BEHAVIOURAL EVALUATION FOR THE POSSIBLE NURSING AND ARTIFICIAL REARING OF BUFFALO CALVES

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ABSTRACT

Since survival of the young mammals depends on sucking success, it is assumed that sucking motivation must be strong and that sucking deprivation would result in frustration which could have a negative impact on their welfare. The present study was carried out to investigate the possible signs of acceptance or rejection of nursing buffalo calves on Brown Swiss cows and the percentage of calf acceptance in relation to its age, with reference to the behavioural and performance differences between nursed and artificially reared calves. The frequency of smelling, licking and rubbing performed by the Brown Swiss cow to nursed calf was significantly increased ($P<0.05$) in case of acceptance for nursing. While, butting and kicking showed a significant ($P<0.05$) high frequency in rejected calf compared with nursed one. Moreover, the age of calf had a prominent effect on the percentage of acceptance to nursing, there was a high percentage of acceptance (80%) at the end of first week of age, this acceptance was clearly decreased at the end of second and third weeks of age (67.9 and 55% respectively, $P<0.05$). On the other hand, artificially reared calves had significantly ($P<0.05$) higher frequency of non-nutritive oral behaviours that are well known to retard the growth rates of calves, including self-grooming and cross-sucking, together with higher frequency of mutual rubbing and nibbling and fed concentrate in comparison with calves nursed with restricted suckling. For that, this study showed a high significant ($P<0.01$) increase in the average daily weight gain for nursed calves over the artificially reared one either reared in group or individually. We conclude that, in dairy cattle, smelling, licking and rubbing were behavioural indicators of acceptance to calf nursing and the age of calf had a pronounced effect on the percentage of this acceptance. Moreover, calves nursed with restricted suckling had higher rates of weight gain in comparison with artificially reared calves owing to the
advantage of this system to reduce the frequency of non-nutritive oral behaviours such as self-grooming and cross-sucking that tended to reduce the growth rates of calves.

**Key words:** Buffalo calf, Brown Swiss cow, nursing, artificial rearing, behaviour, growth rate.

**INTRODUCTION**

Large numbers of buffalo calves are orphaned as a result of disease control and managerial programs.

Little attempt has been made in the past to raise these young animals because of high labor and feed costs and their reputation for being difficult to hand rear. However, while sources of buffalo for domestication are declining rapidly, their value has increased significantly, especially that of potential breeding stock, and this trend is likely to continue in the future (*Tiwari et al.*, 2003). Raising orphaned calves therefore has become a more attractive management option. *Tulloch* (1972; 1979) successfully able to bottle-fed calves that were removed from the dam at birth. More recent attempts to raise large numbers of buffalo calves in a feedlot situation have been very successful.

The use of nurse cows in dairy production may also save labor and calf rearing costs (*Vaarst et al.*, 1997). There are farmers that use this system and all have their own way of putting the groups together, letting the calves stay with the same nurse cow or changing nurse cow during the calf suckles, keeping the nurse cows separated or in larger groups (*Lidfors and Berg, 2004*). The main need for choosing a cow as a nurse cow was good maternal behaviour (*Anderberg, 2001*).

Artificial rearing of animals represents a combination of emotional (separation from the dam) and nutritional (transition from maternal milk to a commercial milk substitute) stressors which in turn resulted in a reduction of the production potential of different domestic species and to induce diseases (*Griffin, 1989* and *Napolitano et al.*, 1995), as various non-nutritive oral activities, including self-grooming (*Terré, et al.*, 2006) and cross-sucking (*Jensen and Budde, 2006*) have been found to occur in calves reared artificially. It has been reported that nursing with restricted suckling and artificial rearing influences the behaviour and weight gain of calves (*Das, 1999*).

