

## Housing System May Affect Calf Behavior and Performance of Jersey Heifer Calves

S.E. Swartzwelder, M.L. Eastridge, J.A. Pempek, K.M. Daniels, and T.T. Yohe

The Ohio State University, Columbus

### Abstract

The way dairy calves are housed may significantly affect their behavior, production performance, and welfare. The dairy industry in-large remains in favor of individually housing their pre-weaned calves in order to avoid undesirable behaviors, such as cross-sucking, and to reduce the transmission of disease-causing organisms. The majority of research on alternative housing systems published to date has been conducted with Holstein calves. The present study examined the effect of paired versus individual housing of Jersey heifers on their behavior and performance. Forty female Jersey calves were allocated to either individual or paired housing treatments at birth and monitored for approximately 9 wk. Calves on both treatments were provided with a single hutch, and calves allocated to the paired housing treatment were provided with a pen enclosure twice the size of individually housed calves. All calves were fed milk replacer via bucket twice daily (1.9 L/feeding first 7 d, then 2.27 L/feeding until weaned) and had ad libitum access to calf-starter and water. Calves were decreased to one milk feeding per day on d 49 and weaning occurred on d 56. Grain consumption was monitored daily and calves were weighed weekly to calculate average daily gain (ADG). Live behavior observations were conducted twice per week around milk feeding. Data were analyzed using the MIXED model procedure of SAS. There was no significant difference observed with respect to ADG for calves housed in pairs compared to those housed individually ( $0.62 \pm 0.02$  versus  $0.59 \pm 0.02$  kg/d;  $P = 0.30$ ). Grain dry matter intake (DMI) was similar across treatments ( $P > 0.10$ ), yet calves housed in pairs tended to weigh significantly more than calves housed individually ( $42.8 \pm 0.8$  versus  $40.8 \pm 0.8$  kg;  $P = 0.08$ ). In addition, pair housed calves were observed cross-sucking 13.6% of

the time during observation periods. In conclusion, housing Jersey heifer calves in pairs allows for social interactions and may increase body weight.

## **Introduction**

The way in which pre-weaned dairy calves are housed is a growing area of interest, as it may affect their welfare, behavior, and production performance. Currently, the majority of the dairy industry houses their heifer calves individually prior to weaning, and examples of this form of housing may include individual hutches, stalls, or pen enclosures. Individual housing is preferred by dairy producers because it allows for individualized management, handling, and treatment of each calf, while avoiding undesirable behaviors, such as cross-sucking, and the increased potential for disease transmission. However, individual housing may have a negative impact on the calves' behavior as they are denied social interactions with conspecifics.

Most dairy operations maintain their weaned calves and mature cows in rather large groups, where social hierarchies are established. Group housing allows for early social interactions, and because of the increased space provided, allows calves to display a more natural behavior repertoire. Furthermore, calves housed in groups or pairs are able to adjust to novel or stressful situations, such as weaning and mixing, more readily than are individually housed calves (de Paula Vieira et al., 2012). Other studies have also reported similar findings with regard to increased DMI throughout the pre- and post- weaning phases when calves are housed with a conspecific (de Paula Vieira et al., 2010; Pempek, 2011). While some studies report enhanced performance, others suggest no change in the performance of pair housed versus individually housed calves. These differences may be due to different management practices or the use of different feeding systems. It is important to analyze the performance of calves housed

in pairs, since there is conflicting evidence whether pair housed calves have higher DMI and ADG than individually housed calves. Chua et al. (2002) reported no difference between housing treatments during the milk feeding period. However, pair housed calves did continue to gain weight throughout weaning, while individually housed calves showed a pause in gains.

