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Review article

Pityriasis versicolor: insight into current knowledge and treatment possibilities

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Abstract

Background: Pityriasis versicolor is a prevalent superficial mycosis caused by saprophytic yeasts of the *Malassezia* genus. It primarily affects adolescents and young adults, presenting as hypo- or hyperpigmented macules on the skin, commonly located on the trunk and upper arms. While various topical and systemic antifungal treatments are available, high relapse rates remain a significant clinical challenge. The condition often leads to psychological distress due to visible lesions on the skin surface.

Aim of the study: Given its high prevalence (reaching up to 50% in some tropical regions) and its psychosocial implications, pityriasis versicolor remains a critical dermatological concern. This study aims to synthesize current medical knowledge about the condition, focusing on the efficacy, indications, and limitations of available treatment options, especially in addressing recurrent cases.

State of knowledge: Pityriasis versicolor is well-characterized in terms of its etiology and clinical manifestations. Numerous therapeutic interventions have been investigated, ranging

from topical agents like azoles or terbinafine to systemic treatments such as itraconazole and fluconazole. Despite these advancements, a universally accepted gold standard for treatment remains undefined, and patient adherence often is a barrier to successful outcomes.
Conclusion: Despite significant progress in understanding and managing pityriasis versicolor, further research is essential. Future efforts should aim to optimize treatment efficacy, reduce relapse rates, and minimize adverse effects. Randomized controlled trials with larger and more diverse populations are particularly needed to establish standardized protocols and explore innovative therapies, including prophylactic measures and targeted treatments.

Key words: pityriasis versicolor, tinea versicolor, mycosis, Malassezia, antifungal agents

Introduction

Pityriasis versicolor (PV), also called tinea versicolor, is a superficial fungal infection caused by overgrowth of *Malassezia* species, a group of yeasts that constitute physiological human skin microbiota [1]. Under certain predisposing conditions, these commensal organisms transition to a pathogenic state, leading to clinical manifestations, including hypopigmented or hyperpigmented macules and patches, most frequently located on seborrheic areas such as the trunk, upper arms, and neck. [2] The condition, despite not being malignant, often presents cosmetic concerns and causes psychosocial distress that significantly impacts the quality of patients' lives, especially among young adults who are the most affected demographic [3].

Prevalence of PV is significantly higher in tropical and subtropical regions, where elevated temperature and high humidity favor *Malassezia* growth [4]. However, cases also occur in temperate climates, especially in individuals with risk factors such as hyperhidrosis, seborrhea, genetic predisposition or immune suppression [1,5]. Despite the availability of effective antifungal therapies, the high rate of recurrence (frequently exceeding 40% within one year) remains a significant challenge in the management of this condition and marks it as an persistent clinical issue [6,7].

Recent advances in diagnostic techniques, including dermoscopy and Wood’s lamp examination, have improved the ability to detect *Malassezia* species and determine their role in the pathogenesis of PV [1,8]. While therapeutic options, from topical antifungal agents, such as azoles and allylamines, to systemic drugs, have demonstrated efficacy, yet high recurrence rate remains a significant concern for both patients and clinicians [6]. This

highlights the need for a deeper understanding of the condition and more effective strategies for long-term management and prevention.

This literature review aims to provide a detailed, up-to-date synthesis of the current understanding of tinea versicolor, summarising the latest research on its epidemiology, clinical presentation, diagnostic approaches and treatment strategies. By identifying the current gaps in knowledge and management, the article's target is to propose directions for future research to optimize the management of this prevalent dermatological condition.

Epidemiology

PV exhibits a wide geographic distribution, with prevalence rates ranging from 1% to 50% depending on regional climatic conditions and population demographics [5]. The condition is particularly endemic in tropical and subtropical regions, where high temperatures and humidity create an optimal environment for the proliferation of *Malassezia* species [3]. Studies from Southeast Asia, sub-Saharan Africa, and South America consistently report prevalence rates exceeding 30%, and even reaching 50% in some areas, which underscore the influence of environmental factors [1]. On the contrary, in temperate climates, *PV* is less common - eg. in Scandinavian countries (like Sweden) prevalence is the lowest, less than 1% of the population [9]. Seasonal fluctuations are often observed in temperate climates, as cases tend to peak during warmer months when perspiration increases [1].

