

# The Effect of Lemon Juice with Coconut Oil Compress in Children with Fever

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## ABSTRACT

**Background and Objective.** Fever is a condition where the body temperature is higher than normal. A body temperature that is too high can cause febrile seizures. A non-pharmacological therapy to reduce body temperature is by applying a lemon with coconut oil compress in the axilla. The purpose of this study was to determine the effect of giving lemon juice with coconut oil compress in children with fever to decrease body temperature.

**Methods.** The research design used was a pre-experimental design (one-group pre-test-post-test design). The technique used was purposive sampling.

**Results.** The results of this study showed that there was a significant decrease in body temperature of children with fever after applying lemon juice with coconut oil compress.

**Conclusion.** A lemon with coconut oil compress can be used as an additional therapy to reduce fever in children and can be applied at home as an initial step before using fever-reducing medications.

*Keywords: body temperature, children, fever, medicine, traditional*

## INTRODUCTION

The state of body temperature above normal or above 38°C for rectal temperature or above 37.5°C for axillary temperature is called fever. Body temperature is normal if around 36.2°C to 37.5°C.<sup>1,2</sup> Body temperature reflects the balance between production and loss of heat from the body, which is measured in units of heat called degrees.<sup>3</sup> Fever is not a disease but a symptom of a disease, as the body's reaction to fight infection, caused by viruses or bacteria. When fighting an infection that enters the body, the body will release a certain amount of heat to the skin. This body reaction is the body's natural process to fight infections that enter the body.<sup>3</sup> Fever occurs due to the presence of a substance known as a pyrogen. Pyrogens are divided into exogenous and endogenous pyrogens. Exogenous pyrogens are pyrogens that come from outside the patient's body, while endogenous pyrogens are pyrogens originating from within the patient's body.<sup>4</sup> The process of fever starts from the stimulation of white blood cells (monocytes, lymphocytes, and neutrophils) by exogenous pyrogens in the form of toxins, inflammatory mediators, or immune reactions. These white blood cells will secrete chemicals known as endogenous pyrogens interleukin-1 (IL-1), interleukin-6 (IL-6), tumor necrosis factor- $\alpha$  (TNF- $\alpha$ ), and interferon (IFN). Exogenous



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and endogenous pyrogens will stimulate the hypothalamic endothelium to form prostaglandins. Prostaglandins that are formed will then increase the thermostat benchmark in the hypothalamic thermoregulatory center. So there will be an increase in heat production and a decrease in heat reduction, which will eventually cause the body temperature to rise to the new standard.<sup>4</sup>

Basic Health Research (Riskesdas) data in 2018 showed that the prevalence of infectious diseases such as acute respiratory infections (ARI), malaria, and diarrhea in children under five has decreased compared in 2013.<sup>5</sup> The prevalence of ARI decreased from 13.8% to 4.4%, malaria decreased from 1.4% to 0.4%, and diarrhea in childhood also decreased from 18.5% to 12.3%. These diseases are generally accompanied by symptoms of fever, which require further treatment.<sup>5</sup>

The preliminary study was conducted on August 23, 2019, in the Children's Room of Dr. Soedarsono Hospital, Pasuruan Regency, with 260 cases. There were 53 patients with indications of fever from May to July 2019, with 26 cases due to ARI. The average age of children with a fever is under five years. Results from interviews with five families of patients in the Pediatric Ward of Dr. Soedarsono Regional Hospital, Pasuruan Regency, revealed that while the children were hospitalized, they received pharmacological therapy, and the caregivers were advised by healthcare professionals to apply warm compresses. However, the families did not administer the warm compresses, citing that the children's fever had subsided and they had already consumed the prescribed medication.

Fever in children can be managed by providing pharmacological or non-pharmacological therapy. Pharmacological therapy used to reduce fever is the antipyretic group or the analgesic group.<sup>6</sup> The selection of the right drug can help reduce fever in children. Most mothers prefer to do self-medication with drugs that have been previously prescribed by a doctor. Paracetamol is the drug most often used to treat fever (antipyretic) in children.<sup>2</sup> Other antipyretics are ibuprofen and aspirin. However, aspirin is not recommended as the first choice because it is associated with Reye's Syndrome, which is a rare but dangerous illness that affects children's liver and brain.<sup>2</sup> The administration of paracetamol and ibuprofen for the treatment of fever or pain in children under two years of age is associated with a less pronounced reduction in temperature and pain during the first 24 hours of treatment, despite demonstrating comparable safety profiles. The use of paracetamol and ibuprofen for the treatment of fever or pain in children younger than two years is associated with less reduction in temperature and pain in the first 24 hours of treatment, with comparable safety. Children in this age group possess an immature thermoregulatory response; consequently, the decrease in body temperature within the initial 24-hour period is often less significant or more gradual compared to older children.<sup>7</sup>

