

## The smartphone app (MyFitnessPal) reduce sugar-sweetened beverages intake among overweight and obese college students

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### ABSTRAK

**Latar Belakang:** Peningkatan prevalensi obesitas dapat disebabkan oleh konsumsi sugar-sweetened beverages (SSBs). Sugar-sweetened beverages mengandung gula yang tinggi, sehingga berkontribusi pada meningkatnya asupan energi dan berkorelasi dengan obesitas. Kombinasi strategi pengaturan diet diperlukan untuk mengendalikan asupan makan terutama konsumsi SSBs dan mencegah terjadinya peningkatan berat badan.

**Tujuan:** Penelitian ini bertujuan untuk menganalisis perbedaan rata-rata asupan energi dan gula dari SSBs setelah diberikan intervensi konseling gizi dan self-monitoring menggunakan aplikasi smartphone (MyFitnessPal) pada mahasiswa dengan status gizi overweight dan obese di Universitas Alma Ata Yogyakarta.

**Metode:** Penelitian ini merupakan penelitian pretest-posttest with control group design. Populasi penelitian adalah mahasiswa Universitas Alma Ata Yogyakarta. Subjek penelitian berjumlah 68 orang mahasiswa (34 eksperimen dan 34 kontrol). Pengambilan subjek penelitian untuk menemukan mahasiswa overweight dan obese dengan teknik purposive sampling dan pengambilan subjek penelitian untuk eksperimen dan kontrol menggunakan teknik random sampling. Data asupan energi dan gula dari SSBs dengan formulir semi-quantitative food frequency questionnaire (SQ-FFQ). Analisis univariat menggunakan distribusi frekuensi dan analisis bivariat menggunakan uji Wilcoxon dan Mann-Whitney. Data dianalisis dengan menggunakan SPSS versi 20 dan nutrisurvey.

**Hasil:** Hasil analisis menunjukkan terdapat perbedaan yang bermakna pada asupan energi dan gula dari SSBs antara kelompok eksperimen dan kelompok kontrol ( $p < 0.05$ ). Penurunan asupan energi dan gula dari SSBs pada kelompok eksperimen lebih besar daripada kelompok kontrol.

**Kesimpulan:** Terdapat perbedaan yang bermakna pada rata-rata asupan energi dan gula dari SSBs setelah diberikan intervensi pada mahasiswa overweight dan obese. Konseling gizi dan self-monitoring asupan makan menggunakan aplikasi smartphone (MyFitnessPal) memperbaiki asupan energi dan gula dari SSBs.

**KATA KUNCI:** konsumsi sugar-sweetened beverages; konseling gizi; MyFitnesspal; self-monitoring

### ABSTRACT

**Background:** The increase in obesity prevalence can be caused by the consumption of sugar-sweetened beverages (SSBs). Sugar-sweetened beverages contain high levels of sugar, which contribute to increased energy intake and obesity risks. A combination of dietary strategies is needed to control food intake, especially consumption of SSBs, and prevent weight gain.

**Objectives:** To investigate the difference between the energy and sugar intake of SSBs after being given nutritional counseling intervention and self-monitoring using smartphone app (MyFitnessPal) among overweight and obese students at Alma Ata University Yogyakarta.

**Methods:** This study was a pre-test-post test with control group design. We recruited university students

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as our participants. A total of 68 students (34 experiments and 34 controls) were obtained. Subjects were divided into two groups using the random sampling technique. Energy and sugar intake data from SSBs were assessed by a semi-quantitative food frequency questionnaire (SQ-FFQ). Data were analyzed using SPSS version 20 and nutrisurvey.

**Results:** The results of the analysis showed that there were significant differences between the energy and sugar intake of SSBs in the experimental group and control group ( $p < 0.05$ ). The decrease in energy and sugar intake from SSBs in the experimental group was greater than in the control group.

