Review Article

doi:10.31674/mjn.2024.v16i01.031

MJN

Comparing the Effectiveness of Water Sponging Combined with Antipyretics Versus Antipyretics Alone in Lowering Fever in Children: A Systematic Review

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ABSTRACT

Background: Fever occurs when the body temperature rises above normal due to external factors, such as exposure to high temperatures or heat sources. This study aims to assess the effectiveness of water sponging in combination with antipyretic versus antipyretic only on reducing body temperature in children with fever. **Methods:** This was a systematic review of primary studies using true experimental designs collected from online sources published between 1994 until 2024. Articles were screened using the PRISMA flow diagram with the following keywords: body temperature, children, fever, febrile, water sponging, antipyretic, randomized controlled trial. The data was reviewed accordingly. **Results:** The findings have revealed that three studies found no significant difference in temperature drops between tepid water sponging combined with antipyretics and antipyretics alone. Other studies, however, noted a faster initial drop with the combination, but temperatures equalized after two hours, with some children experiencing additional discomfort. **Conclusion:** The study concludes that while tepid water sponging combined with antipyretics initially reduces fever faster, both methods equalize within two hours, and the combination may cause additional discomfort.

Keyword: Antipyretic; Body Temperature; Children; Febrile; Fever; Water Sponging

INTRODUCTION

Fever is a frequent reason for parents to seek medical advice for their children. It is one of the most common symptoms prompting visits to healthcare providers (Isa *et al*., 2024). Fever or pyrexia develops when endogenous or exogenous pyrogens produce an increase in the body's thermoregulatory set point (Balli, Shumway, Sharan 2022). Childhood fever is described as a temperature of 100°F or more, which is considered dangerous and necessitates hospitalization (Debsarma, Saha, & Ghosh, 2022; Febriyanti & Sirait, 2018). Fever diagnosis and treatment delays are a major factor in the high under-five mortality rate. Timely identification of the fever's cause and proper management can avert serious illness and death (Phiri *et al*., 2023).

Individuals with fever are typically treated with paracetamol, tepid sponging, or both (Aijaz *et al*., 2022). Fever can be treated both pharmacologically and non-pharmacologically. Various non-pharmacological therapies serve as adjuvants, such as tepid water sponge therapy, compress plaster fever, cool baths, increased fluid intake, and ensuring proper ventilation to help reduce body temperature and provide comfort to the patient (Ariyani *et al*., 2024). Tepid, also known as cold sponging, is a remedy that involves applying a moist, cool liquid to the skin to lower the body's excess temperature. Among the various fever remedies, tepid sponging has demonstrated a particularly significant effect on reducing fever (Aijaz *et al*., 2022). However, according to certain research, there may not be a strong correlation between the effectiveness of non-

Received: September 8, 2023 Received in revised form: June 25, 2024 Accepted: June 26, 2024

pharmaceutical adjuvant therapy and a child's ability to lower their fever (Aluka *et al*., 2013; Souza *et al*., 2022). Lynch *et al*., (2024) also stated that caregivers were less likely to engage in fever-reduction practices believed to be of no use to their children, such as tepid sponging or fans. These findings suggest that the effectiveness of water sponging as a fever-reducing method may be limited or inconsistent.

Research about the effectiveness of using tepid water in addition to fever to lower body temperature in children who have fever will shed light on whether using water sponging in addition to antipyretics is more effective at lowering body temperature in febrile children than using antipyretics alone. This may result in better fever control procedures, improving treatment for young patients, and possibly shortening the length and intensity of fevers.

Despite the fact that several studies have been conducted worldwide on the use of water sponging to treat fever in children (Arista & Husain, 2023; Ariyani *et al*., 2024; Jose *et al*., 2022; Manalu & Nursasmita, 2023), there is still a lack of review papers published on the subject. The purpose of this study is to examine the effectiveness of water sponging in combination with antipyretics versus antipyretics only on reducing body temperature in children with fever.

METHODOLOGY

This is a systematic review of primary studies that investigates the effectiveness of water sponging to lower body temperature in children with fever with a true experiment design. The original articles published from 1994 until 2024 were collected from online databases. The keywords body temperature, children, fever, febrile, water sponging, antipyretic, and randomized controlled trial were used in finding the original articles for this study. The PRISMA flowchart (Moher *et al*., 2009) was utilized to filter the number of articles obtained.

