Effect of Applying Cold Gel Compresses Versus Warm Water Compresses on Reducing Body Temperature among Children with Pyrexia

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Abstract

Background: Pyrexia is a natural response of the body that helps in fighting off foreign substances such as microorganisms and toxins. Warm water compresses lead to blood vessels to dilate and improves blood circulation, which releases heat in the form of sweat and supplies oxygen to brain cells, which stimulates circulation and reduces body temperature. **Aim of the Study**: to explore the effect of applying cold gel compresses versus warm water compresses on reducing body temperature among children with pyrexia**. Subject and method:** a quasi-experimental research design used to achieve the aim of the current study. Setting: The current study was conducted in the pediatric department on the third and fourth floors at Minia University Hospital for Gynecology, Obstetrics, and Pediatrics. A purposeful sample of 70 children under five years with pyrexia were participated in the study. Data collected Tool through the use of one tool: It covered the following parts: Part (1): Bio-demographic data of the children and Part (2): Vital signs record included axillary body temperature, heart rate, and respiratory rate. **Result**: The mean axillary body temperature before compresses in cold gel and warm water groups was $38.8 \pm 0.5^{o}C$ versus $38.9 \pm 0.5^{o}C$ respectively, and after 60, 120 minutes decreased in cold gel compresses group was $38.6^{0}C \pm 0.6$ and $38.3^{0}C \pm 0.6$, while in warm water compresses group was $38.2\ ^{0}C \pm 0.5$ and $37.4^{0}C \pm 0.5$ respectively with statistical significances. **Conclusion**: As pointed the current research results showed that warm water compresses are more effective than cold gel compresses in reducing body temperature among children with pyrexia. **Recommendation**: Develop health education program for nurses regarding different methods of non-pharmacological techniques to reduce body temperature.

Keywords: Children, Cold Gel, Pyrexia, Warm Water.

Introduction

Pyrexia in children is a prevalent clinical symptom of several illnesses that prompts parents to seek medical assistance. Pyrexia is typically defined as a body temperature exceeding 38.3°C when measured rectally, 37.8°C orally, and 37.0°C axillary. It may stem from the interplay between viral or non-infectious processes and the host defense mechanism. Pyrexia in children may have an indeterminate etiology and is referred to as pyrexia of uncertain origin or pyrexia without focus **(Patil et al., 2023).**

The etiology of pyrexia may encompass particular infections such as viral, bacterial, and parasitic, as well as localized inflammation and non-infectious origins, including metabolic and neoplastic factors. Reactions to specific drugs or malingering should also be taken into account **(Patil et al., 2023)**. Accompanying signs and symptoms of pyrexia may include shivering, irritability, myalgia, diaphoresis, lethargy, polydipsia, fussiness, erythema, hyperthermia, tachypnea, chills, dehydration, and anorexia. **(Milhorn, 2024, Kurniawati et al., 2021).**

The clinical management of pyrexia is multifaceted. The application of pharmacological interventions, exemplified by antipyretics like Paracetamol and Ibuprofen, alongside non-pharmacological approaches such as baths, sponging, warm compresses, hydration, disrobing, and room ventilation **(Souza et al., 2022).**

Management of pyrexia using compresses with warm water: the optimal water temperature for compresses is 34°C, classified as warm or lukewarm. Another method to alleviate pyrexia is the application of cold gel compresses, which are composed of hydrogel material based on polyacrylate, incorporating paraben and menthol, and featuring a crosslinked polymer structure that contains over 70% water, facilitating temperature reduction through evaporation. The pharmaceutical action involves administering antipyretic medications, including fever-reducing agents like paracetamol. The World Health Organization has advised the use of paracetamol (acetaminophen) **(Karin et al., (2021).**

Cold gel patches exhibited the greatest water content. This formulation does not induce redness or abrasion; hence, it can serve as a substitute for the traditional sponging approach that necessitates changing the cloth every two minutes. This patch offers cooling for 6 to 8 hours without the need for bothersome changes. The clinical testing of the gel sheet showed its potential for future usage in fever reduction without adverse effects and with efficacy **(Farooq et al., 2018)**.

The study results indicated that warm compresses effectively reduce temperature. Warm compresses elevate external body temperature, prompting the body to perceive the external environment as sufficiently heated. Ultimately, the body will reduce the temperature regulation in the brain rather than enhance the body's temperature management. Warm external temperatures induce dilatation of peripheral blood vessels in the skin, leading to the opening of skin pores and the expulsion of heat, so altering body temperature. Nonetheless, they possessed divergent viewpoints **(Lismayanti et al., 2021)**.

