

## PLASMA ESSENTIAL FATTY ACIDS IN THE KACANG GOAT UNDER DIFFERENT REARING SYSTEMS

M.A. Rajion, M.M. Noordin and A. Salam Abdullah

Faculty of Veterinary Medicine, Universiti Putra Malaysia,  
43400 UPM Serdang, Selangor, Malaysia

### SUMMARY

The plasma essential fatty acid concentrations of 20 Kacang crossbred does reared either under free grazing or intensive rearing systems were measured and compared. The feed samples on offer were identified, collected and subjected to routine proximate analysis and fatty acid determinations. The plasma levels of the essential fatty acids (EFA), namely linoleic acid (18:2n-6) and  $\alpha$ -linolenic acid (18:3n-3) in both the pre-feeding and post-feeding periods were significantly higher in the intensively reared goats than those reared under free grazing conditions. The concentration of linoleic acid in the feed under intensive rearing conditions (6.9mg/100g) was higher than under free grazing conditions (2.9mg/100g). Similarly, the concentration of  $\alpha$ -linolenic acid in the feed under intensive rearing conditions (8.5mg/100g) was higher than under free grazing conditions (4.0mg/100g).

Keywords: plasma essential fatty acids, Kacang goat, rearing systems

### INTRODUCTION

Insufficient intake and utilisation of nutrients from the available feed sources are some factors contributing to the overall poor performance of the Malaysian indigenous Kacang goats which are reared mostly by smallholders in rural areas (Rajion *et al.*, 1993). Small ruminants including the goat not only require adequate supplies of protein and carbohydrates, but to a lesser extent, fats in their diet. While the non-essential fatty acids (NEFA) can be synthesised endogenously by the animal in addition to obtaining them through the feed, the essential fatty acids (EFA), namely linoleic acid (18:2n-6) and  $\alpha$ -linolenic acid (18:3n-3) must be derived from the feed (Gurr and Harwood, 1991). These physiologically active EFA are required to maintain the general well-being of the animal (Lefkowitz *et al.*, 1986; Gurr and Harwood, 1991; Innis, 1994).

Little work has been carried out to determine the supply of EFA to the goat particularly under different rearing and feeding systems. The plasma levels of these EFA in the animal would reflect the levels of their intake from the feed sources which include grasses, legumes and weeds under the free grazing conditions and mainly grasses under intensive rearing. This paper reports the comparison of plasma levels of EFA in free grazing and intensively reared Kacang goats.

### MATERIALS AND METHODS

Twenty randomly selected, adult Kacang x Jamnapari or Kacang x Anglo-Nubian crossbred does were used in the study. Ten does were intensively reared under a cut and carry feeding system without concentrate supplementation whilst 10 does were extensively reared, spending approximately six hours free grazing in tin tailing areas, road verges and rubber plantations.

Representative feed samples were taken from the areas

where they were obtained for the cut and carry intensive system or where the animals grazed under the extensive system. The feed samples were taken on the day blood sampling was carried out and again after one week. Duplicate samples were subjected to proximate analyses and fatty acid determinations.

Blood was sampled by jugular venipuncture into heparinised tubes. Blood samples were taken at 3-4 hours pre- and post-feeding. Plasma was obtained by centrifugation and stored at  $-20^{\circ}\text{C}$  until required for extraction of lipids.

Total lipids were extracted from 2.0 ml plasma or 20 g air dried feed samples using chloroform-methanol (2:1, v/v) using a modified method of Folch *et al.* (1957) described by Rajion *et al.* (1985). The feed lipid extracts were subjected to a column chromatographic clean-up procedure to remove particulate matter and pigments prior to transmethylation, where they were passed through a packed column of anhydrous sodium sulphate, diatomaceous earth, aluminium oxide, aluminium hydroxide, anhydrous sodium sulphate and packed glass wool. A known amount of internal standard of n-heptadecanoic acid (17:0) was added to the total lipid extracts of the plasma and feeds prior to transmethylation. Fatty acid methyl esters (FAME) were prepared using sodium methoxide as the methylating agent.

The FAME were separated on a 20% DEGS packed column in a Pye Unicam gas-liquid chromatograph, at  $200^{\circ}\text{C}$  injector temperature and  $180^{\circ}\text{C}$  column temperature. The carrier gas was nitrogen at a rate of 40 ml/min. The FAME were identified by comparison with a reference standard (Nu-Chek Prep., Minnesota, USA). The absolute amounts of fatty acids were calculated based on the known amount of the internal standard, n-heptadecanoic acid (17:0).

The data were analysed using a one-way analysis of variance (Steel and Torrie, 1980). The differences between

the means were tested for significance using the Duncan's Multiple Range Test.

## RESULTS

Proximate analyses showed higher levels of crude protein in the feeds offered under free grazing conditions but the levels of dry matter (DM), ether extract (EE), acid detergent fibre (ADF) and ash in the feeds of both feeding systems were similar (Table 1). However, the levels of both EFA in the feeds offered in the intensive system were higher than those offered under the free grazing system.

