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INFLUENCE OF 4 HOURS SUPPLEMENTAL LIGHTING ON GROWTH AND OCCURENCE OF PUBERTY IN CREOLE HEIFERS BRED IN A TROPICAL COUNTRY

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Two groups of immature Creole heifers, bred in a tropical country, were assigned at different schedules of light, to study the influence of the short photoperiod (12 hours) in the slight growth and the late puberty of tropical animals.
Control group (8 heifers) received natural photoperiod (11 - 13 hours) and light group(8 heifers) received natural photoperiod plus 4 hours of artificial lighting.
After 22 weeks, the mean daily gain was similar between the two groups (300 g/d) and the feed consumption too (3.3 kg of dry matter/100 kg of body weight). 63% of the heifers out of the 8 of the light group and 25% out of the control group were cyclic ($P < 0.1$).
It was concluded that a supplementation of lighting did not permit to increase the growth in tropical area but seems to lead to a early puberty in the female.

In tropical countries, irrespective of the bred, cattle productions and especially growth are of bad yield. High temperatures and poor forage quality are generally the main environmental factors studied, but the influence of daylength has rarely been incriminated.

In temperature countries, experiments have shown that long daylengh (16 hours) stimulates the growth of lamb (Forbes et al 1982) or of heifers (Peters et al 1978). The rather shorth photoperiod (about 12 hours) of tropical countries may be responsible for part of the slight growth of cattle.

In the same way, the delay in puberty of the female in such a climate is assigned to temperature and nutrition and never to photoperiod; however it has been shown that short daylength influences reproductive efficiency in cattle (Wiltbank et al 1969; Ortavant and Loir 1978).

The aim of this work is to investigate the influence of 4 hours supplemental lighting on the growth and on the occurence of puberty in Creole heifers in a tropical climate.

Materials and Methods

Sixteen creole heifers were blocked by body weight and age into two equal groups.

Between august 1980 and january 1981 one group of heifers received natural light (C group) and the other one, natural light plus 4 hours of artificial lighting (two bulbs of 500 watts each) after the sunset (L group). From august to january, in Guadeloupe (French West Indies), the natural photoperiod varies from 13 to 11 hours (interval from sunrise to sunset).

Each group was housed into a shaded pen and was fed ad libitum with local forage (*Digitaria decumbens* and *Dicanthium caricosum*) and recived a supplementation (2.5 kg/head/day) of mixed pellets of molasses, urea and wheat bran (Table 1). Water was freely available.

The total grass consumption of each group was weighed three times a week, and dry matter of the grass was measured. The sample were pooled for a week and were assayed for total energy (bomb calorimetre), total nitrogen (Kjeldahl method) and in vitro digestibility (Tilley and Terry 1963).

The forage ingested by the heifers had high dry matter content (29.8%). Futhermore the dry matter content was very variable during the experiment and showed two different periods: from weeks 0 to 10 when the mean was 28.4% and weeks 11 to 22 when the mean was 31.1% ($P < 0.05$).

Energy content was 3834 kcal/kg of dry matter and was not correlated with the dry matter content. Total nitrogen was 6.9% of the dry matter. The in vitro digestibility of the organic matter was low (42.7%; Table 1)

Heifers were weighed fortnightly. Furthermore every two months, they were checked for ovarian cyclicity by the method described by Thimonier (1978). Progesterone was assayed by the technique described by Terqui and Thimonier (1974).

Table 1:

Forage and concentrate composition (mean ± SD) according to the different periods (weeks 0 to 10: period I; weeks 11 to 22: period II; and total experiment: weeks 0 to 22).

	Forage			Concentrate
	Total experiment	Period I	Period II	
Dry matter content DM %	29.8 ± 4.1	28.4 ± 3.5	31.1 ± 6.1	88.0
Energy content kcal/kg DM	3834 ± 269	3925 ± 186	3760 ± 306	3766
Crude protein content % DM	6.9 ± 1.1	6.9 ± 1.1	6.9 ± 1.1	16.0
Mineral content % DM	10.2 ± 2.5	9.2 ± 1.7	10.9 ± 2.8	3.5
In vitro digestibility %	42.7 ± 3.5			71.0

Results

Growth and feed intake (Table 2): The growth was similar between the groups during the 22 experimental weeks (312 g/day) and was described by a linear regression ($Y = 148.5 + 0.3 X$ when Y is the body weight (kg) and X is the time in days; Figure 1)

Figure 1:

Growth of Creole heifers submitted to natural photoperiod (▲) and natural photoperiod plus 4 hours of supplemental lighting (△)

