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## The effect of a furnished individual hutch pre-weaning on calf behavior, response to novelty, and growth

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### ABSTRACT

Housing preweaned dairy calves in individual outdoor hutches is common in North America. However, this type of housing lacks stimulation and minimizes calves' ability to express natural behavior. Providing a social companion has been shown to stimulate natural behavior and promote growth, but no research has assessed the effect of providing physical enrichment items to calves pre-weaning. The objective of this study was to determine calf use of physical items added to an individual hutch, and if providing these items affected growth, behavior (e.g., locomotor play and sucking on pen fixtures), and response to novelty after weaning. At birth, Jersey heifer calves were allocated to 1 of 2 types of hutches: furnished ( $n = 9$  calves) or standard ( $n = 10$  calves). Calves were housed in individual hutches on loose gravel and bedded with straw. The outdoor enclosure of furnished hutches contained 2 artificial teats, a stationary brush, a calf "lollie," and a rubber chain link for calves to manipulate. Calves were video-recorded continuously between 0800 and 2000 h twice weekly at 1, 3, 5, and 7 wk of age; behavioral data were collected using the Noldus Observer software program (Noldus Inc., Wageningen, the Netherlands). At 63 d of age (after weaning), calf response to social and environmental novelty was tested. Starter consumption was measured daily, and calves were weighed at birth and weekly thereafter. Pre-weaning behavioral data were not normally distributed, so raw data were square-root-transformed before analysis. Calves used all of the items depending on the time of day, but they spent the most time using the brush. Calves housed in furnished hutches spent almost 50% more time engaged in locomotor play, but they spent the same amount of time sucking pen fixtures as calves housed in standard hutches. We observed no effect of treatment on growth, starter intake, or behavioral response to social and

environmental novelty after weaning. Results suggest that providing some physical complexity to a standard hutch has some benefits for young calves, but further research is encouraged to determine the long-term effects of physical and social complexity for young dairy heifer calves.

**Key words:** calf, behavior, enrichment

### INTRODUCTION

Most dairy calves in the United States are housed in individual pens or hutches before weaning (USDA, 2016). However, individual housing lacks physical and social stimulation, limiting calves' ability to perform natural behaviors (Stull and Reynolds, 2008). Interest has increased in improving barren conditions for dairy calves and other farm animals by enriching the animals' environment using social, physical, sensory, and nutritional methods (see Mandel et al., 2016, for a review). Effective enrichment should include modifications that improve health, promote natural behavior, reduce abnormal behavior, or provide other benefits compared with minimum housing standards (Newberry, 1995; Mandel et al., 2016). Recent research has shown benefits from the social housing of calves (De Paula Vieira et al., 2012; Galliard et al., 2014), but less research has focused on other forms of enrichment, such as adding complexity to their physical environment.

Standard hutches are usually barren, which likely limits natural calf behaviors such as play and grooming. Play behavior is normal in calves and is considered an indicator of positive welfare (Jensen et al., 1998; Boissy et al., 2007; Mintline et al., 2013). Play can be stimulated by external factors (such as the addition of fresh bedding to a pen) and by space allowance (Jensen et al., 1998), but less is known about the effect of additional objects on calf play. Grooming behavior has been under-researched in dairy calves, but there is growing evidence that adult cows are motivated to access a brush and use it to groom places on their body that are difficult to reach (DeVries et al., 2007; Val-Laillet et al., 2008).

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In addition to individual housing, a second standard practice for young dairy calves in the United States is the provision of milk or milk replacer in open buckets (USDA, 2016). Young calves have a strong, innate motivation to suckle, and without an appropriate outlet for sucking (e.g., because of feeding in open buckets), they redirect their sucking behavior to fixtures in the pen or their peers (Jensen and Budde, 2006; Pempek et al., 2016). Feeding calves from buckets with teat attachments or providing an artificial teat after a meal reduces non-nutritive sucking (Rushen and de Passillé, 1995; Veissier et al., 2002).

