

## EFFECT OF ADAPTIVE EXERCISE ON BODY TEMPERATURE IN CHILDREN WITH MOTORIC DISORDER

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### ABSTRACT

*Motoric disorder in child increased every year, especially cerebral palsy. Children with motoric disorder which is majority experiencing long immobilization results in their general condition declining. One of this declining appears on body temperature in child, even lead to hypothermia. A simple exercise which applicatively performed at home can be a simple solution to maintain general condition, especially body temperature. The purpose of this study was to determine effect of adaptive exercise on body temperature change in children with motoric disorder. This study was an experimental study of one group pre and posttest. A total of 31 children (11 girls and 20 boys) aged 2-10 years old performed adaptive exercise consist of warming up 5 minutes, core movement 25 minutes, cooling down 5 minutes. Data were analyzed by paired T test. Body temperature in pretest was  $36.12 \pm 0.53^{\circ}\text{C}$ , and body temperature in posttest was  $36.63 \pm 0.6^{\circ}\text{C}$ , with  $p = 0.00$ . Adaptive exercise can increase body temperature but still in normal range.*

**Keywords:** Adaptive training; temperature; pediatric; cerebral palsy

### ABSTRAK

*Gangguan motorik pada anak meningkat setiap tahun, terutama cerebral palsy. Anak-anak dengan kelainan motorik yang mayoritas mengalami imobilisasi lama mengakibatkan kondisi umum mereka menurun. Salah satu penurunan ini muncul pada suhu tubuh pada anak, bahkan mengakibatkan hipotermia. Latihan sederhana yang dilakukan secara aplikatif di rumah dapat menjadi solusi sederhana untuk menjaga kondisi umum, terutama suhu tubuh. Tujuan dari penelitian ini adalah untuk mengetahui pengaruh latihan adaptif terhadap perubahan suhu tubuh pada anak-anak dengan gangguan motorik. Penelitian ini adalah penelitian eksperimental satu kelompok pre dan posttest. Sebanyak 31 anak-anak (11 perempuan dan 20 laki-laki) berusia 2-10 tahun melakukan latihan adaptif yang terdiri dari pemanasan 5 menit, gerakan inti 25 menit, pendinginan 5 menit. Data dianalisis dengan uji T berpasangan. Pretest suhu tubuh  $36,12 \pm 0,53^{\circ}\text{C}$ , dan posttest suhu tubuh  $36,63 \pm 0,6^{\circ}\text{C}$ , dengan  $p = 0,00$ . Olahraga adaptif dapat meningkatkan suhu tubuh tetapi masih dalam kisaran normal.*

**Kata kunci:** Pelatihan adaptif; suhu; pediatrik; cerebral palsy

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## INTRODUCTION

Cerebral palsy is a post brain injury condition that occurs during growth and development phase in gestational period, thus causing motoric and cognitive disorder. Based on research held by Health Ministry of Indonesia in 2010, cerebral palsy prevalence in child 24-59 months old was 0.09%. In 2014, cerebral palsy prevalence in child was predicted 1-5 every 1000 born alive and would increase every year. Boys suffered cerebral palsy more than girls and often in a first child. Brain injury refers to continuously injury after normal development period, differs from another cerebral palsy

which occurs since from gestation (Rob & Fenella 2012). Although cerebral palsy and brain injury have a different injury period, both have same disabilities, such as postural movement disorder, respiratory problems, orofangeal dysfunction (swallow, chewing, and tongue movement), and psychosocial problems.

Posture and gesture disorder can caused by inability of the brain to regulate and control muscle tone. Increased muscle tone causes muscle spastic, so that the body has difficult to move and immobilization occurs. Immobilization results peripheral vasoconstriction which triggers blood flow resistance in the lower

extremity. Another condition is a reduced venous return, resulting in a decrease of cardiac output and blood pressure (Deden 2014). In the body, heat is produced by one of them by muscle tissue activity. The heat produced then distributed through blood circulation to all parts of the body (Yondry, 2017). An individual in prolonged immobilization may have a problem in declining temperature due to limited muscle dynamic activity. Vasoconstriction occurred will inhibit blood circulation thus accelerates temperature declining towards hypothermia.

