effect of some non-genetic factors on the incidence of the three disorders in five buffalo herds in Egypt. These factors included the effect of farm, year, season and parity on abortion as well as dam's weight at calving, and sex, weight and age (at death) of calves on stillbirth and mortality rate..

Results showed that percentage of pre- and post-natal losses was 16%,, representing 1.33% abortion, 3.65% stillbirth and 11.05% for postnatal mortality up - to six months of age. The incidence of abortion was affected ($P<0.001$) by season, year, dam's parity, and the farm. The same factors in addition to calf's weight exerted significant ($P<0.001$) effects on the rate of stillbirth but dam's weight at calving did not show any significant effect ($P\geq0.05$). Incidence of mortality was significantly ($P<0.001$) affected by season, year, parity, dam's weight at calving, calf's age and weight at death, and farm.

This study put more emphasis on the importance of non-genetic effects as the main contributors impacting productive and reproductive performance of buffaloes. Farm conditions, herd management and policy have pronounced effects on the incidence of abortion, stillbirths, and postnatal mortality. The results of this study could be useful to enhancing productive and reproductive performance in large or small sized buffalo herds.

Keywords: Egyptian Buffaloes, abortion, stillbirth, mortality.

INTRODUCTION

Reproductive problems are important causes of production losses in the livestock industry. Abortion, stillbirth and neonatal mortality have been recognized as the most important factors affecting fertility (Wilde, 2006). Various factors are adopted to account for the fetal loss including management, nutrition, in addition to congenital environmental factors (Khan *et al*., 2011).

Abortion is defined as the premature expulsion of the fetus from the dam and usually occurs after the death of the fetus in the uterus. Abortion can occur as an outbreak, but more often, it occurs as sporadic resulting in reduction of calf's number available for sale and also reduces the potential number of replacement heifers (Jose and Victor, 2009). On the basis of several reports, the rate of bovine abortion was found to reach the rate of 5-50% of the cases studied (Azizollah Khodakaram-Tafti and Ikede, 2005) while in Murrah buffaloes incidence of abortion was reported to be ~7% (Khan *et al*., 2011; Hashmi *et al*., 2013). However, when the fetus is died near term or born dead it is often called “Stillbirth” (Bagley, 1999). The

incidence of stillbirth was recorded to be 1.04% in Murrah buffaloes (Khan *et al*., 2011) and ~3% in Pakistani buffaloes (Hashmi *et al*, 2013); 0.5% in dairy cattle in Bangladesh (Islam *et al*., 2012). It is reported that the causes of stillbirth with a non-infectious atiology is likely to be multifactorial and difficult calving may explain only about half of the stillbirths. As much as one third of those calves seemed clinically normal with no obvious reason for death (Berglund *et al*., 2003).

It is known that the tropical environment is not ideal for calf rearing as the high temperature and humidity could result in some potential diseases. In addition, type of dairy farming (generally poorly resourced small holder farming) in addition to general lack of awareness of long term implications of poorly reared stock that might not encourage farmers to pay close attention to their calf and heifer rearing systems. The environmental and managerial factors might hasten the occurrence of such conditions (Khan and Khan, 1991). Calf's mortality is also associated with the type of housing, feeding, management practices and weather, external and internal parasitic infestation, and bacterial infections especially those causing septicaemia and enteritis (Radostits *et al*, 1994). Additionally, colostrum helps neonatal calf to make a defense against infectious disease that finally results in large loss of neonatal calves and heifers.

Calf's mortality during the early postnatal is considered as one of the major causes that reduce the net profit of livestock enterprises, since it affects the calf's and heifer availability for sale and selection. Buffalo neonatal calf mortality varies from 8.7 to 64 percent throughout world. neonatal calf mortality in the first month of age is accounted to be 84% of the total mortality (Jenny *et al*., 1982) and is particularly high in the third week of life (Umoh.1982). It is also reported by El-Regalaty *et al*. (2013) that the percentage of buffalo calves born and survived to one month of age ranged between 8 to 22% depending upon the previous history of the dam. Moreover, a comparable rate of neonatal mortality reported by Wikse *et al*. (1994) and Johanson and Berger (2003) is ~6-8% during the first month of age and that 75% of the heifer's mortality occurs during the first month of life. Furthermore, according to Afzal *et al.* (1983) the mortality in cattle and buffalo calves ranged from 29.1 to 39.8%. Also, Elregalaty (2001) recorded that most calf mortalities during the first month of age caused by diarrhea and pneumonia in Egyptian buffaloes. Even though, survival of calves is imperative for livestock propagation, a large number of calves die during the first year of their life causing heavy loss in buffalo calves, particularly during the first three months of their postnatal life (Jain 2005).

