



Innovation of Shallot (*Allium Ascalonicum L*) Essential Oil for Fever Reduction in Infants Post-DTaP Immunization

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A B S T R A C T

DTaP vaccination causes an increased body temperature or fever in most infants. There are pharmacological or non-pharmacological efforts to reduce fever in infants post-DTaP immunization. In addition, shallots are a family medicinal plant in Indonesia commonly used to reduce fever. There should be innovation in the dosage form of shallots so their use is more effective and efficient. This study analyzes the effect of shallot essential oil on fever reduction in infants post-DTaP vaccination. It was a quasi-experimental research design, with one group pre and post-test design. The population of this research was all infants aged 1-12 months who were enrolled in the infant cohort in 2020 at Independent Midwifery Practice (IMP) Istiqomah from May to August 2020. Meanwhile, there were 20 samples by accidental sampling. The research instruments were shallot extract oil, a digital thermometer, and an observation sheet. The data analysis used the Repeated Measures Anova test. The results showed that the mean body temperature before immunization was 36.57 degrees Celcius, while after the experiment was 36.9 degrees Celcius. The statistical test results value $\rho = 0.000$. There was a significant difference in the mean body temperature from time to time in infants with shallot essential oil administration. This study concludes that shallot essential oil reduces fever in infants post-DTaP immunization. Further research should use a control group, more significant samples, and inclusion criteria limitation.

INTRODUCTION

Shallot (*Allium Ascalonicum L*) is a family medicinal plant in Indonesia that reduces fever in infants. It has complete nutritional content and active chemical compounds beneficial to health, including SAC / Alliin, prostaglandin A-1, adenosine, diphenyl-amine, cycloalliin, methyl-aliine, dihydro-aliin, profenyl-aliin, profile-aliin, kaemferol, floriglusinol, and quercetin. In addition, alliin (SAC), allisin and adenosine have anti-inflammatory effects (Aryanta, 2019; Kuswardhani, 2016).

Vaccination is an effort to increase the immunity system in individuals to against a disease actively. Its purpose is the body already has immunity against exposure, so the individual only experiences mild illness or is not even sick (Permenkes, 2017). DTap (Diphtheria, Pertussis, and Tetanus) vaccination is the essential vaccination given to infants aged two months to one year. It is given simultaneously with the HB (Hepatitis B) and Hib (Haemophilus Influenzae Type B) vaccines, at four-week intervals three

times. DTaP-HB-Hib vaccination can prevent harmful diseases such as diphtheria, pertussis, tetanus, hepatitis B, and Haemophilus influenza type B (Permenkes, 2017).

There are two types of DPT vaccines: DTaP (acellular) and DwPT (whole cell). The DPT cellular vaccine (DwPT) is a vaccine that contains all the killed pertussis bacteria so that it causes more local reactions and fever. According to Athur C. Guyton (2007), infants respond to DTaP immunization as bacteria. Leukocytes, macrophages, and lymphocytes phagocytize bacteria that enter the tissues or blood vessels. Then, the cells will digest the results of the breakdown of bacteria and release the interleukin-1 (IL-1) substance. IL-1 acts in the central nervous system at the level of the Organum Vasculosum Laminae Terminalis (OVLT). Furthermore, OVLT will synthesize prostaglandins, causing increased body temperature (Aminina, 2014).

The DTaP (Acellular) vaccine contains several essential components in pathogenesis. They trigger the formation of antibodies. The DTaP vaccine has two to four times fewer systemic and local side effects, also does not cause fever (Wahab, Samik, & Julia, 2002). Efforts to reduce fever in infants after DTaP vaccination can be pharmacological and non-pharmacological. The antipyretic is a pharmacological method to stabilize the temperature in the body. It works centrally in the hypothalamus to reduce the temperature by a physiological response. It reduces the heat production by radiation, convection, and evaporation. In addition, it increases blood flow to the skin (Sumarmo & Poorwo, 2010).

Non-pharmacological methods to reduce fever in infants include warm compresses. The warm compresses on feverish infants work with the convection and evaporation method. When the warm skin touches warm water, heat transfer will occur through evaporation to transfer heat energy into gas. Compress the feverish infants with shallot essential oil has the exact mechanism as a warm compress. The water content per 100 grams of shallot bulbs is 80-85%. So it is possible used as a compress in feverish infants. In addition, the essential oil content in shallots can improve blood circulation. Other ingredients that can reduce body temperature are florigucin, cycloaliine, methialine and kaemferol (Tusilawati & Berliana, 2010). Shallot can be given for treatment by whole, raw, cooked, shallot extract, dry crude extract in powder form, or essential oil.