In a situation of mild hypothermia, thermoregulation mechanism is operating maximally to protect heat loss by shivering, reducing peripheral perfusion, increasing blood flow to the brain, increasing urine volume, increasing heart rate, respiratory rate, cardiac output and blood pressure. If this condition is worsening and body temperature declining under 30-32°C, so that enzymatic activity slows down, heat production capacity reduced, the thermoregulation doesn't work, resulting in more organs dysfunction and lead to death caused by cardiorespiratory failure (Avellanas et al 2011). The aim of this study was to determine body temperature response of adaptive exercise. The muscle movement can produce heat that expected to increase body temperature in children with motoric disorder to prevent hypothermia.

## MATERIALS AND METHODS

A total of 31 children participated in this study, they are 20 boys and 11 girls in range of 2 until 10 years old. This study was an experimental one group pre and posttest design. Inclusion criteria for this experimental subject includes: a child aged 2-10 years, was diagnosed congenital motoric disorder, brain injury and cerebral palsy; and not in an inflammatory phase. Research has begun with some questioners and information given by researcher assistant using written and verbal method.

The experimental subjects was selected from august-September 2018, and questioners was filled just after at least one of the parent agree and understand.

Pretest and posttest was done by measuring body temperature on axilla for 5 minutes. Adaptive exercise performed passively and accompanied by a coach. Part of the body that have to be moved are head, shoulder, elbow, wrist, hip, knee, and ankle. There are three phase in performing adaptive exercise, those are: warming up which is dominated by stretching for 5 minutes, core movement dominated by repeated rhythmic movements for 25 minutes, and 5 minutes of cooling down which is dominated by relaxation movement. This adaptive exercise takes around totally 35 minutes (Runciman 2016). The data obtained was analyzed by paired sample T-test.

## RESULTS

There were two types of motoric disorders in this study, cerebral palsy and brain injury. The subjects' number and percentage of each characteristic can be seen in Table 1.

There was correlation between pretest and posttest on body temperature with  $\text{sig} = 0.00$ , indicating that between pretest and posttest have a meaningful correlation power. Body temperature pre and post exercise represent in a figure.

Fig. 1 shows that male subjects have standard deviation on pretest = 0.47 and posttest = 0.55, while Fig. 2 shows that female subjects have standard deviation on pretest = 0.62 and posttest = 0.66. Fig. 3 represents mean of subjects body temperature have standard deviation on pretest = 0.53 and posttest = 0.6. Paired T-test is used to show a meaningful correlation as a whole statistic with  $p < 0.05$ .

Table 1. The different of motoric disorder characteristic of the experimental subjects

Motoric disorders characteristic of the children	n	%
Cerebral palsy	22	71
Brain injury	9	29
Total	31	100

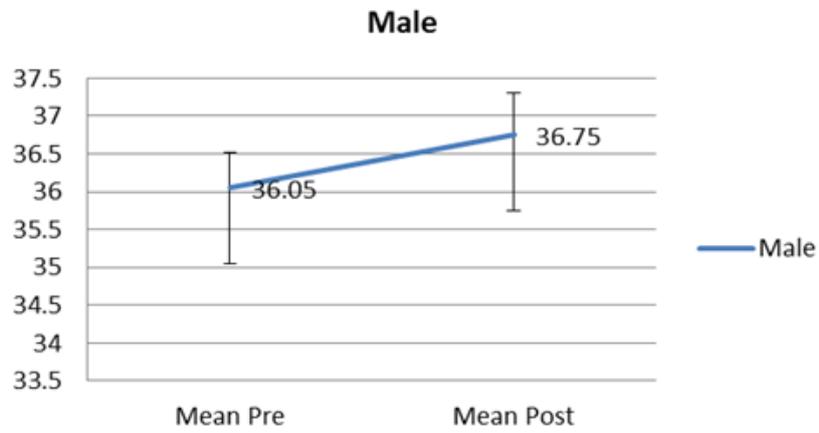


Fig. 1. Male body temperature.