**Conclusions:** There is a significant difference in the average energy and sugar intake of SSBs after being given intervention among overweight and obese students. Nutritional counseling intervention and self-monitoring of food intake using smartphone app (MyFitnessPal) improve energy and sugar intake of SSBs.

**KEYWORDS:** Sugar-Sweetened Beverages Consumption; Nutrition Counseling; MyFitnessPal; Self-Monitoring

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## INTRODUCTION

The high prevalence of overweight and obese status remains a public health problem around the world. The prevalence of overweight according to the World Health Organization (WHO) in 2016 was 1.9 billion adults (aged > 18 years) and 13% of the world's adult population is obese or 650 million of that number (1). According to the Indonesia Basic Health Research (Riskesdas) in 2018 showed that 13.6% of the adult population (aged > 18 years) was overweight and 21.8% was obese. This prevalence of overweight was increased 5% from 2007 (8.6%), while the obese prevalence in 2018 was increased 7% from 2007 (14.8%) (2).

One of the causes of overweight and obesity is the consumption of SSBs such as soft drinks, energy drink, isotonic drink, caffeinated drink, and milk tea/ boba drink (3). Sugary drinks are high in calories which can contribute to weight gain (4). Soft drinks with added sugar contributed substantially to students' daily energy intake (5). The high level of SSBs consumption causes the total energy intake to be even higher. Energy intake from SSBs for adolescents and adults in Indonesia is 420-450 calories per day, which means that more than 20% of their calorie needs came from sweetened drinks (6). Excess energy intake from SSB leads to an increased risk of obesity and other negative effects (7).

High-calorie food intake which causes excess energy can be controlled by dietary management through nutritional counseling. Khofifah's research (2018) showed that nutritional counseling had proven effective in changing eating habit. Nutritional counseling can improve nutritional knowledge, dietary pattern and diet planning that has been agreed with a nutritionist. (8). However, the success of nutritional counseling requires understanding, knowledge and client compliance so that the dietary change effort can be effective and efficient (9).

The combination of nutritional counseling and food intake self-monitoring training using a smartphone application can increase client awareness of the diet plan (10). One of smartphone application to control an individual's food intake is MyFitnessPal (11). The use of MyFitnessPal can help to improve food intake and physical activity (12). MyFitnessPal can be a useful and good choice for individuals who are ready to monitor their calorie intake during their diet program (13).

Consumption of SSB contributes to an increase in energy and sugar intake. Individual involvement in monitoring and controlling daily food intake is required for more effective results. Therefore, nutritional counseling needs to be integrated with the use of a smartphone application to monitor energy and sugar intake from SSB. This study aims to investigate the difference in the

average energy and sugar intake of SSBs after being given nutritional counseling and self-monitoring of food intake (MyFitnessPal) interventions among overweight and obese students.

## MATERIALS AND METHODS

### Study Design

This study was a quasi-experimental pretest-posttest design with a control group and was conducted at one of the private universities in Yogyakarta, in February-July 2020. College students were recruited using purposive sampling method. In total 1,118 students were screened and 140 students had overweight and obese status. The inclusion criteria in this study were active students over 18 years of age, BMI > 23.0 kg/m<sup>2</sup>, having a smartphone with an Android or iOS operating system, not undergoing a weight loss diet program, and willing to participate in the study by filling out the informed consent on the online form. Meanwhile, the exclusion criteria were following a weight loss diet program. The minimum subject is 62 in this study and the subjects who met the inclusion and exclusion criteria were 98 students. During the study, 20 people dropped out due to lost contact and did not follow all research procedures. The total number of subjects who participated in this research until completion was 68 subjects. The subjects were allocated into an experimental group (34 subjects) and a control group (34 subjects).

