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STUDIES ON SOME BEHAVIOURAL PATTERNS, PERFORMANCE AND IMMUNE STATUS IN DAIRY CALVES UNDER FIELD CONDITIONS

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SUMMARY

This study was carried out in two dairy farms in Beni-Suef governorate on a total of 67 calves from birth till weaning age. The calves in farm (I) isolated from their dams after five days postpartum while in farm (II) the calves kept with their dams. Oral and social behavioural patterns of these calves were recorded. Calf performance as well as average daily gain in body weight, girth, height and length were measured till weaning age. Moreover IgG and IgM were estimated in the sera of newly born calves during pre and post colostrol feeding. These paramaters were also estimated in the colostrum.

Results revealed an increase in oral behavioural patterns with the advance of age in calves of both farms. The percentage of time in rumination in calves at the age of 6 weeks was significantly higher (20.20 %) in farm I than in farm II (14.62%). Social behaviour under natural rearing system (farm II) was improved to a greater extent than under artifical rearing (farm I).

The obtained results showed an increase in calf birth weight in farm (I) (30.68 Kg) than those in farm (II) (27.70 Kg), while there was no significant difference in the average daily weight gain between the two farms. Moreover, the other calf body measurements showed no significant differences between the two farms.

The levels of IgG in farm (I & II) at birth amounted to 1.74 and 1.96 mg/ml respectively. After 24 hours post colostrol feeding these val-

ues increased to 35.47 and 39.52 mg/ml. On the other hand, the levels of IgM in farm (I & II) at birth were 0.18 and 0.14 mg/ml respectively, and increased to 2.69 and 2.73 mg/ml 24 hours after post colostrol feeding. In the colostrum, the levels of IgG in farm (I) and (II) (21.95 and 21.24 mg/ml) were higher than those of IgM (2.48 and 2.42 mg/ml). It was concluded that cohabitation of the calves with their dams from birth till weaning favour the calf welfare, improving the social behaviour and immune status which reflects the high performance.

INTRODUCTION

The dairy calves play an important role in the animal production enterprises and farm economies. All systems of calf rearing demand high standards of performance achieved as economically as possible. It is fortunate that in the period up to twelve weeks, the age at which the calf is considered to be reared, good rates of growth are synoymous with economic performance (Thickett et al., 1990). Nowadays under intensive method of calf management it becomes necessary to improve management practices to reduce suboptimal performance and to satisfy normal maintenance behavioural needs of calves (Fraser, 1980). The behaviour of a young calf vary according to its environment which may range from that of the single suckled calf at pasture to that of the veal calf isolated in a wooden crate without access to soild food or bedding (Stephens & Toner, 1975). Systems of rearing, calf age, type and amount of food affecting on oral and feeding behaviour among calves as recorded by (Fraser and Broome, 1990; Sato and Kuroda, 1993; Zerbe et al., 1993, and Watl et al., 1995). In addition Le-Neindre, 1993 mentioned that grooming behaviour vary according to system of calf management and housing, moreover Albright et al., 1991 found that time spent performing grooming decreased with age for stall calves and for penned calves. El-Sayed et al., 1991 demonstrated that absolute rate daily growth of calves was significantly higher in the suckled group (0.68 kg) than in the artificially-fed group (0.53 kg). While Little et al., 1993, concluded that inadequate calf management at the preweaning stage will lead to poor performance. Whatever the system of rearing the colostrum intake by calf as early as possible is essential to achieve maximum immunoglobulin absorption and transfer which protect the calf against infection (Gay, 1983; and Thickett et al., 1990). So the present study was carried out to investigate the effect of rearing systems under field conditions on oral and social behaviour, performance and immune status of dairy calves.

MATERIALS AND METHODS

This study was carried out in two dairy farms in Beni-Suef governorate on a total of 67 calves from birth till weaning under different rearing systems, during the period from February 1997 to the same month on the next year, 1998. Whatever the system of calf management, the calf must received the colostrum directly after birth. Therefore the studied calves were left with their dams for 5 days post calving in both farms and the design managment was done afterthat.

Accommodation and system of mangement:

Farm I: The herd was consisted of 39 Friesian (crossbred with balady) dairy cows. Their newly born calves were usually born in a group calving area (6 x 12 meter) with earthy floor and partially sheded. calves were identified by a metal ear tag while still in the calving area and left with their dams for 5 days post partum to obtain colostrum by natural suckling, afterthat calves were seperated from their dams and artificially fed whole milk from a pail with a floating nipple twice daily at a rate of 10 % of body weight. These calves were housed in a naturally ventilated barn divided into individual pens, with a concrete floor associated with a yard. Hay and straw was offered at one week of calf age, and water supplied after two weeks of age. In addition calf starter was fed at the fivth weeks of calf age at a rate of $^1/_4$ -$^1/_2$ kg/calf daily. Calves of different ages and sizes were housed with each other and weaned at 15 weeks of age.

