

Pediculicidal Activity of *Annona squamosa* Seed Powder in Coconut Oil: A Preliminary Observational Study Highlighting an Urgent Public Health Need

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ABSTRACT

Pediculosis capitis is still a major public health concern, especially for school-age children in areas with inadequate resources, where treatment access and close contact enhance transmission. The search for safe, economical, and efficient substitutes has become necessary due to growing resistance to widely used synthetic pediculicides and their negative dermatological consequences. The clinical significance of efficient care is further highlighted by recent studies from Odisha detailing serious problems linked to protracted and untreated infestations. The pediculicidal effectiveness of *Annona squamosa* seed powder made in coconut oil is assessed in this initial observational study. In order to create a topical solution that was administered in two treatment cycles at weekly intervals, shade-dried seeds were ground into a fine powder and mixed with coconut oil. After the first application, there was a noticeable decrease in live lice, and after the second, they were completely eradicated. During the observation period, no adverse dermatological reactions or infestation recurrence were observed. In addition to the suffocating effect of coconut oil, bioactive substances such as acetogenins and alkaloids that work through mitochondrial inhibition and neurotoxicity may be responsible for the effectiveness. To confirm safety and therapeutic efficacy, more toxicological and clinical research is needed.

Keywords: *Annona squamosa*, Head lice, Pediculosis capitis, Coconut oil, Traditional medicine and Pediculicide.

INTRODUCTION

Pediculus humanus capitis, the causative agent of pediculosis capitis, is a common ectoparasitic infestation of the human scalp (1,8). Direct head-to-head contact is the main way HPV spreads, though it can also occasionally spread through shared personal objects like hats, combs, and beds (6). Persistent itching, inflammation of the scalp, excoriations and secondary bacterial infections are all consequences of infestation, however they are not fatal (11). The discomfort and social shame attached to infestation underscore the necessity of efficient control techniques.

For many years, synthetic pediculicides, such as formulations of malathion and permethrin, have been used extensively (10). However, there has been a resurgence of interest in ethnobotanical therapies due to growing reports of resistance, decreased efficacy, scalp irritation and environmental damage (5,9). Biodegradability, cultural acceptability and possible multi-target modes of action are advantages of plant-derived formulations that may increase therapeutic efficacy while lowering the risk of resistance development and decreasing negative side effects (9).

Custard apple, also called Sitaphal or *Annona squamosa* L. (Family: Annonaceae), has long been

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utilized in a number of indigenous medical systems (7). Insecticidal, antiparasitic and antibacterial qualities are particularly well-known for the seeds (2,7). Through mitochondrial inhibition and neurotoxicity in arthropods, bioactive components such acetogenins, alkaloids and flavonoids have been shown to demonstrate strong insecticidal activity (15).

MATERIALS AND METHODS:

Collection and Preparation of Plant Material

Annona squamosa mature fruits were gathered locally. To avoid fungal contamination and the deterioration of bioactive substances, seeds were separated, properly cleaned to eliminate pulp residues and shade-dried at room temperature until they were completely dry. A mechanical grinder was used to ground the dried seeds into a fine powder. After being sieved to achieve a consistent particle size, the powder was kept in sealed containers.

Formulation Preparation

The seed powder was combined with enough commercially available coconut oil (Parachute TM

coconut oil) to create a uniform, smooth paste that could be applied topically (4). The choice of coconut oil was made because of its well-known moisturizing qualities and propensity to suffocate lice (4).

Application Protocol

- The hair roots and scalp were treated uniformly with the formulation.
- A gentle massage ensured enough covering.
- A reasonable amount of time (around 30 to 45 minutes) was spent in contact with the preparation (10).
- After that, a gentle shampoo was applied to the hair.
- To handle possible egg hatchings, the process was repeated again at regular intervals (about seven days apart) (11).

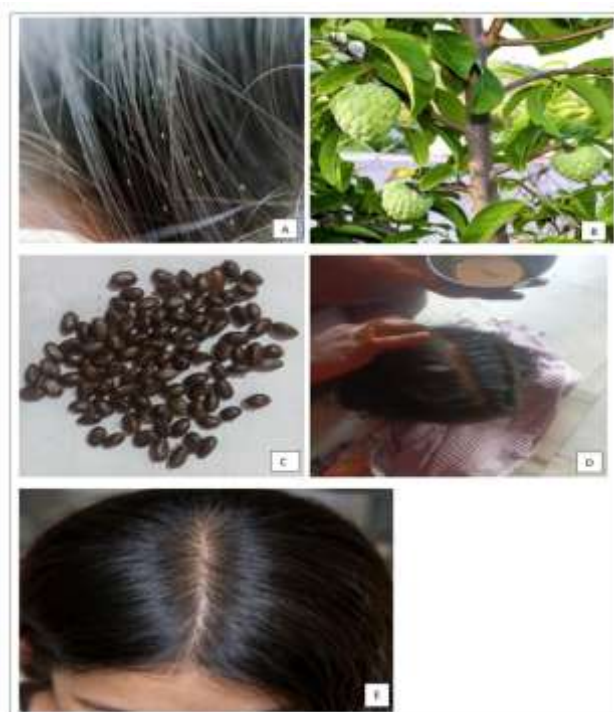


Figure 1: A. Lice-infested human scalp (before treatment), B. *Annona squamosa* plant, C. Shade drying of *Annona squamosa* seeds, D. Application of *Annona squamosa* seed powder mixed with coconut oil on the scalp and E. Scalp condition after treatment showing reduction/elimination of lice infestation.