From a demographic point of view, PV mainly affects adolescents and young adults, due to increased sebaceous gland activity during puberty, which extends the availability of lipids required for *Malassezia* growth [10]. Although rare, cases among children have also been reported [11]. Most of the cases in children under 2 years of age are premature infants that were placed in intensive care after birth and were handled more often and longer by healthcare staff than babies born at term. [1, 11] Cases of PV are uncommon among older adults, likely due to reduced sebum production with age [12]. However, older adults at higher risk of developing the condition are, similar to the pediatric population, those who are hospitalized and immunocompromised [13]

While tinea versicolor affects both sexes, epidemiological studies indicate a marginally higher prevalence in males and link it to increased sebaceous gland activity and sebum production [1]. Also work-related factors, such as exposure to prolonged heat and moisture in agriculture

or other manual labors, are considered to be the reason for the disease occurring more frequently in men [5].

Recurrence rates of this condition remains a notable clinical challenge, with studies reporting relapse in up to 40% of patients within one year following treatment [7].

Risk factors and protective factors

The development of pityriasis versicolor is influenced by host-related, environmental and genetic factors. Main risk factors are hyperhidrosis, which creates a moist environment that furthermore enables fungal proliferation, and seborrhea, where increased sebum production provides lipids essential for the growth of *Malassezia* species [2]. Environmental factors, particularly prolonged exposure to heat and humidity (eg. increased physical activity), significantly contribute to the prevalence of PV [4]. Immunosuppressive conditions, such as those caused by HIV [14], malignancies, or immunosuppressive therapy, also predispose individuals to the condition by impairing the host's ability to control fungal overgrowth. Pregnancy and metabolic diseases, such as obesity or diabetes, also increase the risk of tinea versicolour appearance, as they often occur with poor immune system activity and hyperhidrosis [1].

On the contrary, there are certain protective factors that may reduce the risk of developing this condition. Maintaining dry skin through the use of lightweight, breathable clothing and regular hygiene practices can minimize conditions favorable for fungal growth. Some evidence suggests that a well-functioning immune system, aided by a healthy diet and physical activity, may provide natural defense against *Malassezia* colonization [6]. Furthermore, the use of antifungal prophylaxis in high-risk individuals, such as those with recurrent PV, has been shown to decrease recurrence rates [3]. However, research on protective factors remains limited, necessitating further exploration into lifestyle and medical interventions that could mitigate the condition's impact.

Clinical manifestations

Tinea versicolor manifests as pigmentary abnormalities - macules and patches with hypopigmented, hyperpigmented, or erythematous discoloration. These lesions commonly localize to seborrheic regions, mainly the upper trunk, upper arms or neck [2]. Facial

involvement may also happen and is reported more frequently in the pediatric population than among adults [11]. The pigmentation changes are often sharply demarcated but may coalesce into larger, irregularly shaped areas [2]. Hypopigmented lesions are more conspicuous in individuals with darker skin tones due to the contrast [52], while hyperpigmented lesions predominate in lighter skin types [1]. These pigmentary changes result from the metabolic activity of fungi, which produce dicarboxylic acids, such as azelaic acid, that inhibit tyrosinase, an enzyme critical for melanin synthesis. Additionally, localized inflammation caused by the fungal overgrowth may lead to melanocyte dysfunction, further contributing to altered pigmentation [1]. In chronic or long standing cases, the pigmentation abnormalities may persist even after the fungal elements are eradicated, a phenomenon known as post-inflammatory hypopigmentation or hyperpigmentation [15].

Rarely, PV may extend to the scalp or involve hair follicles, leading to perifollicular scaling or inflammation, a variant sometimes termed *Malassezia folliculitis* [16].

Pruritus, although not a universal symptom, may occur, particularly in warm, humid environments or during physical activities that induce sweating. Patients may also report mild erythema in the early stages, especially in fair-skinned individuals [5].

