British Journal of Medicine & Medical Research
11(5): 1-8, 2016, Article no.BJMMR.20759
ISSN: 2231-0614, NLM ID: 101570965

SCIENCEDOMAIN *international*
www.sciencedomain.org

A Study of Prevalence of Metabolic Syndrome in Patients of Psoriasis of North India

Ashish Dalal[1*], Aneet Mahendra[1] and Sanjeev Gupta[1]

[1]MM Medical College and Hospital, Solan, Himachal Pradesh, India.

Authors' contributions

This work was carried out in collaboration between all authors. Author AD designed and conducted the study and wrote the study protocol. Author AM drafting and revision of manuscript. Author SG study supervision and statistical analysis. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/BJMMR/2016/ 20759
Editor(s):
(1) E. Umit Bagriacik, Department of Immunology, Gazi University, Turkey.
Reviewers:
(1) Farhana Tahseen Taj, KLE University, India.
(2) Anonymous, ECHS Polyclinic, India.
(3) Mutlu Çayırlı, Mevki Military Hospital, Turkey.
Complete Peer review History: http://sciencedomain.org/review-history/11627

Original Research Article

Received 7th August 2015
Accepted 12th September 2015
Published 29th September 2015

ABSTRACT

Aim: To assess the prevalence of Metabolic Syndrome in patients of psoriasis and its relation with disease severity.
Materials and Methods: The study was cross sectional and hospital based. It was conducted on one hundred psoriasis patients of psoriasis between 18 to 70 years of age and of either sex. The severity of disease was assessed using PASI and BSA involved. Metabolic syndrome was diagnosed on the basis of South Asian Modified National Cholesterol Education Program's Adult Treatment Panel III.
Results: The overall prevalence of MS in our study was 42%, which is nearly three times as compared with the prevalence of MS in general population. Presence of MS did not have any association with the severity of psoriasis as assessed by PASI and BSA involvement. Overall disturbances in lipid profile (31% and 29% were having high TG level and low HDL level respectively) and abdominal obesity (30%) were the most important factors contributing to increased prevalence of MS. These were followed by increased BP(26%) and high FPG level (23%).
Conclusion: Due to increased prevalence of MS in psoriasis, dermatologists should go for simple

**Corresponding author: Email: ashishdalal6008@gmail.com;*

cardiovascular evaluations like BMI, blood pressure, fasting plasma glucose and lipid profile to prevent further morbidity.

Keywords: Psoriasis; metabolic syndrome; lipid profile.

1. INTRODUCTION

Psoriasis is a common, chronic, disfiguring, inflammatory and proliferative condition of the skin that affects around 1-3% of population [1], in which both genetic and environmental influences have a critical role. It accounts for 2.3% of total dermatological out patients in North India [2]. The most characteristic lesions consist of reddish, sharply demarcated, indurated plaques present predominantly over extensor surfaces and scalp.

Psoriasis is a genetically determined disease that is aggravated by environmental factors. However the exact pathogenesis is not clear. Currently psoriasis is hypothesized to be an inflammatory disorder centered on cytokines like IL-1, IL-2, IL-6, INF-gamma and TNF-α. Being a chronic immune-inflammatory mediated disease, it can predispose patients to other inflammatory conditions like insulin resistance, obesity, dyslipidemia and hypertension—components that characterizes the metabolic syndrome [3]. Shared genetic risk loci may also account for at least part of the observed association. For e.g. - *CDKAL1* is associated with both psoriasis and type2 diabetes, whereas *PTPN22* is associated with psoriasis and type 1 diabetes. Major factors contributing to this unfavorable cardiovascular risk profile include cigarette smoking, obesity, physical activity, and psychological stress which have a higher prevalence among patients with psoriasis [4,5]. Weight gain has been recently demonstrated to be clinical determinants of MS. A Framingham Heart Study report indicated that a weight increase of ≥2.25 kg over a period of 16 yrs. was associated with an up to 45% increased risk of developing the MS [6], and it has been shown by Palaniappan et al. [7] that each 11 cm increase in waist circumference (WC) is associated with an adjusted 80% increased risk of developing the syndrome within 5 years. Patients with the MS are at 2- to 4-fold increased risk of stroke, a 3- to 4-fold increased risk of myocardial infarction (MI), and 2-fold the risk of dying from such an event compared with those without the syndrome [2].

