The Effect of Thermal Exposure to Carbon Fiber Filament in the Thermoreceptor Area on the Physiological Response of Hypothermic Baby Rabbits

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ABSTRACT

Background: The body has a thermoregulation setting where when it gets hot, the body responds by dilating blood vessels or vasodilation, otherwise it gets a cold response, which causes narrowing of blood vessels or vasoconstriction. The thermal conditioning system is a system that can influence the baby in terms of its thermal quality. So that the baby can feel a comfortable environment or not. Skin temperature is a fundamental factor in heat exchange between the body and its environment. Objective: The purpose of this study was to analyze the effect of thermal exposure to carbon fiber filaments in the thermoreceptor area on the physiological response of hypothermic baby rabbits to changes in body temperature, to analyze the time needed for physiological adaptation of the body’s skin to occur and to analyze the response of the thermoreceptor area on the head, neck, chest, arms, wrists, soles of the feet, to changes in each local area of the body. Methods: The research method used is pure experimental or laboratory experimental, with a post-test only control group design approach that uses experimental animals as experimental objects. The treatment in this study was using baby rabbits. The Sampling of test animals was carried out using simple random sampling. Statistical analysis was performed using IBM SPSS Statistics version 20. The confidence level was set at 95% by one way ANOVA test. Results: The results showed that the response of the thermoreceptor area to thermal exposure on the neck was the highest with an average of 39.77’. Conclusion: Based on the results of the analysis, it was concluded that there was an effect of thermal exposure to carbon fiber filaments in the thermoreceptor area on the physiological response of hypothermic baby rabbit models to changes in body temperature.

Keywords: Thermal Exposure, carbon Fiber Filament, Thermoreceptor, Hypothermic, Baby Rabbits.

1. BACKGROUND

Indonesia has a high neonatal mortality rate (NMR), estimated to be 15 per 1,000 live births in 2017 (1). Kangaroo mother care has been shown to reduce morbidity and mortality in low birthweight infants, including reducing the risk of hypothermia (2). Hypothermia has also been shown to be a risk factor for neonatal sepsis, intra-ventricular hemorrhage, and necrotizing enterocolitis. Hypothermia in newborns is common worldwide with a prevalence ranging from 32 to 85 percent. Hypothermia is an involuntary decrease in body temperature to <350C (960F). low temperatures in the operating room, the spread of maternal heat from the center to the environment, and a decrease in the mother’s central temperature. An important role in preventing hypothermia is to keep the baby’s body temperature warm (3-5).

When the body is hot, the arteries will widen (Vasodilation) but when the body is cold, the arteries will narrow (vasoconstriction). With the Vasodilation process, blood will flow smoothly and quickly (6-8). Vasodilation can be caused by various things, one of which is heat. Vasodilation is a series of stimuli which are processed by the hypothalamus and
forwarded by the efferent nerves (connecting nerves) to become a response (vasodilation). Changes in the size of blood vessels are regulated by the vasomotor center under the influence of the anterior hypothalamus so that vasodilation occurs (9, 10). The background above that providing thermal exposure by conduction in the area of strong thermoreceptor density to get vasodilation for the comfort of the baby’s body temperature. Thus the thermal energy generated does not require a large amount of power to warm the baby’s body, which is a solution for incubators that require large electrical energy (9, 11, 12).

The use of heat or cold induction on parts of the body can affect changes in the body’s physiology (13). The resulting output is the energy expended for the desired comfortable body temperature, which can be as small as possible but produces appropriate thermal comfort (14).

The state of the art of this research is what distinguishes it from previous research, namely that the object of this study used experimental animals of rabbits with the results of thermal exposure by conduction in 6 areas, namely the neck, arms, wrists, soles of the feet, head, and chest. Then an analysis of the relationship between the physiological response of the skin to changes in thermal exposure and the conduction process was carried out (15, 8, 16).

2. OBJECTIVE

The aim of the study was threefold: (1) Analyzing the Effect of Thermal Exposure of Carbon Fiber Filament in the Thermoreceptor Area on the Physiological Response of Hypothermic Baby Rabbits to changes in body temperature. (2) Analyze the time needed for physiological adaptation of the body’s skin to occur and (3) analyze the response of the thermoreceptor areas on the head, neck, chest, arms, wrists, and soles of the feet, to changes in each local area of the body. (2)

3. MATERIAL AND METHODS

Material and Methods

The research design used was purely experimental or laboratory experimental, with a post-test only control group design approach that used experimental animals as experimental objects (17). The treatment in this study was using baby rabbits. The sampling of test animals was carried out using simple random sampling. The treatment grouping is as follows:

K = control group, namely baby rabbits that were not given any treatment;

P1 = treatment group 1, namely baby rabbits that were given thermal exposure to the head;

P2 = treatment group 2, namely baby rabbits that were given thermal exposure to the neck;

P3 = treatment group 3, namely baby rabbits that were given thermal exposure to the chest;

P4 = treatment group 4, namely baby rabbits that were given thermal exposure to the arm;

P5 = treatment group 5, namely baby rabbits that were given thermal exposure to the wrist;

P6 = treatment group 6, namely baby rabbits that were given thermal exposure to the soles of their feet after checking the temperature changes, the experimental animals will be put in the battery cage.

