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Warm Compress on Lowering Body Temperature Among Hyperthermia Patients: A Literature Review

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Abstract. Hyperthermia increased the core human body temperature above normal 36.7-37.5 °C, usually caused by infection, resulting in fever, and was the most common manifestation. One of the efforts that could be done to overcome the symptoms of hyperthermia was the application of warm compresses to the frontal, axillary, and dorsalis pedis. The study aimed to describe body temperature changes in hyperthermic patients after warm compress was applied. This study used a descriptive design with a literature review approach. Twelve articles were included in this review by six journal databases: PubMed, JSTOR, Wiley Online Library, Sage Journal, Taylor and Francis Online, and Google Scholar. The selection was carried out by assessing articles that met the inclusion criteria, including the publication range for 2008-2021, English and Indonesian languages , and open access to full-text pdf. The critical assessment was carried out by using the Critical Appraisal Skills Programmed instrument. The review results showed that the warm compress method had a positive effect in lowering body temperature in the nursing process in patients with hyperthermia. Based on the literature from the reviewed articles, it could be concluded that a warm compress intervention needed to be given to hyperthermic patients to lower the patient's body temperature whether they were undergoing treatment or not.

Keyword: Hyperthermia, Warm compresses, Body temperature

INTRODUCTION

Body temperature is a balance between the production and removal of heat from the body, measured in units of degrees using a thermometer device. The temperature in question is the hot or cold of a substance. Body temperature is the difference between the amount of heat produced by bodily processes and the amount of heat lost to the outside environment (1). There are two types of temperature in the body, namely the core temperature and the skin temperature. Core temperature means that the inner body temperature and its magnitude are always maintained by a constant. While the skin temperature is different from the core temperature, it can rise and fall according to the ambient temperature. Body temperature is divided into two, namely hypothermia and hyperthermia.

Hypothermia is a drastic decrease in body temperature below normal human body temperature, which is below 35 ° C, potentially dangerous (2). Hypothermia can lead to an increased risk of bleeding, myocardial ischemia, impaired wound healing, and an increased risk of infection. Hypothermia will increase oxygen demand, carbon dioxide production, and an increase in catecholamine levels in plasma, followed by increased pulse rate, blood pressure, and cardiac output. This situation is very unfavorable for the patient. The most common cause is prolonged exposure to cold temperatures (3).

Hyperthermia is an increase in the human body's core temperature, which usually occurs as a result of infection or physiological processes (4). This condition occurs when the brain sets a temperature above the normal setting above> 37.5 ° C. The regulation of body temperature is regulated by the brain, precisely in the hypothalamus, a temperature regulation that works when there is an increase in body temperature. The hypothalamus will release efferent impulses to vasodilate the skin, and sweat will be released. Furthermore, the heat will be removed from the body (5).

The incidence of hyperthermia in Indonesia is 80-90% (6). Because Indonesia is a tropical and developing country, its population is susceptible to hyperthermia (7). The survey results of the Ministry of Health of the Republic of Indonesia, the frequency of fever in Indonesia is 15.4 per 10,000 population. Surveys of various hospitals in Indonesia show an increase in the number of fever sufferers (8). Meanwhile, according to the World Health Organization (WHO), the number of fever problems that often occur in children aged under five worldwide reaches 18-34 million because children have a weak body condition, so they are prone to fever. However, the symptoms experienced by children are lighter than adults (9).

One of the efforts that can be done to overcome hyperthermia is applying a warm compress during the treatment period (10). Warm compresses are known to positively lower body temperature in clients with various inflammatory diseases or infections from common conditions such as fever, typhoid, and others, to relatively severe illnesses that attack the nervous system, such as encephalitis (inflammation the brain parenchyma) (11). A warm compress is a compress on areas that have large blood vessels such as the axilla using warm water (12). Giving a warm compress on the axilla (armpit) or the forehead (frontal area) is more effective because many large blood vessels are in that area (13). Signals or impulses to the hypothalamus via the spinal cord can lower body temperature. When heat-sensitive receptors in the hypothalamus are stimulated, the effector system gives off a signal characterized by sweating and peripheral vasodilation. This vasodilation causes the dissipation of heat energy through the skin to increase (14).

