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IS THERE A RELATION BETWEEN ZINC LEVELS, AND RECURRENT RESPIRATORY SYSTEM INFECTIONS IN CHILDREN?
ÇOCUKLARDA ÇİNKO DÜZEYLERİ İLE TEKRAR EDEN SOLUNUM YOLU ENFEKSİYONU ARASINDA İLİŞKİ VAR MIDIR?

Özlem Naciye ŞAHİN[1], Nuray KEÇECİOĞLU[2], Muhittin SERDAR[3], Aysel ÖZPINAR[3]

[1]Acıbadem Üniversitesi Tıp Fakültesi Çocuk Sağlığı ve Hastalıkları ABD, İstanbul

[2]Acıbadem Eskişehir Hastanesi, Eskişehir

[3]Acıbadem Üniversitesi Tıp Fakültesi Klinik Biyokimya ABD İstanbul

ABSTRACT

Objective: There are many consequences connected with an inadequate intake of trace elements and Vitamin D. Allergic disorders and a susceptibility to respiratory infections may be related to deficiencies of trace elements and/or vitamin D. This cross-sectional study aims to investigate associations between recurrent respiratory system infections and Zinc levels; as well as other dependent factors.

Methods: Three hundred and seventy one children living in Turkey were enrolled in the study between 2015 and 2017. Two hundred and forty nine had a history of either recurrent upper respiratory infections such as, acute otitis media, pharyngitis, rhinitis, or lower respiratory tract infections. 122 were considered as healthy controls. Age, gender, existence of adenoid hypertrophy, upper and lower respiratory tract infections, zinc levels, vitamin D levels, IgE levels, and a skin prick test were all evaluated.

Results: A total of 371 children (mean age ± standard deviation = 47±31 months), 180 males and 191 females were included. No significant difference between the zinc levels of children with recurrent upper (mean ± standard deviation = 0,88±0,28) respiratory tract infections and lower respiratory tract (mean ±standard deviation= 0,88±0,35) infections was observed. Likewise, there was no significant difference between IgE levels of children with recurrent respiratory tract infections and healthy controls (p=0,4). Vitamin D levels, however, were found to be significantly lower in children with lower and upper respiratory tract infections (p=0,001).

Conclusion: There was no significant difference in zinc levels between healthy controls and children with recurrent respiratory tract infections. However, if there is a documented low zinc deficiency, children with recurrent respiratory tract infections may be recommended a zinc supplementation protocol. Additionally, these children should also be monitored for adenoid hypertrophy; an independent risk factor for recurrent respiratory tract infections.

Keywords: Zinc, Respiratory, Child

ÖZ

Amaç: Eser elementlerin ve D vitaminin eksik alımı ve allerji çocuk solunum sistemi sağlığı üzerine etkileri bulunmaktadır. Kesitsel çalışmamızda tekrar eden solunum yolun yolu enfeksiyonu ile çinko düzeyleri ve neden olabilecek diğer faktörlerin ilişkisini araştırmak amaçlanmaktadır.

Metod: 2015-2017 tekrar eden akut otitis media, farenjit, rinit gibi üst solunum yolu enfeksiyonu ve alt solunum yolu enfeksiyonu olan, Türkiye'de yaşayan 249 olgu ve 122 sağlıklı kontrol çalışmaya dahil edilmiştir. Çinko düzeyleri, adenoid hipertrofi varlığı allerji deri testi, yaş, cinsiyet, tekrar eden alt veya üst solunum yolu enfeksiyonu öyküsü değerlendirilmiştir.

Sonuçlar: 180 kız, 191 erkek olmak üzere 371 olgu (ortalama ± SD, 47±31 ay), çalışmaya dahil edilmiştir. Tekrar eden üst ve alt solunum yolu enfeksiyonu ile çinko düzeyleri (ortalama ± SD, 0,88±0,28), (ortalama ± SD, 0,88±0,35), arasında anlamlı ilişki saptanmamıştır. Tekrar eden solunum yolu enfeksiyonu olan olgular ile sağlıklı grup arasında, IgE düzeyleri açısından anlamlı istatistiksel fark bulunmamıştır (p=0,4). D vitamini düzeyleri tekrar eden alt ve üst solunum yolu enfeksiyonu olan grupta anlamlı olarak düşük bulunmuştur(p=0,001).

