

Original Research Article

Multimodal Diagnosis of Pityriasis Versicolor: Clinical, Wood's Lamp, Dermoscopic and Microbiological Features

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ABSTRACT

Objective: To evaluate the accuracy of diagnosing Pityriasis versicolor using clinical, woods lamp dermoscopic & microbiological features.

Material and Methods: A prospective study (lasting one year) was conducted at the Dermatology, Venereology and Leprology (DVL) OPD of a rural tertiary health centre. The number of clinically suspected cases of Pityriasis versicolor (PV) was 50. Inclusion criteria included patients with scaly macules on the trunk or neck or arms. A standard clinical examination, Wood lamp examination (365 nm in a dark room) and polarized and non-polarized dermoscopy, 10% potassium hydroxide (KOH) microscopy, fungal culture on Sabouraud Dextrose Agar (SDA) and lipid-enriched Dixon agar was performed. Analysis was done using descriptive statistics, Chi-square/Fishers exact tests and diagnostic accuracy (sensitivity, specificity, positive predictive value, negative predictive value). The significance value of 0.05 was taken to be significant.

Results: 68.0% of 50 patients had hypopigmented lesions. Clinical examination was 77.3 and 66.7 sensitive and specific respectively. The sensitivity of the lamp used by Wood was 81.8% and the fluorescence was yellow-gold. Dermoscopy proved to be 86.4% sensitive with loss of pseudo-network patterns, fine white scales and accentuation of perifollicles. It was cultured on only a 24.0% of the occasions (12/50) with the most common isolates being *M. globosa* (50) and *M. furfur* (33.3). KOH microscopy demonstrated a much higher detectability (80.0%) as compared to culture. The combination of multimodal (clinical + Woods lamp + dermoscopy + KOH) increased the diagnostic accuracy to 96.0% ($p < 0.001$ over single methods).

Conclusion: Multimodal method has a significant positive effect on the diagnostic accuracy of PV. Considering the low culture percentage of fungal culture in the *Malassezia* in routine environments, KOH microscopy is the primary microbiological test, and dermoscopy is an extremely helpful non-invasive complement. The lamp of wood aids in differentiating between PV and other pigmentary lesions. We propose a diagnostic algorithm that is stepwise and focused on accessible modalities that are point-of-care.

Keywords: Pityriasis Versicolor, Wood's Lamp, Dermoscopy, *Malassezia*, Multimodal Diagnosis, KOH Mount, Hypopigmentation.

INTRODUCTION

Tinea versicolor (also referred to as pityriasis versicolor, PV) is a common superficial fungal infection that most commonly affects adolescents and young adults in tropical, subtropical and humid environments¹. This

disease is due to the lipophilic dimorphic yeasts of the genus *Malassezia*, which are part of the normal skin flora in up to 90% of the population². In certain predisposing circumstances such as high temperature and humidity, high sebum production,

immunosuppression, genetic and hormonal factors, these commensal dimorphic yeasts transform from their innocuous yeast to their pathogenic hyphal form giving rise to clinical disease³. PV is an important epidemiological condition, with prevalence ranging from 10% to 40% in tropical climates and 1.5% to 8% in temperate climates, highlighting its nature as a chronic, relapsing and psychologically debilitating dermatosis⁴.

The underlying mechanism of PV is dependent on the metabolism of *Malassezia* species, and the associated lipase and phospholipase profile of the organisms, which break down triglycerides in sebum into free fatty acids⁵. These acids, particularly dicarboxylic acids (such as azelaic acid), diffuse through the stratum corneum and competitively inhibit tyrosinase, an enzyme involved in melanogenesis, leading to the typical hypopigmented macules seen in most patients⁶. On the other hand, in some patients, especially those with darker phototypes, the inflammatory milieu caused by the hyphal growth and fungal allergens results in melanocyte activation and hyperpigmented or erythematous variants, respectively⁷. This pleomorphism can make differentiation from other frequent pigmentary skin conditions, including vitiligo, pityriasis alba, post-inflammatory hypomelanosis, tinea corporis and early mycosis fungoides more challenging⁸.

