

Assessment of Adiposity in Patients with Psoriasis and its Correlation with Disease Severity: A Case-Control Study

Abstract

Background: Psoriasis and obesity are known to share many mediators of inflammation with each other such as TNF- α and IL-6. Obesity, being a low-grade inflammatory state, is known to affect the disease course, severity, predisposition, and response to therapy in psoriatic patients. Whole-body dual-energy X-ray absorptiometry (DEXA) is a proven method to estimate total, abdominal, and extremity fat mass. **Objectives:** The present study aimed to assess the correlation of the severity of psoriasis with adiposity using regional fat mass DEXA indices. **Patients and Methods:** This was a case-control study involving 153 cases followed through till the completion of the study. A total of 153 age and gender-matched controls were included in the study after ruling out confounding factors. DEXA scans were conducted on both cases and controls; the following indices, including total body fat percentage, android–gynoid ratio, and trunk/limb fat mass ratio, were analyzed. **Results:** The total fat percentage, as assessed by DEXA scan, had a mean of 29.13 ± 9.66 (32.12 ± 9.51 for cases and 26.13 ± 8.87 for controls) with a significant P value of <0.001 . The android/gynoid ratio had a mean of 1.01 ± 0.22 (1.09 ± 0.21 for cases and 0.93 ± 0.21 for controls). Percentage fat trunk/percentage fat limbs (central/peripheral fat) had a mean of 1.05 ± 0.16 (1.08 ± 0.15 for cases and 1.03 ± 0.16 for controls) with a significant P value of <0.001 . The correlation of DEXA adiposity grading with the severity of psoriasis was found to be significant, with a P value of <0.001 . **Limitations:** The cross-sectional design restricts assessment to associations rather than causality. Although major confounding factors were ruled out during recruitment, variables such as lifestyle and dietary habits, physical activity levels, and treatment history were not the primary focus and hence not extensively analyzed. The sample size analyses, such as stratification by gender or treatment modalities, may benefit from larger cohorts in future research. **Conclusion:** DEXA is a useful indicator of adiposity, with greater total fat percentage, android/gynoid ratio, and trunk/limb fat mass ratio in cases compared to controls and it was positively correlated with the severity of psoriasis in our study.

Keywords: Adiposity, dual-energy X-ray absorptiometry, psoriasis

Introduction

Psoriasis is a persistent inflammatory disease affecting multiple systems, characterized by a complex pathogenesis involving genetic, immunological, and environmental factors. It falls under the category of papulosquamous disorders within dermatology, displaying diverse morphological variations, severity levels, and courses of illness. In the Jammu and Kashmir region, the prevalence of psoriasis is reported to be 2–4%,^[1] significantly higher (2–3 times) than the rest of North India, based on comparable studies.^[2] This elevated prevalence substantially amplifies the disease burden within this population.

Various risk factors, such as obesity, alcoholism, smoking, diabetes, and

coronary artery disease, are associated with psoriasis and contribute to increased disease severity.^[3,4] Obesity, recognized as a chronic low-grade inflammatory condition, shares inflammatory mediators like tumor necrosis factor (TNF- α) and interleukin (IL-6) with psoriasis.^[5–7] Anthropometric measures such as waist circumference or waist-to-hip ratio, indicating central or abdominal adiposity, serve as significant indicators of health risk and are linked to psoriasis or psoriatic arthritis.

In a study by Setty *et al.*, increased waist circumference and waist-to-hip ratio correlated with the risk of incident psoriasis.^[8] Evaluating fat mass and distribution more precisely can be achieved through dual-energy X-ray absorptiometry (DEXA),

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which is considered the reference method for measuring body composition. DEXA, a relatively recent technique for body composition assessment, provides estimations of body adiposity with a small margin of error.^[9,10]

The objective of this study is to assess the role of DEXA scans in estimating body fat percentage and distribution in psoriasis cases. It aims to establish correlations between the severity of psoriasis, as determined by the Psoriasis Area and Severity Index (PASI), and adiposity measured through DEXA scan. This correlation analysis seeks to facilitate the early initiation of specific management strategies, allowing modification of the course and severity of the disease process.

