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Original article

Introducing the new nutrition guideline to Indonesian overweight/obese adolescents using a short movie: the impact on nutritional knowledge, eating habit and dietary intake

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Summary. *Background:* Overweight and obesity were associated with increased energy intake therefore an effective approach to prevent the excess intake of energy is warranted. The Indonesian Ministry of Health has recently published the new nutrition guideline that aimed to improve dietary practice and to reduce nutrition related problems. *Objective:* The aim of this study was to examine the effect of an educational movie on nutritional knowledge, eating habit and dietary intake in overweight/obese adolescents. *Method:* A total of 80 overweight/obesity subjects aged 15 to 17 years old participated in this study. Those subjects were divided into two groups: control group (lecture only) and movie group (lecture + movie). Nutritional knowledge, eating habit and dietary intake were measured before and after the intervention. *Result:* Both groups had increment in nutritional knowledge after the intervention but movie group had higher increment than those in control group ($p<0,05$). Dietary intake was reduced in both groups and subjects in movie group had significantly higher reduction in energy intake after the first month of intervention ($p<0,05$). Interestingly, subjects in movie group significantly reduced consumption on fried foods ($p<0,0001$), snacks ($p=0,037$), sugar ($p=0,015$) and increased consumption on vegetables ($p=0,029$). Those effects were not seen in control group. *Conclusion:* In conclusion, we showed that an educational movie on a school based promotion of nutrition guideline was effectively increased nutritional knowledge, improved eating habits, and reduced energy intake of overweight/obese adolescents.

Key words: Overweight, adolescents, dietary intake, knowledge, movie

Introduction

The prevalence of overweight and obesity in Indonesian adolescents has been increasing dramatically from 1,4% in 2007 into 7,3% in 2013 (1). This problem was associated with the transition of lifestyle including increased dietary intake and decreased physical activity which lead to a positive energy balance (2). A review of literatures showed that it only takes a small, but persistence, positive energy balance to increase weight in children and adolescents (3). Other investigations also showed that the transition of dietary pattern in early stage of life such as lack of breastfeeding, high energy intake and sweet-beverage are responsible to increase the risk of obesity (4,5). Therefore an intervention for obesity that aimed to improve eating habit especially in adolescents is warranted.

In order to promote a healthy diet to all Indonesian, The Ministry of Health has recently introduced a new nutritional guideline. The purpose of this guideline is to educate people on healthy lifestyle by consumption variety of foods, hygienic lifestyle practices, physical activity and maintenance of normal weight. However, the effort to introduce the guideline to different age groups seems to be less adequate. The current media used to communicate the guideline was through posters located in public areas and community health centres. The lack of promotion is accompa-

nied by insufficient studies on the effectiveness of the guideline to be used in different population groups. To our knowledge, there is no study confirming the effectiveness of the new nutritional guideline on affecting diet in adolescents.

Therefore, this study was initiated in order to evaluate the effectiveness of the nutritional guideline on dietary habit as well as to develop a new nutrition education program. There were some techniques that can be used as a media for nutritional education to adolescents including lecture, flipchart, movie and video games (6). In this study, we used an audio-visual technique to promote the nutrition guideline in a short movie which the materials were taken from Indonesian nutritional guideline. Movie is a potential media to be used for promoting healthy diet (7). It was previously reported that a video lesson series has more superior impact in conducting some dietary changes compared to face-to-face session in housemakers (8). On the other hand, a study in India showed no differences in nutrition knowledge between adolescent girls receiving traditional or audio visual method (9).

There was lack of studies investigating the effect of movie or audio visual media for nutritional education especially among obese adolescents. Therefore, in this study we aimed to evaluate the impact of a movie as the new media to promote nutrition guideline on knowledge, eating habits and dietary intake in overweight/obese adolescents compared to conventional method. We chose overweight/obese adolescents because we assumed that the subject's nutritional status was due to an unhealthy diet. Thus, the intervention can be used as an alternative for obesity treatment in community.

Methods

The study had a controlled intervention design. Subjects were overweight/obese male and female adolescents from two high schools in urban area of Yogyakarta, Indonesia. Initially, a total of 272 high school students from 2 schools were screened. From those who were screened, 90 of them were overweight or obese and 88 of them were agreed to participate in this study. The criteria of overweight/ obesity was based on WHO CDC more than 85th percentile of BMI-for-age. BMI was calculated by dividing body weight (Kg) with squared height (m). Body weight was measured using a digital scale with 0,1 kg precision while height was measured using a microtoise with 0,1 cm precision. Ethical clearance was obtained from Medical and Health Research Ethics Committee (MHREC), Faculty of Medicine, Universitas Gadjah Mada.

