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Serum zinc and calcium level in patients with psoriasis

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Abstract

The purpose of this study was to measure the serum zinc and calcium levels in psoriatic individuals. The Dhaka Medical College's Biochemistry Department conducted a cross-sectional study from 2021 to 2022, involving 110 participants aged 20-55. Group A included 55 diagnosed psoriasis patients and group B included 55 healthy individuals. Serum zinc and calcium measurements were made using a colorimetric technique. Statistical analysis was conducted using the study's data, using unpaired Student's 't' test for continuous variables, Chi-square test for categorical variables, and Spearman's rank correlation coefficient test for correlation (p> 0.5). When compared to healthy subjects, psoriatic patients' mean SD serum zinc and calcium levels (57.488.86 and 7.600.58, respectively) were substantially lower (p 0.001) than those of healthy subjects (79.427.37 and 8.750.45, respectively). Psoriasis and serum zinc and calcium showed a significant inverse relationship (r = -0.769, p0.001 and r = -0.736, p0.001, respectively). Only low serum zinc (p0.066) and considerably low serum calcium (p0.006) were identified in patients with long-term psoriasis (>5 years). It can be inferred from this study that psoriasis patients had lower serum levels of calcium and zinc. Thus, regular evaluation of these biomarkers may be useful in preventing worse outcomes brought on by hypozincemia and hypocalcemia.

Keywords: Psoriasis; Serum; Zinc, Calcium, Bangladesh

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Introduction

The skin condition known as psoriasis is characterized histologically by cutaneous inflammation, increased epidermal proliferation, hyperkeratosis, angiogenesis, abnormal keratinization, shortened maturation time, and parakeratosis (Gisondi et al., 2012; Hagforsen et al., 2012). Around 2–3% of the world's population is impacted. Around 125 million people worldwide are estimated to have psoriasis, according to the World Psoriasis Day Consortium (Gelfand et al., 2005). Despite evidence of a hereditary susceptibility, the cause of psoriasis is still unknown (Harden et al., 2015). Another important area of study is the contribution of the immune system to the development of psoriasis. The aetiology of psoriatic characteristics is still not fully understood, according to numerous research organizations. Systemic

infections, metabolic abnormalities, medicines, and stress are significant environmental influences (Sazzad et al., 2023. Some Human Leukocyte Antigens (HLA) are also present with them (Duweb et al., 2005).

There are abnormalities in the serum zinc and calcium levels in psoriasis. Zinc is an important trace element that is necessary for regular cell division and apoptosis (Sunny et al., 2021). It is essential for many metabolic processes, including cell division, transcription, and translation (Kuddus et al., 2002). For their catalytic functions, more than 300 enzymes require zinc. On the other hand, Jansen et al. (2009) found that the removal of zinc from catalytic sites results in the decrease of enzyme activity. Numerous studies show that people with psoriasis consistently have low serum zinc levels. Guenther reported in 2009 that plasma zinc levels were low in psoriasis. Asymmetry in the distribution of zinc between serum and psoriatic lesions has been suggested by certain investigations that found psoriatic lesions retain a higher zinc concentration than unaffected skin. Large-scale skin exfoliation can lower the serum level of zinc in psoriasis (Nigam, 2005; Kim et al., 2010). Stress depletes zinc levels, and stress has been shown to cause or worsen psoriasis (Remrod et al., 2015). Low blood albumin levels, which are brought on by removing a lot of scales from the body's surface, also contribute to falling zinc levels (Mohamad, 2013). Today, it is believed that oxidative stress plays a significant role in the etiology of psoriasis. Because the extracellular enzyme superoxide dismutase depends on zinc, zinc is regarded as an antioxidant (Alwasti et al., 2011). Superoxide dismutase is essential for the defense against free radical damage. According to Ghosh et al. (2008), a zinc deficiency can enhance oxidative stress-induced cell damage and decrease antioxidant enzyme activity.

Calcium is another important macro mineral that controls a variety of cellular processes, including insulin secretion, muscular contraction, and mast cell degranulation. Because of an imbalance in calcium homeostasis, psoriasis may become worse. Since cadherins are calcium-dependent cell adhesion molecules, hypocalcaemia might harm them and make illnesses worse (Islam et al., 2018). The strong correlation between serum calcium levels and psoriasis has been confirmed by numerous investigations. It has been shown that pustular psoriasis of von Zumbush, a very severe form of psoriasis, is associated with modest hypocalcemia (Sunny, 2017). Low serum calcium levels have been shown to cause lesions to enlarge and become more intense in the majority of patients. According to Puri et al. (2014), calcium depletion from the horny layer may contribute to the development of psoriatic skin lesions.

