

INDIVIDUAL STALLS vs. PENS: GROWTH, BEHAVIOR, DISTRESS AND CARCASS TRAITS^a

The special-fed veal production industry is criticized by some segments of the general public due to several components utilized in the veal production system. One system component criticized is the use of tethers to restrain calves in individual stalls. Although there has been a small increase in the use of individual pens without tethers in the US, most calves are tethered in individual open stalls. However, the individual pen system is the predominant method used in Europe, although group rearing is also increasing. Previous research has demonstrated that there are advantages to individually housing calves compared to rearing in group pens. However, there is a lack of research critically comparing individual stalls and pens. The research study discussed here was a comprehensive comparison of calves tethered in individual stalls compared to calves untethered in individual pens. In addition, three different widths (22, 26, 30 inch) of both stalls and pens were compared.

In order to answer all questions in this comparison of housing design and size, growth performance, behavior, physiological indicators of stress level, calf cleanliness, structural soundness, and carcass characteristics were evaluated.

Calves: Three groups of 36 Holstein calves (total of 108 calves) were obtained from livestock auctions and were randomly allotted upon arrival at the veal farm to either individual stalls or pens of three different widths. Initial weight was the pay weight at the auctions. Additionally, the calves were weighed at week 8 and upon exiting the veal barn. Average daily gain was calculated from the time the calves arrived to week 8, and from week 8 through the final weight, as well as over the entire trial. Carcass weight and other carcass traits (visual and colorimeter evaluation of muscle color) were obtained, as well as a wide variety of behavior, health/treatments, and soundness traits.

Stalls and Pens: All construction consisted of oak boards; the total length of the stall or pen floor was 72 inches. Oak slats were positioned across the front part of the stall or pen floor for 24 inches

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with vinyl-coated expanded metal diagonal-shaped flooring placed 48 inches at the rear of the stall (total length of 72 inches). The sides and fronts of the stalls and pens were 46 inches high from the oak-slat floor which was 15 inches above a concrete floor. Widths of 22, 26, and 30 inches were used for both individual stalls and individual pens, resulting in six different combinations of housing types and widths. The housing types and widths were randomly located in two different central rows of a four-row room.

Use of Statistical Significance: In research, we statistically analyze data primarily to determine if the differences between treatment alternatives are repeatable. A statistical test determines if the differences between the tested treatments or management alternatives happened by chance or can be expected to happen again if these alternatives are used under similar conditions in industry. In this study, there were few statistically significant differences in the comparison of stalls and pens or among the different widths of individual housing types.

Live and Carcass Weights: The calves averaged 18 weeks at slaughter, with live and carcass weights (hide-on) averaging 444 and 302 pounds, respectively. Although there was a tendency for calves in stalls to grow more rapidly than calves in individual pens, there was no statistically significant difference between the two types of housing. Calves in wider pens or stalls did not grow statistically more rapidly than calves in narrower housing. Dressing percent (hide-on) averaged 68 percent and was not influenced by housing type or width.

Blood Traits: There were essentially no differences in hemoglobin, hematocrit, white or red blood cell counts. Hemoglobin averaged 7.3 g/dL at slaughter, which is less than the hemoglobin levels of veal calf groups previously used in Penn State research. Earlier studies conducted by Penn State and the University of California, Davis averaged 7.8 and 8.2 g/dL, respectively, in field studies involving over 2,700 calves.

Body Cleanliness Scores: The calves were scored at different times during the trials, but the most important score for cleanliness was just prior to slaughter. Body cleanliness at slaughter is important since it reflects the amount of excrement and other materials taken from the barn to the packing plant. This is a concern even though veal calves are washed before and/or after slaughter. Although there were no differences in apparent cleanliness of the forequarters and belly, the hindquarters of calves reared in enclosed pens accumulated more fecal material than calves reared in stalls. It should be mentioned that the stalls used in this study were oak which is more porous and more difficult to clean than the harder, more

dense imported lumber usually used in the construction of individual pens. Width of stall or pen did not affect calf cleanliness score at slaughter.

Joint, Navel and Overall Body Condition: There were statistically significant differences in left knee swelling scores with a general increase in swelling as stall or pen width decreased. Although this difference was rather small, the observation does suggest that calves in smaller housing units had greater difficulty in extending their front legs and changing from a lying to a standing position. French researchers also concluded that calves housed in smaller-sized pens tended to keep knees and hocks bent while lying. Maintaining this posture may have contributed to more joint swelling in the smaller pens. There were no differences in navel (e.g., inflammation, redness) or overall body condition (body condition primarily based on apparent degree of fatness). Only minor differences were observed in health status and treatments (e.g., medications) among the stalls or pens of different widths.