The objective of this study was to investigate the effect of some non-genetic factors on abortion, stillbirth and neonatal mortality in five herds of Egyptian buffaloes distributed all over the country.

MATERIALS AND METHODS

Data were collected through examination of calving records of five governmental buffalo herds. Three of these herds are located at Mehallet Moussa (Kafr El-Sheikh, North Delta), one at El-Gemeiza (Middle Delta) and

one at Sids (North Upper Egypt). All herds are raised in experimental farms belong to the Animal Production Research Institute (APRI), Agricultural Research Center, Ministry of Agriculture.

Data were collected during the years from 2000 to 2012, verified and used for this study. Data were investigated to analyze type of fertility failure occurred during gestation including abortion and stillbirth. Also calf losses during post-partum period (early mortality) were analyzed.

Records of 6169 gestation cases (free from all types of Brucella) were collected from reproductive health reports. The causes of loss and age at which loss occurred (either before or after birth) were recorded. The number of buffalo females conceived during the investigation period was 6169 (3230 males and 2939 females). Prenatal losses were divided into 2 parts: abortion (93 records) and stillbirth (228 records). The total number of postnatal losses was 681 calves. Data of postnatal period were recorded starting from birth until 6 months of age.

Supplementary data of farm (1 to 5), year of birth, season of calving, dam's parity, weight and age at calving, in addition to birth weight, sex, and mortality rate of calves were recorded.

Effect of season of the year on abortion, stillbirth and mortality was assigned as cold season (November to April) and hot season (May to October). Year of calving was divided into 3 periods (2000-2004, 2005-2009 and 2010-2012). Parity of the dam is divided into 4 groups (first calving, second calving, from third to fifth calving and above five calvings).

The incidence of abortion, stillbirth and calf mortality was calculated as follows:

Number of females/calves affected
Total number of gestation cases

Data (abortion, stillbirth and mortality) were analyzed using chi-Square to test the distribution of each category using procedure of SAS (2009). Chi-square analysis is suitable for analyzing the categorical data to compare the observed frequencies with expected frequencies under the null hypothesis (Gupta and Kapoor, 2010; Chaudhary *et al*., 2013). This test was used in the current study to find out the effect of year of calving, season of calving, dam's age and parity at calving, farm, and calf's birth weight on the incidence of abortion, stillbirth and mortality.

RESULTS AND DISCUSSION

This study was focusing on the causes that might lead to inefficiency in the stock of buffalo calves available to be selected and used in the process of culling and replacement. Various factors that might account for this phenomenon including environmental factors (e.g. season, year, etc.), managerial factors such as feeding, housing, and mating practices in addition to health causes (diarrhea, pneumonia).

Data presented in Table 1 showed that the total percentage of calf losses in term of abortion, stillbirth and postnatal mortality in five herds of Egyptian buffalo females reached 16%. Abortion accounted 1.33%, the percentage of stillbirth was 3.65% and mortality rate was 11.05% from the

total pregnancies. In comparable with the present results, Afifi *et al*. (1992) reported 4.1% incidence of both abortion and stillbirth in Egyptian buffalo females. Ahmed and Zaher (2008) reported an abortion rate of 1.51% in Egyptian buffaloes, while Islam (2012) reported that stillbirth rate reached 1% in Bangladesh. Also, Khan *et al*., (2011) found that the overall incidence of abortion, stillbirth in Murrah buffaloes was 7.1 and 1.04, respectively.

