



Earthing Method Reducing the Length of Acute Respiratory Infection Among Preterm Infants

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Kata Kunci

Infeksi;
Prematur;
Sistem imun;
Terapi earthing

Abstrak

Bayi prematur mengalami gangguan sistem imun dimana kematangan organ dan sistem tubuh belum optimal. Sistem kekebalan yang terganggu membuat bayi prematur rentan terhadap infeksi mikro-bakteri. Infeksi saluran pernapasan akut adalah infeksi yang paling umum diantara mereka. Penelitian ini bertujuan untuk mengetahui perbedaan lama kejadian ISPA sebelum dan sesudah terapi earthing. Penelitian ini merupakan penelitian eksperimen semu. Lokasi di kabupaten Sukoharjo, Indonesia pada bulan Maret sampai bulan Agustus. Populasi dalam penelitian ini adalah Bayi prematur yang datanya diperoleh dari laporan bulanan Badan Pusat Statistik (BPS) Jawa Tengah. Jumlah sampel bayi prematur sebanyak 192 bayi. Besar sampel adalah 20 bayi. Durasi earthing adalah 1 jam setiap hari selama 30 hari. Analisis statistik menghasilkan nilai $P = 0,000$ dan $t\text{-hitung} = 8,065 > t\text{-tabel} = 2,093$, menunjukkan adanya perbedaan lama ISPA pada bayi prematur sebelum dan sesudah terapi earthing. Disarankan agar ibu dari bayi prematur terus menggunakan perangkat earthing lebih lama untuk meningkatkan sistem kekebalan tubuh dan mencegah infeksi saluran pernapasan akut. Selanjutnya, penggunaan terapi earthing bermanfaat untuk meningkatkan sistem kekebalan tubuh secara umum dalam mencegah atau mempercepat proses penyembuhan infeksi mikroba dengan alat earthing atau langsung tanah.

Keywords

Earthing;
Immune system;
Infection;
Grounding;
Preterm

Abstract

Preterm infants have compromised immune systems where the maturity of the organs and body system is not optimum. The compromised immune system makes premature infants susceptible to micro-bacterial infections. Acute respiratory infection is the most common infection among them. This study aimed to investigate the significant difference in the length of acute respiratory infection before and after Earthing therapy. This research is a quasi-experimental study. The location is Sukoharjo District, Indonesia, from March to August 2021. The population in this study is preterm infants whose data is obtained from monthly reports on Central Java Statistic Agency. The number of samples of preterm infants was 192 infants. The sample size was 20 infants. Earthing duration is 1 hour every day for 30 days. The statistical analysis results in a P-value of 0,000 and t-count $8.065 > t\text{ table } 2.093$, indicating a significant difference in the length of Acute Respiratory Infections among preterm infants before and after Earthing therapy. It is recommended that mothers of preterm infants continue to utilize Earthing devices longer to increase the immune system and prevent acute respiratory infection. Furthermore, using Earthing therapy is beneficial for improving the general immune system in preventing or accelerating the healing process of microbial infection with Earthing devices or straight to the ground.

Introduction

Preterm infants are a vulnerable group where immunity is still weak, and the maturation of organs and body systems is not optimum(1). This situation makes preterm infants susceptible to infection, inflammation, and complications. Earthing researchers from the Neonatal Intensive Care Unit (NICU) in the Penn State Children's Hospital in Hershey conducted Earthing therapy for preterm infants in NICU for two months. It resulted in a clinically stable infant and increased heart rate variability (HRV), indicating vagal nerve transmission(2).

Preterm delivery is the leading cause of 60-80% of neonatal morbidity and mortality worldwide. WHO places the case of preterm infants in Indonesia at the tenth highest globally, with a preterm incidence rate of around 15%. It is the leading cause of neonatal death in Indonesia(3) with a preterm incidence rate of approximately 15%. The highest incidence of infection in preterm infants is caused by pneumonia, acute respiratory infection (ARI), diarrhea, and fever, where pneumonia and ARI are caused by infection, and diarrhea and fever are diseases caused by bacterial infection.

