

Rhythmic gymnastics intervention to reduce body mass index of school-age children with obesity and low physical activity

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ABSTRACT

Obesity is a widespread health concern, prevalent in both developed and developing countries. Among school-age children, obesity can lead to health problems and increase the risk of disability in adulthood. A sedentary lifestyle is a significant contributor to poor health and fitness, and consequently, it may elevate the risk of obesity. To address this issue, rhythmic gymnastics has emerged as a potential method for managing weight and reducing body mass index. The purpose of this study was to investigate the efficacy of rhythmic gymnastics intervention in reducing body mass index among school-age children with low physical activity levels. The intervention was carried out three times a week, and results after four weeks revealed that managed patients lost 1.7 kg of weight with a decrease in body mass index (BMI) of 0.60 SD, while resumed patients lost 2 kg with a decrease in BMI of 0.59. These findings indicate that rhythmic gymnastics intervention can be effective in reducing body mass index in school-age children.

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1. INTRODUCTION

World health organization (WHO) states that there are non-communicable disease problems that include coronary heart disease, cancer, diabetes mellitus, hypertension, and chronic lung disease [1]–[4]. Non-communicable diseases (NCDs) are not transmitted from person to person through the infection process. Obesity is one of the causes of non-communicable diseases which is a global issue and can cause death in the world. Obesity as a risk factor is dangerous and triggers the occurrence of NCD, especially in children with obesity resembling a lipid profile in heart disease and at risk of developing hypertension. Indonesia Ministry of Health states that school-age children who are overweight and obese include health problems that affect health conditions as adults and are risk factors for NCD such as cardiovascular disorders, cancer, osteoarthritis, growth disorders in the legs, diabetes mellitus, sleep disorders, sleep apnea which is included in metabolic and degenerative diseases.

The organisation for economic cooperation and development states that one in six children worldwide is obese. The UK is declared the number one country on the European continent which has the most cases of obese children with a prevalence of 36%, followed by Spain at 27% with cases of children with obesity [5]–[7]. This information is also supported by the WHO statement, that obesity is ranked fifth in giving the risk of death. Annually there are approximately 2.8 million people die. When it is compared with being underweight, the higher death risk is in people with obesity. Data shows that the number of children aged over five years is overweight and is estimated to be more than 42 millions [5]–[7].

Approximately 35 million of them are children with more body weight distributed in developing countries. Indonesia is a developing country so it is a country with a fairly high level of childhood obesity. Based on National Riskesdas data in 2018, the problem of obesity in school-age children is still high at 18.8%, consisting of 10.8% obese and 9.2% very obese. The lowest obesity prevalence was in East Nusa Tenggara, Indonesia (8.7%) and the highest in Papua, Indonesia (13.2%). A fairly high prevalence also occurs with an obesity prevalence of 9.6% in the province of West Java. In addition, the percentage of obese children aged 5-12 in Depok City was 16% [8]–[10].

Nutritional intake of school-age children is important in preparing themselves for growth at the adolescent stage. The period of school-age children is referred to as the latent period where in this period of children's growth is relatively stable and not as fast as growth adolescence but what must be considered is the fulfillment of child's nutrition [11], [12]. During the period of growth and development, children are often attacked by several diseases, especially infectious diseases, chronic infectious diseases, injuries or accidents, and nutritional problems [13].

The nutritional status of children can be determined by their body mass index (BMI), which may indicate whether their BMI is above or below the average for their age group. BMI is an essential factor that may influence a child's physical health in the future [14], [15]. and it can also signify the risk of developing diseases associated with overweight in children. If a child's BMI falls within 1 to 2 standard deviations above their age-specific BMI, they may be categorized as overweight [16], [17]. According to the Ministry of Health of the Republic of Indonesia [8]–[10] a sedentary lifestyle is one of the contributing factors leading to overweight and obesity among school children. Few play facilities and lack of facilities for physical activities cause children to prefer playing indoors [18]. In addition, rapid technological advances in the form of electronic devices such as online games, playStations, television, and computers cause children to be lazy to do physical activities.