### Data Characteristics

The characteristics of the subject data were obtained using a structured questionnaire which can be accessed online using 'Google forms'. Online questionnaire consist of age, gender (male and female), monthly allowance ( $\leq$  DR 1,000,000/month and >IDR 1,000,000/month). Nutritional status obtained from the calculation of Body Mass Index (BMI), body weight (kg) divided by height (m<sup>2</sup>) and determined based on the BMI category according to WHO criteria for the Asia Pacific population (14). Body image (satisfied and dissatisfied), and physical activity (never, 1-2 times / day, 3-4 times / day, 5-6 times / day, and every day). Data related

to SSBs consumption were the frequency of SSBs consumption (<1 time / day and  $\geq$  1 time / day), the amount of added sugar in drinks (1 tbsp, 2 tbsp, 3 tbsp, and 4 tbsp), and distance from SSBs seller (<100 meters, 100-500 meters, and > 500 meters).

### Intervention

Each group performed pre-test assessment to determine the baseline data before the intervention. The intervention of experimental group was nutritional counseling through virtual meeting for  $\pm$  30 minutes by trained nutrition students twice within 2 weeks. The material provided during nutritional counseling includes low-calorie diets, diet goals, dietary requirements, eating strategies, and food selection. In addition, the experimental group was given a guide to using the application MyFitnessPal and advised to use the application MyFitnessPal for 2 weeks to control food intake. Meanwhile, the control group was only given a balanced nutrition diet leaflet without nutrition counseling and MyFitnessPal. The outcome of this study was energy intake and sugar from SSBs. Study flow diagram of this research can be seen in **Figure 1** below.

### Dietary Assessment

Energy and sugar intake data was obtained by the Semi-Quantitative Food Frequency Questionnaire (SQ-FFQ) which contains the types of SSBs, the amount consumed, and the frequency of consumption. The types of SSBs in the SQ-FFQ included soft drinks, caffeinated drinks, energy drinks, isotonic drinks, packaged drinks, and milk tea with boba. Before the intervention, a pre-test was carried out by interviewing the subject's food intake using the SQ-FFQ in both groups. After 2 weeks, the researchers interviewed with the SQ-FFQ again to get energy and sugar intake data after the intervention. Researchers used a nutritional survey to analyse the sugar and energy intake of SSBs before and after the intervention.

Furthermore, researchers collected data related to SSBs consumption including the types of SSBs that were frequently consumed, time to consume SSBs, exposure to mass media related to SSBs information, and location to buy SSBs.