The current results might be slightly higher than those obtained by Gulliksen *et al*. (2009), who found that calf mortality rate during the first year of life in all herds registered in the NDHRS reached 7.8%, including abortion (0.7%) and stillbirth (3.4%). The overall calf mortality rate in liveborn calves in the survey herds was 4.6% which is lower the results obtained in this study. In addition to that, average mortality rate from birth to 2 yr of age was 45.4-64% of the losses occurred during the first 3 months of age (Afifi *et al*., 1992). However, it is reported by El-Regalaty *et al*., (2013) that the percentage of buffalo calves born and survived to one month of age ranged between 8 to 22% depending upon the previous history of the dam. Thus, the reproductive loss could be attributed either to congenital environmental factors or other trans-placental infections (Ahmed and Zaher, 2008) in addition to compromised viability of the fetus associated with maternal milieu (El-Regalaty *et al*., 2013).

Table 1: Prevalence of abortion, stillbirth and postnatal mortality in five herds of Egyptian buffaloes.

Case	Number	Percentage
Total percentage of calf losses	1002	16
Abortion	93	1.33
Stillbirth	228	3.65
Postnatal mortality until 6 months	681	11.05

Effect of season of the year:

As shown in Table (2) the results indicate that the percentage of abortion during cold season (November to April) significantly ($P<0.05$) doubled that (68.8 *vs.* 31.2%) recorded during hot season (May to October). The same trend was also shown in Table (3) for stillbirth, being 68.9 *vs.* 31.1% ($P<0.001$). Higher incidence of abortion and stillbirth in the winter season could be due to the inclement weather and stress conditions that dams were subjected to during most of pregnancy interval that might be reflected on their newborn immunity. However, mortality rate (Table 4) was not affected significantly by season of calving, being 47.3% in cold season and 52.7% in hot season. In accordance with the present results, Khan *et al* (2007) found that season had no effect on calf mortality.

In contrast to the present results regarding incidence of abortion, Al-Samarai (2012) and Pandey *et al*. (2012) recorded the highest abortion rate in summer and spring, while the lowest values were recorded in winter and autumn. They attributed the significant differences between estimates to high temperature degrees which could cause heat stress and abortion in animals. Non significant seasonal effect was recorded by Khan *et al*. (2011), who found that season of calving had no significant effect on the incidence of

reproductive disorders including abortion and stillbirth. Meanwhile, the mortality rate of calves born was higher in summer (52.27%) than in winter (47.3%). However, Mourad and Rashwan (2001) found that the mortality rate of calves were higher in winter (53.6%) than in spring (17.3%) and summer (12%).

Effect of the year:

Data in Tables (2, 3 and 4) indicated that year had significant (P<0.001) effect on the abortion, stillbirth and mortality rates. The lowest rate of abortion, stillbirth and mortality occurred during the period from 2000 to 2004as compared to other periods. However, the highest rates occurred during the period from 2010 to 2012) In accordance with the present results, highly significant effects of year on stillbirth and mortality rates were reported by Pandey *et al*. (2012); and Schmidek *et al*. (2013). Also, Atashi *et al*., (2011) found that year of calving significantly affected the incidence of stillbirth. Contrary, non-significant effect of the year was reported on stillbirth Al-Samarai (2012) and abortion and mortality pattern in buffalo calves (Khan *et al*., 2011). Also, Adangale (2010) reported no effects of period of calving on mortality rates.

Effect of parity of the dam:

Data in Tables (2 and 3) revealed that incidence of abortion and stillbirth were affected significantly (P<0.001) by parity, being almost higher at the first and 2nd parities than at advanced parities. In agreement with the current results, Hashmi *et al* (2013) found that lactation number (parity number) significantly affected the abortion rate in calves. In this respect, Al-Samarai (2012) and Ghavi Hossein-Zadeh (2011) reported a significant effect of parity on stillbirth, partly because of a disproportion between the size of the calf and the pelvic area, which causes a difficult calving and increases stillbirth parturition incidence. Mortality rates in Table (4) indicated that, the mortality cases in the first and second parities was 42.3% from the total mortality recorded in the present study. This is probably because mature cows have greater body size and larger pelvic area compared to heifers; therefore adult cows are capable of developing and giving birth to healthier calves. The results in the present study agreed with those reported by Berger *et al.* (1992) and Zaman *et al*. (2006). In contrast to the present results, Hashmi *et al*. (2013) found high trend of mortality at the sixth lactation, which might point at dam's age.

