RESEARCH REGARDING THE INFLUENCE OF SOME FACTORS ON BODY DEVELOPMENT OF INFANT CALVES

V. Maciuc[1*]

[1]*University of Agricultural Sciences and Veterinary Medicine Iasi, Romania*

Abstract

It is known that in their first month of life, calves have a major sensitivity and they are predisposed to different diseases, with major gravity because of the economic losses these diseases cause for cattle production and reproduction. Our research was made on 320 infant calves from Romanian Black Spotted breed and we observed some factors related with body development as: weight at birth, sex, primiparous/ multiparous cows, maintenance system, and season of the year. Preliminary data was included in a database statistically interpreted with the help of specific methods. The female infant calves obtained from primiparous mothers had an average weight of 39.51 kg and those obtained from multiparous mothers – 40.35 kg. These differences are significant $p < 0.05$, C.I. 95% and show a weight of 49.62 kg at 15 days and 50.87 kg at 30 days for the first category and 59.92 kg at 15 days and 61.23 kg at 30 days for the second category. The weight differences recorded values of 0.84 kg at birth, 1.25 kg at 15 days from birth and 1.31 kg at 30 days from birth for the calves obtained from adults. The male infant calves obtained from multiparous cows had an average weight of 40.75 kg instead of 40.05 kg recorded for the calves obtained from primiparous cows. At 15 days and 30 days after birth the weight differences from the two categories are significant $p < 0.05$ C.I. 95%: 51.65 kg for the calves obtained from multiparous cows and 50.54 kg for the calves obtained from primiparous cows, respectively 62.75 and 61.42 kg. The calves obtained from adult cows recorded the following weight differences: by 0.70 kg at birth, 1.11 kg at 15 days and 1.33 kg at 30 days. These differences recorded in the body development of the infant calves where also observed for the other factors we have studied. Accordingly, the farmers have to be aware of these facts for being able to prevent the abnormal developments or high mortality rates.

Key words: calves, infants, influence factors, body development

INTRODUCTION

The intensive calf breeding wants to avoid and combat calves diseases in the aim of reducing the loss of sucking calves.

Usually calves have two health problems: diarrhoea and pneumonia [2]. The most frequent is diarrhoea which can have an infectious or "mechanical" origin. Diarrhoea is caused by excessive milk feeding, milk supplier or an improper milk supplier. This results into incomplete clot forming followed by a low intestinal absorption and a fast intestinal transit.

Infectious diarrhoea can have viral or bacterial origin. Bacterial diarrhoea is caused by some common etiologic agents: *Escherichia coli* and *Salmonella sp.*

Viral diarrhoea is caused by rotaviruses and coronaviruses. Favourable causes of diarrhoea are the lack of maternity and the lack of hygiene of nursing.

In most of the farms hygiene rules are not observed, especially for new born calves which do not have the capacity to synthesise antibodies in the first eight days of life because passive immunity wasn't submitted from the mother [7]. Hence our initiative to study the influence of some factors on corporal development at sucking calves.

MATERIAL AND METHOD

The research was made in one year's time (January 2012 – December 2012) so as to cover all four seasons. The study was conducted on 320 Black and White Romanian calves from S.C.D.C.B. Dancu Iasi (Research and Development Resort for Breeding Cattle) which are distributed by body mass at birth, sex, mother parity,

*Corresponding author: vmaciuc@yahoo.fr
The manuscript was received: 25.01.2013
Accepted for publication: 18.09.2013

exploitation system, season, all these being factors which can influence corporal development at sucking calves [6].

The parameters taken into account were: monthly average temperature (^{0}C), relative air humidity (%), wind speed (m/s), corporal development based on principal corporal dimensions, average daily gain according to calving season and other important factors, such as disease frequency and calves' mortality in the experimental period.

Primary data was systematized, processed and interpreted [1] by specific methods for this kind of research ($\overline{X}$, $\pm s_{\overline{x}}$, s, p test, confidents interval de C.I.). Also data analyses were made in association with numerous observations from the farm [1].

RESULTS AND DISCUSSIONS

It is known that in their first month of life calves have a great sensitivity and are exposed to different diseases thus causing a major economic loss in cattle production and reproduction [3, 5].

