

Home fever management in children: a systematic review

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ABSTRACT

Fever is a prevalent illness among children. Physical cooling interventions worsen the child's condition as a result of parents' anxiety and misconceptions about fever. This study aims to identify parental physical cooling intervention as fever management for feverish children in the scientific literature. The study adhered to the guidelines in the preferred reporting items for systematic reviews and meta-analyses (PRISMA). The investigations were conducted within scientific electronic databases: ProQuest, Pubmed, Scopus, EBSCO, Google Scholar, and Cochrane, published in English, from January 2013 to August 2023. Authors screened articles for inclusion. After exclusion, there were ten studies included in the analysis with 15,488 participants. The literature review demonstrated that the physical cooling methods employed for home fever management were taking off excess clothes, providing extra fluid, warm compresses, sponging, showering and environmental measures. Sponging techniques and cold compresses are popular among parents. However, the methods have negative effects and are not recommended. Effective fever management optimizes the body's physiological response by ensuring adequate hydration, nutrition, and a conducive environment. When the fever worsens, parents should consider seeking medical treatment.

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1. INTRODUCTION

Fever is a prevalent symptom in pediatric healthcare facilities. According to epidemiological data, fever is the most prevalent symptom and trigger for over 30% of all pediatric visits [1]. In primary health care, the most common causes of fever are acute viral illnesses like upper respiratory infections and diarrhea. These conditions are the most common cause of death worldwide, specifically in developing countries [2].

A study reported that more than 48.3% of children under five suffer from a fever or common cold [3], and the prevalence of self-medication is 22.2% [4]. The most common cause of fever in children is typically a self-limiting viral infection, and the majority of these ailments resolve on their own without the need for extra medical attention [5]. Fever is a physiologic reaction to infection, constraining the proliferation of bacteria and the replication of viruses and increasing the immune system's response [6], [7], not a life-threatening condition [7]–[9]. Given the evidence that fever is a positive phenomenon, fever reduction is a common practice [10].

When the body temperature exceeds a particular point, fever could turn severe, cause cell damage, and reduce oxygen release in tissues [11]. Fever increases metabolic rate and cardiopulmonary system demands, which could trigger pulmonary, cardiac, or neurologic deterioration [12]. Furthermore, fever

imposes a significant metabolic burden and generates severe headache, and discomfort [7], [13]. A prevalent misconception among parents regarding fever is that it may lead to convulsions, brain damage, and death [7]. This may lead to anxiety and excessive handling actions from the parent.

The current World Health Organization (WHO) guidelines on fever management recommend the use of an antipyretics for treating children with a temperature of 38.5 °C or higher, indicating a mild to moderate increase that should not be suppressed consistently [14]. Equivalent to the findings of one study, antipyretics should not be administered merely to reduce body temperature [9], [15]–[17]. Furthermore, the American Academy of Pediatrics (AAP) issued a policy statement stating there is no evidence supporting the use of antipyretics to lower fever in all febrile children [18]–[21].

Within a wide range of fever remedies, they are classified into two main categories: physical remedies and pharmaceutical medications. Pharmacological treatments, including antipyretics, are commonly practiced and have effects by reducing the synthesis of prostaglandin. It raises peripheral vasodilation along with heat loss and also resets the hypothalamic thermoregulatory center to normal [22]. In most cases, even taking alternate antipyretic regimens based on a lack of response to monotherapy and a medical indication [7], [23]. Despite parents belief that the drugs may adversely affect the stomach, harm the kidneys, damage the liver, inhibit the immune system, or trigger allergic responses, it remains essential to treat fever with antipyretics [24]. In contrast, physical remedies including physical cooling, work differently than antipyretics. It works by resolving the metabolically expensive effector mechanisms induced by the increased set point [25]. Physical approaches are non-pharmacological intervention. It encompass a variety of methods to provide heat loss through the processes of conduction, convection, and evaporation [26]–[28]. Basic cooling strategies, such as the practice of removing clothing and blankets, applying a wet towel, or using a fan, warm compresses, are employed to reach the target temperature [28], [29]. The lack of standardization of non-pharmacological interventions in nurses' clinical practice requires the implementation of the best scientific evidence to administer non-pharmacological treatments for febrile children, reducing the length of stay and enhancing the quality of healthcare and decision-making.

