

# ENERGY SUPPLEMENTS TO SKIM-MILK FOR YOUNG CALVES

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## *Summary*

Beef tallow was fed in two experiments, the first on an experiment station to calves receiving basic rations of fresh skim-milk and grain, but it did not cause increased bodyweight gains. When the tallow was mixed with grain, the increase in intake of the mixture was largely cancelled by reduced consumption of hay. When tallow was emulsified in skim-milk in a field experiment, substantial increases in energy intake occurred despite lowered grain consumption. The failure to obtain a production increase in the farm experiment is attributed to husbandry deficiencies which are common when calves are reared in groups under commercial conditions. Growth rates with skim-milk and gain were satisfactory.

## I. INTRODUCTION

The growth rate of calves fed whole milk is much more likely to be limited by energy than protein intake (Jacobson 1969). This situation is accentuated when the butterfat is removed from milk. There is ample evidence that whole milk replacers, in which other animal or vegetable fats are substituted for butterfat, will support high growth rates and such feeds are widely used for young calves (Roy 1964).

McIntyre and Rayner (1966) attempted to develop a method for on-farm addition of tallow to fresh skim-milk. Calf performance was satisfactory, but the feed preparation procedure was considered to be too tedious for farmer use.

This paper reports two further experiments using fresh skim-milk, tallow and grain. At the Biloela Research Station, beef tallow was fed in simple mixtures with grain, while it was mechanically emulsified in skim-milk on a commercial farm at Canungra.

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## II. METHODS

### (a) *Animals and Management*

#### (i) *Experiment 1*

At Biloela, 25 A.I.S. and 18 A.T.S. x Sahiwal calves of mixed sexes were changed gradually from whole milk to treatment rations over the period from 21 to 28 days of age. Mean bodyweight of the calves at the commencement of the experiment (28 days of age) was 50.4 kg. Animals were kept in treatment groups in small, bare yards. For reasons not related to the experiment, animals were removed at various stages, but most received treatments for more than 42 days. Disease prophylaxis was limited to isolation from other stock and a high standard of hygiene.

#### (ii) *Experiment 2*

At Canungra, 12 A.I.S. and 40 A.I.S. x Friesian calves of mixed sexes were used. Following initial colostrum and whole milk feeding from birth, treatments were commenced at 14 days of age when their mean bodyweight was 36.1 kg. Animals were kept in treatment groups in small paddocks. 'Sub-groups were slaughtered after 51 days and 72 days.

The work was performed entirely by the farm labour force and a reasonable, but not unusually high standard of hygiene and management was maintained. To assist disease and parasite control, groups were alternated each 14 days between two paddocks which were spelled in the interim. Oxytetracycline was administered in the liquid feed at double the normal prophylactic level for the first 7 days and subsequently at the normal rate. A precautionary anthelmintic treatment was given although faecal egg counts were generally low ( $< 40$  eggs per g).

In both experiments, liquid rations were fed at 32°C (90°F) in equal amounts twice daily through individual nipple feeders. Dry supplements and water were provided *ad libidum*.

### (b) *Treatments*

#### (i) *Experiment 1*

Fresh skim-milk was fed at a standard rate of 5.54 kg per head daily and all animals received lucerne hay *ad libidum*. Three crushed sorghum grain and tallow treatments were used — grain alone, and mixtures by weight of 4 to 1 and 6 to 1 grain to tallow.

#### (ii) *Experiment 2*

All animals received crushed sorghum grain *ad libidum* and their paddocks, each 0.03 ha in area, were initially well grassed with kikuyu (*Pennisetum clandestinum*). Liquid feeding was at 10 per cent of bodyweight for the first 14 days, 12 per cent for the next 14 days and subsequently 15 per cent of bodyweight daily. Group average allowances at that time and for their-expected weights at the next weighing were calculated at 14 day weighings. Group consumption approximated closely to required levels, but individual rations were estimated on the animals size and measured out approximately by the farmer at each feed.

Three liquid feeds were used — fresh skim-milk, skim-milk plus 2 per cent edible tallow and skim-milk plus 2 per cent refined beef fat. 500,000 i.u. of Vitamin A was administered by intramuscular injection to half of the calves in each of the no fat and tallow groups.

### (c) Feed Preparation

#### (i) Experiment 1

Tallow was simply melted and mixed with crushed grain.

#### (ii) Experiment 2

Refined beef fat was received from the manufacturer as a 50 per cent oil in water emulsion, and a similar emulsion of 50 per cent tallow in skim-milk was prepared by the farm operator. These emulsions were manually mixed with skim-milk to the required concentration prior to feeding.

A simple device for homogenisation by the mechanical shear technique was fabricated. Sufficient closely fitting metal washers to occupy a length of 15 cm were placed on an externally threaded metal tube with an inside diameter of 1.3 cm. Sealing rings and nuts were placed at each end of the set of washers. The section of tube occupied by the metal washers had been previously perforated with 0.48 cm diameter holes at 1.9 cm spacings. One end of the tube was sealed and the other connected to the delivery hose of a small piston pump.

Tallow at 90°C was agitated with skim-milk at 32°C and pumped through the homogeniser at a pressure of 73 kg per cm<sup>2</sup>. Pressure was regulated by adjustment of the end nuts. A stable emulsion was obtained which stored satisfactorily for up to five days in the farm refrigerator.

