

**Nutrition Education on Sedentary Activity for Adolescent****Hurry Mega Insani^{1*}, Lilik Kustiyah², Cesilia Meti Dwiriani², Ayu Mutiara Santanu¹**¹Program Studi Gizi, Fakultas Pendidikan Olahraga dan Kesehatan, Universitas Pendidikan Indonesia, Indonesia²Ilmu Gizi, Fakultas Ekologi Manusia, Institut Pertanian Bogor, Bogor, Indonesia**Article Info***Article History :**Received December 2020**Revised December 2020**Accepted January 2021**Available online April 2021**Keywords :**nutrition education, screen time, sedentary activity***Abstract**

Adolescents are prone to nutrition problems, such as the lack of nutrition, overweight, and obesity caused by sedentary behaviours. Adolescents' activities are influenced by their surrounding environment, such as family, friends, and the duration of gadget use. Nutrition Education is a method to help increasing the adolescent's knowledge about the importance of increasing physical activity and the consequence of sedentary behaviours for adolescents. Knowing the most effective method was the purpose of the study. This study used a quasi-experimental method with control group pre-test post-test design. The study was carried on three groups of adolescents, namely the lecture group, website group, and control group, for two months on school days. The instrument used was ASAQ (Adolescents Sedentary Activity Questionnaire) analysed by one-way ANOVA. The subjects of this study were adolescents aged 15-16 years old in Bandung. This study used purposive sampling to select the subjects. The results showed that Nutrition Education using the interpersonal lecture method could increase 23.7 points of adolescent knowledge compared to Nutrition Education using the website method (6.2 points). Nutrition Education could increase the adolescent's knowledge but it did not have a significant effect on adolescent's physical activities on school days. Some activities of the adolescents were quite high, especially the learning activities of the lecture group (471.7 ± 53.5) and the website group (471.7 ± 53.5). The sleep activity also increased significantly in the lecture group ($p = 0.040$), website group ($p = 0.003$), and control group ($p = 0.015$). Meanwhile, the screen time activity decreased significantly ($p = 0.011$) in the lecture group due to various factors. Further research related to the factors affecting the duration of adolescent's screen time on school days needs to be conducted.

INTRODUCTION

Adolescence (aged 11-21 years) is a period of deep biological, emotional, social, and cognitive changes from childhood to adulthood (Brown 2011). Adolescent nutritional needs are influenced by psychological and social factors, hence cases of adolescents experiencing nutritional problems are often found (Susetyowati et al. 2017). WHO says that more than 1.9 billion adults, 18 years and older, were overweight in 2016. Over 650 million of them were obese. 39% of adults, aged 18 years and over, were overweight, while 13% of them were obese. The worldwide prevalence of obesity nearly tripled from 1975 to 2016. The prevalence of overweight and obesity among children and adolescents aged 5-19 had risen dramatically from 4% in 1975 to over 18% in 2016. The rise occurred similarly among both boys and girls. In 2016, 18% of girls and 19% of boys were overweight. While only under 1% of children and adolescents aged 5-19 years were obese in 1975, more than 124 million children and adolescents (6% of girls and 8% of boys) were obese in 2016. Over 340 million children and adolescents, aged 5-19, were overweight or obese in 2016 (WHO 2016). The substantial increase in childhood overweight and obesity poses a major public health problem worldwide (Lobstein, 2015). The increase in childhood overweight and obesity is a public health concern in developed countries (Kuk, 2006). Weight problems in childhood and adolescence are common in Western countries with overweight rates estimated at 17-25% in West-Europe, Australia, and the United States (Olds, 2010). In 2013, approximately 23.0% and 14.0% of Chinese boys and girls aged 2–19 years were overweight or obese (Ng M, 2014).

One of the nutritional problems in adolescents, with a high prevalence and continues increase in Indonesia every year, is obesity and overweight. The case of overweight in adolescents aged 10-18 years in Indonesia had increased 5.9% or five times in the last three years from 2010 (1.4%) to 2013 (7.3%) (Kementerian Kesehatan RI 2013). Central obesity in adolescents continued to increase every year until reaching 31.0% in 2018 (Kementerian Kesehatan RI 2018). Based on the 2018 Basic Health Research data, the prevalence of obesity in Indonesia, over the age of 18, was around 21.8%. The highest prevalence was found in North Sulawesi (30.2%), DKI Jakarta (29.8%), East Kalimantan

(28.7%), West Papua (26.4%), Riau Islands (26.2%), and followed by other provinces. This data tended to increase from 10.5% in 2007 to 11.5% in 2013 and increased to 21.8% in 2018. (Kementerian Kesehatan RI 2018). Main Results of the Ministry of Health Basic Health Research in 2018 showed that the obesity rate had increased compared to the previous year data. The Basic Health Research data is made every 5 years. In Basic Health Research 2018, the proportion of overweight and obesity in adults, aged over 18 years from 2007 to 2018, was 8.6% in 2007, which increased to 11.5% in 2013 and 13.6% in 2018. Meanwhile, the number of obesity in 2007 was 10.5%, which increased to 14.8% in 2013 and 21.8% in 2018. The indicator of an adult overweight is the Body Mass Index (BMI) which is more than or equal to 25.0 to 27.0.

