

# Non-pharmacological fever and hyperthermia management in children: an integrative review

Manejo não farmacológico da febre e hipertermia da criança: revisão integrativa  
Manejo no farmacológico de la fiebre e hipertermia en niños: revisión integradora

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## Keywords

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## Descritores

Criança; Febre; Enfermagem pediátrica; Cuidados de enfermagem

## Descriptorios

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## Abstract

**Objective:** To identify non-pharmacological interventions for fever and hyperthermia in children indicated in the scientific literature.

**Methods:** an integrative literature review carried out in the LILACS, PubMed and CINAHL databases and in the COCHRANE and SciELO libraries. Articles that addressed non-pharmacological interventions for fever and hyperthermia, published in Portuguese and English, from 2000 to 2019, have been included.

**Results:** The sample consisted of 27 articles, which were grouped, according to their similarities, into seven categories. The interventions used were baths, warm compresses, sponging, encouraging fluid intake, ice packs, cooled blankets, and room ventilation. Different interventions were observed in non-pharmacological fever and hyperthermia management.

**Conclusion:** Practicing non-pharmacological measures alone is not recommended for fever treatment in children, except for interventions that assist in the physiological responses of the body. The results highlight the recommendation of conducting further research that results in evidence to support the best care provided by pediatric nurses to children with fever.

## Resumo

**Objetivo:** Identificar as intervenções não farmacológicas para febre e hipertermia em crianças indicadas na literatura científica.

**Métodos:** Trata-se de uma revisão integrativa da literatura realizada nas bases de dados Lilacs, PubMed e CINAHL e as bibliotecas COCHRANE e SciELO. Foram incluídos artigos que abordassem as intervenções não farmacológicas para febre e hipertermia, publicados em português e inglês, no período de 2000 a 2019.

**Resultados:** A amostra foi constituída por 27 artigos, que foram agrupados, conforme suas similaridades, em sete categorias. As intervenções utilizadas foram: banhos; compressas mornas; *sponging*; incentivo à ingestão de líquidos; bolsas de gelo e cobertores refrigerados; e, por último, a categoria ventilação do ambiente. Observaram-se diferentes intervenções no manejo não farmacológico de febre e hipertermia.

**Conclusão:** A prática de medidas não farmacológicas isoladamente não é recomendada para o tratamento de febre em crianças, exceto as intervenções que auxiliem nas respostas fisiológicas do corpo. Os resultados ressaltam a recomendação da realização de novas pesquisas que redundem em evidências para fundamentar o melhor cuidado do enfermeiro pediatra à criança com febre.

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Conflicts of interest: nothing to declare.

## Resumen

**Objetivo:** Identificar las intervenciones no farmacológicas para la fiebre e hipertermia en niños recomendadas en la literatura científica.

**Métodos:** Se trata de una revisión integradora de la literatura realizada en las bases de datos Lilacs, PubMed y CINAHL y las bibliotecas COCHRANE y SciELO. Se incluyeron artículos que abordaran las intervenciones no farmacológicas para la fiebre e hipertermia, publicados en portugués e inglés, en el período de 2000 a 2019.

**Resultados:** La muestra estuvo compuesta por 27 artículos, que fueron agrupados en siete categorías según sus similitudes. Las intervenciones utilizadas fueron: baños, compresas tibias, *sponging*, incentivo a la ingesta de líquidos, bolsas de hielo y mantas refrigeradas y, por último, la categoría ventilación del ambiente. Se observaron diferentes intervenciones en el manejo no farmacológico de la fiebre e hipertermia.

**Conclusión:** No se recomienda la práctica de medidas no farmacológicas de forma aislada para tratar la fiebre en niños, excepto las intervenciones que ayuden a las respuestas fisiológicas del cuerpo. Los resultados resaltan la recomendación de realizar nuevos estudios que tengan como resultado evidencias para fundamentar un mejor cuidado del enfermero pediatra a niños con fiebre.