A growing amount of literature suggests that long term management considerations should not be limited to a focus on the skin, nails and joints [8,9] as epidemiological research has shown that hypertension, heart failure and diabetes are significantly more common in patients with psoriasis than in controls. Henseler and Cristopher in 1995 observed for the first time that there is correlation between psoriasis and obesity [10]. A low prevalence of multiple cardiovascular risk factors (smoking, hypertension, dyslipidemias, diabetes and MS) in adolescents and rapid escalation of these risk factors by age of 30-39 years is noted in urban Asian Indians. The combined presence of conditions like diabetes mellitus type II, arterial hypertension, hyperlipidemia and coronary heart disease together with obesity, known as the metabolic syndrome, was clearly more prevalent in psoriasis patients [11]. Neimann et al. [12] found that prevalence rates of risk factors for MS like coronary heart disease, DM, dyslipidemia, hypertension and obesity were more common in patients with severe psoriasis than with mild psoriasis.

However, there are only few studies documented, so far on the risk factors and comorbidities associated with psoriasis in Indian people [13,14].

Comprehensive data about prevalence and morbidity of metabolic syndrome and the correlation between severity and duration of disease are still lacking in the Indian context. So our aim was to evaluate the prevalence of metabolic syndrome in psoriasis patients and in addition, its association with disease duration and severity if any.

2. MATERIALS AND METHODS

This prospective study was conducted on 100 patients of psoriasis vulgaris of either sex who attended the Dermatology OPD at a tertiary care center, Maharishi Markendeshwar Institute of Medical Sciences and Research, Mullana, Ambala, Haryana, India from October 2012 to mid-2014. The major proportion of patients in Skin OPD had diseases like endogenous eczema, contact dermatitis, superficial fungal infection, urticaria, scabies etc. However the number of patients having psoriasis was variable throughout the year, with more patients reporting

in winters. Both old and newly diagnosed patients having psoriasis for at least six months but not on any systemic medication were selected for the study. The participation was totally voluntary and a written, informed consent in a language understandable to the subject, explaining the purpose of the research, expected duration of the subject's participation, and description of the investigations to be carried out, was taken from all the subjects willing to participate in the study. A detailed medical history along with physical examination was undertaken and a proforma was designed with special references to the age, gender, weight, height, BMI (Quetelet's index)[weight(kg)/height(m)^2], waist circumference, blood pressure, smoking, alcohol, age of psoriasis onset, type and severity of disease, presence of psoriatic arthropathy and concomitant medications. Patients with atypical presentation of psoriasis and with history of familial dyslipidemia were excluded from the study.

Each participant was thoroughly examined by two dermatologists, who classified psoriasis based on clinical phenotype according to the *International classification of Diseases, Tenth revision.* Classically, the disease involves extensors of the trunk (Fig. 1) and nails in form of transverse grooves on nail plate (Beau's lines), subungual hyperkeratosis, pitting etc. (Fig. 2). Extent of involvement and severity of the disease were assessed according to BSA (body surface area) involvement and PASI (Psoriasis Area and Severity Index) score respectively.

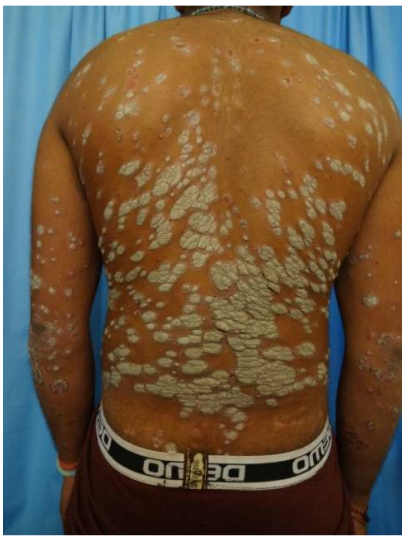


Fig. 1. Scaly plaques in patient of psoriasis

Metabolic syndrome was diagnosed as per criteria of the South Asia modified National Cholesterol Education Program, Adult Treatment Panel III (SAM-NCEP ATP III) [15]. By presence of three or more of the five criteria, as mentioned in Table 2.

