Proceedings of

THE NUTRITION SOCIETY
of
AUSTRALIA

Volume 19

Nineteenth Annual Scientific Meeting
Melbourne, Victoria, September 1995

THE EFFECT OF DIFFERENT DIETARY GRAINS ON THE EXPRESSION OF ATP CITRATE LYASE IN THE ADIPOSE TISSUE OF SHEEP

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The feeding of some cereal grains such as maize is known to allow significant digestion of starch and hence absorption of glucose from the small intestine. Diets allowing the direct absorption of glucose are known to alter the pathways for glucose metabolism within ruminant animals. Accordingly, diets based on maize allow for an increased incorporation of glucose into fatty acids as assessed by the activity of enzymes associated with the citrate cleavage pathway and by direct incorporation of radiolabelled glucose in vitro. The intravenous infusion of glucose allows for similar effects (Rowe and Pethick 1994). This study examined the effects of feeding six grains on the biosynthesis of fat from glucose as assessed by the activity of ATP citrate lyase (ACL, EC 4.1.3.8) in subcutaneous adipose tissue of sheep.

Merino wethers (12 mo, LW = 33kg, body fat score 1.5) were individually housed and fed one of six 'whole' grains (lupin, oats, barley, wheat, maize or sorghum) at three levels of intake (0.8, 1.3 and 1.8 x maintenance) with eight sheep per treatment. All animals received 200 g of cereal chaff and a mineral/vitamin premix. The cereal grains were fed with 0.5% urea and 20 g of virginiamycin per tonne. The diets were fed for two months and then all animals were slaughtered at an abattoir within two to three hours of leaving the sheep accommodation. At 20 minutes post slaughter samples of subcutaneous adipose tissue were collected into liquid nitrogen for the subsequent determination of ACL activity.

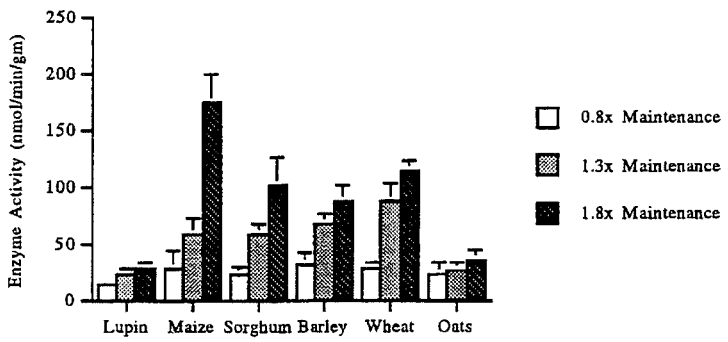

Figure. The activity of ACL increased (P<0.0001) as the level of intake increased for all grain types. The type of grain fed significantly affected enzyme activity (P<0.0001) with lupin and oat grain resulting in the lowest activity while a diet based on maize resulted in the highest levels.

The results are consistent with the digestive physiology of the grains. Lupin contains virtually no starch for digestion; the starch of oats is known to be extensively fermented in the rumen while some 30% of the starch from maize escapes fermentation. Much of the starch in sorghum can escape fermentation (~40%) however it is also resistent to digestion in the small intestine. Clearly the type of grain can influence the pattern of glucose metabolism within adipose tissue. In addition the activity of ACL in subcutaneous adipose tissue is a useful marker of starch digestion in the small intestine.

ROWE,J.B. and PETHICK, D.W. (1994). Proc. Nutr. Soc. Aust. 18:40

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