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Simple Incubator Model for Preventing Hypothery in Low-Birth-Weight Babies

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ABSTRACT

The infant mortality rate (IMR) is still one of the main health problems in Indonesia. Low birth weight is the most elevated indicator of newborn child mortality, particularly in the principal month of life. Based on the health profile of West Sumatra, of all infants weighed in 2017, 2.3% of LBW infants were found. One of the treatments for low-birth-weight babies who experience hypothermia is the skin-to-skin contact method and the use of an incubator. The reason for this review was to decide a simple incubator model for the prevention of hypothermia in low-birth-weight infants. This research uses a research and development approach. The study was conducted at the Independent Practice of the Kurao Clinical Midwife, Nanggalo District, Padang City in 2019. The population in this study was spontaneous newborns without complications at the Independent Practice of the Kurao Pagang Clinical Midwife. The sample was selected by the purposive sampling technique. The research stages consist of problem identification, planning, product draft development, initial product testing and revision of test results. Data analysis using qualitative and quantitative analysis with dependent t-test. The results showed that the normal internal heat level of the child previously being put into the incubator was 36.43oC. After being put into the incubator, the average body temperature of the baby becomes 36.76oC. The results of statistical tests showed a p-value > 0.001 (p-value < 0.05) which means that there is a difference in the baby's body temperature before and after being in the incubator. This simple incubator can be used as an alternative effort to prevent hypothermia in infants with low birth weight. Continuous product development is needed to obtain effective and efficient products.

Keywords: *incubator, hypothermia, and low birth weight*

1. INTRODUCTION

One marker of a country's wellbeing status is the Infant Mortality Rate (IMR), which is still very relevant to assessing the health status of developing countries such as Indonesia. The infant mortality rate (IMR) is still one of the main health problems in Indonesia. Data from Indonesia's health profile in 2017 shows that the neonatal mortality rate in Indonesia is 19 per 1,000 live births. Low birth weight (LBW) is the most noteworthy indicator of baby mortality, particularly in the main month of life. Babies with LBW have a 20-fold greater risk of death than babies born with normal weight. Babies are said to be low birth weight (LBW) if the child weighs <2500 grams upon entering the world regardless of gestational age.[1], [2]

Infant Mortality in West Sumatra was as many as 700 people during 2017, spread over 19 districts/cities with the largest contributor to death was from the city of Padang, which was 111 people. Based on the health profile of West Sumatra, of all babies weighed in 2017, 2.3% of LBW babies were found or 2,225 people. This number decreased from the previous year, wherein 2014 2.2% of infants experienced LBW.[3]

LBW is brought about by a short gestational age (rashness), IUGR (Intra Uterine Growth Restriction) which in Indonesian is called Inhibited Fetal Growth or both. Both of these causes are influenced by risk factors, such as maternal, placental, fetal and environmental factors. These risk factors lead to a lack of fulfilment of nutrition to the fetus during pregnancy.[4]

One problem that often occurs in newborns, especially with LBW is hypothermia.[5] Infant incubator is a medical device in the field of life support that is used to treat premature babies or LBW (Low Birth Weight) babies born weighing less than or equal to 2500 grams. This tool serves

to maintain the warmth and humidity of the baby's body.[6]

The problem is that currently, the price of incubators is still high, which reaches 125-160 million for an imported incubator and locally made incubator products with between Rp. 1 million – Rp. 2 million, but with technology that is still simple, is still very lacking in supporting the care of premature babies. In addition, there are other obstacles, such as the difficulty of distributing incubators to remote areas.[7] One of the problems that might be said to determine the morbidity rate is the economic problem of the patient's family (infant). In light of this, analysts are intrigued in researching the Simple Incubator model for the Prevention of Hypothermia in Low-Birth-Weight Babies".

2. MATERIAL AND METHODS

The research uses a research and development approach that was carried out at the Independent Practice of the Kurao Clinical Midwife, Nanggalo District, Padang City from June to November 2019. The study population was spontaneous newborns without complications with the purposive sampling technique. The research stages consist of problem identification, arranging, item draft advancement, beginning item testing and update of test outcomes. Data analysis using qualitative and quantitative analysis with dependent t-test.

3. RESULTS

An incubator designed for the care of newborns at home uses a simple working principle, namely by using the radiation produced by incandescent lamps, so it can warm the temperature inside the hatchery. The incubator uses an energy source that comes from electrical energy, which is then turned into light energy and heat energy produced by incandescent lamps. The temperature in the incubator can be known through the display of the wall thermometer.

