

# Skin Signs of Zinc Deficiency in Children: A clinical study in Jordan.

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## Abstract

**Aims :** Zinc deficiency is one of important nutritional deficiencies in the world and constitutes a major health problem especially in childhood. No previous studies investigated the deficiency of zinc in Jordanian children and the relation of this deficiency to specific cutaneous manifestation at this age.

**Materials and methods:** Eight hundred children were seen at dermatology clinics (Mutah university Health Center, Karak Teaching Hospital, Jordan) complaining of various clinical dermatological symptoms were investigated for the presence of cutaneous signs of zinc deficiency and then investigated by measurement of serum zinc level for the suspected cases.

**Results:** 56 patients (7%) had the clinical signs suggestive of zinc deficiency and had low level of serum zinc (three cases with acrodermatitis enteropathica, 12 cases had perioral dermatitis with involvement of diaper area, and diffuse eczematoid rash, 22 had chronic diffuse hair loss with abnormal hair texture, recurrent and chronic perleche in 13 cases, and 6 cases with recurrent furunculosis and paronychia).

**Conclusions:** Zinc deficiency is not uncommon problem and needs high grade of suspicion because of a less characteristic appearance of zinc deficiency and may be missed in mild cases of deficiency.

**Keywords:** Children , Cutaneous signs , Zinc deficiency

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## Introduction

Zinc deficiency is one of critical nutritional deficiencies in the world (esp. developing countries) and constitutes a significant health problem especially in childhood population<sup>1,2</sup>. Zinc nutrition deficiency is an insufficient availability of zinc in the diet or due to the malabsorption of zinc by the body. Consumption of food rich in cereal proteins decreases the availability of zinc for absorption

<sup>3</sup>, and similarly use of high amounts of iron and/or copper can potentially reduce zinc absorption. Some other conditions associated with acquired hypozincemia are malignancy, intestinal malabsorption syndromes, chronic medical illnesses, cystic fibrosis, and chronic renal disease<sup>4,5</sup>. The clinical presentation of zinc deficiency varies and depends on serum zinc level<sup>3</sup>. It's known that very low serum zinc level results in clinical features similar to

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acrodermatitis enteropathica. Mild zinc deficiency may be underdiagnosed. It presents with a less characteristic appearance such as psoriasiform skin lesions, perioral erosive dermatitis, and perleche. Other features of zinc deficiency include photosensitivity, hair loss, fragile hair, delayed wound healing and decreased tensile strength of scar tissue, dry skin and persistent cutaneous infections (e.g., candidiasis, paronychia, blepharitis, and conjunctivitis) 6,7. So it is necessary to know various clinical cutaneous manifestations of mild zinc deficiency in children. No previous studies investigated the deficiency of zinc in Jordanian children and the relation of this to specific cutaneous manifestation at this age. This study reveals the high prevalence of subclinical zinc deficiency and indicates that zinc deficiency is a public health concern for the study population.

### **Patients and methods**

Eight hundred children were seen at dermatology clinics (Karak Teaching Hospital and Mutah university medical center) during (January 2011- April 2013) complaining of various clinical dermatological symptoms. The study had ethical approval, and informed consent was obtained from the patient parents. The patients were investigated for the following clinical signs and symptoms (hair loss, abnormal hair texture, psoriasiform skin lesions, perioral erosive dermatitis and perleche, photosensitivity, and persistent cutaneous infections, and acrodermatitis enteropathica). These symptoms were chosen as these are known to be suggestive and characteristic for zinc deficiency. For cases that had the previous clinical signs and symptoms, the following relevant history, physical and laboratory examination was done. Age, sex, history of the present illness, medical history,

and review of systems were obtained from the parents. Skin, hair, nail and general physical examination were done for each. The routine laboratory examination was done (complete blood cell count with differential, level of liver enzymes, total bilirubin, serum protein, albumin, and kidney function test). Thyroid function test was also done in some cases. Serum zinc was repeatedly measured at two different laboratories (in cases of low values). The normal value for zinc was (70-120 ug/dl). Zinc-free vacuum tubes and stainless needles were used. In addition, a morning non-hemolysed fasting sample is recommended for accurate results.

### **Results**

Fifty-six of eight hundred patients (7%) were had the clinical signs suggestive of zinc deficiency and had a low level of serum zinc. Three patients (three males at age 4.5, 4.5, and 5 months) were presented with a dramatic clinical presentation, which

Fifty-six out of eight hundred patients (7%) had the clinical signs suggestive of zinc deficiency and had a low level of serum zinc. Three patients (three males at age 4.5, 4.5, and 5 months) were presented with a dramatic clinical presentation, which was highly diagnostic for acrodermatitis enteropathica (two of them were relatives). They presented initially with perioral erosive dermatitis and perleche, which progresses to involve the face, acral parts, and diaper area (Figure 1).