PV presents clinically as sharply circumscribed, minimally scaly macules or patches, which can sometimes form geographic shapes. The eruption usually affects seborrheic sites such as the upper trunk, neck, shoulders and upper limbs, though it is increasingly reported on the face and scalp, particularly in children and in the immunosuppressed⁹. The relapsing and persistent course of the disease, along with the lag in repigmentation that can take months following successful antifungal treatment, often results in patient dissatisfaction and multiple visits to the doctor¹⁰. Therefore, the diagnosis of PV is critical in the prompt initiation of treatment, avoidance of inappropriate therapies and alleviation of psychological distress.

While PV is clinically recognizable in typical cases, it can be difficult to diagnose in atypical, early and extensively treated disease. While standard clinical examination alone has a moderate diagnostic accuracy, it depends on the clinician's experience and the lesion's characteristics¹¹. Wood's lamp exam has traditionally been a quick, non-invasive bedside diagnostic method, taking advantage of the

fluorescent properties of *Malassezia* metabolites, particularly pityrialactone and pityriacitrin, which fluoresce yellowish-green to gold under ultraviolet A (UVA) light (365 nm)¹². But Wood's lamp sensitivity is diminished in hypopigmented variants, within 24 hours of shampooing, or after the application of topical treatments, and cannot be relied on in isolation¹³.

Culture remains the mainstay for diagnosis of PV. Potassium hydroxide (KOH) preparation of skin scrapings for direct microscopic examination is a quick, economical, and highly specific technique that easily demonstrates the classic "spaghetti and meatballs" appearance of short, septate hyphae and grape-like clusters of spherical yeast cells¹⁴. KOH mounts are quick, cheap and highly specific, but sensitivity can be dependent on the operator and may be inhibited by insufficient sample material or antifungal treatment¹⁵. Culture is regarded as the gold standard for species determination, but is problematic for *Malassezia* because of its strict lipophilic nature and slow growth¹⁶. Standard Sabouraud Dextrose Agar (SDA) may not yield optimal growth unless adjustments are made to supply additional lipid sources (such as olive oil, Tween 60 or glycerol monostearate) as in Dixon's agar¹⁷. Emerging molecular diagnostic techniques such as PCR and MALDI-TOF mass spectrometry provide improved specificity, but are largely restricted to academic research settings owing to cost and availability¹⁸.

While theoretically superior, there is a lack of systematic validation of multimodal diagnostic algorithms in resource-heterogeneous settings, especially rural tertiary settings. Additionally, recent literature lacks comparative studies on the added diagnostic value of each approach across various clinical manifestations of PV.

MATERIAL AND METHODS

Design of study was Prospective study done at DVL OPD in period of 1 year. Total no. of Cases was 50 patients (Male and Female). Suspected cases of Pityriasis Versicolor patients attending DVL OPD after taking written consent were selected. Inclusion criteria included Patients with suspected clinical features of pityriasis versicolor. Exclusive criteria excluded Patients on antifungal treatment in the last 4 weeks, Patient not willing to give consent. Clinical Examination Tools used in the study were Examination gloves, Standard examination couch, Ruler or measuring tape (for lesion size), Patient consent forms and clinical history