The psychological impact of these skin changes is often underestimated. Visible lesions, particularly on exposed body areas, can lead to significant self-esteem issues and social anxiety, especially in adolescents and young adults. Despite being clinically benign, these psychosocial factors contribute to the overall burden of the disease, highlighting the need for quick and effective diagnosis and management [1].

Diagnostic methods

The diagnosis of tinea versicolor is typically straightforward for experienced clinicians, as the condition is often identified solely through a medical interview and clinical evaluation of its characteristic pigmentary changes and scaling [2]. However, the variety of the lesions may cause some troubles - the differential diagnosis often is crucial and includes conditions such as pityriasis rosea, vitiligo, chloasma, seborrhoeic dermatitis and tinea corporis [1]. To verify clinical diagnosis of PV and differentiate it from similar conditions, additional methods are used.

KOH microscopy. Potassium hydroxide (KOH) microscopy remains the gold standard for diagnosis confirmation. A sample obtained via skin scraping, when mixed with KOH and examined under a microscope, reveals the classic "spaghetti and meatballs" appearance, indicative of *Malassezia* yeast and hyphae. This method is highly sensitive and specific when performed correctly [2].

Wood's lamp examination. Wood's lamp examination is another commonly used diagnostic tool. Under ultraviolet (UV) light, lesions of PV caused by *Malassezia* may exhibit a characteristic yellow-green fluorescence. However, the effectiveness of this method can vary based on skin type, recent bathing, and the specific *Malassezia* species involved, making it less reliable in some cases [1].

Dermoscopy. Dermoscopy has emerged as a valuable, non-invasive diagnostic tool, providing detailed visualization of PV lesions, including fine scaling, perifollicular involvement, and sharply demarcated borders [17]. In hypopigmented lesions, a white-to-pale background with subtle scaling is typically observed, while hyperpigmented lesions may exhibit a brownish or golden hue with similar scaling patterns [17]. These findings, although not pathognomonic, can help in differentiating PV from other conditions. Dermoscopy is especially beneficial in cases with atypical presentations or when other diagnostic methods yield inconclusive results. Its ability to identify perifollicular scaling and subtle changes in lesion morphology provides additional diagnostic confidence, especially in resource-limited settings where advanced molecular tools may not be available. However, the effectiveness of dermoscopy depends on the clinician's expertise and familiarity with dermoscopic patterns of the disease [8].

Although the available additional diagnostic methods are effective in confirming PV, a combination of clinical expertise and appropriate use of laboratory tools remains essential for ensuring accurate diagnosis and optimal management [1]. Further research into rapid, cost-effective molecular methods could improve diagnostic capabilities, particularly in resource-limited settings.

Treatment

The treatment of tinea versicolor focuses on eradicating the overgrowth of *Malassezia* species and addressing associated skin abnormalities. Therapeutic options include topical and

systemic antifungal agents, each with specific indications based on the extent and severity of the condition [7].

1. Topical antifungal therapy

Topical antifungals are the foundation of treatment for localized or mild cases of PV due to their high efficacy and low risk of systemic side effects. Topical agents come as lotions, creams, shampoos and foams. Non-specific and specific antifungal agents are distinguished [1-3,6,18].

a. Non-specific topical agents

Non-specific agents are selenium sulphide, zinc pyrithione, propylene glycol, Whitfield's ointment, benzoyl peroxide and sulphur combined with salicylic acid. These agents primarily act by either physically or chemically eliminating infected tissue from the stratum corneum or by altering cell turnover rates [2,19].

Selenium sulphide. Selenium sulphide is considered to be an effective and safe treatment option that is available as 1-2,5% lotion, shampoo or cream [6]. Although this method is low cost and effective, patients' adherence is often poor due to unpleasant smell and stains left on clothes and bedding [20].