**Figure 1: A child with classical clinical picture of acrodermatitis enteropathica at the time of diagnosis and before starting oral zinc treatment**

In addition, they had photosensitivity and intermittent diarrhea. Their zinc level was a mean level of 18.6 ug/dl. Treatment was started with a dose of 1mg/kg with a good clinical response within one week of treatment and even without topical treatment. These cases were mainly breastfed, so their mothers were encouraged to start feeding them milk formulas. The previous clinical symptoms of acrodermatitis (but less dramatic) have been observed in twelve cases during their first year of life (mean age 6.3 months, eight males and four females). They have mild perioral dermatitis in the diaper area with no history of photosensitivity or diarrhea. In addition, they had dry skin with a diffuse eczematoid rash. They have been treated previously as a case of diaper rash, contact irritant dermatitis, and atopic eczema, but with no response or transient response to topical treatment. Their zinc level was low (mean level of 44.1 ug/dl). A good response of their rash had been seen with oral zinc treatment at a dose of 1gm/kg for few weeks. Twenty-two patients (mean age 4.5 years, 20 females and two males) had chronic

diffuse hair loss with hair dryness and brittleness with no other cutaneous manifestations of zinc deficiency. This hair loss was chronic and diffuse over several months in all patients. Specific history was taken to rule out other causes of hair loss (such as acute or chronic telogen effluvium). They have been healthy with no significant medical history. Skin examination revealed diffuse non-scarring patchy alopecia with very dry hair. The hair pull test was normal. Nothing was significant in the physical examination of these patients. Zinc level was with a mean level of 54.8 ug/dl (none of the cases had a normal zinc level). They were started on a zinc supplement for 3-6 months. The hair loss stopped in 2-4 weeks. Follow-up in the next few months showed no evidence of alopecia, with normal-looking hair. Recurrent and chronic perleche with mild perioral dermatitis have been observed in 13 cases (mean age seven years, males 8, females 5 cases); three of them were sisters. These cases had no history of cutaneous rash or hair problem; they were complaining of non-healed cheilitis and perioral eczema and were treated for several months with topical treatment with transient response. Three of them had a history of recurrent conjunctivitis and blepharitis. Zinc level was done for all of these cases and was moderately low at the level of 48.0 ug/dl. Oral zinc treatment was started at the recommended dose, and quick response and healing for their lesions were within one to two weeks of treatment. Follow up showed no evidence of the recurrence of their symptoms. Twenty-seven patients presented with recurrent furunculosis, impetigo, and paronychia. They have been screened for zinc deficiency, which was found to be significantly low in only six cases. Ten cases were found to be a chronic carrier for staphylococcus aureus in their nasals, and one was diabetic. No known cause was found in

others.

### **Discussion**

Zinc serves many biological functions 8, and its biological role in human beings has long been recognized; it is an essential trace element that is an integral component of many metallo-enzymes in the body. It aids in protein synthesis, cell reproduction, and wound healing 6. Essentiality of zinc for humans and its deficiency was recognized; it has become apparent that deficiency of zinc in humans is prevalent and this deficiency of zinc may affect nearly two billion subjects in the developing world 2, 7 and one of these Jordan (an Arabic country in the Middle East). No previous studies were done to investigate the deficiency of zinc in pediatric or adult groups and the relation of this deficiency to specific cutaneous signs.

The approach in this study was to investigate all children presented to our dermatological clinics with miscellaneous cutaneous signs and symptoms with specific concern for investigating specific and characteristic signs for zinc deficiency and then measuring the serum zinc for suspicious cases. Although many laboratory tests are useful, the therapeutic response in suspected cases remains the gold standard of diagnosis, and this was what has been observed in our cases. In addition, the emphasis in this search was to do clinical and laboratory correlations. Serum zinc estimation alone are not very reliable; as the disease activity may not necessarily correlate with serum zinc level.

Seven percent of our children who presented for treatment had specific signs of zinc deficiency and had low serum level. No previous studies demonstrated that in Jordan. Hence, this condition requires early recognition and treatment to prevent long-term effects on

the overall health of the children.

Zinc deficiency may be underdiagnosed. The clinical features associated with deficiency varies and depends on serum zinc level. A significantly low serum zinc level results in clinical features similar to acrodermatitis enteropathica, while mild hypozincemia presents with a less characteristic appearance. The skin lesions resulting from mild or moderate hypozincemia are less dramatic than that of the inherited form. Only three cases in this report had the dramatic symptom of severe zinc deficiency; 95% of our patients had mild to moderate zinc deficiency with clinical signs suggestive of zinc deficiency.