Patients and Methods

Our study was a case-control study conducted in the postgraduate departments of dermatology and radiodiagnosis for one and a half years. Psoriasis was diagnosed based on the typical clinical appearance, distribution, and elicitation of Auspitz's sign. Any postmenopausal, pregnant, and lactating women, patients with a history of alcohol intake, presence of other chronic inflammatory diseases or neoplasia, current use of systemic glucocorticoids, retinoids, statins, growth hormones, anabolic agents, or hormone replacement therapy were excluded from the study. Written informed consent was obtained from all the patients. Ethical committee clearance was obtained before starting the study.

Psoriasis was graded as mild, moderate, or severe according to PASI scoring. Patients were referred to the Department of Radiodiagnosis for evaluating body fat using DEXA scanning.

DEXA technique was performed using the Hologic Discovery USA machine within one week of blood tests and ultrasonography (USG), and was then interpreted by a single trained investigator. The scans were performed after a 12-hour fast (i.e., no food or liquids), with the subject in a supine position with all metal accessories removed. The percentage of total body fat was calculated by the ratio of total fat mass/total body mass. The body fat composition was assessed for the limbs, trunk, android, and gynoid regions, along with total body fat percentage, android/gynoid ratio, and trunk/limb fat mass ratio. Body fat percentage, as measured using DEXA, was used to categorize patients as obese, overweight, normal weighed, or underweight as per the reference criteria.^[10]

Statistical analysis

Data was entered into Microsoft Excel spreadsheet and analyzed using SPSS Version 23. Categorical variables were described as frequencies and percentages, while continuous variables were summarized with minimum, maximum, mean, standard deviation, median, and interquartile range (IQR). Chi-square test was used to analyze the relationship between

two categorical variables, and *t*-tests were used to compare various continuous variables between two groups. A *P* value of ≤ 0.05 was taken as statistically significant.

Ethical consideration

There were no ethical issues involved in the study, as all the investigations were routinely performed in psoriatic patients. DEXA is a better modality for assessing adiposity. The radiation exposure from DEXA is extremely low (almost negligible), measuring 0.1–0.4 microSv, which is well below the background value of 7 microSv per day.

Results

A total of 187 newly diagnosed cases of psoriasis (age >18 years) were enrolled in the study. Of these, 28 patients were lost to follow-up on the hospital's conversion to a coronavirus disease (COVID) center, six patients did not complete all investigations, and 153 patients followed through till the completion of the study. A total of 153 non-psoriatic patients were included as controls and could not be exactly age and gender-matched, with 84 (54.9%) and 90 (58.8%) males and 69 (45.1%) and 63 (41.2%) females in cases and control groups, respectively [Table 1]. The age of participants ranged from 19 to 70 years, with a mean age of 42.96 ± 13.89 years. The mean age in cases was 42.72 ± 13.34 and 43.21 ± 14.46 in controls. On comparing the age and gender in the two groups, the difference was not statistically significant (*P* value of 0.56 and 0.76, respectively, in the gender and age comparison between the two groups).

In the study group, a total of 83 (54.24%) cases had severe psoriasis, as calculated by the PASI scoring system. DEXA scanning adiposity grading showed 87 (28.4%) of our participants to be obese, 102 (33.3%) overweight, 101 (33%) with normal weight, and 16 (5.2%) underweight.

Among these, the distribution of underweight, normal weight, overweight, and obese was 8 (5.2%), 20 (13.1%), 51 (33.3%), and 74 (48.4%) in cases and 8 (5.2%), 81 (52.9%), 51 (33.3%), and 13 (8.5%) in controls, respectively, with a significant *P* value of <0.001 [Figure 1]. The android/gynoid ratio was observed to be normal in 156 (5.2%) and raised in 150 (49%) of the participants. Of the cases, 50 (32.7%) and 103 (67.3%) had normal and raised android/ gynoid ratio. The corresponding figures in the controls were 106 (69.3%) and 47 (30.7%). The difference was significant with a *P* value of <0.001 [Figure 2, Tables 2 and 3].

