Effect of Pair Housing Versus Individual and Group Housing on Behavioural Patterns of Buffalo Calves

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ABSTRACT

This study aimed to evaluate the effect of pair housing versus individual and group housing on behavioural patterns of female buffalo calves (n = 18; 15.0±3.0 days of age) were assigned randomly to 1 of 3 treatments of group housing with (C1=one calf/pen, C2=two calves/pen, or C3= three calves/pen) supplying a total pen space allowance of 1.82 m^2 /calf, regardless of pen size. Behaviour was recorded by direct observation throughout the day from 10:00 to 14:00 clock, during a single day each week for 12 weeks using scan sampling every 15 min within 4 hours' observation sessions. Calves housed in C2 group showed more (P ≤ 0.05) eating and drinking, chewing/ruminating, object manipulation and self grooming, lying activities, and less (P < 0.05) inactivity and standing when compared to calves housed in C1 and C3 groups. In conclusion, raising buffalo calves in paired housing system provided calves more opportunity to express their comfort, grooming, and feeding activities compared to individual and group housing system, however further investigation is still required to study the effect of paired housing system on the performance and physiological indicators in buffalo calves.

Introduction

Buffalo is an economically important source of meat and milk and it plays a significant role through contributions in social and cultural aspects especially in low-income countries (Nanda and Nakao, 2003; Desta, 2012; Arefaine and Kashwa, 2015). In Egypt, the use of buffaloes is steadily increasing in terms of both numbers of animals and number of farms because of the economic returns coming from its production. The total number of buffaloes in Egypt reached about 5.317 million in 2011, The aggregate share of buffalo milk, from all types of production systems is about 81 percent of total milk production in Egypt. The average buffalo production represented 30.8% of national agricultural production per year, the average annual red meat production reached 495,000 tons during the same period, contributing by 45% to overall meat produced (Ibrahim, 2012; Arefaine and Kashwa, 2015).

In Egypt, buffalo calves are generally reared in groups in the same house along with their dams. Recently, in Assiut province, several large commercial farms were built to enhance the production of buffalo in Upper Egypt. The design of these farms was similar to those used for dairy cattle. Inside these farms, the newly born calves get colostrums for the first 3 days of life, and then calves are separated from their dams and raised artificially. During artificial rearing, calves housed either individually or in groups. Based on research finding in cattle, it is already established that rearing calves individually characterized with effective management and handling of waste materials, prevention of cross-sucking and limited cross contamination with pathogens between calves resulting in lower disease incidence and higher weight gain (Weary, 2002; Babu *et al.*, 2004). However, it may result in poor welfare with increased probability of developing abnormal behaviour.

Group housing reduces the labour and economics for housing management and feeding. Boe and Faerevik (2003) reported that calves reared in groups are more social confident and have less fear than calves reared in single boxes, because it has social interactions with other calves (Jensen *et al.*, 1998; Babu *et al.*, 2004; Svensson and Liberg, 2006). Also, Babu *et al.* (2004) and Li-feng *et al.* (2016) stated that feeding rates were higher when animals were fed in groups compared to

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when they were fed individually. On contrary, several researchers recorded that calves housed in groups may suffer from cross-sucking behaviour, chronic social stress, and high risk of infection (Veissier *et al.*, 1998; Jensen and Budde, 2006; Svensson and Liberg, 2006).

Recently, researchers reported several advantages for pair housing in cattle. Chua *et al.* (2002) and Bolt *et al.* (2017) stated that housing dairy calves in pairs allows benefits such as increased space for movement and social opportunities with no disadvantages in health and weight gains. De Paula Vieira *et al.* (2010) stated that pair housing during the milk-feeding stage reduces calf responses to weaning and improves performance after weaning when calves are housed in groups.

Information regarding pair housing effect on buffalo calves well-being is scarce; therefore, the objective of the present study was to compare the effect of pair housing versus individual and group housing on behavioural patterns of buffalo calves.