Although group housing may enhance measures of performance, this form of housing is also associated with negative behaviors, such as cross-sucking, and if calves are housed in large groups, it may lead to higher prevalence of disease (Cobb, 2012). Cross-sucking or suckling other inanimate objects within the hutch or pen is believed to be a direct response of young calves when their innate desire to suckle is not fulfilled (Jensen and Budde, 2006). Such undesirable behaviors may be displayed when calves are able to make direct contact with one another, but the social benefits obtained from pair or group housing may outweigh such behaviors. For instance, calves housed in pairs showed stronger bonds with their companion calf when separated compared to individually housed calves, displaying signs of distress, including vocalization and higher activity levels (Rosager Duve and Jensen, 2011). This strong bond formed between pre-weaned calves suggests that there are indeed social benefits associated with paired housing. In a study conducted by Holm et al. (2002), motivation in calves was observed when they obtained a reward of access to a companion calf. The study also concluded that calves were less motivated to perform tasks to receive partial contact over seeking full contact of a companion. This supports that calves are social beings and may benefit from social interactions, even at a young age.

Even as public pressure continues to rise, producers remain resistant to make the transition to group or paired housing of pre-weaned calves because of increased risk of disease transmission, which may lead to detrimental effects on production later in life. A national survey

of 1,685 US dairy operations showed a positive correlation between group size and mortality (Losinger and Heinrichs, 1996). In this study calves housed in large groups had higher mortality rates than housed in smaller groups or individually, which were nearly equivalent.

The aim of this study was to investigate the effect of housing Jersey heifer calves in pairs provided with one hutch on measures of performance and behavior. It was hypothesized that housing calves in pairs would increase measures of performance, such as grain DMI, ADG, and body weight, and that cross-sucking would occur, yet would not be detrimental to calf health or performance.

### **Materials and Methods**

This study was conducted at The Ohio State University's Waterman Dairy Center, located in Columbus, Ohio. Forty Jersey heifer calves were allocated to either individual or paired housing treatments at birth and monitored for approximately 9 wk. Calves were housed in hutches (non-tethered, wire pen enclosure), and both individually ( $n = 20$ ) and pair housed calves ( $n = 20$ ) were provided with one hutch. Only one hutch was provided to pair housed calves due to the tendency of pairs to remain in the same hutch over 80% of the time in a previous study when two hutches were provided to Holstein heifer calves (Pempek, 2011). The size of the pen enclosure for calves housed in pairs was double that provided to calves housed individually. Calf was considered the experimental unit when designing the study.

### ***Feed***

All calves were offered 1.4 L of high quality colostrum shortly after birth. Each calf was then offered an additional 1.4-2.8 L within the following 12 hr of the first feeding. Land O'

Lakes Cow's Match Jersey Blend (Shoreview, MN) powdered milk replacer (28% CP, 25% fat) was fed throughout the experiment via bucket twice per day. All calves received 1.9 L/feeding the first 7 d and were then increased to 2.27 L/feeding until they were weaned. Calves were gradually weaned, receiving only one milk feeding per day beginning on d 49, and all calves were completely weaned on d 56. All calves had ad libitum access to Land O' Lakes texturized starter (Shoreview, MN) grain formulated for Jersey calves (90% DM, 22% CP) and water.

### ***Performance***

Grain consumption was monitored on a daily basis by the collection of feed refusals. Refusals for pair housed calves were averaged, as it was not possible to monitor individual feed intake between calves housed in pairs. Calves were weighed weekly to calculate ADG. Performance data were analyzed using the MIXED model procedure of SAS 9.3 (SAS, 2012). Because the trial was not completed at the time of writing this paper, data presented included 36 calves; n = 18 for calves housed in pairs and n = 18 for calves housed individually.

### ***Behavior***

Direct behavior observations were conducted on a weekly basis and were centered around morning and evening milk feeding (approximately 500 and 1600 hr, respectively). Trained behavior observers obtained a scan-sample of each individual calf's behavior once every minute and continued for approximately one hour. Observers walked in front of the experimental calves and instantaneously recorded the calves' posture (lying or standing) and behavior. This procedure was repeated once every minute during periods of observation. Behavior categories included: idle, interacting with pen fixtures, object play, self-grooming, locomotor play, feed

ingestion, water ingestion, milk ingestion, other, cross-sucking, allogrooming, and social play. A behavior being displayed was denoted by a “1” and “0” was noted for behaviors not displayed. Behavior data were analyzed using the MIXED model procedure of SAS 9.3 (SAS, 2012). Data presented include 18 calves;  $n = 12$  for calves housed in pairs and  $n = 6$  for calves housed individually.