A study on mice induced by the DPT-Hb vaccine reported that shallot ethanol extract could reduce fever and macrophage counts (Kariyaningtias, Hamid, & Widodo, 2019). In addition, research conducted by Wiryawan also showed that shallot extract could decrease the temperature in mice (*Rattus Norvegicus*) after being induced by 0,5 ml intraperitoneal DTaP vaccine (Wiryawan, 2014).

Meanwhile, a study on humans was conducted by Harianah Akib and Megawati. The study showed that the shallot compress could normalize body temperature faster than applying warm compresses in feverish infants aged 0-1 post-DTaP immunization ($\rho = 0.232$) (Akib & Megawati, 2019). Other research showed that shallot compresses effectively reduce the temperature in feverish infants post-DTaP

immunization and hospitalized children at Bougainvillea War, Dr. Hartoyo Hospital Lumajang (Riyady, 2016). In addition, It also had the same effect on feverish children aged 1-5 years old at Public Health Center Gilingan (Hayuni, Widyastuti, & Sarifah, 2019).

Unfortunately, several studies above have not explained its dosage form and the administration method. Mashed shallot is less practical and has an uncomfortable smell. In this paper, shallots have been extracted into an essential oil to be more efficient and effective to use. In addition, shallot essential oil also reduces dependence on pharmacological therapy to normalize the body temperature post-vaccination. This study analyzes the effect of shallot essential oil on fever reduction in infants post-DTaP vaccination.

METHOD

This research was quasi-experimental, using one group design pre and post-test design. The population of this research was all infants aged 1-12 months who were enrolled in the infant cohort in 2020 at Independent Midwifery Practice (IMP) Istiqomah from May to August 2020. There were 20 samples by accidental sampling. The inclusion criteria were healthy infants, body temperature 36.5-37.0 degrees Celsius, no history of febrile seizures, normal body weight according to age. Meanwhile, the exclusion criteria were infants with a history of high fever (more than 39.0 degrees Celsius), allergies, and seizures; infants who had a cold and coughs; and received other vaccines in one-month intervals except OPV (Oral Polio Vaccine).

The shallot essential oil resulted from shallot bulb extract with a mixture of aquades and 70% ethanol. It was made in the pharmacy laboratory of the Science and Health Faculty, Universitas PGRI Adi Buana Surabaya, by a pharmacist with two stages. The first stage was powder making. Shallot bulbs (*Allium Ascalonicum* L.) washed with clean running water, then dried in the sun for seven days with the top of the simplicia covered with black cloth to not be exposed to direct sunlight. After drying, the simplicia were weighed and then grinded as a powder. The powder was sieved with mesh no. 40 and then weighed. The second step was extracting simplicia using the maceration method, in duplicate using 500 mL (1:10) 70% ethanol solvent. 50 g of simplicia dry powder was added to the macerator, plus 500 mL of 70% ethanol. Shaked for 60 minutes, then let stand for \pm 60 minutes, then shacked again for 15 minutes and let stand for 60 minutes. The process was repeated five times, then left for one day. The residue and the filtrate were separated, the residue was remacerated two times with 100 mL of 70% alcohol. The collected filtrate was evaporated with a rotary evaporator to obtain a thick extract. The extract was dried using a vacuum dryer, and the yield was calculated.

Before the data collection, the authors gave the parents informed consent. The midwife performed a physical examination and measured the body temperature and weight in infants. After counseling about DTaP immunization, she gave DTaP vaccine 0.5 ml intramuscular in vastus lateralis muscle. After the

shot, the parents received 50 ml of shallot essential oil, a thermometer, and an observation sheet. Parents were asked to measure body temperature every three hours and recorded it on an observation sheet. In addition, they measured body temperature every three hours and recorded it on an observation sheet. Shallot essential oil was given to infants every three hours up to 18 hours post-vaccination. Its administration was by applying and light massaging it to the body except for the vaccine injection area, starting from the neck, chest, stomach, back, legs, armpit creases, thighs. The authors monitored the respondents via WhatsApp. When signs of allergies and high body temperature (fever or severe fever > 39.0 degrees Celsius) in infants or parents felt anxious, they were free to leave the research, and infants were administered with antipyretic.

The independent variable was administering shallot essential oil, while the dependent variable was body temperature. The research instruments were shallot essential oil, a digital thermometer, and an observation sheet. Data analysis used the Shapiro Wilk test to determine the standardized residual value and the Repeated Measures ANOVA test to examine the effects of shallot essential oil on the body temperature in feverish infants post-DTaP vaccination.

RESULTS

The results in this study included characteristics of respondents, body temperature pre and post-DTaP immunization, and statistical analysis.