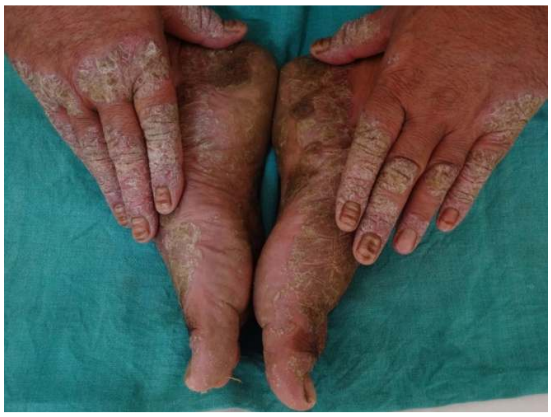


Fig. 2. Palmo-plantar psoriasis involving nails

Blood pressure was measured in the supine position, manually in both arms, by a calibrated sphygmomanometer after patient had been sitting for 5 minutes. Waist Circumference was measured at a level just above the iliac crest, positioning the tape horizontally (Fig. 3). Venous samples were taken at the enrolment visit after the subjects had fasted overnight (at least 8 hrs.) Serum cholesterol and triglycerides were measured with enzymatic procedure. Plasma glucose was measured using a glucose oxidase method.

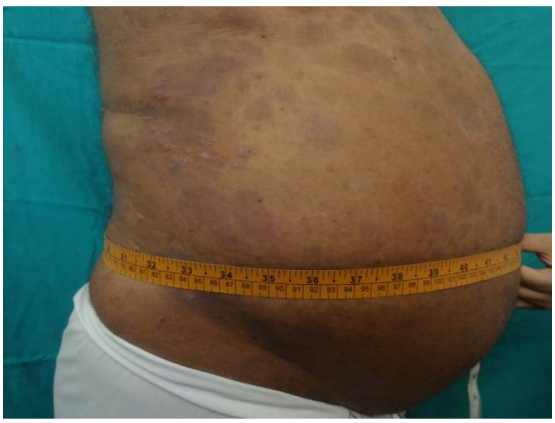


Fig. 3. Waist measurement just above the level of iliac crest

The study was approved by the institutional ethical committee. Analysis was done (using

SPSS, version 17) to find out the association between psoriasis and different attributes like waist circumference, hypertriglyceridemia, elevated HDL, blood pressure, plasma glucose, severity and duration of the disease, smoking, alcoholism etc. The level of significance used was 0.05 for the corresponding degree of freedom. A P-value > 0.05 was not considered as statistically significant and a P-value < 0.05 was considered statistically significant with value <0.001 as highly significant.