Zinc pyrithione. Zinc pyrithione shampoos, which are commonly used for dandruff, have demonstrated effectiveness as body washes in the treatment of tinea versicolor. Their efficacy was highlighted in both an open trial [21] and a double-blind controlled study [22]. In the second-mentioned, 20 patients with PV were treated with either 1% zinc pyrithione shampoo or a placebo shampoo, applied for 5 minutes daily over two weeks. By the study's conclusion, all patients treated with the zinc pyrithione shampoo showed complete clearing of lesions, whereas no improvement was observed in the shampoo base group [22]. These findings support the use of zinc pyrithione 1% shampoo as a practical and effective option for managing this condition.

b. Specific topical agents

Specific agents are newer drugs that have direct activity against the pathogen. As they are a preferred treatment option nowadays, they will be more widely discussed in this review. This group consists of azoles (eg. ketoconazole, clotrimazole, miconazole and fluconazole)

and other drugs such as terbinafine or ciclopirox olamine [1]. While these treatments generally achieve high rates of fungal clearance, their efficacy is limited by patient compliance (multiple applications) or adverse effects that are usually mild (localized skin irritation, erythema, or contact dermatitis) but may reduce tolerability [18]. Despite these limitations, topical antifungals are often sufficient for the initial management of most cases, particularly when combined with proper patient education regarding application techniques and adherence [1,18].

Ketoconazole. Ketoconazole, a broad-spectrum azole antifungal, is available in both topical and systemic formulations, offering flexibility based on disease severity. Topically, ketoconazole 2% cream or shampoo is widely used for localized or mild cases. The cream is typically applied once daily for 2–4 weeks, while the shampoo is used as a body wash, left on the skin for 5–10 minutes before rinsing, over a 3–5 day course [19]. Savin RC *et al.* were the first to prove 2% ketoconazole cream effectiveness in the treatment of tinea versicolor. In 1986 they performed double-blind RCT with 101 participants. Mycological cure was achieved by 84% patients that received 2% ketoconazole cream and only by 22% in the placebo group. Complete cure rates were respectively 84% vs. 10% [23]. Balwada *et. al.* comparised 2% ketoconazole cream for 14 days with 1% clotrimazole cream [24] and Chopra *et al.* compared it with 1% terbinafine cream [25]. It showed a bigger mycological cure rate (90% vs. 85%) than clotrimazole [24] but lower (88% vs. 96%) than terbinafine [25]. Lange DS *et al.* performed a multicenter double-blind, placebo-controlled RCT on ketoconazole 2% shampoo, which proven that three daily applications of ketoconazole 2% shampoo are significantly (P<.001) more effective than placebo (clinical response rate 73% vs. 5%) [26]. Ketoconazol is also available as 1% or 2% foam, but the results of the studies for this form are inconclusive - in 2008 Di Fonzo *et al.* compared 1% foam and 2% cream (both with ketoconazol as an active substance, used 1x/day for 14 days) and got 100% mycological cure at 5 weeks in both groups [27]. In 2014 Cantrell *et al.* performed an open label study of 2% ketoconazole foam used 2x/day for 14 days that showed only 55% of mycological cure at 4 weeks [28]. Presented data suggest using cream or shampoo rather than foam in clinical practice [27,28].

If the effect of ketoconazole treatment is unsatisfactory, adjunctive therapy may also be considered - Shi *et al.* proved that adding 0,1% adapalene gel to 2% ketoconazole cream therapy may increase cure rates [29].

While ketoconazole demonstrates excellent efficacy in fungal clearance, it does not directly address pigmentary changes (mycological cure rates are generally higher than complete/clinical cure rates), which may persist post-treatment. Maintenance therapy, such as weekly use of ketoconazole shampoo, is sometimes recommended to reduce the risk of recurrence in predisposed individuals [3].