The three mentioned cases of severe zinc deficiency were fulfilled the known criteria of acrodermatitis enteropathica; these have lower zinc bioavailability than breast milk. A triad of dermatitis, diarrhea, and alopecia 10 characterizes the condition. The cause was unknown, and the disease was often fatal 11. Recently, hypozincemia in children has been classified into three types 12, 13 Type I is characterized by an inherent defect in the absorption of zinc from the gut, i.e., classical acrodermatitis enteropathica. It is transmitted in an autosomal recessive manner. Type II occurs because of impaired secretion of zinc in breast milk. Type III develops in preterm infants who are put on prolonged parenteral alimentation deficient in zinc. A good response was seen with starting feeding with milk formulas in addition to breastfeeding, and zinc supplement and oral zinc treatment were stopped a few months later with no reversal for their symptoms.

Nearly most of the mentioned cases were had low to moderate hypozincemia, and with lack of inflammation. Twelve cases showed periorificial erosive dermatitis, chronic inflammation, and erythema at the sites of

repeated pressure and trauma (such as napkin area, flexure surfaces of limbs). These cases were diagnosed previously as recurrent candidiasis or atopic eczema but with little response to topical steroids treatment. Very good response to zinc treatment was achieved even without using topical management. Zinc supplementation results in a rapid response and the skin lesions heal without permanent sequelae. Zinc deficiency in children requires a high index of suspicion; hypozincemia should be included in differential diagnosis of a child presents with the previous cutaneous rash.

An important finding in this study was the diagnosis of twenty-two cases of children with chronic diffuse hair. These had no identified cause for this problem except the zinc deficiency. These cases had diffuse thinning of the scalp hair with structural changes of hair, but they had no other signs of zinc deficiency. This is an interesting finding, and only one case has been reported previously 14 with this presentation. The hair loss in these children was not associated with other cutaneous changes of zinc deficiency 9,15. This may add a new way

of looking for the differential diagnosis of hair loss in children from the point of view of zinc deficiency.

Persistent cutaneous infections (e.g., candidiasis, paronychia, blepharitis, and conjunctivitis) is another known finding that is known to be associated with zinc deficiency 4, 16, 17. This has been observed in our cases; 6 cases had chronic and recurrent furunculosis, impetigo (mainly around the mouth) and paronychia and had low zinc level. It is known that prolonged standing zinc deficiency has been found to be associated with frequent infections, delayed wound healing, growth retardation, anorexia, anemia, photophobia, hypogonadism, delayed puberty, and altered mental status 11.

In conclusion, zinc deficiency is not uncommon problem in Jordan and needs a high grade of suspicion because of a less characteristic appearance of zinc deficiency. Recognition of cutaneous lesions related to zinc deficiency is essential; the cutaneous lesions respond well to zinc supplementation.

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## ظواهر نقص الزنك على الجلد عند الأطفال: دراسة سريرية في الأردن.

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### الملخص

**الهدف:** يعتبر نقص الزنك أحد المشاكل التغذوية الهامة في العالم ويخلق مشكلة صحية كبيرة خاصة في مرحلة الطفولة. لا يوجد دراسات سابقة تقيم نقص الزنك لدى الأطفال الأردنيين وعلاقة هذا النقص بمشاكل جلدية تحديدا في هذا العمر. **المنهجية:** تم معاينة 800 طفل في عيادات الأمراض الجلدية (المركز الصحي في جامعة مؤتة و مستشفى الكرك الحكومي التعليمي ، الأردن) وقد تم التحقق من وجود العديد من الأعراض الجلدية السريرية المرتبطة ب نقص الزنك. ثم تم فحصهم عن طريق قياس مستوى الزنك في الدم للحالات المشتبه بها.

**النتائج:** 56 مريضاً (7%) لديهم علامات سريرية توحى بنقص الزنك وكان لديهم مستوى منخفض من الزنك في المصل (ثلاث حالات تعاني من نقص شديد ووراثي تصلحبه التهابات معوية وجلدية ، 12 حالة بها التهاب جلد حول الفم مع شمول منطقة الحفاضة ، وطفح جلدي منتشر ، كان 22 لديهم تساقط الشعر مزمن بلمس شعر غير طبيعي ، التهاب ما حول الفم مزمن ومتكرر في 13 حالة ، و 6 حالات مع حدوث التهابات في بصيلات الشعر و ما حول الاظافر.

**الاستنتاج:** إن نقص الزنك مشكلة شائعة ويحتاج إلى درجة عالية من توقعها بسبب وجود مظاهر ل نقص الزنك غير محددة وقد يمكن أن يتم عدم تشخيصها في الحالات الخفيفة من ذلك النقص .

**الكلمات الدالة:** نقص الزنك ، الأطفال، الطفح الجلدي.