Nanotechnology Perceptions
ISSN 1660-6795
www.nano-*ntp.com*

Serum Zinc And Its Effect On The Severity Of The Cutanenous Disorders In Selected Libyan Cases

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Serum Zinc Levels in Dermatological Conditions: A Comparative Study Zinc plays a crucial role in various physiological processes and has been linked to both health and disease. In this study, we analyzed serum zinc levels in 238 patients diagnosed with psoriasis, seborrheic dermatitis, acne vulgaris, alopecia areata, and vitiligo, comparing them to an equal number of healthy controls.

The findings revealed significantly lower serum zinc levels in patients with acne vulgaris (74.5 ± 14.7 µg/100 mL), alopecia areata (77 ± 12 µg/100 mL), and seborrheic dermatitis (0.82 ± 0.27 µg/100 mL) compared to the healthy control group. Conversely, patients with psoriasis (142.2 ± 52.2 µg/100 mL) and vitiligo (0.82 ± 0.27 µg/100 mL) had significantly higher serum zinc levels than controls.

A positive correlation (r = 0.138) was observed between serum zinc levels and the extent of skin involvement in psoriasis, although this was not statistically significant for seborrheic dermatitis. In acne vulgaris, the most severe cases exhibited the lowest zinc levels (0.67 ± 0.13 mg/L), significantly lower than those with mild, moderate, or severe acne (0.73 ± 0.14 mg/L, 0.75 ± 0.16 mg/L, respectively).

Among alopecia areata patients, those with multilocularis alopecia (AM) had significantly lower serum zinc levels (P = 0.000) compared to those with unilocularis alopecia (AU). Additionally, patients with active vitiligo had lower zinc levels than those with stable vitiligo (P = 0.118), although the difference was not statistically significant.

Keywords: Zinc, dermatitis, enzymes, deficiency, psoriasis.

Introduction

Aim of the study

Assessment of Serum Zinc Levels in Libyan Patients with Dermatological Conditions

Given the limited data on serum zinc levels in Libyan patients with skin disorders, this study aimed to evaluate the impact of serum zinc concentrations on individuals diagnosed with psoriasis, seborrheic dermatitis, acne vulgaris, and the severity of associated skin lesions.

1.Introduction

The Role of Zinc in Dermatological Health and Disease

Zinc constitutes approximately 20% of the body's total zinc content and is predominantly found in the skin, with the stratum spinosum exhibiting the highest concentrations compared to other layers of keratinocytes. In dermatology, zinc is recognized as a crucial trace element that influences both health and disease, with certain skin disorders linked to nutritional deficiencies through various mechanisms.

Nutritional status plays a significant role in immune system function, autoimmunity, and resistance to bacterial infections, highlighting zinc's importance in maintaining dermatological health. As a micronutrient, zinc is involved in numerous enzymatic processes, including DNA, RNA, and protein synthesis, as well as the metabolism of proteins, carbohydrates, and lipids. It is also essential for growth and physical development.

Several studies have reported low serum zinc levels in various dermatological conditions, including acne vulgaris, psoriasis, lichen planus, leprosy, ichthyosis, urticaria, and inflammatory diseases such as atopic dermatitis. Additionally, decreased zinc levels have been observed in oral lichen planus and autoimmune bullous diseases. However, conflicting findings exist, with some studies disputing these associations.

Recognizing the importance of assessing zinc status, international organizations such as the World Health Organization (WHO), the International Atomic Energy Agency (IAEA), and the United Nations Children's Fund (UNICEF) have established standardized indicators for evaluating zinc levels in populations and specific subgroups. These indicators serve as valuable tools for estimating zinc deficiencies and their potential impact on dermatological health.

2.Material and method

2.1 Cases and Controls

Study Population and Methodology

This study involved 238 patients, including 41 with psoriasis, 40 with seborrheic dermatitis, 65 with acne vulgaris, 42 with alopecia areata, and 50 with vitiligo vulgaris. Participants were recruited from the Dermatology Outpatient Clinic at Elfwayhat – OPD and the Dermatology Department at Al-Jumhuriya Hospital in Benghazi over a one-year period from April 2017 to April 2018. Each patient underwent a comprehensive clinical examination and laboratory investigations.

A control group of 238 healthy individuals was selected from the same medical outpatient clinic and hospital staff. A detailed medical history was recorded for all participants, and each study group was matched by age and gender to ensure comparability.

