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GIANNE EVANS CUNHA

**RESPOSTAS COMPORTAMENTAIS DE NOVILHAS EM
ADAPTAÇÃO DURANTE A MUDANÇA DE UMA ÁREA DE
DESCANSO COLETIVA PARA UMA ÁREA DE DESCANSO
INDIVIDUAL**

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Orientadora: Prof. Dra. Ivone Yurika Mizubuti.
Co-orientador: Prof. Dr. José Antonio Fregonesi

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Londrina, 03 de março de 2009.

DEDICO, COM AMOR

Ao meu esposo Franklin e aos meus pais José e Geni

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Gianne Evans Cunha, filha de José Aparecido da Cunha e Geni da Costa Cunha, nasceu em Londrina-Paraná, no dia 13 de março de 1981.

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CUNHA, Gianne Evans. **Respostas comportamentais de novilhas em adaptação durante a mudança de uma área de descanso coletiva para uma área de descanso individual.** 2009. 35f. Dissertação (Mestrado em Ciência Animal) – Universidade Estadual de Londrina, Londrina, 2009.

RESUMO

O objetivo desse trabalho foi examinar as respostas comportamentais de novilhas em crescimento quando são introduzidas em um sistema de free stall e também quando são apresentadas a um comedouro com tranca de pescoço. Foram utilizadas vinte e uma novilhas Holandesas balanceadas por idade ($159\pm 25,0$ dias) e peso corporal ($207\pm 26,3$ Kg). As novilhas foram divididas em 7 grupos de 3 animais cada. Os animais foram observados em 2 tipos de sistema de manejo, sendo o primeiro com baia coletiva onde a cama ($4,6\times 12,0$ m) era constituída de pó de serra e o segundo com baias individuais (*free stall*) com 13 baias (*stalls*) no espaço de descanso ($6,6 \times 12,0$ m), também com cama de pó de serra. Todas as novilhas foram instaladas nas baias coletivas oito semanas antes do início do experimento. Cada grupo foi alocado na baia coletiva experimental por 5 dias e foram gravadas por câmeras durante 3 dias (período 1). Após esse período os animais foram movidos para a baia com camas individuais (*stalls*) contendo o mesmo tipo de comedouro (barras fixas) onde permaneceram por 5 dias sendo gravadas (período 2). Finalmente os animais foram deslocados para uma baia com as mesmas dimensões da anterior que também continha *stalls*, mas com um comedouro onde as barras eram móveis e com tranca de pescoço, sendo observados por 3 dias (período 3). Os comportamentos analisados diariamente foram os seguintes: tempo total de descanso (novilha deitada dentro ou fora da cama), tempo total que os animais passaram em pé (nos corredores, na cama ou com as patas da frente na cama) e tempo total se alimentando. Para o segundo período onde os animais foram movidos para o *free stall* também foi observado o tempo de latência dos animais para utilizarem a cama pela primeira vez. Para o primeiro tratamento (período 1 vs. período 2) houve uma diferença significativa ($P<0,001$) para tempo descansando entre o primeiro dia na nova baia e o período anterior, onde foi observado uma queda de 4 h/d. Houve também diferença entre o primeiro dia e os dias subseqüentes ($P< 0,001$) pois após o primeiro dia os animais voltaram a descansar como antes, portanto não houve diferença entre os períodos ($p=0,127$). Antes da introdução dos animais no *free stall*, as novilhas raramente foram observadas deitadas nos corredores, sendo que este comportamento subiu para 2,5 h/d no primeiro dia no novo sistema ($P<0.001$), declinou para 1,5 h/d no período seguinte ($P = 0.010$), mas continuou mais alto que o período anterior ($P = 0.006$). O tempo despendido em pé nos corredores aumentou de 2,5 h/d para mais de 4 h/d no primeiro dia no *free stall* ($P<0,001$), declinou para 3 h/d ($P<0,001$) durante os dias subseqüentes, entretanto, continuou mais alto do que no período anterior ($p=0,002$). Para tempo em pé com as quatro patas na cama houve diferença ($P< 0,001$) entre o período 1 e o primeiro dia na nova baia e entre os períodos 1 e 2 ($P<0,001$). No entanto, não houve diferença entre o primeiro dia e os dias subseqüentes na baia com divisões. Tempo em pé com somente as patas da frente na cama só foi observado no período 2 e houve diferença entre o primeiro dia e os demais dias na baia com divisões ($P<0,001$). Não houve diferença no tempo que os animais

passaram se alimentando durante o período de transição. Para o segundo tratamento (per. 2 vs. per. 3) houve diferença ($P=0,007$) para tempo se alimentando entre o período 2 e o primeiro dia com o novo comedouro, mas não foi verificada diferença entre períodos ou entre o primeiro dia e dias posteriores no novo comedouro. Para os outros comportamentos não ocorreram diferenças significativas nem entre períodos nem entre o primeiro dia e período anterior, ou dias posteriores a mudança. Pode-se concluir que novilhas necessitam em torno de 24h para se adaptarem a um novo ambiente, para aprenderem como se deitar nas camas individuais e utilizarem um comedouro com tranca no pescoço.