Sonuç: Sağlıklı kontroller ile tekrar eden solunum yolu enfeksiyonu olan olgular arasında çinko düzeyleri açısından anlamlı fark saptanmamıştır. Tekrar eden solunum yolu enfeksiyonunda çinko suplementasyonu ancak eksikliği saptanmış olgulara önerilebilir, ve bu olgular tekrar eden solunum yolu enfeksiyonunda bağımsız risk faktörü olan adenoid hipertrofi varlığı açısından değerlendirilmelidir.

Anahtar kelimeler: Çinko, solunum, çocuk

Corresponding Author: Özlem Naciye ŞAHİN, Acıbadem Üniversitesi tıp Fakültesi Çocuk Sağlığı ve Hastalıkları ABD, İstanbul

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INTRODUCTION

On admission respiratory system symptoms are very common in children referred to peditarics department and is one of the main causes of mortality and morbidity (1). There have been studies indicating a relationship with low intake of dietary antioxidants (zinc, selenium, vitamin E and carotenoids) and allergic disorders (2). Zinc is an essential micronutrient for the function of more than 100 enzymes in humans (3). Zinc is not stored in human body and daily intake is essential. Red meat, dairy, sea food, nuts and cereal are the main sources of zinc (4). This antioxidant element also plays a role in modulating immune system while its effect on airway inflammation remains unclear (5-7). The relationship between vitamin D levels and , low intake of trace elements and asthma were evaluated in several studies. (8). Trace elements affects immune sytem through their antiinflammatory and antioxidant features. Low intake of trace elements causes increased oxidative tissue damage which may make the host immune system vulnerable to reactive oxygen radicals. Zinc, by its immunemodulator effects may affect the respiratory system infections severity (9).

In this study we aim to investigate if zinc levels, allergy status and vitamin D levels have any association with recurrent respiratory system infections.

MATERIAL AND METHODS

Study population

In this cross-sectional study 249children under follow up at Acıbadem Bodrum Hospital for recurrent respiratory tract infections who had been evaluated for 25(OH)vitaminD, IgE level and zinc levels in their past records and as control group,122 healthy children were includedin the study between 2015 and 2017. Children using allergic symptoms had previously been evaluated with skin prick tests (Alyostal ST-IR, Stallergenes S.A France) for 60 common allergens which were, *Alternaria Alternata,* Aspergillus mix *(Aspergillus Fumigatus, A. Nidulans, A. Niger), Cladosporium cladosporoides, C. Herbarum, , Rhizopus Nigricans, Mucor racemosus, Penicillium Mix (Penicillium Digitatum, P.Expansum, P. Notatum), P.Purpurogenum, P.Crustosum, P.Spinulosum, P. Corylophilum D. pteronyssinus, D.Pharinae, storage mites (Acarus siro, Glyciphagus domesticus, Lepidoglyphus destructor, Weed Mixture, Zea Mays, Festuca eliator, Tyrophagus putrescentiae, Paspalum Notatum, Hordoleum Vulgare, Agrostis Vulgaris, Cynodon dactylon, Poa pratensis, Avena Sativa, Secale Cereale, Lolium Perenne, Anthoxantum Odoratum, Phleum Pratense, Triticum Vulgare, Holcus Lanatus,4 cereals(oat, wheat, barley,maize), Sambucus nigra, Artemisia Vulgaris, Urtica Doica, Juniperus Ashesi, 5 Grasses, Olea europea, Chrysanthemium Leucanthemum, Lantanago, Ambrosia Eliator, Salsola Cali, Taraxatum Vulgare, Chenopodium Album, Rumex Acetosa, Parietaria Officinalis, Rough Pigweed, Golden Rod, Almus Glutinosa, Fraxinus Excelsior, Fagus Sylvatica, Betula Alba, Castena Vulgaris, Ulmus Campestris.* For the statistical analysis Statistical Package for the Social Sciences (SPSS) Version 18.0(SPSS, Inc., Chicago,IL, USA) was used. Shapiro-Wilk test was applied to determine data normality The one-way ANOVA for vitamin D level, zinc level and Kruskal Wallis test for IgE level was used. Tukey and Dunn's test were used for post-hoc analysis. Correlations among clinical variables and biomarker levels were analyzed by Pearson correlation test. A statistical significance was considered to be reached at p-value <0.05. This study was approved by Muğla Sıtkı Koçman University Ethics Committee (37-20.3.2018)