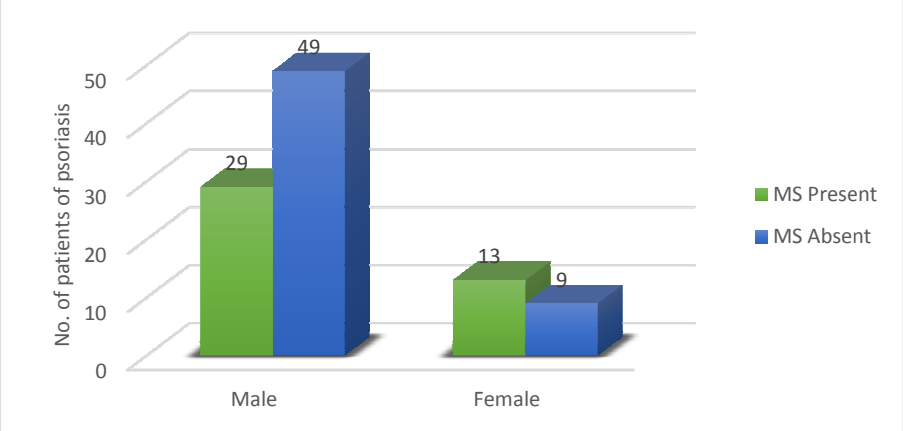
3. RESULTS

This study included 100 patients of psoriasis with mean age 39.92±14.85 (range 18-75 years), and male to female ratio 7:2 (male=78, female=22). Descriptive characteristics of study population are reported in Table 1. Mean body surface area (BSA) involvement was 12.94±13.94% and mean (PASI) was 6.14±4.99. However no statistical significance was noted between BSA involved and MS (*P*= .995); PASI and MS (*P*= .207). Among the study group, 6 patients were hypertensive, 8 had diabetes mellitus and 3 were suffering from respiratory disease (1 patient each had bronchial asthma, COPD and pulmonary tuberculosis).The most common presentation in subjects was of Chronic plaque type (79%) whereas 16% of patients of psoriasis presented as mixed type and only 5% presented as Guttate type. Family history of psoriasis vulgaris was present in only 5% of the patients.

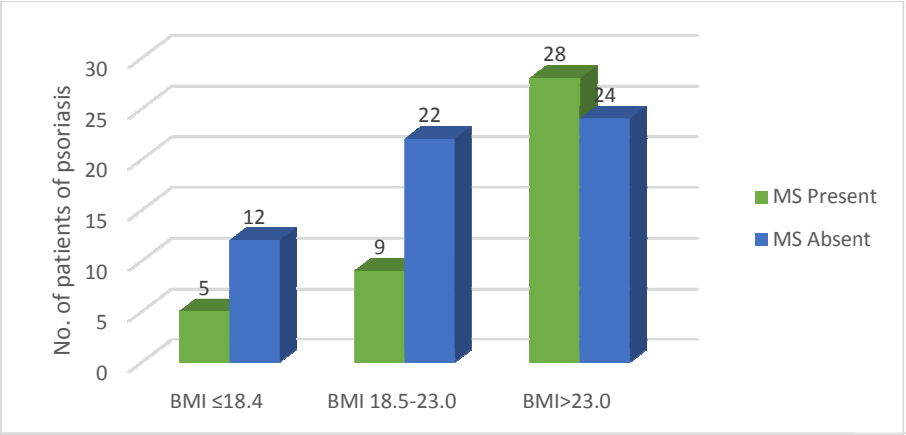
Out of 100 patients of psoriasis, 42 were having Metabolic Syndrome. Among males, 29 (37%) were having MS whereas among females, 13 (59%) were having MS (Graph1), which was not found statistically significant (*P*=.065). It was mainly observed after the 2nd decade and significant (*P*= .003) association was seen between the prevalence of MS and increase in age of patients. It was observed that as the duration of disease increased, the percentage of patients having MS also increased which was not statistically significant (*P*= .132). Distribution of patients having MS according to individual parameters of MS is as described in Table 2. In patients having MS (n=42), dyslipidemia (n=31) and higher WC (n=30) were observed most commonly. Twenty nine and 23 patients were having low level of plasma HDL and higher fasting plasma glucose levels respectively. Twenty six patients were found to be hypertensive. A significant correlation (*P*= .026) between Body Mass Index (BMI) and prevalence of MS was seen, as described in Graph 2.

4. DISCUSSION

Psoriasis affects nearly 2 to 3% of the world's population. It is a multi-systemic inflammatory disease where skin and joints are primarily involved, presenting as erythematous and indurated scaly plaques. There are many reports worldwide that psoriatic patients tend to have concurrent illnesses that are termed as comorbidities, like psoriatic arthritis. Recently studies in western population have highlighted the association between psoriasis with diabetes, obesity, dyslipidemia and cardiovascular disorders; though there are remarkably only a few studies from India [16].