The present study aimed to study nursing in buffalo calves, and then compare it with artificial rearing system from behavioural and performance view.
MATERIALS & METHODS

1- Farm program description:
The present study was carried out on a private dairy farm situated at Ismailia province during the period from October 2006 till March 2007. When the study was conducted, the cow herd in the farm was consists of 26 dairy Brown Swiss cows known with its previous good maternal behaviour and milk supply. Cows had ad libitum access to food and water. Shortly before calving, the cows were transported to individual pens for calving. All buffalo calves were allowed to stay with their mothers during the colostrum period (approximately 5 days), and after that they were usually put to Brown Swiss cow in restricted suckling groups (3-4 calves/cow) (Fig.1). The farm used the Brown Swiss cow as a routine practice to nurse calves during the entire milk period. Nursing take place to calves those born in the farm and those purchased from other farms and markets to save the buffalo milk for sale. At first, all calves are directed to nursing; the rejected ones were directed to artificial rearing either in group or individually reared.

2- Feeding and management:
The nursed buffalo calves were allowed free access to Brown Swiss cows for 30 minutes during suckling, two times daily (one in the morning and the other in the afternoon). Afterwards, calves were separated from cows and returned back to its pen. While artificially reared calves were individually fed fresh whole milk by bottle with rubber teat (Fig. 2), twice daily. Calves were given the same amount of milk as the nursed calves that had been estimated by the weigh-suckle-weigh method (Boggs et al., 1980). Moreover, five weeks later, additional diet was given to calves in the form of 2 liters per meal of a commercial milk substitute reconstituted as one kg milk substitute powder per 10 liters fresh whey. All calves (nursed and artificially reared) were kept together in a separate paddock including a roofed pen with a concrete floor, troughs for feed and water which were provided ad libitum. Calves were weaned at three months of age.

3-Experimental design:
This study including three experiments, the first one was done to reveal the behavioural signs of acceptance or rejection of nursed buffalo calves to Brown Swiss cows. Forty-two buffalo calves and 10 dairy Brown Swiss cows, each nurse three or four calves 5 days after calving were used in this experiment. Nursing takes place by direct contact of calf to the cow for 2 hours. Behavioural signs of acceptance or rejection such as smelling, licking, rubbing, butting and kicking were recorded. Observation was carried out by using video camera for 30 minutes divided into three periods of
10 minutes each, distributed allover the time allowed for the test (Start, middle and end). The rejected calves were directed to artificial rearing.

The second experiment was done on 54 buffalo calves and 12 dairy Brown Swiss cows to test the percentage of acceptance of nursed buffalo calf in relation to its age. 1) at the end of the first week of age, 2) at the end of the second week, 3) at the end of the third week of age. The nurse cow and calf were stayed together for 2 hours at each test. If the Brown Swiss cow not allowed the buffalo calf to suckle within this time, it considers rejection for nursing, and the calf was directly turned to artificial rearing.

The third experiment was performed to show the behavioural and weight gain differences between nursed and artificially reared calves. Calf behaviours, including self-grooming, cross-sucking, mutual rubbing and nibbling and eat concentrate were observed once per week for 30 minute (10 minutes/observation period, three times), distributed all over the time allowed for calf suckling (start, middle and end) and continued for two months. On the other hand, calves were weekly weighed and from those weighing, average absolute daily weight gain was calculated. The observed behavioural patterns were defined according to Froberg et al., 2008 (Table 1).

Table (1): Definitions of behavioural patterns recorded.

<table>
<thead>
<tr>
<th>Behavioural elements</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smell</td>
<td>When the muzzle of cow was in contact with or within 5 cm of calf.</td>
</tr>
<tr>
<td>Lick</td>
<td>When the tongue of the cow touches the calf.</td>
</tr>
<tr>
<td>Rub</td>
<td>When the cow moves its head repeatedly a long the body of calf.</td>
</tr>
<tr>
<td>Butt</td>
<td>Quick hard push with the muzzle or head of the cow against the calf</td>
</tr>
<tr>
<td>Cross-suck</td>
<td>Sucking on any other body part of another calf.</td>
</tr>
</tbody>
</table>

4-Statistical Analysis:
Statistical analysis was done according to Snedecore and Cochran (1980).
RESULTS & DISCUSSION

Cow behavioural response to nursing:

Data of the present study showed that, the behavioural signs exhibited by the Brown Swiss cow to acceptance or rejection of nursed buffalo calf were significantly differed (Table 2). The frequency of smelling, licking and rubbing performed by the cow towards the accepted calf was significantly higher than those directed to the rejected one. However, for kicking and butting the opposite was found.