Table 1. Characteristics of respondents

Age (Months)	Frequency	Percentage (%)
2 - 4	12	60
5 - 6	7	35
> 6	1	1
Total	20	100
DTaP immunization		
First	8	40
Second	6	30
Third	6	30
Total	20	100
Gender		
Boy	15	75
Girl	5	25
Total	20	100

Table 1 shows that most respondents are between 2-4 months old (60%) and boys (75%). Almost half of them get the first DTaP immunization already (40%).

Table 2. Body temperature pre and post-DTaP immunization in infants

Name	Body Temperature PreVaccination (°c)	Body Temperature Post Vaccination (Hour)					Mean
		3	6	9	12	18	
R1	36.9	37.2	37.4	38.2	37.6	37.0	37.5
R2	36.1	37.4	37.5	38.6	38.7	37.0	37.8
R3	36.3	36.8	37.4	38	37.5	37.2	37.4
R4	36.8	37.1	37.5	37.6	37.2	37.0	37.3
R5	36	37.5	37	38.7	37.8	37.5	37.7
R6	36.8	37.8	36.7	37.7	37.3	36.0	37.1
R7	36.5	36.1	37.8	37.7	38.9	37.0	37.5
R8	36.4	37.6	37.6	38.2	37.1	37.0	37.5
R9	36.6	37	38.5	38.2	38.1	37.4	37.8
R10	36.3	37.6	37.8	37.6	37.4	37.0	37.5
R11	36.3	37.1	37.2	37.5	37.9	36.0	37.3
R12	36.5	37.5	37.3	38.6	37.2	36.0	37.3
R13	36.3	37.3	37.2	38.3	37.6	37.0	37.5
R14	36.6	37.3	37.3	37.8	37.6	37.0	37.4
R15	36.9	36.2	37.1	37.7	38	37.2	37.2
R16	36.5	36.9	37.2	38.5	39	37.0	37.7
R17	37.1	37	38.2	37.5	37.1	37.2	37.4
R18	36.8	36.9	37.3	38.4	37.5	37.0	37.4
R19	36.8	37	37.5	37.4	37.5	37.3	37.3
R20	36.9	36.9	37.5	37.2	37.9	37.0	37.3
Mean	36.57	37.2	37.5	38.0	37.7	36.9	37.5
SD	0.299	0.485	0.403	0.456	0.564	0.433	

Table 2 describe that the mean body temperature pre-DTaP immunization is 36.57 degrees Celsius, while post-DTaP immunization is 37.5 degrees Celsius. The temperature reaches peak heat at nine hours post-immunization. Data has a Standard Deviation value less than the mean, so the data has a good representation.

Table 3. Normality Test

	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
First body temperature	.179	20	.093	.955	20	.457
Second body temperature three hours post immunization	.146	20	.200*	.958	20	.511
Third body temperature six hours post immunization	.201	20	.034	.927	20	.136
Fourth body temperature nine hours post immunization	.173	20	.117	.939	20	.235
Fifth body temperature twelve hours post immunization	.201	20	.033	.875	20	.014
Sixth body temperature eighteen hours post immunization	.400	20	.000	.722	20	.000

*. This is a lower bound of the true significance.

Table 3 states that most data have a significance value > 0.05, so the data is a normal distribution.

Table 4. Mauchly's Test of Sphericity

Within Effect	Subjects	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon ^b		
						Greenhouse-Geisser	Huynh-Feldt	Lower-bound
Time		.331	18.898	14	.173	.716	.903	.200

Table 4 indicates that the significance value (p) = 0.173 (> 0.05), so the data is fulfilled the Sphericity assumption.

Table 5. Tests of Within-Subjects Effects

	Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Time	Sphericity Assumed	26.954	5	5.391	24.945	.000
	Greenhouse-Geisser	26.954	3.581	7.528	24.945	.000
	Huynh-Feldt	26.954	4.515	5.970	24.945	.000
	Lower-bound	26.954	1.000	26.954	24.945	.000
	Sphericity Assumed	20.530	95	.216		
Error (Time)	Greenhouse-Geisser	20.530	68.033	.302		
	Huynh-Feldt	20.530	85.780	.239		
	Lower-bound	20.530	19.000	1.081		

Table 5 reveals that the Sphericity Assumed value is 0.000 (< 0.05), so there is a significant difference in the mean body temperature from time to time. Thus, shallot essential oil reduces fever in infants post-DTaP vaccination.

Table 6. Estimates

Time	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
1	36.570	.067	36.430	36.710
2	37.160	.108	36.933	37.387
3	37.450	.090	37.261	37.639
4	37.970	.102	37.757	38.183
5	37.745	.126	37.481	38.009
6	36.945	.097	36.742	37.148

Table 6 indicates that the standard error values are less than the mean so that the data distribution shows good representative.