Nursing responsibilities at the hospital for a child with pyrexia: Assess history taking by gathering pyrexia duration, associated symptoms (cough, vomiting, diarrhea, rash), recent infections, medications, and immunization

history, and physical examination to identify the source of pyrexia, looking for dehydration, respiratory distress, or infection localization. Check body temperature, heart rate, and blood pressure for changes; give antipyretics like acetaminophen or ibuprofen as prescribed; make sure the dosage is right for the child's weight and age, and make sure the child is comfortable by adjusting clothing or bedding, giving a tepid sponge bath, and promoting hydration. Note any side effects or changes in the child's condition after antipyretic and other therapies **(Kliegman et al., 2022).**

Significance of the Study:

Pyrexia is a prevalent presenting symptom in the pediatric population, accounting for about 70% of all pediatric clinic visits **(Shalaby et al., 2021).** Pyrexia is prevalent among children throughout the initial five years of life. The incidence escalates from 2 months to 3 years of age in a child's life. It may result in severe consequences, including seizures and dehydration, necessitating medical consultation **(Anokye et al., 2018).**

Pyrexia in children is a response to pneumonia, diarrhea, malaria, metabolic disorders, and malnutrition, which the WHO estimates accounts for around 10 million child fatalities before the age of five **(WHO, 2019).** The highest occurrence of pyrexia in children aged 3 to 36 months is between 6 to 12 febrile episodes annually. In 50% of all febrile episodes, the predominant condition is an independent upper respiratory tract viral infection. Body temperatures over 40°C are frequently observed in 20 percent of individuals during febrile outbreaks (**Consolini, 2020).**

The cold patch comprises a substantial proportion of water, which synergizes with the body's intrinsic cooling mechanism to facilitate thermoregulation. As the temperature increases, the warmth of the skin induces the evaporation of water from the cold gel patch, resulting in a chilling feeling on the skin's surface. The Gel's unique structure facilitates exceptional heat transfer, allowing for efficient heat dispersion and a sustained cooling effect that endures for up to 8 hours **(Farooq et al., 2018).**

A study conducted by **Nurhanifah et al. (2022)** examined the impact of warm compresses applied to the axilla and femoral regions on body temperature reduction, revealing a decrease of 37.52 °C and 37.91 °C, respectively, in both groups. Also, **Gunawan et al. (2022)** utilized warm compresses on the forehead for 10-15 minutes to alleviate pyrexia. The initial body temperature recorded was 37.80°C, and subsequent to the use of warm compresses, it measured 37.50°C.

Through my work with children during practical training, I noticed that a large percentage of children suffer from pyrexia for various reasons, so I wanted to select and work on a topic related to pyrexia and how to treat it more effectively, for a longer period, and with less side effect than traditional and routine methods.

The current study aim to explore the effect of applying cold gel compresses versus warm water compresses on reducing body temperature among children with pyrexia**.**

Research hypotheses:

The current study results tested the following research hypothesis.

H_0. There are no differences between the effect of applying cold gel compresses versus warm water compresses on reducing body temperature among children with pyrexia.

H_1. There is a difference between the effect of applying cold gel compresses versus warm water compresses on reducing body temperature among children with pyrexia.

Subject and method

Research Design:

A Quasi-experimental research design was used to achieve the aim of the current study.

Sample:

A purposeful sample of 70 children under five years with pyrexia was divided into equal groups by using a systematic random sample by dividing the number of rooms systematically from 1 to 10, then every 2nd room, select room by using regular intervals. The Children included in this study with pyrexia of more than 37.5°c, aged from two months up to five years, and their mothers were willing to participate in this research. The period of study was from April 2023 to September 2023. The researchers collected the personal data of the mothers and their children on an individual basis at their bedside area.

Sample Size

Seventy (70) children under five years were included to conduct the present study according to the following equation:

$$N = \frac{t^2 \times p(1-p)}{m^2}$$

$$N = \frac{(1.96)^2 \times 0.047\ (1-0.047)}{0.05^2}$$

N = 70

Description:

t = confidence level at 95 % (standard value of 1.960)

p = estimated prevalence of children under five years with pyrexia at obstetric and pediatric Minia University Hospital 2021 (0.047)

m = margin of error at 5 % (standard value of 0.050)

The sample size was divided into two groups equally:

- The first group (35 children) received a cold gel compress.
- The second group (35 children) received warm water compresses**.**

Setting:

The current study was conducted in the pediatric department on the third and fourth floors at Minia University Hospital for Gynecology, Obstetrics, and Pediatrics. The hospital receives children from all over Minia governorate who complained of different diseases, and the over number of beds in the pediatric medicine is 84 beds. The Pediatric medicine unit consisted of 13 rooms divided into three rooms for Neurology cases (19 beds), four rooms for Respiratory and chest diseases (19 beds), five rooms for Gastroenterology, Nutrition, and Liver diseases (29 beds), One room for Nephrology (8 beds) and one room for Rheumatology and Immunology (4 beds). It also includes the hematology and oncology unit, Endocrinology and diabetes unit (13 beds), isolation rooms, and children's playroom.