## **Results and Conclusions**

### ***Performance***

Housing Jersey heifer calves in pairs did not significantly increase grain DMI or ADG as initially hypothesized (Figure 1). However, there was a tendency for calves housed in pairs to have a higher overall mean body weight compared to individually housed calves ( $42.8 \pm 0.8$  versus  $40.8 \pm 0.8$  kg;  $P = 0.08$ ) (Figure 2). There was also a housing treatment by time interaction trend ( $P = 0.08$ ), which indicated that calves housed in pairs weighed significantly more than calves housed individually at the onset of weaning during wk 7 ( $53.4 \pm 1.0$  versus  $50.2 \pm 1.0$  kg;  $P = 0.02$ ) through wk 9 ( $65.7 \pm 1.0$  versus  $61.5 \pm 1.0$  kg;  $P = 0.004$ ) (Figure 2).

### ***Behavior***

Scan-sample behavior results revealed that the posture of calves housed in pairs was similar to the posture of calves housed individually. During observation periods, calves housed individually spent significantly ( $P < 0.05$ ) more time interacting with pen fixtures and engaged in object play and self-grooming behaviors but less time consuming grain compared to calves housed in pairs (Figure 3). For example, the calves housed individually spent  $20.8 \pm 0.05\%$  of the time interacting with pen fixtures, while pair housed calves spent  $10.1 \pm 0.03\%$  of the time

interacting with pen fixtures. Pair housed calves also spent less time engaged in object play ( $0.29 \pm 0.005\%$ ) than individually housed calves ( $1.8 \pm 0.01\%$ ). Individually housed calves also spent more time self-grooming ( $3.6 \pm 0.02\%$ ) than pair housed calves ( $2.0 \pm 0.01\%$ ), and time spent ingesting grain was higher for pair housed ( $5.8 \pm 0.01\%$ ) than for individually housed calves ( $3.7\% \pm 0.03\%$ ). The time allocated to milk ingestion was similar for calves in both housing treatments.

Behaviors specific to calves housed in pairs were categorized as: cross-sucking, allogrooming, and social play behaviors. Cross-sucking and allogrooming were observed 13.6% and 2.1% of the time during observation periods, respectively. Lastly, social play was rarely observed, occurring on average 0.70% of the time during observation.

These behavior observations suggest that there are some social aspects that may reduce stress as well. The decrease in the behaviors such as interacting with pen fixtures or playing with objects within the pen observed in paired housed calves suggests that the calves were less stressed. Calves that spend less time engaged in behaviors commonly associated with higher stress levels are assumed to have lower stress levels.

### **Summary**

Although there were no significant differences observed among housing treatments with regard to grain DMI or ADG, calves housed in pairs did tend to weigh more than individually housed calves. During the weaning period and the week thereafter, noted as one of the most stressful times for young calves, calves housed in pairs weighed significantly more than calves housed individually. These results may indicate that the presence of a companion calf may

mitigate the stressors associated with weaning as calves housed in pairs showed a continual increase in body weight throughout the weaning period.

Behavior results revealed that calves housed in pairs spent less time engaged in behaviors that may be associated with stress. For instance, pair housed calves spent significantly less time interacting with pen fixtures, engaged in object play, and self-grooming behavior. Calves housed in pairs also spent significantly more time ingesting starter grain, which may be due to social facilitation. However, calves housed in pairs also displayed cross-sucking behavior. Future studies should investigate alternative feeding systems and environmental enrichment opportunities and how they may affect this behavior within the Jersey breed.

Dairy cattle are social animals and are housed in groups throughout the majority of their lives. Modern dairy producers should consider facilitating early social interactions among young calves, potentially by housing calves in pairs. Learning how to interact socially with conspecifics throughout the milk-feeding phase may make the transition through weaning to group housing systems and other transitions throughout life easier for the animals.

Further investigation on the potential beneficial effects of paired housing on performance and behavior is necessary and specific comparisons between Holstein and Jersey calves should be made, as there may be behavioral breed differences.