The government's efforts to treat preterm infants through hospital neonatal ICUs require high costs and intensive care with financing from Social Health Insurance Administration Agency or Badan Penyelenggara Jaminan Sosial Kesehatan (BPJS) (4). Preterm infants are also be cared for at home after hospital admission with the providing incubator to maintain optimum body temperature. The infants' hygiene and surrounding cleanliness are controlled to prevent exposure to pathogenic microorganisms.

Preterm infants are being cared for at home after hospital admission early after delivery. The infants' well-being mostly depends on the knowledge and ability of mothers and families to care for and provide adequate nutrition with exclusive breastfeeding, maintain optimum body temperature, and prevent infections. Mothers who have previous preterm infants can be resourceful and resilient because they have knowledge and experience from the previous child. On the other hand, many first-time mothers do not have enough information and experience to care for their infants. Therefore, the infants of first-time mothers are prone to have exposure to infection compared to infants of mothers who have previous preterm infants.

Preterm infants have a low level of immunity, so they are susceptible to infectious diseases that cause morbidity and mortality. Low immunity levels can be strengthened by grounding/Earthing, which pediatricians have studied on various continents, and benefits in increased infant immunity.

A study by dr. Charles Palmer, professor of pediatrics from Penn State Children's Hospital, conducted a study on 26 infants aged 6-60 days in the NICU by doing grounding/Earthing on infants who were treated in incubators by connecting the infant's feet to the ground (ground) with copper plates and copper wires. This research was conducted for two years. The study results showed that the vagal nerve function increased by 60% and the infant's skin voltage decreased by 90%, indicating that the infant's health indicators improved and the infant became more relaxed when grounding(2).



Figure 1. Installation of grounding on the infant's feet in the NICU

Research proves that Earthing is beneficial for reducing inflammation because 1) electrons in the soil/earth neutralize free radicals that occur in the inflammatory process and 2) normalize the hormone cortisol, which is beneficial for its regulatory effect on inflammation. Other benefits of Earthing are wound healing, prevention of chronic infections, and autoimmune diseases(5).

Moreover, Earthing is more beneficial for infants at home in community settings because infants do

not have easy and fast access to medical equipment and medication to improve their immunity every time. They were providing Earthing that are very practical, easy, low cost, and effective needs to be encouraged with the use of Earthing devices where infants can still lay on the bed and be connected to the earth/ground. Mothers can also facilitate Earthing by enabling their feet to the soil in the yard while carrying their infants while the infant's skin touches the mother's skin.

Earthing or grounding is a therapy that refers to direct contact between the earth's surface, between the skin of the soles of the feet or hands with soil, grass, sand, or stones. The research subject reported that walking barefoot on the ground promotes health and allows a feeling of well-being in the literature in different cultures worldwide(6). Earthing can reduce or prevent the main signs of infection such as redness, heat, swelling, pain, and loss of function. Rapid resolution of chronic inflammation has been demonstrated in clinical studies with infrared images. The images show the inflammation areas are rapidly getting narrower and eventually healed utterly.