Data Collection Tool:

Data collected through the use of one tool:

The researchers developed a structured interview questionnaire after reviewing related literature. It covered the following parts:

Part (1): Bio-demographic data of the children: covered age, gender, residence, diagnosis, current use of antipyretic, the last time of fever, and history of febrile convulsion.

Part (2): Vital signs record included axillary body temperature, heart rate, and respiratory rate.

Validity:

The tool was evaluated for content validity by five specialists in Pediatric Nursing: two from the Faculty of Nursing at Minia University, one from Assiut University, and two from the Faculty of Nursing at Cairo University. The tool was evaluated for subject coverage, item arrangement, clarity, relevance, applicability, format, and length.

Ethical consideration:

A preliminary written primary consent was acquired from the research ethics committee associated with the Faculty of Nursing at Minia University. The mothers of children in the study received a comprehensive description of the research's objectives and were requested to provide written consent to confirm their cooperation and agreement. Furthermore, participants were informed that their participation in the research was purely voluntary. Mothers were advised that they could withdraw from the research at any time without justifying and that this would not affect the care of their infants. Confidentiality of participant mothers was guaranteed to all.

Pilot study:

Following the development of the tool, researchers conducted a pilot study involving 10% (7 children) of the total participants to assess the tool's clarity, appropriateness, and requisite duration for completion. The findings of the pilot study were utilized to validate the specified data analysis and methodologies. The study's tool was completed without issues, hence strengthening its validity. This study encompassed patients who participated in the pilot study as part of its complete sample.

Data collection procedure:

The current data collection procedure is accomplished through the following steps:

Preparatory phase (Before the intervention procedure):

An interview was conducted with the caregivers of the children who were accompanying them at the time of the procedure to explain the aim of the study and obtain permission to include their children in the current study. Children who met the inclusion criteria were selected for the study and alienated into two equal groups. The two groups of children under five years with pyrexia were placed in the supine position before, during, and after the intervention. Bio-demographic data of the children (part one) and vital signs (part two) were assessed as a baseline.

Cold gel compresses group:

After washing hands and checking the axillary body temperature by using a mercury glass thermometer, respiratory rate by observing abdominal movement and heart rate by using a fingertip pulse oximeter (ChoiceMed) of the child. Keep the child in the supine position and apply cold gel compresses on the forehead (Figure 1. a), axilla area (Figure 1. b), or groin area for 2 hours (one gel compression upto 2 hours in each area). After 30, 60, and 120 minutes, the researchers checked the axillary body temperature (Figure 1. c), respiratory rate, and heart rate (Figure 1.d).

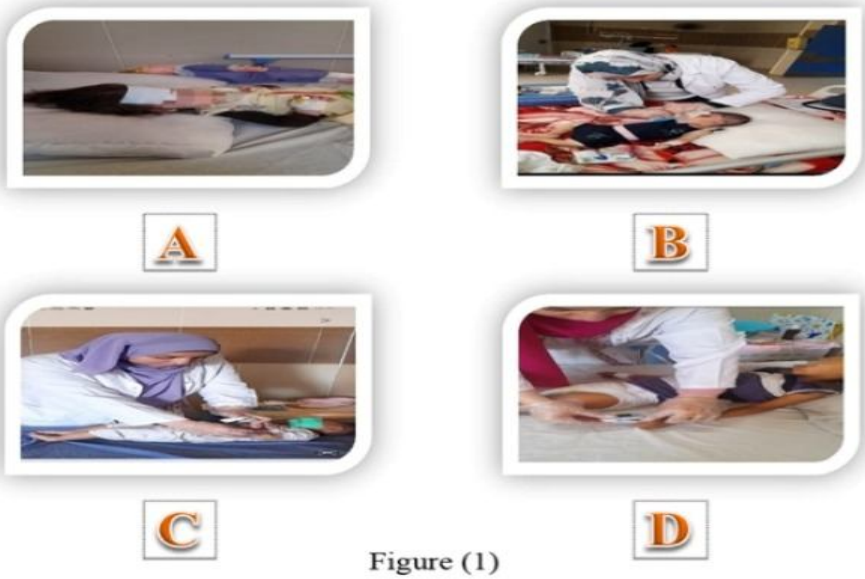


Figure (1)

