THE EFFECT OF MILK TEMPERATURE AND DILUTION ON LIVEWEIGHT GAIN AND INCIDENCE OF DIARRHOEA IN YOUNG CALVES

J.W. Taylor* and J.A. Stewart*

Summary

Jersey calves were fed warm (38°C) or cool (10°C) milk, diluted or undiluted, from five days of age until weaning at 55 kg live weight. The feeding of warm milk resulted in greater liveweight gains to eight weeks of age, and an earlier weaning age, when compared with feeding cool milk. The feeding of undiluted cool milk resulted in a reduction in diarrhoea, and dilution of both warm and cool milk led to increased feed refusals.

I. INTRODUCTION

It is generally suggested that whole milk should be near body temperature when fed to calves, but this is often inconvenient. One simple means of raising feed temperature is to add hot water, but this also has the effect of diluting the milk.

Walker (1950) reported satisfactory liveweight gains from birth to three weeks in three calves fed whole milk at 0°C. Although Tayler and Lonsdale (1969) found in one experiment that calves fed warm milk grew significantly faster than those fed cool milk, in a second experiment they found only a slight and non-significant difference in growth.

Dilution of whole milk with water has been suggested (Sheehy 1934) as a means of avoiding or curing calf diarrhoea. Subsequently (Anon. 1949) it was reported that dilution has no effect on liveweight gains of young calves but appeared to reduce the incidence of diarrhoea.

Using calves from two weeks of age Owen and Brown (1958) found that milk temperature and dilution, as independent factors, did not have a significant effect on calf liveweight gains. However there was an interaction between dilution and temperature; cool (10°C) diluted milk gave greater liveweight gains than warm (38°C) diluted milk whereas when milk was undiluted there was no difference in liveweight gains between warm and cool milk. Incidence of diarrhoea was extremely low and was unaffected by treatment.

Since temperature and dilution of milk may exert their greatest influence on the calf in the first three weeks, this experiment was designed to investigate the effect on growth and diarrhoea from five days of age.

* Department of Agriculture, Victoria, Ellinbank Dairy Research Station, Warragul, 3820.
II. MATERIALS AND METHODS

Seventy-six Jersey heifer calves about five days old with a mean live weight of 24.4 kg were purchased from the local calf market, weighed, blood sampled and randomly allocated to four matched groups on the basis of initial live weight and serum immune globulin level, which was determined by the Zinc Sulphate Turbidity Test (Patterson 1967). The calves were reared outdoors on perennial pasture with portable shelters.

Whole milk (4.2% milk fat, 13% total solids) was fed to each calf by rubber teat twice daily for the first three weeks and once daily thereafter until weaning at 55 kg live weight. Each group was fed one of the following experimental rations.

- Warm, undiluted - 3.6 kg milk at 38°C
- Warm, diluted - 3.6 kg milk plus 0.9 kg water at 38°C
- Cool, undiluted - 3.6 kg milk at 10°C
- Cool, diluted - 3.6 kg milk plus 0.9 kg water at 10°C

Calves were closely observed as they were herded, fed and returned to their paddocks each feeding time. Faecal observations for the first three weeks were recorded as 0 (nil or firm faeces), 1 (loose faeces), or 2 (watery diarrhoea faeces) and a scouring index for each calf was constructed by totalling these figures.

When diarrhoea was seen the calf was given a tablet containing 500 mg. furazolidone at each of three successive feeding times. Where a calf consumed less than half its normal feed it was drenched with an electrolyte replacer.

Calf mortality was tested for independence using Fisher's exact test (Goulden 1952). Other results for surviving calves were analysed by stepwise regression with P=0.05, using pseudo-variables for the treatments. Additional dependent variables used were initial live weight, serum immune globulin level, and the square roots of scouring index and weight of feed refused. This method was chosen since mortality invalidated the initial distribution of calves between groups and analysis of variance would have required an inordinate number of missing values.

III. RESULTS

A total of 22 calves died, representing an overall mortality of 29 per cent. This was independent of main treatment effects although for cool milk, dilution was associated with a higher mortality than when fed undiluted (47% vs. 16%; P = 0.01).

The regression equations and the predicted mean treatment effects using average values for initial live weight and serum immune globulin level are shown in Table 1.
Calf performance was highly variable which, in conjunction with the high mortality and general poor growth, is indicative of a high incidence of infectious disease. Although the infectious agent was not identified, more recent studies in the same environment suggest that a reo-type virus may have been involved (Craven, personal communication).

In this experiment the feeding of cool milk was associated with lower liveweight gains and thus a longer time to attain a predetermined weaning weight. However this was modified in two ways.

Firstly, the reduction in liveweight gain to three weeks was less when cool milk was fed undiluted than when fed diluted. This may have been related to the reduced diarrhoea found with cool undilute milk.

Secondly, the extent of the effect of cool milk on liveweight gain to eight weeks and age at weaning was dependent on the initial live weight of the calves; the higher the initial live weight the greater the effect of cool milk. However over the range of initial live weights in our calves (20-30 kg) the extent of this effect was relatively small; a difference of 1.2 kg for liveweight gain to eight weeks and 2.5 days for

### TABLE 1

Regression equations* and predicted mean treatment effects using average values for initial live weight and serum immune globulin level.

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<th>Residual Standard Deviation</th>
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<th>Warm Milk</th>
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* Explanation of Symbols

WG3 = Liveweight gain to 3 weeks (kg)  I = Initial live weight (kg)
WG8 = Liveweight gain to 8 weeks (kg)  G = Serum immune globulin
A = Age at weaning (weeks)  T = Temperature (warm = 0)
S = Index of diarrhoea  (cool = 1)
F = Feed refusals (kg whole milk)  D = Dilution (dilute = 0)

IV. DISCUSSION

Calf performance was highly variable which, in conjunction with the high mortality and general poor growth, is indicative of a high incidence of infectious disease. Although the infectious agent was not identified, more recent studies in the same environment suggest that a reo-type virus may have been involved (Craven, personal communication).

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age at weaning.

The effect of increasing initial live weight was to reduce liveweight gain to three weeks although weaning age at a fixed live weight was still earlier. This can be explained in terms of a smaller proportion of feed nutrient being available for growth, since feed was not adjusted on the basis of live weight.

If it is postulated that cool milk has a reduced digestibility, the feeding of cool milk would further reduce the availability of nutrients for growth in heavier calves and account for the interaction of initial live weight and milk temperature.

The relationship between temperature and dilution reported here contrasts with that found by Owen and Brown (1958), although in our case the effect of diluting cool milk was seen in younger calves.

Also in contrast to earlier recommendations (Sheehy 1934; Anon. 1949) dilution did not effect a reduction in diarrhoea. In fact dilution negated the reduction in diarrhoea obtained when cool milk was fed and was associated with a higher mortality. Dilution may only be efficacious when diarrhoea is of nutritional Origin (Sheehy 1934).

If a reduced liveweight gain is not considered a disadvantage, then the feeding of undilute cool milk would simplify the calf feeding procedure in situations where a means of heating the milk has to be found. However it is evident from our results that dilution of cool milk with water is inadvisable for feeding calves because it could lead to a higher incidence of diarrhoea and deaths.

V. ACKNOWLEDGEMENTS.

The authors would like to thank Mr. J. Langford and Mr. D. Graham for their assistance in rearing the calves, and Mr. R. Jardine for his assistance with the biometrics.

VI. REFERENCES

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