Observation Criteria

- Whether live lice are present or not
- Re-infestation evidence
- Indications of negative responses or inflammation of the scalp
- A decrease in itching that is subjective

RESULTS AND DISCUSSION:

Pediculosis capitis is still a major global public health concern, especially for school-age children and areas with little resources (8,11). Exploration of alternative therapeutic approaches derived from traditional medical knowledge has become necessary due to growing resistance to regularly used synthetic pediculicides, such as permethrin and formulations based on pyrethroid (5,10). The current early observational study assessed the pediculicidal potential of *Annona squamosa* seed powder made in coconut oil and showed total lice eradication after two topical treatments. These results imply that plant-based remedies could be a useful supplemental approach to treating Pediculosis capitis (9,13).

The found effectiveness is in line with earlier studies that showed *A. squamosa* seeds' insecticidal qualities (2,7). It is recognized that members of the Annonaceae family contain biologically active secondary metabolites, especially acetogenins, which have potent antiparasitic and pesticidal properties (15). In insects, acetogenins mostly work by inhibiting mitochondrial complex I, which disrupts ATP generation and causes metabolic collapse (15). In contrast to many synthetic pediculicides that work via a single neurotoxic mechanism, mitochondrial inhibition causes systemic energy deprivation, which eventually paralyzes and kills lice (3,5). The quick decrease in live lice seen in the current study following repeated application could be explained by this mechanism.

Alkaloidal substances found in *A. squamosa* seeds, in addition to acetogenins, may have a pediculicidal effect via disrupting neural signalling (7). Mortality is increased when neurotoxic impairment of synaptic transmission affects eating behaviour and locomotor

activity (3). The coexistence of neurophysiological and metabolic mechanisms of action points to a therapeutic impact with many targets (9). In the current clinical setting, where growing resistance to single-target pediculicides has been extensively documented, such multi-mechanistic activity is especially significant (5). Botanical drugs with several targets may lessen the selection pressure that leads to the quick emergence of resistance (9).

Coconut oil's function in the formulation probably goes beyond that of a straightforward carrier medium. Lipid-based carriers prolong contact between active phytochemicals and lice by improving cutaneous spreading and increasing adhesion to hair shafts and scalp surfaces (4). By obstructing respiratory spiracles and causing asphyxiation, coconut oil may also have a mechanical pediculicidal impact (4). Its mild antibacterial qualities may also aid in preventing secondary bacterial infections that are frequently linked to scalp excoriation and scratching in long-term infestations (4). The great efficacy seen in this formulation may therefore be explained by the synergistic combination between physical blockage and phytochemical toxicity.

From a clinical standpoint, the creation of accessible and reasonably priced treatments is especially important in low- and middle-income areas, where commercial pediculicides could be expensive or unavailable (12). Community healthcare practices still heavily rely on traditional treatments made from plant-derived compounds (9). To connect traditional knowledge with evidence-based medicine, such treatments must be validated scientifically (9). The above results provide initial observational evidence that *A. squamosa* seed preparations have therapeutic potential; however, care is necessary prior to clinical use.

One significant barrier to the therapeutic application of *A. squamosa* seeds is safety concerns. Due to the strong bioactive chemicals found in the seeds, prior clinical investigations have shown eye toxicity and irritating reactions after unintentional exposure to seed extracts (7). Therefore, there may be health concerns associated with improper preparation, high concentration, or unintentional contact with mucosal surfaces (7). To reduce negative effects, extraction



techniques, dosage, exposure time, and safety procedures must all be standardized (14). Recommendations for regular usage must come after toxicological profiling and dermatological safety assessment (14).

Following reports of serious problems linked to untreated infestations, the clinical value of managing pediculosis effectively has recently attracted increased attention (12). Even though pediculosis-related deaths are incredibly uncommon, these occurrences highlight the fact that persistent infestations are more than just aesthetic or social issues; they can have major negative effects on vulnerable people's health (12).

Prospects for Future Research: The following research is advised in order to confirm the results:

- Pediculicidal bioassays *in vitro*
- Studies comparing the effectiveness of typical permethrin formulations
- Research on skin irritation and toxicity
- Standardization and optimization of dosage
- GC-MS and HPLC phytochemical profiling
- Clinical trials using randomized controls

CONCLUSION:

According to the current exploratory observational investigation, *Annona squamosa* seed powder made with coconut oil shows encouraging pediculicidal effectiveness against pediculosis capitis, eliminating all lice after two applications (2,13). These results may be useful as a low-cost, plant-based substitute for traditional therapies, especially in environments with limited resources (9). However, before making a clinical suggestion, *A. squamosa* seeds' known poisonous and irritating qualities require a thorough safety assessment (7,14). The necessity for efficient and evidence-based therapeutic measures is further highlighted by recent reports of serious consequences, including uncommon mortality linked to neglected or poorly managed head-lice infestations (12). Therefore, before widespread therapeutic acceptance, well-designed experimental research, toxicological

evaluations and controlled clinical trials are necessary to establish standardized formulations, validate clinical efficacy and confirm safety (14).

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