

## Nutrition education via “instagram” and motivational interviewing for weight loss motivation and physical activity in obese female students

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### Abstract

Nutrition education and motivational interviewing are methods to increase motivation, as essential factors in increasing physical activity. The purpose of this study was to determine the effect of nutrition education via Instagram and motivational interviewing, on weight loss motivation and physical activity of obese female students. This study was quasi-experimental with a pre-post-controlled group design that involved thirty-seven obese female students aged 18-23 years at Universitas Diponegoro, selected by proportional stratified sampling. Subjects were divided into three groups, P1 was given nutrition education via Instagram for 30 days (ED) and motivational interviewing four times (MI), P2 was given ED only, and the control (K) was given a leaflet. Weight loss motivation was measured using a healthy diet motivation questionnaire, and physical activity (PA) was measured using IPAQ-SF. Data were analyzed using one way ANOVA, Kruskal Wallis, paired t-test, Wilcoxon, and Mann Whitney. There was an increase in the mean of weight loss motivation that highest in group P1 (109.86 into 126.43), followed by group P2 (114.85 into 121.69) and group K (105.30 into 112.90). The highest increase in the mean of total physical activity was in the P1 group (1341 to 2572), the P2 group (1761 to 2378), and the K group decreased (3404 to 1987) in METs units. There was a significant difference in the mean change in total physical activity and moderate physical activity between P1 and P2 groups when compared to the K group.

## 1. Introduction

World Health Organization (WHO) recommended an accumulated 150-minute/week physical activities in moderate-intensity or an accumulated 75-minute/week in high-intensity. The lack of physical activity is when a person fails to meet the physical activity recommendation to improve or maintain body health. The Indonesian Ministry of Health reports show that as much as 33.5% of Indonesian people aged over 10-year-olds have low physical activity in 2018 (Ministry of Health Republic of Indonesia, 2018). Women tend to have lower physical activity when compared to men, and 32% of those are categorized as less active (Farradika *et al.*, 2019). Lack of physical activity into the causes of obesity.

Obesity incidence increased three-fold from 1975 to 2016 with a percentage of 13% worldwide (World Health Organization (WHO), 2019). In Indonesia, the

obesity incidence rate of over 18-year-olds tended to rise by 21.8%, higher in 2013 (14.8%), and 2010 (10.5%), and occurred more in women. The increasing obesity rate trend is a challenge that is vital to conduct obesity handling efforts on women (Hamrik *et al.*, 2014; Nho, 2017).

Women of Reproductive Age (WRA) with obese nutritional status are at risk of possessing breast cancer, cervix cancer, metabolic syndromes, and polycystic ovary syndrome (Brown, 2008). Obese WRAs also possess an infertility risk of three-fold higher than WRAs with normal nutritional status (Nho, 2017). One of the WRA groups susceptible to obesity is students because this phase addresses lifestyle changes (Kurniawan and Widyaningsih, 2017; Abraham *et al.*, 2018). Approximately 60% and 38.3% of medical students in Universitas Brawijaya and Universitas Udayana, respectively, had low physical activities (Riskawati *et al.*, 2018). These results are different from research that

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showed knowledge level affects the human lifestyle (Jaminah and Mahmudiono, 2018). Lack of knowledge about physical activity and healthy eating behaviours become obstacles in the implementation of healthy lifestyles. Nutrition education is a solution to overcome these obstacles.

Nutrition education is the provision of information covering dietary intake and physical activity under the guidelines for balanced nutrition. It aims to influence the subject's behaviour so that it is applied in their lives (Zaki and Sari, 2019). Nutrition education is carried out through several media and methods (Safitri and Fitranti, 2016). Tedious method utilization may provoke resistance to change on subjects (Zeidi and Hajiagha, 2013). Along with technological advances, developments were made for nutrition education media, from printed media, audio-visual, short message service (SMS), website, and social media. Intervention through social media on students may improve attitude, practice, and perception of physical activities and add insights regarding food material choices (Elmer *et al.*, 2016; Hamadeh *et al.*, 2019). Ease of access puts social media as an effective medium to deliver information (Cavallo *et al.*, 2012).