Terbinafine. Terbinafine, an allylamine antifungal, shows fungicidal activity against dermatophytes, yeasts, and molds by inhibiting squalene epoxidase. This inhibition disrupts sterol biosynthesis, compromising fungal cell membrane integrity [30]. The efficacy of the 1% terbinafine solution has been evaluated in multiple double-blind, randomized, placebo-controlled trials [30-32]. Double-blind, randomised trial by Vermeer *et al.* was a seven-day course of terbinafine 1% solution applied twice daily that resulted in mycological cure rates of 81% eight weeks post-treatment, significantly higher than placebo (41%, $p < 0.001$) [32]. Furthermore, Savin *et al.* demonstrated greater clinical effectiveness of 1% terbinafine solution, with a higher percentage of patients achieving resolution or near-resolution of physical symptoms combined with mycological cure immediately after treatment (48% vs. 30%, $p < 0.05$) and at seven weeks (81% vs. 30%, $p < 0.001$) [31]. Budimulja and Paul (2002) performed two separate trials in a tropical setting to assess the efficacy of 1% terbinafine solution. In the first trial, terbinafine was applied twice daily, achieving a mycological cure rate of 64% eight weeks after starting treatment. The second trial, using a once-daily regimen, achieved a cure rate of 49% [33]. The lower cure rates observed in these studies than in the studies conducted in temperate climates may be attributed to the challenging environmental conditions of Indonesia, where the tropical climate makes pityriasis versicolor a more common condition and clinical challenge. Despite lower cure rates, trials by Budimulja *et al.* showed that terbinafine topical therapy can be effective in treatment of PV [33].

Interesting fact about this drug is that it can only be used as topical agent in treatment of this condition because it is not excreted while sweating and does not reach high enough concentration in the stratum corneum to show antifungal action against *Malassezia* [3]. Therefore, oral terbinafine will not be discussed in this review.

2. Systemic antifungal therapy

Oral antifungal agents are effective but they carry a significant risk of severe adverse effects and therefore are reserved for recurrent disease, extensive involvement or cases of topical

treatment failure [1-5]. Nowadays, itraconazole and fluconazole (all classified as azoles) are used [2]. As mentioned above, terbinafine, although very effective while applied on the skin surface, is not used in systemic form [3]. Common adverse effects of these drugs include gastrointestinal disturbances, such as nausea and abdominal discomfort, and headaches [2]. Rare but serious complications, such as hepatotoxicity, require careful patient selection and monitoring, particularly in those requiring prolonged or repeated treatment. Hepatotoxicity is a significant problem when it comes to ketoconazole - once the gold standard for oral treatment of fungal infections, is no longer recommended to treat skin mycoses due to its hepatotoxicity (approximately 1 in 500 patients) [34, 35]. Drug interactions are also a concern, especially with itraconazole, which inhibits cytochrome P450 enzymes and can interact with medications like statins, anticoagulants, and certain antihypertensives.

Despite their efficacy, systemic antifungals are not curative for pigmentary changes associated with PV, which may persist long after fungal eradication. Maintenance therapy, such as fluconazole 300 mg monthly or ketoconazole shampoo used weekly, is often recommended for patients with recurrent disease to prevent relapses [36].

Itraconazole. Itraconazole, a triazole antifungal, works by inhibiting ergosterol synthesis through the cytochrome P450 enzyme system, leading to disrupted fungal cell membrane function. Known for its strong keratinophilic and lipophilic properties, itraconazole is highly effective against PV [37,38]. Approximately 80% of patients treated with standard dosage that is 200 mg daily for 5-7 days exhibit symptom relief [7,39]. While fungal structural changes occur immediately after treatment, they continue to develop over several weeks, emphasizing the sustained activity of oral antifungal agents [36].

Alternative dosing strategies have been explored in trials, including a single 400 mg dose or 400 mg daily for 3 days in comparison to the traditional 5- and 7-day regimens of 200 mg daily [40]. Some studies suggest that shorter regimens, such as 400 mg daily for 3 days, can be effective, but a single high dose was found to be less reliable [41]. Overall, the 5-day regimen remains the preferred option due to its consistent success rates [37,40].

PV recurrence is common within months or years after treatment, making prophylactic strategies appealing [36]. In a clinical trial, patients who received monthly prophylactic doses of 200 mg itraconazole twice daily over six months showed an 88% mycological cure rate, compared to 57% in the placebo group ($p < 0.001$). Additionally, symptoms like itching,

scaling, and pigmentation changes were significantly lower in the prophylaxis group, suggesting itraconazole's value in reducing relapses [42].