## Introduction

In clinical practice, it is observed that fever accounts for a large part of demand for health services by parents of children.<sup>(1)</sup> Fever, in turn, is a common clinical entity in childhood,<sup>(1)</sup> being defined as body temperature elevation above normal, triggered by the hypothalamus, in response to the release of regulatory proteins called cytokines, produced during inflammatory and immune responses to infection.<sup>(2)</sup>

The axillary temperature values considered as fever are variable in the literature, generally from 37°C to 38°C; however, in clinical practice, fever is commonly considered when the children's temperature is equal to or greater than 37.8°C, and subfebrile when they have temperatures between 37°C and 37.7°C.<sup>(2,3)</sup> However, the pathophysiological concept of fever is universal<sup>(2,3)</sup> as well as its classification. According to etiology, fever is categorized into bacterial, which is usually associated with more serious cases, leading to the deterioration of children's clinical conditions, and viral, which often has a faster resolution, without greater risks for children.<sup>(4)</sup>

Many parents and health professionals consider that fever is a dangerous and harmful sign for children, as a disease and not a sign of abnormality.<sup>(5,6)</sup> There is similarly a fear that fever could cause seizures and/or damage to the children's developing brain, but a risk can only be observed in genetically predisposed children under five years old, or with a family disease history, or in children of any age diagnosed with epilepsy.<sup>(4,5)</sup> It is known that fever is self-limiting and has the function of stimulating the immune system and inflammatory reactions in

the fight against infection.<sup>(4)</sup> Thus, there is practically no risk of seizures due to high fever in previously healthy children, with no associated clinical signs, absence of comorbidities and family history, as well as when the cause of fever is known and children have their water losses replaced. In the case of children with pre-existing and/or very debilitated chronic conditions, fever should be treated quickly, in order not to overload children's bodies with an increase in the metabolic rate and cardiopulmonary system demand.<sup>(4)</sup>

Another issue to be considered and equally controversial in relation to the increase in temperature in children is hyperthermia. Hyperthermia is considered to be an increase in body temperature resulting from bodily or external conditions that produce more heat than the body can eliminate, usually the temperature rises above 40°C and does not respond to antipyretic drugs.<sup>(7)</sup> Some signs and symptoms characterize hyperthermia such as elevated body temperature, hot extremities, increased sweating, feeling of heat and absence of tremors.<sup>(8)</sup> Excess heat production, excess heat from the environment or when heat loss is impaired can overload the body's regulatory mechanisms, resulting in hyperthermia.<sup>(8)</sup> Among the types of hyperthermia, malignant hyperthermia stands out, with a higher risk of complications, which can be considered an unusual and potentially fatal genetic disorder. In general, it occurs in individuals susceptible to exposure to halogenated inhalational anesthetics and/or depolarizing muscle relaxants, succinylcholine for example.<sup>(9,10)</sup> The human organism does not adapt to hyperthermia, therefore, it must be treated as a clinical emergency.<sup>(7)</sup>

Although there is a representative scientific literature on the subject, temperature rise clinical management in children is still very diverse, especially in non-pharmacological management carried out by nurses in care practice. However, it is observed that nurses adopt inconsistent practices in non-pharmacological fever and hyperthermia management, generally based on their previous experiences.<sup>(7)</sup>

Considering the above and the lack of standardization of non-pharmacological interventions in nurses' clinical practice, the need to seek the best evidence available in the scientific literature on the subject emerged, in order to instrumentalize nurses to manage non-pharmacological care for children with fever or hyperthermia, aimed at applying best practices and reducing the suffering of hospitalized children and their families. Knowing the effectiveness of practices traditionally performed, i.e., knowing what really works in healthcare is very important for patients and especially for healthcare professionals in decision-making.

It is necessary to think that, in order to have innovation in fever and hyperthermia treatment, it is necessary to test what is currently recognized as an effective practice and, only then, to modify what is not useful, proposing changes or new treatments and control practices of temperature. The integrative review, in turn, is a more reliable way to identify benefits and harms of the various practices that exist in non-pharmacological fever management.<sup>(11)</sup> Thus, this study aimed to identify the evidence available in the scientific literature on all nursing interventions used in non-pharmacological fever and hyperthermia management.

## Methods

The integrative review was used as a method, which consists of building a broad analysis of the literature, contributing to discussions about research methods and results as well as reflections on further studies.

