

Evaluation of Serum Electrolytes among Psoriasis Patients: A Prospective Case-Control Study from Telangana, South India

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Abstract

Background: Psoriasis is a non-contagious autoimmune skin disorder. Patients present with symptoms of abnormal patches on the skin, joints and nails, which are dry and itchy. There are many factors responsible for this disease which initiates an inflammatory response leading to abnormal keratinization of the skin. Electrolytes play a significant role in maintaining the cell function and fluid balance both within and surrounding the cell. Any disturbance in the electrolyte balance could cause fluid loss and cell death/damage.

Objective: None of the previous research studies have evaluated the role of electrolytes in the management and progression of psoriasis. The present study is aimed to assess the levels of electrolytes (sodium and potassium) among patients diagnosed with psoriasis.

Methods: A prospective case-control study was conducted, which included 25 patients diagnosed with psoriasis and equal number of age and sex matched control group without psoriasis. The study was carried out at the Chalmeda Anand Rao institute of medical sciences, a tertiary care teaching hospital located at Karimnagar, Telangana, India. Blood samples were collected from all the subjects included in the study and serum electrolyte (sodium and potassium) levels were measured using an indicator electrode of standard potential.

Results: The mean levels of serum electrolytes (sodium and potassium) and the ratio of sodium to potassium among the psoriasis patients and the control subjects. The results demonstrated an increase of electrolyte levels of sodium (151.04 ± 3.79 ; $p < 0.0001$), sodium to potassium ratio (44.999 ± 5.37 ; $p < 0.0001$) and a decrease in the levels of potassium (3.352 ± 0.28 ; $p < 0.0001$) as compared to the controls.

Conclusion: There is an evidence of electrolyte imbalance among psoriasis patients. The levels of sodium and sodium to potassium ratio increased and the potassium levels were reduced. Further studies including a larger group of psoriasis patients and a regular follow-up of serum electrolytes may improve the understanding of the role of electrolytes in psoriasis disease and its progression.

Keywords: Psoriasis; Serum electrolytes; Sodium; Potassium; Sodium to potassium ratio

Introduction

Psoriasis is a hyperproliferative cutaneous disease which is autoimmune in nature and characterized by abnormal patches on the skin, nails and joints [1]. The skin patches may be red, itchy, scaly, dry and severity of this disease ranges from small isolated patches to the involvement of the skin throughout the body [2]. Psoriasis is common disease with the prevalence ranging from 2-3% affecting approximately 120 to 180 million people worldwide. About 1.5 Lakh new cases of psoriasis are reported annually. Psoriasis is a non-contagious disease which affects both the sexes equally and has no age predilection [3,4].

The severity of psoriasis is measured by an index called as psoriasis area severity index (PASI) which assesses the surface area of the skin lesions. PASI score starts from 0 (no disease) to 72 (maximum disease) [5]. Genetic factors, environmental factors, recurrent/chronic bacterial and viral infections, immunological factors, lifestyle conditions including stress, seasonal weather changes, certain type of drugs like non-steroidal anti-inflammatory aids (NSAID's), beta blockers, calcium channel blockers etc., could be responsible for the development of psoriasis [6].

The plaque/discoid type psoriasis is the most common type affecting approximately 90% of the patients. Psoriasis is graded as mild (<3%), moderate (3-10%) and severe (>10%) based on the surface area of the body affected.

Psoriasis patients suffer from the complications that include multi-organ abnormalities. The electrolytes sodium and potassium maintain the membrane potential, and osmotic gradient, which in turn helps in maintaining water balance, blood pH, nerve and muscle functions of the human body [7-9]. Abnormalities of electrolytes may worsen the disease and cause severe complications including multi-organ failure. Assessment of electrolytes could be a sensitive indicator of cell damage, which can help in evaluating the severity of disease.

The aim of the study was to measure the serum sodium, potassium and sodium to potassium ratio in patients diagnosed with Psoriasis.

Materials and Methods

The present study included 25 patients attending the dermatology

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out-patient department of Chalmeda Anand Rao Institute of Medical Sciences, Karimnagar, Telangana, India. Among the study participants included, 16 were male and 9 female patients who were diagnosed with plaque psoriasis. Non-psoriatic, healthy subjects were included as controls. The control group was taken from healthy staff, and volunteers. All patients and controls were in the age group of 20-60 years with various grades of severity of the disease.

Inclusion criteria considered was age between 20-60 years, no history of any topical or systemic drug therapy for at least 3 previous months, and no other co-existing diseases/conditions. Chronic alcoholics and smokers, people with hypertension, diabetes, personal or family history of metabolic disease, patients who were on oral contraceptives and any other medication, pregnant women, and post-menopausal age women were excluded from the study.

An informed and oral consent was obtained from the study participants. The study was approved by institutional ethical committee.