Every parent will encounter children with a fever. Many physical cooling methods are used based on tradition, information from physicians, or health beliefs. This study addresses the widespread use by parents of various non-pharmacological physical cooling methods to manage fever in children at home, often based on misconceptions and without scientific validation. The integrative review is the proper method for identifying parents' interventions for feverish children. The majority of the research published was conducted in secondary care settings, as fever is a symptom of a specific disease and is treated in a hospital or clinic setting. In the meantime, publication of research findings related to home fever management remains restricted. This study aims to identify an evidence-based population regarding physical cooling for home fever management.

2. METHOD

2.1. Design

To compile the current knowledge on non-pharmacological physical cooling methods for fever management at home, a thorough literature review was carried out. The preferred reporting items for systematic reviews and meta-analyses (PRISMA) checklist for systematic reviews was followed in the conduct of the review [30].

2.2. Search methods

Using a number of electronic databases, including ProQuest, Pubmed, SCOPUS, EBSCO, Google Scholar, and Cochrane, an automated literature search covering the period from January 2013 to August 2023 was carried out. A wide range of pertinent subjects were covered by the search phrases used, such as “physical cooling,” “non-pharmacological,” “fever,” “parents' fever management,” “home management of fever,” and “fever management in children.” Each term was searched for separately or in combination using boolean operators. This study looks at how parents manage their child's fever, focusing especially on physical cooling methods. The selection of the studies for this literature review was achieved through a thorough assessment of all the publications, which was preceded by a summary of the article titles, abstracts, and keywords.

2.3. Inclusion criteria

All studies that met the following conditions were included in this review: i) population: parents, families, or individuals who deal with fevers at home. ii) Cross-sectional studies, case reports, surveys, quantitative and qualitative studies, and mixed methods. ii) Population-based studies, reported result data on

physical cooling for home fever management. iv) The study focused on mild fevers and manageable at home. And v) studies that were published between January 2013 and August 12, 2023, and written in English.

2.4. Exclusion criteria

Every study that met even one of the subsequent criteria for exclusion was eliminated: clinical studies (basic research and lab medicine), reports, book sections, letters to the editor, editorials, systematic reviews, meta-analyses, randomized controlled trials, and studies with unclear methodology were all excluded. The research on high fever resulting from a verified illness was omitted. To locate any prospective publications that might have gone unnoticed, a thorough investigation was conducted.

2.5. Data synthesis

Selected studies were reviewed by the researchers. For review, the principal author gathered pertinent data and organized it into Microsoft Excel tables. Two additional reviewers confirmed the accuracy of the abstracted data. After comparing and contrasting every article in response to the study question, categories started to take shape. The information that was taken out included how parents identify a fever in their child, where a thermometer should be placed, how medication is used, and above all the kinds of physical cooling methods that studies have consistently shown to be effective in lowering fever. The following data were tabulated from the studies meeting the inclusion criteria: author names and year of publication; number of participants; study design; data analysis; and key results as shown in Figure 1.