Materials and methods

The study was conducted at a local farm in Arab Mtir village, Abnob, Assiut, Egypt, which provided facilities, calves and feed. The study was carried out over 3 months, from February to May, 2016. All experimental procedures were in compliance with the guide for the care and use of Agricultural Animals in Research and Teaching (2010), and approved by Faculty of Veterinary Medicine, Assiut University, Egypt.

Experimental design and Animals Housing

Buffalo female calves (n = 18) (15.0±3.0 days of age) were allotted randomly into 9 pens. Experimental pens (1.5 m length × 1.2 m width × 1.21 m height) consisted of stainless steel partitions that enabled visual and tactile contact between calves. After 1 week of acclimation, calves were assigned randomly to 1 of 3 group-housing treatments (1, 2, or 3 calves/pen). Those assigned to 1 calf/pen remained as they were, whereas those assigned to 2 or 3 calves/pen had the metal partitions between neighboring pens removed to form the larger groups. Three replicated pens of each treatment were formed. The total pen area allowance was kept constant at 1.82 m^2 /calf for all group sizes (Abdelfattah *et al.*, 2013). All the calves took milk by nipple feeding twice a day up to three months of age as routine practices. Green fodder and fresh water were also provided round the clock. Commercial calf starter ration (18% Crude protein) ration were offered in the morning.

Behavioural measurements

Behaviour was recorded by direct observation throughout the day from 10:00 to 14:00 clock, during a single day each week for 12 weeks using scan sampling (Martin and Bateson, 1993), every 15 minutes within 4 hours' observation sessions. The calves' behaviours were observed according to a pre-defined ethogram (Table 1). Individual behavioural measurements were taken every 15 minutes by using the scan sampling recording method. Data was presented as the percentage frequency of each behavioural pattern within category (Andrighetto *et al.*, 1999).

Statistical analysis

For the analysis, pen was considered the experimental unit. The data were analyzed by means of SPSS 16.00 Software. The Shapiro-Wilk test was used to analyze the normality of the data; all the data were normally distributed. The effect of housing on buffalo calves' behaviour was analyzed by one-way ANOVA procedure.

Results

Results represented in Fig. 1, clarified that eating and drinking activities and chewing/ruminating activities in C2 group were significantly (P< 0.05) higher than those recorded in C1 and C3 groups, respectively.
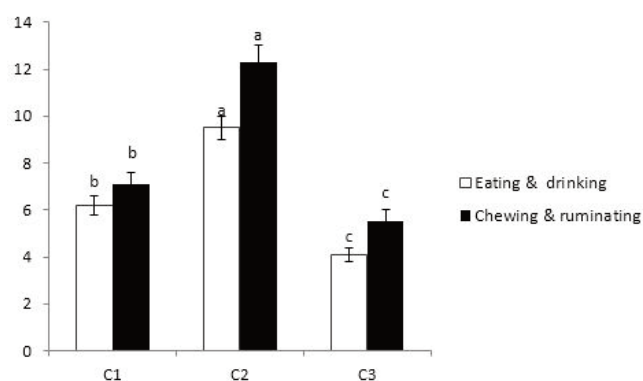

Fig. 1. Effect of pair housing versus individual and group housing on feeding activities percentage in buffalo calves.

Table 1. Ethogram for instantaneous scan sampling of buffalo calves (certain behaviors were combined into a single category)

Behavior	Description	Category
Standing	Standing with all four feet on the ground either active or inactive	Posture
Lying	Lying on sternum with head held in a raised position or down	
Walking	Stepping and moving	
Eating	Head in trough accompanied by chewing movements	Maintenance
Drinking	Mouth around drinker	
Manipulating object	Biting, sniffing, sucking or licking pen fixtures or fitting	
Chewing/ruminating	Irregular, repetitive chewing without discernible food in the mouth	
Self-licking	Movements with tongue over own body surface	
Scratching	Scratching themselves using leg	
Rubbing	Moving body against walls, partitions or other calf	
Inactive	Carrying out no discernible behavior	