Warm compress is done by coating the top of the skin using a soft cloth or towel soaked in warm water with a temperature of 43°C aphorisms (15). There is also a warm compress model by using a tepid sponge compress, a warm compress technique that combines a block compression technique on the superficial vessels with the wiping process. Providing a tepid sponge bath allows the circulation of moist air to help release body heat using convection (16).

In addition to the benefits of warm compresses researched with the various services obtained, warm compress is also very safe and easy to do. You don't even need to spend money so that they can be applied in the nursing care process (Evidence-Based Research (EBN)) in hospitals and at home. For this reason, this literature review study is expected to be a reference source for EBN implementation (17).

OBJECTIVE

This study was conducted to explain the effect of warm compresses on decreasing body temperature in hyperthermic patients by presenting a literature review article that was arranged systematically following the scientific method process.

METHOD

The search for articles was carried out using an electronic database through PubMed, JSTOR, Wiley Online Library, Sage Journal, Taylor, and Francis Onlne. The keywords in advance search engines: (All: warm compress) AND (All: body temperature) AND (All: hyperthermia) AND (All: experimental) and additions to the two journal databases, namely google scholar and research gate. The author then screened journals published in 2008-2021, which could be accessed in full text in pdf format in Indonesian and English versions.

Participants or population (P) in this study were patients with hyperthermic symptoms with Intervention (I) warm compresses, Outcomes (O) in the form of decreased body temperature. All types of Study Design (S) involving male and female subjects from several homes and patients who continued home care using warm compress interventions were not age-restricted. The exclusion criteria were book chapters, abstract proceedings, and posters. Furthermore, the authors conducted an analysis process of each article reviewed and then took the detailed information needed to describe the effect of warm compress in lowering body temperature.

This selection process was carried out using Microsoft Excel, which began by removing duplicates with article titles that did not fit in the search for primary data. Then it ensured conformity to the inclusion criteria by analyzing the abstraction of the selected articles. In the second round of the article selection process, the author conducted a full-text review of the article to prevent doubts about the selected articles. Next, the authors searched for and selected the most relevant studies for review using PIOS suitability. All articles that met the inclusion criteria were thoroughly reviewed without a meta-analysis.

All articles were thoroughly reviewed, specifically criticized, and rated using the Critical Appraisal Skills Programmed (CASP) instrument by three independent authors (LL, AAM, NSP). The articles chosen were articles with good CASP level with a score of 6-8 points and 4-5 points enough. Disagreements related to the assessment of articles and ranking scores, the authors resolved them in the discussion, with the help of a senior mentor (FAF). However, the authors still found many difficulties, so they conducted a discussion again with the help of a supervisor (HS).

This research collected data from various articles in the intervention and control groups: total number of respondents, Intervention or therapy, methods, results, and critical assessments. This research review included only level I, II, and III evidence studies, where the presentation of the steps was not homogeneous, and therefore no meta-analysis was carried out. The findings in this study only present a summary form that was narrative or based on an incident with the treatment group with or without regular treatment or care.