Total fat percentage as assessed by DEXA scan had a mean of 29.13 ± 9.66 (32.12 ± 9.51 for cases and 26.13 ± 8.87 for controls) with a significant *P* value of <0.001 . Android/ gynoid ratio had a mean of 1.01 ± 0.22 (1.09 ± 0.21 for cases and 0.93 ± 0.21 for controls). Percentage fat trunk/ percentage fat limbs (central/peripheral fat) [Figure 3] had a

Table 1: Baseline characteristics of study participants

Characteristic	n (%)	n (%)	n (%)	n (%)
Patient type	Case	Control	***	***
	153 (50%)	153 (50%)		
Gender	Male	Female	***	***
	174 (56.9%)	132 (43.1%)		
Grade of fatty liver	No Fatty Liver	Grade I	Grade II	Grade III
	148 (48.4%)	79 (25.8%)	58 (19%)	21 (6.9%)
Grade on DEXA fat percentage	Underweight	Normal	Overweight	Obese
	16 (5.2%)	101 (33%)	102 (33.3%)	87 (28.4%)
Status of obesity based on android/gynoid ratio	Normal	Obese	***	***
	156 (51.0%)	150 (49.0%)		

DEXA: Dual energy x-ray absorptiometry

Table 2: Distribution of age, DEXA scan (fat percentage), android/gynoid ratio, and percentage fat of trunk/percentage fat of legs ratio among the study participants

Characteristic	Age in years	DEXA scan (fat percentage)	Android/Gynoid ratio	Percentage fat of trunk/percentage fat of legs ratio
Minimum	19	12.3	0.61	0.62
Maximum	70	49.3	1.45	1.33
Mean	42.96	29.13	1.01	1.05
Standard deviation	13.89	9.66	0.22	0.16
Median	45	27.4	1.01	1.035
Inter-quartile range	30–52.25	22.4–37	0.85–1.22	0.92–1.205

Table 3: Comparison of various continuous variables between cases and controls

Parameter	Patient type	Number	Mean	Std. deviation	Mean difference	P
DEXA scan (fat percentage)	Case	153	32.12	9.51	5.99	<0.001
	Control	153	26.13	8.87		
Android/gynoid ratio	Case	153	1.09	0.21	0.16	<0.001
	Control	153	0.93	0.21		
Percentage fat of trunk/percentage fat of legs ratio	Case	153	1.08	0.15	0.006	<0.001
	Control	153	1.03	0.16		

mean of 1.05 ± 0.16 (1.08 ± 0.15 for cases and 1.03 ± 0.16) with a significant P value of <0.001 [Tables 2 and 3]. The correlation of DEXA adiposity grading with the severity of psoriasis was found to be significant, with a P value of <0.001 .

The scatter plot showed a positive correlation between the severity of psoriasis and the percentage of fat on DEXA scan with a significant “ r value” of 0.63 and P value of <0.001 [Figure 4].

Discussion

Our study used DEXA scans to examine the body composition of patients with psoriasis, including both obese and nonobese (overweight, normal weighed, and underweight), in comparison with a control group of healthy patients. DEXA scan is emerging as a safe and accurate method that precisely determines body fat distribution.^[11,12] In the current study, both total fat and regional fat in patients with psoriasis were measured using the DEXA method.