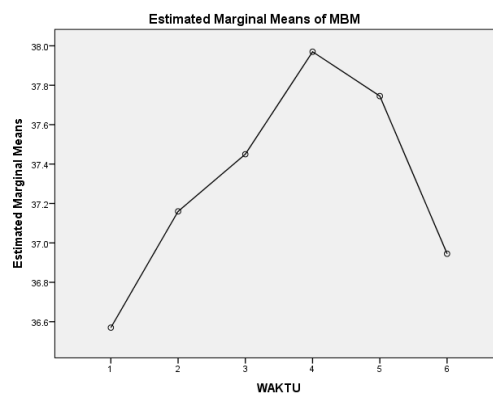


Figure 1. Decrease in body temperature post-vaccination after administering shallot essential oil

Figure 1 shows the peak time in increased body temperature occurs at nine hours post-DTaP immunization. Then, at 12 hours post-DTaP immunization, there is a decreased temperature mean of 37.745. At 18 hours post-DTaP immunization, there is a decline in body temperature mean of 36.945 after administering shallot essential oil.

DISCUSSION

Most infants had increased body temperature at nine hours post-DTaP immunization. However, a small proportion of them started to have increased their body temperature in the first three hours and six hours. All respondents showed no increase in body temperature at more than 18 hours after vaccination. The vaccine used in this research was the DTaP cellular vaccine. It contains killed pertussis bacteria so that most infants experienced fever as a reaction to the microorganisms in the body.

Inadequate fever management cause discomfort for the infants. They become fussy and can develop into dehydration and seizures. In addition to using pharmacological therapy, midwives can provide non-pharmacological treatment. Research on non-pharmacological methods to reduce fever post-DTaP immunization has been widely carried out, such as warm, aloe, and shallot compresses. The principle of fever management with compresses used the conduction and evaporation method. The conduction method is heat transfer by direct contact due to skin exposure to objects around the body. In a feverish infant, there is vasodilation in the blood vessels. It causes increased blood flow to the peripheral blood vessels. Furthermore, it ends in sweat evaporation. In the compress method, there is heat transfer from the body to the environment through the water. In this research, shallot essential oil gave a warm sensation to the skin. Besides that, it has a non-stinging smell, so the infants feel comfortable.

This paper revealed that shallot (*Allium Ascalonicum L*) essential oil reduced fever in infants post-DTaP immunization. It aligns with Jurike's research that reported the same result (Laoh, 2019). In addition, administering shallot for fever has been tested in vitro. There was decreased body temperature in mice induced with the DTaP immunization (Kariyaningtias et al., 2019). Meanwhile, A study reported a body temperature reduction in feverish children at the Public Health Center of Kembaran I after using shallot compress (Cahyaningrum & Putri, 2017) – however, the study did not explain the shallot compressing method. In addition, previous research also revealed that shallot compress could reduce the body temperature in typhoid fever patients aged adolescents to old adults. Its experiment used three peeled and cut shallot cloves, then crushed and mixed with 300 ccs of warm water. Its administration was once a day for 15 minutes in two days in a row (Harnani, Andri, & Utoyo, 2019).

Shallot bulbs contain essential oil to improve blood circulation. Its essential oil contains dialylsulfide, propantiol-Soxide, Aliin, PGA1, diphenylamine and cycloaliine, methylaliine, dihydroaliine, kaemferol and foroglusinol. In addition, Florogucin, cycloaliin, metialine and kaemferolcan can reduce body temperature (Tusilawati & Berliana, 2010). Meanwhile, other substances are organic sulfur compounds; one of them is Allylcysteine Sulfoxide (Aliin). Allylcysteine Sulfoxide is released when the shallot bulbs are cut or sliced. It improves blood circulation by destroying blood clots. As a result, heat is easily

transferred to the peripheral blood vessels and reduces body temperature (Suryono, Sukatmi, & Jayanti, 2012).

Most Indonesian people use shallot (*Allium Ascalonicum L*) to normalize fever in children. Usually, they use shallot for external treatment. Shallot can be sliced, crushed, or grated, mixed with oil (*telon*, eucalyptus, or olive oil), and rubbed on the body. However, Children dislike the crushed or grated shallot because of its smell and rough texture, so they feel uncomfortable. Administering shallot essential oil is a more effective and efficient way. Another advantage is the smell does not sting. It can be used as a compress and massage. How to use shallot essential oil are rub and light massage them all over body regularly during fever. It causes blood vessels vasodilation and increases blood circulation, thereby accelerating the heat transfer from the body to the skin (evaporation).

CONCLUSIONS

This study concludes that shallot (*Allium Ascalonicum L*) essential oil reduces fever in infants post-DTaP immunization. Further research should use a control group to compare experiments and more significant samples to minimize bias. Inclusion criteria could be limited to infants with the first DPT vaccination because they have never been exposed to the immunization before.

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