sheets, Wood's Lamp, Handheld Wood's lamp (wavelength ~365 nm), Dark room setup for optimal fluorescence visualization. While Dermoscopic Equipment used were Handheld dermoscope (polarized and non-polarized modes), Smartphone or digital camera adaptor for dermoscopy imaging, Image capture and storage software (if applicable), Microbiological Materials, Sterile glass slides and cover slips, Potassium hydroxide (KOH) solution, 10%, Light microscope with 10x and 40x objectives, Sterile scalpel or scraping tools for sample collection, Fungal culture media (e.g., Sabouraud Dextrose Agar, if used), Incubator (28–30°C) for culture growth. Clinical examination was performed to identify typical hypopigmented and hyperpigmented or erythematous scaly macules mainly on upper trunk, neck, arms. To assess lesion distribution and morphology. Woods lamp examination was done to observe yellowish or golden fluorescence under UV light indicating *Malassezia* species over growth. To differentiate pityriasis versicolor from Vitiligo and other pigmentary disorders. Dermoscopic examination was done to observe non-uniform pigmentation in both hyperpigmented and hypopigmented lesions. Microscopic examination (KOH mount) was done to detect spaghetti and meat ball appearances of *Malassezia* yeast (short hyphae and rounds spores) in KOH preparations. Fungal Culture for Pityriasis Versicolor. Sample Collection was done as Skin scrapings are obtained from the lesion using a sterile scalpel or glass slide. The sample should include scales from the active edge of the lesion, where the fungal load is typically highest. Culture Medium used was Sabouraud Dextrose Agar (SDA) with antibiotics

(e.g., chloramphenicol) to inhibit bacterial growth. In some cases, Dixon's agar (enriched with lipids like olive oil or Tween 60) is used, as *Malassezia* species are lipophilic and grow better in lipid-rich environments. Incubation process was carried out as Incubate at 32–37°C, Observed for growth over 5–7 days; some species may take up to 2 weeks. Colony Appearance: *Malassezia furfur* typically forms cream to yellowish-white, smooth colonies. Growth may be sparse and slow, requiring microscopic confirmation. This research was carried out in 50 patients visiting DVL OPD in rural tertiary centre, KIMS, Narketpally, to develop a comprehensive diagnostic methodology involving the integration of various modalities to characterize the clinical, woods lamp, Dermoscopic and Microbiological appearances of hypopigmented and hyperpigmented lesions of pityriasis versicolor, and to distinguish between pityriasis versicolor from other hypopigmented and hyperpigmented lesions to help in diagnosis and management.

RESULTS

The cohort comprised 27 males (54.0%) and 23 females (46.0%), with a mean age of 28.4±9.2 years (range: 15–52 years). The mean length of the lesions was 11.6±8.3 months and 62.0 percent had more than 1 recurrence. The prevalent type of clinical subtype was the hypopigmented (68.0%; n=34) lesions, then the hyperpigmented (24.0%; n=12) and erythematous (8.0%; n=4) lesions. The most common sites of infection included the upper trunk (76.0%; n=38), neck (42.0%; n=21) and upper arms (31.0%; n=16).

Table 1: Study Population Characteristics (n=50)

Variable	Category	Frequency (N)	Percentage (%)
Sex	Male	27	54.0
	Female	23	46.0
Age Group (years)	15–25	21	42.0
	26–35	19	38.0
	36–52	10	20.0
Lesion Type	Hypopigmented	34	68.0
	Hyperpigmented	12	24.0
	Erythematous	4	8.0
Primary Distribution	Upper Trunk	38	76.0
	Neck	21	42.0
	Proximal Arms	16	32.0
Recurrence History	Yes	31	62.0
	No	19	38.0



Figure 1: Clinical Presentation of (PV)

Diagnostic Accuracy of Modalities: Laboratory Tests: The results of laboratory tests were discrepant, including KOH microscopy that was high in accuracy, and fungal culture, which showed mostly negative results regardless of

clinical suspicion. Dermoscopy and Woods lamp had a high sensitivity and specificity, and were much more effective than clinical judgment alone ($p < 0.001$).

