No. 20 MARCH 1991

ifoma FISH MEAL FLYER

LEANER BEEF AND LAMB WITH FISH MEAL

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International Fishmeal and Oil Manufacturers Association

EDITOR'S SUMMARY

A system of manipulating the fat : lean content of lambs and cattle is described through dietary changes achieved with natural ingredients. Work at the Rowett Research Institute in Scotland by Dr Bob Ørskov and his colleagues has shown that in the last few weeks of finishing both lambs and cattle, carcass fat can be reduced and lean increased by using cheap low quality diets, such as straw, supplemented with a small supplement of high quality rumen undegradable protein, such as fish meal. They have shown that carcass fat is used as body fuel along with amino acids provided by the undegraded protein resulting in increases in carcass lean.

As well as reducing the fat content of meat, which appears to be required by consumers in developed countries, this dietary system of body fat manipulation can be used in developing countries to store meat "on the hoof" during periods of poor feed supplies, for example, during drought, to spread meat supplies and achieve higher prices for the producers.

MANIPULATION OF THE FAT:LEAN CONTENT OF LAMBS THROUGH DIETARY CHANGES

It has been demonstrated by Drs. Bob Ørskov and Dickon Hovell working at the Rowett Research Institute in Scotland that lambs in good condition on a sub-maintenance straw diet would maintain or even gain weight if a small supplement of fish meal was given. Animals in substantial negative energy balance could gain lean tissue and weight when a source of high quality protein, protected from rumen breakdown, was given provided they had sufficient stored body fat to mobilise. This hypothesis was clearly demonstrated in a slaughter trial in which lambs were given straw based diets plus fish meal as the source of protected (undegraded) protein. Whilst losing fat, the lambs gained lean tissue and thus liveweight and carcass weight. For example, on a high straw diet plus 75g fish meal for 92 days, lambs lost 0.9kg fat, gained about 5kg of lean tissue and gained over 6kg of liveweight (1) (see Table 1).

TABLE 1

Effect of Fish Meal Supplements to Straw Diets on Body Gain and Composition of Lambs (1)

Treatment	Energy Level multiples of maintenance (M)	Live weight gain (kg)	Empty Body gain (kg)	Body fat (kg)	Non-fat gain
Low Straw	0.5	-4.32	-5.05	-3.53	-1.52
Low Straw + fish meal	0.5	0.29	0.64	-1.53	2.27
High Straw	1.0	0.08	-0.80	-1.40	-0.60
High Straw + fish meal	1.0	6.22	4.18	-0.90	5.08

A practical consequence of this technique can be illustrated by the experience of Scottish sheep farmers who, following the Chernobyl disaster, had to delay marketing their lambs which became over-fat. By putting them onto a straw/fish meal diet, carcass fat was reduced to an acceptable level without loss, or even with gain, in carcass weight.They then graded satisfactorily.

The use of fish meal in low energy diets to slim lambs is the subject of the Association's Fish Meal Flyer Number 16.

MANIPULATION OF THE FAT:LEAN CONTENT OF CATTLE THROUGH DIETARY CHANGES

The above work has since been repeated with cattle. Dr. Ørskov's group has now demonstrated that the same principles apply. Overfat cattle were put on a low energy straw:fish meal diet (400g fish meal mixed with 200g sugar beet pulp per animal, daily), which put them into negative energy balance, body fat was mobilised and with the amino acids supplied by the undegraded protein, lean tissue was produced.

TABLE 2

Effect of Feeding Overfat Heifers on Straw or Straw Supplemented with 0.53kg/d of a Mixture of Fish Meal and Sugar Beet Pulp

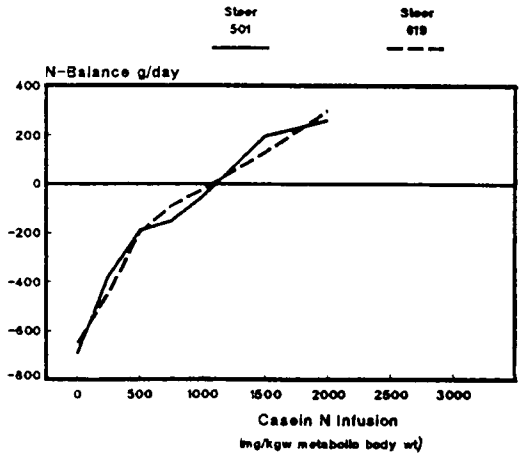
Treatment	Initial weight kg	Final weight kg	Gain/d kg	Intake of straw kg DM/d	Fish and Sugar beet pulp kg DM/d	Carcass weight kg
Initial slaughter	496	496	-	-	-	267
Control	500	451	-0.75	3.0	0	241
Control + fish meal	494	494	0	4.1	0.53	262

As a result 12 cattle (heifers) which had failed to grade because they were overfat subsequently graded, having maintained weight; a similar group given straw only lost weight (2) - see Table 2 above:

It was demonstrated with two fasting steers given increasing amounts of casein infused into the abomasum (that is beyond the rumen) nitrogen retention rose and positive nitrogen balance was achieved (3) - see Figure 1 below:

FIGURE 1

N-balance (3 day means with SE) of two steers given varying amounts of casein by abomasal infusion but no additional energy.



Rather than being metabolised through oxidation to provide energy the casein was utilised efficiently as a source of amino acids to reduce negative nitrogen balance at fasting. With high levels infused it even resulted in positive balance. In other words, this demonstrated that stored fat was being used as the energy source (fuel) for lean growth. The infused steers achieved growth rates in excess of 1kg per day; fasting Suffolk cross lambs given a casein infusion achieved growth in excess of 0.5kg per day (2).

The quality of the undegraded protein is important. It must be well digested and provide a well balanced supply of amino acids especially lysine and methionine. Fish meal has been shown to meet these requirements (4).

THE PRACTICAL APPLICATION

1. The present practice in many developed countries of finishing cattle on high-energy diets may need to be revised. A final finishing period on a very low quality and cheap diet may be more appropriate with a small supplement of a high quality protein not degraded in the rumen, such as fish meal. Use of 200g to 400g of fish meal per day for six or seven weeks prior to slaughter, perhaps mixed with a small amount of sugar beet pulp to aid palatability, would be appropriate.

2. Lambs too in developed countries could be finished on a cheap low quality diet supplemented with a small quantity of a high quality undegraded protein, such as fish meal. Use of 50g to 100g supplementary fish meal for three or four weeks prior to slaughter would be required. There is increasing public concern about the fat in red meat. For example, it has

recently been linked with colon cancer (5). People in most developing countries are being advised to reduce their intake of saturated fat, such as that in red meat. However, with a move away from hormone and growth promoter use in cattle, they are tending to lay down more fat. Fish meal provides a means of reducing the fat in lamb and beef.

3. In underdeveloped countries with widely fluctuating seasonal supply of nutrients, cattle and sheep could be fattened when feed supplies are plentiful. When not, for example in the dry season, they could be maintained on the poor diet plus a small fish meal supplement. This way they could be held for several months and gain from price increases and storage of meat 'on the hoof'.

Conclusion

The conclusion of Dr Bob Ørskov to his work (6) is that whilst fat may be harmful in some circumstances for humans, it is an extremely good source of food for animals. If the fat is mobilised from the animal's reserves and used to produce lean by dietary manipulation through the use of natural feed ingredients, this provides a means of supplying lean meat to humans with the fat content commensurate with that required for health and activity.

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