The United States Department of Health and General Surgery has made recommendations of physical activity for health; Each individual, whether overweight or not, needs to accumulate moderate physical activity for 30 minutes per day with brisk walking approximately five days per week (Carr and Descheemaeker 2002). However, due to the high case of obesity in 2002, American and Canadian scientists from the Institute of Medicine of the National Academy of Scientists increased their recommended time for physical activity to 60 minutes per day. Adolescents who do physical activity for 60 minutes or more per day will have a well and happy development and participate in various kinds of activities (Strong et al. 2005). Walking, reducing television viewing, and engaging in active hobbies, such as gardening, can increase energy expenditure.

The physical activity of adolescents in Indonesia is still quite low. The Indonesian Ministry of Health (2018) stated that more than 33.5% of adolescents aged over 15 in West Java have a low level of physical activity. A study revealed that physical activity in urban areas is very low (51.6%), which becomes the cause of the increasing prevalence of overweight and obesity in adolescents (Rizkiriani, 2014). Research from different researchers mention that the associated health risks and health care costs of childhood and adolescent obesity are considerable, the consequences include metabolic disorders, early puberty and menarche in girls, type 2 diabetes, hypertension, sleep apnea, adulthood obesity, and higher rates of mortality in young adults (Zheng, Biro, Arens, 2010). Overweight and obesity have a risk

of developing diabetes (44%), ischemic heart disease (23%), and cancer (7-41%) (Pedum Gentas Kemenkes RI, 2016).

Physical activity is recognized as a positive outcome of physical and mental health, social and cognitive well-being, and good academic performance (Matiba 2015). Individuals who exercise and eat healthy foods have the opportunity to live a healthy lifestyle and reduce the risk of developing diseases, such as diabetes mellitus 2, depression, and cardiovascular diseases related to the lack of physical activity and lifestyle choices (Matiba 2015). The amount of physical activity taken by individual is related to the quality of health and life rate; the severity of physical activity has a greater effect on bone mass in childhood and adolescence compared to adults (Muros et al. 2016; Edelstein 2015). Physical activity plays an important role in preventing overweight and obesity in young people. Adolescence is a particularly vulnerable time for the development of obesity because of the decrease of physical activity levels (Daniels, 2006). For that reason, overweight adolescents have a higher risk of becoming overweight adults (Diets, 2004). Thus, engaging young people in physical activity remains a behavioural target for obesity prevention.

Studies show that a person usually spends 9.5 hours/day doing sedentary activities (Bankoski et al. 2011). The examples of sedentary activities include watching television, playing gadgets, playing games or computers, sitting around, and chatting (Guimaraes et al. 2012). Gadgets, such as smartphones, are tools used for communication, learning, and entertainment which are mostly owned by adolescents. Excessive smartphone use can affect the duration of physical activity of adolescents (Lepp et al 2013). Excessive sedentary activities and passive behavior will lead to overweight and obesity in adolescents. Sedentary behavior and the increasing incidence of obesity should be taken into account to reduce the prevalence and morbidity due to obesity.

Nutrition education is an effort that can be taken to reduce sedentary activities and the prevalence of obesity in adolescents. Nutrition education for adolescents is an effort to educate adolescents to behave in accordance with nutritional principles (Emilia 2009). Nutrition education can be carried out using various methods, including the lecture method, discussion method, or

online method. Educational programs are obliged to change and modify factors related to unhealthy lifestyles, which focus on sports activities, health, nutrition, and development of special facilities for the selection of healthy lifestyle behaviors in adolescents (Golmakani et al. 2013). Health-related education programs need to be implemented to change and modify the factors associated with an unhealthy lifestyle that focuses on exercise, health, and nutrition (Golmakani et al. 2013). Mahan (2017) explains that the key to changing behavior and nutritional awareness is to show that change and motivation are needed for a better change. Sutrisno and Siswanto (2016) revealed that there are several factors influencing student learning outcomes, including how to convey the material, the methods used, and the tools.

