

EFFECTS OF NUTRITIONAL CHANGES ON OESTRUS IN HEIFERS

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Summary

At first oestrus, two groups of Hereford heifers from different sources had mean liveweights, with standard errors, of 274 ± 3 and 247 ± 5 kg; a group of Australian Illawarra Shorthorn heifers weighed 254 ± 9 kg and a group of Jersey heifers 230 ± 11 kg.

Heifers were fed on a high plane or a low plane of nutrition following oestrus. All high-plane and five out of twelve low-plane heifers returned to oestrus 19 days later and were inseminated. The low-plane heifers that returned to oestrus were heavier than the ones that did not. Nine heifers maintained on a low-plane of nutrition for 49-51 days, returned to oestrus 36 ± 7 days after being changed to *ad libitum* feeding. These nine heifers weighed 225 ± 5 kg at the start, 194 ± 3 kg at the change of feeding level, and 244 ± 6 kg at the first oestrus after change of feeding level ($P < 0.001$).

I. INTRODUCTION

It is generally believed that gross undernutrition in farm animals delays the onset of puberty and leads to impairment of fertility in mature animals (Moustgaard 1959). Sorenson *et al.* (1959) showed that the average age at first oestrus of Holstein heifers fed 140%, 100% or 65% of Morrison's feeding standards from an early age was 37, 49 and 72 weeks respectively and the average body-weights were 270, 271 and 242 kg. Crichton, Aitken and Boyne (1959) reared heifers on a high plane of nutrition, a low plane, or a high plane until 10 months of age followed by a low plane until puberty; heifers on the last treatment reached puberty six months later than those on the high plane and three months later than those on the low plane.

When heifers were fed rations of varying protein content, but equivalent in digestible energy, fertility was related to the protein content of the ration (Bedrak *et al.* 1964); all ten heifers gaining weight conceived, whereas none of the ten that were barely maintaining or losing weight became pregnant during a two months' joining period.

The present paper records observations on the effects of large changes in general nutritional level on oestrus activity and fertility in pubescent heifers and some observations on the liveweight at puberty of particular groups of heifers.

II. MATERIALS AND METHODS

(a) Live-weight at first oestrus

The liveweight at detection of first oestrus was determined in 34 grade Hereford heifers (Group 1), 27 grade Hereford heifers (Group 2), 16 Australian Illawarra Shorthorn (A.I.S.) heifers (Group 3), 15 Jersey type heifers (Group 4).

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They were introduced to pen feeding when they were 9-15 months of age. Rectal palpation of ovaries indicated that the ovaries were then inactive. They were fed *ad libitum* a hammer-milled diet of 60% lucerne hay and 40% grain sorghum. Water was always available.

The animals were observed at least twice daily for oestrus. In 1966 a vasectomized bull was used, but to facilitate disease control the bull was not used in 1967 when satisfactory results were obtained by observing the mounting behaviour of the heifers in groups after they were released from their pens. Ovaries were palpated per rectum every two weeks to detect onset of ovarian activity.

(b) Nutritional trial

Eighteen heifers were allotted at random to two groups that were to receive 1.4 kg of the 60/40 ration (described above) per 45 kg liveweight per day (6 high-plane heifers) or 0.23 kg/45 kg/day (12' low-plane heifers) following their first, second or third detected oestrus. Until this time all heifers were fed the ration *ad libitum*.

Heifers were weighed in the morning, just before feeding, at regular intervals and on the day after detection of oestrus. The ration given to individual animals was adjusted according to liveweight after each weighing.

Heifers were inseminated if they returned to oestrus 16-25 days after being placed on their high or low plane of nutrition. All high plane heifers were examined by laparotomy 30 days after insemination, and pregnancy was diagnosed on the basis of recovery of a live embryo through an incision in the uterus. Two low-plane heifers were similarly examined but because of the results obtained, the ovary and oviduct were removed from the other three heifers three days after insemination and examined for ovulation.

All low plane heifers, except these three, were maintained on the nutritional treatment for 48-51 days before being offered feed *ad libitum*. Liveweights were recorded when the feed level was changed and when the first subsequent oestrus was recorded.

III. RESULTS

(a) Liveweight at first oestrus

Oestrus was recorded in Groups 1-4 at mean liveweights ($\pm$ standard error) of 274 ± 3 , 247 ± 5 , 254 ± 9 , 230 ± 11 kg, respectively ($P < 0.001$). The mean weight over all groups at first oestrus was 254 ± 3 kg.

(b) Nutritional trial

One heifer allocated to the high-plane treatment was never detected in oestrus and was excluded from the analysis. The mean liveweight at the oestrus when treatments commenced was 232 ± 11 kg in the high plane-heifers and 230 ± 4 kg in the low-plane. All five high-plane heifers returned to oestrus one cycle (19.5 ± 1 day) later and were inseminated. Five of the 12 low-plane heifers also returned to oestrus 19 ± 0.7 days later. Their average liveweight at oestrus (236 ± 8 kg) was significantly higher than the average weight (226 ± 5 kg) of the 7 heifers which did not return to oestrus within 25 days.

Thirty days after insemination, foetuses were removed from four of the five high-plane heifers, but the two low-plane heifers examined first were not preg-

nant and had small inactive ovaries; there were no active corpora lutea and no follicles larger than 0.5 cm. The ovaries of the other three low-plane heifers were therefore examined three days after insemination and contained morphologically normal corpora lutea.

The nine heifers maintained on the low plane of nutrition for 49-51 days returned to oestrus 36 ± 7 days after being placed on *ad libitum* feeding. The mean liveweight of these heifers had declined from 226 ± 5 kg at oestrus to 194 ± 3 kg after seven weeks on the low plane, but increased to 244 ± 6 kg at the first oestrus after the return to *ad libitum* feeding. These changes are highly significant ($P < 0.001$).

IV. DISCUSSION

The results suggest that the occurrence of oestrus and ovulation in pubescent heifers is dependent upon liveweight as well as on change in liveweight. Under conditions of drastic change in diet, interpretation of liveweight is complicated by changes in gut fill, but the results indicated that when weight was being lost the lightest heifers were the first to stop showing oestrus. After being returned to a high plane of nutrition, resumption of oestrus occurred only after the heifers had reached a significantly higher liveweight than at initial oestrus.

The high-plane heifers showed satisfactory fertility. Fertility in the low-plane heifers appeared to be low, but relevant observations were sacrificed so as to obtain evidence of ovulation. Because oestrus cycle length was normal, the growth and regression of corpora lutea was normal in the five low-plane heifers that returned to oestrus one oestrus cycle after the commencement of treatment. Three of these heifers ovulated normally at this return to oestrus when examined three days after insemination but neither embryo development, further oestrus nor ovulation had occurred in the two heifers examined 30 days after insemination.

The function and fate of corpora lutea in low-plane heifers at the onset of nutritional anoestrus requires investigation.

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VI. REFERENCES

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