**Table 1.** Proximate analyses (%) and essential fatty acid concentrations (mg/100 g) in feeds under different rearing systems.

	Free Grazing	Intensive
Dry matter	29.6	22.8
Crude protein	16.1	8.1
Ether extract	2.5	2.5
Acid detergent fibre	36.7	40.5
Ash	7.8	6.7
Linoleic acid (18:2 n-6)	2.9	6.9
$\alpha$ -Linolenic acid (18:3 n-3)	4.0	8.5

**Table 2.** Plasma fatty acid concentration (mg/100 ml) in pre-fed goats. Mean  $\pm$  S.E.M..

Fatty acid	Free Grazing (n=10)	Intensive (n=10)
16:0	150.1 $\pm$ 27.1	80.8 $\pm$ 16.3
18:0	61.6 $\pm$ 12.7	55.1 $\pm$ 10.9
18:1	167.2 $\pm$ 25.7	88.7 $\pm$ 28.5
18:2 n-6	27.6 $\pm$ 7.4 <sup>b</sup>	50.3 $\pm$ 11.3
18:3 n-3	5.1 $\pm$ 1.7 <sup>b</sup>	9.6 $\pm$ 2.1

<sup>a,b</sup> values within a row subgroup with no common subscripts differ significantly ( $p < 0.05$ )

There was a significantly higher ( $p < 0.05$ ) concentration of both EFA in the plasma of intensively reared goats compared to the grazed goats in both the pre-feeding (Table 2) and post-feeding period (Table 3). These EFA levels tended to increase after feeding under both rearing systems. The levels of linoleic acid in the plasma of goats in both the pre-feeding and post-feeding periods were consistently higher than  $\alpha$ -linolenic acid under both rearing systems.

**Table 3.** Plasma fatty acid concentration (mg/100 ml) in post-fed goats. Mean  $\pm$  S.E.M.

Fatty acid	Free Grazing (n=10)	Intensive (n=10)
16:0	73.5 $\pm$ 6.1	79.7 $\pm$ 6.0
18:0	71.4 $\pm$ 6.0	54.8 $\pm$ 3.6
18:1	92.3 $\pm$ 5.9	28.0 $\pm$ 9.7
18:2 n-6	33.4 $\pm$ 4.5 <sup>b</sup>	61.6 $\pm$ 4.1 <sup>a</sup>
18:3 n-3	5.0 $\pm$ 0.6 <sup>b</sup>	12.3 $\pm$ 0.8 <sup>a</sup>

## DISCUSSION

The results showed that the concentrations of both linoleic and  $\alpha$ -linolenic acid were higher in the plasma of goats reared intensively than those free grazing suggesting a higher intake of these EFA in the former system in which the feeds were offered *ad libitum*. This correlated well with the occurrence of higher levels of EFA in the feeds used for intensive rearing which was mainly African stargrass (*Panicum maximum*). However, the feeds eaten by the free grazing animals which were mainly leafy plants which included grasses such as *Brachiaria decumbens*, *Axonopus compressus*, *Cylindrica imperata* and *Paspalum conjugatum* and legumes which included *Centrosema pubescens*, *Mimosa pudica*, *Stylosanthes guyanensis* and others such as *Displagium esculentum*, *Mikania cordata* and *Melastoma malabratichum* were high in crude protein.

The increase of the EFA in the plasma of post-fed animals compared with the levels in the pre-fed animals further demonstrated that the intensively reared animals were acquiring more EFA from their feed sources, assuming that both groups of animals ate to appetite. The positive relationship between the levels of the EFA and PUFA in the feeds and the levels measured in the plasma of the Kacang goat have been reported by Rajion *et al.* (1996).

The results of this study showed that feeds offered to goats reared under an intensive system provided a higher intake of the EFA which are required for the well being of the animal.

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**RINGKASAN***ASID LEMAK PERLU DALAM PLASMA KAMBING KACANG DI BAWAH SISTEM PETERNAKAN BERLAINAN*

Kepekatan asid lemak perlu dalam plasma 20 ekor Kambing Kacang kacukan betina yang diternak samada secara ekstensif atau intensif telah diukur dan dibandingkan. Makanan yang diberi telah dikenalpasti, dikumpulkan dan dijalankan analisis proksimat dan penentuan asid lemak. Tahap asid lemak perlu, iaitu asid linoleik (18:2n-6) dan asid linolenik (18:3n-3) dalam tempoh sebelum dan selepas makan adalah lebih tinggi dalam plasma kambing diternak secara intensif berbanding dengan kambing di ternak secara ekstensif. Kepekatan asid linoleik dalam plasma kambing diternak secara intensif (6.9mg/100g) adalah lebih tinggi daripada diternak secara ekstensif (2.9mg/100g). Begitu juga kepekatan asid linolenik dalam plasma kambing diternak secara intensif adalah lebih tinggi daripada diternak secara ekstensif.