There was a significant difference between cases and controls in trunk fat mass, android/gynoid ratio, and trunk fat mass to limb fat mass. Thus, increased accumulation of total fat percentage, in particular of trunk fat and android fat, was identified in cases with psoriasis, especially those with severe psoriasis. Based on fat deposition sites and their pathophysiological significance to metabolism, body fat distribution can be generally divided into intraabdominal/visceral fat (including visceral fat and abdominal subcutaneous fat), upper body fat (including trunk fat and android fat), and lower body fat (gynoid fat). Visceral fat and upper body fat are known to be related to higher risks of metabolic disorders such as hypertension and type 2 diabetes, and so of psoriasis and its severity.^[13]

The correlation of DEXA adiposity grading with the severity of psoriasis was again found to be significant in our study with a P value of <0.001 and r value of 0.63. The prevalence of overweight and obesity in psoriasis is also found to be higher in the data from the Vigitel study.^[14] According to this

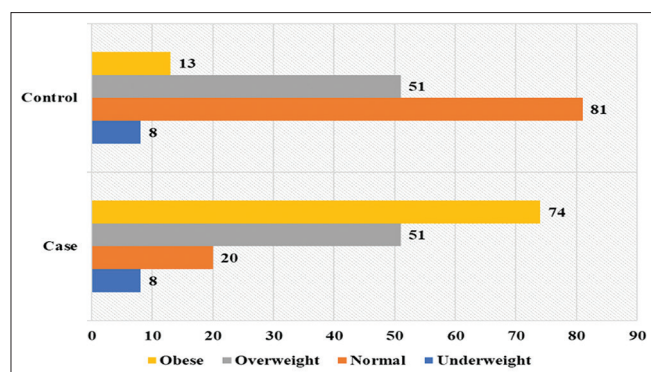


Figure 1: Bar chart depicting relationship between participant type and weight categories based on body fat percentage measured by DEXA scan

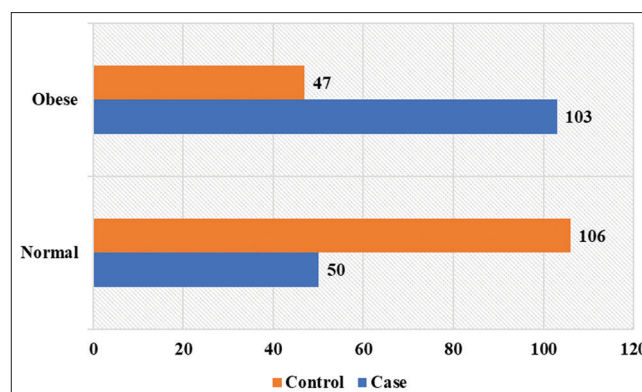


Figure 2: Bar chart showing the relationship between participant type and status of obesity based on android/gynoid ratio

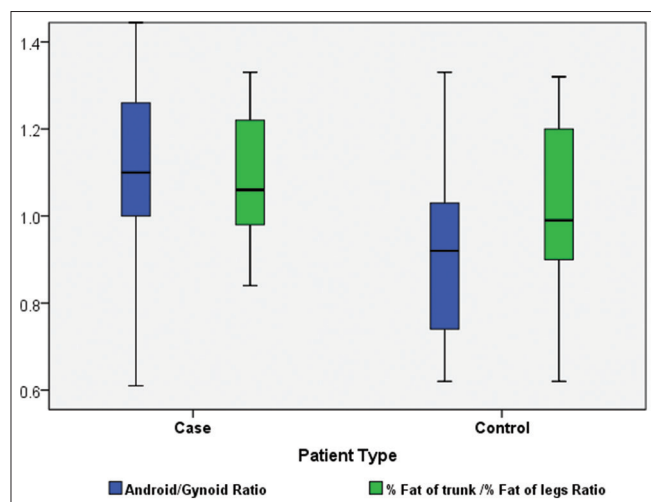


Figure 3: Box plot depicting a comparison of android/gynoid ratio and percentage of trunk fat/percentage of leg fat ratio between cases and controls

study, a survey held in 27 Brazilian cities, and the prevalence of overweight and obesity ($\text{BMI} \geq 25 \text{ kg/m}^2$) in the city of Belo Horizonte-MG, where the study was conducted, reached 48.1%. Studies of psoriasis show prevalence rates of 51.8% being overweight and obese as defined by BMI.^[15] Classifications of obesity by BMI and waist circumference (WC) showed no significant difference, as demonstrated by Lauria *et al.*^[16] However, both rates showed low agreement with the measures of body fat as evaluated by the DEXA technique. Flegal *et al.*^[17] also demonstrated that BMI and WC correlate better with each other than with DEXA-determined percentage of body fat. In addition, these authors showed that BMI and WC give an inadequate measure of percent body fat compared to DEXA.