Feeding norms for 0-3 months aged calves and sucking program until weaning (90 days) on S.C.D.B. Dancu, Iasi are presented in tables 1 and 2.

After 40-60 minutes from calving the calf is left to suck of its mother cow. Colostrum had a higher nutritive value than normal milk and with its high content of immunoglobulin assures the transfer of passive immunity from mother to baby calf, an action that registered other factors in the category with antimicrobial unspecific character: lysozyme, lactoferrin, lactopexidoz-thiocyanate-hydrogen-peroxide, xanthine oxidase, vitamin B12 and folic acid.

The first day after calving, colostrum feeding is of 4-5 times with 0.5 – 0.6 litres per one feeding, the next two days colostrum quantity grows to 0.7-1.0 l per one feeding and at the same time one reduces the number of colostrums feedings per day and it should not be increased until the end of the first week when calves must eat 6 l colostrums in 2-3 feedings per one day.

Table 1 Feeding norms for calves between 0 – 3 month(s) of age

S.U. kg.	U.N.	P.B.D. g	Salt g.	water l.
1.4	2.2	250	10	6

S.U. – dry matter, U.N. –nutritive units, P.B.D. – crude protein digestible. Kg. Kilograms, g. grams, l. litres

Table 2 Milk feeding scheme for calves until weaning (90 days) on S.C.D.B. Dancu

Period days	Colostrum		Integral milk		Concentrate	Hay
	Number of feeding	Quantity litres/meal/head	Number of feeding	Quantity litres/meal/head	Quantity grams/meal/head	Quantity grams/meal/head
1 - 2	5 - 6	0,5 -0,7				
3 - 6	3	0,7 - 1				
7 - 13			2	3	50-100	Ad libitum
14 - 83			2	3	100-250	Ad libitum
83 - 90			1	2	350-400	Ad libitum

External environmental factors have a great influence upon calf breeding near the breeding system (housing, moving and hygiene), feeding and health.

In order to determine the influence of climatic parameters (temperature, atmospheric humidity, air stream and precipitation) on calves' breeds in individual modules**,** outside the barn, values were monitored in 2012 for S.C.D.C.B. Dancu Iasi.

Figure 1 presents the monthly temperature evolution and its influence on average daily gain (fig. 2) in 2012.

An average monthly temperature between -6^{0}C in winter season (January-February) and 28^{0}C in summer season (Julie-August) was found.

Monthly temperature values' curve has an ascendant phase from March, with maximum value in July and August, after that following a descendant phase in autumn, with minimum values in winter. Minimum temperature values were registered in January and February [4].