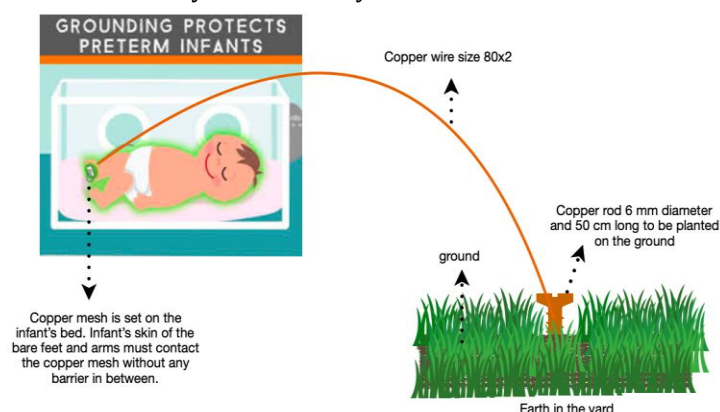


Figure 2. Installation of grounding/Earthing at Home

Based on a survey in Sukoharjo Regency, Central Java, Indonesia, of 10 mothers with preterm infants who care for preterm infants at home with an incubator, none know about Earthing therapy. A follow-up survey was conducted on eight mothers who accidentally applied Earthing (by playing barefoot on safe soil and grass), saying their children became sick less often. Some also reported that before Earthing, their children were often admitted to the hospital due to infectious diseases. After their children apply grounding by playing in the soil or grass barefoot, they never are admitted to the hospital anymore. Many parents also reported that their children are healthier and never admitted to the hospital after being exposed to the ground/earth regularly. This Earthing method is beneficial for mature-born infants in the community. Despite the benefit of the earthing method for preterm or mature-born children, there are very few clinical studies to investigate the benefits of Earthing.

ARI is a severe infection that prevents normal breathing function. This study mostly manifested in the congestion in the nasal sinuses and cough. Preterm infants are susceptible to significant respiratory morbidity because of lung immaturity at birth, especially those born before 34 weeks. Infants born between 32 and 37 weeks gestation also have increased respiratory symptoms and rehospitalization prevalence because of the respiratory problem from infancy until preschool age(7,8). Bennett et al. conducted a cohort study in a community with 50 preterm infants with biweekly sampling reported that 52% of them had a viral respiratory infection(9).

This research is significant in being one of the solutions to naturally increase the infant's immune system and reduce inflammation and the risk of infection for preterm infants cared for at home. The results of this study will benefit the family economically as a cheap, effective, efficient, and practical therapy with minimum side effects. Increasing the immunity of preterm infants improves the quality of health and long-term growth and development to be significant for the advanced generation. Earthing therapy is also beneficial for the state in reducing the burden of financing by BPJS.

Researchers are interested in further researching the benefits of grounding/earthing on the incidence of acute respiratory infection. It is hoped that with Earthing therapy, the immune system of preterm infants will increase so that they become stronger against respiratory infection for optimal growth and development of infants through natural therapies.

