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increased body water and decreased body fat. On the other hand, Finlayson (4) after instilling lactose in calcium containing test solutions into segments of rat ileum concluded there was no lactose effect on intestinal calcium absorption but there was an effect on bone deposition.

In our in vivo intestinal perfusion study (1, 2), we used a proven technique I had applied to prior studies of intestinal calcium transport. This included an elucidation of the site of vitamin D action on intestinal mucosal calcium transport (5) and delineation of the effects of massive small bowel resection on intestinal calcium transport (6). It was our hope that with this technique we might shed light on the lactose effect of calcium transport. Our experiments failed to do this (2). However, a clue may have appeared since our experiments were performed. Armbrrecht and Wasserman (7) describe in an abstract where 160 mM lactose increased the initial rate of Ca²⁺ uptake in rat everted gut sacs but the magnitude of enhancement decreased rapidly if the lactose concentration was reduced. We used 10 mM lactose in our in vivo luminal perfusions. Was this below the threshold of significant enhancement of intestinal calcium transport? Before that explanation is too readily accepted, it is appropriate to recall that the lactose content of undiluted rat milk is 100 mM and that of cow's milk 150 mM (8, 9). What is a physiological lactose concentration in the rat intestinal lumen where content have been diluted by succus entericus? Certainly less than 160 mM, and in the rat probably considerably less than 100 mM. Perhaps it might be fruitful to repeat our experiments using luminal lactose concentrations greater than 10 mM.

The data obtained in the balance studies

conducted by Drs. Schaafsma and de Waard are clear enough. Yet the fundamental question remains: What is the mechanism at the intestinal mucosal cell whereby lactose could affect calcium transport? Neither Drs. Schaafsma and de Waard's balance study nor our in vivo perfusion study have provided this answer.

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Absolute versus relative availability of zinc

Dear Sir:

The recent article on zinc availability of foods using the extrinsic label technique provides useful information on the availability of zinc from foods (1). In their discussion of this technique, the authors compare their

data with data derived by other techniques (Table 1, first 3 columns). As can be seen, the data derived from the extrinsic labeling technique is significantly lower. Unfortunately, Evans and Johnson did not satisf

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TABLE 1
Availability of zinc

Foodstuff	% Zn absorbed			
	Evans and Johnson (1) ^a	O'Dell et al. (2) ^b	Momcilovic et al. (3) ^c	Evans and Johnson (1) ^d transformed
Raw corn flour ^e	51	56		98
Nonfat dry milk	41	79		79
Milk based infant formula	37		86	71
Soy protein based infant formula	26		67	50

^a Based on extrinsic label technique. ^b Based on growth. ^c Based on femur zinc. ^d Data transformed to relative availability based on nonfat dry milk at 79%. ^e Evans and Johnson (1) fed an endosperm flour while O'Dell et al. (2) implied they fed a whole corn flour.

torily explain why this was so. This can be explained by distinguishing between the absolute availability and the relative availability of zinc.

Both O'Dell et al. (2) and Momcilovic et al. (3) reported their data as a percent of a zinc standard which was given as 100%. This could be called relative availability. Methods using ⁶⁵Zn techniques to determine zinc availability directly could be called absolute availability. Since it is known that the availability of zinc compounds, such as zinc sulfate, is incomplete, absolute availability cannot be compared to relative availability without transforming the data to one form or the other. Welch et al. (4, 5) have reported zinc availability using intrinsic labeling but each time they have reported the availability of their ⁶⁵Zn standard so the reader can easily calculate the relative availability and compare it to other data. Regrettably, Evans and Johnson (1) did not include similar data.

Welch and coworkers have reported the absorption of ⁶⁵Zn as 84% (4) and 65% (5). Other investigators have reported values of 66% (6), 61 to 74% (7) and 44% or below (6-9) as the absorption or apparent absorption of ⁶⁵Zn using different procedures. Factors which have been identified that influence the absorption of zinc include age of the animal (10, 11), protein level of the diet (6), zinc level of the normal diet (6, 7, 8, 10) and calcium content of the diet (7, 8, 12). Because of these variables it is difficult to estimate the percent absorp-

tion of ⁶⁵Zn with any degree of accuracy, if it is not given. In future studies using either the intrinsic or extrinsic technique the absorption of the ⁶⁵Zn standard should be reported so relative availability can also be calculated.

A rough estimate of relative availability can be made by assuming that the relative availability of zinc from a given food is equal to a value already reported. The relative availability of zinc from other foods in the same study can then be calculated from this assumed value. The last column of Table 1 has made this transformation on the basis of the relative availability of zinc from nonfat dry milk as being the same as in the study of O'Dell et al. (2). The relative availability of the zinc from the infant formulas is now in a similar range to that reported by Momcilovic et al. (3), while the relative availability of zinc from the corn is very high when compared to the value given by O'Dell et al. (2).

The difference in relative availability of zinc from the corn could be explained on the basis of phytic acid and fiber content of the flour. The corn flour fed by Evans and Johnson (1) was an endosperm flour while that fed by O'Dell et al. (2) was implied to be whole corn flour. The whole corn flour would be significantly higher in both phytic acid and fiber than the endosperm flour and would thus be expected to have a lower zinc availability. The relative zinc availabilities show this difference.

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Reply to Franz

Dear Sir:

As Dr. Franz points out, we did compare our experimental values with those obtained by other investigators but we did not satisfactorily explain the discrepancies that were observed. Dr. Franz has outlined one possible explanation and we will herein offer an alternative explanation.

In spite of our original claim, the zinc availability values listed in Table 2 of our publication are not absolute availability values. In our initial experiments, we first estimated the quantity of zinc absorbed daily by a growing rat and then assumed that all of the available zinc in the test food would be absorbed as long as the quantity fed was less than the estimated daily absorption. Although we believe this is a valid assumption, we overlooked the fact that zinc-repleted animals secrete zinc into the small intestine, thus introducing an endogenous zinc pool with which the exogenous zinc pool will mix. The zinc nutriture of the test animals has a marked influence on the quantity of zinc in this endogenous pool. Since our test animals were fed a zinc adequate diet, the zinc label mixed with both

exogenous and endogenous zinc and as a result we probably obtained falsely low bioavailability values.

We do not agree entirely with Dr. Franz's comments regarding the relative nature of the values obtained by O'Dell et al. and Momcilovic et al. In our opinion, the experimental design used by these investigators gives a very close approximation of the absolute availability of zinc in the test foods. Therefore, if we had originally obtained absolute availability values we could have compared results accurately.

The fact that we used zinc adequate animals in our experiments does not invalidate the results obtained with regard to extrinsic and intrinsic labeling of foods. However, in future experiments test foods labeled with extrinsic ^{65}Zn will be fed to zinc-depleted rats to obtain a more accurate estimation of absolute availability.

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Dear Sir:

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