Palavras-chave: Adaptação. Sistemas de confinamento. Comedouro. Comportamento. Bem-estar animal.

CUNHA, Gianne Evans. **Behavioral Responses of Heifers in Transition From Sawdust-Pack to Free Stall Housing**. 2009. 35p. Dissertation (Master's degree in Animal Science) – Universidade Estadual de Londrina, Londrina, 2009.

ABSTRACT

The objective of this work was examining behavioral responses of early heifers when they are introduced to a free stall pen and headlock feed bunk. Twenty-one Holstein dairy heifers balanced by age (159 ± 25.0 d) and BW (207 ± 26.3 kg) were used. The heifers were divided in 7 groups of 3 animals each. The animals were housed in either a pen that consisted of a sawdust bedded-pack area (4.6 x 5.0 m; width x depth) or in free stall pens (6.6 m x 12 m; width x depth) containing 13 stalls. All heifers had at least 8 wks previous experience lying on a bedded sawdust pack. Each group were housed on the sawdust bedded pack for 5 d and recorded for 3d. After this first period the heifers were moved to a free stall pen with the same type of feed barrier and recorded for 5 d (period 2) and the last period the animals were moved to a new free stall pen fitted with a headlock feed barrier and monitored for 3 d (period 3). The behaviours recorded were lying, standing, feeding and for the period 2 the latency to use the stall as well. For the first treatment (sawdust-pack vs. Free stall) there were significant difference ($P < 0.001$) between the sawdust-pack period and the first day in the stall where lying time felt 4 h/d and difference between the first day and subsequent days in a free stall ($P < 0.001$) but there was not difference between periods 1 and 2 ($P = 0.127$). Before introduction to the free stalls, heifers were rarely observed lying down in the alley, but this behavior increased to 2.5 h/d were introduced to free stall housing ($P < 0.001$), this time declined to 1.5 h/d on the days following the change in housing ($P = 0.010$), but this was still higher than during the baseline period on the sawdust pack ($P = 0.006$). Standing in the alley increased approximately 2 h/d ($P < 0.001$) in the first day in the stall pen, this time declined to approximately 3 h/d ($P < 0.001$) during the days following the switch, a value still higher than during the baseline period ($P = 0.002$). For standing with 4 hooves in the bedded area there was difference between pack and first day in free stall ($P < 0.001$) and between pack vs. free stall ($P < 0.001$), but there was not difference between the first day and subsequent days. Time standing with the front hooves in the stall was measure just in free stall and was observed significant difference between the first day and subsequent days in the free stall pen ($P < 0.001$). There was no change in feeding time during the transition period. For the second treatment (slats vs. headlock) there was significant difference in feeding time between the period in the slat feed bunker and the first day in a headlock ($P = 0.007$). It Was not found difference between the baseline period and the headlock period and between the first day with headlock feeder and subsequent days. The others behavior observed did not change during this experiment. In conclusion, dairy heifers take around 24 h to adapt to a new house system and learned how to lay down in stalls and how to use the headlock feed bunk.

Keywords: Adaption. Confinement systems. Feed bunk. Behavior. Animal welfare.

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INTRODUÇÃO

Atualmente muitos trabalhos estão sendo realizados na área de bem estar e comportamento de gado leiteiro. No entanto, os focos dos estudos são os animais em produção ou bezerros, onde os produtores imaginam que se deve ter mais atenção. Poucos estudos nessa área são realizados tendo como foco as novilhas, tanto na adaptação em novos ambientes como o manejo em geral.

É observado que na maioria das propriedades canadenses as novilhas são mantidas em baias com espaço para descanso coletivo e um corredor com divisórias simples por onde os animais têm acesso ao alimento. No entanto, quando atingem a idade fértil, os animais são inseminados e transferidos para baias maiores, com cama dividida em pequenos cubículos, também chamada de free stall, onde o corredor de alimentação possui divisórias com tranca de pescoço para evitar a competição no comedouro e facilitar o manejo dos animais, como por exemplo, aplicar medicamento, vacina, coleta de sangue, ou até mesmo para separar um animal do rebanho.

Essa transição é abrupta e os animais necessitam se adaptar rapidamente as novas condições de vida, e esse processo de adaptação ainda não é bem conhecido, como por exemplo, o tempo que as novilhas levam pra se adaptarem as mudanças.

Quando as novilhas são introduzidas ao novo ambiente, podem demonstrar padrões de comportamentos diferentes quando comparado ao período anterior às mudanças ou quando os animais já estão adaptados ao novo ambiente. A observação contínua do comportamento durante esse período de transição é necessária e pode ajudar a entender e definir como ocorre a adaptação e quanto tempo leva para os animais aprenderem a lidar com as novas áreas de descanso e novos comedouros.

Esse trabalho representa o início desse entendimento, pois os animais devem ser observados para demonstrar o tempo gasto para que ocorra a adaptação ao novo ambiente, bem como os padrões de comportamentos durante este período.

REVISÃO DE LITERATURA

As mudanças ambientais bruscas podem causar problemas e dificuldades para futuras adaptações (GODDARD et al., 1998). O entendimento de como as mudanças de ambientes, sistemas ou manejo afetam o comportamento animal pode ajudar a melhorar o bem estar durante essa fase, uma vez que os cientistas terão informações para trabalhar no intuito de diminuir o estresse causado durante esse período.