Behavioral observation may serve as an indicator for acceptance or rejection of nursing in farm animals (Stokey et al., 1997). Immediately after birth, the most important sense in the cow for recognition of her calf seems to be olfaction and the function of licking is to strengthen the bond between mother and young (Lidfors, 1994). Additionally, Von Keyserlingk and Weary, 2007 stated that the attachment between the cow and her calf was thought to be strengthened by the cow licking behaviour. Similarly, in small ruminants, Levy and Poindron, 1987 demonstrated that grooming and nosing behaviours aid the bonding and recognition of the lamb by the ewe. Thus, higher frequency of these behaviours can be interpreted as a stronger relationship and in many studies on nursed cows; knowledge of this has been used to facilitate the process of nursing.

Table. (†): Behavioural signs of acceptance or rejection of nursed buffalo calf to Brown Swiss cow in 30 minute observation session.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Accepted calf</th>
<th>Rejected calf</th>
</tr>
</thead>
<tbody>
<tr>
<td>Behavioural item</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean frequency of:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smelling</td>
<td>11.8 ± 0.66*</td>
<td>5.6 ± 1.09</td>
</tr>
<tr>
<td>Licking</td>
<td>15.3 ± 1.48*</td>
<td>5.8 ± 0.40</td>
</tr>
<tr>
<td>Rubbing</td>
<td>9.1 ± 0.50*</td>
<td>4.6 ± 0.50</td>
</tr>
<tr>
<td>Butting</td>
<td>5.1 ± 0.40</td>
<td>11.1 ± 0.71*</td>
</tr>
<tr>
<td>Kicking</td>
<td>2.8 ± 0.30</td>
<td>6.7 ± 0.82*</td>
</tr>
</tbody>
</table>

* Significance at $P<0.05$
Percentage of calf acceptance

Data in table (3) reported that, the age of buffalo calf had an effect on the percentage of acceptance for nursing. There was a high percentage of acceptance (80%) when the calf was introduced to nursing at the end of first week of age, after that this acceptance was markedly reduced to 67.9 and 55% at the end of second and third weeks of age respectively.

In order to utilize the increased maternal responsiveness of the cow after parturition, several researchers have aimed to introduce the nursed calf as soon as possible postpartum (Hudson and Mullord, 1977; Le Neindre et al., 1979; Nicoll, 1982a), as during this period, the animal's genetic programming causes it to be maximally sensitive to a stimuli from the environment specially motive object. Our results agree with previous studies mention that calves try to suckle other cows than their mothers during the first days of life before they learn that they are often rejected by others (Edwards, 1983; Murphey et al., 1990; Illman and Špinka, 1993; Roulin, 2002).

Table (3): The percentage of calf acceptance for nursing in relation to its age.

<table>
<thead>
<tr>
<th>Calf age</th>
<th>Variable</th>
<th>First week</th>
<th>Second week</th>
<th>Third week</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Number of calves for nursing</td>
<td>20</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Number of accepted calves</td>
<td>10</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Percentage of acceptance</td>
<td>80%, 9%</td>
<td>78%, 9%</td>
</tr>
<tr>
<td></td>
<td>Chi-square</td>
<td>6.55*</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Significance at P<0.05

Calf behaviour:

In the current study, artificially reared calves performed a significant high frequency of cross-sucking (non-nutritional), self-grooming, mutual rubbing and nibbling and fed concentrate than those of nursed calves (Table 4). Even though the artificially reared calves obtained the same amount of milk as the restricted suckling calves and were fed from bottle with rubber teat, their innate need for sucking was not satisfied. Thus, de Passillé et al. 1992 suggested that the
higher frequency of cross-sucking in the artificially reared calves may be due to unsatisfied need for sucking in this treatment. Moreover, Terré et al., 2006 attributed these increases to the frustration associated with suppression of social behaviour and sucking as a consequence of early separation from the dam. On the other hand, it has been reported that both the performance of sucking and the time taken to ingest milk are important factors to reduce the frequency of cross-sucking (Loberg and Lidfors, 2001), and Froberg et al., 2008 showed that the average duration of milk ingestion for artificially reared calves was almost 10 minute shorter compared to the average suckling time in restricted suckling. For that, this could explain

the higher frequency of these behaviours that demonstrated in artificially reared calves in this study.