Graph 1. Gender wise distribution of metabolic syndrome



Graph 2. Distribution of patients according to BMI

Table 1. Descriptive characteristics of study population

Baseline characteristics	Psoriasis patients
Age (years) (Mean ± SD)	39.92±14.85
Mean duration of disease (years)	5.65±5.32
Male/Females (n)	78/22
BSA involvement (Mean ± SD)	12.94±13.9435
PASI (Mean ± SD)	6.14±4.9957
Alcohol (n)	22
Smoking (n)	31
BMI(kg/m^2) (Mean ± SD)	23.93±5.27
Waist circumference (Mean ± SD)	85.047±11.6
FPG(mg/dl), (Mean ± SD)	97.48±23.0522
Cholesterol(mg/dl), (Mean ± SD)	179.42±43.014
TG (mg/dl), (Mean ± SD)	170.3±89.9094
HDL(mg/dl), (Mean ± SD)	42.94±9.4728
LDL(mg/dl), (Mean ± SD)	99.7879±28.9779
SBP(mmHg), (Mean ± SD)	127.71±12.3045
DBP(mmHg), (Mean ± SD)	81.18±7.2535

BSA, Body Surface Area; BMI, Body Mass Index; DBP, Diastolic Blood Pressure; FPG, Fasting Plasma Glucose; HDL, High Density Lipoprotein; LDL; Low Density Lipoprotein, PASI, Psoriasis Area and Severity Index; SBP, Systolic Blood pressure; TG, Triglycerides

Table 2. Distribution of patients of psoriasis having Metabolic Syndrome (MS) according to individual parameters of MS

Metabolic syndrome parameters	Male patients with MS (n=29)	Female patients with MS (n=13)	Total
Waist Circumference (males ≥90 cm, females ≥ 80cm)	18 (60 %)	12 (40 %)	30 (100%)
Hypertriglyceridemia (TG ≥ 150 mg/dl)	23 (74.19 %)	8 (25.81 %)	31 (100%)
Low High Density Lipoprotein (males < 40, females < 50 mg/dl)	17 (58.62 %)	12 (41.38 %)	29 (100%)
High Blood Pressure (≥ 130/85 mm Hg)	20 (76.92 %)	6 (23.08 %)	26 (100%)
High Fasting Plasma Glucose (≥ 100 mg/dl)	17 (73.91 %)	6 (26.09 %)	23 (100%)

The Metabolic Syndrome consists of constellation of metabolic abnormalities that confer increased risk of cardiovascular disease (CVD) and diabetes mellitus (DM). It was initially observed in 1923 by Kyln [17] and later on has been given several names, including the 'Metabolic Syndrome', the 'Insulin Resistance Syndrome', the 'Plurimetabolic Syndrome', and the 'Deadly Quartet'. It was originally described as the clustering of four conditions that when

present together in one individual increased the risk of cardiovascular disease. The four conditions were glucose intolerance, hypertension, dyslipidemia and central obesity. After the initial work done by McDonald in 1978, several hundred studies have been conducted worldwide to examine the association between psoriasis and individual components of MS.

Psoriasis and MS share certain proinflammatory cytokines and immunological mediators but the exact link is yet to be elucidated. Proinflammatory cytokines like TNF-α, IL-6 etc. and other adipocytokines such as leptin, PAI-1 which are over expressed in psoriasis plaques, are known to contribute to features of the metabolic syndrome, such as dyslipidemia, hypertension and insulin resistance [17].