This study was aimed at providing nutrition education as an effort to reduce the sedentary behaviour and prevalence of obesity in adolescents, as well as finding out a more effective method between lectures and online nutrition education through website to increase adolescent knowledge about nutrition education.

METHODS

Participants

This study used a quasi-experimental control group pre-post test design which was conducted in three different senior high schools in urban areas. This research was conducted for 6 weeks and had obtained Ethical Approval from the Research Ethics Commission involving Human Subjects, Bogor Agricultural University No. 040/IT3.KEPMSM-IPB/SK/2018. The subjects were determined using the minimum number of research samples of 30 people who can represent the population of the study (Cohen et al. 2007). Thus, for three treatment groups, a minimum sample size was 90 people.

The subjects of this study were high school students. This study used purposive sampling to select the subject. The inclusion criteria of the subjects were: (1) second grade high school students, (2) having a smartphone with a sufficient capacity to open a website, and (3) willing to participate in the research proven by signing an informed consent. The exclusion criteria of the subjects were: (1) rarely attending the school, (2) did not have a device/smartphone, and (3) participating

in other studies. Subjects in each school were chosen by randomizing the class.

Materials and Apparatus

Knowledge of nutrition and health was collected from a questionnaire. The subjects filled out the questionnaire guided by the researchers. Physical activity data were collected by interviewing the subjects using the activity questionnaire (ASAQ).

Procedures

Nutrition education was carried out by dividing the subjects into two treatment groups (lecture group and website group) and one control group. Nutrition education with the lecture method (group I) was conducted 6 times for 6 weeks. The lecture was held for 30 minutes followed by 30 minutes of discussion. Nutrition education using the website (group II) began with uploading nutrition education materials on the ipbnutrition.ipb.ac.id website. After received an explanation about how to use the website, the subjects studied the nutrition education material available on the website for six weeks. Subjects were asked to read the nutrition education material at least six times in six weeks. In the control group (group III), subjects received a leaflet containing nutrition education material every two weeks. The subjects had six weeks to study the material. Table 1 shows the implementation of nutrition education based on the type of treatment.

Data Analysis

The obtained data were processed and analyzed using Microsoft Excel 2010 and SPSS 16.0 software. Nutritional knowledge and physical activity data were presented descriptively. Difference tests were carried out using the oneway ANOVA test. Before analyzing the data, researchers used Wilcoxon test and One-sample Kolmogorov-smirnov test to see the normality and homogeneity of the data (Table 5). Researchers used paired t-test to see the difference before and after nutrition education was carried out.

RESULT

Balanced Nutrition Knowledge Level

Table 2 shows that, before nutrition education was carried out, more than half of the subjects in the control group (54.3%) and 48.5% of the subjects in the lecture group had low levels of nutritional knowledge. Meanwhile, more than half of the website group subjects (60.6%) had a sufficient level of knowledge.

After nutrition education was carried out, the knowledge of nutrition in the lecture group subjects (63.6%) increased significantly ($p < 0.05$) into the high (63.6%) and moderate (36.4%) categories. In the website group, the nutritional knowledge of the subjects increased significantly ($p < 0.05$). Most of them were in

Table 1. The Steps of Nutrition Education Implementation based on The Type of Treatment

Group type	1 st Week	2 nd Week	3 rd Week	4 th Week	5 th Week	6 th Week
Lecture group	<ul style="list-style-type: none"> • Pre-test • 1st Leaflet Distribution • Theory 1 	<ul style="list-style-type: none"> • Review • Quiz • Theory 1 	<ul style="list-style-type: none"> • 2nd Leaflet Distribution • Review • Quiz • Theory 2 	<ul style="list-style-type: none"> • Review • Quiz • Theory 2 	<ul style="list-style-type: none"> • 3rd Leaflet Distribution • Review • Quiz • Theory 3 	<ul style="list-style-type: none"> • Review • Quiz • Theory 3 • Post-test
Website group	<ul style="list-style-type: none"> • Pretest • Leaflet Distribution • Website Identification 	<ul style="list-style-type: none"> • Website monitoring 	<ul style="list-style-type: none"> • 2nd Leaflet Distribution • Website monitoring 	<ul style="list-style-type: none"> • Website monitoring 	<ul style="list-style-type: none"> • 3rd Leaflet Distribution • Website monitoring 	<ul style="list-style-type: none"> • Post-test
Control group	<ul style="list-style-type: none"> • Pretest • Leaflet • Distribution 	-	<ul style="list-style-type: none"> • 2nd Leaflet Distribution 	-	<ul style="list-style-type: none"> • 3rd Leaflet Distribution 	<ul style="list-style-type: none"> • Post-test

the moderate category (51.5%). More than half of the subjects in the control group (60.0%) had a sufficient nutritional knowledge, but it did not differ significantly. There was a significant change in nutritional knowledge in the lecture group after nutrition education, covering a value change (23.7) when compared to the website

group (6.2) and the control group (4.3).