Instagram is the second-leading popular social media after Facebook, with a significant increase of users that reached 60.97 million. Most of Instagram users (59%) were 18-21-year-olds. One group in such an age range is students who have positive behaviour on brands on Instagram. Studies mentioned that as Instagram users, students tend to follow accounts they wish to follow the development (Rochman and Iskandar, 2015).

Instagram has a vision of "We bring you to the people and things that you love" that enables its users to see, share photos/videos and communicate through comments and direct messages (Cahya and Yulianto, 2018; Instagram, 2020). Instagram features to ease the delivery or acceptance of a message or material. The previous study on female adolescents showed that nutrition education provision based on social media of Instagram and WhatsApp could significantly increase subjects' nutrition knowledge (Zaki and Sari, 2019).

The motivation of conducting regular physical activities and a healthy diet is the key to obesity management, following changes in eating behaviour besides nutrition knowledge improvement (Gourlan *et al.*, 2013). Motivational Interviewing (MI) is a collaborative discussion method between counsellors and clients that aims to strengthen the motivation and commitment to change through client-centred collaboration and autonomy (Miller and Rollnick, 2012; Hardcastle *et al.*, 2013; Willis, 2017).

The American Heart Association recommends the MI method as a practical approach as the first step of weight loss. The provision of MI as an additional intervention in a weight loss program, for 4-5 times with 45-60 minutes duration, increases physical activities and brings success in losing weight (Carels *et al.*, 2007). Another study stated that the MI intervention increased the mean of moderate and vigorous physical activities from 90.33 minutes to 213.5 minutes in the fourth month after the intervention (Mahmoodabad *et al.*, 2017). The provision of MI to patients at risk of cardiovascular diseases increased walking activities, decreased diastolic blood pressure, and decreased cholesterol levels (Zaki and Sari, 2019).

Based on the background, few studies have been made that combine nutrition education methods via Instagram with motivational interviewing to improve weight loss and physical activities in obese women. Therefore, the authors were interested in conducting the present study to discover the effects of nutrition education via Instagram (ED) for consecutive 30 days with or without motivational interviewing (MI) on the weight loss motivation and physical activities on obese female students Universitas Diponegoro Semarang.

## 2. Materials and methods

### 2.1 Design, location, time

This study was included in public nutrition's scientific scope with a quasi-experimental design and a pre-post controlled group design. The study was conducted from June to September 2019 and took place at Universitas Diponegoro Semarang. This study obtained permission from the Health Research Ethics Committee Faculty of Medicine Universitas Diponegoro number 479/EC/KEPK/FK UNDIP/XI/2019.

### 2.2 Subjects and sampling

The subjects in this study were active students from non-health faculties, aged 18-23 years, had a nutritional status of obesity ( $BMI \geq 25 \text{ kg/m}^2$ ), were not pregnant, injured, participated in educational programs or nutritional counselling from other parties, has an Instagram account and is an active user, and is willing to be a study subject by filling out an informed consent. The exclusion criteria were subjects who resigned during the intervention period, died, and did not fulfil the intervention for 100%.

The subjects in this study were selected using the proportional stratified sampling method according to the inclusion criteria. The sample size was calculated using paired numerical analysis. Forty-five subjects were obtained through the screening process; however, eight

subjects dropped out so that the total subjects were 37 people. Furthermore, the subjects were divided into three groups, i.e., the first treatment group (P1) for 14 subjects, the second treatment group (P2) for 13 subjects, and the control group (K) for 10 subjects. P1 group was given nutrition education and motivational interviewing and leaflet. P2 group was only given nutrition education and leaflet, while the K group was only given a leaflet containing information on balanced nutrition and the importance of maintaining body weight at the beginning of the study.