Keratinocyte proliferation and differentiation are tightly controlled by intracellular calcium. One of the major participants in the psoriasis pathogeneses is assumed to be keratinocytes. They make up the majority of the cells of the epidermis. They usually serve as a defense against outside invaders like infectious pathogens. According to certain accounts, aberrant keratinocyte differentiation and proliferation are brought on by a deficit in calcium intake. According to some transient receptor potential cation channels (TRPC), calcium ion entrance into cells is regulated (Birnbaumer et al., 2009). It was also stated that downregulation of TRPC 1, 4, and 6 was related with significant abnormalities in calcium ion influx in psoriatic keratinocytes. For the topical therapy of psoriasis, they recommended using TRPC channel activators (Birnbaumer et al., 2009).

Psoriasis is becoming more common, as it is in other developing nations, in Bangladesh. This study's objectives include determining the serum zinc and calcium levels in psoriatic patients as well as correlating these levels with the development of the disease. However, our nation lacked studies to back up the aforementioned association. Since there is a knowledge and information gap surrounding the medical evaluation of psoriasis patients, this study has taken the effort to close that gap. So, the purpose of this study is to measure the serum zinc and calcium levels in psoriatic patients and to connect these levels with the course of the disease.

Materials and Methods

Study design and population

The Department of Biochemistry at Dhaka Medical College in Dhaka, Bangladesh, conducted the current cross-sectional analytical investigation from July 2021 to June 2022. In order to conduct this study, 55 psoriasis patients with confirmed diagnoses (group A) and 55 healthy individuals (group B) were chosen based on predetermined selection criteria from the outpatient dermatology and venereology department at the Dhaka Medical College Hospital as well as from the hospital grounds through direct contact with staff members such as nurses and doctors or patients present. Age and sex were balanced between the two groups. The history and distinctive appearance of erythematous papules and plaques with a silver scale in common areas including the scalp, elbows, knees, and back were used to make the clinical diagnosis of psoriasis.
A comprehensive history, physical examination, and standard laboratory tests were used to evaluate each patient. To determine the clinical kind of the disease and its surface area, patients underwent examinations. The following patients were not included in the study because they met each requirement: 1. diabetic coma, 2. hypertension, 3. parathyroid conditions, 4. a serious systemic disease (malignancy, cardiovascular disease, bone disease, hepatic disease, or renal failure), 5. people using supplements or medications that modify the metabolism of zinc or calcium, such as rifampicin, phenytoin, or phenobarbital, 6. an acute or persistent infection, 7. pregnancy and breastfeeding, 8. a recent history of malnutrition and diarrhea.
Data collection

Each patient filled out a questionnaire that asked about their demographics, medical history, drug use, the extent and duration of their psoriasis, and whether they had any psoriasis in their families. Then, laboratory tests including liver function, renal function, thyroid function, complete blood count, fasting blood sugar, zinc, calcium, albumin, and 25-hydroxy vitamin D3 levels were advised for all subjects.
Sample gathering and preservation

Following every aseptic precaution, a disposable syringe was used to draw 6 ml of fasting venous blood from each study participant. To estimate fasting plasma glucose and resting blood sugar, 2 ml of blood was put into a test tube containing NaF after the needle was removed from the nozzle. To prevent hemolysis, 4 ml of blood was gently pushed into a dry, clean, deionized, graduated, screw-capped plastic test tube. The test tube was then kept in a slanting position until a clot formed before being centrifuged at 3000 rpm for 10 minutes to separate the serum and collect it in a labelled deionized, eppendrof. Early as practicable, all biochemical tests were conducted. In the event that the analysis is put off, the serum was kept at -200C. For the indices of this investigation, adequate cleaning of plastic and glassware was crucial. Pipettes, glassware, and plastic items were properly washed with tap water after being cleaned with detergent. For 24 hours, all the equipment was submerged in 20% nitric acid (HNO3) in deionized water. They were then dried outside after being rinsed three times with deionized water.