RESULTS

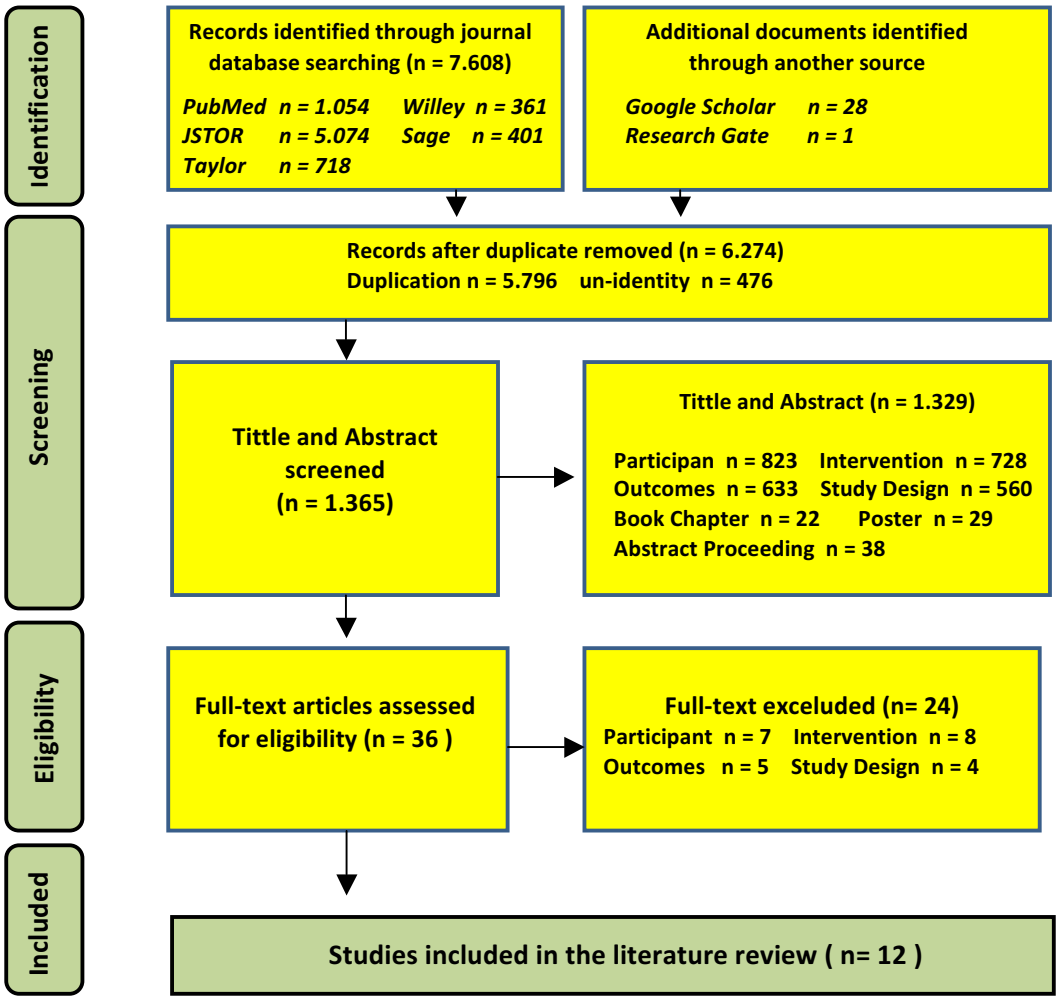
The selection of research articles that used predefined search keywords in the combined database search published from 2008-2021 yielded 7,608 articles, as shown in Figure 1. Through three screenings, most of the studies did not include articles that met the

PIOS criteria. Non-hyperthermic subjects (n=823) did not use the warm compress intervention (n=728), did not focus on lowering body temperature (n=633), and did not use the experimental (n=560). In addition, (n=476) the article was not used because it did not have an identity with (n =5,796) duplicate articles. This has been eliminated in Microsoft Excel.

After the journal elimination process was carried out, it resulted in 12 articles that fulfilled the PIOS. here are some of the results of the article

1. Desain
   Of the 12 articles obtained, the research design included RCT (Randomized Controlled Trials) found in article number 6. The next is a Quasi-experimental design found in articles number 5, 8, 9, 12. True experimental research design is in articles 10 and 11. The pre-experimental research design is listed in articles number 1 and 2. In contrast, the empirical research design is in article number 7. And the case study design is in articles number 3 and 4.
2. Instrument
   This literature uses three instruments, namely (1) observation sheet, (2) digital thermometer, (3) mercury thermometer. Articles that use observation sheet instruments are only the first article, then articles 2, 3, 4, 5, and 7 use a digital thermometer instrument, while articles that use a mercury thermometer instrument are article number 6.
   Of the 12 articles reviewed, most of the instruments used are digital thermometers. Still, judging from the accuracy of the measurements, the mercury thermometer has an accuracy rate of 99% because mercury responds to a temperature that is not related to other factors.
3. Intervention
   Warm compress intervention in this literature uses two methods, namely tepid sponge and towel, with the forehead, axilla, and femoral areas where the Intervention using the tepid sponge method is considered more significant because direct compression is carried out in several places. In contrast, the technique of using towels is only done on the forehead area.
   The three areas of compression both have large blood vessels and are considered adequate for reduction. However, the axilla is deemed to be more effective and significant because, in addition to having large veins. There are also apocrine glands that have good vasodilation ability to reduce the temperature. This area is also very close to the brain, a temperature control sensor called the hypothalamus.
4. Main results
   The results of 12 articles found that warm compresses are effective in reducing body temperature in hyperthermic patients.

