Short Communications

SC 2185

Conversion of aromatic amino acids to fatty acids by adipose tissue

Recent investigations have shown that several aliphatic amino acids are metabolized by adipose tissue[1-3]. Isoleucine, alanine, serine, valine and isoleucine appear to be utilized by pathways similar to those occurring in other mammalian tissues. This line of research has been extended in the present study in which the metabolism of phenylalanine, tyrosine and tryptophan by adipose tissue has been investigated. These aromatic amino acids are of particular interest since it has been shown that they form acetyl-CoA[4] which should be a good precursor for the biosynthesis of fatty acids.

The incubation procedures with epididymal adipose tissue from the mouse have been previously described[3]. In addition to the ^{14}C-labeled amino acids, non-labeled glucose (0.011 M) and succinate (0.01 M) were added to the Krebs bicarbonate buffer. Acetoacetate was characterized by preparation of a derivative with 2,4-dinitrophenylhydrazine; acetate was identified by preparation of the *p*-bromophenacyl derivative.

The transfer of phenylalanine, tyrosine and tryptophan carbon to fatty acids and CO_2 is shown in Table I. 1.38 % of added phenylalanine was recovered as CO_2 while 0.28 % was recovered as fatty acids. These conversions are of the same order of magnitude as those previously found for valine and isoleucine but considerably less than observed for alanine, serine and leucine[1-3]. Conversion of tyrosine to fatty acids was 1.97 %, or 7-fold greater than for phenylalanine. On the other hand, the conversion of tyrosine to CO_2 was less than that observed for phenylalanine. Phenylalanine is irreversibly converted to tyrosine[5]. Thus, pathways other than degradation through tyrosine which lead to acetyl-CoA must account for the low conversion of phenylalanine to fatty acids. Fig. 1 is a typical radioactive tracing of a chromatograph from tissue extracts after phenylalanine incubation. Shown on the record is acetoacetate, which along with fumarate is one of the major end products of phenylalanine and tyrosine catabolism[5]. Acetate and butyrate are also shown as products.

TABLE I

RECOVERY OF [^{14}C]FATTY ACIDS AND $^{14}CO_2$ AFTER INCUBATION OF EPIDIDYMAL ADIPOSE TISSUE WITH [^{14}C]PHENYLALANINE, TYROSINE AND TRYPTOPHAN

1.4 g of tissue were incubated for 3 h at 37.5° in 14.0 ml of Krebs-bicarbonate buffer. The labeled amino acids were present at a final concentration of 1 mM, unlabeled glucose (11 mM) and succinate (10 mM) were present.

^{14}C-Labeled acids added	*No. of expts.*	*Added dose (μC)*	*Fatty acids (% of added dose)*	*CO_2 (% of added dose)*
L-[$^{14}C_6$]Phenylalanine	4	3.98	0.28 ± 0.00*	1.38 ± 0.77
DL-[2-^{14}C]Tyrosine	4	5.83	1.97 ± 0.07	0.97 ± 0.17
DL-[2-^{14}C]Tryptophan	4	5.83	0.16 ± 0.02	0.98 ± 0.10

* Standard error of the mean.

The conversion of tryptophan to fatty acids was considerably less than that found for tyrosine although oxidation to CO_2 was comparable. One path of tryptophan degradation is via alanine[5]. Conversion to fatty acids of this amino acid is less than previously reported for alanine[2]. A possible explanation for these findings is that degradation of tryptophan in adipose tissue to alanine and ultimately to acetyl-CoA is not a major path in the catabolic scheme of this amino acid in this tissue. Since conversion to CO_2 exceeded conversion to fatty acids by 6-fold, entry into the cell is not a limiting factor.

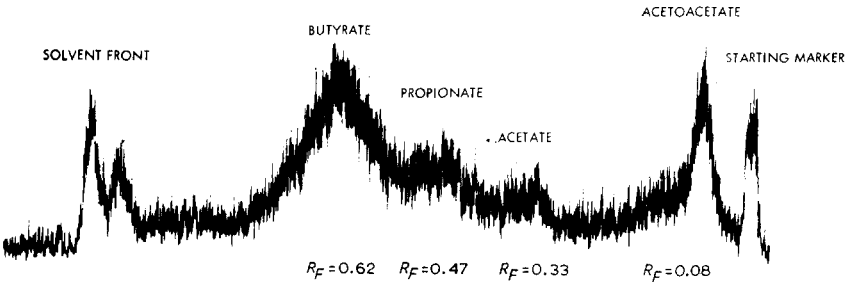

Fig. 1. Scan of the paper chromatogram of extracts obtained from mouse adipose tissue after incubation with L-[^{14}C]phenylalanine. Supernatant and combined washings were electrodialyzed, extracted with ether, made basic with NH_4OH and chromatographed on Whatman No. 1 paper for 20 h with ethanol – conc. ammonia – water (95:1:5). Paper strips were counted on Nuclear-Chicago Actigraph II unit. Radioactive ink was added at the starting mark and at the solvent front for identification. Detector, Model D47 (micromil window); collimator, 0.25 in; Scan speed, 0.75 in/h; time constant, 20 sec; count-rate range, 300 counts/min.

The ability of adipose tissue to utilize carbohydrates and fatty acids has been well documented[6]. The results of this communication and earlier ones[1-3] indicate that this tissue can also utilize amino acids. The general pattern of overall metabolism of the three major foodstuffs in adipose tissue, as it unfolds, appears to follow pathways similar to those in most other mammalian tissues.

This investigation was supported in part by Grant No. A-2174 from the U.S. Public Health Service and a grant from the Wesson Fund for Medical Research and Education. The technical assistance of J. PRENDERGAST is gratefully acknowledged.

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Received September 10th, 1962

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