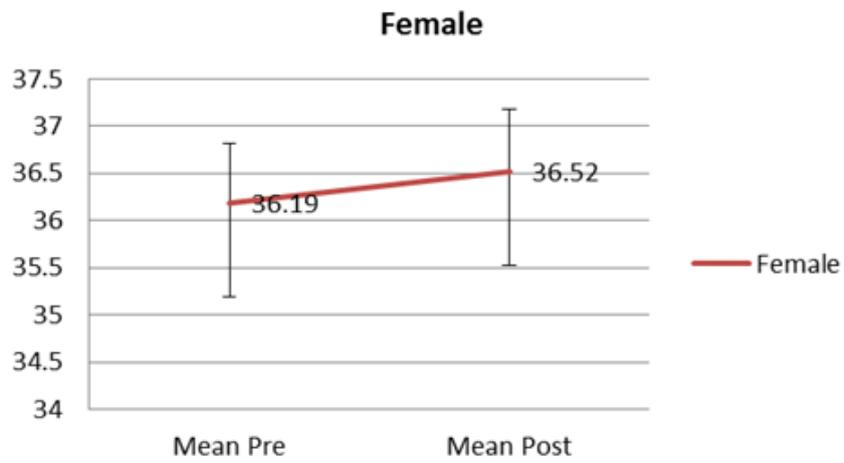


Fig. 2. Female body temperature.

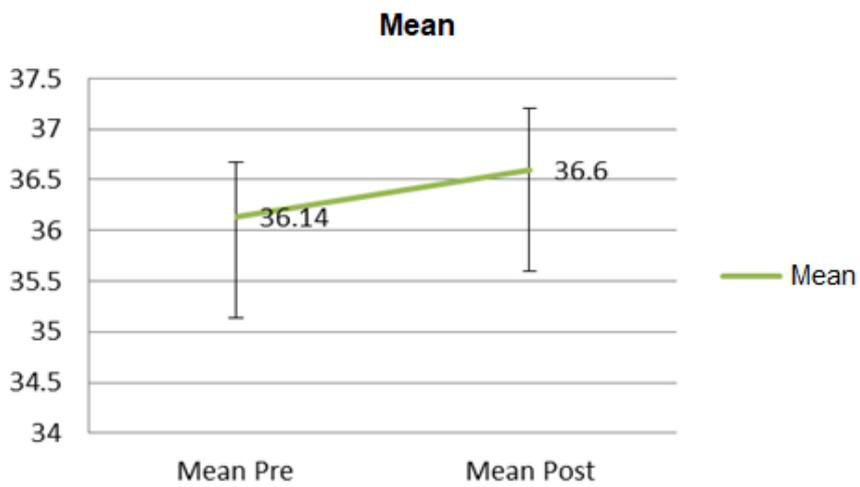


Fig. 3. Mean body temperature.

## DISCUSSION

This study shows the body temperature pretest ( $36.12 \pm 0.53$ )°C, body temperature posttest ( $36.63 \pm 0.6$ )°C, so that this body temperature is outside very mild hypothermia condition  $<36.5$ °C (Shaheen et al 2012). Female has different physiological and morphological characteristic in regulation of body temperature. The difference includes less blood volume, lower hemoglobin level, smaller cardiac, low body mass, greater fat mass percentage, wider body surface area, higher core temperature threshold for skin vasodilatation and produce sweat, wider vasoconstriction of upper and lower extremity at rest, and geometrically has a slimmer body shape (Kei 2012). Those underlies female body temperature higher than male (female= $36.19$ °C, male= $36.05$ °C), and during exercise increase of temperature lower than male (female= $36.52$ °C, male= $36.75$ °C).

Cold exposure may increase metabolic rate, so that food requirements is increased, in the other side foods are also needed to compose fat deposits which function as a heat isolator and required if there is prolonged cold exposure (Yondry 2017). When the extremity and fat reserves thin out, the ability of the body's homeostasis towards the body temperature will be disrupted, so the body have to perform muscles movements dynamically to maintain body temperature. A dynamic muscles activity can increase metabolic rate up to more than 10 times (Yondry 2017).

Several studies showed that exercise was the one of the strong factor helping maintain body temperature, and other study explained that heat was increasing during exercise in line with with activity in the muscle. About 80% of energy consumption was changed into heat using only about 20% to create a movement (Kei 2012). In this study, we just measured body temperature. According to Runciman (2016) in this training, not only body temperature that can be shown as an effect, Runciman also measured the strength, aerobic capacity, flexibility, anaerobe capacity, and agility. Therefore, further study about many factors and diversity of problems is necessary.

## CONCLUSION

Adaptive exercise can increase body temperature but still in normal range. It can be used in home program of children with motoric disorder.

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