Para melhorar o bem estar de vacas leiteiras, as propriedades vêm substituindo um antigo sistema de confinamento, que consiste em manter os animais em cubículos individuais presos por uma corrente (*tie stall*), por sistemas onde os animais são mantidos em grupos e livres de correntes. Nos novos sistemas, os animais podem permanecer tanto em baias com área de descanso coletiva e coberta por uma cama de palha ou pó de serra (chamados *strawyards* ou *sawdust-pack*), como em baias com área de descanso divididas em cubículos individuais cobertas por pó de serra ou areia, chamado de sistema *free stall* (LEAVER, 1999).

Vários estudos vêm sendo realizados com o intuito de determinar qual sistema proporciona uma melhor qualidade de vida para animais confinados. As pesquisas revelam que o sistema com área de descanso coletiva é o que oferece o melhor conforto, pois os animais passam mais tempo deitados e o sistema permite que ocorra um sincronismo neste comportamento. No entanto, nesse sistema os animais ficam sujos, pois defecam na cama e deitam por cima, o que eleva a incidência de mastite nos rebanhos (FREGONESI; LEAVER, 2001 e 2002).

Para que o sistema com área de descanso coletiva funcione, é necessário que a limpeza dessa área ocorra diariamente e a reposição e troca de cama seja feita com mais frequência, para evitar que os animais fiquem sujeitos a doenças. Isso leva a um alto custo de manutenção porque demanda mais mão de obra e material de cama.

O sistema *free stall* proporciona uma melhor limpeza do animal e um menor índice de mastite já que o animal não permanece deitado em cama úmida contendo fezes e urina, porque o sistema não permite que os animais sujem a cama.

O desenho dos *stalls* é feito de forma que os animais precisam se levantar para defecar e urinar, e ao se levantar uma barra (*neck rail*) localizada na

parte posterior do *stall* e elevada do chão, impede que o animal fique em pé na cama, pois a mesma reduz o tamanho do local de descanso, fazendo com que o animal posicione as patas traseiras nos corredores, onde os dejetos podem ser limpos com mais facilidade através de rodos automáticos.

O sistema *free stall* tem um maior custo de implantação, no entanto demanda de menos mão de obra, pois a limpeza pode ser feita com menos frequência e menos uso de material de cama, portanto a manutenção tem um custo inferior ao sistema com área de descanso aberta.

Para que o conforto não seja prejudicado neste tipo de sistema, é necessário que a baia possua um cubículo (cama) para cada animal e o espaço oferecido seja suficiente para que as vacas consigam se deitar com facilidade (FREGONESI; LEAVER, 2001 e 2002).

Os padrões de comportamento em animais adultos alocados em baias com área de descanso coletiva comparadas com baias tipo *free stall* são estudados atualmente com o objetivo de proporcionar melhor bem estar às vacas. Fregonesi e Leaver (2001 e 2002) encontraram que o tempo de descanso foi melhor em animais que permaneciam em baias coletivas, mostrando que as práticas de manejo na fazenda influenciam o bem estar animal. O tempo de descanso pode ser utilizado como indicador de como está ocorrendo a adaptação e como um ambiente inconveniente influencia o comportamento (JENSEN, 1999).

Além do tipo da área de descanso, a qualidade da cama também influencia o tempo de descanso. Fregonesi et al. (2007) observaram uma drástica redução no tempo de descanso e um aumento significativo do tempo que os animais passam em pé quando a cama oferecida continha níveis elevados de umidade. Segundo Cook et al. (2004) os animais não se sentem confortáveis na cama úmida e isso pode ocasionar sérias lesões de casco.

O tempo diário de descanso está intimamente ligado com o crescimento do animal (HÄNNINEN et al., 2003; MONGENSEN et al., 1997). Alguns pesquisadores têm demonstrado que vacas com restrição no tempo de descanso apresentam altos níveis de cortisol no plasma, além de outros indicadores fisiológicos de estresse (FISHER et al., 2002; TUCKER et al., 2007), que reafirmam a importância desse comportamento como um indicador de bem-estar.

Muitos estudos têm mostrado que o espaço oferecido na área de descanso muda o sincronismo do descanso (FAEREVICK et al., 2008; MOGENSEN

et al., 1997; NIELSEN et al., 1997;). No entanto, em algumas situações onde o espaço é suficiente para todos, os animais demonstram competição por espaços mais confortáveis, com mais material de cama, menos vento ou com acesso as paredes (ANDERSEN; BOE, 2007; BOE et al., 2006; GYGAX et al., 2007). Quando se compara área coletiva com áreas divididas (*free stall*), o comportamento pode ser muito importante, pois no sistema *free stall* há divisões na cama sem a presença de paredes para proteger dos ventos.

Hagen and Broom (2004), estudando a reação emocional no aprendizado de gado leiteiro, observaram que os batimentos cardíacos aumentaram nos 2 primeiros dias que os animais foram submetidos a processos de aprendizagem, podendo refletir o estresse neste processo de aprendizagem.