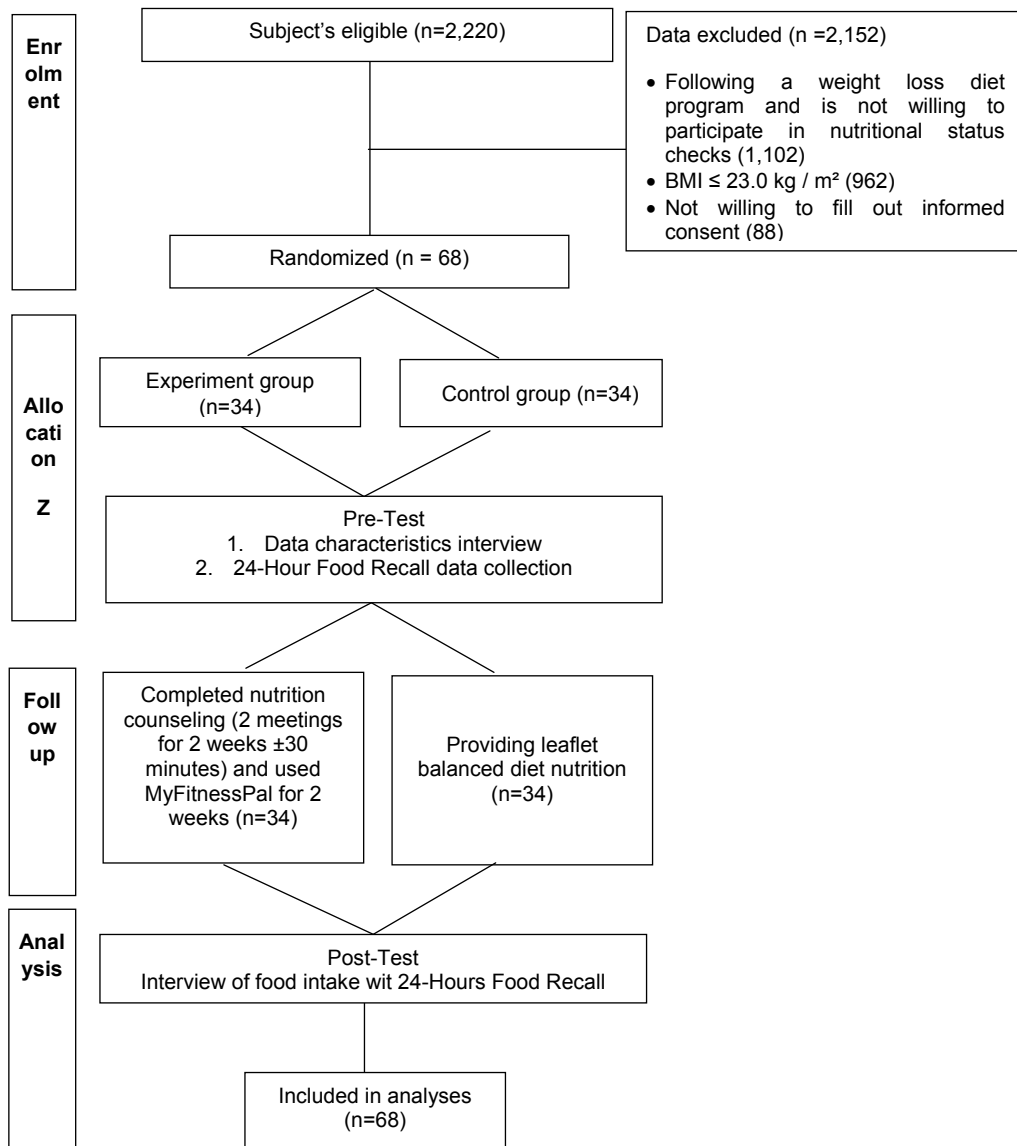


Figure 1. Study flow diagram

The SSBs data were obtained using a structured questionnaire which can be accessed online using ‘Google forms’. Research subjects filled out an online questionnaire and answered nine questions related to SSBs consumption.

**Statistical Analysis**

Continuous data will be presented with mean and standard deviation (SD) and categorical data will be presented as numbers and percentages (%). To determine the difference in the average SSBs intake in the control and experimental groups, the statistical

test (Wilcoxon test) was performed. The use of the Wilcoxon test was carried out because the data were not normally distributed. Meanwhile, determining the difference in the average energy and sugar intake of SSBs between the experimental group and the control groups was analysed using the Mann-Whitney test. Data were analysed using SPSS version 20 and Nutrisurvey. The results of statistical analysis with p-value <0.05 were stated as significant.

**Ethical Clearance**

This research has obtained research approval and feasibility from the Ethical Committee of Alma

Ata University (KE/AA/II/10120/EC/2020). Data were collected with the consent of research subjects who previously had given online informed consent.

## RESULTS AND DISCUSSIONS

### Baseline Characteristics of Research Subjects

Based on the following **Table 1** showed that the characteristics of research subjects based on age, gender, nutritional status, body image, physical activity, the inheritance of obese history, monthly allowance, frequency of SSBs consumption, amount of added sugar, and distance from SSBs seller. There was no significant difference in the characteristics from experimental and control groups ( $p > 0.05$ ). This due to the number of groups is identical and shows no difference.

