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Research Article

Efficacy of Topical Ivermectin Weekly for 12 Weeks in Pediculosis Capitis

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Abstract: Chronic, heavy infestation with head lice (Pediculus humanus capitis) can rarely cause anaemia, particularly in rural females who already have iron-deficiency anaemia. A single treatment with topical ivermectin (IVM) may produce an earlier response and higher cure rate than oral IVM. Objective: To determine the efficacy of weekly topical ivermectin (2% concentration) given for 12 weeks in patients with pediculosis capitis. ***Methods:*** This prospective clinical study was conducted in the Department of Dermatology, Abbasi Shaheed Hospital, Karachi, from 17 May to 16 November 2019. A total of 194 patients meeting the inclusion criteria were enrolled by non-probability consecutive sampling. All subjects were treated with 2% topical ivermectin applied to the scalp and hair, left in place for 10 minutes, and rinsed. Infestation and pruritus severity were scored at baseline and at 12 weeks. Efficacy was defined as the absence of live lice at the 12-week assessment. Data were analysed in SPSS v21; results were stratified by age, gender, body mass index (BMI), hair length, hair texture, and hair curliness, with post-stratification chi-square testing ($p \leq 0.05$ considered significant). ***Results:*** Of 194 patients, 20.1% were male and 79.9% were female (mean age 27.15 ± 8.78 years). Mean infestation and pruritus scores fell from 1.46 ± 0.74 and 1.65 ± 0.65 at baseline to 0.29 ± 0.52 and 0.31 ± 0.50 at 12 weeks, respectively. At 12 weeks, 73.2% of patients had no infestation and 70.6% had no pruritus. Overall treatment efficacy was 60.3%. Efficacy was significantly associated with male gender (84.6% vs 54.2% in females, $p = 0.001$) and shorter hair length (≤35 cm: 67.0% vs >35 cm: 53.2%, $p = 0.049$); no significant association was found with age, BMI, hair texture, or hair curliness. ***Conclusion:*** Weekly topical ivermectin (2%) for 12 weeks demonstrated high efficacy in pediculosis capitis, producing significantly higher cure of infestation and faster relief of pruritus, with male sex and shorter hair length as favourable prognostic factors

Keywords: Efficacy; Topical ivermectin; Pediculosis capitis; Head lice; Pruritus.

INTRODUCTION

Pediculosis capitis, infestation of the human scalp by Pediculus humanus var. capitis, remains a widespread global health problem that crosses socioeconomic boundaries and is the most frequent ectoparasitic infestation of childhood.1,2 Prevalence is highest among school-aged children, and infestation shows no consistent relationship to personal hygiene.1,3 Although rarely a marker of serious systemic disease, several case reports and case series have described chronic, heavy lice infestation as a rare but recognised precipitant of iron-deficiency anaemia, particularly in women and girls with no other identifiable cause of blood loss.4

Transmission occurs chiefly through direct head-to-head contact, with a supporting role for shared fomites such as combs, hairbrushes, and headgear.5 Pruritus, the dominant symptom, results from host sensitisation to louse saliva introduced during blood meals; repeated scratching predisposes to secondary bacterial infection.2,6 Beyond the physical burden, pediculosis capitis causes substantial social distress, parental anxiety, and school absenteeism, and remains a common presenting complaint in both primary care and dermatology clinics.3,7

Management combines mechanical removal (wet combing, nit removal), topical pediculicides, and, in selected cases, oral therapy.2 Resistance of head lice to first-line pyrethroid and organochlorine pediculicides is increasingly well documented,8 and has been linked to point mutations in the voltage-sensitive sodium channel (VSSC) gene of the louse — the so-called knock-down resistance (KDR) mechanism — reported in louse populations from multiple countries.9-11 This growing resistance has renewed clinical interest in alternative agents, chief among them ivermectin.