Outro estudo que relata o estresse na adaptação foi desenvolvido por Rzasa et al. (2007), que utilizaram índices sanguíneos de glicose, fibrinogênio, hematócritos, cortisol, haptoglobina, soro amilóide A, proteína total e frações de proteínas (albuminas e globulinas) para monitorar o estresse da adaptação em gado de corte em novo rebanho. Os pesquisadores relataram que os animais demoram uma semana para normalizarem os índices observados.

É possível encontrar trabalhos sobre a adaptação de novilhas prenhes ao *tie stall*, porém não há estudos comportamentais para a categoria de novilhas no processo transitório entre cama coletiva e *free stall*, sendo importante o início das pesquisas na área.

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OBJETIVOS

OBJETIVO GERAL

Estudar as respostas comportamentais de novilhas em diferentes sistemas de confinamento, determinando o tempo necessário para adaptação quando são movidas de um sistema com área de descanso coletiva para um sistema com área de descanso individual (free stall), bem como o comportamento desses animais quando apresentados a um novo sistema de alimentação.

OBJETIVOS ESPECÍFICOS

Determinar as mudanças comportamentais durante dois períodos de transição através da observação contínua.

Determinar tempo de descanso diário, tempo em pé, tempo se alimentando, tempo com as patas na área de descanso, latência para utilizar a cama com divisões pela primeira vez, e tempo deitado nos corredores.

Determinar o tempo de adaptação a um novo sistema de alimentação com presença de um canzil com tranca de pescoço.

ARTIGO

Behavioural Responses of Heifers in Transition from Sawdust-Pack to Free Stall Housings

ABSTRACT

The objective of this research was examining behavioral responses of early heifers when they are introduced to a free stall pen and headlock feed bunk. Twenty-one Holstein dairy heifers balanced by age (159 ± 25.0 d) and BW (207 ± 26.3 kg) were used. The heifers were divided in 7 groups of 3 animals each. The animals were housed in either a pen that consisted of a sawdust bedded-pack area (4.6 x 5.0 m; width x depth) or in free stall pens (6.6 m x 12 m; width x depth) containing 13 stalls. All heifers had at least 8 wks previous experience lying on a bedded sawdust pack. Each group were housed on the sawdust bedded pack for 5 d and recorded for 3d. After this first period the heifers were moved to a free stall pen with the same type of feed barrier and recorded for 5 d (period 2) and the last period the animals were moved to a new free stall pen fitted with a headlock feed barrier and monitored for 3 d (period 3). The behaviours recorded were lying, standing, feeding and for the period 2 the latency to use the stall as well. For the first treatment (sawdust-pack vs. Free stall) there were significant difference ($P < 0.001$) between the sawdust-pack period and the first day in the stall where lying time felt 4 h/d and difference between the first day and subsequent days in a free stall ($P < 0.001$) but there was no difference between periods 1 and 2 ($P = 0.127$). Before introduction to the free stalls, heifers were rarely observed lying down in the alley, but this behavior increased to 2.5 h/d were introduced to free stall housing ($P < 0.001$), this time declined to 1.5 h/d on the days following the change in housing ($P = 0.010$), but this was still higher than during the baseline period on the sawdust pack ($P = 0.006$). Standing in the alley increased to over 4 h/d ($P < 0.001$) in the first day in the stall pen, this time declined to approximately 3 h/d ($P < 0.001$) during the days following the switch, a value still higher than during the baseline period ($P = 0.002$). For standing with 4 hooves in the bedded area there was difference between pack and first day in free stall ($P < 0.001$) and between pack vs. free stall ($P < 0.001$), but there was not difference between the first day and subsequent days. Time standing with the front hooves in the stall was measure just in free stall and it was observed significant difference between the first day and subsequent days in the free stall pen ($P < 0.001$). There was no change in feeding time during the transition period. For the second treatment (slats vs. headlock) there was significant difference in feeding time between the period in the slat feed bunker and the first day in a headlock ($P = 0.007$). There was no difference between the baseline period and the headlock period and between the first day with headlock feeder and subsequent days. The others behavior observed did not change during this experiment. In conclusion, dairy heifers take around 24 h to adapt to a new house system and learned how to lay down in stalls and how to use the headlock feed bunk.

Keywords: Adaption. Confinement systems. Feed bunk. Behavior. Animal welfare.

Introduction

Within the realm of animal welfare research there are many studies focusing on adult cows. However, few studies have been accomplished on heifers adaptation to new environments and management systems. Usually, housing conditions for heifers consist of pack stalls: an open area with sawdust bedding while food is accessed by a simple feeding barrier, without a headlock device. However, later in life heifers are usually moved to free stall housing; with sand bedding and headlock feeding barriers. The animals must learn rapidly how to cope with this new physical and social environment. It is not very well understood, how long it takes for heifers to adapt to this new environment.

When allocated to a new environment, heifers may show different behavioural pattern from the previous one until they have successfully adapted to. These changes can cause developmental problems and difficulties for future adaptations (GODDARD et al., 1998). Understanding how changes in housing systems and management affect animal behaviour may allow animal welfare scientists to explore ways to decrease stress in the animals during the transition period.