Based on **Figure 2** showed that caffeinated drinks such as tea and coffee in the experimental group (38.8%) and the control group (41.3%) were frequently consumed. Most of the subjects (experimental group 52.5% and the control group 45.4%) consumed SSBs when gathering with friends. The behaviour of imitating not only from the habits of parents but peer groups can also be influencing. This due to students spend more time outside with their friends (15). In terms of mass media exposure, most of the subjects were exposed to SSBs information from television (experimental group 45.3% and the control group 42%). In general, students have watched advertisements more than once on social media and television every day. Students who are exposed to mass media have 2,758 times the chance to consume sweetened soft drinks (16). Students buy SSBs at the minimarket (experimental group 47.1% dan and control group 49.1%. Minimarkets now provide many choices of SSBs with high sugar and calorie content (17).

### Bivariate Analysis

#### *The Difference between Energy and Sugar Intake of SSBs*

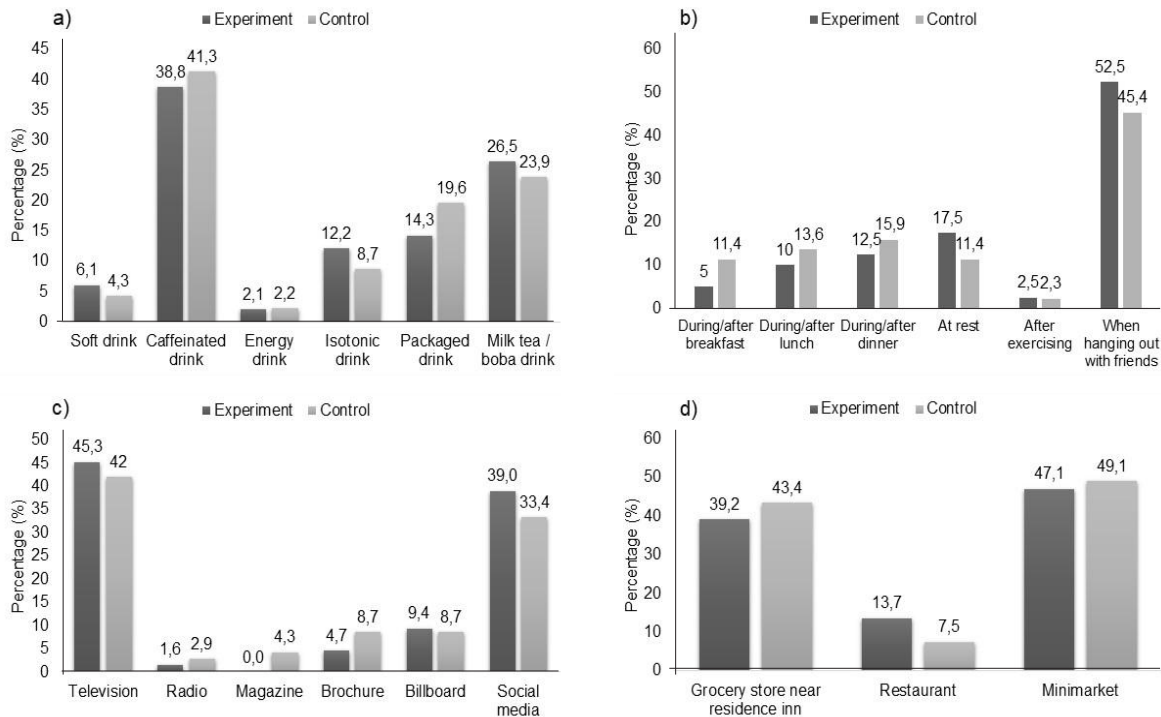
There was a significant difference in the energy and sugar intake of SSBs after being given nutritional counseling and self-monitoring food intake (*MyFitnessPal*). There were energy and sugar