Farm II: The herd was consisted of 28 Friesian (crossbred with balady) dairy cows, housed separately in naturally ventilated double row byre on a tied stall with concrete floor. Their newly born calves were born either inside the cattle byre during the neight or outside under shaded area during the day time. Calves were identified in the second days post-partum by a plastic ear tag, and transfered with their dams to an area beside the feeding space inside the byre and left to obtain colostrum and stay throughout the suckling period till weaning at 15 weeks of age. Those calves were naturally suckled from their dams twice daily in the early morning and late afternoon which was associated with milking times. Straw, hay, green fodders and concentrate were offered to the calves after the third week of age. Water was available through common water troughs in both farms.

Behavioural patterns observations and measurements:

It include the oral behaviour including drinking water, eating hay or straw, eating concentrates and rumination. Social behaviour that recorded in-

clude selfgrooming, groom other calves (mutual grooming), suck other calves and moo. Each behavioural patterns was considered in sequence and record occurred as the number of calves in group engaging in that behavioural pattern during a period of about 15 seconds (Webster et al., 1985). The complete seen of behavioural patterns was repeated at 5 minutes intervals for periods of 60 minutes. Observation were made at 2, 6, 10 and 14 weeks of calf age over periods of 4 hours per day in early and late morning and early and late afternoon times.

Calf performance: It is expressed as the average daily gain, kg (ADG) from birth till weaning age as mentioned by (Browning et al., 1995 & Shell et al. 1995). In addition body measurements as well as heart girth (cm), height at withers (cm) and length from point of shoulder to point of buttocks (cm) were recorded at birth and weaning age (Virtala et al., 1996).

Immunoglobulins estimation: IgG and IgM were estimated in both serum of newly born calves and colostrum as follows:-

Samples:

1- Blood samples, were taken from claves by jugular vein puncture immediately after birth (pre colostrol feeding) and 24 hours post colostrol feeding in clean polyethylene tubes and centrifuge to obtain serum.

2- Colostrum samples, about 10 ml of first milking colostrum was taken from dams immediately after calving in clean polyethylene tubes.

Both serum and colostrum samples were stored at -20° in deepfreezer till further analysis.

IgG and IgM were estimated in serum by immunoturbidinetric assay (Hills and Tiffany, 1980) while in colostrum was measured by single radial immunodifusion or antibody plate method as described by (Fahey and Mckelvey, 1965 and Fleenor & Stott, 1981).

The Obtained results were statistically analyzed by using analysis of variance (ANOVA) according to Snedecor and Cochran, 1989. Statements of statstical significance were based on $P < 0.05$.

RESULTS

Table (1): Mean values for percentage of time spent in oral behaviour of calves based on 4-hrs observations per day in the two examined farms throughout the experimental period.

Behavioural patterns	Calf age in weeks	Farms	
		I	II
- Drinking water	2	0.00	0.00
	6	0.10 ± 0.10 b	0.14 ± 0.14 b
	10	3.17 ± 0.57 a	1.05 ± 0.77 a, *
	14	4.87 ± 1.09 a	1.89 ± 0.55 a, *
- Eating hay, grass or straw	2	2.94 ± 0.90 c	0.00
	6	7.29 ± 1.74 b	9.14 ± 2.91 c
	10	10.88 ± 1.06 b	13.90 ±5.71 b
	14	16.62 ± 2.14 a,*	21.44 ± 4.29 a
- Eating concentrates	2	0.00	0.00
	6	5.19 ± 1.78 b	1.33 ± 1.30 b,*
	10	6.82 ± 1.65 b	7.56 ± 4.96 a
	14	11.35 ± 1.69 a	9.32 ± 4.88 a
- Rumination	2	1.57 ± 0.59 b	0.00
	6	20.20 ± 2.43 a	14.62 ± 2.97 b, *
	10	21.10 ± 1.69 a	16.04 ± 6.89 ab
	14	21.95 ± 2.35 a	19.23 ± 2.01 a

a ,b,c Means ± S.E. of the column of the same parameter,with the same letter are not significantly different at $P < 0.05$

* Means significantly different at $P < 0.05$

Table (2): Mean values for percentage of time spent in some social behaviour of calves based on 4-hrs observations per day in the two examined farms throughout the experimental period.