The subjects were divided into 2 groups, movie group and control group. Both groups received a lecture for 30 minutes with materials based on Indonesian nutrition guidelines. At the movie group, subjects were additionally showed a movie on a healthy diet with the material taken from Indonesian nutrition guidelines. In order to prevent a communication between groups, each group was taken from different high schools. The intervention was given outside subject's curricular activities. After the school is finished, subjects were asked to gather in a class and the each of intervention was given in one time point for the whole group member. The lecture and the movie were given in the class. This was done to prevent disturbance or pressure from their peers in school.

The movie was developed and produced by our team with technical assistance from professional video maker. This animation movie is 9 minutes length with 2 parts. The first part explains the background of the guideline and the second part explains the contents of Indonesian nutrition guideline for adolescents. Before the movie was used in the targeted group, it was tested in several groups including undergraduate nutrition students and non-subject high school students. The accuracy was evaluated by lecturers and fellow students of School of Nutrition and Health, Faculty of Medicine, Universitas Gadjah Mada. The clarity was evaluated by non-subject high school students in the similar school that this study was done.

All the interventions were done in 10 weeks. Before the intervention (week 0), dietary intake was recorded using a semi-quantitative food frequency questionnaire (SQ-FFQ). The SQ FFQ form that was used in this study is previously developed and validated among similar age group in the same area of Indonesia (10). The SQ-FFQ included 10 food groups : main food/cereals, vegetable side dish (peas, nuts, soy products), animal-based side dish (meat, fish, egg),

vegetables, fruits, oil, snacks, drinks, one dish meal, others (sugar, salt). The questionnaire form was filled by interviews done by trained enumerators. Additionally, subjects were asked to fulfil a questionnaire to test their knowledge on nutrition and healthy diet based on Indonesian nutrition guideline. The interventions were given twice (week 1 and week 6). Right after the interventions the nutrition knowledge was evaluated (week 1 and week 6). Additionally, the evaluation of dietary intake was done 4 week after each intervention (week 5 and week 10). Questionnaire for nutrition knowledge were developed and validated by authors specific for adolescents based on Indonesian Nutrition Guideline (11). Before used in the study, the nutrition knowledge questionnaire was tested among non-subjects high school students. This includes 26 questions that were asked based on information provided by Indonesian Nutrition Guideline.

Eating habits including consumption of fried foods, snacks, sugar, vegetables and fruits were recorded before and after the intervention. Fried foods were foods that were prepared by frying and served as for appetiser, side dish or snacking purposes. Sugar was recorded based on consumption of table sugar and sugar in the sweetened foods and beverages. Snacks were foods that consumed in between subjects eating hours (breakfast, lunch and dinner).

A statistical analysis was done using SPSS and GraphPad PRISM. A paired t-test was used to examine the effect of both interventions on knowledge, eating habits and dietary intake. A Wilcoxon signed rank test was used in not-normally distributed data. An independent t-test was used to evaluate the effectiveness of education on healthy diet using movie compared to control. A spearman correlation test was used to analyse the correlation between knowledge and dietary intake in obese adolescents. The significance was reach when $p < 0.05$.

Results

Characteristics of subjects are shown in table 1. Subjects were purposively selected based on nutritional screening, however only those who agreed to participate in this study then further examined for nutritional knowledge, eating habits and dietary intake. From 88 participants that were agreed to join this study, there were 8 drop outs. In this study we showed that there were no differences in BMI and dietary intake between groups before the intervention. Subjects were asked whether they received prior information regarding nutritional guideline, and there were no difference between groups. Additionally, there were also no differences in nutrition knowledge between groups before the interventions ($p>0.05$).

The interventions were given once in a month consecutively. Following the intervention, an evaluation of knowledge was done. In this study we showed that there was an increment in nutritional knowledge in both groups. Additionally we also showed that the

Table 1. Characteristics of subjects in control group and movie group

	Control group (n=40)		Movie group (n=40)		
Characteritics of Subjects	**Mean**	**SD**	**Mean**	**SD**	***p***
Age (years)	16.2	0.7	15.9	0.7	0.035
Boody weight (kg)	73.6	14.5	70.2	11.42	0.411
Height (m)	1.6	0.09	1.59	0.07	0.669
BMI (kg/m2)	28.5	3.7	27.6	3.3	0.172
Energi intake (kcal)	2334	623.9	2314	487.8	0.874
Carbohydrate intake (g)	255.1	84.5	258.5	67.7	0.847
Protein intake (g)	67.8	22.9	75.2	22.4	0.148
Fat intake (g)	117.7	50.1	108.9	31.7	0.519
Fiber intake (g)	12.8	5.9	12.2	4.9	0.732
Percent fat intake	154.9	69.5	147.2	44.1	0.690
Percent fiber intake	40.5	19.9	39.3	16.9	0.935

Table 2. Changes in knowledge of healthy diet and dietary intake in both groups after the first and second interventions.