In the current study, prevalence of MS (according to the SAM NCEP-ATPIII criteria) [15] was 42 % among the patients of psoriasis, which was in concordance with the studies conducted by Madanagobalane et al. [18], Gisondi et al. [19] and Love et al. [20]. A study conducted in general population in Jaipur [21], using the modified NCEP ATPIII criteria, reported 13% prevalence of MS. Almost similar prevalence of MS (i.e. 11.2%) was reported in the general population in a study conducted in Chennai [22], using the EGIR (European Group for the Study of Insulin Resistance) criteria. So as compared to the prevalence of MS in general population, prevalence of MS in patients of psoriasis was found to be almost thrice as reported in our study. Whereas lower prevalence of MS in psoriatic patients as compare to our study was reported by Nisa et al. [14] and Choi et al. [23] i.e. 28% and 17.8% respectively. These findings explain the increased future risk of cardiovascular-metabolic morbidity and mortality among individuals with psoriasis. Also the prevalence of MS varies among populations because of differences in genetic background, diet, level of physical activity, levels of over and under nutrition, and body habits.

Comparing various variables, an overall increasing trend was observed in prevalence rate of MS with increase in the age in our study and this was also statistically significant (*P*= .003). These finding were in concordance with the study conducted by Kanjilal et al. [24] and Reddy et al. [25] who reported highest prevalence in 6th decade. However this trend was discordant with the findings of Berner et al. [26] where the prevalence of MS peaked in the 30-39 years age group among males and the 40-49 years age group among females. This difference of findings can be due to the fact that their study was conducted in urban area (New York) of a developed country where the dietary patterns and lifestyle behaviors are markedly different from our area while the present study was conducted in rural area of a developing country. Regarding disease duration of psoriasis and the prevalence of MS, our study similarly to other studies by Madanagobalane et al. [18] and Mallbris et al. [27] did not find significant relationship, whereas Nisa et al. [14] found a higher prevalence of MS in psoriasis patients those having longer mean disease duration.

There have been conflicting reports on the relationship between the severity of psoriasis and the presence of MS. In our study, no significant relationship was seen in between disease severity assessed by PASI and prevalence of MS (*P*= .207). Other studies conducted by Madanagobalane et al. [18], Nisa et al. [14] and Gisondi et al. [19] have also shown that prevalence of MS doesn't correlate with the disease severity and extent of involvement. However, Sommer et al. [11] and Choi et al. [23] found positive correlation between disease severity and prevalence of MS.

The inflammatory hypothesis has gained popularity as an explanation for increased risk of cardiovascular disease and diabetes mellitus, in diseases characterized by chronic inflammatory diseases such as psoriasis, rheumatoid arthritis, SLE etc. Cytokines characteristics for psoriatic inflammation such as TNFα and IL-6 present in high levels both systemically and locally have been shown to induce insulin resistance. Moreover it is also possible that patients with psoriasis use topical CS for long periods, which are absorbed systemically and predispose the patient to diabetes. In the current study, 30% of the patients of psoriasis were having high fasting plasma glucose level (≥100 mg/dL). Almost similar or higher percentage was reported by Love et al. [20], Al-Mutairi et al. [28], Pereira et al [29] and Madanagobalane et al. [18]. Whereas Sommer et al. [11], Ghiasi et al. [30], Nisa et al. [14] and Gisondi et al. [19] reported lower prevalence of fasting plasma glucose levels i.e 11.7%, 17.7%, 18% and 19% respectively.

Several reports suggested that psoriatic patients have a proatherogenic lipoprotein profile including hypertriglyceridemia, raised plasma concentration of LDLc, VLDLc and lipoprotein (a), a lowered HDLc concentration, and apolipoprotein B (apoB), as well as low

concentration of Apo A-1. These lipid abnormalities seen in psoriatic patients, while promoting atherosclerosis, might in parallel facilitate and maintain the systemic inflammatory reaction predisposing to MS. Dyslipidemia was also present in our study as 52% patients were having low HDL level and 48% were having hypertriglyceridemia. Almost similar findings were reported by Nisa et al. [14]. The findings of current study were disconcordant with Madanagobalane et al. [18] and Love et al. [20] who reported 30% and 33% of patients with low HDL levels respectively. In the studies conducted by Gisondi et al. [19] and Madanagobalane et al. [18], a lower percentage of patients had raised TG levels. A higher percentage (64%) of patients with abnormal plasma HDL level was reported by Periera et al. [29].