Warm water compresses group:

The warm water compressing procedure was applied as follows: Required articles: 6 sponge towels, a steel/enamel basin, Mackintosh, two bath towels, glass thermometer, bath thermometer, and warm water from (32-37^{o}C) after washing hands and checking the axillary body temperature by using mercury glass thermometer, respiratory rate by observing abdominal movement and heart rate by using fingertip pulse oximeter (ChoiceMed) of the child, a long mackintosh spread under the child and keep the child in supine position.

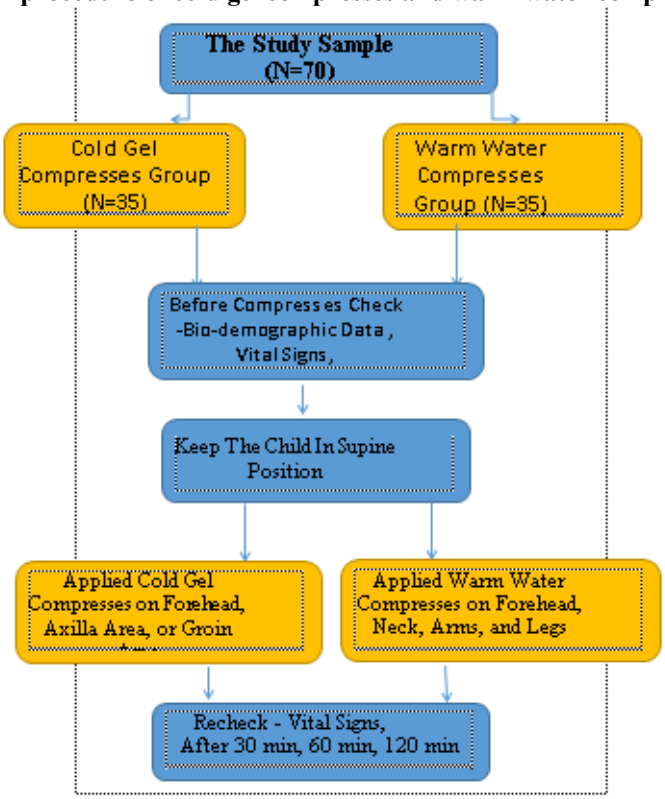
After ensuring privacy, the dress was removed, and the child was covered with the top sheet. Two sponge towels are used to put over the forehead and neck without touching the eyes. A sponge towel is used over one arm, starting from

the acromion process and proceeding laterally to the fingers and then medially reaching the axilla. The sponge towel is left in the axillary pit. The same sequences were done for the other arm. A sponge towel is used for the legs to apply from the groin, proceeding laterally to the feet and then medially reaching the groin. The sponge towel kept on the fold of the groin keeps every sponge towel for 4-6 minutes in its place, (figure 2. a).

After 30, 60, and 120 minutes, the researcher checked the axillary body temperature (figure 2. b), respiratory rate, and heart rate (figure 2. c) and recorded the results. If it continues to be >37.5^{0}c, warm water compresses were administered for another 30 minutes.

Figure (2)

Data collection procedure of cold gel compresses and warm water compresses groups :



Statistical Analysis:

The data that was gathered was organized in tables, analyzed, and computerized using the Statistical Package for Social Science (SPSS version 28.0). Descriptive and inferential statistics were utilized to present the study data. The data were expressed descriptively through the use of numbers and percentages (%). Quantitative data were presented by mean and standard deviation (SD). Quantitative continuous data were compared using a t-test to compare the two groups. The Chi-square and Fisher exact tests were used to test the association between two qualitative variables or

To detect differences between the two groups. The Pearson correlation test was used to detect the significance and degree of association between the quantitative variables of the two groups. The level of significance was accepted at a *P*-value < 0.05.

Results:

Table (1): Demographic data of the studied children in cold gel compresses & warm water compresses groups (n=70).