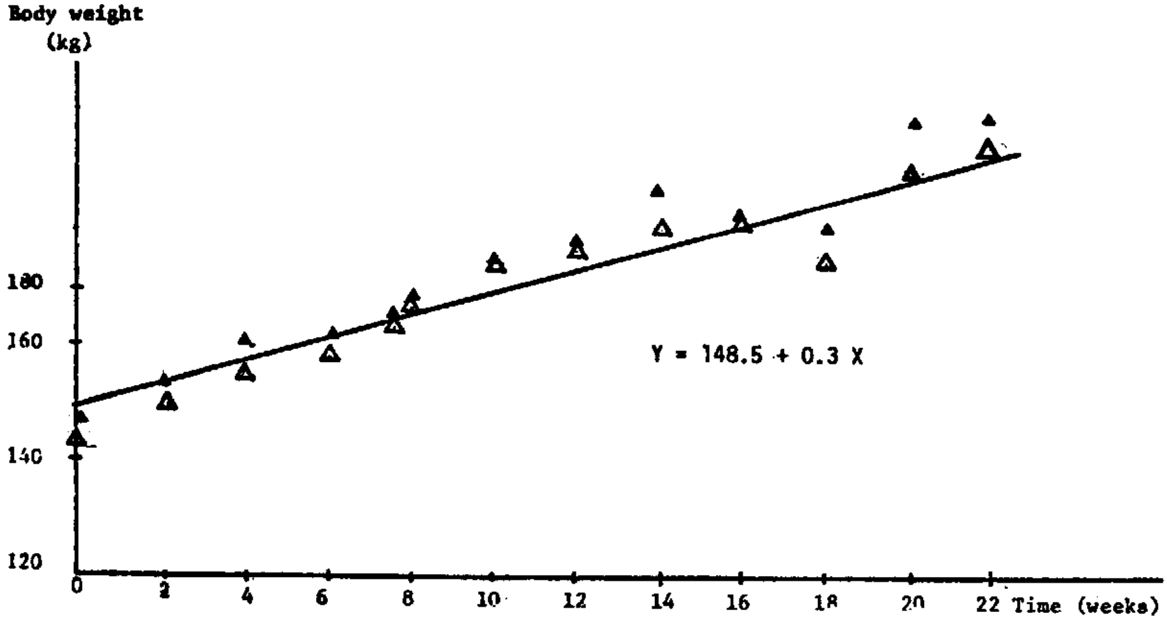

Table 2:

Dry matter intake, mean daily gain and efficiency ratio according to difference periods (see legend of Table 1) of two groups of heifers receiving either natural photoperiod (control group: C) or photoperiod of long daylenght obtain by 4 hours of supplemental lighting (light group: L); mean ± SD.

Group	Total experiment		Period I		Period II	
	C	L	C	L	C	L
Consumption kg dry matter/100 kg body weight	3.3 ± 0.3	3.3 ± 0.3	3.5 ± 0.3	3.4 ± 0.2	3.1 ± 0.2	3.2 ± 0.3
Mean daily gain g/day	312 ± 25	300 ± 41	347 ± 82	419 ± 102	268 ± 92	204 ± 103
Efficiancy ratio feed intake/gain of body weight	19	18	16	13	22	28

The efficiency ratios were similar between the two groups: Dry matter intake/gain of body weight (18 g/g) energy intake/gain of body weight (70 kcal/g); protein intake/gain of body weight (200 g/g).

However, for both groups the pattern of the growth showed two different periods:

-During the first one (from weeks 0 to 10), the mean daily gain (MDG) was 347 g for the C group and 419 g for the L group, i.e. 17% higher (Although this difference was not significant). The efficiency ratio (dry matter intake/gain of body weight) was lower in the L group than in the C group (13 vs 16).

-During the second one (from weeks 11 to 22), the MDG was 204 and 268 g respectively for L and C groups i.e. 24% higher for C group. The efficiency ratios were 28 and 22 respectively for L and C groups.

The dry matter intake was the same in the two groups (3.3 kg/day/ 100 kg of body weight) and it was correlated with the dry matter content of the forage ($r = 0.82$; $P < 0.01$) and the energy content ($r = 0.73$; $P < 0.01$). The correlations with rainfall, relative humidity and ambient temperature were not significant.

There was a negative correlation between MDG and dry matter content of the forage stronger in the L group ($r = -0.63$) than in the C group ($r = -0.37$).

Puberty: None of the heifers had a cyclic ovarian activity at the beginning of the experiment. 22 weeks later, five heifers were cyclic in the L group (62.5%) and two in the C group (25%).

The mean weight of the cyclic heifers was 195 kg in the L group and 213 kg in the C group ($P < 0.1$).

Discussion

In this experiment the mean daily of the creole heifers (300 g/d) was lower than other results under similar conditions (500 g/d, Rulquin, unpublished data). Hence the poor quality of forage have lead to a feed restriction and to very bad efficiency ratio especially during the second period (from weeks 11 to 22).

The lack of significant light effect on the growth of the heifers in this experiment did not agree with the results of (Ringer 1972) in bulls and Peters et al (1978) in heifers. These works showed in increase of the growth with a long daylength photoperiod. But our results agree with other negative results obtained in sheep (Hackett and Hiller 1979) and in steer (Roche and Boland 1980). In our experiment the only slight difference between the "light treatment" of the two groups (11 to 13 h of daylength in the C group vs 15 to 17 h in the L group) or an insufficient intensity of the supplemental light must explain the lack of response of growth.

A more obvius explanation of the results would be a consequence of the extremely poor quality of the forage. So the feed restriction did not permit the expression of the light effect. Besides, the first period caracterized by a rather high level of feed intake showed a light effect on growth in spite of the small difference between the daylength treatments. On the opposite, during the second period of low level of feed there is no light effect on growth.

Heifers of the L group seem to reach puberty before, than heifers of the C group similarly to results of Peters and Tucker (1978) in Holstein heifers. This early puberty in the L group should not be a consequence of quicker growth since the mean weight of the cyclic heifers in the L group is the same than in the C group and must be a specific light effect. In bull, long daylength increases the number of LH pulses per day (Leining 1978) and puberty occurs, in ewe, when the number of LH pulses is higher than a threshold (Ryan and Foster 1980). So it is possible that 4 hours of supplemental lighting advances puberty in heifers by an increase of LH pulsatility, but this hypothesis has to be verified in a next work.

Conclusion

Increase in daylength with 4 hours of supplemental lighting from the natural photoperiod had no effect on the growth of creole heifers in tropical conditions of Guadeloupe. But the effect on the occurence of puberty although non significant seems to exist

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