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**EFFECTS OF FEEDING TALLOW ON PERFORMANCE
AND CARCASS QUALITY OF DAIRY CALVES**

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SUMMARY

Sixteen entire male Australian Illawarra Shorthorn calves in four groups each of four animals were used to study the effects of different milk diets on growth and carcass quality.

The growth rates of calves fed wholemilk were significantly faster than those of calves fed skim-milk. Growth rates of groups fed skim-milk and tallow compared favourably with those of the wholemilk group and were higher than the skim-milk group though not significantly so.

Energy intake and dressing-out percentage of all other groups were significantly higher than in the skim-milk group. This group ate much more hay and grain than others.

The group fed skim-milk plus 2% tallow were most efficient in converting feed energy to liveweight gain.

The carcasses of calves fed tallow were superior to those fed wholemilk and skim-milk.

I. INTRODUCTION

The standard practice on dairy farms which sell cream is to feed wholemilk to calves for about 2 weeks. Skim-milk is then gradually substituted so that as little butterfat as possible is given to calves. Calves, except heifer replacements, are commonly sold at 4-6 weeks at 100-150 lb liveweight.

As the small number of heifers required for herd replacement need little skim-milk, the surplus is normally fed to pigs. However, skim-milk is by no means essential for pig production, and even on those farms where a pig enterprise is conducted ostensibly only to utilize surplus skim-milk, alternative feeds are commonly used during periods when insufficient skim-milk is available. The possibility of using this skim-milk to expand veal production from unwanted calves accordingly presents itself.

Artificial rearing of calves for slaughter at 3-4 months of age is common in Europe, where a relatively high-price specialist market exists for this type of heavy-weight veal (Wilson 1961). Barton (1964) has also suggested that this form of production could be a valuable sideline on New Zealand dairy farms, as south-east Asia offers a market for this type of veal. If satisfactory techniques can be developed it might be even more applicable to Australian dairy farms which sell cream and on which both calves and skim-milk are available.

In calves reared for slaughter at 3–4 months, a rapid rate of growth is essential to provide the subcutaneous fat cover required by the premier veal trade. There is severe price discrimination against unfinished or plain carcasses.

A high energy intake is essential for a rapid growth rate in calves, but removal of butterfat from wholemilk of average composition reduces its digestible energy value per unit weight by almost half. The addition of tallow as a high energy source might compensate for this loss.

Several investigations of feeding fat and tallow to calves have been made. Stone, Rennie, and Ingram (1963) found that calves fed 10% fat in liquid diets performed as well as those on commercial calf starter rations, while calves given 15% fat showed improved growth rates, dressing-out percentages and monetary returns over feed costs. Johnson *et al.* (1956) gave 2.5%, 5.0% and 10.0% tallow in calf starters and all rations showed a 5.6% increase in growth rate compared with calf starter only. This increase was attributed to a greater intake of alfalfa pellets with the tallow diets. Hodgson and Murdoch (1960) used three different rations—milk replacer only, milk replacer plus 10% homogenized fat, and milk replacer plus 10% fat physically blended into the mix. Weight gains from both fat diets were significantly higher than those from milk replacer alone. Homogenized fat also gave significantly greater weight gains than physically blended fat. Ritchley *et al.* (1956) found no statistically significant differences in average daily gain between calves fed wholemilk *ad lib.* and others fed an *ad lib.* diet of skim-milk, tributyrin lard and tallow.

These favourable overseas reports led to an experiment at the Biloela Research Station, in central Queensland, to test these findings under Queensland conditions. Biloela is the centre of a dairying area where cream rather than wholemilk is sold and tallow is readily available from local meatworks.

II. EXPERIMENTAL PROCEDURE

Sixteen entire male Australian Illawarra Shorthorn (A.I.S.) calves were allocated among four different treatments when 6 days old. They were left on their dams for 48 hr after birth, then fed their dams' milk at 10% of body-weight in two daily feeds for 4 days. The change from wholemilk to each of the four treatments was completed by the 12th day after birth.

The four liquid diets were given at 20% of body-weight in two daily feeds. The diets were—

- A. Wholemilk
- B. Skim-milk
- C. Skim-milk plus 3% tallow
- D. Skim-milk plus 2% tallow

Water, lucerne hay and hammer-milled sorghum grain were offered *ad lib.* to all four groups, which were penned separately.

The wholemilk and skim-milk used were fresh and were fed at body temperature. In preparing diets C and D a quantity of skim-milk approximately three times the weight of tallow to be used each day was heated to 60°C. A stable homogeneous mix was obtained with 0.5% and 0.7% by weight of an emulsifier (G.M.S. (Polymer Corporation), a glyceryl monostereate) and a stabilizer (Alginade I.C.P. (Algenate Industries), a sodium alginate base) respectively. The tallow was also heated to 60°C, added to the mixture and stirred vigorously. Each feed was prepared by adding the premixed emulsion at 60°C to skim-milk at body temperature. A soluble antibiotic (Aurofac D (Cynamid—D.H.A.)) was included for the first 3 weeks of each treatment.

Milk intakes were recorded individually, and group hay and grain intakes were measured. Calf weights were recorded weekly.

