ACUTE EFFECTS OF FOOD AND ETHANOL ON PLASMA ZINC CONCENTRATION

B. Richards[1], D.M. Flint[1], and M.L. Wahlqvist[1].

[1] Section of Human Nutrition, Deakin University, Geelong, Victoria, Australia, 3217.

ABSTRACT

The effect of food intake and 35g ethanol on plasma zinc concentration (C_{Zn}) was assessed in six healthy subjects. In the fasting state no significant differences were found in C_{Zn} between observations at 0900, 1100 and 1500 hours. After breakfast and lunch, plasma zinc fell to 79% of the 0900 value by 1500 hours. Ethanol alone produced no change in C_{Zn}, but it prevented the fall in C_{Zn} induced by food.

INTRODUCTION

It is generally thought that the effect of food on plasma zinc concentration depends on the zinc content of the food ingested (1). However it has been suggested that a carbohydrate load causes a fall in plasma zinc which may be due to movement of zinc into cells (2,3).

Alcoholics have been shown to have low plasma zinc concentrations (4), which might be related to liver disease (5) or to zincuria (6). The immediate effects of alcohol ingestion on plasma zinc concentration are not well documented. The acute intake of alcohol does not apparently cause hyperzincuria (6,7). Dreosti, however, demonstrated that, in rats, a short exposure to alcohol disturbed the distribution of zinc within the body (8). The combined effects of food and alcohol have not been reported.

In this study we have examined the effect of food and of ethanol ingestion on plasma zinc concentration (C_{Zn}).

METHODS

Subjects were healthy adult volunteers, three males and three females, whose ages ranged from 21 to 36 years. All were within 10% of desirable body weight (9). Each subject was studied after an overnight fast, but all had free access to distilled deionized water. Observations were made at 0900, 1100 and 1500 hours in four different circumstances:

(1) With continuation of fast.

(2) With 35g ethanol in distilled water drunk at 0900 hours.

(3) With breakfast and lunch from 0900 to 0905 and from 1230 to 1245 hours respectively: breakfast consisted of a buttered yeast bun and coffee with milk and lunch of a bread roll with salad and coffee. Breakfast was estimated to contain less than 1 mg of zinc and lunch about 1 mg zinc (10).

(4) With meals at 0900 and 1230 hours and 35g ethanol in distilled water at 0900 hours.

All glassware, syringes and disposable tubes used were free from zinc contamination. Blanks were run throughout. C_{Zn} were measured on a Varian Technicon AA6 Atomic Absorption Spectrophotometer, using a modification of the method of Meret and Henkin (11).

Serum albumin concentrations were measured on a Centrifichem Autoanalyser using the bromocresol green method.

Statistical analyses were made using the Student's t test for paired comparisons.

RESULTS

1. Fasting

There was no significant difference between C_{Zn} at 1100 or 1500 hours and that at 0900 hours. In Figure 1 these results are expressed as a percentage of the 0900 hours value (0.89 ± 0.02 µg/ml).

2. Ethanol Ingestion

There was no significant difference in C_{Zn} during the day when ethanol alone was ingested (Figure 1).

3. Food Ingestion

There was a significant fall in C_{Zn} from 0900 to 1100 hours when it was 92% of the 0900 value ($p < 0.01$), and this fall continued to 79% of the 0900 value at 1500 hours. The 1500 hours value was significantly different from the 1100 hours ($p < 0.05$) and the 0900 hours ($p < 0.01$) values (Figure 1).

4. Ethanol and Food Ingestion

There was a significant fall in C_{Zn} from 0900 hours, to 92% of baseline at 1100 hours ($p < 0.02$), but there was no further fall from 1100 to 1500 hours (Figure 1). C_{Zn} at 1500 hours was significantly greater when ethanol was ingested with food than when it was not ($p < 0.02$).