Methodology

2.2 Clinical Examination for Patients and Controls

Each participant, including both patients and controls, underwent a comprehensive general, physical, systemic, and dermatological examination, along with relevant laboratory investigations to ensure accurate clinical assessment.

2.3 **Exclusion Criteria**

Individuals with a history of diabetes, hypertension, psychiatric disorders, cardiac conditions, or other chronic skin diseases were excluded from the study. Additionally, all patients had not received any treatment for their dermatological condition for at least six months prior to enrollment.

2.4 **Ethical Considerations**

Before initiating the study, approval was obtained from the hospital director, as there was no formal ethical committee in the institution. Verbal consent was secured from both patients and controls before participation.

2.5 **Sample Collection and Zinc Analysis**

A 5 mL blood sample was drawn from each participant into a plain tube and promptly sent to the laboratory for serum separation. The separation was performed using centrifugation at 4°C when necessary. Zinc concentration was analyzed using the Philips PU9200XES Series Atomic Absorption Spectrophotometer.

2.6 **Statistical Analysis**

All statistical analyses were conducted using SPSS software (Version 23) for Windows. Results for continuous variables were expressed as mean ± standard deviation (SD), while categorical variables were presented as number and percentage (%). Comparisons between the patient and control groups were performed using t-tests and F-tests, with a significance level of $P < 0.05$.

3 Result

3.1 demographic data

Study Population

This study included a total of 238 patients, comprising 41 with psoriasis vulgaris, 40 with seborrheic dermatitis, 65 with acne vulgaris, 42 with alopecia areata, and 50 with vitiligo vulgaris. Each patient group was compared to an equal number of age- and sex-matched healthy controls to ensure statistical reliability.

Table 1 presents the demographic characteristics of both the patient and control groups.

Demographic data	**patients**				**Control subject**					
	number	Age	male	Female	number	Age	male	female	P value	
									Age	Sex
Psoriasis	41	32.5±9 yrs.	20 (48.8%)	21 (51.2%)	50	31.8±9 yrs.	23 (46%)	27 (54%)	.699	479

Seborrheic dermatitis	40.	30 ±17yrs.	11(27,5 %)	29 (72,5%)	40	30 ±17yrs	13(46%)	27(54 %)		
Acne vulgaris	65	12 ± 6.3 years	11 (16.9%)	54 (83.1%)	65	22 years ± 7.4	11 (16.9 %)	54 (83.1 %)		
Alopecia areata	42	29.3 ±7 yrs	24 (57%)	18 (43%)	50	32 ±10 yrs	3(46%)	27(54 %)	0.117	0.196
Vitiligo vulgaris	50	34 ±6 yrs	24(48%)	26(5 2 %)	50	32.2±9 yrs	23(46 %)	26(52 %)	.235	.902

Table 1. Demographic data of skin diseases patients and control subjects under study

3.1 Serum Zinc Levels

Among 41 psoriasis patients, serum zinc levels ranged between 40–71 µg/dL, whereas in the control group, levels ranged from 71–112 µg/dL. The reduction in serum zinc levels observed in psoriasis patients was highly significant ($P < 0.01$) when compared to controls.

For 40 patients with seborrheic dermatitis, the mean serum zinc level was 0.82 ± 0.27 mg/L, while in the control group, it was 0.89 ± 0.19 mg/L. Although zinc levels appeared lower in patients, the difference was not statistically significant ($P > 0.05$).

Among 42 alopecia areata patients, serum zinc levels were significantly lower compared to the control group ($P = 0.000$).

For 65 acne vulgaris patients, the mean serum zinc level was 0.74 ± 0.14 mg/L, whereas in the control group, it was 0.89 ± 0.19 mg/L. This difference was highly significant ($P < 0.01$), indicating a strong association between acne severity and reduced serum zinc levels.

In 50 vitiligo patients, serum zinc levels were significantly higher compared to controls. Additionally, female patients exhibited lower serum zinc levels than males, although this difference was not statistically significant.

Table 2 provides a detailed comparison of serum zinc levels among different patient groups and controls.