III. RESULTS

The results are summarized in Tables 1–3.

TABLE 1
CALF PERFORMANCE AND FEED INTAKE

Group and Diet	A. Wholemilk	B. Skim-milk	C. Skim-milk + 3% Tallow	D. Skim-milk + 2% Tallow
Liveweight 6 days (lb)	68	87	77	84
Liveweight 85 days (lb)	237	205	255	269
Rate of gain (lb/day)	2.15	1.50	2.25	2.30
Dressing-out percentage	54.8	49.6	55.6	55.6
Total milk intake (lb)	1,764	1,833	2,022	2,158
Total fat intake (lb)	71	Nil*	61*	43*
Total hay intake (lb)†	24	55	28	28
Total grain intake (lb)†	25	53	28	28

* Skim-milk was assumed to be fat-free for the purposes of statistical analyses.

† Hay and grain were fed daily on a group basis, so the results are group total intakes divided by 4.

The remainder of the results in Table 1 were individually recorded, added to give a group total, then divided by 4.

(a) Growth Rate

There were large differences both within and between groups in average body-weight at 6 days. Those between groups are shown in Table 1. A convariance analysis of weight gain on initial weight could not be done because of heterogeneity among regressions.

The liveweight differences at 6 days were corrected, using the expression given by Brody (1945),

$$R = \frac{\log_e W_2 - \log_e W_1}{t_2 - t_1}$$

where W_2 = final weight (85 days);
 W_1 = initial weight (6 days);
 $t_2 - t_1$ = 79 days.

The k values obtained for each animal were examined by an analysis of variance. There was a significant difference between treatments ($P < 0.05$). The multiple range test (Duncan 1955) showed that group A calves had

significantly greater growth rates than those of group B ($P < 0.05$). Differences between treatments C and B and D and B, though large, were non-significant. They may well have been significant if larger numbers of calves had been available.

(b) Energy Intake

Liquid.—Differences in milk intake between treatments were non-significant.

Wholemilk was assumed to contain 4% butterfat and to have a gross energy value of 343 kcal/lb (Overmann and Gaines 1933). The gross energy values for tallow and butterfat were assumed to be 4,313 and 4,177 kcal/lb respectively.

TABLE 2
AVERAGE ENERGY INTAKE PER CALF (MCAL)

Group	Hay + Grain, Digestible Energy	Milk, Digestible Energy*	Total Digestible Energy
A	47	600	647
B	102	334	436
C	53	615	668
D	53	568	621

* Milk was assumed to be 100% digestible.

Differences in energy intakes from the liquid diets were highly significant ($P < 0.01$) (Table 2). Treatments A and C had significantly higher energy intakes than group B ($P < 0.01$), and D was significantly greater than B ($P < 0.05$).

Solid.—Dry-matter determinations for lucerne hay and grain were 89% and 90% respectively. Digestibility and digestible energy values for lucerne hay and grain were assumed to be 70% and 77%, and 1,337 kcal/lb and 1,554 kcal/lb respectively (National Research Council 1959).

Treatment B had a significantly higher energy intake than the other treatments ($P < 0.01$).

TABLE 3
FEED CONVERSION EFFICIENCY

Group	Energy Intake (lb livewt. gain/kcal)
A	3,964
B	4,136
C	3,910
D	3,503

Feed conversion efficiency.—The figures in Table 3 were derived by dividing total digestible energy intake in Table 2 by change in liveweight in 79 days. Though no valid statistical analyses could be carried out because hay and grain intakes were group averages, Table 3 does indicate the relative efficiencies of conversion of the four groups of calves.

(c) Dressing-out Percentage

There was a significant difference between groups ($P < 0.05$) in dressing-out percentage. Groups A, C and D had significantly higher dressing-out percentages than group B ($P < 0.05$). There were no significant differences between groups A, C and D.

IV. DISCUSSION

The results show that growth rate, dressing-out percentage, energy intake and efficiency of conversion of calves given tallow with skim-milk were equivalent to those in calves given wholemilk and superior to those in calves given skim-milk alone. The higher intakes of hay and grain by calves given skim-milk did not compensate for their low energy intake from the liquid diet. Those given tallow did not eat more hay and grain than those fed wholemilk.

The carcasses of the calves were weighed and graded by meatworks staff. In the wholemilk group two were graded "second" and two "third" in the wholemilk group. All calves given skim-milk graded "third" and all the calves which received tallow were graded "second". The higher grading of the carcasses of calves fed tallow was attributed to the superior finish of their carcasses.

There did not appear to be any superiority in calves which received skim-milk plus 3% tallow over those which received skim-milk plus 2% tallow. The latter group had a slightly higher rate of gain and a higher efficiency of conversion.

There were no cases of scouring or other health problems. The faeces of calves which received tallow had a light grey colour but were of the same consistency as those of healthy calves.

The time required to mix the tallow with skim-milk is the main practical problem involved in feeding calves a ration based on tallow and skim-milk. If a simpler method could be devised, tallow could be widely used with skim-milk to produce medium-weight veal calves on Queensland dairy farms from which cream is sold.

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