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Assessing Serum Concentration of Zinc among Females Aged 18-30 Under Cover of a Relief Foundation in Iran

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A B S T R A C T

Background: Nowadays, zinc deficiency is common among low and high-economic level people. Predisposing factors other than economic ones should be considered. Current study investigated the serum concentration of zinc and its correlation with different parameters among disadvantaged female population under cover of a relief foundation in Iran.

Methods: In an analytical cross-sectional study, 1026 females aged 18-30, from all around of Iran were enrolled. Demographic and anthropometric data were registered and venous blood samples were collected. Serum zinc levels were compared in different groups of participants based on age, body mass index, education level and geographic region of their residence. Correlation between serum zinc and iron was investigated as well.

Results: Mean serum zinc was 78.3±13.7 µg/dL. Significant difference was detected between mean serum zinc among different BMI groups (ANOVA, p=0.03), while it was not significant in different education levels and age intervals (ANOVA, p=0.61 and 0.95 respectively). Participants from two western provinces of Iran (Khoozestan and Lorestan) had significantly higher zinc level. There was a positive relationship between serum iron and zinc (Pearson correlation coefficient, r=0.1, p=0.001).

Conclusion: Findings reveal the important role of socioeconomic and geographic situations and their effect on nutritional status in populations. Other researches focusing on food accessibility, eating behaviors, knowledge level and other reasons that expose poor populations to insufficient nutritional intake are recommended.

Introduction

Zinc (Zn) is a necessary trace element for cell generation, growth activation and preventing infections as well as a strong supporter of the immune system [1-3]. Zinc containing enzymatic system is used for regulation of growth and development, maturation of sexual glands, promoting fertility and synthesis of nucleic acids [4,5]. Main sources of zinc are oysters (which are not common in Iranian diet), red meat and poultry. Other good food sources include beans, nuts, certain types of seafood (such as crab and lobster), whole grains, and dairy products.

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Zinc deficiency seems to be common in developing countries such as Iran, especially in low-income families [5-8]. The reason refers to low dietary intake of rich and bioavailable sources of zinc (such as animal meat), mainly related to high expenses of those foods, besides a high consumption of legumes and cereals resulting in inhibition of zinc absorption [9,10].

Socioeconomically disadvantaged people are more susceptible to consume a nutritionally inadequate diet. Economically disadvantaged people under cover of relief foundations are an example of nutritionally in-need population. Deprivation of a sufficient healthy diet and health care services due to low socioeconomic situation, together with inadequate knowledge and concern makes them highly liable to a decreased health condition. Therefore, deprived people need different and additional health care concern compared to general population. Moreover, to look cost-effectively, health condition of poor people affectively determines the health indices of a society.

Obviously, zinc deficiency is common among low-economic level population. But the aim of this study is not proving this fact, whereas we tried to find the external economic, social and demographic factors affecting this fact. Because nowadays, zinc deficiency is common among high-economic level people as well, we believe that finding the predisposing factors -other that economic situation- are considerable.

In our country, relief foundations are specifically responsible for satisfying the necessary requirements of socioeconomically disadvantaged people. Current study conducted to evaluate the serum levels of zinc among young females advocated by 'Imam Khomeini Relief Foundation' (IKRF) in Iran.

The main purpose was to provide a better insight into the micronutrient intake and health-related needs of this population in order to more precisely design and program complementary health services for them.

Subjects and methods

Study population

In an analytical cross-sectional study, single young females aged 18-30 years old, from all around of Iran (about 33 from each province) under cover of IKRF were enrolled by non-random, purposeful sampling during six months in year 2011. Sample size was calculated 600, based on previous population studies and considering 95% confidence interval.

Exclusion criteria were the presence of recognized hemolytic anemia, main organ disorders such as cardiovascular, gastrointestinal, renal, and hepatic diseases as well as cancerous state, in addition to personal dissatisfaction of getting involved in the study after the explanation session.