This was further substantiated in our study, which showed that by comparison, all cases of severe psoriasis had increased adiposity as measured by DEXA scan, and none had normal adiposity. This signifies that while other methods of adiposity measurement may fail to detect adiposity in many cases of psoriasis, DEXA scan can help to improve the detection and, thus, further management of adiposity in cases of psoriasis.

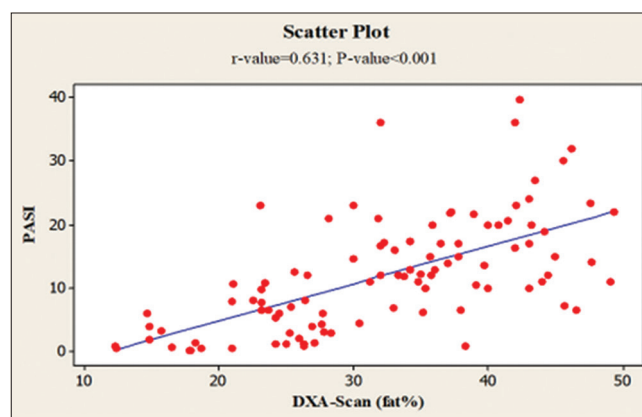


Figure 4: Scatter plot depicting the correlation between the severity of psoriasis and percentage of fat on DEXA scan. r value = 0.63, P value < 0.001

As adiposity, measured by DEXA scan, correlated positively with the severity of psoriasis, early detection and accurate assessment of adiposity can significantly reduce the progression of severity of psoriasis as well as the morbidity associated with it. For many decades, the BMI was the predominant index in the evaluation of obesity due to its simplicity and low cost. However, this method does not take into account several obesity-related factors, such as muscle mass, bone structure, age, sex, and ethnic group.^[7,10,18] Although WC provides a simple measure of central fat deposition, a better predictor of adverse cardiovascular events, it also fails to provide a reliable measure of obesity compared with DEXA. DEXA technique is considered superior in the assessment of body composition with precision of ~99% in the estimation of soft tissue composition.^[19,20]

There seems to be a reciprocal influence between obesity and psoriasis.^[21] Excess adipose tissue induces a chronic proinflammatory state with increased C-reactive protein and cytokines, such as $\text{TNF-}\alpha$ and IL-6, which not only promotes the development of cutaneous lesions but also impairs the patient's response to systemic treatments.^[22-25] Moreover, psoriasis, with the metabolic deregulation coupled with the impairment in quality of life, sedentary lifestyle, and poor eating habits, favors weight gain.^[25,26] Thus, a more sensitive and accurate tool for assessment of adiposity

in psoriasis can effectively help in early detection and management of increased adiposity that plays a pivotal role in the etiopathogenesis of psoriasis, its increased severity, associated comorbidities and effect on quality of life.

Limitations

The cross-sectional design restricts assessment to associations rather than causality. Although major confounding factors were ruled out during recruitment, variables such as lifestyle and dietary habits, physical activity levels, and treatment history were not the primary focus and hence not extensively analyzed. The sample size analyses, such as stratification by gender or treatment modalities, may benefit from larger cohorts in future research.

Conclusion

The following conclusions were made from our study:

1. In psoriatic patients, there was increased deposition of fat around the trunk and in android pattern with increased android–gynoid ratio as compared to controls.
2. There is a positive correlation between adiposity and the severity of psoriasis as measured by DEXA scan. As adiposity correlates positively with the severity of psoriasis, early detection and accurate assessment of adiposity can significantly reduce the progression of psoriasis and its associated morbidity.

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Conflicts of interest

There are no conflicts of interest.

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