Ambulation, Behavior and Excitability: The majority of the animals (88 percent) when housed in their stalls or pens scored between 2.5 and 3.5 (possible scores of 1 to 5) for excitability and behavior. This is well within the range of acceptability. None of the calves were either apathetic (score of 1) or extremely difficult to handle (score of 5). Calves in stalls tended to be more excitable than were calves in pens. There was little effect of housing design or width on ambulatory ability. Most calves (92 percent) either moved normally or exhibited modest staggering or stiffness of leg joints when released for loading. Calves moved with some hesitation while being loaded, perhaps due to the novelty of the experience rather than due to a physical impairment. This agrees with conclusions by French researchers.

Hairball Count and Organ Condition: The abomasum (one of the four stomach compartments) was palpated on the slaughter line and the number and size of hairballs were recorded. The number of hairballs was assumed to be an indirect determination of the intensity of self- and/or neighbor-grooming due to the housing regime. Hairballs do not develop in calves fed solid feeds with or without milk replacer. The calves averaged 1.9 hairballs 2 inches or less in diameter, .67 hairballs between 2 and 4 inches, and .05 hairballs greater than 4 inches. However, there were no housing design or width effects on hairball count or diameter, and there were no apparent health or growth impairments from hairball accumulation. The accumulation of hairballs suggests that grooming does occur in stalls and pens of different widths. Self-grooming could not be differentiated from neighbor-grooming. However, since

there were dividers on the fronts of the pens and stalls which prevented most neighbor-grooming, the hairball accumulation resulted primarily from self-grooming.

Conditions of the liver, lung and spleen were also evaluated at slaughter. All but one calf in the 26-inch stall treatment exhibited excellent liver condition; eight calves exhibited less than excellent lung condition, and all calves had excellent spleen condition.

Blood Indicators of stress: Three different blood components were analyzed on all the calves in this study to determine the level of distress that might have been caused by housing design or stall/pen width (cortisol, acute phase proteins, and neutrophil/lymphocyte ratio). All of these were determined each 28 days throughout the three different group production cycles. There were no differences between stalls or pens of different widths in any of these characteristics. The averages of these traits were within the ranges of calves in non-veal management systems.

Other Behavior Traits: Twelve calves within each of the three production groups, representing both housing designs and the three widths, were videorecorded five times in each of weeks 9, 13 and 18. A film frame was recorded every 1/20 second with 24 hours of observation recorded on a 2-hour tape. The videotapes were observed for 15 seconds each hour and half-hour for the entire 24-hour recorded periods. Over 26 different behaviors were observed, recorded and analyzed. The observing of a particular behavior occurring was the numerical information recorded for statistical analysis. Of particular attention was the appearance of "stereotypies" which are a highly repetitive abnormal behaviors, such as tongue rolling. Although the frequency of the primary stereotype observed, such as tongue rolling, increased between week 9 and week 18, there was no statistically significant difference between stalls and pens of different widths. French researchers determined that calves in smaller pens spent more time rolling their tongues than did calves in larger pens. Another stereotypic type of behavior observed was "sham chewing," which occurred at a very low frequency; however, the frequency of "sham chewing" tended to increase as stall or pen size decreased.

The various behavioral traits that were observed, recorded and analyzed are too numerous to mention here, but included almost every activity or change in position or posture that the calf could make. If any reader is interested in these specific traits, a list can be provided to them.

Carcass Color and Grade: All carcasses were subjected to visual evaluation and mechanical measurement (colorimeter) of muscle color (carcass grade) at slaughter and 24 hours later. There were no

differences due to housing design or width in either the visual evaluations or mechanical measurements at either time after slaughter. It is interesting to note that muscle color lightened between slaughter and 24 hours post-slaughter, which has been noted in earlier research at Penn State and elsewhere.

Economic Implications: When housing designs (tethered in stalls vs. non-tethered in individual pens) are compared critically, there is little or no difference in calf well-being, performance, behavior, health status, signs of distress, carcass desirability or other factors. Calves tethered in open stalls did not exhibit any increased stereotypies, distress, or other indicators of abnormal behavior as compared to calves in individual pens. If it is assumed that calf age and weight will remain about the same or perhaps increase slightly over the next few years, there is justification to use stalls at least 26 inches wide and pens at least 30 inches wide. If calf size increases significantly (e.g., to 23 weeks and 510 pounds) in the next few years, then 30-inch stalls and 30- to 36-inch pens would be justified from the standpoint of animal well-being and performance. It seems unlikely that slaughter age and weight will decrease. If calves continue to be plentiful for special fed-veal production, and age and weight decreases (e.g., to 16 weeks and 410 pounds), then 24-inch stalls and 30-inch pens may be acceptable. Increasing stall or pen size would reduce the number of calves per barn thus probably increasing production costs. Perhaps the veal industry should give more consideration to the total impact of further increases in slaughter age and weight. Based on the results of this study, there is no apparent advantage to adopt non-tethered veal production systems from the calf's standpoint, but this change may be supported by public perception and marketability of veal products.