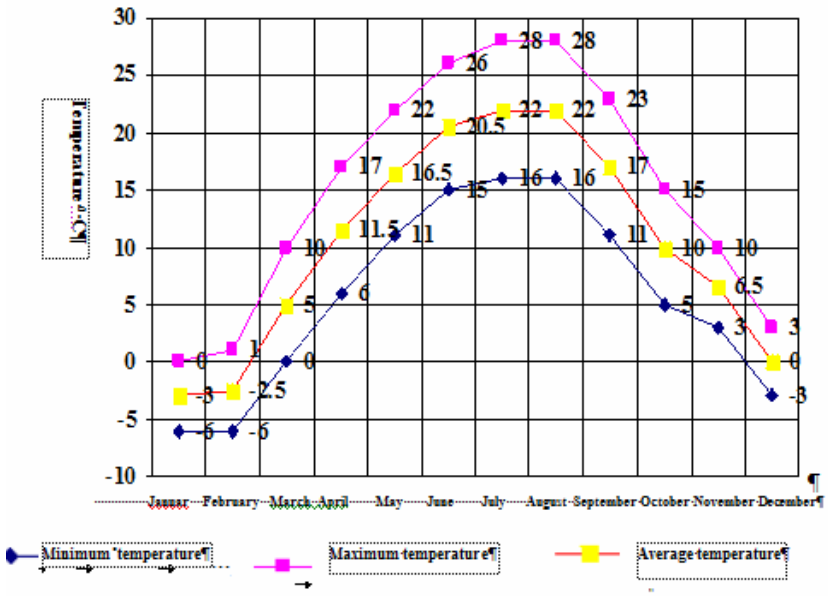

Fig. 1 Evolution of monthly temperature

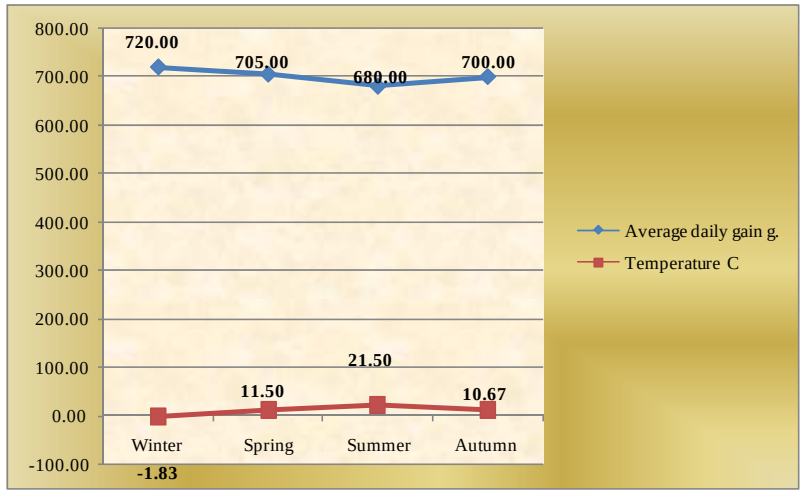

Fig. 2 Temperature Influences on average daily gain

The temperature has influenced corporal development of calves, resulting from average daily gain evolution and body mass evolution from birth until the age of 30 days, period in which the experiment took place.

Therefore in winter months the calves' average daily gain in the first 30 days of life was 720 grams and in summer months was 680 grams.

Thereby average daily gain has a low descendant curve in warm season and a low growing in cold season with maximum value in winter.

Relative humidity was between 85.33% in winter and 69.00% in summer. In spring and summer, when the smallest relative humidity of air was registered, the smallest average daily gain of 686 grams was obtained. One can conclude that low calves' appetite in warm

and dry season has influenced food ingestion and, thus, average daily gain.

For air stream monthly evolution an average of 2.83 m/s in winter and 3.27 m/s in summer was found. Starting with September, in autumn season and in early winter air stream speed had registered the smallest intensity. Afterwards, in winter, spring and autumn a higher intensity was registered, but with variation from a month to another. Precipitation had also registered an average value of 31 mm with maximum value of 91 mm in July and a minimum value of 3 mm in November. Precipitation level was low in January – March and August - December whereas in April – July a higher level of precipitation was registered, the exception being encountered in October when a value of 52 mm was registered.

The average body mass of calves at birth (tab. 3) was almost the same in winter (40.45 kg), spring (40.29) and autumn (40.40 kg), in summer being smaller (39.14 kg). The differences in average body mass at birth between seasons were significant for $p < 0.05$, C.I. 95 %.

In table 4 are presented data of male and female calves' corporal development resulted from primiparous cows and multiparous cows. Male calves from multiparous cows had an average body mass of 40.75 kg compared to 40.05 kg for calves from primiparous cows. At 15 days old and 30 days old the differences between the two categories are significant $p < 0.05$ C.I. 95 % (51.65 kg for calves from multiparous cows and 50.54 kg for calves from primiparous cows, 62.75 kg and 61.42 kg respectively).

Table 3 Body mass on birth depending on season

Season	Winter	Spring	Summer	Autumn
N. heads	82	80	79	72
$\bar{X}$ kg	40,45 ± 0,23	40,29 ± 0,17	39,14 ±0,29	40,40 ± 0,09