Behavioural patterns	Calf age in weeks	Farms	
		I	II
- Grooming (self-grooming)	2	5.20 ± 0.99	5.96 ± 1.51 [b]
	6	5.48 ± 0.89 [*]	8.35 ± 0.98 [a]
	10	6.02 ± 0.97	7.01 ± 0.86 [a]
	14	6.89 ± 0.78	7.41 ± 0.88 [a]
- Groom other calf	2	0.00	0.00
(mutual grooming)	6	0.50 ± 0.25	0.98 ± 0.39 [b]
	10	0.43 ± 0.19 [*]	1.58 ± 0.83 [a]
	14	0.41 ± 0.22	0.72 ± 0.37 [b]
- Suck other calf	2	0.00	0.00
	6	1.20 ± 0.56 [a]	0.46 ± 0.18 [*]
	10	0.90 ± 0.51 [a]	0.00
	14	0.68 ± 0.33 [b]	0.30 ± 0.18
- Moo	2	0.30 ± 0.12 [b,*]	1.91 + 0.62 [a]
	6	0.87 ± 0.42 [a,*]	1.82 ± 0.69 [a]
	10	0.49 ± 0.23 [b,*]	1.90 ± 0.67 [a]
	14	0.41 ± 0.18 [b]	0.91 ± 0.54 [b]

[a ,b] Means ± S.E. of the column, of the same parameter with the same letter are not significantly different at $P < 0.05$

[*] Means significantly different at $P < 0.05$.

.Table (3): Mean values body weight, height, girth and length at birth and weaning time in the two examined farms .

Item \ Farm	I	II
- Body weight (Kg)		
. At birth	30.68 ± 0.89	27.70 ± 0.52
. At weaning	99.27 ± 1.55	93.45 ± 1.64*
Av. daily body gain (Kg/day)	0.65 ± 0.01	0.63 ± 0.02
- Height (cm)		
. At birth	67.23 ± 0.78	70.88 ± 0.93
. At weaning	81.53 ± 1.09	84.83 ± 1.66
Av. daily body gain (cm/day)	0.14 ± 0.001	0.13 ± 0.002
- Girth (cm)		
. At birth	71.46 ± 0.98	69.52 ± 1.05
. At weaning	94.46 ± 1.96	93.25 ± 1.72
Av. daily body gain (cm/day)	0.22 ± 0.001	0.22 ± 0.002
- Length (cm)		
. At birth	62.30 ± 0.76	63.64 ± 1.16
. At weaning	84.92 ± 1.01	86.16 ± 1.58
Av. daily body gain (cm/day)	0.22 ± 0.005	0.22 ± 0.005

* Means significantly different at $P < 0.05$

Table (4): IgG and IgM levels of calf serum at birth and 24 hours after post-colostrol feeding and these values in the colostrum.

Ig level (mg/ml) \ Farm	I	II
- Serum IgG		
. At birth	1.74 ± 0.32	1.96 ± 0.56
. 24 hours after post-colostrol feeding	35.47 ± 3.75	39.52 ± 4.58
- Serum IgM		
. At birth	0.18 ± 0.04	0.14 ± 0.04
. 24 hours after post-colostrol feeding	2.69 ± 0.40	2.73 ± 0.39
- Colostrol IgG	21.95 ± 0.68	21.24 ± 0.68
- Colostrol IgM	2.48 ± 0.15	2.42 ± 0.16

DISCUSSION

The behaviour and performance of dairy calves can be affected by different rearing system. Table (1) declard the mean values for percentage of time spent in different oral behaviour that including drinking water, eating hay or straw, eating concentrate and rumination. It can be noticed that the average time spent in drinking behaviour increased with advanced age in both farms, while this percentage showed a high value in farm I when compared with the other farm, throughout the experimental period. This may be attributed to the nature of food and the amount of dry matter intake in farm (I) and this associated with an increased demand for water consumption, this result agree with that finding by Fraser and Broom, 1990. On the other hand, the time spent of eating hay, grass or straw in calves reared in farm (I) started at 2 weeks of age reached to 2.94 while in farm (II), the hay or straw did't offered to those calves at this age, in addition there was a increase in time spent in eating hay with advanced age, specially among calves reared on farm II at 12 weeks of calf age (21.44) when compared with those calves on farm I (16.62), this may be attributed to the small amount of concentrates offered to those calves, which was compan-stated by eating large amount of hay or straw as well as shown in farm (II). The results of eating concentrates in two farms showed a significant high in time spent of this behaviour in farm (I) when compared with those in farm (II) and this result concide with the aformentioned results related to eating of hay and agree with that obtained by Nicol and Sharafeldin, 1975, Fraser

and Broom, 1990; and Kale et al. 1992. Moreover, the calves which reared on farm (I) spent a significant high percentage of time in rumination (20.20) at age of 6 weeks when compared with those reared in farm (II) (14.62) this result is in agree with Sato and Kuroda, 1993, who mentioned that artifically reared calves showed ruminating more than naturally suckled calves, where those calf suffering from frustration which associated with the suppression of social behaviour.