Sedentary Activity

The results showed that the duration of sedentary activities of adolescents in this study were screen time, casual time, learning and doing homework, travel to

Table 2. Distribution of Subjects based on The Level of Nutritional Knowledge Before and After Nutrition Education

Nutrition Knowledge	Lecture	Website	Control	p value ¹
	n (%)	n (%)	n (%)	
Baseline	61.8 ± 10.2	69.0 ± 12.8	57.0 ± 15.1	0.001
Deficient	16 (48.5)	7 (21.2)	19 (54.3)	
Sufficient	15 (45.4)	20 (60.6)	14 (40.0)	
Superior	2 (6.1)	6 (18.2)	2 (5.7)	0.000
End line	85.5 ± 11.1	75.3 ± 13.1	61.3 ± 20.1	
Deficient	0 (0.0)	5 (15.2)	9 (25.7)	
Sufficient	12 (36.4)	17 (51.5)	21 (60.0)	0.000
Superior	21 (63.6)	11 (33.3)	5 (14.3)	
Transformation (Baseline-End line)	23.7	6.2	4.3	
p-value ²	0.000	0.024	0.130	

¹significant if p <0.05 with one-way ANOVA test among lecture, website, and control groups

²significant if p <0.05 with paired t-test difference test before and after nutrition education

Table 3. Average Time Allocation (Minutes/Day) of Physical Activity of Adolescents on School Days

Sedentary Activity	Lecture (mean ± SD)		Website (mean ± SD)		Control (mean ± SD)		P-value	
	Baseline	Endline	Baseline	Endline	Baseline	Endline	Baseline	Δ
Screen time (watching television/ movie, playing video/computer games/ gadgets)	140.7 ± 91.3	94.8 ± 63.4	152.2 ± 122.4	150.6 ± 93.0	135.4 ± 87.4	127.1 ± 88.1	0.785	0.133
P-value	0.011 ¹		0.822		0.922			
Casual activities (reading, playing musical instruments, sitting around)	116.0 ± 57.9	108.5 ± 42.3	91.5 ± 34.3	102.3 ± 38.8	129.3 ± 70.3	122.0 ± 63.7	0.242	0.117
P-value	0.590		0.065		0.374			
Learning and doing homework	445.8 ± 62.5	471.7 ± 53.5	418.5 ± 84.1	471.7 ± 53.5	346.6 ± 76.5	394.4 ± 55.0	0.000 ²	0.466
P-value	0.164		0.000 ¹		0.001 ¹			
Travel to school or other places (public transportation, motorbike)	60.7 ± 31.4	83.0 ± 65.2	39.5 ± 21.3	38.9 ± 31.4	80.7 ± 53.1	60.0 ± 52.4	0.000 ²	0.008 ²
P-value	0.150		0.955		0.016 ¹			
Personal activities (grooming, bath- ing, and praying)	42.4 ± 16.8	63.6 ± 30.8	70.9 ± 29.2	63.7 ± 29.8	60.4 ± 41.7	63.7 ± 42.3	0.001 ²	0.006 ²
P-value	0.004 ¹		0.104		0.574			
Sleeping	444.8 ± 81.6	479.3 ± 68.0	441.3 ± 111.3	513.3 ± 127.7	473.8 ± 84.8	544.5 ± 141.0	0.289	0.392
P-value	0.040 ¹		0.003 ¹		0.015 ¹			

school or another places, personal activities, and sleeping. Table 3 shows the average change of the activity time allocation of a teenager in minutes during the school day. Meanwhile, Table 4 shows the average change of time allocation. Adolescents have a high duration of learning and doing homework than screen time or casual activity during school days. Their sleep activity increased after the intervention and had a higher duration than other activities. A lecture group had a low duration of personal activities than other groups.

Sedentary Activity

Physical activity of friends, parents, and the social environment of adolescents is related to the level of physical activity of the adolescents themselves (Cheng 2014). An active environment can help teens reduce their sedentary activity and become more active. Table 3 shows the average change of the activity time allocation of a teenager in minutes during school days.