<sup>(11)</sup> Six steps were taken: theme identification and hypothesis or research question selection for elaborating the integrative review; establishment of criteria for inclusion and exclusion of studies/sampling

or literature search; definition of information to be extracted from selected studies/categorization of studies; assessment of studies included in the integrative review; interpretation of results and presentation of knowledge review/synthesis.<sup>(11)</sup>

Developing the guiding question was structured based on PICO strategy, which emerges as a fundamental element proposed by the Evidence-Based Practice (EBP) to develop the research question and build the question for a bibliographic search for evidence.<sup>(12)</sup> PICO accounts for Patient, Intervention, Comparison and "Outcomes".<sup>(12)</sup> P was assigned to pediatric patients with fever or hyperthermia; I, for nursing interventions; C, for non-pharmacological measures used for fever and hyperthermia; O, for decreased body temperature. Thus, the following guiding question was: What are the nursing interventions used in non-pharmacological fever and hyperthermia management?

Through descriptors, the electronic databases PubMed, LILACS and CINAHL, and the SciELO and COCHRANE libraries were searched. Open access articles in Brazilian Portuguese and English, that addressed the age group from 29 days to 18 years, including children and adolescents, published from 2000 to 2019 have been included. The search covered the period from 2000 to 2019 and was carried out from September 2019 to March 2020, using the following descriptors and/or keywords: fever, child and nursing, with the addition of the Boolean operator AND between them.

In the PubMed database, filters were added: "Free full text, Humans, English, Portuguese, Child: birth-18 years, Infant: birth-23 months, Infant: 1-23 months, Preschool Child: 2-5 years, Child: 6-12 years, Adolescent: 13-18 years". Operationalization in CINAHL occurred through the selection "MW Word in Subject Heading", writing the words: Child, Fever and Nursing, being complemented by the filter "full text and age".

LILACS search, initially, using the "subject descriptor" filter, did not result in any article. However, after having repeated the search using the "words" filter, it was successful. Meanwhile, in the SciELO library, the search was simplified, selecting only the field "all indexes". Finally, in the COCHRANE li-

brary, the keywords Child, Fever and Nursing were used, obtaining 421 articles in total.

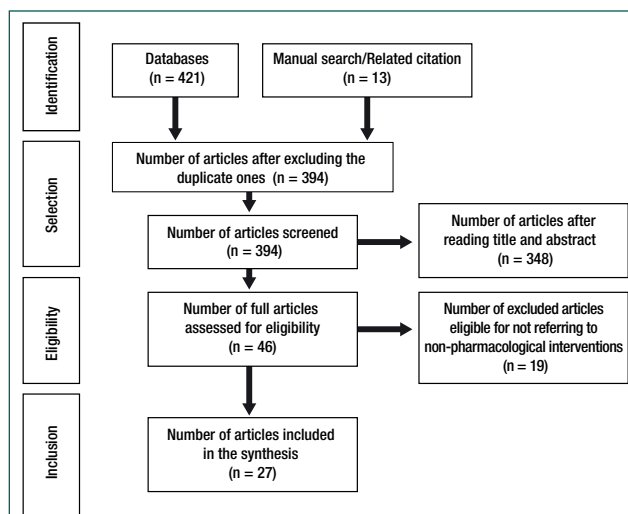
Additionally, an active and manual search was carried out based on “articles similar” to the articles found, as indicated by each database, with an additional 13 articles, totaling 434 articles. Preliminarily, 40 articles were removed because they were duplicated and 348 were excluded after reading the title and abstract, as they did not contain the theme of fever and hyperthermia in children and adolescents, with 46 articles remaining. All texts were fully read, and 19 studies were excluded, which did not report non-pharmacological interventions for fever and hyperthermia in children and adolescents, totaling 27 articles, which were analyzed.

Information collection was performed by means of a specific instrument, built by a researcher, in which information about publications was recorded, namely: year of publication and publication; language; access date; country of origin; type of study; main results; sample size; ethical aspects described; level of evidence; database, objectives, results and studies’ recommendations. The classification used for the level of evidence of publications was according to Oxford Center of Evidence-Based Medicine recommendations.<sup>(13)</sup> Article analysis took place through an exhaustive reading and separation of the relevant information and its interpretation. All articles were compared in their similarities and differences, with the categories emerging in response to the research question.<sup>(11)</sup> Planning the entire study followed the PRISMA guidelines, which brings the requirements for writing systematic reviews (Figure 1).<sup>(14)</sup>

## Results

Study characterization was carried out highlighting the main attributes of the articles selected for the present integrative review and respective classification according to the level of evidence from Oxford, as shown in Chart 1.

