Zeitschrift für
Ernährungswissenschaft Z. Ernährungswiss. 22, 1–5 (1983)

ORIGINALARBEITEN

Zinc status of Libyan children – a pilot study

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Summary

Hair zinc has been investigated in children of North and South Libya. The hair zinc content amounts to 213 ± 36 μg/g in newborns. There is no difference between the values of newborns from North Libya and newborns from South Libya. The hair zinc values decrease during infancy. In toddlers and school-children the hair zinc content is 88 ± 35 μg/g, 89 ± 25 μg/g resp. These values are as low as those reported in American children with low height percentiles or nearly as low as those found in dwarfs with poor zinc status from Egypt and Iran.

Zusammenfassung

Der Haarzinkgehalt wurde in Haaren von Kindern aus Nord- und Südlibyen bestimmt. Der Zinkgehalt betrug 213 ± 36 μg/g bei libyschen Neugeborenen. Es bestand kein Unterschied zwischen den Werten von Neugeborenen aus Nord- und Südlibyen. Der Zinkgehalt fällt während der Säuglingszeit ab. Bei Klein- und Schulkindern lag der Zinkgehalt bei 88 ± 35 μg/g bzw. 89 ± 25 μg/g. Diese Werte sind so niedrig wie die bei amerikanischen kleinwüchsigen Kindern oder fast so niedrig wie bei den ägyptischen und persischen Zwergen mit vermindertem Zinkstatus.

Key words: zinc, hair, malnutrition, Libya

Introduction

The estimation of the trace element content in hair may provide useful informations on long-term nutrition. Dietary deficiencies can reduce the zinc content of hair (8, 9), therefore the zinc content of hair has been used as an indicator of a long-term insufficient zinc supply. A low zinc status can occur in children and adolescents. Zinc requirements depend on growth, dietary habits, and health state.

In 1972, a correlation between a low zinc content in hair, anorexia and a reduced growth was stated for children (8). Zinc deficiency was found in adolescents with retarded growth in rural areas of Egypt and Iran. The hair zinc content of these adolescents was reduced to 30–75 µg/g hair (19). Similar findings have been reported from other countries, including Turkey, Marocco, and Portugal (7).

No data exist whether zinc depletion may occur in Libya. Climate is similar to Egypt, but nutrition and rate or kind of infections differ. The purpose of the present investigation was to estimate the zinc status of Libyan children by analysis of hair.

Methods

41 hair samples were taken from infants and children in North Libya (Tripoli and environments). The children were seen in an outpatient clinic because of acute diseases. Those with chronic diseases were excluded from the study. The study includes 11 newborns, 10 infants, 6 to 10 months old, 10 pre-school children and 10 school-children. In addition, hair samples of 29 infants were taken in Sebha, an oasis in South Libya, from 11 newborns, 8 infants, 2 to 4 months old, and 10 infants, 6 to 10 months old. These infants stayed in the hospital because of maternal diseases. Most of the infants, as well in North as in South Libya, were exclusively breast-fed (n = 23), some received human milk plus cow's milk formula (n = 5), the rest received different commercially available cow's milk formula. The food of the other children was a mixed one, containing cereals, meat products, vegetables, and fruit. Water was usually taken from local wells. Infections very rarely comprise hookworm or schistosomiasis, but ascaridiasis or infestations with taenia solium were common.

Hair samples, about 150 mm in length, weighing approximately 100 mg, were cut close to the scalp at the back of the head, and prepared (11) for instrumental neutron activation analysis (13).

Results

The hair zinc content of 22 newborns amounted to 213 ± 36 µg/g. There was no significant difference between the hair zinc content of newborns in North Libya (n = 11, 202 ± 41 µg/g) and newborns in Sebha (n = 11, 223 ± 26 µg/g).

Infants from Sebha, between 2 and 4 months old, exhibited slightly lower values (n = 8, 178 ± 63 µg/g, range 130–399). The hair zinc content of older infants from North and South Libya amounted to approximately 53 % of the newborn values (n = 20, 110 ± 52 µg zinc/g). There was a broad range from 38 to 252 µg/g. Again there was no significant difference between the values from North and South Libya.