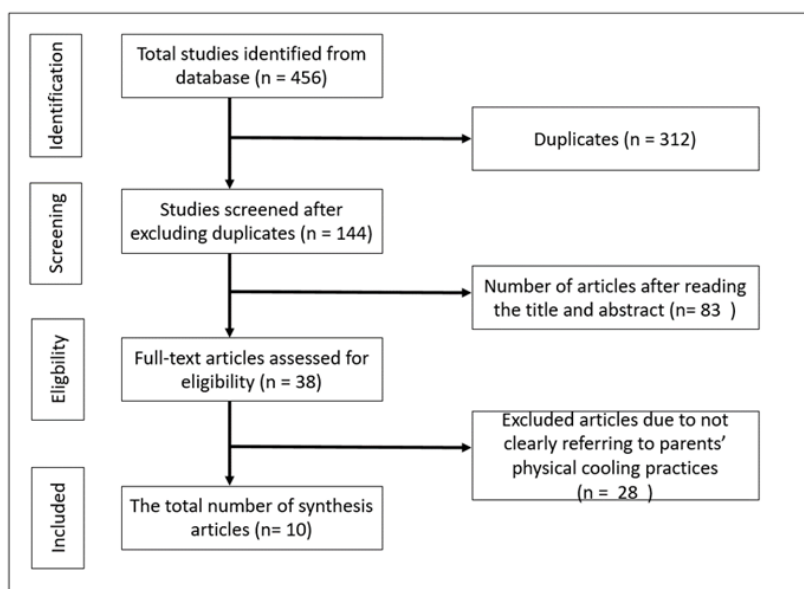


Figure 1. Study inclusion

3. RESULTS AND DISCUSSION

The body of literature comprised a total of ten studies [5], [24], [31]–[38] were published between January 1, 2013 and August 11, 2023 in the English language. Turkey, Sudan, Australia, Malaysia, Istanbul, Egypt, India, Germany, Qatar and Saudi Arabia were the countries of publication. The participants in the present study consisted of 15,488 as shown in Table 1. The studies were classified according to evidence levels and provided insights into the non-pharmacological practices employed by parents for managing fever at home.

The literature regarding parents' non-pharmacological practices for managing fever at home remains limited. The analyzed studies indicate that fever is defined as a child's temperature above 38 °C. Parents can detect fever by using a thermometer to measure their child's temperature. However, some only touch the forehead or other parts of the body's surface. Rectal is the optimal site to take a temperature for children under three years old, and oral or axilla for children above three years old. Home remedies for managing fever include removing heavy clothes and giving the child light ones, in spite of putting on blankets and cotton clothes to keep the child warm. Providing extra fluids and checking the child's body temperature regularly every 15-30 minutes, and controlling the environmental temperature are other practical efforts. Administering antipyretics is believed to be the right way to reduce fever [31], [39].

Table 1. Characteristics and main findings

| Source | Country | No. of participant | Age (years) | Study design | Data analysis | Key results |
|--------|--------------|--------------------|------------------------|---|--|--|
| [5] | Turkey | 320 mothers | 33-39 years old | Descriptive and correlational test | Chi-squared, ANOVA | When children (1-5 years) experienced fever, mothers usually took off their clothes and administered antipyretics. The child's armpit temp. was taken every 15 minutes for fever. Giving compresses with warm and cold water, rubbing with vinegar and water, and showering. |
| [31] | Sudan | 332 mothers | <20 up to 49 years old | Descriptive, community-based study | Descriptive analysis | Physical methods, along with antipyretics, are employed in home management. The most common approach is to apply cold water for tepid sponging. The compress sites are on the head, entire body, groyne area, and axilla. Other home remedies include extra fluids, bathing, and light clothing. |
| [32] | Australia | 12,179 parents | 34-39 years old | Cross-sectional survey | Chi-square, linear regression | Parents were aware that a fever is defined as a temperature higher than 38°C. The use of cool or tepid sponges, putting kids in cool or tepid baths, and alternating between two or more medicines to lower the temperature were all non-evidence-based temperature reduction techniques. The belief that "it is important to be able to measure temperature" and fever management practices, such as applying a tepid or cool sponge and alternating two or more medicines to reduce fever," have made major contributions to lowering fever. |
| [33] | Malaysia | 430 parents | 35-42 years old | Cross-sectional, a community-based survey | Logistic regression analysis was | Using antipyretics, cold sponges, and homoeopathic ways to lower the temperature if there are no other symptoms Parents could tell if a child had a fever by taking a temperature in the ear and axilla and by touching the kid. Antipyretic administered when the temperature was over 38.5. |
| [34] | Istanbul | 342 mothers | <30, >30 years old | Cross-sectional analytical study | Chi square test, ANOVA | Mothers noticed fever by touching their children, while others recognized it in their appearance. checking the child's temperature every 15 minutes. Taking the child's clothes off, administering an antipyretic syrup or suppository, giving the child a warm shower, applying heat, wiping the child's body with vinegar, and then administering antibiotics were the mother's initial actions for fever. |
| [35] | Egypt | 294 mothers | ≤30, >30 years old | A cross-sectional study | Spearman's correlation test, Ordinal regression analysis | Mothers diagnose fever by forehead touch or thermometer, visit a doctor or health care facility, and measure temperature properly for children under five years old. Mother properly identified the optimal site for measuring children under five's temperature as rectal for under three and oral or axillary for four to five. Alternative treatments, such as lukewarm water compresses, enhance outcomes. |
| [36] | India | 65 parents | >18 years old | Cross-sectional | descriptive and inferential statistics | Most parents gave the children extra fluids and lowered the room temperature to bring down a fever. Additionally, they checked the temperature often. Parents gave their child cold compression by soaking a cotton cloth in lukewarm water. They also utilized blanket and cotton clothes in order to keep their child warm. |
| [37] | Germany | 481 parents | >20 years old | A cross-sectional study | A multiple linear regression | When determining the existence of fever, parents typically measure the child's temperature in the rectum or the ear and define fever as temperatures above 38°C. Calf wraps were the most commonly employed method, aside from forehead compresses and the use of damp cloths. |
| [24] | Qatar | 400 parents | >15 years old | A survey-based, cross-sectional study | Pearson chi-square test | Instead of simply feeling the child's forehead, parents typically use a thermometer to figure out whether the child has a fever. Parents believe that children with fever need antipyretics, and they apply natural remedies like cold sponges. |
| [38] | Saudi Arabia | 645 parents | 25-33 years old | A cross-sectional study using an online questionnaire | Descriptive statistics | Most children's temperatures were taken in the armpit with an electronic thermometer. Fever was defined as 38°C, and parents employed cold sponges, ice packs, and warm sponges. The proper antipyretic depends on the doctor's guidance. |