Ghiasi et al. [30] found that psoriatic patients are at 2.2 time's higher risk for developing hypertension than non-psoriatic patients. Contributing factors may include cigarette smoking, dyslipidemia, obesity, physical inactivity and psychological stress. In our study, 37% patients were hypertensive (B.P ≥ 130/85 mm Hg) which was almost similar to that by Gisondi et al. [19] (40%) and Al-Mutairi et al. [28] (32%). However Sommer et al. [11] and Love et al. [20] reported lower prevalence of hypertension among the patients of psoriasis i.e. 21% and 28% respectively.

5. CONCLUSION

Overall disturbances in lipid profile (increased TG levels in 31% and low HDL in 29%) and abdominal obesity (30%) were the most important factors contributing to increased prevalence of MS in psoriasis in the present study. Hence a dermatologist should go for simple cardiovascular evaluations like BMI, blood pressure, fasting plasma glucose and lipid profile. Knowledge of the distribution of cardiovascular risk factors in psoriasis patients would allow primary and secondary preventive measures to be applied.

6. STUDY LIMITATIONS

As the present study was a cross sectional type, the directionality of association between psoriasis and MS could not be determined i.e it cannot be concluded what happened first, psoriasis or MS.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Schon MP, Boehncke WH. Psoriasis. N Engl J Med. 2005;352:1899–912.
2. Kaur I, Handa S, Kumar B. Natural history of psoriasis: A study from the Indian subcontinent. J Dermatol. 1997;24:230-4.
3. Krueger JG, Bowcock A. Psoriasis pathophysiology: Current concepts of pathogenesis. Ann Rheum Dis. 2005; 64(Suppl 2):ii30-6.
4. Gottlieb AB, Dann F, Menter A. Psoriasis and the metabolic syndrome. J Drugs Dermatol. 2008;7(6):563-72.
5. Christophers E. Comorbidities in psoriasis. J Eur Acad Dermatol Venereol. 2006; 20:52-5.
6. Wilson PWF, Kannel WB, Silbershatz H, D'Agostino RB. Clustering of metabolic factors and coronary heart disease. Archives of Internal Medicine. 1999; 159(10):1104–1109,.
7. Palaniappan L, Carnethon MR, Wang Y, et al. Predictors of the incident metabolic syndrome in adults: The Insulin Resistance Atherosclerosis Study. Diabetes Care. 2004;27(3):788–793.
8. Mehta NN, Azfar RS, Shin DB, Neimann AL, Troxel AB, Gelfand JM. Patients with severe psoriasis are at increased risk of cardiovascular mortality: Cohort study using the general practice research database. Eur Heart J. 2010;31(8):1000-6.
9. Ahlehoff O, Gislason GH, Charlot M, Jørgensen CH, Lindhardsen J, Olesen JB, et al. Psoriasis is associated with clinically significant cardiovascular risk: A Danish nationwide cohort study. J Intern Med. 2011;270(2):147-57.
10. Henseler T, Christophers E. Disease concomitance in psoriasis. J Am Acad Dermatol. 1995;32:982–6.
11. Sommer DM, Stefan Jenisch, Michael Suchan. Increased prevalence of metabolic syndrome in patients with moderate to severe psoriasis. Arch Dermatol Res. 2006;298:321-8.
12. Neimann AL, Shin DB, Wang X, Margolis DJ, Troxel AB, Gelfand JM. Prevalence of cardiovascular risk factors in patients with psoriasis. J Am Acad Dermatol. 2006;55: 829-35.
13. Sundharam JA, Singh R, Agarwal PS. Psoriasis and diabetes mellitus. Indian J Dermatol Venereol Leprol. 1980;46:158-62.