The inclusion criteria for this systematic review were a full-text study published in the previous fifteen years that examined the effectiveness of water sponging to lower body temperature in children with fever, using a true experiment or randomized controlled trial study design, articles published in English, and research subjects were children. Articles from review studies, case reports, press releases, books, and dissertations were excluded. The author included all related articles after assessing the aim, population and sample, intervention, comparison, and a summary of the study outcomes. The extracted data contains the authors, year of study, study location, study design, sample size, population, intervention, comparison, and outcomes (table 2). The quality assessment of research articles was carried out by the Center for Evidence-Based Management (CEBM) in 2019 (CEBM, 2019).

Ethical Consideration

The study was approved by Ethical Committee Board of Faculty of Medicine, Universitas Islam Al-Azhar, Indonesia with the Reference number 034/EC-04/FK-06/UNIZAR/V/2024 on 27th May 2024.

RESULTS

Search Outcome

The study's main research articles were searched using online databases such as Elsevier, Google Scholar, Elsevier, and PubMed. The process of screening articles with inclusion criteria using a PRISM flow (Figure 1). The first search process for articles found 270 articles. Two of these articles were removed due to duplication, leaving 268 studies. Then, 260 studies were excluded based on their titles and abstracts, leaving 8 full-text studies for review. Subsequently, 3 studies were excluded for specific reasons, leaving 6 studies appropriate for quality review.

Quality Assessment Results

The study will be included in the review if it fulfills 75% of the criteria. All four selected studies have fulfilled the requirement. Table 1 displays the results of the research quality assessment based on CEBM (2023).

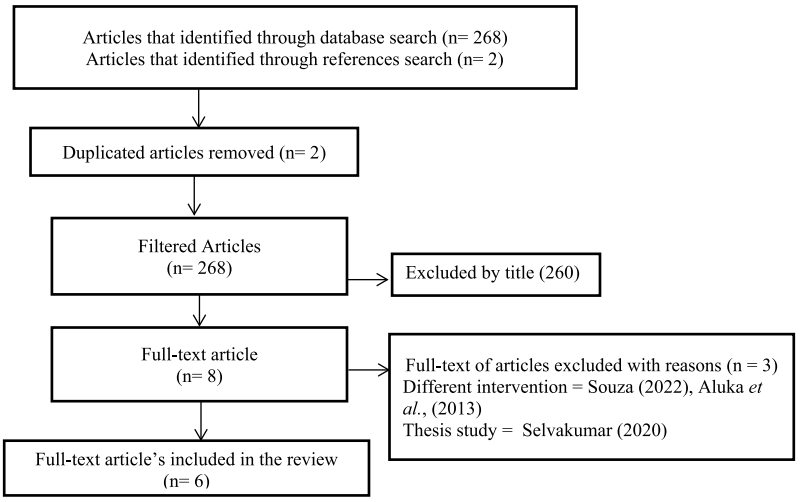

Figure 1: PRISM Flow Diagram

Table 1: The Quality Assessment of Research Articles Based on CEBM 2023

Study	Criteria							
	1	2	3	4	5	6	7	8
Basavaraj, Pocha, & Dhati, (2018)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Priya *et al*. (2023)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Khaliq *et al*. (2019)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mahar *et al*., (1994)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sharber (1997)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Thomas *et al*. (2009)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Description of the question criteria:

1. Was the assignment of patients to treatments randomized?
2. Was the sample appropriately measured to reduce bias?
3. Were the groups similar at the start of the trial?
4. Are the research studied that used is valid and reliable?
5. Aside from the allocated treatment, were groups treated equally?
6. Were all patients who entered the trial accounted for?
7. And were they analyzed in the groups to which they were randomized?
8. Were measures objective or were the patients and clinicians kept "blind" to which treatment was being received?

Analytical Results

The total number of participants in this review was 935 children. Only one study is located in Pakistan (Khaliq *et al*., 2019), Thailand (Mahar *et al*., 1994), and the United States (Sharber, 1997), while the other three are located in India (Basavaraj, Pocha, & Dhati, 2018; Priya *et al.*, 2023; Thomas *et al*., 2009). Two studies included all children with an axillary temperature of ≥101°F (Khaliq *et al*., 2019; Thomas *et al*., 2009); two studies included children with rectal temperatures >38.9°C (Mahar *et al*., 1994; Sharber, 1997); another included children with temperatures >99°F (Basavaraj, Pocha, & Dhati, 2018); and another included children with temperatures of 100.4°F (Priya *et al*., 2023). Only one study used cold water sponging (Khaliq *et al*., 2019), while the other three used tepid water sponging (Basavaraj, Pocha, & Dhati, 2018; Priya *et al*., 2023; Mahar *et al*. (1994); Thomas *et al*., 2009; Sharber, 1997). One study administered a 10 mg/kg dosage of antipyretic (paracetamol) (Thomas *et al*., 2009), one study administered a 15 mg/kg dosage of acetaminophen, while the other three studies administered a 15 mg/kg dosage (Basavaraj, Pocha, & Dhati, 2018; Mahar *et al*. (1994);

Khaliq *et al*., 2019; Priya *et al*., 2023).