Behavioral patter in adult dairy cows housed in pack and free stall systems has been largely studied. Fregonesi and Leaver (2001 and 2002) found that the amount of time spent lying was greater in pack than in free stalls, showing that differences in management practices between systems may have effect on cow's welfare. Also, lying behavior may be used as an indicator of how the animals can adapt to the physical environment, as well as unsuitable physical environments may impair this behavior (JENSEN, 1999).

Resting behavior is related with growth rate. Calves that rest for longer grow more (HÄNNINEN et al., 2003; MONGENSEN et al., 1997;). And some researchers have demonstrated that cows with restricted lying times have elevated levels of plasma cortisol and other indicators of physiological stress (FISHER et al., 2002; TUCKER et al., 2007), reaffirming that rest behavior is an important welfare indicator.

Many studies reported that space allowance in resting areas change the synchronous resting (FAEREVICK et al., 2008; MOGENSEN et al., 1997; NIELSEN et al., 1997), however, in some situations when the space allowance should be enough, the animals had been demonstrated competition for more comfortable resting areas, like spaces with more bedding material, less draft or with access to a wall (ANDERSEN; BOE, 2007; BOE et al., 2006; GYGAX et al., 2007). When it was compared sawdust-pack with free stall this difference can be really important for resting behavior because the free stall has a limited area to rest with no wall to protect of draft.

Hagen and Broom (2004), studying emotional reaction to learning in cattle reported that heart rate increase on the first two days than the animals were in learning process. This may reflect the stress of habituation to the new environment.

The present study will examine behavioral responses of early heifers to different housing conditions. It will also determine how long of an adjustment period is necessary for heifers to adapt when they are moved from sawdust-pack to free stall housing. In addition, this study aims to describe the animals' acclimation to new feed bunks with head locks.

Materials and Methods

Animals, Housing, and Diet

Twenty-one Holstein dairy heifers were used in the study. The animals were divided into 7 groups of 3 animals each. Groups were balanced for age (159 ± 25.0 days; mean \pm SD) and BW (207 ± 26.3 kg). The animals were housed at The University of British Columbia Dairy Education and Research Centre (Agassiz, BC, Canada) and were managed according to the guidelines set by the Canadian Council on Animal Care (1993). The heifers were housed in either a pen that consisted of a sawdust bedded-pack area (4.6 x 12.0 m; width x depth) and a standing alley with rubber flooring (4.6 x 3.05 m), which divided the pack from the feeding area or in free stall pens (6.6 m x 12 m; width x depth) containing 13 stalls (each 0.83 m centre to centre and 1.8 m; width x depth). Each lying stall was fitted with a neck-rail positioned at 1.0 m from the curb and 0.85 m vertically from the bed from the stall. Stalls were configured in 3 rows separated by two 3 m wide alleys. Flooring consisted of textured rubber and cleaned 6 times per d by an automatic scraper. All lying areas were cleaned once per day at 0900 h and fresh sawdust added twice a month during the entire experimental period.

The pen containing the sawdust bedded pack was fitted with a slanted feeding bunk barrier containing 13 feeding spaces separated 25 cm apart center to center. Fresh food was provided once daily at 0800 h and feed was pushed up 2 times per day. Heifers were provided ad libitum access to chopped fescue hay (*Festuca arundinacea*) and 2.3 kg/heifer/d of concentrate that was top-dressed on the ration. Each day beginning at 0730 h, immediately prior to the once per day delivery of fresh feed at 0800 h, orts were removed. A mineral salt lick was available

to each pen and water was freely available from a self-filling trough. Composition of the concentrate was 91% DM, 16.48% CP, 23.85% NDF, 9.04% ADF, 1.21% Ca and 0.64% P and the grass hay contained 90.80% DM, 15.14% CP, 51.71% NDF, 29.90% ADF, 0.41% Ca and 0.28% P.

Experimental Treatments and Design

All heifers had at least 8 wks previous experience lying on a bedded sawdust pack. Soon after, there was the formation of the group animals that were housed together on the sawdust bedded pack for 5 d with lying, feeding and standing behaviors recorded on the last 3 d (Period 1). On the following day animals were moved to a new pen fitted with the same type of feed barrier but contained free stalls rather than a bedded pack. Lying, standing and feeding behaviors were monitored for 5 d (Period 2). Finally, animals were moved to a new free stall pen fitted with a headlock feed barrier 4.6 meters in length containing 13 feeding places (35 cm centre to centre). All behaviours were monitored for 3 d (Period 3).

Behavior

Behavior was recorded for 24 h/d during all periods; using 2 cameras/pen (Panasonic WV-BP334 24V) positioned 10 m above the pen. The cameras were attached to a video multiplexer (Panasonic WJ FS416) and time-lapse recorder (Panasonic AG 6540; Panasonic, Mississauga, Ontario, Canada). Red lights (100W) were hung 10 m above the pen to facilitate video recording at night. Heifers were photographed before the trial commenced to facilitate individual identification of them during video playback.

Video recordings were scanned at 5 min intervals (MITLOHNER et al., 2001) to quantify stall usage (lying, standing in the alley, standing with 2 hooves in the stall or standing with all 4 hooves in the stall), and feeding times. When the heifers were moved from the sawdust-pack to free stall, latency time to use the stall for the first time (defined as lying on the stalls) was also measured. When heifers were moved from the slanted feeding bunk barrier to the headlock feeding barrier latency time to use headlock feeding bunk barrier for the first time was also recorded (defined as eating).