Research population

The population consisted of newborn New Zealand rabbits weighing approximately 60 grams. The reason for choosing baby rabbits as a research sample is because some of their characteristics almost have physiological similarities to humans (In addition, adjustments to the tools used in this study made it possible to carry out baby rabbits that met the inclusion and the exclusion criteria. Sampling was done by simple random sampling to avoid bias due to variations in age and weight.

Research Sample

1. Criteria for inclusion of research subjects

Inclusion criteria are the general characteristics of research subjects from a population, a target, and reachable will be studied (17). In this study, namely:

a) New Zealand baby rabbit breed,

b) Gender male or female,

c) Body weight is approximately 60 grams,

d) Newborn age 0-5 days,

e) Rabbits are in good health, no visible anatomical abnormalities

2. Exclusion criteria for research subjects

Exclusion criteria are as follows:

a) Rabbit is sick,

b) There are visible anatomic abnormalities,

c) How to determine the sample.

Sampling was done by simple random sampling to avoid bias due to variations in age and weight. Randomization was carried out because there were inclusion and exclusion criteria so that it was considered quite homogeneous. The study used seven, namely one control group and six experimental groups, by comparing the results of observations in each control group and experimental group. Each group consists of four rabbits, so that the total number of rabbits 28 rabbits used in this study. All of them were taken randomly from a group of rabbits that had been adapted to feed for a week.

Determine the sample size

The size of the study sample was determined based on the federer formula: (t-1) (n-1) ≥ 15

t = treatment group

n = number of samples per group

The number of samples in this study is:

(t-1) (n-1) ≥ 15

(7-1) (n-1) ≥ 15

n ≥ 2.5 + 1

n ≥ 3.5

Based on these calculations, the number of samples needed is rabbits for each experimental group. So the required sample size is 28 rabbits for 7 treatment groups.

Research variable.

The variables of this study are as follows: The independent variable is Thermal Exposure to Fiber Carbon Filament. The dependent variable is the Physiological Response of Baby Rabbits Body temperature of baby rabbits after thermal exposure

Tools and materials

Tools and Materials, namely: This study used 28 samples of rabbits with a new birth weight of approximately 60 grams. Experimental animals were conducted by giving thermal exposure to carbon fiber filament (18, 2).
The Effect of Thermal Exposure to Carbon Fiber Filament in the Thermoreceptor Area on the Physiological Response of Hypothermic Baby Rabbits

Method of collecting data and data analysis technique

The data collection method used is: observation. Observation techniques or direct observation are data collection activities by conducting direct research on the environmental conditions of the research object that support research activities, so that a clear picture of the condition of the research object is obtained. The data collection technique is by direct observation. the object studied in the thermal exposure test on the baby rabbit’s body through carbon fiber filament.

4. RESULTS

This study used 28 baby rabbits with 6 treatment groups and 1 control group where each group consisted of 4 baby rabbits that met the inclusion and exclusion criteria.

Descriptive analysis data on temperature measurements in 6 treatments, namely head, neck, chest, arms, wrists, soles of feet as follows:

Hypothesis determination

Ho: there is no difference in average temperature in each group of hypothermic baby rabbits with thermal exposure to different parts of the thermoreceptor area

Ha: there is a difference in average temperature in each group of hypothermic baby rabbits with thermal exposure to different parts of the thermoreceptor area

In the ANOVA test, if Ha is found, it is accepted or the difference is significant, so a t-test must be carried out to find out which groups are different. Based on Table 3, the sig value (0.371) is greater than α (0.05), so Ho is accepted and it is concluded that the variation between groups is the same or homogeneous. Based on the ANOVA test in Table 4, the sig value (0.0001) was smaller than α (0.05), so Ho was rejected and it can be concluded that there is a difference in the average temperature in each group of hypothermic baby rabbit models by giving thermal exposure to the different thermoreceptor areas

In this study, the thermal exposure group was divided into more than 2 groups, so it is necessary to know which group has a significant difference. This is known through the post hoc table. In the Bonferroni post-hoc test results we will find groups that are significantly different, with a sig value <α (0.05). Or by paying attention to the sign (*).

5. DISCUSSION

Before proceeding with the One way Anova test, one of the assumptions is that the variances are the same. From the Test of Homogeneity of Variances table it can be seen that the test results show that the variants of the 6 groups are the same.
(P-value = 0.371), so that the P value > 0.05 and the One way Anova test are valid to test this relationship.

This analysis was conducted to find out in which group there was a significant difference. The results of the L test after treatment showed that there were no significant differences between the various groups in the measurement so that it could be said that environmental conditions affected the condition of the newborn baby rabbits. Heat dissipation due to continuous exposure to cold affected the body’s ability to produce heat, resulting in hypothermia (19, 20).

In this study, the results showed that the average temperature in all groups tended to increase after being given thermal exposure to newborn rabbits with hypothermic conditions compared to the normal temperature of baby rabbits, namely 38-39.9°C.

6. CONCLUSION

Overall the results of this study are among others the findings are there are an Effect of Thermal Exposure to Carbon Fiber Filament in the Thermoreceptor Area to changes in body temperature, which can be described by changes in the baby rabbit’s temperature during hypothermia and after being given thermal exposure,.

There is a difference in the time it takes for the physiological adaptation of the body's skin to occur, which is about 5 minutes and the response of the thermoreceptor areas on the head, neck, chest, arms, wrists, soles of the feet, to changes in each local area of the body with the highest point on the head followed by the neck.

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