Effect of the farm (location):

As shown in tables (2, 3 and 4), farm exerted highly significant (P<0.001) effects on the incidence of abortion, stillbirth and calf's postnatal mortality up to six months. The results (Table 5) also indicate that, the lowest percentage of abortion and stillbirth (to the total number of recorded disorders) were recorded in Gemaiza station (0.08% and 0.53%, respectively), while, the highest percentage (2.83% and 7.2%, respectively) were recorded in Nataf Kadim station. While the mortality rate was lower in Nataf Gadid and Sids stations (3.9% and 4.27%, respectively). The highest incidence of mortality were recorded in Gemaiza station (22.35%). These resultes may be due to lower abortion rates recorded in the current study

(Table 5) which may result in the delivery of weak / unfit newborn or lower birth weights of those new born calves as the livability of the calf may be increased as a result to increased birth weight. As reported by (Ghavi Hossein-Zadeh, 2011) in Iranian buffaloes, and Hashmi et al., (2013) and in Iraqi buffaloes; Schmidek et al., (2013) found that farm affected stillbirth and mortality but not abortion rates, where it might reflect poor managerial conditions during the last period of pregnancy.

Table(2):Percentage of aborted Egyptian buffalo from total recorded abortion cases as affected by season, year of calving, parity of dam and farm.

Factor	Number	%	Chi-square	Significance
Season:				
Cold	64	68.8	13.17	***
Hot	29	31.2		
Year period:				
2000-2004	5	5.4	42.0	***
2005-2009	32	34.4		
2010-2012	56	60.2		
Parity:				
1	61	65.6	87.26	***
2	19	20.4		
3-5	10	10.8		
>5	3	3.2		
Farm:				
Nataf Gadied	9	9.7	64.15	***
Nataf Kadeem	44	47.3		
Mehlet Mousa	28	30.1		
Saedes	11	11.8		
Gemaiza	1	1.1		

***** Highly significant (p<0.001).**

Effect of calf's sex:

Results in Tables (3 and 4) revealed that effect of calf sex was significant (P<0.001) on stillbirth and not significant on abortion. Generally, male calf experienced higher stillbirth (88.2%, Table 3) and nearly similar mortality (53.3%; Table 4) as compared to females The overall incidence of stillbirth in Iranian buffaloes was 12.8%, where male births had greater odds of stillbirth than female ones (Ghavi Hossein-Zadeh, 2011).The rates of stillbirth was reported to be 7.59 % as reported by Khan *et al*. (2007), who mentioned a non-significant difference in the calf mortality in male calves was 50.66% while it was 49.33% in female calves. The sex of the calf may cause variation in stillbirths percentage especially with larger birth weights, which is in general, and so the probability of calving problems increased and consequently results in stillborns and higher rates of mortalities.

Effect of dam's weight at calving:

Data in Table (3), indicated that dam weight at calving insignificantly affected stillbirth percentage, while, the dam weight had a significant (P<0.001) influence on mortality rate. Abortion, stillbirth and mortality rates might be genetically affected, since Hansen *et al*. (2004) and Ghavi Hossein-

Zadeh and Ardalan (2011a) reported an unfavorable trend of direct maternal genetic effects for stillbirths in the Danish Holstein population, even though these traits are influenced by both direct (calf) and maternal effects and with generally low heritabilities as reported in the literature (Koots *et al*., 1994a).

Effect of calf's weight at birth:

Table (3), showed that, calf's weight at birth significantly (P<0.001) affected rate of stillbirth. The current results were coherent with those reported in the literature (Schmidek *et al*., 2013). Calves weighed less than 20 kg was recorded 81.1% from the total stillbirth. As shown in Table (4), no significant effects of calf's birth weight on the rate of abortion. These results are in agreement with those previously reported that birth weight was the effect that most influenced the mortality rate. Calves weighing less than 22 kg (females) and less than 24 kg (males) were at a higher risk of low vigor and pre-weaning mortality (Schmidek *et al*., 2013). There is also a consensus that lighter calves are at a higher risk of death than heavier animals, even considering the occurrence of calving problems in heavier calves.