Six categories were established in accordance with the physical cooling methods employed for reducing children's fever in the reviewed articles: taking off excess, extra fluid, warm compresses; sponging; showering; environmental measures. The clinical management of fever in children exhibits a wide range of approaches, notably in the field of non-pharmacological care. These practices, however, demonstrate

inconsistencies that might be attributed to variations in previous experiences. Considering fever may lead to major problems in children, like febrile seizures, this illness is thought to be self-manageable and can be treated at home with nonpharmacological or pharmacological medication.

In pediatric practice, normal body temperature ranges include neonates 36.1-37.7 °C, two year olds 37.2 °C, and 12 year olds 37 °C [40]. The majority of parents determine their child's body temperature by tactile measurement [24], [33]–[35], only a few use thermometer [24], [35] and measure temperature on forehead, ear [33], [37], armpit [33], [38] or rectum [37], and also most of them use non-prescription antipyretics [12], [24], [32], [34]. Families that have thermometers regularly control their feverish children every 15-30 minutes [5], [34], [36]. Tactile temperature measurement is practical, but it is not precise. Parents will need a thermometer at home to measure the temperature before administering medication [32], [41].

The National Institute for Health and Care Excellence suggests utilizing an electronic thermometer and an appropriate site to check a child's body temperature in the armpit [31], especially for children between one month and five years old [42]. Although antipyretics remain the foundation of fever treatment according to the doctor's prescription [24], [31], [33], [38], physical cooling measures are also applied. The following represent six of the non-pharmacological body cooling methods reviewed in the literature.

3.1. Taking off excess clothes

Removing excess clothing and changing the child's clothes, sheets, and blanket to thin and light materials is the first action that parents take after knowing about the feverish child [5], [31], [34]. Taking off clothes is an effective method to lower the temperature through evaporation and convection. Theoretically, this might contribute by decreasing peripheral vasoconstriction and thereby allowing heat to be lost more effectively [43], [44].