Three studies found that there was no clear difference in temperature drops between the groups that were given an antipyretic along with tepid water sponging and those that were just given an antipyretic (Basavaraj, Pocha, & Dhati, 2018; Priya *et al*., 2023; Sharber, 1997). The other three studies reported that the combination group experienced a faster temperature drop initially, but both groups' temperatures equalized after two hours (Khaliq *et al*., 2019; Thomas *et al.*, 2009). Three studies reported additional results of discomfort experienced by children in the combination group (Basavaraj, Pocha, & Dhati, 2018; Mahar *et al*., 1994; Sheber, 1997).

Due to variations in several aspects, particularly the differences in water temperature for sponging and the dosages of antipyretics, along with the absence of standard deviation data in some original studies, the decision was made not to conduct a meta-analysis. The absence of standard deviation data makes it difficult to accurately compare the results across studies and to perform a robust statistical analysis. Therefore, a qualitative analysis was chosen solely to gain some understanding of the efficacy of tepid sponging in conjunction with antipyretics.

Table 2: Description of Primary Studies

No.	Author Names (Year)	Study Design	Study Location	Participants		Follow-up Duration	Population	Intervention	Comparison	Outcome
				Combination Group	Antipyretic-only Group					
1.	Basavara, Pocha, & Dhati, (2017)	RCT	India	246	254	2 hours	Children aged 6 months to 12 years with axillary temperature >99ºF	Tepid sponging and paracetamol 15mg/kg	Paracetamol 15mg/kg	There is no discernible difference in the two groups' temperature drops. Compared to children in the sole antipyretic group, children in the combination group experienced more discomfort.
2.	Priya *et al*. (2023)	RCT	India	50	50	2 hours	Children aged 6 months to 12 years with axillary temperature >100.4ºF	Tepid sponging and oral paracetamol 15mg/kg	Oral paracetamol 15mg/kg	There no significant difference in reduction pattern of temperature among the groups. In both groups, the temperature significantly drops from baseline to two hours after the intervention.
3.	Khaliq *et al.* (2019)	RCT	Pakistan	50	50	2 hours	Children aged less than 14 years with axillary temperature ≥101ºF	Cold sponging and oral paracetamol 15mg/kg	Oral paracetamol 15mg/kg	In the first 30 minutes, fever in intervention group fell more quickly than in control group; nevertheless, after two hours, both groups' temperatures dropped to the same degree.
4.	Mahar *et al.* (1994)	RCT	Thailand	35	40	2 hours	Children aged between 6 and 53 months with with rectal temperature of > 38.9°C	Tepid sponging and oral paracetamol 15mg/kg	Oral paracetamol 15mg/kg	Children in the sponged group cooled below 38.5°C sooner than controls. At 60 minutes, 38 controls remained above 38.5°C, compared to 15 sponged children. Sponging caused crying, but only one child experienced shivering and irritability.
5.	Sharber (1997)	RCT	United States	10	10	2 hours	Children aged 5 to 68 months with rectal temperature of > 38.9°C	Tepid sponging and oral acetaminophen 15mg/kg	Acetaminophen 15mg/kg	Sponge-bathed subjects cooled faster initially, but no significant temperature difference was seen after 2 hours. They also reported higher discomfort scores.
6.	Thomas *et al.* (2009)	RCT	India	73	77	2 hours	Children aged 6 months to 12 years with with axillary temperature ≥101ºF	Tepid sponging and syrup/tablets paracetamol 10 mg/kg	Syrup/ tablets paracetamol 10 mg/kg	The intervention group experienced a faster temperature drop, but both groups' temperatures equalized after two hours.

DISCUSSION

The results of this review study are more inclined toward suggesting that, in addition to antipyretic medication, water sponging—using either warm or cold water—can help children with fevers reduce their body temperature more rapidly. This was in line with a previous review study by Akyirem & Bossman (2021), which stated that tepid sponging offers several advantages as a physical cooling therapy. Caregivers can easily learn and administer it without the need for healthcare personnel, thereby conserving resources. Another systematic review study by Dullius and Fernandes (2024) also suggests non-pharmacological management techniques, including massage therapy, compresses, warm water, and soap with marshmallows, combined with the use of an antipyretic (paracetamol), which was shown to be effective in reducing fever among the pediatric population. A study by Alomari and Alyahya (2024) indicates that, in terms of parental practices for managing their child's fever, approximately 70.1% of parents frequently applied cold compresses.