Ivermectin is a macrocyclic lactone anti-parasitic, established for decades in the treatment of scabies and, through mass drug administration programmes, onchocerciasis, with a well-characterised safety profile in these indications.12,13 Early reports described topical ivermectin application as an effective option against human ectoparasites.14 Subsequently, a large randomised trial demonstrated that oral ivermectin (given twice, one week apart) was superior to topical 0.5% malathion lotion for difficult-to-treat head lice.15 In parallel, a randomised, vehicle-controlled trial established the efficacy of topical 0.5% ivermectin lotion as a single 10-minute application, without the need for

nit combing.16 A further trial assessing multiple concentrations of topical ivermectin lotion reported a concentration-dependent relationship with treatment efficacy,17 and a subsequent review reaffirmed the efficacy and tolerability of topical 0.5% ivermectin lotion.18 Other formulations acting by physical (non-neurotoxic) mechanisms — including spinosad and high-concentration dimeticone-based lotions — have also shown good pediculicidal and ovicidal activity in randomised and cohort studies, reflecting the broader shift toward non-insecticidal treatment strategies as resistance spreads.19-23

Given the emergence of local resistance and treatment failure with conventional pediculicides, sustained topical ivermectin therapy is a promising strategy worth evaluating in our population. This study was therefore designed to determine the clinical efficacy of weekly topical ivermectin (2% concentration) given for 12 weeks in patients with pediculosis capitis

Materials and Methods

Study design and setting: This was a prospective, single-arm clinical study conducted in the Department of Dermatology, Abbasi Shaheed Hospital, Karachi, Pakistan, over a six-month period from 17 May 2019 to 16 November 2019, following approval by the College of Physicians and Surgeons Pakistan (CPSP).

Sample size and sampling technique: Sample size was calculated using the WHO sample-size calculator, based on a reported lice-free rate with ivermectin from prior topical ivermectin trial data, a 7% margin of error, and 95% confidence level, yielding a required sample of 194 patients. Non-probability consecutive sampling was used.

Inclusion criteria: Patients of either gender, aged 5–45 years, with a confirmed diagnosis of pediculosis capitis and no other apparent disease.

Exclusion criteria: Body weight under 15 kg; known allergy to ivermectin; pregnancy or breastfeeding; drug intolerance; multiple known allergies; or treatment for pediculosis within the preceding two weeks.

Diagnosis: Pediculosis capitis was diagnosed on scalp pruritus confirmed by visible nits, nymphs, and live lice, using a 10× magnifier. A minimum of three live lice and five apparently viable nits was required for inclusion. Infestation severity was scored 0 (none) to 4 (very severe, >20 lice), and pruritus severity was scored 0 (none) to 3 (severe, near-constant itching with deep scalp injury).

Intervention: After written informed consent, all subjects received topical ivermectin (2% concentration) applied under the supervision of a consultant dermatologist with more than five years' experience. On day 1, the medication was applied thoroughly to scalp and hair, left in place for 10 minutes, then rinsed with water; hair was towel-dried without blow-drying to avoid a confounding lousicidal thermal effect. Gentle detangling with a wide-toothed comb was permitted before and after treatment. Subjects avoided adjunctive treatments (nit combing, hair cutting, or chemical treatment) until the 12-week evaluation, unless earlier rescue treatment was clinically required. Application was repeated weekly for 12 weeks, and efficacy was assessed at the 12-week visit.

Outcome definition: Efficacy was defined as complete absence of live lice at the week-12 assessment, sustained from the first lice-free week through week 12.

Statistical analysis: Data were analysed using SPSS version 21. Qualitative variables (gender, hair texture, hair curliness, infestation and pruritus severity) were summarised as frequencies and percentages; quantitative variables (age, height, weight, BMI, hair length, infestation and pruritus scores) were summarised as mean ± standard deviation. Effect modifiers (age, gender, BMI, hair length, hair texture, hair curliness) were controlled through stratification, and post-stratification chi-square testing was applied to assess their association with efficacy. A p-value ≤ 0.05 was considered statistically significant.

Results

A total of 194 patients aged 5–45 years met the inclusion criteria and completed 12-week follow-up. Of these, 39 (20.1%) were male and 155 (79.9%) were female. The overall mean age was 27.15 ± 8.78 years, mean weight 60.49 ± 15.49 kg, mean height 159.81 ± 13.94 cm, and mean BMI 23.38 ± 3.99 kg/m². Mean hair length was 35.38 ± 17.18 cm. Regarding hair characteristics, 79.4% of patients had average hair texture and 87.6% had straight hair.

At baseline, mean infestation and pruritus scores were 1.46 ± 0.74 and 1.65 ± 0.65 respectively; 68.6% of patients had mild infestation, 16.0% moderate, and 15.5% severe, while 44.3% had mild pruritus, 45.4% moderate, and 10.3% severe. Following 12 weeks of weekly topical ivermectin, mean infestation and pruritus scores fell to 0.29 ± 0.52 and 0.31 ± 0.50 respectively. At the 12-week assessment, 73.2% of patients had no infestation, 23.7% mild, and 3.1% moderate infestation; 70.6% had no pruritus, 27.3% mild, and 2.1% moderate pruritus.