After a fasting of 12-14 hours, 5 ml of venous blood was collected aseptically from each study subject. Biochemical parameters including the serum sodium and potassium were analyzed.

Indicator electrodes with good selectivity for specific ions (sodium/Potassium) were used to estimate the serum sodium and potassium. The values obtained were compared with a stable reference electrode of constant potential. The strength of the charge is directly proportional to the concentration of selected ions [10-12].

Statistical analysis of the data obtained was performed using Microsoft Excel, and tables were generated. The measure of central tendencies (mean), and the variability (standard deviation (SD)) were calculated. Statistical Package for the Social Sciences (SPSS, Version 15.0) (SPSS Inc., Chicago, USA) was used to calculate the unpaired and independent Student's t-test (p value) to find the significance of the results. The results were presented as mean \pm SD and p value.

Results

The mean levels of serum electrolytes (sodium and potassium) and the ratio of sodium to potassium among the psoriasis patients and the control subjects is shown in Table 1.

The results demonstrated an increase of electrolyte levels of sodium (151.04 ± 3.79 ; $p < 0.0001$), sodium to potassium ratio (44.999 ± 5.37 ; $p < 0.0001$) and a decrease in the levels of potassium (3.352 ± 0.28 ; $p < 0.0001$) as compared to the controls.

Discussion

Psoriasis is a chronic, proliferative, inflammatory and recurring skin disease. The scaly patches observed on the skin of patients suffering from psoriasis is due to hyper keratinization of the epidermal cells. These keratinocytes in turn interfere with the immune function of the skin, leading to an inflammatory process. The keratinocytes start to proliferate and secrete interferons, cytokines and causes the psoriatic lesions and also induce proliferation of T lymphocytes and type 1 helper cells (Th1) [13]. The abnormal keratinization process among

psoriasis patients affects the barrier capacity of the skin. This manifests as increased trans-epidermal water loss, which is directly proportional to the severity of the disease. The expression of aquaporins, a family of water transporting proteins present in the plasma membranes of stratum corneum and stratum spinosum have been found to decrease in the lesional and perilesional skin of psoriasis patients [14].

Previous studies had reported that an increase in the trace elements like copper, cadmium, mercury, nickel and zinc could cause elevation of sodium to potassium ratio [15,16]. Psoriasis may be caused by an increased oxidative stress since most of the trace elements enter into the enzymatic process needed for the functioning of antioxidants [17]. The experimental studies on mice had also confirmed that chronic stress may exacerbate skin disorders by influencing the activities of cortisol hormone. Increased cortisol activities could in turn effect the skin barrier function [18-21]. Also, the cortisol directly contributes to sodium retention in the blood [22]. Thus, the raised sodium to potassium ratio can be used to assess the activity of adrenal gland in patients with psoriasis. Increased sodium levels in the body cause raised sodium to potassium ratio, which leads to dry skin and mucosal membrane presenting as scaly patches on the surface of skin of psoriasis patients.

In the present study, the sodium to potassium ratio (Na/K) was increased, which was is in contrast to a previous study which showed a low sodium to potassium ratio among psoriasis patients [18]. The results of the current study agreed with a previous Indian report by Basavaraj et al. [18].

Thus, the raised sodium to potassium ratio can also be used to assess the activity of adrenal gland in patients with psoriasis.

The psychological stress experienced after the onset of skin lesions in psoriasis patients may also trigger the cortisol hormone which could influence the progression of the disease. A high Na/K ratio was more associated with an acute stress, while a low Na/K ratio could be associated with chronic stress as noted by a previous study [19-23]. Few other studies observed that the increased Na/K ratio may not be clinically significant [24]. Whereas in our study the increased Na/K ratio was in accordance with higher inflammatory skin lesions among psoriasis patients.

Lack of regular follow-up, and non-estimation of cortisol activities among the study subjects could be considered as limitations of the present study.

Conclusions

Psoriasis is a chronic inflammatory disease of the skin which is mostly autoimmune in nature. Even though there are many factors which trigger the inflammatory response in psoriasis, and since electrolytes play an important role in hydration of the cells and its functions, the present study is confined to the estimation of levels of sodium and potassium. The high sodium to potassium ratio observed in this study is the first of its kind finding. The psychological stress experienced by psoriasis patients can aggravate the activities of adrenocortical hormones, which in turn could be responsible for the increased levels of sodium in the blood. The measurement of Na/K ratio may help in detecting the cell damage and its inclusion in the diagnosis/prognosis could help in assessing the severity of the disease and its progression. Further studies including a large group of patients and a regular follow-up testing is required to confirm the present results.

Parameter	Control group Mean \pm SD	Test group Mean \pm SD	p Value
Sodium	139.40 \pm 2.5	151.04 \pm 3.79	<0.0001*
Potassium	4.38 \pm 0.35	3.352 \pm 0.28	<0.0001*
Sodium/Potassium ratio	32.07 \pm 2.63	44.999 \pm 5.37	<0.0001*

SD: Standard Deviation; *Statistically significant

Table 1: Comparison of electrolyte activities among various study subjects.