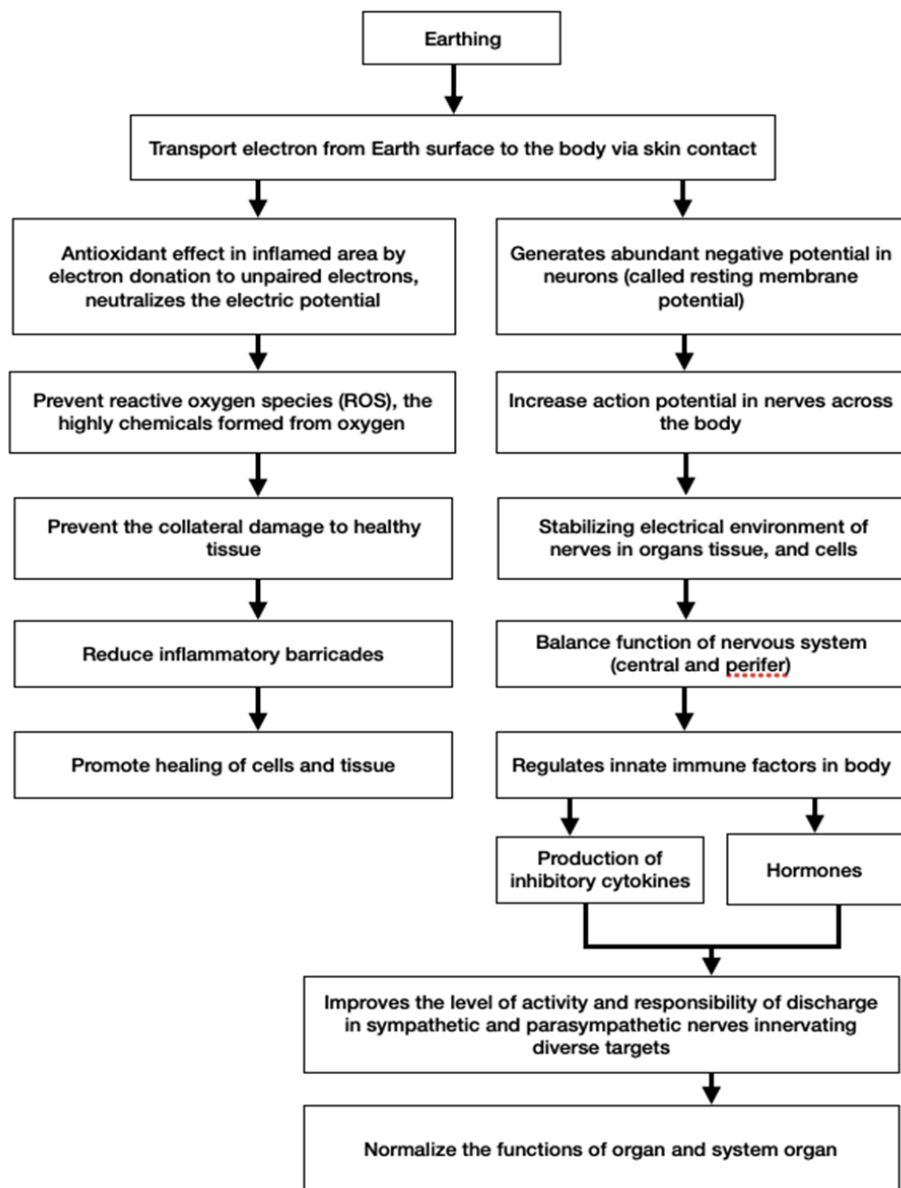


Chart 1. Mechanism of Action of Earthing on Preterm Infant

Methods

This research is a quasi-experimental study. The location is in the Work Area of the Sukoharjo District Health Office from March to August 2021. According to Central Java Statistic Agency, the number of samples of preterm infants born between 32 and <37 weeks of gestation were 192 infants (10).

The sample size in experimental research is calculated using the formula(11)

$$(t - 1) (r - 1) > 15 \quad \{1\}$$

Where :

t=number of treatment groups;

r=number of replications.

With t=1 group,

$$\text{then: } (1 - 1) (r - 1) > 15 \quad r > 16. \quad \{2\}$$

The total sample was 20 infants to anticipate the proportion of experimental units who resigned or dropped out. The sampling technique in this study used purposive sampling.

Restriction Criteria

Inclusion Criteria

- Preterm infants who were born between 32 and 37 weeks of gestational age.
- Aged 0-12 months
- Preterm infants with no congenital abnormalities
- The infants were being cared for at home

Exclusion Criteria

- Parents refuse their preterm baby to be given therapy

Earthing device is made by connecting the copper mesh, copper wire, and a copper rod. A copper rod is planted in the ground around the yard, while the copper mesh is placed in the infant's bed as a mat during day nap time.

The forms of intervention that will be carried out after obtaining informed consent are 1) installation of an Earthing device; 2) explanation of the procedure for installing the grounding device: the infant sleeps on the grounding device, it must be in contact with the infant's skin on the extremities of the hands and feet, without any barrier in between; 3) the Earthing time is 1 hour/day for 30 days.

Time of inspection and data collection: 1) during the first visit; 2) 30 days after the first visit, then grounding intervention was given for 30 days; and 3) the 30th day after the Earthing/grounding intervention. Health monitoring is carried out during the data collection interval, either in person or online.

Researchers are also always ready to take the infant to the hospital if there is a situation where the infant is hot, does not want to drink, cannot rest, or has breathing problems. However, previous research studies show that this therapy is safe and natural.