Although itraconazole is generally well-tolerated, rare side effects, such as liver toxicity and congestive heart failure, have been reported [4]. For safety reasons, it should not be used in individuals with active liver disease or a history of heart failure. Itraconazole's interaction with the cytochrome P450 system can also result in significant drug interactions, which may cause serious cardiac complications [4].

Fluconazole. Fluconazole, a triazole antifungal, inhibits cytochrome P450-dependent ergosterol synthesis, disrupting fungal cell function similarly to itraconazole and ketoconazole [7,43]. It is highly effective in treating PV and remains in the stratum corneum for up to two weeks after administration [43]. Studies have demonstrated that fluconazole is equivalent to, or in some cases more effective than, oral ketoconazole [44, 45]. Recommended regimen is 300 mg once weekly for 2–4 weeks, which has shown superior mycological cure rates compared to lower or single-dose regimens [44,45]. A large randomized trial by Amer (1997) reported mycological cure rates of 93% with 300 mg weekly for four weeks and 87% with 300 mg bi-weekly for four weeks, compared to 73% for 150 mg weekly ($p < 0.0001$) [46]. Alternative regimens have been explored, such as a single 400 mg dose, which demonstrated higher mycological cure rates than a single 400 mg dose of ketoconazole (82% vs. 53%, $p < 0.01$) [45]. Although relapse rates were slightly higher with oral fluconazole compared to topical clotrimazole at four weeks, fluconazole showed comparable or superior efficacy at 12 weeks in a randomized trial [47]. Overall, fluconazole's long-lasting presence in the skin, low toxicity, and convenience make it a valuable option for PV treatment, particularly for patients seeking alternatives to topical therapies [43-47].

Ketoconazole. Although oral ketoconazole at a dose 200mg daily for 10 days was proven to be an effective treatment method for tinea versicolor [6], its hepatotoxicity outweighs potential benefits. As mentioned before, 1 in 500 patients receiving oral ketoconazole may suffer from liver-linked adverse effects [34,35]. Additionally, multiple interactions between ketoconazole and other drugs may occur. Therefore, it should no longer be prescribed [3,4].

3. Phototherapy

Phototherapy has been studied as a potential treatment for tinea versicolor, with UVB light showing some ability to inhibit fungal growth [48]. However, its use is limited due to

inconsistent outcomes and concerns about long-term skin damage. Newer approaches, including the 308-nm excimer laser, narrow-band UVB therapy, and photodynamic treatments with 5-aminolevulinic acid or methylene blue, have shown promise in small studies [48-51]. Therefore, large-scale, randomized, and placebo-controlled trials are needed to confirm these findings and establish their clinical value. While effectiveness of this method is unclear and may not achieve the same level of fungal clearance as standard therapies, it can be valuable for patients with contraindications to standard antifungals [2,49].

Conclusion

Pityriasis versicolor, a superficial mycosis caused by *Malassezia* species, remains a current clinical concern, characterized by high recurrence rates. Its prevalence varies based on climate, reaching up to half of the population in tropical regions. Visible pigmentary changes on the skin surface have a significant psychosocial impact, highlighting the need for effective management of this condition. The diagnostic process is relatively simple, relying mostly on taking patient history and physical examination. When uncertain, clinicians can use additional methods such as dermoscopy, which is highly accurate but comes with limitations such as higher cost and the need for specialized training.

Treatment typically involves topical antifungals for mild cases and systemic agents for more extensive or recurrent disease, each with specific indications and limitations. While antifungal agents show high effectiveness in clinical trials, patient adherence remains a frequent challenge, often leading to treatment failure. Despite significant advancements in managing PV, further research is necessary to increase treatment efficacy, reduce relapse rates and minimize side effects. Randomized controlled trials (RCTs) with larger, more diverse populations are essential for evaluating long-term outcomes and establishing standardized treatment protocols. Another crucial area for investigation is the use of prophylactic therapy to help reduce the rate of recurrence.

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