3.2. Extra fluid

Children lose a lot of water due to fever. Dehydration may occur when a fever persists for an extended period of time. Therefore, parents should encourage their children to consume more water. The reviewed article examines the practice of parents providing more fluid intake for feverish children [31], [36]. Despite encountering challenges related to a lack of appetite, which frequently ends in episodes of vomiting.

Fever imposes metabolic demands, which leads to water loss. Dehydration will occur if parents do not provide oral rehydration with adequate fluid solutions. Dehydration affects the hemodynamics of blood circulation and may alter the electrolyte and acid-base balance that necessary for healthy cells and tissues [15], [45]. In accordance with established guidelines on fever management, it is highlighted that ensuring sufficient hydration and nutrition is of the utmost priority in the management of febrile children. Instead of emphasizing the temperature reduction [1], [14].

3.3. Warm compresses

The most widely used of physical cooling is warm compresses [5], [31], [34], [37], [38]. A pilot randomized clinical study used warm compresses at water temperatures ranging between 34 and 37 °C (93.2 and 98.6 °F). For 15 minutes, the child was not dressed or covered in the forehead, axillary, or inguinal areas [28], [31]. Warm compresses raise body temperature, enabling the hypothalamus to control it. This widens peripheral blood vessels and causes vasodilation, letting the body release heat and preventing shivering [28].

Research indicates that the application of warm compresses has been found to be effective in lowering the level of fever in pediatric patients experiencing pyrexia [46]. When used in combination with antipyretics, case studies reveal that warm compresses significantly reduce fever among children [47], [48]. In general, the use of warm compresses is still debatable. Empirical studies showed warm sponging resulted in a significant decrease in body temperature within 15 to 30 minutes. But after 60 minutes, it was no more significant, as the temperature elevated and the fever recurred [27], [48].

3.4. Sponging

The sponging technique, identical to the application of a warm compress, increases heat loss through the mechanisms of conduction, convection, and evaporation [28]. Lots of researchers consider that "sponging" is identical to "warm compressing," but there are distinctions. In the context of "sponging," the warm water is rubbed gently on both the upper and lower regions of the body, from the neck to the toes [28], [44]. A study found that cooling people by soaking their skin and blowing warm air across their bodies reduced their mean rectal temperature by 0.071 °C/min [49]. On the other hand, the efficacy of cold compresses remains controversial. A case series demonstrate that immersion in iced water can reduce a body to less than 38.9 °C in less than 45 minutes [43]. Another finding states that sponging had been demonstrated to be effective only in the short term but had no long-term benefit beyond two hours [22]. However, this method may induce peripheral vasoconstriction, which inhibits the cooling process. Despite the absence of experimental evidence to the contrary [50].

Sponging is most commonly practiced using tap water or lukewarm water [24], [35], [36], [38]. This approach is nevertheless also employed for cold compresses. Considering the cold compress method as a physical cooling technique persists to be controversial regarding its effectiveness. Yet, parents tend to use this approach [31], [32]. Cold sponging for physical methods of lowering the temperature are no longer advised, as they provide little benefit and may even make the situation worse. children feel shivering, chills, goosebumps, irritable and crying [22], [51].

Sponging with cold water may induce peripheral cooling, but blood vessel constriction may result in heat preservation [5]. Exposure to cold water was the only remedy leading to significant shivering, and it was not even helping the body decrease temperature at the best rate. Even shivering carried on for as long as an hour after soaking [52]. Shivering is considered a discomfort in the provision of cold compresses [28], [53], despite the fact that it can generate even more heat, higher metabolic demand, marginal cerebrovascular and cardiac supply, and rebound hypothermia [28].

3.5. Showering

Showering is defined differently according to the methodology of each study. Bathe by showering water all over the body, or bathe just a part of the body. Bathing with warm water is a frequently used treatment for the purpose of physical cooling [5], [31], [32], [37]. As in a quasi-experimental study proving that warm water foot bath therapy is beneficial in lowering body temperature in febrile children [47]. Warm water foot bath therapy stimulates the blood vessels to enlarge, enhancing blood flow, releasing heat through perspiration, and supplying oxygen to the brain cells [47], [54].