Results represented in Fig. 2, clarified that object manipulation and self grooming activities in C2 group were significantly (P< 0.05) higher than those recorded in C1 and C3 groups, respectively. While, the inactivity behavioural patterns incidence in C2 group was significantly (P< 0.05) lower than those recorded in C1 and C3 groups, respectively.
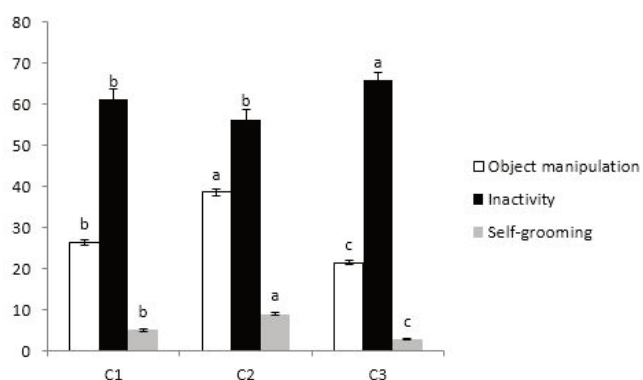

Fig. 2. Effect of pair housing versus individual and group housing on object manipulation, inactivity and self grooming activities percentage in buffalo calves.

Results represented in Fig. 3, clarified that standing activities in C2 group were significantly (P< 0.05) lower than those recorded in C1 and C3 groups, respectively. While it reflected that the lying behavioural patterns in C2 group were significantly (P< 0.05) higher than those recorded in C1 and C3 groups, respectively. However, it had shown no significant (P> 0.05) differences in walking activities between C1, C2, and C3 groups.
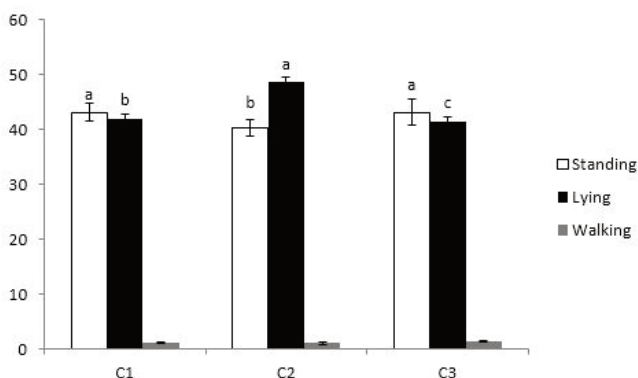

Fig. 3. Effect of pair housing versus individual and group housing on movement and resting activities percentage in buffalo calves.

Discussion

According to our knowledge, this is the first study investigated the effect of pair housing versus individual and group housing on behavioural patterns of buffalo calves. Previous studies have tested the effect of regrouping, group size in different spaces, housing veal calves in large groups, while maintaining calf floor space allowance or individual versus group rearing in dairy cattle and veal calves (Rushen and de Passillé, 1992; Abdelfattah *et al.*, 2013). No previous work was done on buffalo calves.

Results represented in Fig. 1, clarified that eating and drinking activities and chewing/ruminating activities in C2 group were significantly higher than those recorded in C1 and C3 groups, respectively. Supporting the present study, De

Paula Vieira *et al.* (2010) found that paired calves had a shorter latency to start feeding, visited the starter feeder more frequently, spent more time at the feeder, and consumed more starter than individually housed calves. Also, Duve *et al.* (2012) recorded that calves receiving the high milk allowance and housed in pairs spent more time feeding than did those receiving the high milk allowance and housed singly. Regarding the group housing, similarly, Abdelfattah *et al.* (2013) reported that calves in pens of 2 were observed eating, drinking, chewing and ruminating more than calves in groups of 4 or 8. Abdelfattah *et al.* (2013) attributed the fewer percentages of calves eating and drinking throughout the day in the groups contain from 4 or 8 calves to the increased social interaction among calves in these groups, which may be resulted in increased the speed of diet consumption, thereby reducing eating and drinking behaviour in comparison to calves in groups of 2.