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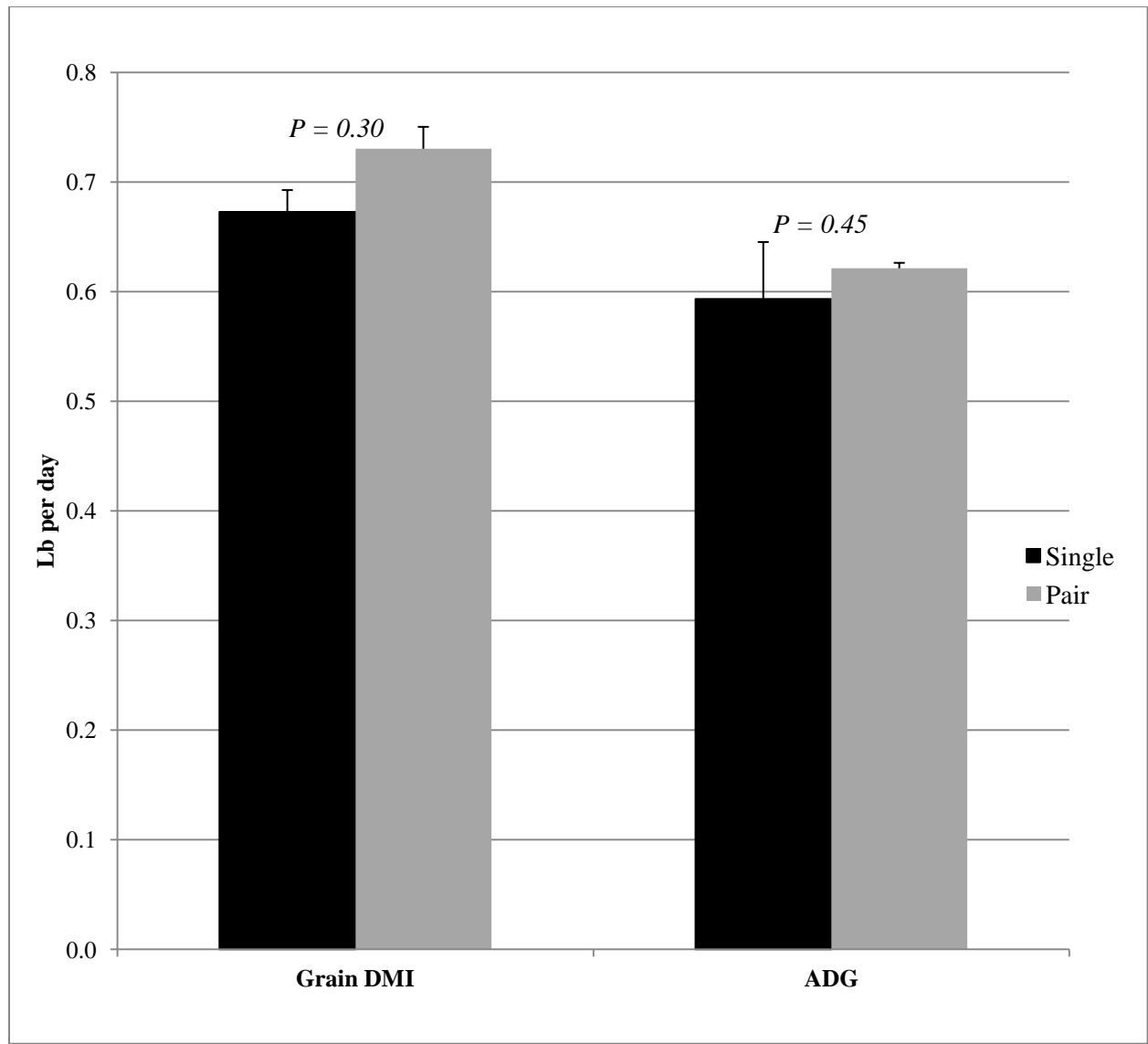


Figure 1. Grain DMI (kg/d) and ADG (kg/d) for calves housed in pairs (n = 18 calves) or individually (n = 18 calves) during the milk feeding and weaning periods.