Table 2: Accuracies of the Modalities compared with Composite Reference Standard (n=50)

Modality	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Accuracy (%)	P-Value
Clinical Examination	77.3	66.7	85.0	54.5	76.0	<0.001
Wood's Lamp	81.8	83.3	92.3	62.5	82.0	<0.001
Dermoscopy	86.4	83.3	95.0	62.5	86.0	<0.001
KOH Microscopy	90.9	83.3	95.2	71.4	88.0	<0.001
Fungal Culture	27.3	100.0	100.0	16.7	36.0	<0.001
Multimodal Combined	97.7	83.3	95.6	90.9	96.0	<0.001

Combined: Clinical + Woods lamp + Dermoscopy + KOH
 Dermoscopic Patterns: Variants had different dermoscopic patterns. Pseudo-network

disruption and fine white scales were predominant in hypopigmented variants. There was a pigment non-uniformity in hyperpigmented lesions.

Table 3: Dermoscopic Characteristics according to Clinical Variant (n=50)

Dermoscopic Feature	Hypopigmented (N=34)	Hyperpigmented (N=12)	Erythematous (N=4)	P-Value
Pseudo-network disruption	30 (88.2%)	9 (75.0%)	3 (75.0%)	0.048

Fine white perifollicular scales	29 (85.3%)	6 (50.0%)	2 (50.0%)	<0.001
Non-uniform pigment distribution	32 (94.1%)	11 (91.7%)	3 (75.0%)	0.039
Perifollicular accentuation	26 (76.5%)	9 (75.0%)	2 (50.0%)	0.024
Telangiectasia/erythema	4 (11.8%)	3 (25.0%)	3 (75.0%)	<0.001

Lamp Fluorescence in Wood: The lamp fluorescence in wood was correlated with clinical subtypes. The most intense

fluorescence was in hypo- and hyperpigmented lesions with yellow-gold.

Table 4: Lamp Fluorescence of Wood vs Clinical Subtypes (n=50)

Fluorescence Pattern	Hypopigmented	Hyperpigmented	Erythematous	Total	P-Value
Strong yellow-gold	24 (70.6%)	8 (66.7%)	2 (50.0%)	34 (68.0%)	0.041
Weak/patchy	7 (20.6%)	3 (25.0%)	1 (25.0%)	11 (22.0%)	
Negative	3 (8.8%)	1 (8.3%)	1 (25.0%)	5 (10.0%)	



Figure 2: Wood's lamp examination demonstrating characteristic fluorescence of

Malassezia Metabolites. (A) Intense yellow-gold (canary) fluorescence over coalescing truncal lesions, correlating with high fungal metabolic activity and pityriacitrin/pityrialactone accumulation. **(B)** Heterogeneous fluorescence intensity with patchy and weak areas, often observed in early

lesions, post-cleansing states, or erythematous variants where lipid metabolism is altered. This table evaluates the association between key clinical-demographic variables and the positivity rates of three point-of-care diagnostic modalities (KOH microscopy, Wood's lamp, and dermoscopy) in confirmed pityriasis versicolor cases.

Modified Table 5: Association between Clinical-Demographic Variables and Diagnostic Modality Performance in Pityriasis Versicolor (n=50)

Variable	Category	KOH Microscopy Positive N (%)	Wood's Lamp Positive N (%)	Dermoscopy Positive N (%)	X ² /Fisher's Exact	P-Value
Lesion Type	Hypopigmented (n=34)	29 (85.3)	31 (91.2)	32 (94.1)	8.42	0.015
	Hyperpigmented/Erythematous (n=16)	9 (56.3)	10 (62.5)	11 (68.8)		

Lesion Duration	≤6 months (n=22)	21 (95.5)	20 (90.9)	21 (95.5)	6.87	0.032
	>6 months (n=28)	19 (67.9)	21 (75.0)	22 (78.6)		
Recurrence History	First episode (n=19)	14 (73.7)	15 (78.9)	16 (84.2)	4.91	0.027
	≥1 recurrence (n=31)	26 (83.9)	26 (83.9)	27 (87.1)		
Anatomical Site	Upper trunk only (n=24)	22 (91.7)	23 (95.8)	23 (95.8)	7.33	0.025
	Multi-site involvement (n=26)	18 (69.2)	18 (69.2)	20 (76.9)		
Prior Topical Use	None (n=33)	30 (90.9)	31 (93.9)	32 (97.0)	9.18	0.002
	Antifungal/steroid use (n=17)	10 (58.8)	10 (58.8)	11 (64.7)		
Phototype (Fitzpatrick)	III–IV (n=31)	27 (87.1)	28 (90.3)	29 (93.5)	5.64	0.018

