COMPARSION OF LIPID SYNTHESIS METABOLISM IN SHEEP, DEER AND GOATS

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Introduction

Young deer are generally very lean with a high protein and low fat content. We suppose the lipid accumulation system of deer is different from the other rumen animals.

We investigated the lipid metabolism at the adipose tissue of sheep, deer and goats.

Materials and Methods

Animals and pasture

Castrated male sheep, deer and goats were used. All were the same age (2.5 years) and all grazed the same ryegrass-clover pasture in May 1988 at Animal Research Unit of Maasey University. The pasture used contained (w/w) approximately 0.90 ryegrass and 0.10 clover, and was grown during the autumn-winter period. All forages were fed in the fresh state.

Ultrasonic scanning and biopsy of fat samples

The measurement of subcutaneous fat depth was made using ultrasonic scanning on the live animals. A sample of subcutaneous adipose tissue (about 0.5 g) was removed under tranquilising and local anaestheic from the shoulder area of all animals, and maintained at 37°C in physiological saline (9 g sodium chloride/L).

Protein and DNA concentration

The lipid samples were homogenated with appreciable distilled water by elemer-poter glass homogenizer. The 0.5 ml of homoginate samples were taken to the experiments.

The concentration of protein and DNA were determined by the methods of Lowry determination of protein in the presence of triton X-100 (C. Wang and R.L. Smith, 1975), and modified fluorometric micromethod for DNA (R.R. Switzer and G.K. Summer, 1971), respectively.

Lipid metabolism

Rates of lipogenesis in adipose tissue were determined from measuring rates of [U-^{14}C] acetate and D-[U-^{14}C] glucose uptake, using 50 mg tissue slices incubated for 2 hr at 37°C in the in vitro procedures of Pike and Roberts (1980, 1981). Ovine insulin and adrenaline bitarate were added to the 2.5 ml buffer in each flask. Rates of oxidation of [U-^{14}C] acetate and D-[U-^{14}C] glucose were determined by trapping and counting $^{14}CO_2$ as described by Pike and Roberts (1980, 1981). Glycerol release, a measure of lipolysis, was measured in the flasks used for both the acetate and glucose incubation using the enzymic method of Wieland (1974).

Results and Discussion

Fat depth measurement

Table 1 shows the fat depth of sheep, deer and

TABLE 1. MEAN FAT DEPTH AND LIVE WEIGHT OF SHEEP, DEER AND GOATS

Kind	No. of animals	Fat depth (mm)	Live weight (kg)
Sheep	8	12.19±2.77	73.2±2.9
Deer	8	Not determined	99.9±3.2
Goat	7	1.29±0.39	44.4±3.1

goats. The fat depth of sheep were very fatty from about 9 mm to 17 mm, mean 12.2 mm. The subcutaneous adipose tissue samples of sheep were taken the most easily in all kinds. The value of the goat fat depth were very thinnery from 0 to 2.0 mm, mean 1.3 mm. In case of deer, the fat depth could not be determined and it was difficult to take the adipose tissue.

Protein and DNA concentration

Table 2 shows the concentration of protein and DNA in the adipose tissues. The concentration of protein and DNA in the deer adipose tissue was the highest value. We supposed lipid metabolism of deer adipose tissue had been strongly controlled by the protein and DNA assay.

TABLE 2. CONCENTRATION OF PROTEIN AND DNA IN ADIPOSE TISSUES FROM SHEEP, DEER AND GOATS

	Sheep	Deer	Goat
Protein(mg/g)	15.01±6.46	48.82±21.14	33.66±16.40
DNA(μg/g)	0.386±0.206	0.802±0.384	0.719±0.354

Adipose tissue metabolism

Acetate was taken up by adipose tissue for lipid synthesis in much greater quantities than glucose. Table 3 shows the incorporation and oxidation of acetate and glucose in adipose tissue from sheep, deer and goats. The rates of acetate incorporation tended to be lower in the adipose

TABLE 3. INCORPORATION AND OXIDATION OF ACETATE AND GLUCOSE, TOGETHER WITH GLYCEROL RELEASE (nmol/g WET TISSUE PER HOUR), IN ADIPOSE TISSUE FROM SHEEP, DEER AND GOATS

	Sheep	Deer	Goat
Acetate oxidation	138.7±103.9	284.2±158.2	152.2±120.2
Acetate incorporation	210.6±132.0	188.7±130.7	277.9±208.6
Glucose oxidation	52.9± 54.1	51.3± 19.5	77.1± 45.3
Glucose incorporation	62.6± 74.7	34.2± 15.3	84.2± 57.6
Glycerol release	135.4± 94.5	114.8± 79.0	149.9± 89.9
Acetate incorporation/ Glycerol release	2.32± 1.76	2.24± 1.76	2.00± 0.88

Amount of [U-^{14}C] acetate and D-[U-^{14}C] glucose either incorporated into adipose tissue or oxidized to carbon oxide

tissue from deer compared with those sheep and goats, although the difference did not attain significance ($p > 0.05$).

The conversion value to CO_2 in sheep adipose tissue was lower than that of deer and goats. The value of the incorporation was between deer and goats. Acetate incorporation/glycerol release was the highest in all kinds. That is, lipid accumulation system tended to be higher more than others. In case of deer, the conversion value from acetate to CO_2 was the highest, and acetate incorporation and glycerol release value were the lowest of all kinds. The value of acetate incorporation and glycerol release of goats were the highest and the ratio of conversion to fat was small.

(**Key Words**: Lipid Synthesis, Adipose Tissue, Fat Metabolism)

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