Das, 1999, stated that cross-sucking decreased with calf age and this could partly be explained by a reduced dependency on the milk as diet and partly due to the increase in other behaviours such as eating solid feed. Thus, Margerison et al., 2003 suggested that food ingestion could serve as a replacement stimulus to suckling. Therefore, it is probable that the artificially reared calves were more motivated to consume food than restricted suckling calves (Jonasen and Krohn, 1991), because of a higher fat content in suckled milk compared to the parlour milk (Sanh et al., 1997).

Table (4): Behavioural difference between nursed and artificially reared calves in 30 minute observation/week.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>nursing with restricted suckling (RS)</th>
<th>Group artificial rearing (AR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Behavioural item</td>
<td>Mean frequency of:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cross –sucking</td>
<td>1.4 ± 0.41</td>
</tr>
<tr>
<td></td>
<td>Self-grooming</td>
<td>2.7 ± 0.73</td>
</tr>
<tr>
<td></td>
<td>Mutual rubbing</td>
<td>2.7 ± 0.73</td>
</tr>
<tr>
<td></td>
<td>Nibbling and fed concentrate</td>
<td>0.3 ± 1.09</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.4 ± 0.69*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7.6 ± 0.44*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.8 ± 0.44*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8.1 ± 1.04*</td>
</tr>
</tbody>
</table>

* Significance at $P<0.05$
Calf weight gain:
There was a significant increase \((P<0.01)\) in the average daily weight gain of buffalo calves nursed with restricted suckling than artificially reared one (Table 5). There have been several earlier studies on the practice of using nurse cow. Many of them have focused on the weight gain of the nursed calves (Hudson and Mullord, 1977; Wyatt et al., 1977; Rosencrans and Hohenboken, 1982). A number of studies have reported higher live weight gain in dairy calves under restricted suckling compared to artificial rearing (Knowles and Edwards, 1983 Little et al., 1991 and Bar-Peled et al., 1997) as demonstrated in our results. However, Hernandez et al., 2005 denoted that there was no apparent difference between restricted suckling and artificially reared calves in the average daily live weight gain from birth to weaning.

The enhanced growth in suckling calves has been attributed to a higher fat content in consumed residual milk (Mejia et al., 1998) and the greater quantity of milk consumed (Jonasen and Krohn, 1991). Also, in restricted suckling, milk is channeled by the reticular groove reflex directly to abomasum, and energy and protein are utilized more efficiently than if the milk passes into the rumen, as what happens with part of the milk when it is consumed rapidly as in the most of the artificial rearing methods (Sanh et al., 1995), together with the better welfare condition associated with suckling which in turn reflected on the growth rates of calves while artificially reared calves were suppressed by the entire early separation from the dam.

Table (5): Average absolute daily weight gain (gm) of nursed and artificially reared buffalo calves.

<table>
<thead>
<tr>
<th>Treatment Variable</th>
<th>Nursing with Restricted suckling</th>
<th>Group artificial rearing</th>
<th>Individual artificial rearing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily weight gain</td>
<td>860 ± 27.8(^a)</td>
<td>810 ± 21.1(^b)</td>
<td>790 ±28.9(^b)</td>
</tr>
</tbody>
</table>

Significance at \(P<0.01\)

In conclusion, this study has demonstrated that behavioural indicators such as smelling, licking and rubbing were a signal for nursing acceptance together with a marked effect for calf age on the percentage of this acceptance. On the other hand, nursing with restricted suckling reduced the...
frequency of non-nutritive oral behaviours and thus tended to improve the growth rates of calves compared to the artificial rearing system.