Publications on non-pharmacological fever and hyperthermia management are still in small numbers. Concerning year of publication, there was no homogeneity in the distribution of all articles.



**Figure 1.** PRISMA flowchart of the literature search process

Among the countries where the researches were conducted, England and the USA stood out when they were responsible for the authorship of six publications/country. Australia reached second place, being responsible for the authorship of five publications. The other countries (Brazil, India, Italy, Ireland, Nigeria, New Zealand and Switzerland) were responsible for ten publications.

Regarding the methodological design, considering the 27 studies analyzed, four randomized clinical trials (RCTs), three systematic reviews, three best practice guides, eight literature reviews, five reflection studies, three quantitative studies, one qualitative study were obtained.

The articles obtained after review were grouped based on the non-pharmacological measures used in fever and hyperthermia management in children, and seven categories were elaborated: baths; warm compresses; sponging; encouraging fluid intake, ice packs and refrigerated blankets; removal of excess clothing; environment ventilation.

### Category 1. Bath

In this category, five studies mentioned applying immersion bath to reduce body temperature in febrile children, the intervention was used with warm, cold water and alcohol.<sup>(7,15-19)</sup> However, the effectiveness of bathing with warm or cold water was challenged due to inefficiency in reducing prostaglandins and triggering discomfort in children, when presenting chills and tremors.<sup>(16)</sup> Moreover, the drastic temperature reduc-