**Table 1. Characteristics of Research Subjects Between the Experiment and Control Groups**

Variables	Experiment Group (n=34)		Control Group (n=34)		p-Value*
	n	%	n	%	
Age group					
18-21 years	23	67.7	21	61.8	0.891
22-26 years	11	32.4	13	38.2	
Gender					
Male	5	14.7	8	23.5	0.355
Female	29	85.3	26	76.5	
Nutritional status					
Overweight	7	20.6	9	26.5	
Obesity grade I	20	58.8	18	52.9	0.837
Obesity grade II	7	20.6	7	20.6	
Body image					
Satisfied	2	5.8	1	3.0	
Not Satisfied	32	94.1	33	97.0	0.555
Physical activity					
Never	4	11.7	5	14.7	
1-2 times/week	12	35.3	17	50.0	
3-4 times/week	9	26.5	7	20.6	0.667
5-6 times/week	2	5.9	1	3.0	
Every day	7	20.6	4	11.7	
Inheritance obesity history					
Yes	13	38.2	12	35.3	
None	21	61.8	22	64.7	0.801
Monthly allowance					
≤ Rp 1.000.000/ month	19	55.9	22	64.7	
>Rp 1.000.000/ month	15	44.1	12	35.3	0.457
SSBs consumption frequency					
< 1 time/day	6	17.6	13	38.2	
≥ 1 time/day	28	82.64	21	61.8	0.059
The amount of added sugar in the drink					
1 tbsp (13 gr)	18	52.9	25	73.5	
2 tbsp (26 gr)	14	41.2	9	26.5	
3 tbsp (39 gr)	2	5.9	0	0.0	0.121
4 tbsp (52 gr)	0	0.0	0	0.0	
Distance from SSBs seller					
<100 meters	13	38.2	18	52.9	
100-500 meters	12	35.3	9	26.5	0.476
>500 meters	9	26.5	7	20.6	

\*Chi Square Test; Tbsp, table spoon; BMI was categorized by Overweight ( $\geq 23$ - $24.9$  kg/m<sup>2</sup>); Obesity grade I (25,0 – 29,9 kg/m<sup>2</sup>); Obesity grade II ( $\geq 30$  kg/m<sup>2</sup>)

intake of SSBs reduction in the experimental group. However, there was no significant difference before and after the intervention in the control group, even though there were energy and sugar intake of SSBs



**Figure 2. SSBs Related Information. a) Type SBBs, b) Time of Consuming SSBs, c) Mass Media Exposure, d) Location to Buy SSBs**

**Table 2. The Difference Energy and Sugar Intake from SSBs between Experimental and Control Group**

Variables	Experiment Group		p-Value	Control Group		p-Value
	Before intervention	After intervention		Before intervention	After intervention	
Energy intake (kcal)	179.59±147.424	92.00±91.782	<0.001	112.46±126.391	86.95±85.893	0.172
Sugar intake (gram)	38.35±28.833	21.56±22.897	<0.001	28.76±31.612	20.68±21.690	0.055

Data presented as Mean±SD.

reduction (Table 2). Table 3 showed significant differences in the energy and sugar intake of SSBs in the experimental group and the control group (p<0.05) (Table 3).

**Table 3. The Difference Energy and Sugar Intake of SSBs Between Experimental And Control Groups**

Variables	Experiment group (n=34)	Control group (n=34)	p-value
Energy intake (kcal)	87.59±55.642	25.51±40.498	<0.001
Sugar intake (gram)	16.76±5.936	8.08±9.920	<0.001

Data presented as Mean±SD.

The main finding of this study is that nutritional counseling and self-monitoring of food intake using smartphone app (the MyFitnessPal) for 2 weeks can affect the consumption of SSBs. The results showed that there were differences in energy and sugar intake of SSBs before and after the intervention in the experimental group. The decrease in energy and sugar intake from SSBs after the intervention was smaller than before the intervention.

Previous study conducted by Khory (2016) showed that after nutritional counseling, most of the adolescent’s eating behavior get better. The research subjects began to reduce their consumption of sugary drinks and soft drinks (8).

