

RESEARCH ARTICLE

Senam Sehat Anak Indonesia Improve Peak Expiratory Flow Rate in Children with Obesity

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ABSTRACT

Introduction: Excessive fat accumulation in the obese child causes complex problems in the respiratory system. Respiratory system function can be improved by exercise. One exercise model that is suitable for children is Senam Sehat Anak Indonesia (SSAI). The quality of the respiratory function system is measured using Peak Expiratory Flow Rate (PEFR). **Objective:** to validate the PEFR's differences in obese children before and after performing SSAI.

Methods: This research using one group pre-posttest experimental design with total sample of 20 obese children using purposive sampling method. The research instrument uses weight scale, height scale, and peak flow meter. SSAI was given to all subjects twice a week for six weeks. Paired T Test statistical analysis was used to examine the PEFR's differences before and after performing SSAI, considered significant if $p < 0.05$.

Results: The PEFR's mean of all subjects before performing SSAI was 258.25 ± 39.51 L/minute, while PEFR's mean after performing SSAI twice a week for 6 weeks was 282.50 ± 43.03 L/minute, ($p = 0.000$).

Conclusion: The PEFR's mean of obese children was increase significantly after performing SSAI twice a week for 6 weeks.

Keywords: Obesity, SSAI, PEFR

ABSTRAK

Latar Belakang: Akumulasi lemak berlebih pada anak obes menimbulkan permasalahan cukup kompleks pada sistem respirasi. Fungsi sistem respirasi dapat ditingkatkan dengan latihan fisik. Salah satu bentuk latihan fisik yang ramah bagi anak-anak adalah Senam Sehat Anak Indonesia (SSAI). Kualitas fungsi sistem respirasi dapat dinilai menggunakan nilai Arus Puncak Ekspirasi (APE). **Tujuan:** Membuktikan perbedaan nilai APE sebelum dan sesudah melakukan SSAI pada anak obes.

Metode: Penelitian ini menggunakan desain eksperimental *one group pre post-test* dengan sampel sebanyak 20 anak obes dengan purposive sampling. Instrument penelitian menggunakan timbangan berat badan, pengukur tinggi badan, dan *peak flow meter*. Subjek penelitian melakukan SSAI dua kali dalam seminggu selama enam minggu. Analisis hipotesis menggunakan pair T Test, signifikan apabila $p < 0,05$.

Hasil: Rerata nilai APE subjek penelitian sebelum melakukan SSAI sebesar $258,25 \pm 39,51$ L/menit. Setelah melakukan SSAI dua kali dalam seminggu selama enam minggu, rerata nilai APE menjadi $282,50 \pm 43,03$ L/menit, ($p = 0,000$).

Kesimpulan: Nilai APE pada anak obes meningkat setelah melakukan SSAI dua kali dalam seminggu selama enam minggu.

Kata Kunci: Obesitas, SSAI, APE.

INTRODUCTION

Obesity, considered as a health problems in Indonesia due to its increasing number, and therefore need to be treated. Obesity is condition with excessive fat accumulation with Body Mass Index (BMI) score reaches 30 or more (World Health Organization, 2019a). To determine whether a child is obese or not, can be measured using relative body weight (RBW). Relative body weight is the result of comparison between actual weight and ideal weight that can be determined by CDC's stature-for-age and Weight-for-age graph then showed as a percentage. The children are said to be

obese if RBW score reaches more than 120% (Salbe et al., 2002; O'Neill et al., 2007). In addition, based on NCD Risk Factor Collaboration, 12 out of 100 children aged 5-19 years old in Indonesia are obese in 2016 (NCD Risk Factor Collaboration, 2016). World Health Organization (WHO) said that obesity called as global epidemic because it becomes world health problem, including Indonesia (World Health Organization, 2019b).

Obese children tend to have many health problems that can decrease quality of life, one of them is respiratory problems (Direktorat Bina Gizi

dan Kesehatan Ibu dan Anak, 2011). Excess fat accumulation increase the workload of respiratory muscles and increase the airway resistance, thus has negative impact in respiratory function, such as pulmonary disorders. Pulmonary disorders can be identified by pulmonary function examination. One parameter used for assessing quality of pulmonary function is peak expiratory flow rate (PEFR). Peak expiratory flow rate will be lower in people with higher BMI score, due to its high airway resistance and less maximal work of the respiratory muscle. Treatment for better PEFR is needed in children with obesity, in order to optimize the lung function (Gundogdu and Eryilmaz, 2011; Jena et al., 2017).

