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# *Short communication:* Feeding distillers dried grains in replacement of forage in limit-fed dairy heifer rations: Effects on post-trial performance

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## ABSTRACT

The objective of this study was to determine the effect of increasing the inclusion rate of distillers dried grains with solubles (DDGS) in replacement of forage in diets that were limit-fed during peripubertal growth on performance during the first 3 mo of first lactation. A secondary objective was to also characterize reproductive performance of the dairy heifers. A 16-wk randomized complete block design study was conducted using 48 Holstein heifers (199 ± 2 d of age) with 3 treatments. Treatments were (1) 30% DDGS, (2) 40% DDGS, and (3) 50% DDGS, with the remainder of the diet consisting of grass hay and 1.5% mineral mix. Heifers were individually limit-fed using Calan gates at 2.65, 2.50, and 2.35% of body weight on a dry matter basis for 30, 40, and 50% DDGS, respectively. After completing the feeding study, heifers were fed a common diet according to standard herd management. Data on reproductive performance and milk production for the first 3 mo of lactation were collected for each heifer from dairy herd records. At 3 wk prepartum and at calving, body weight, frame measurements, and body condition score were recorded. We found no differences in reproductive or frame measurements taken around parturition. However, due to relatively small numbers of heifers for evaluation of reproductive parameters, results should be viewed as qualitative rather than conclusive, and more research is necessary. We noted a treatment by month effect for somatic cell count; however, there were no other differences for any of the lactation parameters measured. Results demonstrate that up to 50% of diet can be fed in limit-fed rations as DDGS, compared with 30 or 40%, to peripubertal dairy heifers without negative consequences to first-lactation performance during the first 3 mo.

**Key words:** distillers grains, heifer, lactation performance

## Short Communication

The optimal growth rate and feeding strategy of growing dairy heifers in which to maximize reproductive and lactation performance has been well researched. Increasing ADG to shorten the length of the rearing period and decreasing age at first calving has been shown to result in an earlier return on investment (Ettema and Santos, 2004). However, increasing the ADG of growing dairy heifers has been demonstrated to have a negative effect on mammary development and lactation performance (Van Amburgh et al., 1998; Zanton and Heinrichs, 2005; Meyer et al., 2006).

Feeding heifers high-concentrate diets but restricting ADG during the prepubertal period has been demonstrated to maintain milk production when compared with high-forage diets (Carson et al., 2000; Zanton and Heinrichs, 2009). In a previous study, Manthey et al. (2016) demonstrated limit-feeding diets with increasing inclusion amounts of distillers dried grains with solubles (**DDGS**) resulted in no differences in growth performance or ADG. Anderson et al., (2015) limit-fed heifers a corn and soybean product based control diet, low-fat DDGS, or high-fat DDGS and found that heifers fed the DDGS diets had similar or improved milk production.

Very limited research has been conducted examining the effect of limit-feeding diets with DDGS as the primary concentrate ingredient during the peripubertal growth period of dairy heifers on subsequent reproductive and lactation performance. Therefore, the main objective of our research was to evaluate the effect of increasing the inclusion rate of DDGS in replacement of forage in limit-fed diets on the post-trial body size at calving and production performance of heifers during the first 3 mo of lactation. A secondary objective was to collect data on reproductive performance; however, as heifer numbers were limited, conclusive interpretations of the effects of treatment diets fed during peripubertal development on reproduction were beyond the scope of the current study. We hypothesized that increasing the inclusion rate of DDGS would result in maintained or improved reproductive and lactation performance.

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Forty-eight Holstein heifers (199 ± 2 d of age) were originally used in a randomized complete block design with 3 treatment diets. The feeding period lasted for 16 wk, beginning during the prepubertal period. Treatment diets (Table 1) were (1) high forage with 30% of diet as DDGS (**30DG**), (2) moderate forage with 40% of diet as DDGS (**40DG**), and (3) low forage with 50% of diet as DDGS (**50DG**) on a DM basis. The forage portion of the diets consisted of grass hay. The amount of feed offered was determined as a percentage of BW and decreased with increasing concentrations of DDGS to allow for similar intakes of energy across treatments. Diets were fed at 2.65, 2.50, and 2.35% of BW for 30DG, 40DG, and 50DG, respectively (DM basis). Diets were formulated using the NRC (2001) to provide similar energy intakes when fed to a 250-kg Holstein heifer. Heifers were fed individually using a Calan gate feeding system (American Calan Inc., Northwood, NH). Ingredient and nutrient composition of diets fed during peripubertal growth are provided in Table 1. Details regarding diet formulation, nutrient analysis, and nutrient intakes are described in Manthey et al. (2016, 2017). During the feeding period, growth performance, rumen fermentation, nutrient digestibility, metabolic profile, and onset of puberty were evaluated (Manthey et al., 2016). After the feeding period, heifers were returned to the general herd at the South Dakota State University Dairy Research and Training Facility (Brookings). Heifers were then managed under standard farm operating procedures.