Other study also found that the average energy intake of SSBs decreased after being given nutritional counseling (18).

Providing nutritional counseling is an effort to overcome nutritional problems through regulating food and beverages (8). Individual nutritional counseling can help to solve the nutrition problems particularly diet and overeating. Combination nutritional counseling on a low-calorie diet and self-monitoring of food intake can change eating behavior with self-control in eating. Self-control involves self-centered adaptation mechanisms and a behavioral point of view to make decisions with logical considerations so that an individual can control his own behavior to achieve the desired goals (19).

The combination of food and drink regulation interventions monitored through application assistance can also help individuals to self-monitor their food intake. Previous study has shown that the *MyFitnessPal* app can help individuals who have difficulty meeting their nutritional goals (20). Another similar study also found that overall users who are committed to using the app as a food record, tend to lead to a reduction in food intake expected to meet weight loss goals (21).

The benefit of nutritional counseling and self-monitoring of food intake with the *MyFitnessPal* app include research subjects know the nutritional content of each food they consume and they have the ability to select foods that are recommended, restricted, and prohibited for consumption. Diet success is determined by changes in the behavior of research subjects. As is well known, the recommended low-calorie diet given is a step to reduce food intake, especially limiting the intake of SSBs. Overeating is a response to feelings, low self-regulation of emotions, low self-control, and high social pressure (19). Therefore, regulating and self-monitoring of food intake can help to limit the food intake of study subjects.

It can be understood that obese people reduce food intake more easily than increase physical activity. The diet method for obese sufferers includes a reduction in calories and a balance of macronutrient composition (22). The nutritional

counseling materials including goals, conditions, eating strategies, and dietary arrangements. The recommended dietary requirements are limiting SSBs frequency, limiting sugar of sweetened drinks consumption and limiting the consumption of total sugar a day (50 grams or 4 tablespoons) (23). Currently, soft drinks have replaced many drinks that contain nutrients such as milk or fruit juices (22).

In this study, caffeinated drinks were frequently consumed by the subjects. Caffeinated drinks contain additives that can encourage repeated consumption (25). Consumption of SSBs is associated with higher energy intake and an increased risk of obesity (24). The energy content in SSBs cannot replace the energy obtained from food. This is based on the fact that drinks are different from food even though they have almost the same energy. The effects of hunger, satiety, and energy compensation from soft drinks are distinctly different. Soft drinks only have a temporary effect on satiety, so the stimulation of hunger will appear a few moments later (26). Therefore, it is important to limit the consumption of high-sugar soft drinks and better replace them with water and low-fat milk consumption (22).

The strengths of this research include pre-test and post-test experimental research with the control group, the use of smartphone applications that can be downloaded for free on both Android and iOS. Meanwhile, the limitations of this study are the short duration of intervention, online counseling, high dropout rate, using only bivariate analysis, representativeness of the research subject, online food intake interviews that take a long time, which can lead to information bias. To anticipate the research subject loss to follow up, before data collection was carried out, the researcher performed a time contract and asked the subject's willingness to be interviewed.

## CONCLUSIONS AND RECOMMENDATIONS

A difference was found in the mean energy and sugar intake of SSBs following the nutritional counselling and self-monitoring of food intake (*MyFitnessPal*). There were significant differences in energy and sugar intake of SSBs between the

experimental group and the control group. The decrease in energy and sugar intake from SSBs in the experimental group was greater than the control group. The combination of nutritional counselling and self-monitoring of intake using the *MyFitnessPal* app can be used as a strategy to control dietary intake, especially SSBs consumption among overweight students. This strategy can also be an alternative way for overweight and obesity prevention programs at universities.

The recommendations for further research can be carried out a combination of qualitative and quantitative studies. Further research can be carried out with other variables such as changes in body weight to determine the effectiveness of nutritional counselling and independent monitoring of food intake with the *MyFitnessPal* application on weight changes as an effort to prevent obesity.

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