Fever is a common bodily response that helps fight foreign agents. The hypothalamus, or thermoregulatory center, regulates body temperature. An increase in temperature causes changes like feeling warmer, increased metabolism, higher oxygen consumption, and elevated pulse and respiration rates. These metabolic changes produce more heat, expanding internal blood vessels and constricting peripheral ones, making the patient anxious, tired, and uncomfortable (Balli, Shumway, and Sharan, 2023). The current healthcare system emphasizes integrating complementary and alternative therapies for comprehensive care. Studies have shown that tepid sponging provides comfort and reduces temperature (Pavithra, 2018). Nurses play a crucial role in fever management, and while antipyretic therapy is effective, non-pharmacological interventions like cold and tepid sponging offer results without adverse side effects (Kathwal *et al*. 2022).

Based on the research titled Application of Evidence-Based Nursing Tepid Sponge Bath in reducing body temperature in febrile children, tepid sponge bath therapy is very effective in reducing body temperature in children with hyperthermia (Rafael *et al.*, 2023). Tepid sponging allows the body to lose heat through conduction, convection, or evaporation. Conduction involves the transfer of heat between two objects in direct contact. Convection occurs when warm air surrounding an object is replaced by cooler air in a continuous cycle. (Paasi *et al.*, 2023). As a lukewarm sponge wash is applied to the skin, it absorbs body heat. As the water heats, it begins to evaporate, changing from a liquid to a vapor. This phase shift demands energy, which is absorbed from the body's heat, thereby helping to chill the body down (Encyclopaedia Britannica, 2023).

Although most primary studies suggest that the combination therapy of water sponging and antipyretics is no more effective in reducing body temperature than antipyretics alone, some studies indicate that this combination may lead to a faster temperature drop. One study suggests that children may experience discomfort during water sponging due to the sudden change in body temperature. The sudden exposure to water, which has a different temperature than the body, may be the cause of this discomfort, as it can be startling and uncomfortable. However, it's generally safe to combine antipyretics with water sponging to treat fever in children, as long as you carefully monitor the treatment's duration and closely observe the children's reactions to ensure their comfort and well-being.

The current systematic review exclusively incorporates randomized controlled trials (RCTs) to ensure the highest level of evidence quality. By utilizing randomization and control groups, RCTs minimize bias, yielding more reliable and valid results, which are crucial for accurately evaluating the effectiveness of the interventions under investigation. Therefore, this study can significantly contribute to the development or revision of guidelines and protocols for the management of fever in children. Regulatory bodies and professional organizations can utilize the evidence from this study to update their recommendations and protocols, ensuring that water sponging is appropriately included as a recommended intervention. Nurses, through education and training, can play a crucial role in facilitating the implementation of these guidelines in clinical practice, ensuring adherence and efficacy in patient care.

Future research efforts, supported by nursing leadership and expertise, can further optimize the technique, compare it with other interventions, and explore its long-term benefits. These initiatives are expected to enhance the understanding and utilization of water sponging as an effective therapeutic approach in pediatric care, with nurses playing a pivotal role in implementation, monitoring, and ongoing evaluation.

CONCLUSION

The results of this study suggest that water sponging may be a valuable adjunct treatment in the management of children with fever. This study's novelty lies in its comprehensive synthesis of existing evidence on the effectiveness of tepid water sponges using a systematic review approach.

The recommendation for practice is that water sponges should be considered as an effective adjuvant intervention for reducing body temperature in children with fever. Healthcare professionals should include water sponges as a first-line or adjunctive treatment in the management plans for children with fever. Further research should focus on optimizing the implementation of water sponges, including determining the appropriate temperature and duration of the sponge as well as the most effective technique for application.

Limitations

This review underscores the need for more large-scale, high-quality studies due to limited primary research and varying methodologies. Including non-English publications could enhance understanding by incorporating diverse practices and outcomes. Expanding research beyond Asia will improve the generalizability of findings across different healthcare systems and cultural contexts. Addressing these areas in future studies will lead to a more comprehensive understanding of the interventions studied.

Conflict of Interest

The authors declare that they have no competing interests.

ACKNOWLEDGEMENT

The researchers express their gratitude to the staff of the Faculty of School of Health Science at Mamba'ul Ulum Surakarta, Indonesia for the execution of this study.

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