Figure 1. Prisma Diagram



Characteristics of the study with the number of participants involved in this study were 406 people assigned randomly or randomly to 10 participants in the intervention group and 10 participants in the control group. The results of the research in the intervention group showed a positive effect on decreasing body temperature. This literature consists of 12 articles, and all interventions were reported to be significantly effective at lowering body temperature. The subjects in this study were patients with hyperthermia.

Tabel 1.
Respondent Characteristics

Variable	Category	N	%	Mean	SD
Age	Age (1-5 tahun)	120	30.7	0.95	16.9
	Age (1-3 years)	36	9.2		
	Age (1-10 years)	36	9.2		
	Age (2-8 years)	34	8.7		
	Age (3-6 years)	76	19.4		
	Age (10-12 years)	30	7.6		
	Age 11 years	1	0.25		
	Age (0-40 years)	38	9.7		
Gender	Male	197	50.5	0.90	12.04

	Female	144	36.9

Tabel 2.
Characteristics of The Articles

No	Author (Year) Title	Method	Result
1.	H. Sri et al., (2016) The Effectiveness of Warm Water Compresses Against Decreasing Body Temperature of Fever Children Ages 1 - 3 Years Old at SMC Rs Telogorejo Semarang	**Objective:** This is to determine the effectiveness of warm water compresses in reducing body temperature in children **Design:** Pre experiment **Sample:** 36 Respondent **Intervention**: Warm compress **Instrument**: Questionnaire	Warm water compresses have effective in reducing body temperature in febrile children aged 1-3 years, with a value of p = 0.000 (p <0.05)
2.	Purwanti et al., (2008) The Effect of Warm Compress on Changes in Body Temperature in Pediatric Hyperthermia Patients in the Inpatient Room Dr. Moewardi Surakarta	**Objective:** This is to determine the decrease in body temperature in children **Design:** Pre experiment **Sample:** 30 respondent **Intervention:** Warm compress **Instrument:** Digital Thermometer	The results showed that the warm compress was proven to produce significant changes, namely with an average body temperature of 0.97 ° C with an SD of 0.35 ° C, the value of P = 0.001, which weighed on P <0.05.
3.	Mulyani et al., (2020) The Effectiveness of Tepid Water Sponge on Decreasing Body Temperature in Children with Hyperthermia Nursing Problems: A Case Study	**Objective**: The study aimed to determine the effectiveness of TWS as an intervention in providing nursing care to children with hyperthermia problems. **Design**: A case study **Sample:** 2 Respondent **Intervention:** Warm compress **Instrument:** Digital thermometer	Warm compress intervention can overcome the problem of hyperthermia in children.
4.	Anisa (2019) The Effectiveness of Warm Compress To Lower Body Temperature In An. D With Hyperthermia	**Objective**: The study aimed to determine the effectiveness of warm compresses to reduce body temperature in children's fever. **Design**: A case study **Sample:** 1 Respondent **Intervention:** Warm compress **Instrument:** Digital thermometer	The results showed a decrease after applying a warm compress according to the target to be achieved.
5.	Fadli et al., (2018) The Effect of Warm Compress on Changes in Body Temperature in Febris Patients	**Objective**: The study aimed to handle the body temperature of children who experience febrile. **Design :** Quasi eksperiment **Sample:** 17 respondent **Intervention:** Warm compress **Instrument:** Digital thermometer	This study indicates the effect of warm compresses on changes in body temperature of febrile patients with results p = 0.0001.
6.	Aulya et al. (2019) The Difference Between the Conventional Warm Compress and Tepid Sponge Technique Warm Compress in the Body Temperature Changes of Pediatric Patients with Typhoid Fever	**Objective**: The study aimed to examine the difference between conventional warm compresses and warm sponge techniques to change body temperature. **Design:** Quasi ex **Sample :** 20 (10 interventions, 10 controls) **Intervention:** Warm compress	Significance test result data using General linear model repeated measurement (p-value 0.03 for conventional heating compress and p-value 0.01 in the warm sponge warm compress technique)