Intake	Pretest	Posttest 1	Posttest 2	Mean difference Pretest-post test 1	Mean difference Pretest-post test 2
Knowledge of healthy diet					
Control group	48.1±7.3	60.1±7.7*	61.9±9.7*	12.0±9.4	13.7±11.1
Movie group	48.0±6.6	68.4±8.3*	76.0±9.3*	20.4±10.7**	28.0±11.9**
Dietary Intake					
Energy intake (kcal)					
Control group	2334.1±623.9	1984.2±744.5*	1853.4±595.6*	-349.9±700.7	-480.7±758.6
Movie group	2314.0±487.7	1681.2±620.8*	1685.0±519.6*	-632.9±693.9**	-629.0±592.0
Protein intake (g)					
Control group	67.8±23.0	74.2±34.1	64.1±27.6	6.4±28.0	-3.7±27.4
Movie group	75.1±22.3	60.3±32.1*	62.2±25.7*	-14.8±30.4**	-12.9±26.1
Fat intake(g)					
Control group	117.8±50.1	94.1±40.7*	110.3±145.7*	-23.7±46.8	-7.5±154.4
Movie group	108.9±31.8	72.6±30.9*	80.1±28.7*	-36.3±39.3	-28.8±41.2
Carbohydrate intake (g)					
Control group	255.0±84.5	213.4±82.7*	207.8±75.1*	-41.6±92.0	-47.2±93.7
Movie group	258.5±67.8	200.9±86.9*	192.7±56.2*	-57.6±99.5	-65.8±66.9

*Significant difference towards pretest. p<0.001
**Significant difference towards control group. p<0.001

knowledge of obese adolescents in movie group was higher than those in control group (Table 2).

Dietary intake was evaluated throughout the interventions in this study (Table 3). Changes in dietary intake were seen in both groups. In a group of overweight/obese adolescents receiving movie on nutritional guideline, there is a reduction in total energy, protein, fat and carbohydrate intake (p<0,001). In the control group, changes in dietary intake was also seen similar to those in movie group (p<0,001) but not in protein intake. We then evaluate the differences in dietary changes between groups and we found that movie group reduced total energy intake more than those in control group. From the dietary intake that was being investigated, fat consumption is a critical point that was needed to be evaluated. Therefore the adherence of dietary fat toward national recommendation was expressed as a percent. In this study we showed that nutritional education was able to reduce dietary fat intake in both groups (p=0,01 and p<0,001 for control group and movie group respectively). Interestingly in movie group, the fat intake can be reduced into 97,98% of recommendation of fat intake (Figure 1).

The impact of the interventions on eating habits is shown in Figure 2. In this study, eating habit was represented based on consumption of fried foods, snacks, sugar, vegetables and fruits which were measured before and after the intervention. After the intervention, there was reduced consumption on fried foods (p<0,0001), snacks (p=0,037), sugar (p=0,015) and increased consumption on vegetables (p=0,029) on movie group. On the other hand, there were no significant changes in consumption on fried foods (p=0,297), snacks (p=0,269), sugar (p=0,291) and vegetables (p=0,360) in the control group. There were no changes in fruit consumption in movie group (p=0,116) and control group (p=0,299).

Discussion

In this study we showed that movie can be a good additional method to increase nutritional knowledge in a conventional nutrition lecture. All overweight/obese adolescents that received nutritional education increased their knowledge but subjects in movie group

Table 3. Correlation between changes in knowledge on changes in dietary intake in both groups after the first and second interventions.

	Changes in knowledge (0-1) and changes in dietary intake (0-1)		Changes in knowledge (0-2) and changes in dietary intake (0-2)	
	r	*p*	r	*p*
Control group				
Energy intake	0.03	0.43	0.04	0.41
Protein intake	-0.19	0.12	-0.02	0.44
Fat intake	0.04	0.39	-0.03	0.43
Carbohydrate intake	-0.07	0.32	0.17	0.16
Movie group				
Energy intake	0.07	0.34	0.22	0.09
Protein intake	0.07	0.33	0.18	0.13
Fat intake	-0.01	0.49	0.21	0.10
Carbohydrate intake	0.01	0.47	-0.11	0.26

gain more knowledge compared to control group. These interventions were also reduced total energy, protein, fat and carbohydrate intake. Additionally, subjects in movie group showed an improvement in eating habits by reducing consumption of fried foods, sugar and snacks while increasing vegetable intake. These effects were not seen in the control group.