Overall treatment efficacy — defined as complete and sustained clearance of live lice by week 12 — was observed in 117 of 194 patients (60.3%).

On stratified analysis, efficacy was significantly associated with gender: 84.6% of male patients achieved efficacy compared with 54.2% of female patients (p = 0.001). Efficacy was also significantly associated with hair length: patients with hair ≤35 cm achieved efficacy in 67.0% of cases versus 53.2% among those with hair >35 cm (p = 0.049). No significant association was found between efficacy and age group (p = 0.827), BMI group (p = 0.657), hair texture (p = 0.494), or hair curliness (p = 0.236).

Table 1. Baseline Demographic and Clinical Characteristics (n = 194)

Characteristic	Value
Male, n (%)	39 (20.1)
Female, n (%)	155 (79.9)
Age, years (mean ± SD)	27.15 ± 8.78
Weight, kg (mean ± SD)	60.49 ± 15.49
Height, cm (mean ± SD)	159.81 ± 13.94
BMI, kg/m² (mean ± SD)	23.38 ± 3.99
Hair length, cm (mean ± SD)	35.38 ± 17.18
Hair texture — average, n (%)	154 (79.4)
Hair curliness — straight, n (%)	170 (87.6)

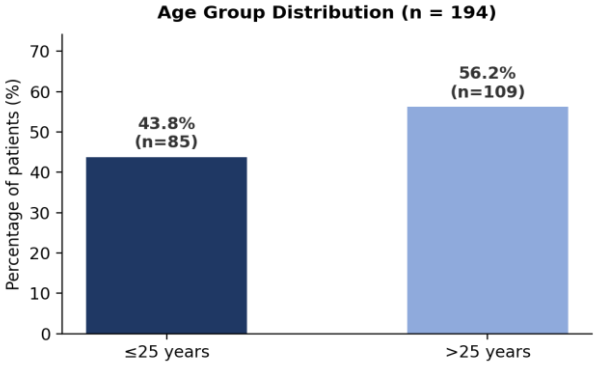

Figure 1. Age Group Distribution (n = 194)

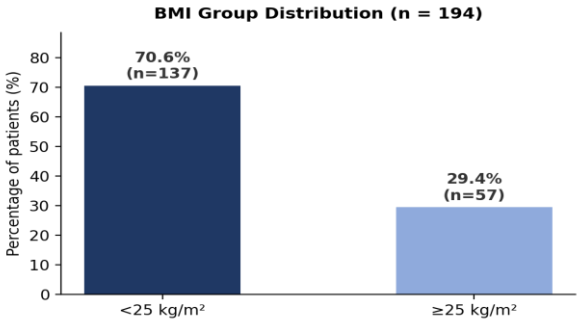

Figure 2. BMI Group Distribution (n = 194)

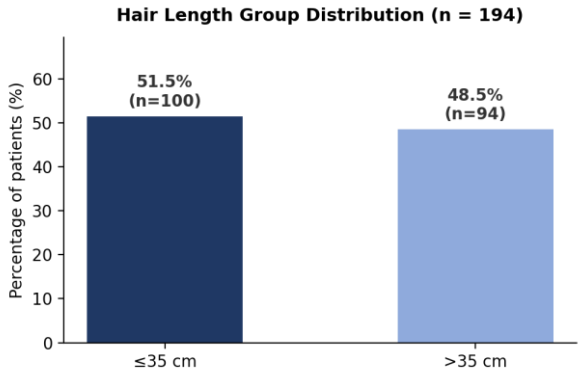

Figure 3. Hair Length Group Distribution (n = 194)

Table 2. Infestation and Pruritus Scores: Baseline vs Week 12 (n = 194)

Parameter	Baseline (mean ± SD)	Week 12 (mean ± SD)
Infestation score	1.46 ± 0.74	0.29 ± 0.52
Pruritus score	1.65 ± 0.65	0.31 ± 0.50

Table 3. Overall Treatment Efficacy at Week 12 (n = 194)