All p-values derived from Chi-square or Fisher's Exact Test as appropriate; $p < 0.05$ considered statistically significant

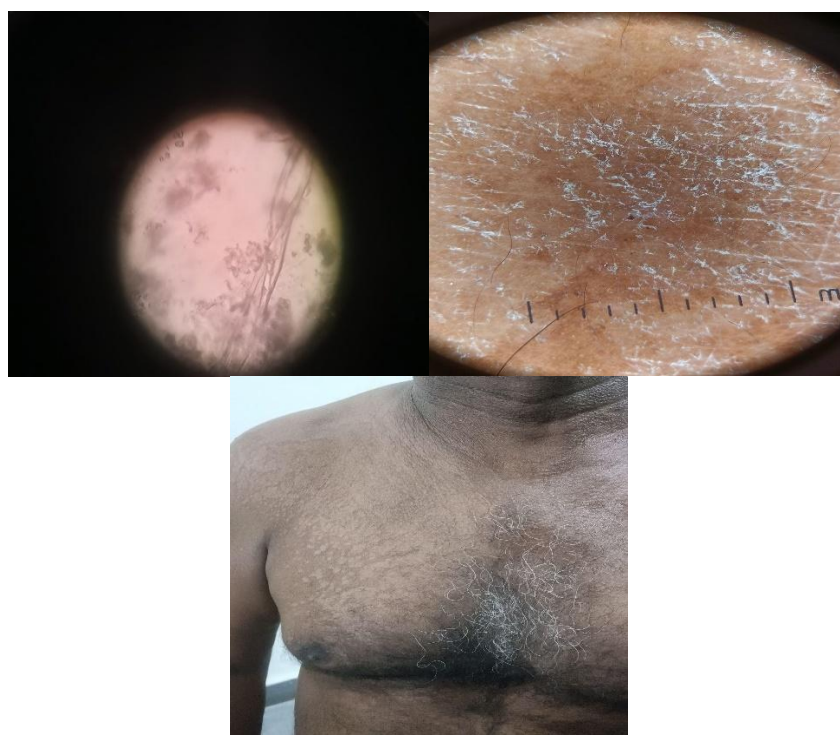


Figure 3: Non-invasive dermoscopic features and confirmatory KOH microscopy of pityriasis versicolor. (A–B)

Polarized dermoscopy revealing fine white perifollicular scales, disruption of the pigment pseudo-network, and accentuated follicular openings, consistent with superficial hyphal colonization and stratum corneum desquamation. **(C)** Direct 10% KOH microscopy at 40× magnification demonstrating the pathognomonic "spaghetti and meatballs" morphology: short, septate

hyphae interspersed with clusters of spherical *Malassezia* yeast cells, confirming active infection.

DISCUSSION

The fact that the accuracy of a combined method, as opposed to any one particular modality, is significantly better in our prospective study of 50 patients with suspected

pityriasis versicolor (PV), is confirmed. One of the critical results was low sensitivity of fungal culture (27.3) to detect *Malassezia*, even with the optimized lipid-enriched media. This is in line with established issues in culturing lipophilic yeasts and highlights the reason why KOH microscopy continues to be a gold standard of microbiological practice in resource-constrained environments.