Statistical analysis

Animal responses were analyzed by using a PROC MIXED model in SAS (2003), with group (n=7) and day (n=7) as observational units during the first treatment (sawdust-pack vs. free stall), where were compared the period on sawdust-pack with the first day in the stalls; the first day with the subsequent days in the stalls; and also the period in the sawdust-pack with free stall. On the second treatment (slats vs. headlock) was used group (n=7) and day (n=5) as an observational units, where were compared the period on slats feed bunk with the first day in the headlocks feed bunk; the first day with the subsequent days in the headlock feed bunk; and finally compared differences between periods in the slats feed bunk and headlocks feed bunk.

Results

Transition from the sawdust-pack to free stall housing

During the baseline observations when all heifers were housed on the bedded pack, lying times averaged approximately 14 h/d (Fig. 1 A). On the day heifers were first moved to the free stall pen, lying times declined to 10 h/d ($P < 0.001$), but recovered ($P < 0.001$) on the following days. Lying times on the days following the switch to free stall housing were not different from those observed during the baseline period ($P = 0.127$). Heifers differed in their latency to first lie down in the free stalls (Fig. 2); one heifer lay down just 25 min after introduction into the new pen, while another was never observed lying in a stall during of this study (i.e. for 8 d after introduction to free stall housing).

Before introduction to the free stalls, heifers were rarely observed lying down in the alley (Fig. 1 B). This behavior spiked on the day animals were introduced to free stall housing, averaging approximately 2.5 h on this day ($P < 0.001$). Time spent lying down in alley declined to approximately 1.5 h/d on the days following the change in housing ($P = 0.010$), but this was still higher than during the baseline period on the sawdust pack ($P = 0.006$).

While housed on the bedded pack pen, heifers spent approximately 2.5 h/d standing idle in the alley (Fig. 1 C). On the day heifers were switched to free stall housing, this standing time increased to over 4 h/d ($P < 0.001$). Time spent standing in the alley declined ($P < 0.001$) to approximately 3 h/d during the days following the switch, a value still higher than during the baseline period ($P = 0.002$).

In addition to standing outside of the stalls, heifers spent some time standing either fully or partially on the bedded area. During the baseline observations on the bedded pack heifers spent approximately 1 h/d standing with all four hooves on the

bedded area (Fig 1. D). This behavior declined to just a few min/d on the day of switch ($P < 0.001$) and the days following the switch to free stall housing ($P < 0.001$), with no difference between these last two phases ($P = 0.432$). On the day heifers were introduced to free stall housing they spent on average 70 min/d standing with their front hooves in the stall and their rear hooves in the alley. This time fell to 35 min/d ($P < 0.001$) on the days following the switch to the new housing.

Heifers averaged of 6 h/d at the feed bunk across the all 3 periods. There was no change in this behavior on the day of switch ($P = 0.850$) or the days following the switch to free stall housing ($P = 0.928$).