		Instrument: Mercury thermometer	
7.	B. Maling et al., (2012) The Effect of Warm Tepid Sponge Compress on Decreasing Body Temperature in Children aged 1-10 Years with Hyperthermia (A Case Study at RSUD Tugurejo Semarang)	**Objective:** To determine the effect of warm tepid sponge compresses on decreasing body temperature in children aged 1-10 with hyperthermia. **Design:** Experiment **Sample:** 36 respondent **Intervention:** Warm compress **Instrument:** Digital thermometer	The warm compress intervention shows the effect of warm tepid sponge compresses on decreasing body temperature with a p-value of 0.0001 <0.05 with an average decrease of 1.4 ° C
8.	Dewi (2016) The Difference in Body Temperature Decrease Between Giving Warm Water Compresses with Tepid Sponge Bath In Fever Children	**Objective:** To analyze the difference in giving warm water compresses and warm sponge baths in decreasing body temperature on child fever in Hijr Ismail room RSI A Yani Surabaya **Design :** Quasy eksperiment **Sample:** 90 respondent **Intervention:** Warm compress **Instrument:** Digital thermometer	This study indicates a difference between providing a warm compress and decreasing body temperature warm sponge bath, with a significance value (p) of 0.000.
9.	Wardiyah et al. (2016) compared the Effectiveness of Giving Warm Compress and Tepid Sponge to Decrease Body Temperature of Children with Fever in Alamanda Room. Rsud Dr. H. Abdul Moeloek, Lampung Province, 2015	**Objective**: The study aimed to compare the effectiveness of giving warm compresses and tepid sponge to decreasing the body temperature of children who have a fever in the Alamanda room dr. H. Abdul Moeloek, Lampung Province in 2015. **Design :** Quasi eksperiment **Sample:** 30 respondent **Intervention:** Warm compress **Instrument:** Digital thermometer	The results of statistical tests showed that there was a difference in the decrease in body temperature between warm compresses with a mean of 0.5 ° C and tepid sponge with a mean of 0.8 ° C (p-value < α, 0.003 < 0.05).
10.	Ayu et al., (2015) Warm compresses of water on the axillary and forehead areas against decreasing body temperature in fever patients at PKU Muhammadiyah Kutoarjo	**Objective:** To find out the difference in the effectiveness of giving warm water compresses on the axilla and forehead to decrease the body temperature in fever patients at KRIPMD PKU Muhammadiyah Kutoarjo **Design :** True eksperiment **Sample:** 38 respondents **Intervention:** Warm compress **Instrument:** Mercury thermometer	The t-test analysis showed that the technique of applying warm compresses to the axillary area was more effective in decreasing body temperature than the technique of giving warm compresses to the forehead (t count = 5.879 p = 0.000).
11.	Masruroh et al., (2017) The Effectiveness of Giving Warm Compress on Axilla and Femoral Against Decreasing Body Temperature in Preschool Fever Children at Ambarawa Hospital	**Objective**: The study aimed to determine the effectiveness of giving warm compresses to the axilla and femoral to decrease preschool fever children's body temperature at Ambarawa Hospital. **Design :** True eksperiment **Sample:** 76 respondents **Intervention:** Warm compress	The decrease body temperature of children with fever after receiving warm compress was an average of 1.3 ° C while on the femoral, an average of 0.7 ° C. There was a significant difference in body temperature before and after receiving warm compress with a p-value of 0.000 and a

		Instrument: Digital thermometer	p-value of 0.000 femoral.
12.	Rahmawati and Purwanto (2020) The Effectiveness of Warm And Cold Compress Differences Against Changes in Body Temperature in Children in Rsud Dr. M. Yunus Bengkulu	**Objective:** To study the effectiveness of giving warm and cold compresses to changes in body temperature in children in the Edelweiss room, Dr. M. Yunus Bengkulu **Design :** Quasi eksperiment **Sample:** 30 respondents **Intervention:** Warm compress **Instrument:** Digital thermometer	The two-sample t-test showed that the value of t = -2.030 is estimated to be t = 2.030 with P-Value = 0.029 <0.05 which means significant.