Obesity is influenced by many factors, including genetic factors and environmental factors. Obesity is not only influenced by exposure to information, knowledge, and attitudes of children, but also needs to be supported by other environmental factors, such as parents, peers, and schools [19], [20]. One of the efforts to overcome obese children is to do physical activity that is appropriate for age, motoric development, and children's abilities, for example, cycling, swimming, dance, and exercise at least twice a week for 20 to 30 minutes [21]. Physical activity makes the body fit so that the ideal body weight is achieved, and reduces obesity [22], [23]. Rhythmic gymnastics as a program Improving student health has advantages over other sports activities, especially for school-age children, among others can improve organ function, honesty, and competitiveness. Purwanto [24] states that rhythmic gymnastics has benefits, namely improving heart function, burning excess fat in the body and perfecting the muscles of the thighs, arms, waist, abdomen, and chest.

This study aimed to reduce and evaluate a body mass index of school-age children with low physical activity problem using rhythmic gymnastics intervention. The intervention was carried out 3 times a week for managed patients and resumed patients. This study is conducted in RT 01 RW 04 Sukamajubaru, Tapos, Depok. The study was evaluated by measuring weight and height. The result is then Entered into the BMI/U formula by the Child anthropometric standards in the minister of health of the republic of Indonesia number 2 of 2020, the results obtained from five school-age children measured that one child was overweight and one child was obese.

2. RESEARCH METHOD

The research design used a descriptive case study. This research utilized school-age children. One child was overweight, and one child was obese. This sample is adequate because this research is not running compassion or correlation analyses. Therefore, a very small sample is possible. Several similar research were proposed by [25]–[27]. The research instrument used the standard operating procedure (SOP) for rhythmic gymnastics, an assessment sheet containing measurements of height using a microtoice and weight using a scale then calculating the Z-Score according to the age and sex of the child based on the anthropometric standard of children by the Minister of Health of the Republic of Indonesia Number 2 of 2020 and an evaluation sheet rhythmic activity.

The data that have been found during the assessment are grouped and analyzed based on subjective and objective data so that nursing diagnoses can be formulated, then develop plans or nursing interventions, and carry out nursing implementation and evaluations on managed patients and resumes. The rhythmic gymnastics innovation intervention was carried out three times a week for four weeks so that a total of 12 times with a duration of ± 30 minutes of exercise. Researchers also monitored the patient's condition before, during and after doing rhythmic gymnastics and took measurements of children's height and weight before and after doing rhythmic gymnastics. Moreover, the intervention was carried out on school-age children with overweight and obesity living in Kp. Sindangkarsa RT01/RW04 Sukamajubaru Village, Tapos District, Depok City,

Indonesia. The study was approved by the ethical committee of the Faculty of Health, Universitas Pembangunan Nasional Veteran Jakarta with (No etik: 320/VI/2022/KEPK).

3. RESULTS AND DISCUSSION

Table 1 show a height and weight evaluation of An. S with a diagnosis of obesity. Moreover, Table 2 shows An. R data with a diagnosis of overweight. The general goal of the first intervention, namely obesity and overweight can be overcome, which is characterized by weight loss and improvement of BMI [28]. The number of patients in this study was two people with a patient being managed, namely An. S and a patient resume, namely An. R The implementation provided is in the form of health education about overweight and obesity as well as rhythmic gymnastics. The provision of health education related to overweight and obesity includes the understanding of overweight and obesity, the causes and signs of overweight and obesity as well as knowing how to assess a child's BMI calculated by BMI/U and Z-Score in children aged 5-18 years adjusted to age and gender, how to deal with overweight and obesity and the impact of obesity on health.

Table 1. Height and weight evaluation of An. S

Week	An. S patients			
	1	2	3	4
Height and weight before intervention	height=150 cm weight=60 kg	height=151 cm weight=59.6 kg	height=152 cm weight=59.1 kg	height=152 cm weight=58.5 kg
Height and weight after intervention	height=151 cm weight=59.7 kg	height=151 cm weight=59.2 kg	height=152 cm weight=58.6 kg	height=152 cm weight=58.3 kg
Total weight loss	Weight loss=1.7 kg			

The results of the implementation showed that An.S and An. R was able to re-explain the meaning of overweight and obesity, the causes and signs of overweight and obesity as well as how to assess the BMI of school-age children, how to overcome overweight and obesity and the impact of obesity on health. The results of the research by Asnidar *et al.* [29] show that the provision of health education can reduce a child's BMI because the knowledge possessed by the child will affect his confidence in his abilities. in changing attitudes and behavior, especially the food intake.