Items	Cold gel compresses group (n= 35)		Warm water compresses the group (n= 35)		Test of significance	
	No.	%	No.	%	X^2	*P* - value
Age/months						
2<9	9	25.7	6	17.1	5.680	0.202 NS
9<16	14	**40.0**	14	**40.0**		
16<23	5	14.3	8	22.9		
23<30	5	14.3	1	2.9		
30-37	2	5.7	6	17.1		
Mean ± SD	13.0 ± 10.8		17.1 ± 11.5		1.541	0.128NS
Gender						
Boy	23	**65.7**	19	**54.3**	0.952	0.329 NS
Girl	12	34.3	16	45.7		
Residence						
Urban	7	20.0	8	22.9	0.085	0.771 NS
Rural	28	**80.0**	27	**77.1**		

NS= not statistically significant differences

Table (1) shows that about two-fifths of children in the cold gel compresses and warm water compresses groups (40.0% & 40.0% respectively) ages ranged from 9<16 months, with a mean age in the cold gel compresses and warm water compresses groups were 13.0 ± 10.8 months and 17.1 ± 11.5 months respectively**.** Boy gender was approximately 65.7% & 54.3% presented among children in the cold gel compresses and warm water compresses groups, respectively. The majority and around more than three quarters (80% and 77.1% respectively) of all cases in the cold gel compresses and warm water compresses groups are living in rural areas. No statistically significance differences were found between the demographic data of both groups, which evidenced that homogeneity was found between the children in the cold gel compresses and those in the warm water compresses groups.

Table (2): Medical data of the studied children in cold gel compresses & warm water compresses groups (n=70).

Items	Cold gel compresses group (n= 35)		Warm water compresses the group (n= 35)		Test of significance	
	No.	%	No.	%	X^2	*P* – value
Diagnosis						
Gastroenteritis	17	48.6	10	28.6	5.931	0.204 NS
Pneumonia	**9**	**25.7**	8	**22.9**		
Encephalopathy	6	17.1	8	22.9		
Brain Atrophy	1	2.9	6	17.1		
Bacteremia	2	5.7	3	8.6		
Use antipyretic						
Yes	35	100.0	35	100.0	…..	…..
If yes, Duration/ hr					2.105	0.349 NS
6	16	45.7	12	34.3		
8	7	**20.0**	5	**14.3**		
10	12	34.3	18	51.4		
Mean ± SD	7.1 ± 4.0		8.2 ± 3.4		1.393	0.168NS
Previously pyrexia						
Yes	35	100.0	35	100.0	…..	…..
times/ last months					6.058	0.109 NS
Two	6	17.1	1	2.9		
Three	10	28.6	7	20.0		
Four	5	14.3	10	28.6		
> 4 times	14	40.0	17	48.6		

Table (2) presents that 25.7% and 22.9% have pneumonia in cold gel compresses and warm water compresses groups, respectively. All cases (100% and 100% respectively) of the studied children use antipyretic in cold gel compresses and warm water compresses groups. About one-fifth (20.0%) of children in the cold gel compresses group and less than one-fifth (14.3%) of them in the warm water compresses group, their last duration of antipyretic administration was eight hours; the mean duration of using antipyretic in cold gel compresses and warm water compresses groups were 7.1 ± 4.0 and 8.2 ± 3.4 hours respectively. All cases (100% and 100% respectively) have previously pyrexia in cold gel compresses and warm water compresses groups. Less than half of the studied children in the cold gel compresses and warm water compresses groups (40.0% and 48.6%, respectively) have previously repeated pyrexia more than four times in the last months. No statistically significance differences were found between the medical data of children in both groups, which evidenced that homogeneity was found between the warm water compresses and cold gel compresses groups.

Table (3): Mean scores of vital signs among the studied children in cold gel compresses & warm water compresses groups (n=70).

Vital signs	Cold gel compresses group (n= 35)	Warm water compresses the group (n= 35)	Test of significance	
			t-test	P – Value
Temp. before	38.8 ± 0.5	38.9 ± 0.5	0.895	0.374
Temp.after_30m	38.7 ± 0.5	38.6 ± 0.5	0.455	0.650
Temp.after_60m	**38.6 ± 0.6**	**38.0 ± 0.5**	2.528	**0.014***
Temp.after_120m	**38.3 ± 0.6**	**37.2 ± 0.5**	6.443	**0.0001****
Heart Rate before	121 ± 23	127 ± 19	1.903	0.091
Heart Rate after_30m	120 ± 21	124 ± 19	2.128	0.07
Heart Rate after_60m	120 ± 20	121 ± 21	1.372	0.175
Heart Rate.after_120	120 ± 19	120 ± 20	1.531	0.130
Respiratory Rate. before	**40 ± 6**	**39 ± 6**	3.075	**0.09 NS**
Respiratory rate.after_30m	**41 ± 9**	**36 ± 6**	2.592	**0.012***
Respiratory rate.after_60m	**41 ± 9**	**36 ± 5**	2.712	**0.009****
Respiratory rate.after_120	**40 ± 9**	**35 ± 5**	2.842	**0.006****

Table (3) represents that the mean axillary body temperature after 60 and 120 minutes among children in the cold gel compresses group was more than those in the warm water compresses group, 38.6^0C ± 0.6 vs 38.0^0C ± 0.5 and 38.3^0C ± 0.6 vs 37.2^0C ± 0.5 respectively with statistical significance differences, *P*- value ≤ 0.014 and 0.0001 respectively.