Laboratory procedures

Determining the serum zinc level

The serum zinc level of each subject—both psoriasis sufferers and healthy controls—was measured. Each eligible case and control was given a 5 ml intravenous blood sample. Until the time of analysis, supernatant serums were separated by centrifugation for 10 min at 4000 rpm and kept at 40°C. Zinc-free

polypropylene syringes were used to take blood samples, which were then put in zinc-free centrifuge tubes. A commercial kit (Zinc Assay Kit, Elitech, France) was used to measure the serum zinc concentration using atomic absorption spectrophotometry (Spectra AA 10 plus, Varian, Dickinson, Texas, USA). Adults with serum zinc levels between 60 to 120 micrograms per deciliter were considered to be normal.

Determining the serum calcium level

Serum calcium was estimated using a colorimetric method, using a color complex between calcium and o-cresolphtalein in alkaline medium. The procedure involved a cuvette, ethanolamine, chromogen, and calcium cal. The absorbance was measured against the blank, and the reference value was 8.4-10.2mg/dl. The conversion factor was 0.25.

Determining fasting plasma glucose

The fasting plasma glucose was enzymatically estimated using the "Glucose Oxidase" (GOD- PAP) technique. Using the semi-automatic Evolution-3000 analyzer, readings were recorded. The typical range for fasting plasma glucose is 3.9 to 5.6 mmol/l, according to the American Diabetes Association.

Data analysis

A predesigned data collecting sheet was used to record all of the data. The unpaired Student's 't' test was used to compare continuous variables between research subject groups. Continuous variables were represented as mean SD. Chi-square test was used to compare categorical variables, and absolute frequencies and percentages were provided. To compare the association between various factors and psoriasis, the Spearman's rank correlation coefficient (r) test was used. With significance set at p 0.05 or higher at the level of the 95% confidence interval, all p values were two-tailed. The Windows SPSS version 22 program was used to conduct the analyses.

Aspects of ethics and the process for maintaining confidentiality

The Dhaka Medical College's ethical review committee granted the study its ethical approval. The danger of physical, psychological, social, and legal harm during blood collection was minimal. A unique code was assigned to each patient, which was followed in each and every step of the procedure, and the name and address were recorded on a separate sheet to protect anonymity. The study's nature, procedure, goal, risks, and benefits were thoroughly discussed to the study subjects before obtaining their written informed consent. Here, neither a placebo nor an experimental new medicine was used. To protect their rights and health, the study participants' interests were not jeopardized.

Results

Baseline characteristics

This study included 110 participants in total. 39 (71%) of the 55 psoriasis patients and 16 (29%) of the 55 healthy participants were men, whereas 44 (80%) of the 55 psoriasis patients and 11 (20%) of the 55 healthy subjects were men. In the psoriasis group, 33 patients (60%) and 22 patients (40%) were single, whereas 32 patients (58%) and 23 patients (42%) were single and married, respectively, in the control group.

However, there was no discernible difference between the groups in terms of marital status. The mean age of the psoriasis patients was 35.7±4.3 years, whereas the mean age of the controls was 35.1±4.1 years. Age and gender variations between the two groups were negligible. 96% of psoriasis patients had the chronic plaque form, whereas 4% had the pustular kind. In 44 (80%) of the patients, there was a confirmed family history of psoriasis in first degree relatives.

Table 1: Distribution of study subjects (N=110) in both groups according to age and gender

Parameters	**Group A (n=55)**	**Group B (n=55)**	***p* value**
Age (in years) (mean ± SD)	35.7 ± 4.3	35.1 ± 4.1	0.493 [a]
Gender[#]			
Male	39 (71%)	44 (80.0%)	0.183[b]
Female	16 (29%)	11 (20.0%)	

Evaluation of blood pressure and body mass index

There were no significant differences in terms of blood pressure body mass index and fasting plasma glucose between psoriatic patients and healthy subjects (Table-2). Average blood pressure of Psoriatic patients was 117.40 ± 6.94 (mm Hg) and 116.00 ± 7.21 (mm Hg) for healthy individuals. The study identified average BMI 20.36 ± 1.81(mm Hg) in Psoriatic patients and 19.73 ± 3.04 (mm Hg) in health people.