Data on reproductive performance which included the age at first AI service, number of AI services, and age at conception were collected from herd health records. According to normal herd protocols at time of study, when heifers reached 13 mo of age a progesterone controlled internal drug release (**CIDR**) was inserted intravaginally for 7 d. At CIDR removal, heifers were given an injection of $PGF_{2\alpha}$ and then AI serviced within the next 7 d, approximately 12 h after estrus behavior was observed. The CIDR was readministered and heifers were resynchronized if they displayed estrus behavior at approximately 21 d later or were confirmed nonpregnant (open) 30 d later via ultrasound by a veterinarian. Heifers were allowed 5 services before they were culled from the herd. Decision to begin AI services was based solely on age. Age at conception was based on AI service dates and when pregnancy was subsequently confirmed. Body growth measurements, including BW, withers and hip heights, heart and paunch girth, body length, and hip width, were measured 3 wk prepartum (based on predicted calving dates) at approximately 4 h postfeeding. Body length was measured from the top point of the withers to the end of the ischium (Hoffman, 1997). Body condition score was assessed by 2 individuals based on the scale described by Wildman et al. (1982), with 1 = emaciated and 5 = obese. Within 48 h postcalving, heifers were once again weighed and measured as previously described; calf weights were also recorded. Because of the staggered dates that heifers were brought on to the prepubertal feeding trial due to heifer availability and the differing amounts of time that it took for heifers to conceive, calving took place over a 15-mo period from January 2015 to February 2016.

Lactation performance data were collected from January 2015 through June 2016. Data were collected from DHIA records on each individual heifer for the first 3 mo of lactation. Cows were milked twice daily at 0600 and 1800 h. For statistical analysis, data were analyzed by month of lactation because milk samples were collected for DHIA analysis randomly during each month from the farm, and calving dates differed for each heifer because the DIM at each test date were not equal for each heifer. The average DIM were 19.0 ± 9.3, 47.9 ± 9.2, and 80.15 ± 9.9 d for mo 1, 2, and 3, respectively. Milk samples were analyzed for fat and protein concentration, as well as SCC at Heart of America DHIA Laboratory (Manhattan, KS). Mid-infrared spectros-

**Table 1**. Ingredient and nutrient composition of treatment diets with increasing inclusion amounts of distillers dried grains with solubles (DDGS) in replacement of grass hay limit-fed to growing replacement Holstein dairy heifers during the prepubertal growth phase

| | Treatment[1] | | |
|---|---|---|---|
| Item | 30DG | 40DG | 50DG |
| Ingredient,[2] % DM | | | |
| DDGS | 30.0 | 40.0 | 50.0 |
| Grass hay | 68.5 | 58.5 | 48.5 |
| Vitamin and mineral premix[3] | 0.75 | 0.75 | 0.75 |
| Limestone | 0.30 | 0.30 | 0.30 |
| Sodium bicarbonate | 0.30 | 0.30 | 0.30 |
| Salt | 0.15 | 0.15 | 0.15 |
| Nutrient, % of DM | | | |
| DM, % | 86.7 | 86.7 | 86.8 |
| CP | 16.8 | 19.2 | 21.5 |
| NDF | 54.4 | 50.8 | 47.1 |
| Ether extract (petroleum) | 3.06 | 3.74 | 4.41 |
| Starch | 2.38 | 2.89 | 3.41 |
| ME, Mcal/kg of DM | 2.27 | 2.39 | 2.51 |
| $NE_G$, Mcal/kg of DM | 0.81 | 0.90 | 0.99 |

[1]30% dietary inclusion rate of DDGS (30DG); 40% dietary inclusion rate of DDGS (40DG); 50% dietary inclusion rate of DDGS (50DG).

[2]Formulated using NRC, 2001.

[3]Contained: 2.2 g/kg of lasalocid, 14.5% Ca, 8.0% P, 21.0% NaCl, 2.5% Mg, 1.5% K, 2.0% S, 4,100 mg/kg of Mn, 1,250 mg/kg of Cu, 70 mg/kg of Co, 70 mg/kg of I, 53 mg/kg of Se, 5,500 mg/kg of Zn, 325 mg/kg of Fe, 704,000 IU/kg of vitamin A, 140,800 IU/kg of vitamin $D_3$, and 5,280 IU/kg of vitamin E (Future Cow Supreme Premix B2000, Land O' Lakes Inc., St. Paul, MN).