Exercise improve lung function by increasing respiratory muscle strength and decrease airway resistance (Chaitra B and Maitri, 2011). One exercise that can be performed easily by children is a fun aerobic exercise; so called Senam Sehat Anak Indonesia (SSAI). Senam Sehat Anak Indonesia is gymnastic model created in 2015 for elementary and junior high school age children, and also has reviewed by The National Sports Research Centre of The Indonesian Youth and Sports Ministry (Pemerintah Kabupaten Wonosobo, 2016). This gymnastics type is short-term light-to-moderate submaximal aerobic exercise accompanied by cheerful song, considered as a suitable aerobic exercise for obese children. However, the effect of SSAI on improving PEFR in children with obesity remain unclear, therefore need to be elucidated. The objective of this study is to evaluate the effect of SSAI on improvement of PEFR in children with obesity.

METHODS

Samples and Variables

In this one group pre-posttest experimental design, 20 obese children was recruited. SSAI was given twice a week for 6 weeks. Purposive sampling method was applied. The inclusion and exclusion criterias were:

- a. Inclusion criterias: (1) Children with range of age 8-12 years old and RBW score more than 120%. Relative body weight (RBW) is the result of comparison between actual weight and ideal weight according to CDC's stature-for-age and weight-for-age graph then showed as a percentage, (2) Willing and get permission from parents who are required by signature on the informed consent paper sheet, (3) Physically fit to do exercise based on Children's PAR-Q Screening Form.
- b. Exclusion criterias: (1) Having respiratory disease history, (2) Having cardiovascular disease history,

(3) Having movement disorders.

- c. Drop out criteria: (1) Not performing SSAI 3 times in a row from the total number of gymnastic, (2) Performing SSAI less than 10 times.

This study has received the ethical clearance from Health Research Ethics Commission (KEPK) of Medical Faculty of Diponegoro University Semarang-Dr. Kariadi Hospital with the number 135/EC/KEPK/FK-UNDIP/V/2019. The researcher has also asked the informed consent to the subjects's parent before the research is carried out.

Senam Sehat Anak Indonesia (SSAI)

Senam Sehat Anak Indonesia (SSAI) is an aerobic exercise accompanied by cheerful song to attract children's interest in performing the exercise (Irsyada, Setiawati and Hendrianingtyas, 2018). This gymnastic was introduced by The Education, Culture, Youth and Sports Department and became popular in 2015. SSAI has been evaluated by The National Sports Research Center of The Indonesian Youth and Sports Ministry (Pemerintah Kabupaten Wonosobo, 2016). This gymnastic is included in the category of short-term light to moderate-sub maximal aerobic exercise, and considered able to improve lung function. SSAI is also used to rehabilitate chronic obstructive pulmonary disorder/COPD and asthma patient, proven by an increase of PEFR, posture improvement, and increased fitness (Chaitra B and Maitri, 2011; Riyan, Setiawati and Hendrianingtyas, 2018). Senam Sehat Anak Indonesia was performed for twelve times (twice a week for 6 weeks).

PEFR Assessment

PEFR assessed using peak flow meter. Peak Expiratory Flow Rate (PEFR) percentage represents the value zone. Green zone (80-100%) indicates respiratory function is considered safe and low risk for breathing disorders. Yellow zone (50-79%) indicates respiratory function needs caution, because worsening sign of airway found and the subjects may experience shortness of breathing and wheezing. While red zone (<50%) indicates warning sign of airway that requires immediate treatment to save the airway from obstruction (Adeniyi and Erhabor, 2011; The American Academy of Allergy Asthma & Immunology, 2019).

Research subjects instructed to do PEFR assessment 3 times each session, and the highest score will be taken. First PEFR assessment session was done before first SSAI was given and last PEFR assessment session was done after 12th SSAI was given.

Table 1. Subjects Characteristics

Characteristic	N=20 Mean ± SD
Age	9.05 ± 0.69
Height (cm)	138.65 ± 7.08
Weight (kg)	48.28 ± 6.56
RBW Percentage (%)	148.04 ± 19.74
Pretest PEFR (L/min)	258.25 ± 39.51
80-100 (green zone)	12 (60 %)
50-79 (yellow zone)	8 (40 %)

Table 2. Result of Pretest and Posttest PEFR Assessment

Assessment	Pretest	Posttest	P (paired t test)
PEFR (L/Minute)	258.25±39.51	282.50 ± 43.03	0.000
Percentage (%)	87.03 ± 14.13	95.06 ± 14.71	0.000
80-100 (green zone)	12 (60 %)	18 (90%)	
50-79 (yellow zone)	8 (40 %)	2 (10%)	

