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PROTEIN INTAKE AND EXERCISE FOR PREGNANT HEIFERS 1/

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Producers are seeking all possible means of increasing productivity in their cattle herds since they are faced with a continued squeeze between costs and returns. Consequently, more livestock operators are breeding females to calve first when two years of age, recognizing that such a practice may substantially add to their management problems. The nutritional level of two-year-old heifers during pregnancy, while not as critical as that during lactation, may have considerable influence on calving difficulties as well as subsequent calf production.

The purpose of the present study was to investigate the effect of protein level and exercise during pregnancy on parturation problems and calf production.

Experimental Procedure

During each of three consecutive winters beginning in 1963-64, 28 head of two-year-old heifers pregnant from breeding to the same sire, were stratified by weight and previous treatment and randomly allotted to a low and a high level of protein intake for the winter pregnancy period. The heifers on the low level of protein were fed either meadow hay alone or meadow hay plus a small amount of rolled barley while those on the higher level of protein received the same ration along with 0.68 kg. of cottonseed meal daily as supplemental protein. The levels of protein were 20% above, and 20% below NRC recommendations for the high and low levels fed, respectively. Meadow hay fed during the study averaged about 8.5% crude protein.

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The heifers were individually fed from mid-November until they calved in the spring. Length of the feeding period varied from 104 to 137 days among individual heifers. During the last two years of the study eight heifers assigned to each level of protein intake were forced to exercise by making them walk for 3.2 km. each day while the remaining six heifers on each level of protein were confined in a large holding lot after daily feeding. This phase of the study was imposed only during the last 40 to 70 days of pregnancy in the second year and during the last 57 to 86 days of pregnancy in the last year of the study.

After calving, the heifers were fed a common ration calculated to provide adequate nutrition for continued growth and lactation. During the summer all heifers grazed in common on sagebrush-bunchgrass type range and they were re-bred in a single sire group. Conception data were obtained on all heifers for their second breeding season.

Individual body weights were taken at the beginning of the winter feeding period, mid-way through the trial and just prior to the beginning of calving season each year of the study. Body weight changes were also recorded over the lactation period for individual heifers during the subsequent summer. Calves were weaned at an average age of 205 days the first year of the study and at about 160 days of age the last two years of the study. Suckling gains of calves were reported as a measure of milk production for individual heifers.

The heifers were bred during a 60-day period. The same sire was used for breeding the heifers during each of the three years of the study. The heifers were about 15 months of age and averaged approximately 273 kg. in weight at the start of the breeding season. At the beginning of the winter feeding period the average weight of the heifers was 352 kg.

Individual calving records were maintained on all heifers to denote whether or not assistance in delivery was required. An attempt was made to give all animals adequate and equal time to calve before rendering assistance. Birth weights were recorded on all calves and the weights were adjusted for sex effect according to the method described by Phillips (1953).

Results and Discussion

Weight gains of heifers fed the higher level of protein during the winter pregnancy period averaged three times greater than gains of those heifers fed the lower level of protein (table 1). In this study, a daily intake of 0.82 kg. (high level) of crude protein was required to enable heifers to gain sufficient weight through the winter to offset weight loss at calving. In contrast, Bedrack et al. (1964) reported daily gains of 0.34 kg. in two-year-old heifers consuming about .5 kg. of crude protein daily. The heifers used by these workers, however, were open and about 45 kg. lighter than those used in this study.

TABLE 1. EFFECT OF FEEDING TWO PROTEIN LEVELS DURING THE WINTER PREGNANCY PERIOD ON PERFORMANCE AND CALF PRODUCTION IN TWO-YEAR-OLD HEIFERS.