14. Nisa N, Qazi MA. Prevalence of metabolic syndrome in patients with psoriasis. Indian J Dermatol Venereol Leprol. 2010;76:662-5.
15. Enas EA, Mohan V, Deepa M, Farooq S, Pazhoor S, Chennikkara S. The metabolic syndrome and dyslipidemia among Asian Indians: A population with high rates of diabetes and premature coronary artery disease. J Cardiometab Syndr. 2007;2: 267-75.
16. Mahajan R, Handa S. Pathophysiology of psoriasis. Indian J Dermatol Venereol Leprol. 2013;79(Suppl 7):S1-9.
17. Steinthorsdottir V, Thorleifsson G, Reynisdottir I, Benediktsson R, Jonsdottir T, Walters GB, et al. A variant in CDKAL1 influences insulin response and risk of type 2 diabetes. Nat Genet. 2007;39(6):770-5.
18. Madanagobalane S, Anandan S. Prevalence of metabolic syndrome in South Indian patients with psoriasis vulgaris and the relation between disease severity and metabolic syndrome; A hospital based case control study. Indian J Dermatol. 2012;57(5):353-7.
19. Gisondi P, Tessari G, Conti A, Piaserico S, Peserico S, Giannetti A, et al. Prevalence of metabolic syndrome in patients with psoriasis: A hospital-based case-control study. Br J Dermatol. 2007;157:68-73.
20. Love TJ, Qureshi AA, Karlson EW, Gelfand JM, Choi HK. Prevalence of the metabolic syndrome in psoriasis. Arch Dermatol. 2011;147:419-24.
21. Ramachandran ASC, Satyavani K, Sivasankari S, Vijay V. Metabolic syndrome in urban Asian Indian adults-a population study using modified ATP III criteria. Diabetes Res Clin Pract. 2003;60:199-204.
22. Deepa M, Farooq S, Datta M, Deepa R, Mohan V. Prevalence of metabolic syndrome using WHO, ATPIII and IDF definition in Asian Indians: The Chennai Urban Rural Epidemiology Study (CURES-34). Diabetes/Metabolic Research and Reviews. 2006;23(2):127-34.
23. Choi WJ, Park EJ, Kwon IH, Kim KH, Kim KJ. Association between psoriasis and cardiovascular risk factors in Korean Patients. Ann Dermatol. 2010;22:300-6.
24. Kanjilal S, Shanker J, Rao VS, Khadrinarasimhaih NB, Mukherjee M, Iyengar SS, et al. Prevalence and component analysis of metabolic syndrome: An Indian atherosclerosis research study perspective. Vasc Health Risk Manag. 2008;4(1):189-97.
25. Reddy KS, Prabhakaran D, Chaturvedi V, Jeemon P, Thankappan KR, Ramakrishnan L, et al. Methods for establishing a surveillance system for cardiovascular diseases in Indian industrial populations. Bull World Health Organ. 2006;84(6):461-9.
26. Bener A, Zirie M, Musallam M, Khader YS, Al-Hamaq AO. Prevalence of metabolic syndrome according to adult treatment panel III and International Diabetes Federation criteria: A population-based study. Metab Syndr Relat Disord. 2009;7(3):221-9.
27. Mallbris L, Granath F, Hamsten A, Stahle M. Psoriasis is associated with lipid abnormalities at the onset of skin disease. J Am Acad Dermatol. 2006;54:614-21.
28. Al-Mutairi N, Al-Farag S, Al-Mutairi A, Al-Shiltawy M. Comorbidities associated with psoriasis: An experience from the Middle East. J Dermatol. 2010;37(2):146-55.
29. Pereira R, Sangeeta TA, Varthakavi PK. A study of the prevelance of diabetes, insulin resistence, lipid abnormalities and cardiovascular risk factors in patients with chronic plaque psoriasis. Indian J Dermatol. 2011;56(5):520-6.
30. Ghiasi M, Nouri M, Abbasi A, Hatami P, Abbasi MA, Nourijelyani K. Psoriasis and increased prevalence of hypertension and diabetes mellitus. Indian J Dermatol. 2011;56(5):533-6.

Peer-review history:
The peer review history for this paper can be accessed here:
http://sciencedomain.org/review-history/11627