Another potential benefit to increasing the complexity of the physical environment of a hutch is improved response to novelty. Evidence from calves and laboratory animals suggests that increasing the complexity of the environment can affect the animal's response to novelty (e.g., De Paula Vieira et al., 2012; Zimmermann et al., 2001). For example, calves housed with a partner pre-weaning were less reactive to environmental and social novelty (De Paula Vieira et al., 2012). Although social and physical enrichments are very different, an investigation of the effect of physical enrichment on response to novelty is warranted in calves.

More physical complexity in a farm animal's environment may also improve feed intake and growth. Although little research has been done with calves, research using pigs has determined that the addition of extra space and an area with peat and straw improved feed intake and food conversion ratios compared with pigs housed in standard pens (Beattie et al., 2000). Research is needed to determine whether physical enrichments added to a standard hutch can also affect calf growth early in life.

The overall goal of this study was to assess the use and effect of physical enrichment items (chosen to stimulate grooming, play, and oral behaviors) in a furnished hutch compared with a standard hutch. Our specific objectives were to (1) determine the duration and frequency of item use by calves; (2) determine the effect of the furnished hutch on calf behavior; (3) determine the effect of the furnished hutch on calves' response to environmental and social novelty post-weaning; and (4) determine the effect of the furnished hutch on starter intake and growth.

## MATERIALS AND METHODS

This study was conducted at the Ohio State University's Waterman Dairy Center, located in Columbus, Ohio, in accordance with the guidelines set by the Institutional Animal Care and Use Committee (Animal Use Protocol: 2015A00000050).

## *Animals, Housing, and Feeding*

Nineteen female Jersey calves were used in this study from birth to 9 wk of age (63 d). The study began in June 2015 and ended in September 2015. Calves were housed in individual hutches (Calf-Tel Deluxe, Hampel Corp., Germantown, WI) with a wire panel pen enclosure (1.22 × 2.72 m). Hutches were placed on loose gravel and bedded with straw; straw was added weekly to each hutch and was completely cleaned and changed between calves. Hutches were placed approximately 0.6 m from each other in 2 rows; calves had visual contact with at least one other calf at all times, but they had no physical contact with each other during the pre-weaning period.

All calves received 1.9 L of colostrum through a bottle as soon as possible after birth and again within 6 h of the first colostrum feeding, per regular farm standard operating procedures. If colostrum of acceptable quality (>50 mg/mL IgG, measured using a colostrometer) was not available, a colostrum replacement (bovine IgG, colostrum replacement; Land O'Lakes Animal Milk Products, Shoreview, MN) was fed to the calf. As part of the farm's normal practice, total proteins in plasma were measured from each calf to determine passive transfer (see Pempek et al., 2016, for a description of this process). All calves enrolled in the experiment had adequate passive transfer (total proteins ≥5.2 g/dL; Dawes et al., 2002).

Calves were fed milk replacer (Cow's Match Jersey Blend; 28% CP and 25% fat, as-fed basis; Land O'Lakes Animal Milk Products) twice daily at approximately 0500 and 1700 h using an open bucket; buckets were removed and cleaned after the calves completed their milk meal. During the first 7 d of life, calves were fed 1.89 L of milk replacer per feeding (3.78 L/d), and then 2.27 L per feeding thereafter (4.5 L/d). Gradual weaning from milk replacer began on d 49 of age; calves were decreased to 1 milk feeding (morning feeding only) per day for 7 d. All calves were weaned on d 56, and remained in hutches until d 63 of age.

Throughout the experiment, calves had ad libitum access to texturized starter (22% CP; AMPLI-Calf Jersey Blend, Land O'Lakes Purina Feed LLC, Shoreview, MN) medicated with 44 g/t of monensin (Rumensin; Elanco Animal Health, Greenfield, IN) and ad libitum access to water. The daily ambient temperature (°F) and relative humidity were recorded from 0800 to 2000 h at the Columbus station of the Ohio Agricultural Research and Development Center from June to September 2015; these records were used to calculate temperature-humidity index (THI; mean ± SD = 81.3 ± 7.13 THI; minimum = 67.0; maximum = 92.9; Zimbelman and Collier, 2011). The THI was recorded

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