Fig. (1): Four buffalo calves nursed by Brown Swiss cow (restricted suckling)

Fig. (2): Buffalo calf artificially reared by bottle with a rubber teat in separate cage.
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الملخص العربي

تقييم سلوكى لإمكانية الرضاعة الطبيعية بالأم البديلة والرعاية الصناعية لعجول الجاموس

نظرا لاعتماد حياة العجول الصغيرة على نجاحه في الرضاعة. لذا يفترض أن الدافع للرضاعة لا بد أن يكون قويا. والحرم من الرضاعة قد ينتج عنه احباط والذي قد يؤدى إلى أثر سلبي في رفاهيته وحياته. وتمتاز ألبان الجاموس بمكوناتها الغذائية عالية القيمة ومذاقها المتميز. لهذا يزيد الطلب عليها مما يعكس على ارتفاع ثمنها ويعود ذلك بفائدة عالية على المربين. لذلك تجري بعض المحاولات لتربية صغار الجاموس الرضع على الابقار لتوفير آلبانها ومن ثم الاستفادة بسعرها المرتفع. وهذه الدراسة
احدي هذه المحاولات لتربية صغار الجاموس على أبقار براون سوس. وقد أجريت هذه الدراسة في أحد مزارع الالبان الخاصة بمحافظة الإسماعيلية وذلك لبيان الاتي:

1 - استنباط الأنماط السلوكية لإقامة أبقار براون سوس في حالة قبول أو رفض رضاعة صغار الجاموس.

2 - علاقة عمر هذه الصغار بنسبة قبول أبقار براون لها.

3 - اختلاف الأنماط السلوكية ومعدلات النمو لصغار الجاموس في حال رضاعتها من أبقار براون سوس أو صناعيا باستخدام الحلمات. وقد أسفرت النتائج عن الاتي:

تمت هذه الدراسة في أحد المزارع الخاصة بمحافظة الإسماعيلية لملاحظة مدى قبول أو رفض التبني من أبقار براون سوس لعجول الجاموس وكذا نسبة قبول التبني لعم العجل والرعاية الصناعية.

وأما بالنسبة لحالة رد فعل الرضاعة البيئية ورضا هذه الصغار وقابليتها للتحمل والتحرك وتأثيرها على معدل الزيادة اليومية في وزن العجل فكان هناك تأثير ملحوظ.

وقد تم الحصول على النتائج التالية:

1 - اختلفت سلوكيات أبقار براون سوس تجاه صغار الجاموس علي حسب قبولها أو رفضها لرضاعة هذه الصغار. حيث حدث زيادة ملحوظة في سلوكيات الشم، لحس الجسم، و احتكاك الجسم وانخفاض معدل الدفع الجانبي والرفس في حالة قبول رضاعة هذه الصغار وحدث العكس في حالة رفضها لرضاعتها.

2 - كان لعمر صغار الجاموس تأثير واضح علي حسب قبول أبقار براون سوس لرضاعة هذه الصغار. حيث زاد هذا المعدل معنئيا في الأسبوع الأول من العمر(80%) ثم انخفض في الأسبوعين الثاني والثالث (79.9 و55%) على التوالي.

3 - كان هناك فرق معنئيا واضح في الأنماط السلوكية و معدلات النمو بالنسبة لصغار الجاموس التي تم رضاعتها صناعيا عن مثيلتها التي تم رضاعتها من أبقار براون سوس. حيث زادت بعض السلوكيات الغير مفيدة غذائيا في الصغار التي تم رضاعتها صناعيا مثل لحس الجسم، رضاعة بعض الأجزاء غير البارزة من صغار اخري واحتكاك اجسامها والنأمة وتمinus النواحي معنى زيادة زيادة معنئيا عن الصغار التي تم رضاعتها من أبقار براون سوس ولذا انعكس ذلك علي معدلات نموها خلال فترة القطب حيث انخفض هذا المعدل معنئيا عن الصغار التي تم رضاعتها من أبقار براون سوس.