References

1. Krueger G, Ellis CN (2005) Psoriasis-recent advances in understanding its pathogenesis and treatment. *J Am Acad Dermatol* 53: 94-100.
2. Boehncke WH, Schon MP (2015) Psoriasis. *Lancet* 386: 983-994.
3. Christophers E (2001) Psoriasis-epidemiology and clinical spectrum. *Clin Exp Dermatol* 26: 314-320.
4. Pietrazak A (2010) Department of Dermatology and Venereology, Medical University of Lublin, Poland-Lipid disturbances in Psoriasis in Mediators of inflammation 535-612.
5. Larisa H (2006) Psoriasis Update. *Skin & Aging* 14: 46-50.
6. Nestle FO, Kaplan DH, Barker J (2009) Psoriasis. *N Engl J Med* 361: 496-509.
7. Freedberg IM, Arthur ZE, Klaus W, Frank KA, Lowell AG, et al. (2003) *Fitzpatrick's Dermatology in General Medicine* (6th edn), Mc Graw-Hill ISBN 0071380760.
8. William DJ, Timothy GB (2006) *Andrews' Diseases of the Skin: Clinical Dermatology* (10th edn), saunders ISBN 0721629210.
9. Roumelioti ME, Glew RH, Khitan ZJ, Rondon-Berrios H, Argyropoulos CP, et al. (2018) Fluid balance concepts in medicine: Principles and practice. *World J Nephrol* 7: 1-28.
10. Covington AK. Introduction: Basic Electrode Types, Classifications, and Selectivity Considerations. In: Covington AK (ed.) *Ion Selective Electrode Methodology* CRC Press. Boca Raton 1-20.
11. Meyerhoff ME, Opdycke WN (1986) Ion Selective Electrodes. *Advances in Clinical Chemistry* 25: 1-47.
12. Frant MS (1994) History of the Early Commercialization of Ion-selective Electrodes. *Analyst* 199: 2293-2301.
13. Lee Y, Je YJ, Lee SS, Li ZJ, Choi DK, et al. (2012) Changes in transepidermal water loss and skin hydration according to expression of aquaporin-3 in psoriasis. *Ann Dermatol* 24: 168-174.
14. Hassan IA, Kazi TG, Kazi N, Kandhro GA, Baig JA, et al. (2011) Evaluation of cadmium, chromium, nickel, and zinc in biological samples of psoriasis patients living in pakistani cement factory area. *Biol Trace Elem Res* 142: 284-301.
15. Pratyusha, Sashidhar Reddy B, Sangeeth (2018) To assess the levels of lipid profile, uric acid, albumin/globulin ratio and trace elements in the serum of psoriasis patients. *Int J Contemporary Med Res* 5: B13-B16.
16. Estabraq A, Wasan T, Sami M (2011) Serum Copper, Zinc and Oxidative Stress in Patients with Psoriasis. *Iraqi J Med Sci* 9: 137-142.
17. Barrea L, Balato N, Di Somma C, Macchia PE, Napolitano M, et al. (2015) Nutrition and psoriasis: is there any association between the severity of the disease and adherence to the Mediterranean diet? *J Transl Med* 13: 18.
18. Basavaraj K, Darshan M, Shanmugavelu P, Rashmi R, Yuti MA, et al. (2009) Study on the levels of trace elements in mild and severe psoriasis. *Clin Chim Acta* 405: 66-70.
19. Grundin TG, Roomans GM, Forslind B, Lindberg M, Werner Y (1985) X-ray microanalysis of psoriatic skin. *J Invest Dermatol* 85: 378-380.
20. Romana-Souza B, Lima-Cezar GS, Monte-Alto-Costa A (2015) 'Psychological stress-induced catecholamines accelerates cutaneous aging in mice', Department of Histology and Embryology.
21. McKay LI, Cidlowski JA. Physiologic and pharmacologic effects of Corticosteroids. In: Kure DW, Pollock RE, Weichselbaum RR, Bast RC, Ganglier TS, et al. (eds.) *Holland-Frei Cancer Medicine* (6edn), Hamilton, Ontario: Decker.
22. Dr. Lawrence W (2017) L.D. Wilson Consultants.,Inc."The Sodium /Potassium Ratio."
23. Latimer KS, Mahaffey EA, Prasse KW (2003) *Duncan and Prasse's Veterinary Laboratory Medicine: Clinical Pathology* (4th edn), Ames, IA: Blackwell.
24. Stockham SL, Scott MA (2011) *Fundamentals of Veterinary Clinical Pathology* (2nd edn), Ames, IA: Blackwell. *Can Vet J* 52: 161.