Table 2. Height and weight evaluation An. R

Week	An. R patient			
	1	2	3	4
Height and weight before intervention	Height=150 cm Weight=47 kg	Height=151 cm Weight=46.6 kg	Height=151 cm Weight=46 kg	Height=152 cm Weight=45.6 kg
Height and weight after intervention	Height=150 cm Weight=46.6 kg	Height=151 cm Weight=46 kg	Height=151 cm Weight=45.6 kg	Height=152 cm Weight=45 kg
Total weight loss	Weight loss=2 kg			

Moreover, Figures 1(a) and (b) show weight evaluation and trend of patient An. S and patient An. R, respectively. Then, the next interventions provided is rhythmic gymnastics. The intervention was carried out on two patients, both managed patients and resume patients. Rhythmic gymnastics intervention starts by providing clients with information related to the goals, benefits and steps of rhythmic gymnastics. Rhythmic gymnastics is also defined as an activity that is very fun and suitable to be applied to children because most children like to do activities accompanied by songs. Rhythmic gymnastics can be done individually or in groups.

In children, this gymnastics can be combined with easy movements and accompanied by happy music. Gymnastic movements performed on An. S and An. R is adapted to the lyrics of the song produced by The Ministry of Education and Culture's. The rhythmic gymnastics movement starts from the warm-up, core, and cooling movements. The intervention was performed on An. S and A. R are three times a week for four weeks which are routinely carried out on Tuesdays, Thursdays, and Saturdays so that the total implementation of rhythmic gymnastics on clients is 12 times or exercises. Research by Yudho *et al.* [30] revealed that effective gymnastics exercises were carried out three times a week in 12 sessions conducted on children with an age range of 10 to 12 years. Regular exercise increases physical activity and children's health [31].

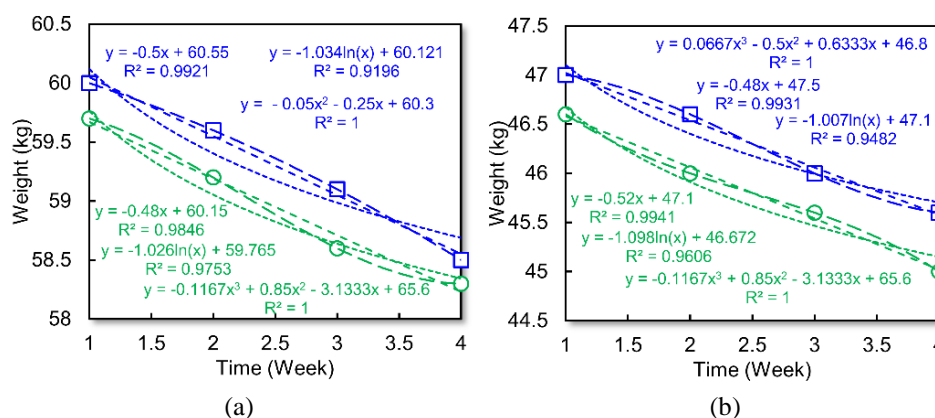


Figure 1. Weight evaluation and trend of (a) patient An. S, (b) patient An. R

Table 3 and Table 4 show BMI evaluation of An. S patient and An. R patient, respectively. For additional explanation, a research conducted by Prakoso *et al.* [32] related to the effect of exercise on weight loss, showed that exercise was proven to reduce body weight by 66.78%, percent body fat by 86.42%, and cholesterol levels by 27.67%. The same is the case with the time the author did to An. S and An. R is for 12 meetings, where initially there was no sport because the school was still online, so during the intervention there was an increase in physical activity in children. Age of An. S 10 years and age An. R 11 years where both patients are included in the category of school-age children. conducted a study which that stated that physical activity carried out by children aged 10 to 12 years affected on the process of growth and development as well as the motor skills of a child. As a child's nerves and brain mature, so do his motor skills, so all simple movements are the result of interwoven patterns of interaction from various parts of the body which are controlled by the brain.