The new Indonesian nutrition guideline was released by Ministry of Health in 2014 (11). The aim of this nutrition guideline is to provide an instruction of healthy diet and lifestyle for the community based on principal of consumption variety of foods, hygienic lifestyle practices, physical activity and maintenance of normal weight. The general nutrition guideline messages are consisted by 1) Consume variety of foods; 2) Eat a lot of vegetables and enough fruits; 3) Eat high protein side dishes; 4) Consume a variety of carbohydrate sources; 5) Limit consumption of sugar, salt and fatty foods; 6) Routinely has breakfast; 7) Drink enough and clean water; 8) Read label on the packaged food; 9) Wash hand with soap and clean flowing water; 10) Have enough physical activity and keep a normal body weight. In additional to that, there are additional messages for adolescents including: 1) Eat three times a day together with family; 2) Regularly consume fish and other protein sources; 3) Bring your own food for lunch and snacks at school; 4) Limit consumption of fast food and snacks; 5) Brush teeth at least 2 times a day; 6) Do not smoke.

Introducing the new nutrition guideline to the sub-population is an essential part of the health promotion. The nutrition guideline was diversified towards several sub-populations in Indonesia such as pregnant women, babies, children, adolescent, adults and elderly. Each of the sub population has different characteristics which made it challenging to promote these messages. In this study, we proposed an innovation in promoting the nutrition guideline by using a movie. To our knowledge, there is a limited study showing the role of audio visual media on nutritional knowledge in overweight/obese adolescents. Rao et al. (9) showed no differences in nutrition knowledge between adolescent girls receiving traditional or audio visual method. In this study, we showed that having an audio visual media as an additional to a conventional lecture was significantly increase nutritional knowledge in overweight/obese adolescents.

Having a sufficient knowledge on nutrition is important for a good food intake and lifestyle habit in children and adolescents. A cross sectional study in South Italy showed that nutrition knowledge was positively associated with vegetable and fruit intakes and negatively associated with sweets, snacks, fried food and sugary drinks (12). In addition, several other studies also agreed that nutrition knowledge in important in determining eating habits (13,14). As showed in this study, introduction of nutrition guideline increased the knowledge of subjects in both groups along with reduced intake of energy, fat and carbohydrate. However, only those in movie group had reduction on fried foods, snacks, and sugar consumption as well as increment on vegetable consumption.

The dietary fat intake in our study was alarmingly high. Before the intervention, we showed that in both group, the dietary fat intake was almost 1,5 times higher than national recommendation for fat intake. This high fat intake was associated with childhood obesity (5). A school based nutrition education is one of important public health intervention to improve nutrition status in children and adolescents. An intervention study done by Luepker et al. (15) showed that a school-based food service modifications and a classroom health curricula has been able to reduce percent dietary intake from fat. In this study we also showed that after the intervention there was a significant reduction in total dietary intake, especially from fat. We also showed that in movie group, the percentage of fat intake was reach almost 100% of recommendation for dietary fat intake.

The aim of overweight/obesity treatment in children and adolescence was not solely to reduce the dietary intake, but more importantly to improve their eating habits. Dietary intake such as plant-based foods consumption has been suggested to protect against overweight in adolescents. Consumption of nuts, grains and vegetables but not fruits were associated with reduction in the risk of overweight in adolescent of Southern California (16). We showed that introducing nutrition guideline in overweight and obese adolescents using a lecture and a movie was able to significantly increase the intake of vegetables while this effect was not seen in control group. On the other hand, this intervention did not affect fruits consumption in both groups.

Besides fruits and vegetables, considering other types of food consumption is important in order to have a well balanced diet. A study in 1,562 years old children showed that consumption of sweetened beverages, sweets and snacks were associated with overweight status (17). In addition to that, the consumption of fried food away from home was also associated with increased risk of overweight in older children and adolescents. Therefore, in order to improve the nutrition status and reduced the accumulation of fat, a dietary approach to reduce intake of fried foods, sweet foods and beverages as well as snacks are necessary. As seen in this study, we showed that introduction to nutrition guideline in overweight and obese adolescents was able to reduce consumption of fried foods, sugars and low nutrient energy dense snacks in the movie group.

There were some limitations in this study. First, although the sample size of this study is relatively small, total of subjects who finished the study was similar to our calculation of minimal sample size which is 40 subjects in each groups. Second, this study is conducted in students from urban area which have more access towards information and technology compared to those whole lives in rural area. Third, although an obesity screening was performed to gather the subjects, we did not randomised adolescents from the whole city. Those limitations might have an impact on generalisation of the result into a broader adolescent's population. However, we argued that this study is focused on the development of intervention towards overweight and obese adolescents. Thus future study with broad and randomised population can be done following the technique that is being reported in this study.

In conclusion, we showed that movie was effectively improved nutritional knowledge of overweight/obese adolescents in our study. We also showed that there was a reduction on dietary intake after the intervention and movie group has higher reduction than those in control group. Additionally, our finding also showed that there was a significant reduction in percent fat intake to national recommendation. Movie also improved eating habits by reducing fried foods, sugar, snacks and increasing vegetable consumption. Further study is needed to confirm this advantage of using a movie in promotion of nutrition guideline at the other age group such as elementary school aged children.

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