DISCUSSION

Of the 12 articles obtained, the research design included RCT (Randomized Controlled Trials), a procedure commonly used in drug trials or medical procedures. RCT involves the process of giving treatment to subjects randomly. As in article number 6, the number of respondents is 20 people consisting of 10 people in the intervention group and 10 from the control group. Furthermore, a Quasi-experimental design is an experiment that does not place subjects, either into the experimental group or the control group randomly. There are four types of quasi-experimental methods. Each design type is detailed again into a more specific design (28). As contained in articles 5, 8, 9, 12.

Further research design is a true experiment. In this research, the researcher can control all external variables that affect the course of the experiment. The design of this research is contained in articles 10 and 11 (29). The pre-experimental research design is a research design that has not been categorized as a real experiment. This is because random or random sampling has not been carried out in this design. There is not enough control over the confounding variables that can affect the dependent variable. There are articles number 1 and 2.

In contrast, the experimental research design is in article number 7. And the case study design is research that emphasizes a deeper understanding of certain phenomena in individuals. Case studies are also useful in exploring issues that are unknown or still known about specific phenomena, which can be found in articles 3 and 4.

The measurement results of this literature used several instruments, namely (1) observation sheet, (2) digital thermometer, (3) mercury thermometer. An observation sheet is a measuring tool used in article number 1. This sheet includes the respondent code, age, gender, temperature before and after the compress. This study was proven to be effective in decreasing body temperature in feverish children aged 1-3 years, with a value of p = 0.000 (p <0.05) (28).

The digital thermometer is a measuring instrument used in articles 2, 3, 4, 5, 7, 8, 9, and 12 to measure the temperature before and after the warm compress intervention. With the results in article number 2, the warm compress intervention was proven to produce significant changes with a value of P = 0.001 P <0.05 (18). Article number 3 of the results of this study can overcome the problem of hyperthermia in children (19). Article number 4, with the results of warm compress intervention, can lower body temperature in children who experience hyperthermia (20). Article number 5 with research results showed that the effect of warm compresses on changes in body temperature in febrile patients with results p = 0.0001 (4). Article number 7 with the results of warm compress research showed an effect on decreasing body temperature with a p-value of 0.0001 <0.05 with an average decrease of 1.4°C (21). Article number 8 shows the results of this study indicate a difference between giving a warm compress and a reduction in body temperature by taking a warm sponge bath,

with a significance value (p) of 0.000 (16). Article number 9 The results of statistical tests show that there is a difference in the decrease in body temperature between warm compresses with a mean of 0.5 ° C and tepid sponge with a mean of 0.8 ° C (p-value < α, 0.003 < 0.05) (9). And article number 12 showed the results of the two-sample t-test, the value of t = -2.030 is estimated to be t = 2.030 with P-Value = 0.029 <0.05, which means significant (23).

Mercury thermometer is a measuring instrument used in articles 6 and 11. Measurement of body temperature was carried out using a mercury thermometer because it has an accuracy rate of 99%. Mercury responds to body temperature and is not related to other factors. The study of article number 6 showed that the data results were tested for significance using the General linear repeated measurement model (p-value 0.03 for conventional heating compresses and p-value 0.01 for the warm sponge warm compress technique) (24). And article number 11 showed a decrease in the body temperature of a feverish child after being given a warm compress on the axilla, an average of 1.3 ° C. In contrast, the weather of the femoral was 0.7 ° C. There was a significant difference in body temperature before and after receiving the warm compress with a p-value of 0.000 and p-value of 0.000 femoral (25).