Table 4 Average value for corporal development to female and male calves

Average	N. heads.	Mother category	At birth		15 days		30 days	
			P.T. cm	Gr. Kg	P.T.cm	Gr. Kg	P.T.cm	Gr. Kg
Male calves								
$\bar{X}$	109	multiparous	76,35	40,75	82,36	51,65	87,73	62,75
$\bar{X}$	58	primiparous	74,16	40,05	80,13	50,54	84,27	61,42
$\bar{X}$ total	167		75,77	40,24	81,92	50,72	86,37	61,67
$\bar{X}$ s.m.z.	109	multiparous	0-15 days	683 g	15-30 days	731 g	0-30 days	707 g
$\bar{X}$ s.m.z.	58	primiparous	0-15 days	681 g	15-30 days	726 g	0-30 days	704 g
$\bar{X}$ s.m.z. total	167		0-15 days	685 g	15-30 days	730 g	0-30 days	708 g
Female calves								
$\bar{X}$	98	multiparous	76,18	40,35	82,20	50,87	87,44	61,23
$\bar{X}$	48	primiparous	74,09	39,51	79,18	49,62	84,06	59,92
$\bar{X}$ total	146		75,73	40,08	81,39	50,19	86,38	60,37
$\bar{X}$ a.d.g.	98	multiparous	0-15 days	675 g	15-30 days	702 g	0-30 days	688 g
$\bar{X}$ a.d.g.	48	primiparous	0-15 days	663 g	15-30 days	687 g	0-30 days	675 g
$\bar{X}$ a.d.g. total	146		0-15 days	674 g	15-30 days	699 g	0-30 days	685 g

$\bar{X}$ *- average, P.T. thoracic perimeter, Gr. Body mass*

Body mass differences were by 0.70 kg at birth, 1.11 kg at 15 days of life and 1.33 kg at 30 days of life in favour of adult cows. The same aspects are registered for thoracic perimeter which has an average value of 76.35 cm for males from multiparous cows and 74.16 cm for males from primiparous cows with significant differences between these two categories for $p < 0.05$. Also the evolution of the thoracic perimeter at 15 days of life was 82.36 cm for calves from multiparous cows and 80.13 cm for calves from primiparous cows and at 30 days of life was 87.73 cm respectively 84.27 cm.

As for the female calves from primiparous cows, these had an average body mass at birth of 39.51 kg compared to 40.35 kg for the female calves from multiparous cows. These differences are significant for $p < 0.05$, C.I. 95 % and are maintained at 15 days of life (49.62 kg and 50.87 kg) and at 30 days of life (59.92 kg and 61.23 kg). Body mass differences were by 0.84 kg at birth, 1.25 kg at 15 days old and 1.31 kg at 30 days old, in favour of calves from adult cows. Thoracic perimeters had the same evolution as body mass: 74.09 cm – 76.18 cm at birth, 79.18 cm – 82.20 cm at 15 days old and 84.06 cm – 87.44 cm at 30 days old.

Male and female calves body mass evolution from primiparous and multiparous cows on each season are presented in table 5. Thus, the smallest value for body mass was registered in summer for female calves from primiparous cows**.** Differences of average values between sexes and body mass between season and mother category are significant for $p < 0.01$, C.I. 95 %.

Analysing these values it becomes obvious that at all ages calves born in summer had an inferior body mass and body development compared with calves' born in cold seasons (winter and autumn). The same aspects are valid for thoracic perimeter (tab. 6) which is intermediary positively correlated (0.33 – 0.37%) with body mass. The smallest value was registered in the summer season on female calves from primiparous cows, respectively at birth 75.29± 0.33, at 15 days old 81.14± 0.32 and at 30 days 86.03± 0.39, for this character multiparous cows had superior value from primiparous cows depending on season and sex. The average daily gain on different ages depending on sex and season is presented in figures 3 and 4. Here we can see a different evolution depending on the studied factors.

On S.C.D.B. Dancu, Iasi, starting with 1986 calves are housed in individual modules outside barns from calving until 30 or 40 days old.

It is a modern system which spread in cattle farms from our country regardless of region or climatic conditions with remarkable results, that this system is generalised in cattle farms. In the process of our research we have noticed a significant reduction of enteritis, bronchopneumonia and umbilical infection cases. Of the health problems we can mention gastrointestinal type, which appears in warm seasons and influenced calves' appetite and favours infection sources [4].

The calves' mortality rate was bigger in summer than in other seasons, calves born in cold season having a good vitality and resistance. The good environmental influence for calves housed in individual modules is obvious from a reduced percentage of mortality (3.76 %,) reported at studied calves [4].