Table 3. BMI evaluation An. S

Week	An. S patient			
	1	2	3	4
BMI before intervention	BMI= +4.57 SD.	BMI= +4.33 SD	BMI= +4.13 SD	BMI= +4.01 SD.
BMI after Intervention	BMI= +4.35 SD.	BMI= +4.25 SD	BMI= +4.03 SD.	BMI= +3.97 SD
Total weight loss	BMI=0.60 SD			

In doing rhythmic gymnastics An. S and An. R seemed happy to follow each step of the movement and did well because the movements were simple according to the lyrics of the song and easy to understand. Rhythmic gymnastics accompanied by happy songs will make children feel happy and children are more motivated to be involved in direct learning of doing gymnastics [23]. Gymnastics is an inexpensive sport, easy to do both individually and in groups and very popular among children to the elderly [31].

Table 4. BMI evaluation An. R

Week	An. R patient			
	1	2	3	4
BMI before intervention	BMI=+1.71SD	BMI= + 1.53 SD	BMI= + 1.39 SD	BMI= + 1.23 SD
BMI after Intervention	BMI=+ 1.64 SD	BMI=+ 1.39 SD	BMI=+ 1.31 SD.	BMI=+ 1.12 SD
Total weight loss	BMI= 0.59 SD			

Table 4 shows the distribution of rhythmic exercise intervention evaluations in managed patients and resumed patients. In the managed patient, namely An. S. Based on the results in the table, show that An. S's body weight before doing rhythmic gymnastics intervention was 60 kg and An. S's body weight after doing rhythmic gymnastics decreased to 58.3 kg. So it can be concluded that An. S experienced a weight loss of 1.7 kg. In addition to BMI An. S also decreased by 0.60 standard deviation (SD) after performing rhythmic gymnastics intervention 12 times in four weeks. In the patient's resume, namely An. R. based on the results in the table, it shows that An. R weight before doing rhythmic gymnastics intervention was 47 kg and An. S

weight after doing rhythmic gymnastics decreased to 45 kg. So it can be concluded that An. R experienced a change in body weight in the form of a weight loss of 2 kg, in addition to BMI An. R also decreased by 0.59 SD after performing rhythmic gymnastics intervention 12 times in four weeks. Thus it can be concluded that rhythmic gymnastics can reduce body weight as well as body mass index in An. S and An. R. Moreover, Figures 2(a) and (b) show BMI trend of patient an. S and patient an R, respectively.

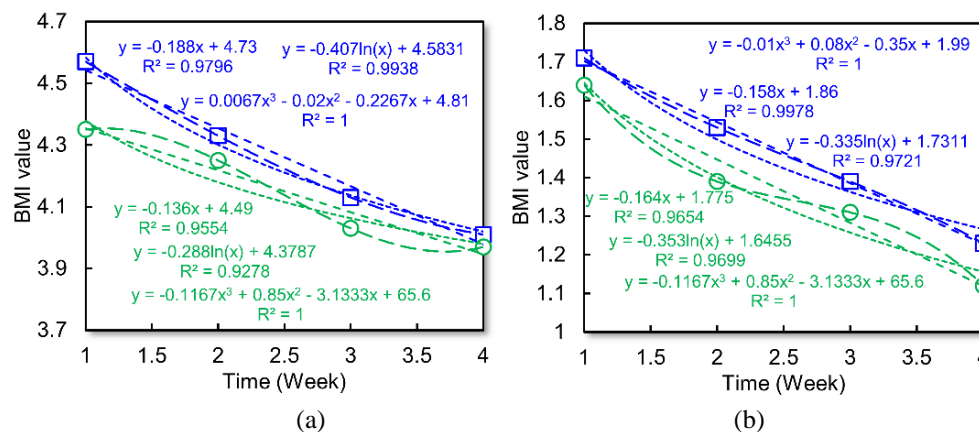


Figure 2. BMI trend of (a) patient An. S, (b) patient An. R

In line with research of rhythmic gymnastics training on the reduction of body mass index (BMI) in RA Muslimat Tarbiyatunnasi'in students, Paculgowang Diwek Jombang. The study obtained results indicating that rhythmic gymnastics had a significant effect on the reduction of BMI in students, with $p=0.000$ ($p<0.05$) [33]. Another study [34] examined the effect of gymnastics on weight loss in obese children. The study included an intervention group and a control group, with the latter not receiving gymnastics intervention. The results showed that the intervention group had significant weight loss, whereas the control group did not experience any effect on weight loss.