Showering reduces the core temperature temporarily but does not affect the thermoregulatory set point; when out of the water, the child or infant may suffer a quick temperature rebound, raising the probability of a febrile seizure [7]. A warm bath, about 38 to 40 °C [47], will help to enlarge the sweat glands, eliminate sweat odor, and provide freshness and comfort [46]. According to a study, when people's skin was wetted and exposed to constant sprays of water without forced air, the temperatures dropped at a rate of 0.068 °C per minute. This technique is somewhat similar to the showering-physical cooling technique [49].

3.6. Environmental measures

The ventilation strategies used were window opening and fan use [36]. The use of fans to cool the surrounding environment was considered valuable, as long as patients had no tremors and the central temperature did not increase [44]. This cooling method is based on the concept of evaporation. According to a study, the implementation of environmental temperature conditioning has been observed to result in a decrease in body temperature. A study was conducted to investigate the effect of wetting the participants' skin surface and exposing it to an ambient temperature of 21 °C on their body temperature. The findings revealed a reduction in body temperature at a rate of 0.061 °C per minute. In a tropical climate, it is possible to achieve a low environmental temperature by using air conditioning systems. On the other hand, patients' body temperatures were lowered by wetting the skin and exposed to an ambient temperature of 33.9 °C. This resulted in a gradual decrease in body temperature, specifically at a rate of 0.020 °C per minute. The decline in body temperature is more significant at low ambient temperatures than at high ambient temperatures [49].

Regarding health services, nurses have a particular role in caring for fever and frequently apply non-pharmacological remedies based on personal beliefs and practical experience rather than scientific evidence [28]. Non-evidence-based physical cooling methods are no longer recommended due to discomfort. Alternating and combining antipyretics may be effective, but evidence for comfort improvements is inconclusive and not recommended in management guidelines [32].

Prior research has extensively explored non-pharmacological methods of managing fever in children, focusing on practices such as removing excess clothing, providing extra fluids, and using various physical cooling methods like warm compresses, sponging, and environmental measures. The current review suggests that warm compresses, particularly when combined with antipyretics, can effectively reduce fever in children. However, the overall effectiveness remains debatable due to the temporary nature of the temperature reduction. The review compared the performance of various physical cooling methods, noting that while techniques like sponging and warm baths provide temporary relief, they do not address the underlying thermoregulatory mechanisms, leading to quick temperature rebounds. The study highlighted widespread parental misconceptions about fever management, such as the belief that physical cooling methods are universally effective. This underscores the need for better education and standardized guidelines to help parents manage fever more effectively at home. By comparing various methods and their effectiveness, the study provides valuable insights for clinicians and policymakers to develop evidence-based guidelines that can help reduce the reliance on potentially ineffective or harmful practices.

It is essential to educate the community concerning how to treat fever at home, particularly for those with inadequate health literacy. Simple non-pharmacological practices, particularly before administering antipyretics and visiting a health professional [55]. It is important to ensure the availability of specific information on non-pharmacological fever practice at home and in a language that is easy to understand. Clear and accessible sources of information can offer guidance to parents in effectively managing low-grade fever and reducing the need for visits to healthcare facilities.

3.7. Strength and limitation of the study

The reviewed articles involve large-scale population-based survey research. This study provides population-based evidence regarding parents' experiences managing feverish children at home. This review follows the proper procedures for systematic reviews. The articles reviewed were population-based survey studies and provided limited information about the actual physical cooling techniques employed. The selected articles were all original research, written in English, and published from 2013 to 2023. Due to searching only full-text publications, data extraction may have a selection bias.

4. CONCLUSION

The application of physical cooling for managing feverish children is still debatable, particularly in the context of the discomfort-inducing effects of warm compresses and sponging. Instead of employing physical cooling interventions to lower fever, fever management must focus on enhancing the physiological response, which includes providing fluids, nutrition, and a comfortable environment. While previous research laid the groundwork for understanding non-pharmacological fever management, this study advances the field by offering a comprehensive review and comparison of various methods, emphasizing the need for standardized, evidence-based practices.

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