Table 5 Body mass average value on male and female calves depends of season

$\bar{X}$	N. cap.	at birth		15 days		30 days	
		Primiparous	Multiparous	Primiparous	Multiparous	Primiparous	Multiparous
Male calves							
Winter	42	40.43± 0,33	40.71± 0,45	50.74± 0,13	51.53± 0,38	61.79± 0,42	62.81± 0,51
Spring	41	40.23± 0,15	40.6± 0,37	50.63± 0,15	51.22± 0,25	61.57± 0,37	62.54± 0,47
Summer	41	39.73± 0,11	40.28± 0,23	50.08± 0,21	50.72± 0,19	60.59± 0,28	61.6± 0,32
Autumn	41	40.37± 0,27	40.53± 0,42	50.69± 0,27	51.33± 0,30	61.63± 0,39	62.71± 0,49
Female calves							
Winter	37	40.28± 0,13	40.57± 0,35	50.45± 0,22	51.15± 0,48	61.13± 0,38	62.22± 0,31
Spring	37	39.72± 0,15	40.34± 0,31	49.82± 0,25	50.87± 0,31	60.77± 0,18	61.74± 0,25
Summer	37	39.41± 0,19	40.09± 0,13	49.63± 0,11	50.49± 0,24	59.52± 0,31	61.15± 0,22
Autumn	27	39.81± 0,21	40.27± 0,12	50.19± 0,37	51.07± 0,35	60.81± 0,37	62.14± 0,34

Table 6 Thoracic perimeter average value on male and female calves depends on season

$\bar{X}$	N. heads	At birth		15 days		30 days	
		Primiparous	Multiparous	Primiparous	Multiparous	Primiparous	Multiparous
Male calves							
Winter	42	75.73± 0,43	76.47± 0,47	81.40± 0,53	82.41± 0,58	86.39± 0,48	87.80± 0,54
Spring	41	75.59± 0,35	76.36± 0,31	81.34± 0,35	82.32± 0,27	86.27± 0,35	87.68± 0,33
Summer	41	75.03± 0,29	76.02± 0,33	80.48± 0,31	81.82± 0.39	85.79± 0,48	86.79± 0,40
Autumn	41	75.87± 0,37	76.53± 0,42	81.49± 0,38	82.53± 0,37	86.23± 0,48	88.05± 0,53
Female calves							
Winter	37	75.29± 0,33	76.08± 0,38	81.14± 0,32	82.17± 0,32	86.03± 0,39	87.11± 0,34
Spring	37	75.09± 0,28	75.97± 0,22	80.92± 0,25	81.97± 0,39	85.88± 0,28	86.94± 0,45
Summer	37	74.61± 0,33	75.39± 0,23	79.77± 0,31	80.85± 0,38	85.08± 0,41	85.98± 0,51
Autumn	27	75.51± 0,57	76.10± 0,42	81.18± 0,29	82.03± 0,45	85.97± 0,48	86.98± 0,54