Also, the mean respiratory rate after 30, 60, and 120 minutes among children in the cold gel compress group was more than those in the warm water compress group (41 ± 9 vs. 36 ± 6; 41 ± 9 vs 36 ± 5; and 40 ± 9 vs 35 ± 5 respectively) with statistical significance difference, *P* - value ≤ 0.012; 0.009; and 0.006 respectively.

On the other hand, no statistical significant differences were found between children in both groups related to their body temperature before and after 30 minutes, heart rate at all times of compresses, and respiratory rate before the compresses groups.

Table (4): Correlation between Bio-demographic data of the studied children and alteration in the axillary body temperature

		Groups									
		Cold gel compresses	Warm water compresses	cold gel compresses	warm water compresses	cold gel compresses	warm water compresses	cold gel compresses	warm water compresses	cold gel compresses	warm water compresses
		Age		Duration of pyrexia		Number of pyrexia episodes/ last months		Previous elevation of body temperature		Frequency of previous febrile convulsion	
T.before	r	0.315	-0.068	-0.014	0.302	-0.024	0.175	-0.204	**0.338**	-0.324	0.611
	P value	0.065	0.698	0.936	0.078	0.893	0.316	0.239	**0.047***	0.395	0.081
T.after_30m	r	0.367	-0.066	0.031	0.214	-0.003	0.166	-0.206	0.237	-0.476	0.598
	P value	0.0٦	0.708	0.860	0.217	0.987	0.342	0.235	0.170	0.196	0.089
T.after_60m	r	0.381	-0.022	0.141	0.166	0.054	0.254	-0.278	0.272	-0.235	0.523
	P value	0.06	0.902	0.418	0.341	0.759	0.141	0.106	0.114	0.542	0.149
T.after_120m	r	0.303	0.163	0.206	0.261	0.008	**0.349**	**-0.355**	0.277	-0.226	0.349
	P value	0.077	0.350	0.235	0.129	0.964	**0.040***	**0.037***	0.107	0.558	0.357

*Significant correlation at 0.05

Table (4) reveals that fair positive correlation between occurrences times of pyrexia and axillary body temperature after 120 minutes of compresses in the warm water group (r =0.349, *P* - value ≤ 0.040) and between the previous elevation of body temperature and axillary body temperature before compresses in warm water group (r =0.338, *P* - value ≤ 0.047). On the other hand, fair negative correlation between the previous elevation of body temperature and axillary body temperature after 120 minutes of compresses in the cold gel group (r = -0.355, *P* - value ≤ 0.037).

Discussion

A cold gel patch is applied to a child with pyrexia on the forehead, groin, and armpit, where large blood vessels are present, to lower body temperature naturally. The hydrogel on polyacrylate-base content in the patch accelerates the transfer process. The cold gel patch transfers body heat and contains parabens and menthol to lower body temperature (**Bintang et al., 2020).**

Warm water compresses cool the body through evaporation. Compressed with warm water makes the body think the outside temperature is hot enough. With warm weather, the peripheral blood vessels in the skin widen and experience vasodilation, opening the skin pores and allowing heat to escape, lowering body temperature. Most interventions occurred in the axilla **(Burhan & Rauf., 2020).**

Regarding medical data of the studied children, reference to diagnosis presents that more than one-quarter and more than one-fifth of them have pneumonia in cold gel compresses and warm water compresses groups, respectively**.** This result is **unlike the study done by Souza et al. (2022) entitled** "Effectiveness of warm compresses in reducing the temperature of febrile children: A pilot randomized clinical trial" conducted at the University Hospital of the Universidade de São Paulo (HU-USP), a secondary-level teaching hospital, Brazil, their studied sample 33 child, aged between one month and 11 years. They stated that respiratory pathologies present 56% and 70% in the intervention and control groups, respectively.

Also, the **recent Egyptian study done by Mohamad et al. (2021) entitled** "Effect of warm water foot bath therapy on body temperature among children with fever," done at the outpatient clinic in Misr El-Hora General Hospital, studied a sample of 100 children, aged between 2-10 years. They found that Upper Respiratory disorders present 68% and 54% in the study and control group respectively.