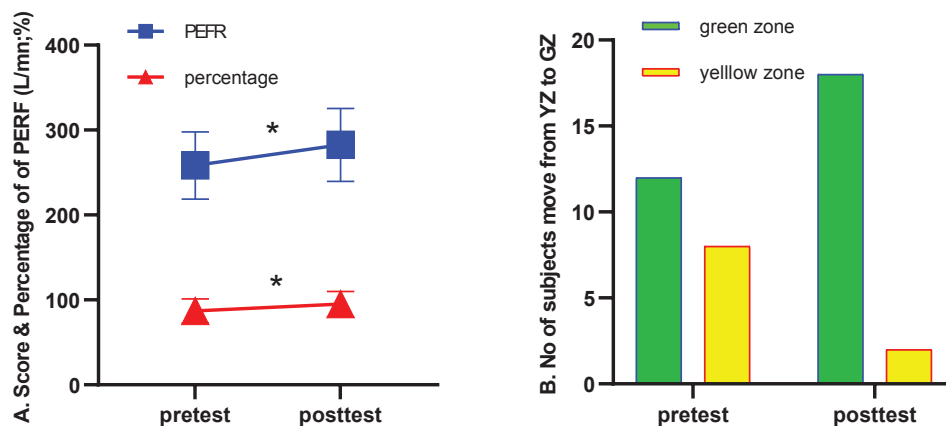


Figure 1. A. The difference score of PEFR in pretest and posttest; B the difference PEFR percentage in pretest and posttest. Paired t test: * p<0.05

Data Analysis

PEFR data will be stated as mean and standard deviation, and were put under Shapiro-Wilk normality test. Paired T Test analysis was adopted to asses hypothesis for normal distribution data. Data analysis was performed with a computer program. The differences will be considered significance if p<0.05.

RESULTS

Characteristics of the 20 subjects who were involved in this study indicated that entire they were including in obesity, because their RBM higher than 120% as listed on the table 1.

The baseline data indicated that entire subject was involved in the study, in addition to obese, they

were also possess PEFR 285.25 L/min and 60% of them was in green zone and 40% in yellow zone. After performing SSAI exercise twice a week for 6 weeks (twelve times), PEFR and its percentage is shown in table 2.

PEFR score was improved significantly from 258.25 in pretest, to 282.50 in posttest, p<0.05. Its percentage also increase significantly from 87.03% in pretest, to 95.06% in posttest, p<0.05 (figure 1A). In line with PEFR, the number of subjects in green zone was also increased, from 12 to 18 children in posttest. In contrast, number of subjects in yellow green of pretest was decrease, from 8 to 2 subjects in posttest (figure 1B). It was showed that performing SSAI, able to improve PEFR score in obese children.

DISCUSSIONS

Twenty obese children, after performing SSAI twice a week for 6 weeks (twelve times), show an improvement on PEFR score and percentage. The results is in accordance with the hypothesis stated that there is an improvement on PEFR score of obese children after performing SSAI. The increase of PEFR score is affected by several factors, such as decreased airway resistance, increased strength and endurance of respiratory muscle, and increased of lung elasticity/ lung recoil (Chaitra B and Maitri, 2011; Strasser, 2013; Wicaksono, Setiawati and Margawati, 2016).

Children who performed SSAI is also performing a rhythmic and regular warming up, stretching, core exercises, and also cooling down movement. Based on Strasser et al., (2013) exercise that involves regular muscle movements can decrease visceral fat accumulation in the muscles and airway of obese people (Strasser, 2013). The total energy usage is increase during the exercise, hence the visceral fat tissue is unloaded. Therefore exercise with rhythmic and regular movements that routinely carried out in obese people can decrease airway resistance and strengthen respiratory muscles (Chaitra B and Maitri, 2011).

Airway in obese people tends to be narrower than people with normal BMI score. Inflammation mediators accumulation, associated with excess fat around the respiratory tract, thus the higher BMI score in obese people, the higher the airway resistance. Senam Sehat Anak Indonesia (SSAI), performed in obese children in this research, is an aerobic exercise. A routine aerobic exercise increases epinephrine. Hewitt et al., stated that epinephrine known as a hormone able to dilate bronchus. Obese people whom doing aerobic exercise routinely, is thought to have maximum inspiration volume capacity, and maximum airflow to the lung (Hewitt et al., 2010; Bora, Sudhir and Swamy, 2017).

Senam Sehat Anak Indonesia is light-to-moderate submaximal aerobic gymnastic type. Aerobic exercise with light to moderate intensity movements require the combination of muscle strength and endurance in order to be able to do various movements, such as stretching and relaxing regularly, hence chest wall muscle and diaphragm. During exercise, respiratory rate increases to fulfill oxygen demand and metabolic needs. SSAI improve PEFR in obese children by increasing the strength and endurance of respiratory muscle, improve lung expansion, optimize oxygen volume, and also decrease airway resistance (Riyan, Setiawati and Hendrianingtyas, 2018). Further research on the effect of SSAI to PEFR in obese children with a larger sample size is needed. Control group is also needed to validate

the differences between those who performed SSAI and those whose not. It is also necessary to measure bodyweight after performed SSAI twice a week for six weeks.

CONCLUSIONS

The PEFR's mean of obese children was increase significantly after performing SSAI twice a week for 6 weeks.

CONFLICT OF INTEREST

There are no conflicts of interest.

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