Table (3): Percentage of stillbirth of Egyptian buffaloes from total recorded stillbirths as affected by season, sex of calf, year of calving, parity of dam, dam weight at calving, calf weight and farm.

Factor	Number	%	Chi-square	Significance
Season:				
Cold	157	68.9	32.44	***
Hot	71	31.1		
Sex of calf:				
Male	201	88.2	132.79	***
Female	27	11.8		
Year period:				
2000-2004	13	5.7	107.87	***
2005-2009	74	32.5		
2010-2012	141	61.8		
Parity:				
1	167	73.6	296.19	***
2	39	17.2		
3-5	16	7.0		
>5	6	2.2		
Dam weight (kg):				
≤ 350	108	50.2	0.01	NS
>350	107	49.8		
Calf weight (kg):				
<20	172	81.1	221.39	***
20 -30	31	14.6		
>30	9	4.3		
Farm:				
Nataf Gadied	24	10.5	166.34	***
Nataf Kadeem	112	49.1		
Mehlet Mousa	67	29.4		
Saedes	18	7.9		
Gemaiza	7	3.1		

***** Highly significant (p<0.001). NS: non significant (p<0.05).**

Effect of calf's age at mortality:

Data in Table (3) indicated that mortality rate of calves was affected significantly (P<0.001) by calf age, being higher (92.5% from the total mortality) during pre-weaning than at weaning and post-weaning (5.6 and 1.9, respectively).The main causes of increasing mortality during pre-weaning were diarrhea, pneumonia or both, representing above 70% of mortality cases. The current results are in accordance with the results of Moran (2011), who observed that the highest pre-weaning mortality reached 81% as reported by a survey of various Indian dairy systems. However, Mourad and Rashwan (2001) showed that yearly average of calf mortility was 29.3% (calves died between births and weaning (~three months of age). They added that the highest mortality during the neonatal stage was due to inadequate care in management of newborn calves. From 31 to 60 days of age, mortality was mainly caused by an inadequate diet and milk withdrawal.

Table (4):Mortality rate of Egyptian buffalo calves from total recorded postnatal mortality as affected by season, sex of calf, year of calving, parity of dam, age at dead, dam weight at calving, calf weight and farm.

Factor	Number	%	Chi-square	Significance
Season:				
Cold	322	47.3	2.01	NS
Hot	359	52.7		
Sex of calf:				
Male	363	53.3	2.97	NS
Female	318	46.7		
Year period:				
2000-2004	13	5.7	31.57	***
2005-2009	74	32.5		
2010-2012	141	61.8		
Parity:				
1	166	24.4	25.89	***
2	122	17.9		
3-5	215	31.6		
>5	178	26.1		
Age at dead:				
Pre-weaning	630	92.5	1074.56	***
At weaning	38	5.6		
Post-weaning	13	1.9		
Dam weight (kg):				
< 350	229	35.1	175.87	***
350 - 450	350	53.6		
>450	74	11.3		
Calf weight (kg):				
<=30	177	26.9	140.45	***
>30	481	73.1		
Farm:				
Nataf Gadied	43	6.3	522	***
Nataf Kadeem	151	22.2		
Mehlet Mousa	154	22.6		
Saedes	38	5.6		
Gemaiza	295	43.3		

***** Highly significant (p<0.001).NS: non significant (p<0.05).**

Table 5: Prevalence of abortion, stillbirth and postnatal mortality in five herds of Egyptian buffalo.

m Farm	Total number Of pregnancies	*Total number (N) and percentage of disorders (%)		* Incidence of Abortion number (N) and percentage (%)		*Incidence of Stillbirth number (N) and percentage (%)		*Incidence of Postnatal mortality number (N) and percentage (%)	
Farm (Herd)	N	N	%	N	%	N	%	N	%
Nattaf Gedid	1104	76	6.89	9	0.82	24	2.17	43	3.9
Nattaf Kadeem	1555	307	19.74	44	2.83	112	7.2	151	9.71
Mehallet Mousa	1300	249	19.15	28	2.15	67	5.15	154	11.85
Sids	890	67	7.53	11	1.24	18	2.02	38	4.27
Gemaiza	1320	303	22.96	1	0.08	7	0.53	295	22.35

***Trait percentage was calculated as the number of each trait recorded /total number of pregnancies in each herd**.

CONCLUSION

Farm conditions, herd management and policy (as main non-genetic factors) are found to have pronounced effects on the incidence of abortion, stillbirths and postnatal mortality. The results of this study could be useful to enhance productive and reproductive performance in large and small sized buffalo herds.