A warm compress can be done in several methods, including using the tepid sponge technique and a towel placed in one area only. Compress using a tepid sponge is a combination of the block technique with a wipe (29). In this technique, compression is carried out using a sponge or washcloth stored in one place and several places with large blood vessels such as the forehead, axilla, and femoral (30).

Based on the articles reviewed, a tepid sponge has a significant positive effect on reducing body temperature compared to using a warm compress using a towel. The tepid sponge is more influential because direct compression is carried out in various places, facilitating more intense signal delivery to the hypothalamus. In addition, giving the wipes will accelerate the dilation of peripheral blood vessels. It will facilitate heat transfer from the body to the surrounding environment, accelerating the decrease in body temperature. This statement is reinforced by Eny et al. (2015), which explains the effectiveness of warm compresses on the axilla and forehead. There are also many apocrine glands (28) that have a good vasodilation ability in reducing temperature. This area is also very close to the brain, a place where there is a temperature control sensor, namely the hypothalamus. While compressing using a towel is only done on one area, namely the forehead. Even though there are large blood vessels, it is only done in one area, so the tepid sponge technique is more significant in lowering body temperature.

The age that is prone to hyperthermia is following the article described by (25) is the range of 21-30 years. At this age, there tend to be many activities and psychological disorders such as stress, resulting in a weak immune system. However, this research contradicts the explanation stated that the ages that were prone to hyperthermia were children and toddlers because, at this age, the temperature regulation mechanism had not yet matured, which caused the body to be unable to maintain a balance between heat production and heat dissipation (9). Body temperature in children fluctuates wildly, this was because the thermostat in children was still immature, so it was easy to change and was sensitive to changes in environmental temperature. The child's thermostat will mature when the child enters adolescence. Along with achieving this maturity, body temperature would increase with temperature variations.

Men tend to experience hyperthermia because boys are said to be more active than girls (31). Another study(25) said that women were the gender with an average of experiencing the most hyperthermic symptoms. This was because hormone factors affected increasing body temperature and noted that women had more hormones than men. In women, there was an increase of temperature between 0.3-0.6 C above basal temperature when progesterone secretion occurs at the time of ovulation (25).

The mean temperature measurement using a mercury thermometer was higher, namely 36.34 + 0.41, compared to the temperature measurement using a digital thermometer, namely 36.02 + 0.49. The difference is the difference between the results of this measurement can occur due to several things, for example, when the temperature measurement is not done right after waking up, but in the range 06.00 - 08.00. At that time, a person has been active first to affect the increase or decrease in body temperature (17). In addition, one digital thermometer is used to measure 3-4 research subjects (9 to 12 times the measurement) so that the performance of the digital thermometer can decrease. In addition, it is explained that the use of a digital thermometer allows more errors to occur. However, measurements using a mercury or mercury thermometer are more accurate because mercury is used only once for one research subject.

From all the articles reviewed, it is proven that warm compress positively lowers the temperature. With a warm compress, the outside body temperature becomes warm so that the body will interpret that the outside temperature is hot enough. Finally, the body will lower the temperature control in the brain to not increase the body temperature control. When the weather outside is warm, it will make the peripheral blood vessels in the skin widen and experience vasodilation so that the skin pores will open and facilitate expelling heat, which then changes body temperature. However, they had different perceptions. This article said that the warm compress intervention should be done when the child had a temperature rise to 40 or had previous fever seizures (19).

The findings in this study provide confidence and understanding that warm compress is very effective in lowering body temperature. This can not only be done in hospitals and other health services but can also be done at home as the first Intervention before further action is taken in health services.

CONCLUSION

This study shows that warm compress is effectively used to lower body temperature in nursing patients with hyperthermia. Based on the analysis of several studies, it can be found that a warm compress intervention needs to be given to hyperthermic patients to reduce the patient's body temperature whether they are undergoing treatment or not. Hospital nurses can apply warm compresses as an alternative intervention in hyperthermic patients.

Therefore, for the following study, the authors recommend presenting warm compress intervention with hyperthermia for some instances or diseases. Thus, the presentation that is conveyed is clearer and more detailed about a condition. In addition, to make it easier for nurses to implement the cases at hand.

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