Below is the development of Earthing device in collaboration with a Ph.D. in Electrical Engineering from Gadjah Mada University, Indonesia:



Figure 3. Skin voltage measurement before grounding results in 274.8 mV
Picture source by Estiningtyas



Figure 4. Skin voltage measurement when Earthing results in 0.000 mV.
Picture source by Estiningtyas



Figure 5. The measurement of skin voltage when using Earthing device resulted in 4.8 mV.
Picture source by Estiningtyas



Figure 6. Measurement of skin voltage using Earthing device fluctuates between 3.9 mV up to 0.0 mV
Picture source by Estiningtyas

Results

Table 1 shows the majority of mothers aged >35 years old were 12 mothers (68%), graduated from high school were 15 mothers (75%), and multiparous were 13 mothers (65%). The etiology of preterm delivery was preterm rupture of membrane 7 (35%), preeclampsia 4 (20%), history of preterm delivery 4 (20%), anemia 3 (15%), and antepartum hemorrhage 2 (10%). The characteristics of infants aged 0-6 months were 10 (50%) and the same number of those aged 6-12 months, and the majority were female with 12 infants (68%), most of them born late preterm 32 to <37 weeks of gestation 11 infants (55%), and birth weight between 2000 to <2500 grams 12 infants (60%).

Table 1. Socio-demographic variables of mothers and preterm infants

Respondents	Socio-demographic variables	Frequency	%
Mothers	Age		
	20-35 years old	8	32
	>35 years old	12	68
	Level of Education		
	High School Graduate	15	75
	Higher Education Graduates	5	25
	Parity		
	Primipara	7	35
	Multipara	13	65
	Etiology of Premature Delivery		
	Premature rupture of membrane	7	35
	Preeclampsia	4	20
	Antepartum Hemorrhage	2	10
Infants	History of Preterm Delivery	4	20
	Anemia	3	15
	Age		
	0-6 months	10	50
	6-12 months	10	50
	Sex		
	Male	8	32
	Female	12	68
	Gestational Age		
	Late Preterm 34 to <36 weeks of gestation	11	55
	Early Preterm 32 to <34 weeks of gestation	9	45
	Infant's weight at birth		
	1500 to <2000 gr	8	40
	2000 to <2500 gr	12	60
Total		20	100

Table 2. The incidence of Acute Respiratory Infection Among Infants Before and After Earthing therapy

Infants	Total days of Acute Respiratory Infection among all infants		Sig. (2-tailed)	Paired sample test (t-test)	t table at df 2
	Before Earthing	After Earthing			
20 infants aged 0-12 months	100 days	15 days	0	8.065	2.093
Mean	5 days	0,75 day			

In this study, the control process was done for 30 days without Earthing. The presence of acute respiratory infection was monitored by examining the presence of congestion in the nasal sinuses and cough. Before Earthing therapy, 17 out of 20 infants had an acute respiratory infection (ARI) with a minimum duration was three days and a maximum of 10 days. They were given suspension to treat ARI obtained from the midwives. After the experiment of Earthing therapy, this number was reduced to 12 infants with ARI. Infants were not given medication during Earthing therapy. The mean value before Earthing therapy was five days, while it was reduced to 0,75 days after therapy. The statistical tool used was paired sample t-test with the result was P-value of 0,000 and t-count 8.065>t-table 2.093. It can be concluded that there is a significant difference in the duration of incidence of ARI among preterm infants before and after Earthing therapy.

Discussion

Table 1 shows the majority of mothers aged >35 years old (12 or 68%), graduated from high school (15 or 75%), and multiparous (13 or 65%). This finding is following a study(12) on postpartum mothers in Banyumas District, Indonesia, where the majority of the mothers aged ≥35 years old (52,2%), graduated from high school (52,5%), and multiparous (71,7%).

The majority of mothers were aged >35 years old, which means a high risk of preterm delivery. A mother who has a relatively low level of education also tends to have a lower knowledge in health management for mother and fetus than mothers with higher education levels. Inadequate knowledge leads

to poor health management during pregnancy, resulting in pregnancy complications. In this study, multiparous mothers had a history of preterm delivery, influenced by genetics.

The etiology of preterm delivery was preterm rupture of membrane 7 (35%), preeclampsia 4 (20%), history of preterm delivery 4 (20%), anemia 3 (15%), and antepartum hemorrhage 2 (10%). Goldenberg et al. (13)13 stated that the obstetric precursor of preterm birth is spontaneous labour with intact membranes (45%), delivery because of maternal or fetal infection (30%), and preterm premature rupture of membrane or PPRM (25%).