Table 2: Baseline parameters of study subjects (N=110) in both groups

Parameters	**Group A (n=55)** (mean ± SD)	**Group B (n=55)** (mean ± SD)	***p* value**
SBP (mm Hg)	117.40 ± 6.94	116.00 ± 7.21	0.325
DBP (mm Hg)	76.30 ± 6.91	76.80 ± 6.44	0.709
BMI (kg/m^2)	20.36 ± 1.81	19.73 ± 3.04	0.211
FPG(mmol/l)	6.71± 2.14	6.11± 1.52	0.107

Unpaired student's t test was done to measure the level of significance. Group A-Psoriatic patients. Group B- Healthy individuals.

Comparison of serum zinc and calcium

Serum calcium and zinc were significantly lower in psoriatic patients than in healthy subjects (Table 3). Average serum zinc of Psoriatic patients was 57.48 ± 8.86 (µg/dl) and 79.42 ± 7.37 (µg/dl) for healthy individuals. The study identified average Serum calcium 7.60 ± 0.58 (mg/dl) in Psoriatic patients and 8.75 ± 0.45 (mg/dl) in health people.

Table 3: Comparison of serum zinc and calcium of study subjects (N=110) in both groups

Parameters	**Group A (n=55)** (mean ± SD)	**Group B (n=55)** (mean ± SD)	***p* value**

Serum zinc (µg/dl)	57.48 ± 8.86	79.42 ± 7.37	<0.001
Serum calcium (mg/dl)	7.60 ± 0.58	8.75 ± 0.45	<0.001

Unpaired student's t test was done to measure the level of significance. Group A-Psoriatic patients. Group B- Healthy individuals..

Correlation of serum zinc level with psoriasis

The study identified 83.6% of individual with psoriasis is suffering from hypozincemia and 89%of individual with psoriasis is suffering from hypocalcemia. There was a significant inverse correlation of serum zinc and calcium with psoriasis. Serum calcium was 8.00 ± 0.70 (mg/dl) that suggested it significantly decreased in psoriatic patients with increasing duration of diseases but serum zinc level was 61.58 ± 10.8 (µg/dl) that didn't significantly decrease. Correlation of serum zinc level with psoriasis (r-0.769, p<0.001). Correlation of serum calcium level with psoriasis (r-0.736, p<0.001), shown in figure 1.

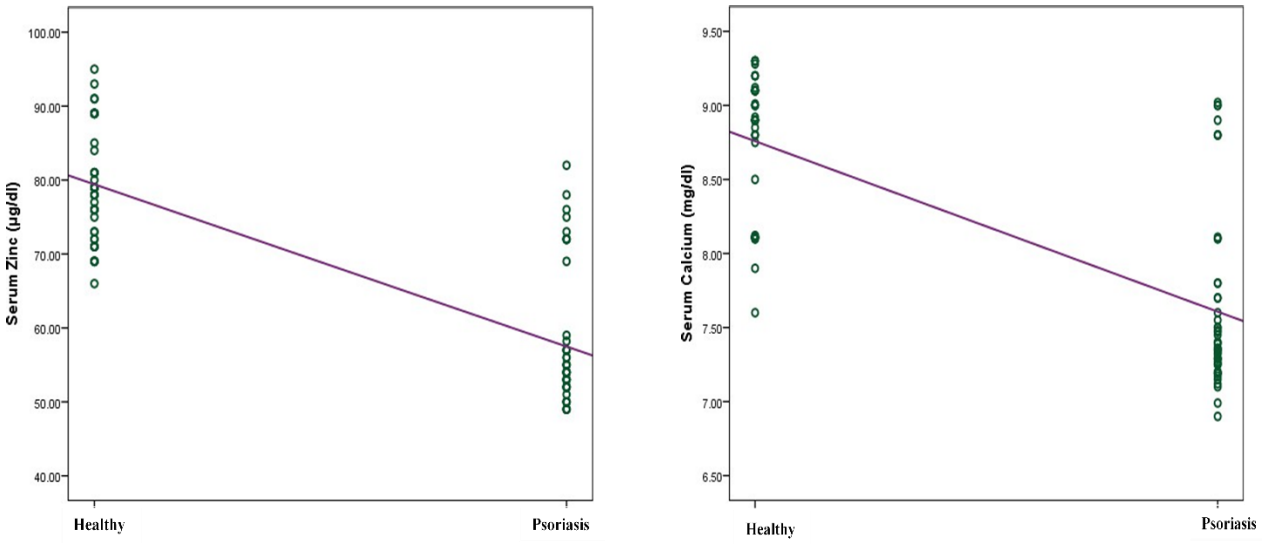

Figure. 1: Correlation of serum zinc level with psoriasis (A), Correlation of serum calcium level with psoriasis (B)