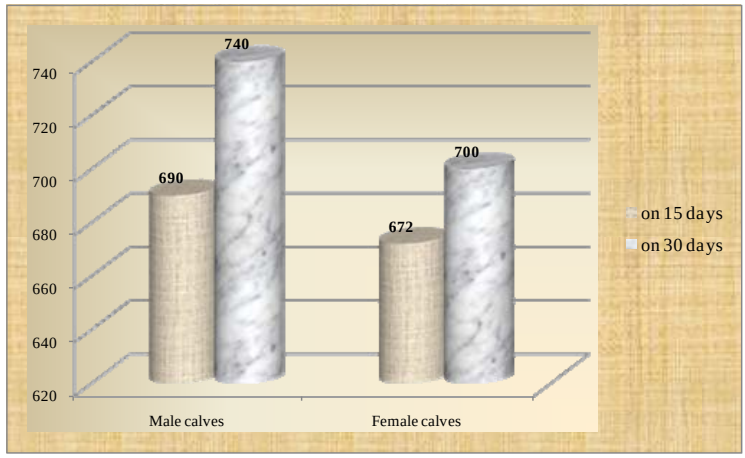

Fig. 3 Average daily gain evolution depends on calves' sex and age

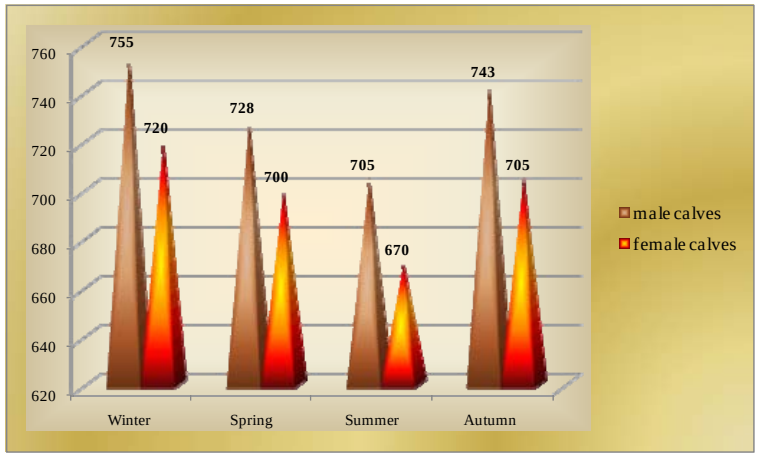

Fig. 4 Average daily gain evolution depends on calves' sex and season

Similar research, made in another county from the Moldovan area, shows that the calves housed outside had registered a better average daily gain than the calves housed inside the barn, but with a greater specific consumption. This can be explained through the influence of a healthy climate, without emission for calves housing outside, in individual modules [8].

CONCLUSIONS

The results that were presented allow us to conclude that the influence of the above discussed factors – calves housing, feeding, mother parity, calves sex, climatic factors (temperature, humidity, and stream air speed) – has a great impact on corporal development and health.

Monitoring these factors we can avoid the loss of mortality from cattle production and reproduction.

ACKNOWLEDGEMENTS

S.C.D.C.B. Dancu Iasi for possibility to made this research.

REFERENCES

[1] Cucu Gr. I., Maciuc V., Maciuc Domnica – Cercetarea ştiintifică şi elemente de tehnică experimentală în zootehnie. Ed. Alfa, Iaşi, 2004

[2]Lago A., McGuirk S.M., Bennett T.B., Cook N.B., Nordlund K.V. - Calf Respiratory Disease and Pen Microenvironments in Naturally Ventilated Calf Barns in Winter. Journal of Dairy Science, Volume 89, Issue 10 , Pages 4014-4025, October 2006

[3] Macdonald K.A., McNaughton L.R., Verkerk G.A., Penno J.W., Burton L.J., Berry D.P., Gore P.J.S., Lancaster J.A.S., Holmes C.W.-A Comparison of Three Strains of Holstein-Friesian Cows Grazed on Pasture: Growth, Development, and Puberty. Journal of Dairy Science**,** Volume 90, Issue 8 , Pages 3993-4003, August 2007

[4] Maciuc V., Creangă Şt., Ujică V., Popescu E.C. - Research regarding baby calves housing in individuals igloo nestled outside barn. Lucrări ştiinţifice seria zootehnie, vol 55 (16) U.Ş.A.M.V. Iaşi, 2011

[5] Maciuc V., Nistor E. C., Bugeac T. - Research regarding reproduction capacity at dairy cows and the ways of improvement by application of biotechnologies. European Congress on Biotechnology. Journal of Biotechnology, Volume 161, Supplement, P. 23, 2012

[6] Roy J.H.B.- Factors Affecting Susceptibility of Calves to Disease. Journal of Dairy Science, Volume 63, Issue 4 **,** Pages 650-664, April 1980

[7] Trotz-Williams L.A., Leslie K.E., Peregrine A.S.- Passive Immunity in Ontario Dairy Calves and Investigation of Its Association with Calf Management Practices. Journal of Dairy Science**,** Volume 91, Issue 10 , Pages 3840-3849, October 2008

[8] Ujică V., Stan V., Gîlcă I., Gavrilaş Angela – Cercetări privind întreţinerea viţeilor sugari, pe tot timpul anului, în cuşti individuale, amplasate în afara adăpostului. Cercetări Agronomice în Moldova, vol. XXIV, p. 85-89, Iaşi 1991.