PPROM is defined as spontaneous rupture of the membranes at less than 37 weeks gestation or minimum at one hour before the contractions begin. In most cases, the etiology of membrane rupture is unknown, but asymptomatic intrauterine infection is a frequent precursor (13). Recent studies suggest that preterm labour is thought to be a syndrome initiated by multiple mechanisms, including infection/inflammation, uteroplacental ischemia or hemorrhage, uterine overdistension, stress, and other immunologically mediated processes (14). A precise mechanism cannot be established in most cases; therefore, factors associated with preterm birth, but not obviously in the causal pathway, have been sought to explain preterm labour. Since many risk factors result in increased systemic inflammation, increasing stimulation of the infection or inflammation pathway might explain some of the increases in preterm births associated with multiple risk factors (15).

In this study, the primary cause of preterm delivery was preterm rupture of the membrane (7 or 35%). Another case was the spontaneous delivery with membrane intact (7 or 35%) accompanied by a history of preterm delivery and anemia in pregnancy. The factors related to the history of preterm delivery were not confirmed. Anemia, as reported by Rahmati et al. (16), increases the risk of preterm delivery by 1.56 times higher. Other respondents reported that her preterm delivery was accompanied by preeclampsia (4 or 20%). According to Davies et al. (17), preeclampsia is an important contributor with risk factor 4.43 times resulting in preterm delivery. Two preterm delivery (10%) was accompanied by antepartum hemorrhage. Klinger et al. (18), in a population-based cohort study stated that pregnancy with antepartum hemorrhage affected 32.2% preterm delivery, while 67.8% of preterm delivery is not accompanied by antepartum hemorrhage.

The characteristics of infants aged 0-6 months were 10 (50%) and the same number of those aged 6-12 months, and the majority were female with 12 infants (68%), most of them born late preterm 32 to <37 weeks of gestation 11 infants (55%), and birth weight between 2000 to <2500 grams 12 infants (60%). Most infants had birth weight between 2000 to <2500 grams which is more beneficial for preterm infants because the growth and development of organs are better than those of less than 2000 grams. Vilanova et al. (19)19 reported that the percentage of infant mortality rate among preterm infants born in the hospital found that the lower the birth weight, the higher percentage of infant mortality rate.

Before Earthing therapy, 17 out of 20 infants had an acute respiratory infection (ARI) with a minimum duration was three days and a maximum of 10 days. After Earthing therapy, this number was reduced to 12 infants with ARI. The mean value before Earthing therapy was five days, while it was reduced to 0,75 days after therapy. The statistical tool used was paired sample test (t-test) with the result was P-value of 0,000 and t-count 8.065>t-table 2.093. It can be concluded that there is a significant difference in the duration of incidence of ARI among preterm infants before and after Earthing therapy.

Direct contact with the earth allows the free transport of electrons from the earth's surface to spread to the body through the skin and provides an antioxidant effect. Electron transfer creates an antioxidant microenvironment in the inflamed area, slows or prevents reactive oxygen species (ROS) processes that occur due to oxidative bursts from causing "collateral damage" to healthy tissue, and prevents or reduces the formation of called "inflammatory barricades"(2).

Clinically, grounding therapy in infants benefits stability and enhances the rate of variability (HRV), indicating increased vagal nerve transmission. The vagal nerve extends from the brainstem to the abdomen. The primary nerve in the autonomic nervous system supplies and regulates vital organs, including the lungs, heart, and digestive system (2). The vagal nerve extends from the brainstem to the abdomen, which is the main nerve of the autonomic nervous system (2). The vagal nerve supplies and regulates major organs such as the lungs, heart, and small intestine. Furthermore, the common Earthing method reduces inflammation. It lowers the voltage on the infant's skin due to environmental radiation such as medical devices and incubators that cause stress effects on the infant.