Cutaneous disorder	**Mean Serum zinc Mean ± SD Patients (238)**	**Mean Serum zinc Mean ± SD Control (238)**	**P value**
Psoriasis	142.2±52.2	90.2±18.9	000*

Acne vulgaris	74.5 ± 14.7	94 ± 13.4	0.0001
Seborrheic dermatitis	0.82±0.27	0.89±0.19	p>0.05
Vitiligo	111±40	90.2±17	.001*
Alopecia areata	77 ± 12	90.2 ± 18.9	.000*

Table 1.Serum zinc levels(µg/dl) in cutaneous disorders

3.2 skin lesion activity Correlation Between Serum Zinc Levels and Dermatological Conditions

Psoriasis

A positive correlation (r = 0.138) was observed between serum zinc levels and the extent of skin involvement in psoriasis patients. However, this correlation was not statistically significant (P > 0.05).

Seborrheic Dermatitis

A positive correlation (r = 0.398) was noted between serum zinc levels and the affected skin area in seborrheic dermatitis patients.

Acne Vulgaris

Patients with very severe acne had the lowest serum zinc levels (0.67 ± 0.13 mg/L) compared to those with mild (0.73 ± 0.14 mg/L), moderate (0.75 ± 0.16 mg/L), and severe acne (0.82 ± 0.10 mg/L). However, these differences were not statistically significant.

Alopecia Areata

Among the 42 alopecia areata (AA) patients, 14 (33.3%) had alopecia unilocularis (AU), while 28 (66.7%) had alopecia multilocularis (AM). Patients with AM exhibited significantly lower serum zinc levels (P = 0.000) compared to AU patients.

Vitiligo Vulgaris

Vitiligo patients were classified into two groups: active and stable, based on disease progression (Table 2). The mean serum zinc levels were significantly higher in vitiligo patients compared to controls. However, patients with active vitiligo had lower zinc levels than those with stable vitiligo, although the difference was not statistically significant (Table 3).

Discussion

Skin involvement	**Mild Mild <25**	**Moderate25-49**	**sever50-74**	**very sever ≥75**	**p**
Psoriasis	(**PASI score**) 171±49	**(pASI score**) 124±46		~	.004*
Seborrheic dermatitis	0.79±.25	0.84 ±.29		~	398
Acne vulgaris	0.73± 0.14	0.75 ± 0.16	0.82 ± .100	.67 ± 0.13	0.90
Alopecia	(Unifocal Alopecia) 81 ± 11	(Multifocal alopecia) 68.4 ± 10	~	~	.000*
Vitiligo	Localize 117 ±37	Generalize 100±46	~	~	.118

Serum Zinc Levels and Their Role in Dermatological Conditions

Zinc in Skin Health and Disease

Serum zinc levels typically range from 70 to 180 µg/100 mL, with a mean value of 120 ± 22 µg/100 mL. Zinc functions as a cofactor for over 1,000 enzymatic reactions and is essential for more than 2,000 transcription factors. Additionally, zinc plays a vital role in keratinocyte proliferation and inflammation suppression within the skin.

Acquired zinc deficiency (ZnD) remains a global health concern, affecting approximately 17% of the world's population, particularly those suffering from malnutrition due to starvation, severe illnesses, or alcohol dependency. High-risk groups include infants, the elderly, and pregnant women. ZnD is commonly associated with acrodermatitis enteropathica, a cutaneous disorder caused by zinc deficiency.

Numerous studies have linked low serum zinc levels to various dermatological conditions, including acne vulgaris, psoriasis, lichen planus, leprosy, ichthyosis, urticaria, and chronic venous leg ulcers. However, some studies have failed to establish such an association, leading to conflicting conclusions.

Serum Zinc Levels in Psoriasis

The current study found significantly lower serum zinc levels in psoriasis patients compared to healthy controls, aligning with previous findings by Greaves and Boyde and Morgan et al. Several researchers have reported exceptionally low serum zinc levels in psoriasis patients, likely due to zinc loss through excessive skin exfoliation.

Voorhees et al. suggested that psoriatic lesions retain high zinc concentrations, indicating an imbalance driven by accelerated cell turnover and increased protein synthesis, which could contribute to reduced serum zinc levels. However, Hinks et al. reported no significant changes in serum zinc among psoriasis patients. McMillan and Row observed a decline in serum zinc levels as the affected skin surface area increased, a finding consistent with the results of this study.

Serum Zinc Levels in Acne Vulgaris

Several researchers have investigated the relationship between low serum zinc levels and acne vulgaris, with mixed findings. Amer et al. and Ozugus reported a negative correlation between serum zinc levels and acne severity, while other studies found no significant correlation. Cochran et al. noted a significant link between serum zinc levels and the severity and type of acne lesions, but this association was not observed in the present study.