RESULTS

249 children with recurrent respiratory tract infections aged (mean±SD), 49±30 months and 122 healthy controls aged 43±32 months with test results including all the test variables of the study were included in the study.Mean age of childrenwere50±36 months. Vitamin D levels in childrenwith LRTI and URTI were significantly lower when compared to healthy controls (Figure 1a). IgE levels in children with LRTI and URTI respectively and was not significant when compared to healthy controls (Figure 1c) .Zinc levels in healthy children were, (mean±SD), 0,93±0,31 pg/ml, while it was (mean±SD), 0,88±0,37, and 0,88±0,35 pg/ml, (mean±SD), respectively in children with LRTI and URTI and was not significant (Table 1). The prevalence of low serum zinc (<70µg(dL) level among children with recurrent respiratory tract infections was not signficantly increased (p=0,2).There was a significant very weak negative correlation between age and vitamin D levels of children (p=0,029),(r=-0,180). The evaluation of zinc, IgE and Vitamin D levels revelaed a very weak correlation between IgE and Vitamin D levels (r=-0,137). There was an insignificant very weak correlation between IgE and zinc (p=0,134), (r=0,078); and there was an insignificant very weak correlation between zinc and vitamin D levels (p=0,534)(r=0,032). All of the children with high IgE levels were prick positive for airborn allergens while none of them were zinc deficient.

DISCUSSION

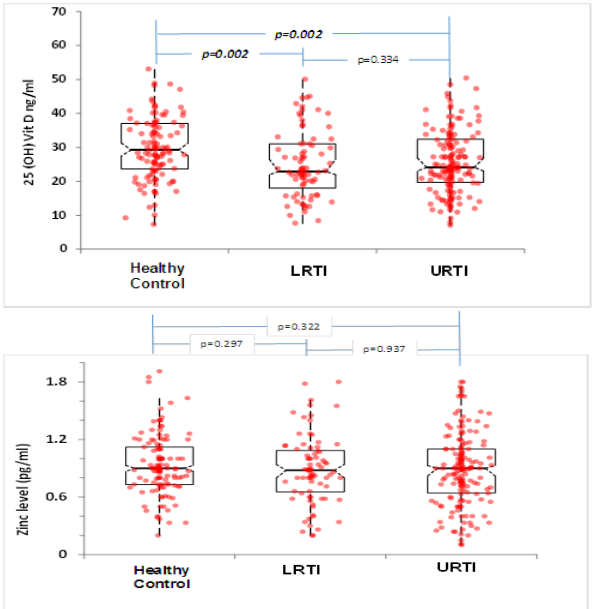
The aim of this study was to investigate the effect of serum zinc levels,serum vitamin D levels, presence of adenoid hypertrophy, and allergy status on prevalence of recurrent upper and lower respiratory tract infectionsin children. Zinc influences the expression of genes in immune system (10-12). It is mostly recognized as a signaling ion. Intracellular zinc binds irreversibly to the regulatory part of signaling proteins which affect cell signal transduction. Zinc's impact on infection has been shown in various studies. In a recent study a significant decrease in respiratory tract infection in the zinc suplemented group was documented (13). In pediatric age group adenoidectomy is the second most common surgical procedure in otorhinolaryngological practice (14). Despite new techniques complications of surgery have been mentioned in previous studies (15,16). Vitamin D levels have been associated with upper respiratory tract infection and adenotonsillar disease (17,18). Individuals response to zinc suplementation may also vary accordig to different genetic features among populations. This may be the contributing factor for the discrepancies reported in the literature. The results of the present study did not indicate any relationship between low zinc levels and recurrent respiratory tract symptomatology as had been demonstrated in previous

Table 1. Associations of Vitamin D, IgE, zinc levels and recurrent respiratory tract infections.