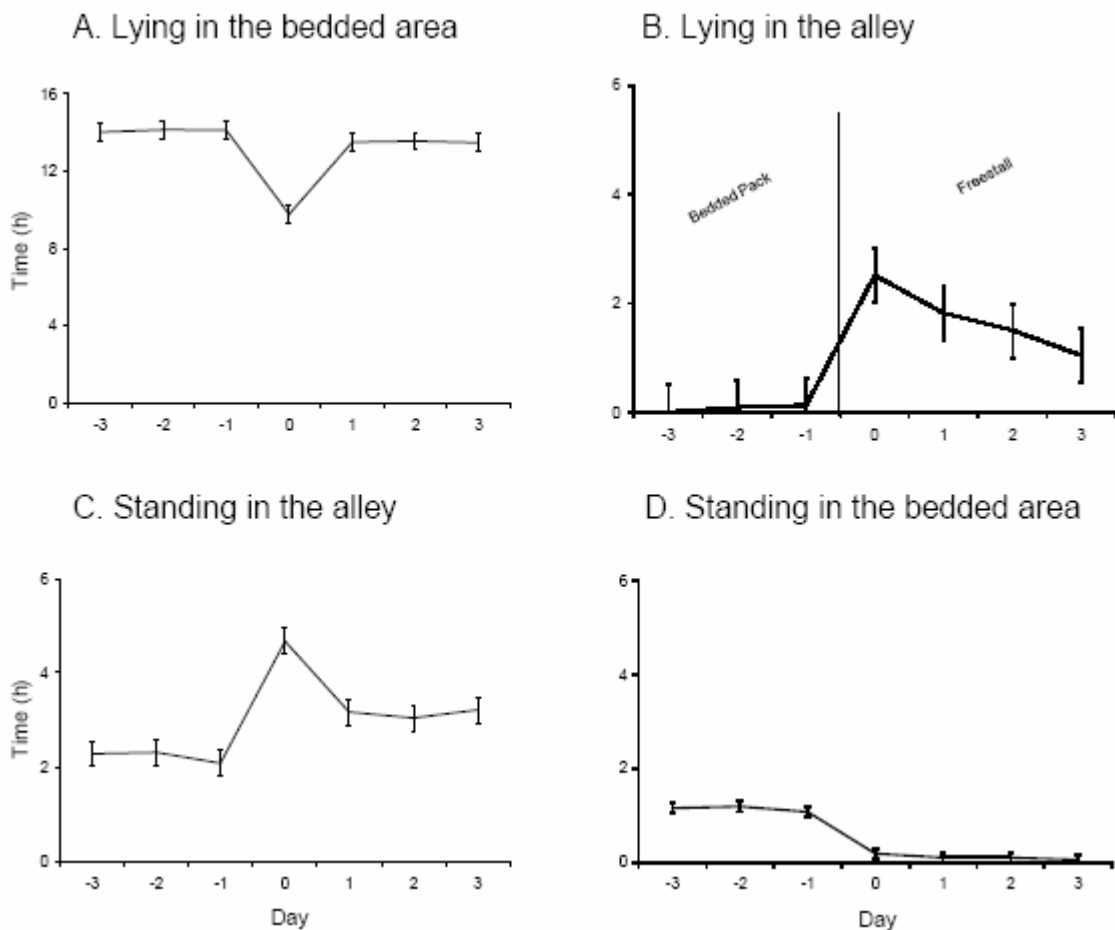


Figure 1 – Time (h/d) spent (A) lying in the bedded area, (B) lying in the alley, (C) Standing in the alley, and (D) standing in the bedded area. Least squares means (\pm SE) are reported separately per day when groups ($n = 7$, each of 3 heifers) were in a sawdust-pack (days -3 to 0) and free stall pen (days 0 to 3). Day 0 is the switch day.

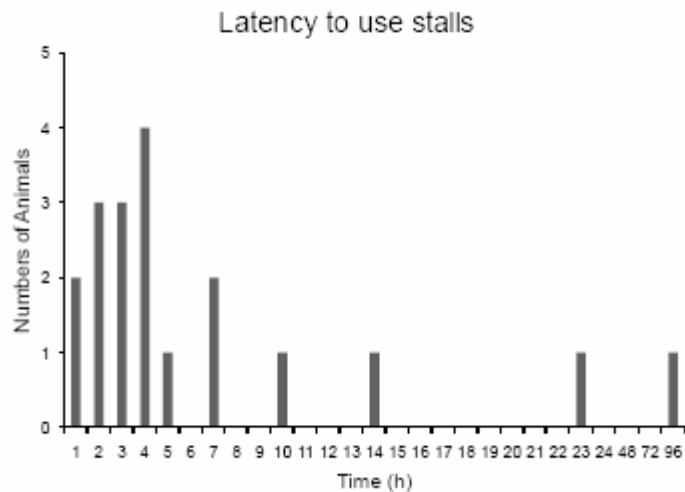


Figure 2 – Latency time (h) to use the stall for the first time.

Transition from fixed to head locking feed barrier

There were no differences in the time spent lying down in the free stalls, standing in the alley, or standing either partially or fully in the free stalls, when the heifers accessed feed by fixed barrier or when they were switched to a head locking feed barrier (Table 1). Only one animal was observed lying in the alley during this phase of the experiment, so no statistics are provided for this variable.

The time heifers spent feeding declined by more than 40 min on the day they were switched to the new feed barriers ($P = 0.007$). Feeding time recovered partially on the days following the switch, such that time did not differ statistically from either from the baseline period ($P = 0.212$) or from the day of switch ($P = 0.163$).

Table 1 – Mean \pm SE time (min/d) heifers spent lying in the free stalls, standing in the alley, with their front legs in the stall or with four hooves in the stall, and time spent feeding.

Behavior	Means (min/d)		
	Slats Days -2 and -1	Head locks Day 0	Head locks Days 1 and 2
Lying			
In the stall	823 \pm 20 ^a	839 \pm 20 ^a	850 \pm 20 ^a
Standing			
In alley	182 \pm 15 ^a	202 \pm 15 ^a	187 \pm 15 ^a
2 feet in stall	36 \pm 3 ^a	40 \pm 3 ^a	37 \pm 3 ^a
4 feet in stall	5 \pm 2 ^a	6 \pm 2 ^a	5 \pm 2 ^a
Feeding	367 \pm 17 ^a	322 \pm 17 ^b	337 \pm 17 ^{ab}

^{a,b}Numbers within a row with different superscript letters differ at $P \leq 0.05$

Discussion

In both experiments the most important day was the day of change to a new environment. Rzasa et al., (2007) worked with blood levels (glucose, fibrinogen, hematocrit, cortisol, haptoglobin, serum amyloid A, total protein and concentrations of protein fractions [albumins, globulins]) to monitor adaptation stress in beef cows, related that stress adaptation to a new herd lasting 1 week. In this study it was compared behavior and the animals showed us the adaptation happened in 1 day.

Transition from the sawdust-pack to free stall housing In this study there was significant difference in lying time between the baseline period and the first day in a new housing system and between the first day and subsequent days, but there was no difference between the periods. Hänninen et al. (2005) founded the same result

when they reported that there is no effect of housing (concrete and rubber mat) on total resting time of calves observed for 20 weeks. In the same study the researcher founded a positive correlation between lying time and growth, when the animal rest more grew more.