In toddlers from North Libya (n = 10, 88 ± 35 µg/g) and school-children from North Libya (n = 10, 89 ± 25 µg/g), the hair zinc contents were even lower (fig. 1). Four out of ten toddlers and two out of ten school-children exhibited hair zinc contents of less than 70 µg/g. The hair zinc content in another three school-children was between 70 and 80 µg/g.

Discussion

There is no currently available laboratory assay that gives an entirely satisfactory index of the zinc nutritional status. However, zinc hair levels are frequently depressed as a result of marginal zinc nutrition. Assuming a

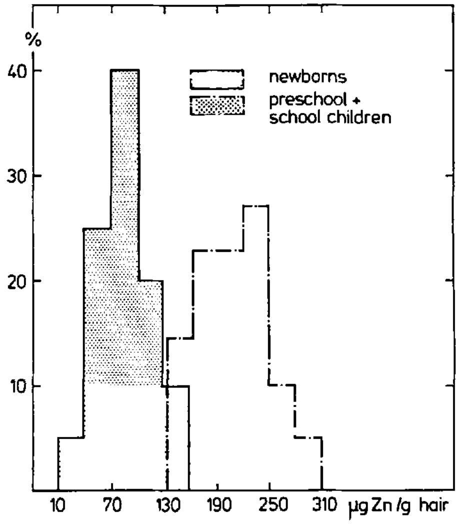

Fig. 1. The zinc content of hair in newborns and pre-school and school-children from Libya. The distribution pattern of the percentage of samples with different zinc contents.

normal rate of hair growth, the zinc level of the first centimeters close to the scalp reflects zinc status during the last months. For adults, a normal value is suggested if the zinc content is >105 µg Zn/g of hair, a low hair zinc level to be < 70 µg Zn/g (4).

The hair zinc content of Libyan newborns is in the same range as reported from American newborns (2) and fits to the mean or median values reported for healthy adults in different parts of the world (136–288 µg Zn/g of hair) (1, 2, 5, 15, 17, 18). The values of Libyan infants of 6–10 months amounted only to about half of the values of newborns. During infancy, a rapid decline of hair zinc contents also has been observed by Hambidge et al. (8) in Colorado (U.S.A.), while Strain et al. (20), also in the U.S.A., showed only a moderate decline from 138 µg Zn/g hair at birth to 102 µg Zn/g hair at 12 months of age in Ohio.

6-month-old infants fed infant milk formula with a low zinc content had a hair zinc content of only 56 ± 10 µg/g (21). In Libya the lowest hair zinc contents were found in pre-school children with 88 ± 35 µg/g. These values are much lower than in healthy American children, 3–4 years old (130 ± 8.3 µg/g) (9). The values correspond to those measured in American pre-school children with low height percentiles 87 ± 5.9 µg/g (9) in which a causal relation of a low zinc status and poor growth had been postulated.

Low hair zinc values had not only been found in Libyan pre-school but also in school-children. These values are lower than those reported from England, Iran, and Panama (3, 10, 14, 16). Only girls from Thailand (6) had similar low hair zinc values. One third of the Libyan pre-school and school-children exhibited hair zinc values below 70 µg/g. These values are nearly as low as those reported in Egyptian dwarfs with poor zinc status (19).

The low hair zinc values can be caused by a reduced zinc intake, a decreased zinc availability or an increased zinc loss. There are no data available on the daily zinc intake in Libyan children. Malnutrition is not common nowadays. It cannot be excluded that zinc losses by sweat in the hot climate may contribute to the low zinc status of Libyan children. Blood losses caused by hookworm infections are not as common in Libya as in Egypt. As a result of this pilot study, one should extend this study to investigate the zinc content of the food, the zinc content in blood, and the growth rate of those children with a low zinc status.

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(Received August 11, 1982)

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