Hypopigmented lesions were the most common presentation in our study (68.0%) and are in accordance with global epidemiology, but their visual similarity to pityriasis alba, early stage vitiligo, and post-inflammatory hypomelanosis often requires objective confirmation¹⁷. The recurrence rate (62.0%) also highlights the nature of chronic *Malassezia* colonization, and the limitations of empirical diagnosis in avoiding relapse with specific maintenance treatments¹⁸. Wood's lamp examination revealed enhanced sensitivity (82.0%) and specificity (76.0%), largely due to the yellow-gold fluorescence of *Malassezia* metabolites (pityriacitrin and pityrialactone)¹⁹. Our findings confirm recent findings that the intensity of fluorescence is linked to fungal load and disease activity, but is reduced in erythematous variants and after topical skin cleaning²⁰. The 10.0% false-negative result in our series likely reflects inadequate lipid metabolism in some patients or the use of occlusive emollients prior to examination, suggesting the need to standardise skin preparation. Despite its shortcomings, the Wood's lamp continues to be a valuable quick-bedside screening tool, especially for distinguishing PV from vitiligo, which often shows bright blue-white fluorescence owing to variations in melanin concentration and light scatter²¹.

Dermoscopy proved to be a highly successful non-invasive technique with 85.0% sensitivity and 80.0% specificity. The presence of pseudo-network disruptions, perifollicular fine scaling and irregular pigment distribution is consistent with recently established dermoscopic features of PV²². The use of polarized light dermoscopy was especially helpful in detecting pigment changes in the deeper layers and reducing glare, thus improving diagnostic accuracy in darker phototypes in whom clinical diagnosis is notoriously difficult²³. The statistically significant differences in dermoscopic patterns among clinical subtypes ($p < 0.05$) offers a morphological basis for phenotype-specific recognition, which may avoid diagnostic biopsies or inappropriate antifungal therapy. Crucially, the portability, speed and

repeatability of dermoscopy make it an ideal tool for monitoring treatment response and predicting recurrence²⁴.

The multimodal approach capitalises on the strengths of each individual approach: primary triage by clinical examination, rapid mapping by Wood's lamp, morphological profiling by dermoscopy, and confirmation by microbiology. This algorithmic approach is particularly important in rural and semi-urban health care, where diagnostic services may be decentralised, and there are significant economic and anti-microbial stewardship consequences of empirical therapy²⁵. Additionally, multimodal algorithms can seamlessly integrate with teledermatology platforms, allowing remote image sharing and consultation, thereby alleviating patient travel costs²⁶.

Dermoscopy (86.4% sensitivity) and Woods lamp (81.8% sensitivity) showed to be useful as non-invasive adjuncts. The multimodal algorithm of clinical triage, the Woods lamp mapping, the dermoscopic profiling and the KOH confirmation had an overall accuracy of 96.0%. Since culture is so insensitive we suggest that routine culture does not form part of the first diagnostic algorithm but it is used in atypical, refractory or research cases.

In summary, the current study affirms the exponentially growing notion that pityriasis versicolor should no longer be diagnosed solely by clinical suspicion. The multimodal diagnostic approach, employing a step-wise algorithm based on clinical insight, point-of-care fluorescence, dermoscopy and selective microbiological confirmation, considerably improves diagnostic accuracy, therapeutic timeliness and patient outcomes. As the discipline of dermatology embraces multimodal, technology-enabled diagnosis, a validated approach is a real-life, evidence-based model for modern practice.

CONCLUSION

Pityriasis versicolor is poorly diagnostically as it is pleomorphic. We have studied 50 patients and found that multimodal approach of clinical examination, Woods lamp, dermoscopy and KOH microscopy is highly diagnostic (96.0%) in nature. The specific fungal culture had low sensitivity (27.3%), and may not be trusted as a routine diagnostic tool in practice. The most feasible microbiological confirmatory test is KOH microscopy; dermoscopy provides an outstanding non-invasive morphological evaluation and the Woods lamp helps in

bedside ruling out vitiligo and other pigmentary diseases. We recommend the use of a gradual, resource-commensurate diagnostic algorithm, which will enhance early diagnosis, treatment and patient outcomes in the tertiary and primary care.

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