Non-pharmacological therapies that can be done include giving lots of drinks, being placed in a normal temperature

room, using thin clothing, and giving warm compresses.<sup>8</sup> One of the best ways to reduce a child's fever is to apply a warm compress. Compresses can be given through a variety of alternative herbal ingredients such as shallots, leeks, coconut oil, lemon, or scallions.<sup>9,10</sup> In Indonesia, the use of herbal ingredients has been practiced for centuries and is still very popular for maintaining health and treating disease, because it is believed to be safe from chemical drugs.<sup>10</sup>

Giving coconut oil and lemon scrubs when the body has a fever can lower the temperature because humans have components and mechanisms in maintaining energy balance and body temperature balance. Body temperature must be regulated because the rate of chemical reactions of cells depends on body temperature, and excessive heat can damage cell proteins.<sup>11,12</sup>

## METHODS

The research design used was the one-group pre- and post-test design. One group of subjects was measured before and after the intervention.

In this study, the researchers prepared the compress by mixing the lemon and coconut oil (squeezing one lemon into two tablespoons of coconut oil), stirring until well blended. Before applying lemon and coconut oil, the axillary temperature of patients with fever was measured using a mercury thermometer, then the temperature was measured again after putting the lemon and coconut oil compress on the child's axilla or forehead for 20 minutes, and repeated as needed while the child is experiencing fever. The compress was replaced with a new one each time it began to dry out. The compress can be applied several times a day, on average, 2-3 times.

The population in this study was all pediatric patients who had a fever and sought consultation at the Children's Room of Dr. Soedarsono Hospital, Pasuruan Regency. Those patients who met the inclusion criteria were included in the study. Inclusion criteria are as follows: willingness to be included in the study, having a body temperature of  $>37.5^{\circ}\text{C}$ , aged 1-5 years, experiencing fever for 1-3 days, with a medical diagnosis of moderate ARI, the patient did not undergo intravenous therapy, and did not take antipyretics. Figure 1 shows the flow diagram of respondent recruitment.

Sample size was determined using the following formula:<sup>13</sup>

$$n = N / [1 + N (d)^2]$$

n = Sample Size

N = Population Size

d = 95% precision value or significant 0.05

$$n = N / [1 + N (d)^2]$$

$$= 26 / [1 + 26 (0.05)^2]$$

$$= 26 / 1.065$$

$$= 24.4 \text{ rounded up to 24 respondents.}$$

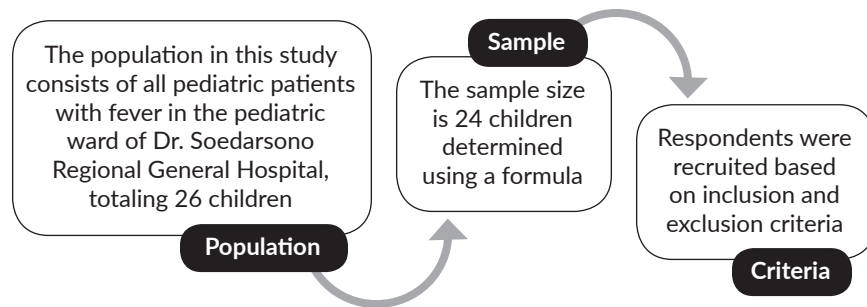


Figure 1. Flow diagram of respondent recruitment.

The sampling technique used was non-probability purposive sampling. The researchers used a paired t-test with a significance level of  $p < 0.05$  to determine whether there is a difference in the mean of the two independent samples. The data in question was the same sample, but had two sets of data.<sup>14</sup> An analysis of differences in body temperature of children under five years old before and after the intervention of applying lemon compress with coconut oil was done.

In this study, the dependent variable was a decrease in body temperature while the independent variable was the administration of lemon and coconut oil compress.

## RESULTS

### Characteristics of Respondents

Table 1 shows that the average age of respondents is 26.79 months with a minimum age of 13 months and a maximum age of 48 months.

Table 2 shows that more than half of the children with fever are males (54.2%).

Table 3 shows that the average body weight of respondents is 14.042 kg with a minimum weight of 8.5 kg and a maximum weight of 20 kg.

Table 4 shows that more than half of the children have diarrhea (54.2%) and a quarter have febrile seizures (25.0%).

### Body Temperature before and after Applying Lemon Water with Coconut Oil Compress

Table 5 shows that the average body temperature of the respondents is 38.2°C. Before the intervention of lemon juice and coconut oil compress, the children's body temperature value is at least 37.5°C, and the maximum temperature is 39.4°C.

Table 6 shows that the average body temperature of the respondents is 37.2°C. After the intervention of lemon juice and coconut oil compress, the children's body temperature value is at least 36.6°C, and the maximum temperature is 37.8°C.