**Chart 1.** Studies included in the integrative review

Author(s)/Year	Level*	Objective(s)	Method	Interventions	Conclusions
Pavithra C. 2018. <sup>(1)</sup>	1B	To compare the effect of warm sponging with hot sponging in children with fever.	Randomized clinical trial	Warm sponging + antipyretic; hot sponging + antipyretic	Substantial reduction in body temperature with warm and hot sponging. Warm sponging causes mild discomfort when compared to hot sponging. Using hot sponging is recommended to reduce body temperature and promote comfort among children with fever.
Salgado PA, et al. 2015. <sup>(7)</sup>	5	To identify the evidence available in the literature on the best nursing care for patients with elevated body temperature.	Integrative review	Warm bath; warm compresses; combined therapy (physical + antipyretic method); ice packs; room ventilation	To treat children with a fever, fluid intake should be encouraged, excess clothing removed, air circulation in the environment and parents' education. Although some studies in pediatrics demonstrate that using combination therapy is more effective in reducing body temperature than the administration of antipyretic alone.
Axelrod P. 2000. <sup>(15)</sup>	5	To assess external cooling measures for fever treatment	Literature review	Bath with alcohol; sponging; combined therapy (warm sponging + antipyretic); sponging with alcohol; icy sponging; refrigerated blankets	Children treated with warm sponging and antipyretics generally have greater discomfort than those treated with antipyretic alone. It is advised that physical methods are indicated only in hyperthermia treatment.
Thompson HJ et al. 2007. <sup>(16)</sup>	5	To determine whether there are trends in national practices in fever and hyperthermia management in neurologically vulnerable patients.	Quantitative study	Ice packs; refrigerated blankets; baths	Recommended interventions in fever and hyperthermia management: use of ice packs, refrigerated blankets and baths.
Casey G. 2000. <sup>(17)</sup>	5	To provide an explanation of the physiological mechanisms in controlling children's body temperature and how they change in fever.	Reflection study	Cold bath; warm sponging; combined therapy (warm sponging + antipyretic)	Warm sponging and bathing in cold water is not recommended, as they can increase discomfort, in addition to quickly reducing body temperature and causing a thermal shock.
Joanna Briggs Institute for Evidence Based Nursing and Midwifery. 2001. <sup>(18)</sup>	1A	To determine whether the available evidence supports the types and timing of the various nursing interventions commonly used for reduce fever in children.	Best practices guide	Warm sponging; combined therapy (sponging + antipyretic); cold bath; application of cold compresses; removing clothes; use of fans; encouraging fluid intake	Warm sponging is not indicated for fever treatment. It is recommended to encourage fluid intake, removal of excess clothes or sheets.
Watts R. 2012. <sup>(19)</sup>	1A	To establish which non-pharmacological measures are effective in managing fever in healthy children from 3 months to 12 years of age.	Systematic review	Warm sponging; combined therapy (sponging + antipyretic); use of fans; rest and encouraging fluid intake	Warm sponging has no beneficial effect. It is recommended to encourage fluid intake, removal of excess clothing.
Purssel Edward. 2000. <sup>(20)</sup>	5	To assess the effectiveness of physical methods in fever treatment in children	Reflection study	Warm sponging; combined therapy (warm sponging + antipyretic); removal of excess clothing and ventilation of the environment.	Using combination therapy offers little advantage over the administration of antipyretic alone in treating febrile children.
McDougall P. 2014. <sup>(21)</sup>	5	To increase the reader's understanding of the pathophysiology of fever in children and the identification of serious illness.	Literature review	Removing excess clothing; encouraging fluid intake; warm bath; cold bath; sponging	Cold or warm baths should not be given. Sponging or bathing at room temperature, encouraging fluid intake and removing excess clothing are recommended interventions.
Clarke P. 2014. <sup>(22)</sup>	5	To analyze the knowledge base of pediatric nurses in relation to fever in children.	Literature review	Sponging with alcohol; cold sponging	Sponging with alcohol is contraindicated in fever treatment. Guiding parents on encouraging the supply of fluids, removing excess clothing and watching for signs of seriousness.
Lava SAG, et al. 2012. <sup>(23)</sup>	5	To describe fever management in children.	Quantitative study	Warm sponging	Physical methods are not recommended due to insufficient clinical advantages.
Alves JG. 2008. <sup>(24)</sup>	1B	To compare the effects of warm sponging and dipyrone with only dipyrone in fever treatment.	Randomized clinical trial	Combined therapy (warm sponging + antipyretic)	Adding warm sponging to the dipyrone promotes faster cooling.
Watts R. 2003. <sup>(25)</sup>	1A	To determine the best available evidence that supports the types and timing of nursing interventions	Systematic review	Encouraging fluid intake; removing excess clothing; ventilation of the environment; warm sponging; combined therapy (warm sponging + antipyretic)	It is recommended to encourage fluid intake, removal of excess clothing or ventilation of the environment.
Moran P. 2012. <sup>(26)</sup>	5	To identify fever and signs of severity and provide guidance on fever management.	Literature review	Opening of windows and ventilation of the environment; warm sponging; combined therapy (warm sponging + antipyretic)	Lack of evidence to indicate the opening of windows or ventilation of the environment. Warm sponging does not offer significant advantages over the use of antipyretics alone.
Christie J. 2002. <sup>(27)</sup>	5	To compare and evaluate the effectiveness of cooling methods and determine best practices based on evidence-based guidelines.	Literature review	Warm sponging; combined therapy (warm sponging + antipyretic); use of fans; removing clothes and blankets	Warm sponging is not recommended, as use of fans and removal of clothes are unnecessary interventions.
Thomas S et al. 2009. <sup>(28)</sup>	2B	To compare the effectiveness of warm sponging and antipyretic drugs versus only antipyretic drugs in treatment of febrile children.	Randomized clinical trial	Combined therapy (warm sponging + antipyretic)	Adding warm sponging to the administration of antipyretics does not offer any advantage in reducing the temperature and can result in discomfort.
Meremikwu MM. 2009. <sup>(29)</sup>	1A	To assess the benefits and harms of using physical cooling methods in fever management in children	Systematic review	Warm sponging; combined therapy (warm sponging + antipyretic)	Warm sponging associated with paracetamol achieves a better antipyretic effect than just the antipyretic; however, lack of evidence makes it difficult to conclude possible benefits and harms associated with this common practice.