Based on a defined program, 16 camps were organized in Samenolaemeh camp center in Mashhad city during six months. Each camp was programmed for five days and 66 females from two provinces of Iran were participated.

In the first day of camping, participants were invited to an explanation session; informed consent was obtained from all participants and a special questionnaire containing demographic information and familial and medical history were filled. Anthropometric measurements were done for each person using a calibrated digital balance and a meter with an accuracy of 0.1 kilogram and 0.5 centimeter respectively. Body mass index (BMI) was calculated through weight (kg)/height^2 (m). In early morning of second day, fasting blood samples were collected from antecubital vein and then assessed using colorimetric assay for serum iron (Ferene method, ParsAzmun, Karaj, Iran) and zinc (Randox, United Kingdom). All steps of study were performed under supervision of a physician.

Ethical considerations

The study aims and methods were described to the participant and the signed informed consent forms were obtained from them prior to participation. Moreover, the study protocol was approved by the Ethics Committee of Mashhad Medical University Chancellor for Research and IKRF (no. 1162).

Statistical analysis

Statistical analyses were performed by use of the Statistical Package for Social Sciences (SPSS, version 11.5) and interpreted as mean ± standard deviation (SD). One-way ANOVA was used for comparison between the mean values of serum zinc in different groups of age, BMI, education level, and province of their residense. The correlation between serum zinc and iron was investigated by Pearson correlation coefficient. *P-value* of less than 0.05 was considered as significant level.

Results

After completion of the related questionnaires, 1026 young females with an

Table 1. Demographic characteristics and serum zinc concentration of the participants

Variable	No.	Mean serum zinc level (µg/dL)	Median serum iron level (µg/dL)
Overall	1026	78.3±13.7	76.29
Age (years)			
18-24	521	78.5±13.2	73.1
25-30	505	78.1±14.2	72.2
Education (years)			
0	15	80.1±19.6	70.13
1-6	235	78.2±14	78.7
6-12	363	78.2±13.8	76.1
≥12 years	413	78.4±13.8	75.2
BMI (kg/m2)			
<20	17	69.7±14.8	59.5
20-24.9	217	77.5±13.9	71.5
25-29.9	643	78.5±13.9	77.9
≥30	149	79.7±12	77.8

Table 2. The mean serum zinc concentration in current study and other previous investigations

Serum zinc	Age/sex of studied population	Country
103.6±18 (µg/dL)	19-82/male and female	Iran (2011)[6]
104.6±18 (µg/dL)	18.87±1.31/female	Iran (2008)[11]
8.9-29.9 (µmol/L)*	20-94/male and female	Iran (2012)[12]
78.3±13.7 (µg/dL)	18-32/female	Iran (current study)
97.2 (µg/dL)	18-65/male and female	Spain (2000)[13]
15.5±3.4 (µmol/L)Δ	15-80/female	Kuwait (2003)[14]
8.5±2.4 (µmol/L)□	13-35/female	Nepal (2009)[15]
109.6 (µg/dL)	20-30/female	Pakistan (2013)[16]

*equal to 57.8-194.3 µg/dL
Δequal to 100.7±22.1 µg/dL
□equal to 55.2±15.6 µg/dL

average age of 25.6±2.9 years (ranged 18-30) were enrolled in the study. Demographic characteristics of participants and the serum zinc concentration based on each category of age, educational level, and BMI are presented in Table-1.

Mean serum concentration of zinc among 1026 participants was 78.3±13.7 µg/dl. The comparison between current findings and previous published studies in Iran and other countries relating to serum zinc concentration is indicated in Table-2.

Age: Statistical analysis indicated an insignificant difference in mean serum zinc between age intervals (One-way ANOVA, p=0.61)

BMI: Higher BMI was associated with higher serum zinc concentrations and the difference between mean serum zinc in different BMI groups was significant (One-way ANOVA, p=0.03).

Education: There was no significant difference in mean serum zinc between participants of different education level (One-way ANOVA, p=0.95).

