

ZINC, IRON AND ELECTROLYTE CONCENTRATIONS IN
SWEATS SECRETED BY THERMAL STIMULATION AND
BY PHYSICAL EXERCISE ***

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Zinc is an important essential element. The role of this element in human beings has been well established. It is necessary to take required amount from the daily diet. However, we also have recognized¹ that remarkable amount of zinc is excreted through the skin, which often exceeds daily urinary excretion. The present study was undertaken to investigate whether any difference of zinc concentration was found in the sweats between perspired by thermal stimulation and secreted by physical exercise.

Experimental procedure

The subject was a female long distance runner (24 years old, with height of 150 cm. and weight 39kg). Sweat was collected in the polyethylene arm bags after the arm, hand and nail had been cleansed by detergent and rinsed by extra pure water thoroughly. The sweat was collected in two different conditions. One was in the artificially conditioned hot room where the subject rested in a chair and the other was the collection while running in the outside under moderate temperature. The experiment was carried out for three days. The first and the third days were assigned for the collection of thermal sweat and the second day was for the collection of the sweat with physical exercise. The subject ran on her own pace, which was about 8 km/hr, for 2½ hours. The sweat was collected for the first 30 minutes and following every 60 minutes in running. It was

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filtered through the 0.1 μ pore sized "Tefron" membrane filter. Epidermal cells were removed. Zinc and other elements in the filtrate (cell free sweat) were analysed by atomic absorption spectrometry.

Results

The results are shown in Table 1. Zinc, which is found in the cell free sweat obtained in exercise, ranged between 860-490 $\mu\text{g/liter}$, being decreased as the time proceeds. This value was greater than those of 380-190 $\mu\text{g/liter}$ and 320-170 $\mu\text{g/liter}$ of the first and the third days, which were induced by thermal stimulation.

TABLE 1
ZINC AND OTHER ELEMENTS (Fe, Na, and K)
FOUND IN THE SWEAT INDUCED BY THERMAL
STIMULATION AND BY PHYSICAL EXERCISE

Exptl. day	Time elapsed (minutes)	Sweat rate (g/hr.)	Zn (μg / liter)	Fe (μg / liter)	Na (g / liter)	K (g / liter)
1	51	505	380	22	1.1	0.17
	25		190		1.4	0.14
2	30	212	860	31	0.49	0.19
	60		530		0.51	0.16
	60		490		0.36	0.15
3	40	530	320	17	0.71	0.15
	12		170		1.1	0.13

Mean value of iron in running was 31 $\mu\text{g/liter}$. The values in the thermal perspiration on the first and the third days were 22 and 17 $\mu\text{g/liter}$ respectively.

Mean sodium concentration on the second day was 0.45 g/liter which was lower than that of 1.3 g/liter and 0.9 g/liter on the first and the third days. This may be due to the lowered sweat rate, but probably is caused by the exercise.

The potassium concentrations did not show marked change through three experimental days and the value was around 0.16 g/liter.

Discussion

The sweat zinc concentration cited in this paper, in the thermal perspiration, was lower than that of our previous study¹ and other report². It may be caused by the decreased zinc retention of this subject. The serum zinc concentration was 85 $\mu\text{g}/\text{dl}$ which is lower than the normal value. It is probable that the physical perspiration will cause progressed dermal zinc excretion, and will lower the sweat zinc concentration. Same effect was also observed in our former studies. It seems that it is necessary to take a satisfactory amount of dietary zinc for hard and long physical exercise.

REFERENCES

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2. Prasad, A.S. (1963): Zinc, iron and nitrogen content of sweat in normal and deficient subjects, *J. Lab. & Clin. Med.*, 62, 84.