Results represented in Fig. 2, clarified that object manipulation and self grooming activities in C2 group were significantly higher than those recorded in C1 and C3 groups, respectively. Similarly; Abdelfattah *et al.* (2013) reported that calves housed in pairs had higher objects manipulation and self-grooming activities than calves in groups contain 4 or 8 calves. They suggested that the increase in object manipulation and self grooming activities in calves housed in pairs may be attributed to the social deprivation, which may be enhanced the non-nutritive oral activities in dairy calves (Veissier *et al.*, 1997; Chua *et al.*, 2002). While; regarding the significant reduction in object manipulation and self grooming activities in calves housed individually in compare to calves housed in pairs this articles could not figure out the reason or give any suggestion. On contrary, Chua *et al.* (2002) reported no differences in the amount of time spent self-grooming between individually and pair-housed calves.

Results represented in Fig. 2, the inactivity behavioural patterns incidence in C2 group was significantly lower than those recorded in C1 and C3 groups, respectively. In agreement with these findings, Abdelfattah *et al.* (2013) recorded that calves in pairs were less inactive than calves in groups of 4 or 8; authors attributed the increased of inactivity in group housed calves to be as a result of displaced calves waiting for access to the feed. The current article could suggest that the calves in pairs were less inactive than calves housed individually or in groups due to the increase in their feeding, object manipulation and self grooming activities.

Regarding standing activities, results represented in Fig. 3, clarified that standing activities in C2 group were significantly lower than those recorded in C1 and C3 groups, respectively. Similarly, Abdelfattah *et al.* (2013) reported that calves housed in groups contain 4 and 8 calves stood more when compared with pairs housed calves, and attributed this to the availability of free space in these groups which gives an opportunity for calves to stand and walk more. As it is already established that calves moved more easily when they were housed together in a pen than when they were housed in individual stalls because they can walk together around the pen and lie down close to other calves leaving space for others to remain standing (Veissier *et al.*, 1997). Similarly, Babu *et al.* (2004) stated that the time spent for idle standing activities in individual housing were more than group housing. On contrary, Chua *et al.* (2002) and De Paula Vieira *et al.* (2012) mentioned that pair-housed calves spent more time standing than individually housed animals.

Current results represented in Fig. 3, reflected that the lying behavioural patterns in C2 group were significantly higher than those recorded in C1 and C3 groups, respectively. In agreement with these finding Abdelfattah *et al.* (2013) reported that calves housed in pairs observed lying more than

groups contain 8 and 4 calves; they attributed the reduced lying behaviour in groups of 8 and 4 to the greater social interaction between calves and disturbance from pen-mates, which prevent lying in those groups. While, Chua *et al.* (2002) recorded no differences in the lying down between calves housed individually or in pairs. Moreover, Babu *et al.* (2004) stated that the time spent for sleeping/lying activities in individual housing were more than in group housing.

The current study results represented in Fig. 3, have shown no significant differences in walking activities between C1, C2, and C3 groups. Similarly, Telezhenko *et al.* (2012) stated that group size had no effect on movement of cows. On contrary, Abdelfattah *et al.* (2013) reported that calves housed in groups of 8 and 4 walked more than calves housed in small groups of 2, suggesting that increased group size was accompanied with increased locomotion.

Conclusion

The results of these experiments provide the first direct evidence that pair housing improve the behavioural pattern expression in buffalo calves. Current study results reflected that housing buffalo calves in pairs allows benefits such as increased opportunities for social interaction and movement with no disadvantages on health. In conclusion, paired housing system provided calves more opportunity to express their comfort, grooming, and feeding activities compared to individual and group housing system.

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