Table 4. Average Time Allocation (Minutes/Day) Changes of Activities during School Days

Sedentary Activity	Transformation (mean \pm SD)			P-value
	Lecture	Website	Control	
1. Screen time (watching television/movie, playing video/computer games/gadgets)	-45.8 \pm 109.9	-1.6 \pm 91.2	-8.3 \pm 84.8	0.133
2. Casual activities (reading, playing musical instruments, sitting around)	-7.5 \pm 56.5	-50.0 \pm 131.5	-7.3 \pm 84.6	0.117
3. Learning and doing homework	25.9 \pm 91.5	53.2 \pm 92.4	47.8 \pm 100.1	0.466
4. Travel to school or other places (public transportation, motorbike)	22.3 \pm 68.4	-0.6 \pm 34.3	-20.6 \pm 58.2	0.008 ¹
5. Personal activities (grooming, bathing, and praying)	21.2 \pm 36.9	-7.3 \pm 25.5	3.3 \pm 41.3	0.006 ¹
6. Sleeping	34.5 \pm 100.9	72.1 \pm 127.2	70.7 \pm 145.2	0.392

Meanwhile, the website group has a low duration of travel to school or another place than other groups.

DISCUSSION

Balanced Nutrition Knowledge Level

On the given nutrition education topic, the average of the lecture group subjects who answered correctly increased higher than the website group and control group. It could be because the subjects could easily understand the material through the lecture method (direct learning method). Supriati (2016) argues that nutrition education using the lecture method can increase knowledge. Education using a lecture method provides the subject with a better understanding, discussion, and opportunities to ask questions directly to peers, teachers, and nutritionists. Nutrition education using the lecture method can increase adolescent knowledge (Safitri 2016). Oneway ANOVA test showed that there was a significant difference ($p < 0.05$) in the mean score before and after the intervention. There was also a change in values of the three nutrition education subjects.

Activities related to monitors or screen time of the lecture group subjects (Table 3) on school days decreased significantly ($p < 0.05$) from 140.7 minutes to 94.8 minutes. Research data from 2002-2010 stated that television viewing duration had decreased in 30 countries (Bucksch et al. 2010).

Decreasing the subject's screen time activity can help increase the subject's moderate and vigorous activities so that they can meet the physical activity recommendations of the Ministry of Health. Adolescents who have a high screen time duration can be caused by their dissatisfaction with the school environment (Cao et al, 2011). The increasing activity of adolescent screen time will certainly affect their health. Morales-Ruan (2009) states that high screen duration can lead to overweight and obesity in adolescents. Meanwhile, the subject's personal activity (42.4 minutes to 63.6 minutes) and sleep time (444.8 minutes to 479.3 minutes) increased significantly ($p < 0.05$). The increased sleep time could be caused by the amount of moderate and vigorous physical activity the subject did at school. Physical activity is closely related to the quality of a person's sleep. The harder the activity, the better the quality of sleep (Apriana 2015). A good quality sleep can increase the academic score of the subject.

In the website group and control group, learning and sleeping activities increased significantly ($p < 0.05$). The physical activity of adolescents is influenced by the socio-demographic factors and lifestyle of the adolescents (Cheah 2018). The data collection was carried out in the midterm exam days for all subjects. It resulted in the increase of the duration of the subject's learning and the decrease of the duration of the subject's screen time. Therefore, the decrease and increase of the activity duration might not be the result of nutritional knowledge.

The one-way ANOVA test results, before the nutrition education was carried out, showed that there were significant differences ($p < 0.05$) on activities of the subjects, including studying, trips to school or other places, and personal activities on school days. After nutrition education was carried out, there was a significant difference ($p < 0.05$) in activities, ranging from trips to school or other places and personal activities, on school days. These changes were not the results of nutrition education. It could be caused by other factors, such as the environment or lifestyle. It was because significant values had been obtained before nutrition education was carried out, which means that the duration of these activities were different among the groups before nutrition education was carried out.

The subject characteristic data that were not homogeneous, which resulted in changes of the physical activity duration, were not necessarily caused by nutrition education, but other factors, such as the influence of the subject's parents, peers, and other demographic factors. This is a drawback of this study. Meanwhile, the strength of this research is that researchers could use website media as a more attractive and accessible method to deliver nutrition education to adolescents.

CONCLUSION

Adolescents have a high nutritional knowledge, especially adolescents in the lecture group, after the nutrition education was carried out. The physical activity of adolescents was relatively low and had not met the recommendations of the Ministry of Health. Nutrition education could significantly increase nutrition knowledge in the lecture group and website group, but the effect on the physical activity of adolescents was not significant.

Some of the activities of the subjects were quite

high, especially learning activities of the website and control group subjects on school days. The sleep activity of all subjects on school days increased significantly. Meanwhile, screentime activity on school days was quite low.

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