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تأثير العوامل غير الوراثية على معدلات حدوث الإجهاض والأجنة الميتة ونفوق العجول بعد الولادة فى الجاموس المصرى

حسين أحمد مصطفى الرجلاتى و حسن بيومى أبو العلا
معهد بحوث الأنتاج الحيوانى – مركز البجوث الزراعيه - مصر

يسبب فقد أجنة الجاموس أثناء الحمل وعند الولادة وكذا عقب الولادة خسائر إقتصادية ضخمة (سواءً بمزارع الجاموس الكبرى، أو على مستوى صغار المزارعين) ومن ثم بقطاع الثروة الحيوانية ككل. لذا تهدف هذه الدراسة إلى تقديرمؤشرات حدوث الإجهاض، والأجنة الميتة وقت الولادة، وكذا النفوق المبكر للعجول عقب الولادة، وذلك فى خمسة قطعان من الجاموس تابعة لمعهد بحوث الإنتاج الحيوانى، موزعة على عدة مناطق من الجمهورية - حيث تضمن البحث بالدراسة عدد ٦١٦٩ حالة حمل (بغرض تحديد معدلات حدوث كل من الظواهر الثلاثة محل الدراسة). كذلك تم دراسة تأثير كل من: المزرعة، سنة الإجهاض أو الولادة، موسم الإجهاض أوالولادة، رقم الموسم للأم، وزن الأم عند الولادة، بالإضافة إلى عمر وجنس العجل عند النفوق - على كلٍ من الظواهر الثلاثة المدروسة.

وقد أظهرت النتائج أن العدد الإجمالي لفقد النتاج (أثناء الحمل - وخلال فترة ما بعد الولادة) هو ١٠٠٢ عجلاً (بنسبة ١٦ ٪). وصل العدد الإجمالى للإجهاضات إلى ٩٣عجلاً (بنسبة ١,٣٣ %)، وكذا عدد العجول النافقة أثناء الولادة أو عقبها مباشرة ٢٢٨ عجلاً (بنسبة ٣,٦٥ %)، كما بلغ عدد حالات النفوق المبكر للعجول المولودة (حتى عمر ستة أشهر) ٦٨١ عجلاً (بنسبة ١١,٠٥٪). تأثر حدوث الإجهاض بشكل كبير بفصل السنة، ومرحلة الحمل، ورقم موسم ولادة الأم، إضافة إلى تأثير المزرعة. بالرغم من أن جميع هذه العوامل (إضافةً إلى عامل وزن العجل) قد كان لها آثاراً كبيرة على معدلات نفوق العجول (وقت أو عقب الولادة)، إلا أنه لم يكن لوزن الأم عند الولادة أثراً كبيراً على هذه المعدلات. كان لفصل السنة، رقم الموسم، وزن الأم عند الولادة، المزرعة بالإضافة إلى عمر ووزن العجل عند النفوق تأثيرات معنوية كبيرة على معدلات نفوق العجول خلال الستة أشهر الأولى بعد الولادة. وتلقى هذه الدراسة مزيد من الضوء على أهمية العديد من العوامل غير الوراثية من حيث تأثيراتها الجوهرية على كلٍ من معدلات الإجهاض أثناء الحمل، وفقدان العجول أثناء الولادة، وكذا نفوق العجول الجاموسى المولودة (خلال الستة أشهر الاولى بعد الولادة).

لذا توصى هذه الدراسة بضرورة تلافى جميع أسباب الخلل الرعائى للجاموس (سواءً بالمزارع الكبيرة، أو على مستوى صغار المزارعين) للنهوض بإنتاجية هذا الحيوان، وتقليص للخسائر الإقتصادية الناجمة عن فقد النتاج خلال فترات ماقبل، أو أثناء، أو ما بعد الولادة.