Province: Analysis of variance revealed a significant difference in mean serum zinc among participants of different provinces (p=0.01). Participants from Lorestan (western province) had the highest mean levels of zinc (96.3±13.7 µg/dl), while individuals from Sistan va Baluchestan (south-eastern province) had the lowest serum zinc concentrations (69.5±9.7 µg/dl). Serum zinc levels of participants from Khoozestan and Lorestan which are located in the west of Iran were significantly higher than about half of Iran provinces.

There was a positive relationship between serum levels of iron and zinc among participants (Pearson correlation coefficient, r=0.1, p=0.001).

Discussion

Current study indicated that serum zinc level is low among young females supported by Imam Khomeini Relief Foundation. No significant correlation was found between serum zinc concentration and age groups and education, whereas BMI and the province of residence indicated significant correlations. Our findings are in accordance with the study of Argani et al. They revealed that zinc supplementation improves serum zinc among males and females and BMI among male subjects [17]. Furthermore, analysis revealed a positive

correlation between the mean serum values of zinc and iron in studied individuals which is in accordance with the results of Sarwar et al. study. [18].

Based on categorization of zinc deficiency in previous literature [19, 20], mild to moderate zinc deficiency (50-85 μg/dl) was detected in 728 participants (71%), while 10 individuals (1%) suffered from severe zinc deficiency (<50 μg/dl). In a descriptive study conducted by Haghollahi et al, 5.8% and 1.4% of females aged 18.8±1.3 years had respectively mild to moderate and severe zinc deficiency [11]. Researches in Pakistan indicated that 67 out of 353 (19%) females aged 15-45 years, had mild to moderate zinc deficiency [16], while that was reported 55.7% in Iraq [20] and 41.5% in India [21]. Comparison between serum zinc levels in population currently studied and other similar populations in age and sex, reveal the important role of socioeconomic situation and its effect on nutritional status in populations.

In fact, suboptimal micronutrients such as zinc and iron usually occur when homeostasis is disturbed due to increased physiological requirements, abnormal losses, or insufficient dietary intake [22]. Daily food patterns, eating preferences, and limited access to rich sources of readily available zinc (especially in low-income populations) together with more grain and legume consumption which reduces zinc absorption, may also play a role in developing the inadequacy of zinc and other micronutrients. Recent researches even in developed countries have indicated a decreased intake of zinc, selenium, and vitamin B_{12} in young females, probably because of meat and poultry avoidance and increased trends in unrefined cereals, nuts, and legumes [23].

Provinces in Iran are not only different in climate, altitude, agricultural soil and animal cover, but also contain variety of customs and eating behaviors. Khoozestan and Lorestan which are two neighbor provinces located in west of Iran revealed a higher level of serum zinc with significantly higher means. This finding suggests that there might be an exclusive eating behavior and customs or particular traditional foods, which results in more intake and better absorption of zinc or maybe a different type of soil or vegetation causing higher serum zinc concentration in people of that geographic region.

Statistical analysis revealed a significant positive correlation between serum zinc and iron levels which replicates the results of several previous studies [24, 25]. This suggests that food sources of zinc and iron are common and serum deficiency of these two trace elements might occur simultaneously. Therefore, in serum deficiency of each iron or zinc, the deficiency of the other should be considered.

The main limitation of current study is lack of dietary intake data of participants. Collecting such data is highly suggested in future researches which focus on the relationship between serum elements and external variables.

Conclusion

Comparison between serum zinc levels in population studied and other similar populations in age and sex, reveal the important role of socioeconomic and geographic situation and their effect on nutritional status in populations. Other researches focusing on food accessibility, eating behaviors, knowledge level and other predisposing reasons that expose the disadvantaged populations to insufficient nutritional intake, accompanied with complementary micronutrient evaluations are recommended.

Conflict of interest

The authors declare that they have no competing interests.

Financial Resource

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Ethical Standards Disclosure

This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving human subjects/patients were approved by the Ethics Committee of Mashhad Medical University Chancellor for Research. Written informed consent was obtained from all subjects.

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