### III. RESULTS

Only a few cases of milk diarrhoea occurred in each experiment. One animal in experiment 2 was killed by predators.

Mean performance and feed consumption are summarised in Tables 1 and 2. Differences between feed treatments in rates of bodyweight gain did not occur in either experiment. As individual feed consumption was not recorded, statistical analysis of these data was not attempted but the groups not receiving fat appear to have had higher intakes of hay in experiment 1 and grain in experiment 2.

Mean digestible energy intakes of the experimental calves, based on the value of the National Academy of Sciences (1966) and those of Morrison (1957),

TABLE 1  
*Mean growth rate and feed consumption of calves in experiment 1*

	Treatment			Mean S.E. of Difference
	Grain	6:1 Grain- Tallow	4:1 Grain- Tallow	
Initial bodyweight (kg)	53.8	50.5	47.9	—
Daily weight gain (kg)	0.75	0.74	0.68	0.050
Period fed (days)	51.8	55.8	57.4	—
Daily feed consumption—				
Milk (kg)	5.44	5.44	5.44	—
Fat (kg)	0	0.068	0.086	—
Grain (kg)	0.404	0.404	0.340	—
Hay (kg)	0.753	0.517	0.562	—

TABLE 2  
*Mean growth rate and feed consumption of calves in experiment 2*

	Treatment			Mean S.E. of Difference
	No Fat	Tallow	Refined Fat	
Initial bodyweight (kg)	36.0	35.7	36.7	—
Daily weight gains—				
First 51 days (kg)	0.60	0.59	0.53	0.033
Total period (72 days) (kg)	0.64	0.68	0.63	0.047
Daily feed consumption —				
Milk (kg)	7.57	7.39	7.30	—
Fat (kg)	0	0.150	0.150	—
Grain (kg)	0.458	0.313	0.277	—

are shown in Table 3. No account was taken of pasture consumption in experiment 2. Requirements for calves of these average bodyweights and daily gains, based on estimates (Jacobson 1969) for non-ruminant calves, are also set out in Table 3.

Vitamin A treatment produced no response, the total period daily gains averaged over both the no fat and tallow groups being 0.65 kg and 0.66 kg (S.E. of difference 0.045) for Vitamin A supplemented and non-Vitamin A supplemented respectively.

#### IV. DISCUSSION

The failure to obtain a performance response from added tallow in experiment 1 appears to have been due to reduced intake of dry feeds by the tallow fed calves such that the net change in energy intake was small (Table 3). The calculated digestible energy intakes lie in the range of energy requirements listed by Brisson, Cunningham and Haskell (1957) and Jacobson (1969).

TABLE 3  
*Digestible energy intake and requirement of calves fed the experimental diets*

	Mean Intake kcal/day	Requirement* Kcal/day
Experiment 1—		
Grain	5063	5566
6:1 Grain tallow	5218	5756
4:1 Grain tallow	5268	5520
Experiment 2—		
No fat	4444	4699
Tallow	5332	4936
Refined fat	5175	4682

\* This is calculated from the mean of requirements derived by Jacobson (1969).

Although grain intakes were lower than for the no fat calves, both fat treatments in experiment 2 resulted in appreciable increases in energy intake from the concentrates fed. The calculated energy intake from the milk and grain of the non-fat animals was within the range of requirements quoted by Jacobson (1969) but is below his mean value used to derive the value in Table 3.

Reduction of voluntary intake of dry feeds by calves receiving fat has been reported by McIntyre and Rayner (1966). With a relatively high level of fat in the liquid ration, a useful net increase in energy intake was obtained in our experiment. However, when fat is administered with the grain in a dry supplement, this substitution problem may be a barrier to increasing energy intake.

Protein intakes in experiment 2 were calculated to be adequate and the fat emulsions were physically at least as satisfactory as those used by McIntyre and Rayner (1966) to produce weight gains in excess of 1.0 kg daily. The failure to obtain higher performance from the groups receiving fat may be an instance of the reduction in performance under commercial conditions, as compared to research station (Davidson and Martin 1965).

Weight gains averaging 0.9 kg per day in a farm trial using a high energy calf feed have been reported by Haskew (1968). However, in that case, only a small number of housed, individually penned calves receiving close attention were used. Roy (1964) has emphasised that very high standards of husbandry and management are necessary for large groups of commercially reared calves to achieve the performance which high energy rations are capable of supporting.

Husbandry and management in this experiment were at least equal to the average on Queensland dairy farms. However, many departures from desirable standards, which may have contributed to a depression of performance, were observed on this farm indicating that technically ideal methods may frequently not be commercially practicable.

Although low compared with attainable levels, the performance of calves in both experiments represented satisfactory pre-weaning gains for animals intended for either dairy or beef production indicating that a simple grain and skim-milk ration is sufficient for this purpose.

The lack of response to Vitamin A is consistent with the finding by Gartner and Alexander (1966) of high hepatic reserves in Queensland cattle even under drought conditions. High reserves can also be expected in progeny which have received colostrum from such animals.

## V. ACKNOWLEDGMENTS

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