According to the researcher's opinion, reference to diagnosis presents that less than half and more than one quarter have Gastroenteritis in cold gel compresses and warm

water compresses groups, respectively. Most mothers of children do not have good practices and sufficient information on how to take care of their children and personal hygiene. Also, the period of study was from April 2023 to September 2023 in the summer, when the researchers collected the personal data of the mothers and their children.

Concerning the use of antipyretic, the present study proved that all cases of the studied children use antipyretic in cold gel compresses and warm water compress groups. This finding is **congruent with the study done by Souza et al. (2022)**. They declared that 25% and 12% of the cases used Paracetamol, respectively, in intervention and control groups, 75% and 88% of the cases used Dipyrone in the intervention and control group.

This finding **interferes with a recent Egyptian study done by Mohamad et al. (2021).** They declared that (84% &72%, respectively) of cases used antipyretic in the study and control groups.

From the researcher's point of view concerning the use of antipyretics, the present study proved that all cases of the studied children use antipyretics in two groups Because most mothers of children have a mistaken belief or misconception that using antipyretics more effective in treating and managing the fever than any compresses.

Concerning the last duration of antipyretic administration and Mean duration/ hrs. of using antipyretic, the present study proved that about one-fifth of children in the cold gel compresses and less than one-fifth of them in the warm water compresses their last duration of antipyretic administration was eight hours. The mean duration/ hrs . ± SD of using antipyretic in cold gel compresses and warm water compresses groups were 7.1 ± 4.0 and 8.2 ± 3.4 respectively.

This study **contradicted with recent Egyptian study done by Mohamad et al (2021).** They found that 47.6% & 44.4%, respectively, of participants in the study and the control groups their last duration of antipyretic administration was eight hours.

Regarding previous pyrexia, the present study proved that all children have previously pyrexia in cold gel compresses and warm water compresses groups.

This finding is **supported with the study done by Kartini et al. (2019) entitled** "The difference between the conventional warm compress and tepid sponge technique warm compress in the body temperature changes of pediatric patients with typhoid fever". Conducted at the Kampili Community Health Center, Indonesia, their studied sample was 20 children aged between 3 - 12 years; they stated that children have previous elevation of body temperature from 1-3 days 35% & 35% respectively presented in conventional warm compress and Tepid Sponge Warm Compress group, from 4-6 days 65% & 65% respectively presented in conventional warm compress and Tepid Sponge Warm Compress groups.

From the researcher's opinion regarding previous pyrexia, in present study proved that all cases have previous pyrexia in the two groups because most mothers of children do not focus on treating the illness itself or the cause of the pyrexia but rather focus on treating and managing the pyrexia only by using antipyretic. They only go to the doctor after days of pyrexia have passed and the temperature reaches above 39 ^{0}C. In addition, the hospital's policy is to give antipyretics to children who suffer from pyrexia.

Concerning the frequency of previous pyrexia in the last month, the present study displayed that less than half of the studied children in cold gel compresses and the warm water compresses groups (40.0% and 48.6% respectively) have previous pyrexia repeated more than four times in the last months.

Regarding to vital signs record of the studied children represent that the mean axillary body temperature after 60 and 120 minutes in the cold gel compresses group was more than warm water compresses group, 38.6^{0}C ± 0.6 vs. 38.0^{0}C ± 0.5 and 38.3^{0}C ± 0.6 vs. 37.2^{0}C ± 0.5 respectively with statistical significancant differences, *P* - value ≤ 0.014 and 0.0001 respectively. This finding rejects the null hypothesis of this study.

Also, the mean respiratory rate after 30, 60, and 120 minutes among children in the cold gel compress group was more than those in the warm water compress group (41 ± 9 vs. 36 ± 6; 41 ± 9 vs 36 ± 5; and 40 ± 9 vs 35 ± 5 respectively) with statistical significant differences, *P* - value ≤ 0.012; 0.009; and 0.006 respectively.

On the other hand, no statistical significant differences were found between children in the two groups related to their body temperature before and after 30 minutes, heart rate at all times of compresses, and respiratory rate before compresses groups.

This finding is concordant with the study done by Karin et al. (2021) entitled "Tepid sponging and compress plaster on toddlers who have a fever." performed at Antang Public Health Center, Makassar, Indonesia. Their studied sample, included 30 toddlers, showed that the average body temperature before being given warm compresses was 38.29^{0}C decreased by 0.82^{0}C as well as the cold gel compresses decreased by 0.46^{0}C . after being given treatment for 30 minutes.