Table (2) demonstrate the mean values for percentage of time spent in some social behaviour including, self-grooming, groom other calf (mutual grooming), suck other calf and moo. It is clear that there was no significant difference among calves in both farms in the aspect of time spent in grooming throughout the experimental period except at 6 weeks of calf age, where in farm (II), calves spent more time in grooming (8.35) than in farm (I) (5.48). The abscence of differences between the two farms throughout the observation period agree with that obtained with Albright et al., 1991, who mentioned that there was no difference in grooming behaviour between calves under different housing condition. Moreover, it can be noticed that calves reared in farm (II) spent more time in grooming other calves and reach its maximum at ten weeks of age (1.58) while in farm (I) reached to 0.43 at the same age. Intersucking in calves constitute the major oral behavioural abnormalities in artifically bucket-fed calves than calves suckled from their dams, and this may attributed to the lack of natural suckling which increase the desire of suckling other animals (Sambraus, 1985 and Sato & Kuroda, 1993). In addition the calves which are sucked usually stand quite and show no responses towards the sucking calves (Fraser and Broom, 1990). From Table (2) it was clear that the incidence of suck other calf in farm (I) was clearly higher when compared with those reared in farm II. On the other hand calves housed in farm (II) spent significantly higher percentage of time in mooing than calves reared in farm (I), this may be related to tthe housing of calves with their dams in cattle barn and also the strong relationship between those calves and their dams, so calves will moo more specially when heaving the voice of the dams or seeing them, this agree with obtained by Webster et al.,1985.

Calf performance was expressed as the average daily gain of body weight and other body measurements, from Table (3) it can be noticed that, birth weight among calves in farm (I) was significantly higher (30.68 kg) than those in farm (II) (27.70 Kg). In addition at weaning age (15 week), the mean value of calf weight in farm (I) (99.27 Kg) was significantly high than calves in farm (II) (93.45 Kg), while there was no significant difference between the two farms in the average daily weight gain this agree with El-Sayed et al. 1991 Duc et al. 1993 and Browning et al. 1995 and Quigley et al., 1995. In addition Metz,

1987 stated that calves kept with their dams for the first ten days, consumed about 40% of the milk produced by the cow and weight gains of calves kept with the mother during the first 10 days period were almost double those of the calves separated at birth. The initial birth weight appeared to have no effect on subsequent average daily gain. This agree with Caldow et al. 1988, but disagree with Peters, et al. 1987 and Thickett et al. 1990. The other calf body measurement, represented as height, girth and length showed no significant difference between the calves in the two farms but it can be noticed that there was a slightly higher in height and length in farm (II) when compared with farm (I). The average daily gain in height, girth and length in farm (I) were 0.14, 0.22 and 0.22 cm respectively while farm (II) were 0.13, 0.22 and 0.21 cm. This similarity between the two farms is due to the effect of natural suckling in early stage of life (Quigley et al., 1995).

Table (4) declard the immunoglobulin levels in both calf serum and colostrum it can be concluded that the levels of IgG in farm I & II at birth amounted to 1.74 and 1.96 mg/ml respectively. After 24 hours post-colostral feeding these values increased to 35.47 and 39.52 mg/ml. On the other hand, the levels of IgM in farm I & II at birth were 0.18 and 0.14 mg/ml respectively. They increased to 2.69 and 2.73 mg/ml 24 hours after post-colostrol feeding. Gay, 1983 and Nocek et al., 1984 showed that serum of calves at birth may be devoid of IgG & IgM (agammaglobulinaemia) or contain negliable amount of them because of the lack of placental transfer of immunoglobulins in bovine neonate. The presence of those calves with their dams in the first five days of life in both farms I & II showed no significant differences in the levels of IgG and IgM at birth and 24 hours post-colostrol feeding. This results agree with Stott et al.,1979; Quigley et al., 1995 and Rajala and Castern, 1995. In the colostrum, the level, of IgG in farm (I & II) (21.95 and 21.24 mg/ml) respectively were higher than those of IgM (2.48 and 2.42 and mg/ml). From the aforementioned results, it can be concluded that the rearing of calves with their dams in the first five days of life to receive the colostrum directly after birth will reflect on the improvement of performance and immune status of newly born calves. In addition cohabitation of those calves with their dams throughout the suckling period from birth to weaning age favour of calf welfare improving the social behaviour and high performance. The early offering of hay and straw at one week of calf age will improve the oral behaviour specially rumination which will reflect on the high performance and daily gain of their body measurements.

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