One hypothesis suggests that zinc deficiency may contribute to increased androgen production, which in turn influences sebaceous gland activity. However, the precise role of zinc in acne pathogenesis remains unclear.

Serum Zinc Levels in Seborrheic Dermatitis

Although serum zinc levels in seborrheic dermatitis (SD) patients appeared lower than those in healthy controls, this difference was not statistically significant. One study reported that zinc levels in healthy controls were lower than the reference range in patients with different clinical types of eczema. Another study found that mean serum zinc levels were significantly lower in eczema patients compared to controls.

Furthermore, Mrinal et al. noted that endemic zinc deficiency is prevalent in rural Iran, Egypt, and Turkey, likely due to dietary habits such as consuming whole grain bread rich in fiber and phytates, which inhibit zinc absorption. Serum zinc levels in eczema patients were significantly lower than in controls, suggesting a potential role of zinc deficiency in eczema pathogenesis. The current study found a positive correlation between low serum zinc levels and the severity of skin lesions in SD patients, as well as a correlation between serum zinc levels and the extent of skin involvement.

Serum Zinc and Copper in Alopecia Areata

Both zinc (Zn) and copper (Cu) are essential trace elements required for hair follicle function and regeneration. Several studies suggest that a zinc/copper imbalance may contribute to alopecia areata (AA) pathogenesis by disrupting oxidative and antioxidant activity. Zinc and copper are critical for many enzymatic functions, including alkaline **phosphatase activity in** hair follicles and copper/zinc superoxide dismutase, a potent antioxidant.

Zinc deficiency impairs DNA and RNA synthesis, which is essential for normal hair follicle cell division and hair growth. The present study found significantly lower serum zinc levels in AA patients compared to controls, aligning with previous studies that reported similar findings.

Furthermore, patients with alopecia multilocularis (AM) had significantly lower serum zinc levels compared to those with alopecia unilocularis (AU), consistent with Abdel Fattah et al.'s study, which identified an inverse correlation between serum zinc levels and AA severity. However, no correlation was found between disease duration and serum zinc levels, contradicting earlier studies that reported an inverse relationship between zinc levels and AA duration.

Serum Zinc Levels in Vitiligo

Zinc plays a crucial role as a cofactor and modulator in various skin conditions, including dermatitis enteropathica, bullous pemphigoid, decubitus ulcers, alopecia areata, psoriasis, vitiligo, and skin cancer. Zinc is also essential for immune function and inflammatory responses and is a key component of metalloenzymes involved in melanogenesis.

Although numerous studies have investigated the impact of trace elements on vitiligo, findings remain inconsistent. The present study found that serum zinc levels in vitiligo patients were higher than in controls, consistent with previous research. Similar results were reported by Ali et al. and Basha et al., who observed elevated zinc levels in vitiligo patients.

However, many previous studies found significantly lower serum zinc levels in generalized vitiligo patients. Arora et al. also reported lower serum zinc levels in vitiligo patients, though this difference was not statistically significant. The present study found no significant correlation between serum zinc levels and vitiligo disease activity, consistent with prior research.

Conclusion :

This study concludes that serum zinc levels were significantly lower in patients with psoriasis and acne vulgaris compared to healthy controls. However, the reduction in serum zinc levels in seborrheic dermatitis was not statistically significant.

A positive correlation was observed between low serum zinc levels and the extent of skin involvement in psoriasis, acne vulgaris, and seborrheic dermatitis. Additionally, low serum zinc levels appeared to be a key risk factor for alopecia areata (AA), particularly in cases with more extensive disease progression.

Given these findings, routine serum zinc testing and therapeutic zinc supplementation may be beneficial for patients with alopecia areata to support disease management and treatment.

Recommendation:

Zinc Deficiency: A Global Concern and Its Relevance to Libya

Zinc deficiency (ZnD) remains a significant health issue in both developing and developed countries. Particular attention should be given to endemic zinc deficiency, which may be prevalent among Libyans, given their dietary preference for seed-based foods such as rice and pasta.

Further research is essential to accumulate substantial evidence on the role of micronutrients in the development and progression of dermatological conditions, highlighting the need for continued investigation into their impact on skin health.

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