This is different from the research conducted by Noyes and Barber-Westin [35] that the combined intervention is diet and exercise counseling (gymnastics and running) which is carried out on children aged 9-10 years, after doing exercise for three times a duration of 45 minutes per week. For 8 weeks, the average BMI decreased by 0.6 kg/m² and the average level of physical fitness increased by 1.66 ml/kg/minute. A different study was also conducted by Hadi *et al.* [36] regarding the effect of exercise on body fat percentage which states that there is a decrease in the percentage of body fat after routine exercise and is quite effective in burning body fat and in losing weight. In the table of evaluation results of weight loss and body mass index of patients managed and resumed, it was found that there was a difference in weight loss between An. S with An. R was on An. S lost 1.7 kg in weight while An. R by 2 kg.

This can be seen at the time of implementation that An. S is less active in doing movements because his body condition is heavier than An. R. Physical activity has a significant impact on weight stability. Physical activity that is done regularly causes more calorie-burning [37]. There are other differences regarding An. S diet and behavior. An. S and An. R. although overall eating behavior between An. S and An. R are almost the same, namely, they like to eat fast food, sweet foods, often snack and snack, but after studying An. S eating pattern, they eat heavily more than 3 times a day and do not like to eat vegetables. An. R eat heavily 3 times a day. Research by [38], [39] states that obese people tend to have excessive eating habits. The obese child will eat when he feels like eating, not when they are hungry because usually, the child is more responsive to external hunger cues. This excessive eating pattern makes it difficult to overcome excess weight if they do not take care of themselves and have a strong determination to lose weight.

Demir and Özcan [40] found that there was a relationship between feeding patterns and parenting patterns on the incidence of obesity in children. This is also associated with the impact of parenting on the satiety response of children when given food, so that the lower the child's satiety response, the higher the risk of obesity in children. In line with this study stated that there was a relationship between diet and the incidence of overweight in SMA Negeri 5 Surabaya students [41], [42]. The data was obtained based on the results of research on respondents with a pattern of overeating 2.6 times as high as risk of being overweight than respondents with a pattern of eating enough and less. A similar study was also conducted by Rofieq [43] the OR value of 0.625 means that children with heavy eating habits more than three times per day are at risk of 0.625 times as high as obesity than children who have the habit of eating less than three times per day. Most

children's lives are in the school environment or playing with their peers. Sometimes children trust their peers more than their parents, thus affecting their diet, physical activity, and lifestyle [44]. Research by [45] shows that gymnastics can improve fitness. It was proven after the implementation of rhythm exercise An. S and An. R said his body became healthier and less tired. In addition to improving physical fitness and keeping the body healthy school-age children can learn and play without complaining of excessive fatigue [46].

This is also in line with that rhythmic activities such as rhythmic gymnastics as easy and inexpensive activity have been shown to contribute significantly to maintaining a person's body mass index and fitness condition [47]. A similar study was also conducted by regarding the role of rhythmic gymnastics on the physical fitness of elementary school students where the physical fitness of elementary school students in Ciakar, Tangerang Regency after being given rhythmic gymnastics intervention, increased with a result of 54.98% which means rhythmic gymnastics [46]. Several limitations to this research, such as the low possibility of generalizability. The findings from a descriptive case study may not be generalizable to other individuals or groups because they are based on a single case or a small sample size. Then, these studies require significant time and resources to conduct, which can limit the number of cases that can be studied and the generalizability of the findings. However, despite these limitations, descriptive case studies can still provide valuable insights into complex phenomena and can effectively generate hypotheses and explore new research areas.

4. CONCLUSION

As a conclusion, rhythmic gymnastics is an effective method for managing overweight and obesity, which can lead to a reduction in body weight and body mass index (BMI). The intervention involved three sessions per week for both managed and resumed patients. Moreover, the findings from a descriptive case study may not be generalizable to other individuals or groups because they are based on a single case or a small sample size. Then, these studies require significant time and resources to conduct, which can limit the number of cases that can be studied and the generalizability of the findings. Finally, these findings suggest that rhythmic gymnastics intervention can effectively reduce the body mass index of school-age children.

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