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Author(s)/Year	Level*	Objective(s)	Method	Interventions	Conclusions
Robertson J. 2002. <sup>(30)</sup>	5	To identify the factors for treating fever; evaluate the value of interventions used to treat childhood fever and, provide information to parents that will allow them to safely manage their febrile child at home.	Reflection study	Warm sponging; combined therapy (warm sponging + antipyretic); encouraging fluid intake; removing excess clothing	It is recommended to encourage fluid intake and remove excess clothing.
Author(s)/Year	Level*	Objective(s)	Method	Interventions	Conclusions
Bemath VF. 2002. <sup>(31)</sup>	5	To assess the effectiveness of warm sponging in relation to the combined use of paracetamol with warm sponging in reducing body temperature.	Literature review	Warm sponging; combined therapy (warm sponging + antipyretic)	Warm sponging is effective in treating febrile children in the first 30 minutes and has an additive effect when combined with paracetamol.
National Institute for Health and Care Excellence: Clinical Guidelines. 2013. <sup>(32)</sup>	5	To present the recent clinical guideline on fever management in children.	Best practices guide	Warm sponging; removing excess clothing	Warm sponging is not recommended for fever treatment. It is recommended to remove excess clothing and blankets, encourage fluid intake and breastfeed for babies.
Roberts S. 2008. <sup>(33)</sup>	5	To explore issues related to fever in young children, how to recognize it and discuss different forms of treatment.	Reflection study	Warm sponging; use of fans	Warm sponging is not recommended. Use of fans to cool the environment should be indicated, as long as feverish children do not show tremors.
Edwards H et al. 2007. <sup>(34)</sup>	5	To present assessment of an education program effectiveness for the development of evidence-based knowledge aimed at fever management.	Quantitative study	Encouraging fluid intake; warm sponging	It is recommended to encourage fluid intake and warm sponging 30 minutes after antipyretic administration.
Beard RM. 2008. <sup>(35)</sup>	5	To distinguish between fever and hyperthermia, assess and intervene appropriately.	Reflection study	Encouraging fluid intake; cold sponging; use of ice packs.	Recommended methods for the duration of the antipyretic: cold sponging on the forehead, use of ice packs on the groin and armpits and encouraging fluid intake.
Thompson HJ. 2011. <sup>(36)</sup>	5	To define fever from the nurses' perspective, report nurses' decision making regarding fever management, and report barriers to evidence-based practice.	Qualitative study	Blanket removal; opening windows; use of fans; ice packs; refrigerated blankets; baths	Lack of creation of multidisciplinary protocols. Nurses use interventions based on empirical experience, there is no evidence-based recommendation on the best method.
Aluka TM et al. 2013. <sup>(37)</sup>	1B	To investigate the effectiveness of cold sponging compared to oral use of paracetamol in treatment of febrile children.	Randomized clinical trial	Cold sponging	Discomfort triggered by cold sponging should not limit using this intervention, considered a safe technique, it should be encouraged, including in order to avoid seizures.
Chiappini E et al. 2009. <sup>(38)</sup>	5	To provide guidance on managing the signs and symptoms of fever in children.	Literature review	Warm sponging; exposure to cold air; refrigerated blankets; ice packs and sponging with alcohol	Physical methods are not recommended to reduce fever, only to treat hyperthermia.
Bridgwater K et al. 2008. <sup>(39)</sup>	5	To provide guidance on best evidence-based practices to assist nurses in providing care to children and adolescents with fever.	Best practices guide	Warm sponging; removing excess clothing; encouraging fluid intake	Using tepid sponging for fever management is not recommended, it is only recommended to remove excess clothing and encourage fluid intake.

Oxford Evidence Level \*1A: Systematic Review (with homogeneity) of Randomized Controlled Trials; 1B: Individual Randomized Controlled Trial (with narrow Confidence Interval); 2B: Individual cohort study (including Low Quality RCT); 5: Expert opinion without explicit critical appraisal, or based on physiology (lab or animal experiments)

tion promoted by bathing with cold water can cause a thermal shock.<sup>(17)</sup>

In fever and hyperthermia management in patients with neurological injuries, bathing was a non-pharmacological measure chosen third by nurses.<sup>(16)</sup>

### Category 2. Warm compresses

The non-pharmacological measure warm compress, as well as other physical methods, presents a similar mechanism of heat loss by conduction and convection.<sup>(20)</sup> A study describing using warm compresses soaked in water at temperature between 29 and 30°C, applied in the axillary and inguinal region for 30 minutes, was found.<sup>(2)</sup>