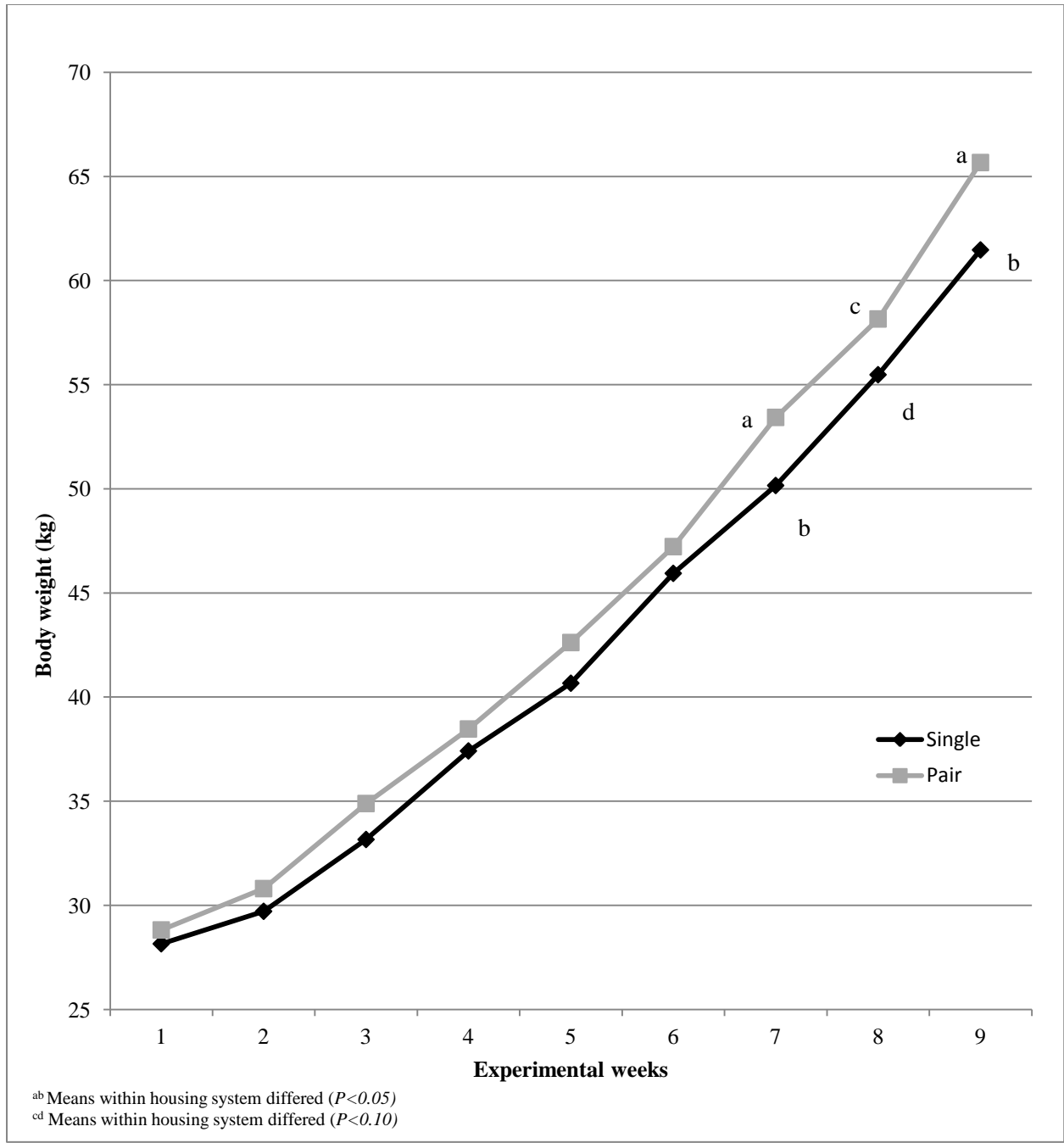


Figure 2. Mean body weight (kg) for calves housed in pairs (n = 18 calves) or individually (n = 18 calves) during the milk feeding and weaning periods.