Efficacy	n	%
Yes	117	60.3
No	77	39.7

Table 4. Association of Efficacy with Demographic and Hair-Related Variables

Variable	Efficacy: Yes, n (%)	Efficacy: No, n (%)	Total	p-value
Male	33 (84.6)	6 (15.4)	39	
Female	84 (54.2)	71 (45.8)	155	0.001*
Hair ≤35 cm	67 (67.0)	33 (33.0)	100	
Hair >35 cm	50 (53.2)	44 (46.8)	94	0.049*
Age ≤25 y	52 (61.2)	33 (38.8)	85	
Age >25 y	65 (59.6)	44 (40.4)	109	0.827
BMI <25 kg/m²	84 (61.3)	53 (38.7)	137	
BMI ≥25 kg/m²	33 (57.9)	24 (42.1)	57	0.657

**Statistically significant at $p \leq 0.05$ (chi-square test)*

DISCUSSION

Although pediculosis capitis is rarely a cause of serious morbidity, its impact on social wellbeing, family life, and school attendance is considerable, which sustains ongoing interest in identifying reliable, well-tolerated treatments.3,7 In this study, weekly application of 2% topical ivermectin for 12 weeks produced marked reductions in both infestation and pruritus scores, with 73.2% of patients achieving complete clearance of live lice and 70.6% becoming free of pruritus by week 12; overall efficacy was 60.3%.

These findings sit alongside a growing body of trial evidence for ivermectin-based regimens in pediculosis capitis. A randomised, vehicle-controlled trial established the efficacy of a single 10-minute application of topical 0.5% ivermectin lotion,16 while a separate trial assessing multiple topical ivermectin concentrations reported a concentration-dependent relationship between formulation strength and eradication rate.17 On the oral side, a large multicentre randomised trial demonstrated that two doses of oral ivermectin (400 µg/kg, one week apart) achieved superior clearance compared with topical 0.5% malathion lotion in difficult-to-treat, previously resistant infestations.15 Direct head-to-head randomised comparisons of topical versus oral ivermectin at the concentrations and schedules used in different populations remain relatively limited, and our 60.3% efficacy figure — while consistent with the general direction of this literature — should be interpreted as a single-arm, non-comparative result rather than benchmarked precisely against any one trial.

Non-neurotoxic, physically acting alternatives such as spinosad and high-concentration dimeticone-based lotions have also
demonstrated good pediculicidal and ovicidal efficacy in randomised trials, reinforcing a broader shift toward

physical or biologically targeted mechanisms as resistance to conventional neurotoxic pediculicides spreads.19-23 The sustained reduction in pruritus observed in the present cohort through week 12 most plausibly reflects the continued absence of live lice, though a direct antipruritic or emollient effect of the vehicle cannot be excluded from this study design.

The significant association between efficacy and male gender is most parsimoniously explained by the strong co-association between female sex and longer hair length in this cohort — hair length itself was independently and significantly associated with efficacy ($p = 0.049$), with shorter hair conferring better clearance, presumably reflecting more complete and even product coverage of the scalp and hair shaft. No significant associations were found for age, BMI, hair texture, or hair curliness, suggesting these factors do not meaningfully influence treatment response and that topical ivermectin efficacy is broadly consistent across these subgroups.

Ivermectin has an established safety record from decades of use in scabies treatment and in mass drug administration programmes for onchocerciasis.12,13 Together with the well-documented and growing resistance of head lice populations to pyrethroid and organochlorine pediculicides8 — linked to knock-down resistance mutations in the louse voltage-sensitive sodium channel gene across multiple countries9-11 — these findings support topical ivermectin as a rational option where conventional first-line agents are failing, while underscoring the need for larger comparative trials in this population.

Study limitations: This was a single-centre, non-randomised study without a comparator arm, conducted in an urban tertiary-care setting; the absence of randomisation and blinding, together with a relatively modest sample size, limits causal inference and generalisability to broader or more rural populations. Comparative, ideally randomised, trials against oral ivermectin and other first-line pediculicides, with longer follow-up beyond 12 weeks, are needed to confirm these findings and to define the optimal concentration and treatment interval.

Conclusion

Weekly topical ivermectin (2% concentration) given for 12 weeks demonstrated high efficacy in the treatment of pediculosis capitis, producing significantly higher clearance of infestation and faster relief of pruritus. Male sex and shorter hair length were identified as favourable prognostic factors for treatment success, while age, BMI, hair texture, and hair curliness did not significantly influence outcome. These findings support topical ivermectin as an effective, well-tolerated option for pediculosis capitis, particularly relevant in settings facing rising resistance to conventional pediculicides.

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