The same correlation happened with older cows in a study realized by Mongensen et al. (1997), where the animals gained weight longer they lay down. The lying time is very important to animal's development. The same results was found by Dellmeier et al. (1985), where they tested four (4) methods of calf confinement and there were no differences between the house systems to lying time. The opposite result was found by Fregonesi (1999) and Fregonesi and Leaver (2001), where was reported that strawyards has a high degree of comfort when compared with stalls. Their studies they found total lying time and lying synchrony were lower in stall. Results like these were found by other researchers (MANNINEN et al., 2002; TUCKER et al., 2007).

Before to use the stall for the first time, heifers were observed lying in the alley. In this research was observed a significant difference between periods and between the first day in the stalls. In previous studies, changes in stall design, management, housing systems did not affect the place to lying downs, except once, two cows were observed lying down outside the stall (FREGONESI et al., 2007). Cows can cope with some restriction to lying down, but they need to lay down to alleviate strain on the legs and hooves (COOPER et al., 2007), and the motivation to lay down increase after few hours of deprivation (METZ, 1985). In this study the lying in the alley could be observed in almost all animals, indicating that animals may not yet learned to save position to lying down in the stalls (JENSEN, 1999).

The latency to use the stall was a parameter that show the individuality of

animals. All heifers had the same space, food and conditions, whatever they had a different behavior. It was found animals than lay down in less than 25 minutes and a heifer that never was observed lying down during the all period. Furthermore, it should be consider the space and cleanness of the pens. Each pen had capacity to 13 heifers and was used just 3 heifers per pen, where there was no press to lay down and the alleys were kept clean, that probably facilitated animals to lay down in those alleys. Jensen (1999) working with heifers tethered for 3,10 or 24 days, observed that animals tethered for 3 days had a large latency to lay down, which indicate the animals may not yet learned to save position to lying down.

If the lying time felt in the first day in the stall, the stand time must be higher, and was observed an increase in standing in the alley. This change can be because the stalls were not comfortable like a sawdust-pack (FREGONESI; LEAVER, 1999 and 2001) or the heifers were learned a save way to lay in stalls (JENSEN, 1998). Fregonesi et al. (2007) observed a reduced lying time and increase in stand time when the cows were kept in a pen with wet bed.

Time spent fully or partially in the stall is affected by many factors, like neck rail placement, stall width and cow size (TUCKER et al., 2004, 2005) and also, to escape uncomfortable standing surfaces (STEFANOWSKA et al., 2001; TUCKER et al., 2006) or as a refuge from dominant herd mates (GALINDO; BROOM, 2000). In this study, heifers spent more time standing partially in the stalls in the first day in a new pen, because they were to adapting in a new house and learning how to lying down in a new bedded area. Was impossible to measure the time spent partially in the sawdust-pack because there was no clear delineation between the bedded area and alley in the pack area, standing with only the front hooves on the bedded area could not be reliably identified. For fully standing time were observed differences

between periods, first day in the stall and sawdust-pack and first day and subsequent days in the stall. Heifers spent less time standing fully in the bed because in the new pen had stalls that inhibited this behavior when was compared with a opened bedded area, were the animal stand fully all the time to play or before lying down.

Feeding time was not affected by treatments. Fregonesi et al. (2007) working with bed quality observed that cows spent less time lying down in a wet bed but they did not change the feed behavior. The same happened in this study, where the heifers had the same feeding time in both periods. Several authors had been studied comfort of stall and comfort of stand area, have found effect on time spent feeding (FREGONESI et al., 2004; HALEY et al., 2000 and 2001;).

Transition from fixed to head locking feed barrier

The lying time, lying in the alley, standing time, standing fully or partially in the stalls was not affect by treatments. The only behavior affected was feeding that declined 40 minutes in the switch day to headlock. The opposite happened in the first period where the animals change all behavior and kept the feeding behavior stable. This results showed that the changes in the feed bunk affect just the feeding time and the changes in a bedded area affect others behavior but not feeding behavior. Many works had been done with space in the feed bunk (De VRIES et al., 2004), or space and design (HUZZEY et al., 2006) but the animals adapting to a new feed bunk have no research. Huzzey et al. (2006) worked with two design of feed bunk and they related that feeding time reduced when cows used the headlock barrier compared with the post-and-rail barrier, and they also observed that feeding time decrease when increase a density stocking. Those researches had the objective to choice a better-feed bunk area and determinate the ideal stock density to

proportionate a better welfare to dairy cows, but they do not measure the adaptation to a novel feed bunk.

Conclusion

This study showed that growing heifers adapted to a new environment or feeding area in one day. The latency to use the stall is a very individual behavior and may vary from a few hours to many days. The feeding behavior just change when the feed bunk is changed, so when the animals are in a new pen with the same feed bunk, the feeding time stilled the same.

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CONCLUSÕES DA DISSERTAÇÃO

Este estudo mostrou que novilhas em crescimento se adaptam a um novo ambiente ou novo comedouro em um dia.