Measure	Level of protein	Year of study 1	2	3	Average
Daily gain during winter pregnancy kg.	Low	0.20	-0.03	0.20	0.12
	High	0.51	0.17	0.44	0.37**
Daily gain during summer lactation, kg.	Low	0.28	0.34	0.33	0.32
	High	0.14	0.28	0.19	0.20*
Number requiring calving assistance	Low	7	5	5	6
	High	3	2	1	2
Birth weight a/ of calves, kg.	Low	29.6	29.4	28.4	29.2
	High	31.3	29.7	30.3	30.4*
Sucking gain a/ of calves, kg./day	Low	0.55	0.71	0.63	0.63
	High	0.58	0.76	0.66	0.67*
Percent calves b/ weaned	Low	70	79	77	75
	High	70	86	86	81
Percent heifers conceived for second calf	Low	70	55	90	72
	High	90	80	100	90

a/ Adjusted for sex effect
b/ Percent of heifers bred
* Significant difference $P < 0.05$
** Significant difference $P < 0.01$

The reason for the reduced gains during the second year of the study is not apparent, although the heifers were somewhat heavier at the beginning of the feeding trial than during the other two years. Exercise during the late pregnancy period caused a reduction ($P < 0.05$) in daily gain (table 2). Similar observations were made by Gonzalez and Butcher (1962) relative to the effect of exercise on steer gains.

Calves from heifers on the higher protein intake averaged 1.2 kg. heavier at birth ($P < 0.05$) than those from heifers fed the lower level of protein. Earlier work by Butcher (1958) also indicated an increase in birth weight with a higher level of protein intake in first-calf-heifers.

TABLE 2. EFFECT OF FORCED EXERCISE DURING LATE PREGNANCY ON HEIFER GAINS AND EASE OF CALVING.

Measure	Physical treatment	Year of study 2	Year of study 3	Average
Daily gain during late pregnancy, kg.a/	Confined	0.44	0.42	0.43
	Exercised	0.20	0.26	0.23**
No requiring calving assistance	Confined	2	5	3.5
	Exercised	5	1	3.0

a/ Gain during approximately last 50 days prior to beginning of calving season.
** Significant difference $P < 0.01$.

Birth weights of calves from mature cows appear to be more independent of the dam's nutritional level during pregnancy. However, in an earlier study involving mature cows at this station (Wallace and Raleigh, 1964), a decrease in birth weight was noted when cows were fed a low protein diet during pregnancy. On the other hand, Black (1938) found no difference in birth weights of calves from mature cows fed different protein levels and similar results were reported by Marion (1962) with cows maintained on different levels of energy during pregnancy.

Heifers in thriftier condition at calving time as a result of higher protein intake through the winter had less calving trouble than those fed the lower level of protein (table 1). The two years in which the effect of exercise on ease of calving was studied provided conflicting results (table 2). The number of heifers requiring assistance in delivery was greater among exercised heifers one year but in the following year the number was greater among the confined heifers. Irrespective of forced exercise, heifers fed the low protein diet had more calving problems throughout the study than those fed the higher level of protein (table 1). These results agree with those reported by Reid et al. (1964) in first-calf-dairy heifers receiving three planes of nutrition during pregnancy. Over the course of the current study five calves were stillborn from heifers fed the low level of protein while four calves were stillborn from those fed the higher level.

Gains made by the heifers during lactation favored those wintered on the low protein ration although it appears that a part of this gain was made at the expense of milk provided to their calves (table 1). Calves from the low-protein cows gained about .045 kg. less per day ($P < 0.05$) during the suckling period and thus averaged 10 kg. lighter at weaning time than calves from the high-protein cows. Percent calf crop and percent of heifers rebred for their second calf were higher in heifers fed the higher level of protein. Poor reproductive performance caused by reduced protein intake has also been reported by Bedrack et al. (1964) and Wiltbank et al. (1965).

Summary

A three-year study on the effect of two levels of protein during the winter pregnancy period for two-year-old heifers was conducted. During the last two years of the experiment the influence of exercise during late pregnancy on calving difficulty was also studied. Body weight changes, calving problems, subsequent conception date of the heifers as well as birth weight, suckling gain and weaning weight of the calves were considered.

Feeding a higher level of protein through the winter pregnancy period resulted in greater gains during pregnancy, less assistance required in calving, lower gains during lactation and a higher conception rate when rebred. Birth weights, suckling gains and weaning weights were also higher in calves from heifers fed the higher protein level.

Forced exercise (walking heifers for 3.2 km. daily) during late pregnancy failed to exert a consistent influence on ease of calving but did markedly reduce weight gains of heifers.

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