Table 1. Characteristics of Respondents Based on Age

Variable	N	Min	Max	Mean	SD
Age	24	13	48	26.79	11.006

Table 2. Characteristics of Respondents Based on Gender

Sex	n	%
Male	13	54.2
Female	11	45.8
Total	24	100.0

Table 3. Characteristics of Respondents Based on Weight

Variable	N	Min	Max	Mean	SD
Weight	24	8.5	20	14.042	0.7975

Table 4. Characteristics of Respondents Based on Comorbidities

Comorbidity	n	%
Febrile convulsion	6	25.0
Diarrhea	13	54.2
Hypokalemia	4	16.7
Bronchitis	1	4.2
Total	24	100.0

Table 5. Body Temperature before Applying Lemon Juice with Coconut Oil Compress

Measurement	N	Min	Max	Mean	SD
Pre-intervention Body Temperature (°C)	24	37.5	39.4	38.2	0.5033

Table 6. Body Temperature after Applying Lemon Juice with Coconut Oil Compress

Measurement	N	Min	Max	Mean	SD
Post-intervention Body Temperature (°C)	24	36.6	37.8	37.2	0.2953

## DISCUSSION

Infancy or childhood is a period of physical and mental growth.<sup>15</sup> During this growth period, the organs in the body are developing, including the immune system.<sup>16</sup> This is one of the reasons why it is difficult for children to fight bacterial and viral infections that cause fever. Fever is not a disease but a sign that the body is fighting off an infection. Infection occurs in response to the entry of microbes that cause an increase in prostaglandin synthesis, which can cause pyrexia, which, if not treated immediately, can cause febrile seizures and result in death.<sup>8,10</sup> Fever can also be due to environmental factors such as the ambient temperature being too high, or autoimmune diseases such as arthritis, systemic lupus erythematosus.<sup>7</sup>

Research conducted by Nurlaili et al. showed that male respondents experienced an increase in body temperature more than female respondents. Gender is one of the factors that can affect body temperature. This is caused by the body's metabolic activity. Men have the hormone testosterone, which increases their metabolic rate; therefore, the body temperature of men is higher than that of women.<sup>9</sup>

In addition to gender, weight can also affect the occurrence of fever. The body consists mostly of water. The body can lose water through sweat, which affects weight. This has no impact on the amount of fat in the body.<sup>17</sup>

A study by Varma, et al. (2019) demonstrated that the application of a mixture of coconut oil and lime is effective in reducing body temperature in children with febrile conditions. Coconut oil contributes to the mitigation of elevated body temperature. From a mechanistic perspective, coconut oil possesses potent anti-inflammatory properties capable of suppressing pro-inflammatory cytokines, specifically tumor necrosis factor-alpha and interleukins, which are upregulated during inflammatory or infectious processes. Because these specific cytokines are responsible for modulating the febrile response within the hypothalamus, the administration of coconut oil subsequently attenuates core body temperature.<sup>17</sup> Furthermore, this mechanism encourages evaporation through sweat, ultimately lowering the body temperature until it reaches the normal range.<sup>18</sup> The research conducted differs in the type of citrus used; applying lemon juice and coconut oil compresses to the axillary area is effective in reducing heat since there are large blood vessels in the axilla.

The selection of lemon juice as a primary agent instead of lime, when combined with coconut oil, is strategically based on its distinct biochemical properties and safety profile for pediatric application. Lemon (*Citrus limon*) contains a high concentration of limonene and volatile flavonoids, which provide a mild sedative effect through aromatherapy, thereby aiding the relaxation of the peripheral nervous system and facilitating the hypothalamus in initiating vasodilation. Furthermore, lemon juice typically exhibits a more stable citric acid concentration that, when integrated with coconut

oil as a carrier, optimizes evaporative cooling without the higher risk of skin irritation often associated with the sharper acidity of lime. This synergy between the bioactive compounds of lemon and the emollient properties of coconut oil enhances heat dissipation through the skin surface, effectively restoring thermal balance in febrile children.<sup>18</sup>

The reduction in body temperature occurs significantly through the application of lemon juice and coconut oil compresses. These compresses work by optimizing heat dissipation via the large blood vessels in the axillary area; consequently, respondents receiving this treatment experience a measurable decrease in body temperature without the need for additional pharmacological intervention.

The limitations of this study include a small sample size, making it non-generalizable, selection bias due to recruitment from only one hospital, thus the results may not be applicable to other hospitals, and the absence of a control group, meaning conclusions about changes in body temperature are solely attributed to the compress.

## CONCLUSION

There is a significant effect on reducing the body temperature of toddlers with fever after applying lemon juice with coconut oil compress.

Prior to the application of lemon juice and coconut oil compress, the average body temperature of children was 38.2°C. After the intervention, there was a decrease in the children's mean body temperature (37.2°C).

Further research is needed with a larger sample size and a stronger study design to explore the mechanisms of the effectiveness of lemon with coconut oil compress.

### Statement of Authorship

All authors certified fulfillment of ICMJE authorship criteria.

### Author Disclosure

All authors declared no conflicts of interest.

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