Also, **Souza et al. (2022)** found that the mean ± SD body temperature before intervention was 38.3 ± 0.3 & 38.4 ± 0.6, respectively, in the intervention and the control groups. The mean±SD body temperature after 30 minutes was 37.8 ± 0.6 & 37.9 ± 0.6, respectively, in the intervention and the control groups with highly statistically significant differences. The mean ± SD body temperature after 60 minutes was 37.4 ± 0.6 & 37.3 ± 0.5, respectively, in intervention and the control groups with highly statistically significant differences.

This result contradicted with study done by Kartini et al (2019). They recorded that the average for the conventional warm compress pre-test of participants body temperature was 37.83^{0}C while the average tepid sponge technique warm compress pre-test of them body temperature was 38.04^{0}C. It is known that both the conventional warm compresses and tepid sponge technique significantly influence changes in body temperature p = 0.03. The tepid sponge technique is better used for fever management in children with typhoid fever than conventional warm compresses because the decrease was only found in the 5 to 15-minute period for the conventional warm compresses, while the tepid sponge technique decreased the temperature for between 5 to 30 minutes; 60 minutes after both types of compresses were used, there was an increase in temperature again.

Conversely, the study done by **Akyirem & Bossman (2021)** entitled "Is tepid sponging more effective than paracetamol at relieving fever in febrile children in hot tropical climates? A mini-review". Performed in Gha*na*, aged between 2 to 120 months, This Study declared that tepid sponging was less effective than paracetamol at relieving fever in febrile children.

Based on the study result**, from the researcher's point of view**, warm compresses could influence and reduce the body temperature of children under five due to the effects or action of giving warm compresses, making vasodilatation of blood vessels, pores of skin, reducing of blood viscosity, improving metabolism, and stimulating impulse through skin receptor sent to hypothalamus posterior to decrease the body temperature through evaporation technique, to facilitate the displacement of body temperature. Each gram of evaporated water causes a loss of body temperature of about 0.58 kcal units. In the condition of an individual without sweat, the evaporation mechanism exists about 450 - 600 ml/day. In this condition, one of the ways of releasing the temperature was through evaporation. So this accelerates heat exchange between the body and the environment.

Concerning the correlation between the Bio-demographic data of the studied children and alteration in the body temperature reveals that fair positive correlation between many times of pyrexia and axillary body temperature after 120 minutes of compresses in the warm water group (r =0.349, *P*-value ≤ 0.040) and between the previous elevation of body temperature and axillary body temperature before compresses in warm water group (r =0.338, *P* - value ≤ 0.047). On the other hand, fair negative correlation between the previous elevation of body temperature and axillary body temperature after 120 minutes of compresses in the cold gel group (r = -0.355, *P* - value ≤ 0.037).

This result agreed with a study done by Pereira &Sebastian (2018) entitled "Effectiveness of hot water foot bath therapy in reduction of temperature among children (6-12 years) with fever in selected hospitals at Mangaluru". Their study sample was 60 children. The study showed that there is a significant association of pre-test body temperature of the experimental group with initial body temperature (X^2 = 11.03, $P < 0.05$) and in the control group with child's age and initial body temperature (^{2} = 9.64, 9.33, $P < 0.05$). The result revealed that there is a significant association in post-test body temperature of the control group with the child's age, gender, and initial body temperature (χ2=10.93, 3.59, 7.90 at $p < 0.05$.

This study interferes with a recent Egyptian study done by **Mohamad et al. (2021),** which found that there was no association between children's age and their baseline and after warm water foot bath therapy application among study and control groups.

Conclusion: based on the current research results showed that fair positive correlation between many times of pyrexia and axillary body temperature after 120 minutes of compresses in the warm water group and the previous elevation of body temperature before compresses in the warm water group. On the other hand, fair negative correlation between the previous elevation of body temperature and axillary body temperature after 120 minutes of compresses in the cold gel group. Also, warm water compresses are more effective than cold gel compresses in reducing body temperature among children with pyrexia.

Recommendations:

- Provide the hospital with written protocol on methods of warm water compress therapy to be applied in the hospitals.
- Provide training program to nurses working in different clinics and hospitals regarding applying warm water compress therapy for hyperthermia children.
- Develop health education programs for mothers and nurses regarding different methods of non-pharmacological techniques to reduce body temperature.
- Further studies are recommended to examine the long-term effect of applying warm water compress therapy on body temperature among children with pyrexia.

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