While there is a shortage of research in the national territory addressing warm compresses, there

is a high number of international publications on sponging in the literature in relation to warm compresses.<sup>(7,17-34)</sup> It is observed in the national literature that the authors often translate the term “sponging” as warm compress in Brazilian Portuguese. In this regard, they seem to consider sponging techniques and applying warm compresses as analogous procedures; however, they differ from each other, although they involve the same heat loss mechanism.<sup>(7)</sup>

The best outcomes found were related to the warm compress intervention in association with antipyretic. Comparative studies among patients receiving antipyretic therapy alone versus those who received antipyretic therapy in combination with a warm compress obtained faster body cooling in the first 15 minutes of the combined

intervention.<sup>(24)</sup> However, constant observation should be maintained in patients undergoing “warm compress”, as there may be the triggering of some adverse reactions, such as tremors and vasoconstriction.<sup>(7,28)</sup>

### Category 3. Sponging<sup>1</sup>

Sponging has been widely used to reduce body temperature in children. The mechanisms involved in heat loss are conduction, convection and evaporation.<sup>(20)</sup> In research, sponging intervention was used with the addition of cold, warm water and alcohol.<sup>(1,7,15-39)</sup> Parents and nurses in hospital also practice applying cold sponging.<sup>(36)</sup> The technique suffers some variations; however, in general, children are kept without clothes and their body, from neck to feet, is gently rubbed with the compress soaked in warm water.<sup>(19)</sup> Another technique also performed is rubbing with the warm compress only on the upper and lower limbs, keeping the children’s trunks covered.

The main recommendation for fever treatment through sponging is using warm water and an average time of 15 minutes.<sup>(1,24,28)</sup> The water temperature can vary from below the children’s body temperature to the limit of 33°C.<sup>(24,28,37)</sup> In several studies, warm sponging has been used in conjunction with an antipyretic.<sup>(1,7,14,16-19,23-29)</sup> The combined intervention, warm sponging and antipyretic, obtains favorable opinion only when the use has as main objective to offer comfort to children.<sup>(19,24)</sup>

In a randomized clinical trial on warm versus antipyretic sponging, it was found that warm sponging was responsible for the fastest temperature reduction in the first 30 minutes, but after that period, antipyretic was effective in the long run.<sup>(7)</sup> In another study, also a randomized clinical trial, the administration of dipyrone was compared with the administration of dipyrone + warm sponging. It has been observed that warm sponging does not offer additional long-term effects, even when administered together with antipyretic.<sup>(24)</sup>

Although some articles recommend warm sponging in treatment of febrile children, other research questions its use; they highlight a strong opposition to the method due to adverse effects, such

as toxicity (bathing and sponging with alcohol), discomfort in children, vasoconstriction, elevated body temperature, rapid temperature reduction, efficiency restricted to the first 30 minutes after application and lack of synergism in use combined with antipyretic.<sup>(1,15,17-20,22,23,26-28,32,33,37,39)</sup>

Research indicates that there is no evidence to prove that antipyretics or warm sponging prevent febrile seizures or their recurrences.<sup>(24)</sup> However children with hyperthermia may benefit from using the intervention.<sup>(38)</sup>

### Category 4. Encouraging fluid intake

Fever, in general, causes significant water loss in children. Thus, when the febrile state is prolonged, there is a risk of children presenting dehydration. Therefore children should be encouraged to increase fluid intake.<sup>(7,18,19,21,22,25,30,32,34,35,39)</sup> Especially children on exclusive breastfeeding, it is essential to offer breast milk more often.<sup>(7,26,32)</sup> Studies indicate that increase in cold fluid intake produces internal refrigeration in children and assists the physiological responses of the body to fever.<sup>(39)</sup>

### Category 5. Ice packs and refrigerated blankets

Ice packs and/or refrigerated blankets are used to reduce body temperature in case of fever and hyperthermia.<sup>(7,16,36,38)</sup> Nurses who specialize in Neurology have adopted these interventions as their first choice, considering that these measures are effective in treatment of patients with neurological injury.<sup>(16)</sup>

Evaporation and convection mechanisms provide heat loss and give the refrigerated blanket the effectiveness in hyperthermia treatment.<sup>(15,16)</sup> Using ice packs, applied in the underarm, neck and groin regions, obtained a negative result, proving to be ineffective.<sup>(27)</sup>