Increased vagal nerves indicate control of the autonomic laden system that regulates involuntary body functions such as the lungs, heart, and digestive system. This improvement in health indicators, according to Dr. Palmer, can prevent inflammation and disorders in vital body organs regulated by the autonomic nervous system that occurs due to incomplete maturation of the nervous system, such as term infants. The Penn State researchers also reported that grounding immediately and substantially reduced the skin tension induced in infants from the ambient electric field radiating from the medical equipment and incubators in the vicinity. This voltage can have a stressful effect on preterm infants. In studies

published in 2005 and again in 2016, Earthing has significantly reduced induced stress on the body (2).

In this study, Earthing to the ground can reduce skin voltage by 95%. In the outdoor, the electric voltage on the skin is up to 274.8 mV, which can be reduced to 0.000 mV. The skin voltage of 0.000 mV is the indicator of the skin voltage when grounding is working. In the experiment with the Earthing device connected to the ground, the skin voltage is reduced from 3.9 mV to 0.000 mV. The skin voltage is rapidly and significantly reduced until 99,9% in 3-5 seconds after the sole of the feet touches the Earthing device. The low skin voltage affects the level of stress hormone in the cardiovascular system. The low-stress level reduces the inflammatory barricades, hence improving the immune system.

Doctors in the ICU Department have found that grounding can increase the body's defenses in preterm infants and reduce the risk of complications that result in death. Doctors found that Earthing performed through grounding patches in the incubator clinically in a short time resulted in significant improvements in the autonomic nervous system, which were significant for regulating stress and inflammatory responses (2). The immune system in preterm infants can be increased to match the immune system functions in term infants. Infections and complications related to infection are significant causes of death in preterm infants. However, how to improve the immune system in preterm infants is still limited, and how the environment influences the growth of this immune system after birth (20). Earthing naturally increases the body's immunity against infection by increasing the concentration of gamma globulins. Earthing also provides anti-inflammatory and immune-strengthening effects(21). If a patient has infections, Earthing enables faster healing. Earthing study on a diabetic patient who had diabetic wounds for eight months experienced wound healing after two weeks of grounding and a significant reduction in pain. A study of patients who had an accidental incision wound experienced faster healing for two days (5).

Furthermore, a research study showing the effective healing process with non-infant subjects shows that Earthing improves sleep quality and reduces pain intensity(5). The pilot project study of the Earthing therapy experiment for 1 hour showed that the intervention group experienced an improvement in the mood to positive, thus helping to mitigate the detrimental effects of negative moods such as anxiety, stress, and depression (22). Reduction of inflammatory effects due to Earthing therapy through infrared examination and assessment with blood chemistry and red blood cell counts (23). A study of 33-year-old respondents with chronic knee inflammation for 15 years, causing the inability to stand for long periods, reported experiencing a very rapid reduction in pain levels to moderate pain levels after 30 minutes. After one week, respondents can sleep soundly. After four weeks, respondents can play soccer (5).

A study by the Earthing Institute of adult patients with pneumonia, anemia, and fatigue who underwent inpatient or outpatient therapy for seven months in hospital experienced a significant improvement in condition within 20 minutes of Earthing every day. After regular Earthing, they experience increased energy levels and reduced flu symptoms such as coughing, runny nose, sneezing; sleep better; cure iron deficiency anemia (24).

For Indonesian child health and nursing, this method adds to the nursing intervention for preterm infants. It considers the continued application of technology with the application of Earthing in the Intensive Care Unit at the hospital and in community settings.

Conclusion

There is a significant difference in the length of Acute Respiratory Infections among preterm infants before and after the Earthing therapy with a *P-value* of 0,000 and t-count 8.065>t table 2.093. It is recommended that mothers of preterm infants continue to utilize Earthing devices longer to increase the immune system and prevent acute respiratory infection. Furthermore, continuing to apply Earthing therapy is beneficial for improving the general immune system. A strong immune system prevents microbial infections or accelerates the healing process when an infection occurs. For a family without earthing device, it is recommended for mothers to do Earthing straight to the soil or grass while carrying the infants where there is skin contact between infants and mothers because it also has the same effect to improve the immune system.

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