Discussion

The goal of the current study was to measure the serum levels of calcium and zinc in psoriasis patients. For comparison, a control group of 55 seemingly healthy persons who were age and gender matched was added along with 55 psoriasis sufferers who were considered the research group for this reason. In this investigation, a few baseline, clinical, anthropometric, and laboratory variables of the study patients were compared. Regarding these traits and attributes, there were no appreciable differences across the groups, reflecting the homogeneity of the groups. In the current study, psoriatic patients had considerably lower mean serum zinc levels (p 0.001) than controls (79.42 7.37g/dl) (57.48 8.86g/dl). This finding was in line with a case-control study conducted by Younes et al. (2010), where the mean value of blood zinc in psoriatic patients was substantially lower (p 0.05) than the control group (60.2215.39g/dl), on average, than in the control group.

Similar studies were conducted by Kumar et al. (2012), in which it was discovered that psoriatic patients' serum zinc levels were considerably lower than those of the control group in both studies (p 0.001). Afridi et al. (2010) conducted another investigation and discovered that psoriatic patients had significantly lower zinc levels than the control group (p 0.001). Lower zinc levels were found to be significantly associated (p 0.001) with psoriasis by Nigam (2005) and Basavaraj et al. (2010). In this study, 83.6% of the psoriatic patients had hypozincemia, compared to 16.4% of the control group. Al-Jebory (2012) carried out a similar type of investigation. According to the study's findings, 98% of psoriatic patients had lower serum zinc levels than the controls (p 0.001).

There was no statistically significant difference in the serum zinc concentration between the two groups, according to research by Ala et al. (2013) (p=0.57). The failure to take into account the degree of skin involvement and the relationship between surface area involvement may be the cause of these contradictory findings for serum zinc levels in psoriasis, according to their hypothesis. In the current investigation, psoriasis patients' mean serum calcium levels were substantially lower (7.60 0.58 mg/dl) than those of the control group (8.75 0.45 mg/dl) (p 0.001). This finding was in line with another study by Mohamad (2013), in which the serum calcium levels of psoriatic patients were substantially lower (p0.05) than those of the control group (9.840.81mg/dl), especially in cases of severe psoriasis (6.50.33mg/dl). Similar research by Lee et al., 2005, discovered that generalized pustular psoriasis significantly reduced serum calcium levels (p0.05).

In other research, Shahriari et al. (2010) discovered a significant correlation between hypocalcemia and psoriasis (p 0.001), while Sreekantha et al. (2010) discovered that the serum calcium level was considerably lower in psoriasis patients than in controls (p 0.001). In this study, we discovered that 11% of psoriatic individuals had normal serum calcium levels while 89% had hypocalcaemia. This finding was in line with a case control study conducted by Qadim et al. (2013) on 98 patients with psoriasis and 100 controls. Here, 42.9% of patients had normal serum calcium levels, while 57.1% of patients had hypocalcaemia.
A study by Elhaddad et al., (2017) reported no significant difference in serum calcium level between psoriasis and control (p>0.05), which is contrary to our findings. When the Spearman's rank correlation coefficient (r) test was used in the current investigation, it was discovered that serum zinc and calcium levels were significantly inversely correlated with psoriasis patients (r = -0.736, p0.001 and r = -0.769, p0.001, respectively). No pertinent studies were discovered in this regard. In the current study, the blood calcium and zinc levels were compared according to the length of the psoriasis, and the results show that while the serum calcium level considerably reduced (p0.006) with increasing length of the disease, the serum zinc level did not alter significantly (p0.066). Al-Jebory (2012) conducted a study of a similar nature, finding that the mean serum level of zinc did not substantially decrease with increasing psoriasis duration (p>0.05). There were no pertinent studies found for calcium.

Conclusion

It is established that low serum zinc and calcium levels are observed in psoriasis patients and are associated with the development of the condition. As a result, it is indicated that testing for these minerals (zinc and calcium) in psoriasis may help to prevent complications and disease aggravation.

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