For fever treatment, use of ice packs in association with antipyretic was successful.<sup>(16)</sup> In a study conducted with a group of febrile patients with neurological impairment, they were submitted to use of refrigerated and antipyretic blankets, and a rapid reduction in body temperature was observed, in addition to a significant decrease in daily energy expenditure.<sup>(15)</sup> However, applying these non-pharmacological interventions in febrile patients can

trigger cutaneous vasoconstriction, tremors, sympathetic system activation and discomfort.<sup>(15,16,38)</sup> It can be observed that these non-pharmacological measures were seen as useful by some and considered problematic by other researchers, with no consensus among them.<sup>(15,16,36,38)</sup>

### Category 6. Removal of excess clothing

The removal of excess clothes, sheets and blankets provided comfort to febrile children by allowing heat loss by irradiation.<sup>(21,25,27,32,36,39)</sup> It is essential that febrile babies are kept with their heads uncovered, because in this way, the loss of excess heat occurs.<sup>(39)</sup> Nurses mentioned adopting this measure as the first option in fever management of patients.<sup>(21,25,27)</sup>

### Category 7. Environment ventilation

In this category, the techniques used to ventilate the environment were window opening and fan use.<sup>(18-20,25,27,33,36,38)</sup> Use of fans for cooling the environment was seen as beneficial, provided that patients did not present tremors and resulted in elevation of the central temperature.<sup>(30)</sup> Although fan use has been recommended by some, recent research has questioned its effectiveness in reducing body temperature.<sup>(19,20,26)</sup>

## Discussion

The results indicated that there are several non-pharmacological interventions described in the literature being implemented in clinical practice. It is also noteworthy that the largest supply of scientific production is concentrated in developed countries, and developing countries such as Brazil, India and Nigeria were responsible for a small contribution.

Regarding the levels of evidence in the selected studies, only eight of the 27 studies reached evidence level 1, according to the Classification of Oxford Centre for Evidence Based Medicine, three systematic reviews, 1 best practice guide based on a systematic review and four randomized clinical trials.<sup>(13)</sup> The findings highlight the absence of a greater number of surveys with consistent evidence,

which allow the development of protocols aimed at best practices.

Non-pharmacological interventions to treat fever were the focus of the largest number of studies. Although they are also widely used in our country, such interventions can trigger a rapid reduction in body temperature associated with the presence of anguish, discomfort and tremors, without effective resolution of the febrile state of children.<sup>(15,17-19,21,23,27,28,32,33,37-39)</sup> Overall, it is observed that there is no absolute consensus on using these interventions in fever treatment, studies show the need for additional research in order to explore the benefits and adverse effects associated with current practices.<sup>(15,20,28)</sup>

It is known that pediatric nurses are responsible for managing fever in children on a daily basis, however several studies have shown that they do not base their interventions on the best evidence, basing their actions on individual convictions and clinical experience. The resulting care may be considered ineffective, as it does not bring benefits to children or may even be iatrogenic, when considering discomfort caused by using inconsistent non-pharmacological measures.<sup>(36)</sup> In this regard, it is necessary to invest in permanent education for nurses, so that patient care is more scientific and qualified.<sup>(36)</sup>

The main objective of any non-pharmacological intervention in children is to offer them comfort. Thus, fever management should be individualized and based on knowledge of the efficacy of the measures used. Only interventions that aid in body physiological responses are indicated such as encouraging fluid intake and removing excess clothing.<sup>(7,18,19,21,22,25,30,32,35,39)</sup>

No specific studies were found on children with hyperthermia; however, there are studies aimed at adult patients with hyperthermia caused by overheated environment, heat stroke, medication use or physical activity at high temperatures.<sup>(9,10,35)</sup> The non-pharmacological measures used were body cooling with immersion in cold water and/or cold intravenous serotherapy with good results, but seem very aggressive interventions to be applied to children.<sup>(35,40)</sup>



## Conclusion

Care should be individualized and directed to the impairment presented by children, be it fever or hyperthermia. Implementing non-pharmacological measures in treatment of febrile children is not recommended, according to the literature, except for interventions that aid in the physiological responses of the body, such as encouraging fluid intake and removing excess clothing. Given the lack of studies that support non-pharmacological interventions in children with fever, it is recommended to conduct further research that results in evidence to support the best care of pediatric nurses to children with fever.

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