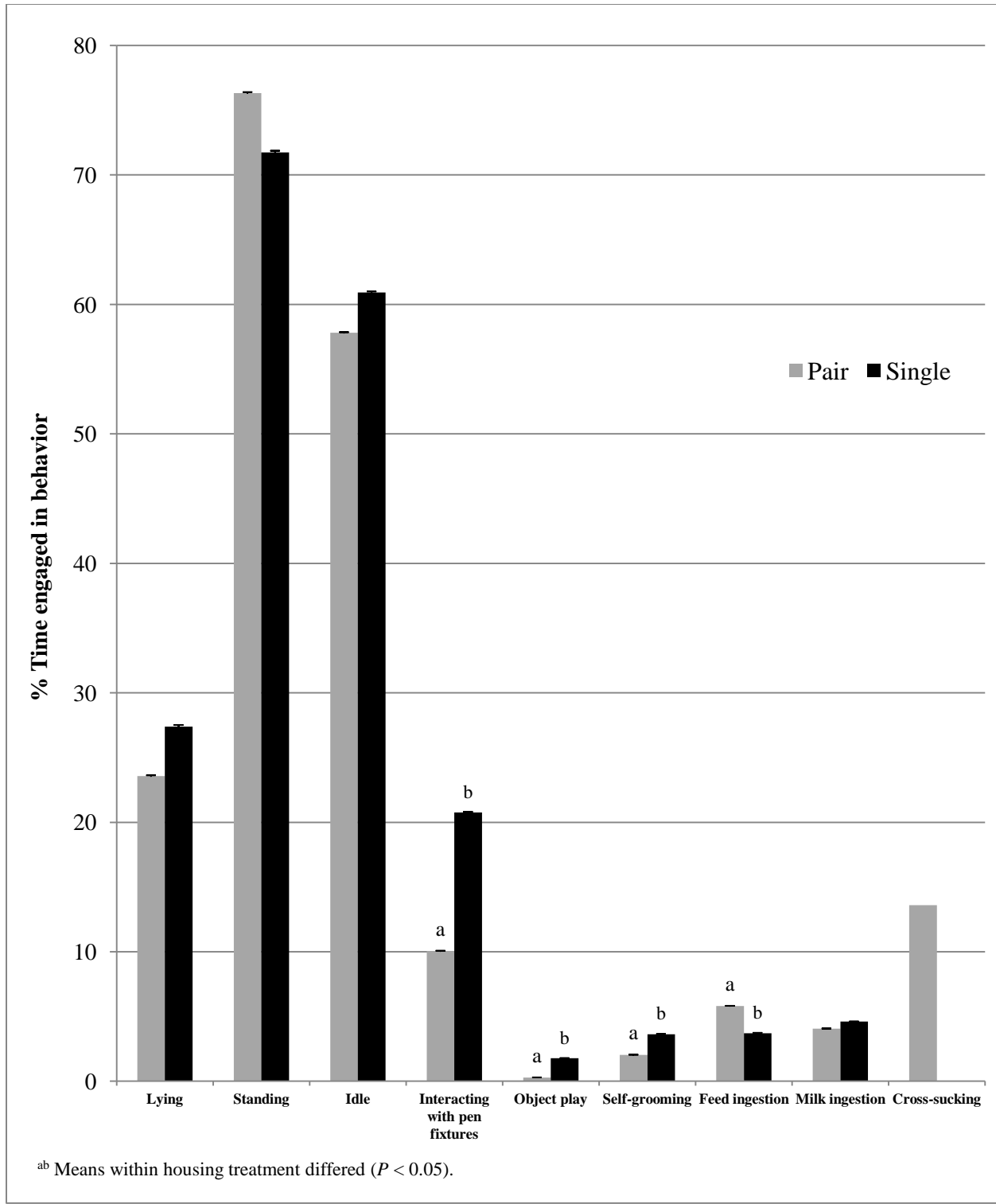


Figure 3. Mean ( $\pm$  SEM) percentage of time calves housed in pairs ( $n = 12$  calves) or individually ( $n = 6$  calves) spent engaged in each behavior.