This incubator design uses a thermostat as a temperature controller. If the temperature in the incubator cabin exceeds a predetermined limit, the incandescent lamp in the lower cabin will automatically turn off so that the baby cabin temperature drops again. The lamp will turn on automatically when the temperature reaches the optimal point. The presence of a thermostat will make the incubator more effective and safer for babies. In the lower cabin, a water reservoir is also added so that the humidity in the incubator cabin is guaranteed. The water used is sterile and will be replaced when it has been used.

The opening and closing mechanism on the incubator cabin is the front as the door opens and closes to make it easier for parents to put or pick up the baby. The incubator is also equipped with a drawer where the incandescent lamp can be easily opened by pulling. On the drawer and cabin door, there is a handle that feels comfortable when used because it has dimensions that are by anthropometry.

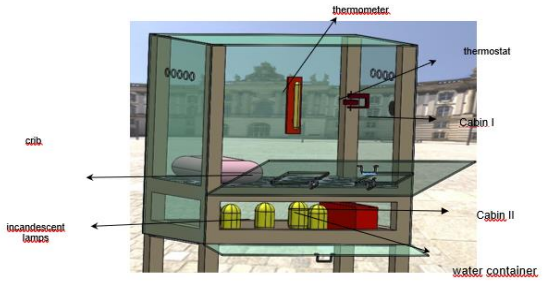

Figure 1 : Part of a simple baby incubator

Before being tested on babies, this simple incubator was tested for safety first by using experimental animals, namely rabbits. As a result, this simple incubator is safe to use and can increase or stabilize the temperature.

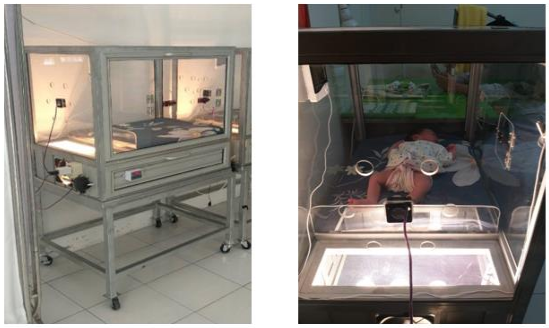

Figure 2: Simple baby incubator design

The number of research samples was 16 normal newborns. The results of observations using a simple incubator can be seen in the table below.

Table 1. Average Temperature of Babies

	Birth Weight	**Temperature (Pretest)**	**Temperature (Posttest)**
Mean	3.24	36.43	36.76
Median	3.2	36.5	36.75
SD	0.41	0.30	0.18
Min	2, 7	35.6	36.4
Max	4.2	36.8	37.0

In light of Table 1 it is realized that there is an increase in the baby's body temperature after being put into the incubator. The difference in the average body temperature of the baby before being incubated with the baby's body temperature after being in the incubator was analyzed using a dependent t-test with the results presented in table 2.

Table 2. Results of bivariate Analysis

Group	N	Mean	SD	p-value
Pretest	16	36.43	0.3	0.001
Posttest	16	36.76	0.18	

Statistical test results show p-value > 0.001 (p-value < 0.05) which means there is a difference in body temperature of a baby before and after incubator.

4. DISCUSSION

The baby incubator is shaped like a closed container where the warmth of the environment can be regulated by heating the air to a certain temperature, which serves to warm the baby. Baby incubators need stable humidity so that conditions in the incubator are maintained properly. Baby incubators play an important role in maintaining the body temperature of newborns.

Infants have not had the option to control their internal heat level, so they will encounter pressure because of changes in the climate from the mother's belly to the external climate where the temperature is higher. Hotness age without shuddering is the aftereffect of utilizing earthy colored fat for heat creation. Earthy colored fat stores are found all through the body and can expand body heat up to 100%. To consume earthy colored fat, babies frequently need to utilize glucose for energy which will change over fat into heat. This earthy colored fat will be drained in a brief time frame with cold pressure. The more extended the gestational age and the higher the child's weight, the more the child's stock of earthy colored fat. Therefore, the temperature of the incubator must match the baby's weight. The greater the baby's weight, the lower the incubator temperature, and vice versa, the lower the baby's weight, the higher the incubator temperature.

The use of this simple incubator is an effective alternative to maintain and stabilize the temperature of the newborn so that hypothermia does not occur. This simple incubator can overcome heat loss and cold stress in newborns, especially in low-birth-weight babies. The use of incubators can also be used in the referral process to reduce the morbidity and mortality of newborns.

5. CONCLUSION

The initial design of a simple incubator refers to an existing incubator with modifications to the materials used, which are more economical. The trial results of the simple incubator model showed that the incubator was effective for the prevention of hypothermia in newborns with a p-esteem < 0.05, which implies that there was a distinction in the baby's body temperature before and after being in the incubator.

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