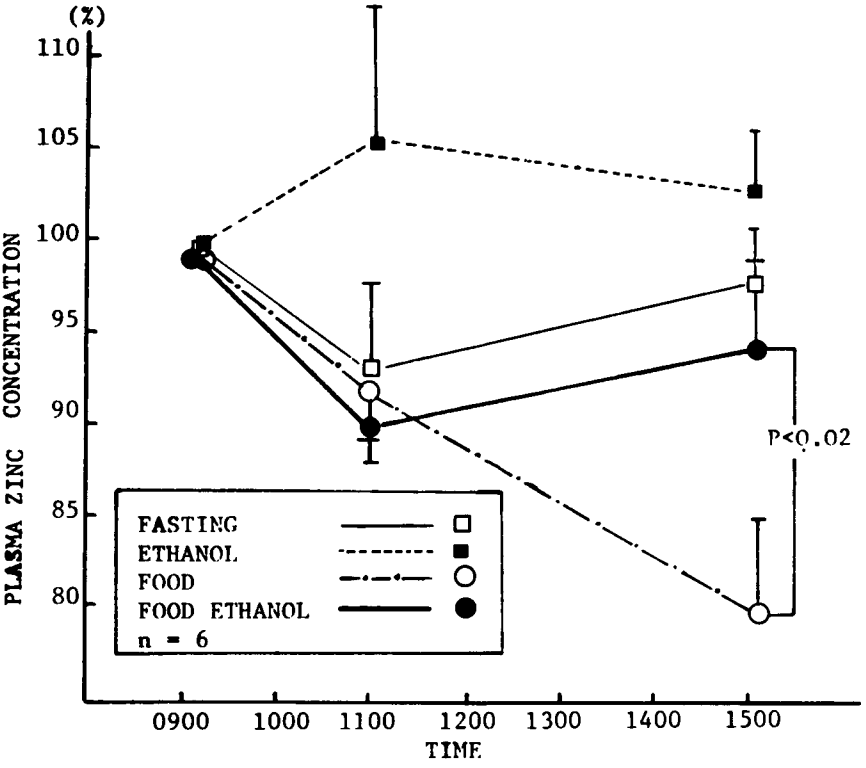

FIGURE 1: THE EFFECT OF FASTING, ETHANOL, FOOD, FOOD AND ETHANOL ON PLASMA ZINC CONCENTRATION

5. Serum Albumin Concentrations

Serum albumin concentrations did not change during the day in the fasting state or when ethanol was ingested. (Table 1)

TABLE 1

Serum Albumin Concentrations in the Fasting State and when ethanol was ingested (n=6) (Mean ± S.E.)

	g/l 0 900 hours	g/l 1100 hours	g/l 1500 hours
Fasting	42.8 ± 1.0	42.0 ± 0.8	42.1 ± 0.7
Ethanol	42.2 ± 0.9	42.4 ± 1.0	41.8 ± 0.8
Ethanol and food	42.6 ± 1.5	42.4 ± 0.9	42.4 ± 0.8

DISCUSSION

No diural variation in C_{Zn} was found in this study.

The fall in plasma zinc with the ingestion of food confirms previous reports (2,3). However, others have suggested that any fall induced by food would be offset by the absorption of zinc from food (1-3). In this present study, food eaten was not rich in zinc. The fall in plasma zinc concentration observed may have been due to the movement of zinc from the extracellular to the intracellular compartment, or zinc excretion may have been promoted in the faeces or urine. Plasma insulin would have increased after meals in this investigation and may have promoted the uptake of zinc by tissues, but this requires further investigation.

Ethanol ingestion changes the effect of food on C_{Zn}. This effect of ethanol could not be accounted for by plasma water shifts as judged by serum albumin concentrations which remained unchanged. Also, ethanol alone did not affect C_{Zn}. It seems likely that ethanol has inhibited the movement of zinc from the extracellular to the intracellular space in the post-prandial state. This has implications for the body's ability to retain zinc when alcohol is ingested with food. However, the possibility that ethanol has led to the retention of zinc which otherwise would have been excreted cannot be ruled out.

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