

## Effects of Dietary Triolein, Tripalmitin, and L-Phenylalanine on Calcium Absorption in the Rat\* (33702)

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It has been reported that when the source of fat in the diet is oleic rather than palmitic acid, the fecal loss of calcium is greater because the former aids in the formation of a calcium-oleic acid-phosphate complex, which is excreted (1).

The results of chemical balance studies from this laboratory (2), however, have shown that triolein causes better absorption of calcium than tripalmitin or tristearin when the triglyceride constitutes a high percentage (25%) of the diet.

The purpose of this investigation was to compare the effect of these two triglycerides on net calcium absorption, using <sup>47</sup>calcium instead of chemical balance method.

The influence of dietary L-phenylalanine on calcium absorption was also investigated because although it has been shown that the uptake of radiocalcium by rat femur 24 hr after oral administration of 0.8 M L-phenylalanine was the same as controls (3), the effect of long-term feeding of this amino acid on calcium absorption has not been investigated.

**Materials and Methods.** Thirty-two male rats of Holtzman strain weighing 190–210 g were divided into four groups. The animals were kept in individual cages for 2 weeks. Distilled water was provided *ad libitum*. All the rats received equal amounts of diet (15 g/day). The composition of four diets is given in Table I. The first two diets contained 25% tripalmitin while the other two had 25% triolein. Four % L-phenylalanine was present in diets 1 and 3 but absent in diets 2 and 4. Calcium and phosphorus content of all

TABLE I. Composition of the Diets.<sup>a</sup>

Ingredients	Diets (%)			
	1	2	3	4
Casein	20.0	20.0	20.0	20.0
Vitamin mixture	2.2	2.2	2.2	2.2
Mineral mixture	4.0	4.0	4.0	4.0
Celluloflour	4.0	0.0	4.0	0.0
L-Phenylalanine	0.0	4.0	0.0	4.0
TP	25.0	25.0	0.0	0.0
TO	0.0	0.0	25.0	25.0
Cerelose	44.8	44.8	44.8	44.8

<sup>a</sup> Analyzed values (%): calcium 0.62; phosphorus 0.48; fat 25.00.

the diets were 0.62 and 0.48%, respectively, by analysis.

After allowing 1 week for adaptation, tail cups were affixed to prevent coprophagy and thus recycling of <sup>47</sup>calcium. After an 8-hr fast, 1 μCi of <sup>47</sup>calcium in 1 ml of skimmed milk was administered to each rat by stomach tube and the same amount was kept as standard. Two hr later, each rat was placed in a Lucite holder and the total body count was measured for 1 min or longer to obtain at least 10,000 cpm, using Packard model 440 Armac scintillation detector. Total body counts were measured again after 1, 2, 3, 5, and 7 days. All counts, corrected for background (122–150 cpm) and physical decay, were expressed as percentage of the administered dose of initial body radioactivity. The percentage of retained <sup>47</sup>calcium in each rat was plotted on semilog paper against time. The curve so obtained fell rapidly in the first day, then became almost linear. Extrapolation of the straight portion of curve back to zero (the day of administration) was used to estimate net intestinal absorption or retention of calcium.

Tail cups were emptied daily, the 7-day fecal collection for each rat was pooled, weighed, and kept frozen until analysis.

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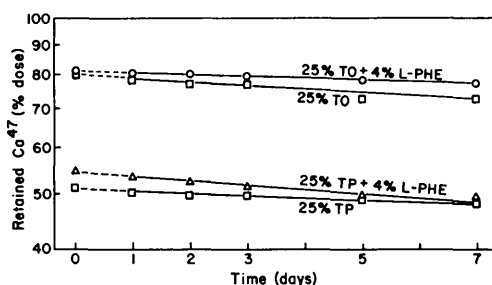


FIG. 1. Effects of dietary triolein, tripalmitin, and L-phenylalanine on net calcium absorption.

Total fecal fat was extracted by petroleum ether using Goldfish apparatus. F & M gas chromatogram with flame ionization detector was used to study the pattern of excreted fats. Dietary calcium and phosphorus were analyzed by atomic absorption spectrophotometer and a modified Fiske and Subbarow method (4), respectively.

**Results and Discussion.** Figure 1 reveals that diets containing 25% triolein caused better absorption of calcium than those containing 25% tripalmitin, 80% as compared to 50%. This is in accord with the results of other studies (2) obtained by chemical balance methods. The adverse effect of tripalmitin may be due to the formation of large amounts of calcium soaps as evidenced by great increase in fecal volume when this triglyceride was fed. Gas chromatographic analysis of fecal fat of the groups fed tripalmitin showed that it was mostly (>90%)

palmitate. Again the theory that oleic acid causes more excretion of calcium than palmitic acid cannot be substantiated from our data which show that triolein causes a much better absorption of calcium than tripalmitin. Whether the discrepancy is due to feeding triglycerides instead of fatty acids cannot be determined from the present data, but is very unlikely.

Including 4% L-phenylalanine in the diet had no significant effect on calcium absorption regardless of the type of triglycerides fed. Similar results were obtained by measuring  $^{45}\text{Ca}$  uptake by femur 24 hr after an oral dose of 0.8 M L-phenylalanine (3).

**Summary.** Tracer study showed that 25% dietary triolein caused better absorption of calcium than 25% tripalmitin, 80% as compared to 50%. Including 4% L-phenylalanine in the diet, however, did not influence calcium absorption significantly, regardless of the nature of triglyceride.

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