	Groups			
Variables	**Control n=122**	**URTI n=81**	**LRTI n=168**	***p***
Vitamin D (ng/mL) (mean±SD)	31.01±12.78	24.97±9.83	26.49±11.28	<0.001
IgE (IU/ml) Median (%25-75)	9.45 (4.6-27.8)	11.0 (5.3-49.3)	15.15(6.34-45.69)	0.050
Zinc (pg/ml) (mean±SD)	0.93±0.31	0.88±0.35	0.88±0.37	0.506

studies (20-23). Interestingly, zinc levels in our study were not correlated with IgE levels as asthmatic/ wheezer individuals were reported to have lower serum zinc levels in previous reports (24,25).

Zinc defficiency on the other hand has implications on vitamin A status as zinc participates in the absorbtion, mobilisation, transport and metabolism of vitamin A, through its involvement in protein synthesis and cellular enzyme fuctions (26). A limitation of this study may be that adequate serum zinc levels may not reflect functional zinc deficiency in children with recurrent respiratory tract infections always because different protein families take part in zinc uptake and cellular efflux which are also influenced by gene expressions and responsible for variety of diseases (27). There are studies regarding relative importance of zinc suplementation for decreasing mortality in pneumonia (28). According to the results of our study most of the children were non atopic and zinc sufficient in study group.



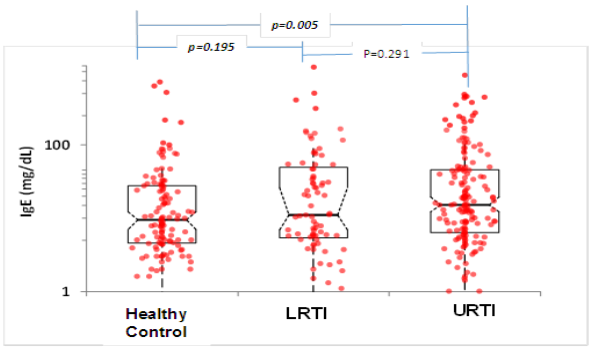


Figure 1a,1b and 1c: plot diagrams showing relation of URTI and

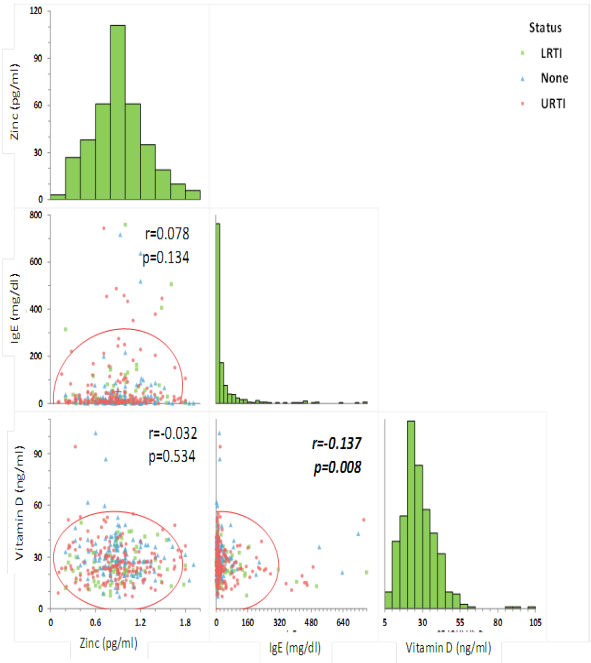


Fig.2 Correlations of Zinc, Vitamin D and IgE levels with LRTI and URTI

As conclusion, existance of adenoid hypertrophy and vitamin D levels in children with recurrent lower and upper respiratory tract infections should be monitored and the efficacy of zinc suplementation may be based on documented low zinc levels.

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