### 2.3 Intervention

#### 2.3.1 Nutrition education

This study's independent variables were nutrition education via Instagram (ED) and motivational interviewing (MI). Nutrition education was provided through the @healthydietgizi Instagram account, with one topic per day for 30 consecutive days in the form of infographics. The @healthydietgizi Instagram account is private and can only be followed by subjects in P1 and P2 groups. Apart from providing education, the authors also acted as an admin who managed the Instagram account. A total of three to four infographics were uploaded daily. The ED materials provided included obesity, planning, and recommendations for physical activities, sedentary lifestyle, and dietary patterns following balanced nutrition principles. Under the agreed agreement at the beginning of the study, the subject should leave likes and comments on each infographic uploaded. It aimed to ensure that the subject received and read every education given. Besides, the authors sent each new upload to the study subjects' personal Instagram account via direct messages to provide easy access.

#### 2.3.2 Motivational interviewing

Motivational Interviewing is a collaborative discussion between the subject and the counsellor using the nutritional counselling method based on the Standardized Nutritional Care Process principles, which aims to strengthen the subject's motivation and be adjusted to the constraints of each subject (Hardcastle *et al.*, 2013; Mirkarimi *et al.*, 2015; Mahmoodabad *et al.*, 2017). The MI was given by a nutritionist, with a frequency of 4 times for 45-60 minutes per individual for each meeting. The meeting was held on an agreed day between the subject and the nutritionist. This study's dependent variables were motivation to lose weight, total physical activities, walking activities, moderate physical activities, and vigorous physical activities.

### 2.4 Research instrument

Weight loss motivation was measured by the Healthy

Diet Motivation Questionnaire, a modified Behavioral Regulation in Exercise Questionnaire (BREQ-3) with the final result of a score (Cid *et al.*, 2018; Sweeney *et al.*, 2019). Based on  $r$  calculation  $> r$  table of 0.2159 and a Cronbach's Alpha value of 0.738, Healthy Diet Motivation Questionnaire was valid and reliable (Sujarweni, 2014). Physical activities were measured using the International Physical Activity Questionnaire Short Form (IPAQ-SF) questionnaire and expressed in metabolic tasks per week (METs) (Rocha and Marega, 2010). Measurement of body weight and height. Body weighing was using a digital stepping scale with an accuracy of 0.1 kg, and height was measured using a microtoise with an accuracy of 0.1 cm affixed to the wall.

### 2.5 Data collecting and analysis

The data collected were data on subjects' characteristics, motivation to lose weight, and physical activity. Subjects' characteristics data included name, age, weight, height, department, faculty, monthly allowances, current residence, WhatsApp number, and Instagram account. The age of the subject is the age from birth to the study conducted, measured in units of years. Allowance is subjects' money, whether it came from parents, scholarships, or side works to meet food and non-food needs per month, with a high category if  $\geq$ IDR 1,000,000.00 and low if  $<$ IDR 1,000,000.00 (Kurniawan and Widyaningsih, 2017).

Weight loss motivation is the drive that exists within a person to adopt an active lifestyle and eat healthy foods to lose weight as measured using the Healthy Diet Motivation questionnaire. Total physical activity is defined as all forms of subject activity that can expend energy and is measured once a week. The total physical activities consisted of walking, moderate physical activities, and vigorous physical activities (Gilbert *et al.*, 2018). Walking activity is defined as walking for at least ten consecutive minutes measured for one week. Moderate physical activity is defined as activities that require a certain amount of effort and increase heart rate with a score of 3-6 METs covering badminton, swimming, playing golf, gardening, cycling at moderate speed, and daily homework. Vigorous physical activity is defined as physical activities that require significant effort and cause shortness of breath and increase heart rate by a score of  $>6$  METs. Data were processed using Statistical Package for the Social Sciences (SPSS). Data analysis used the One-Way ANOVA test, Kruskal Wallis, Paired T-Test, Wilcoxon, and Mann Whitney (Dahlan, 2011).

### 3. Results

Table 1 shows the characteristics of subjects. The subjects were 20 years old, with a mean Body Mass Index (BMI) of 28.5 kg/m<sup>2</sup>±2.7. As many as 70.3% of study subjects were from Science and Technology, 67.6% resided in boarding houses, and 56.8% had monthly allowances of <IDR 1,000,000.

After conducting different tests on motivation to lose weight, total physical activities, walking activities, and vigorous physical activities, Table 2 summarises that there were no differences between the three groups at the beginning of the study. However, different tests on moderate physical activities show differences between the three groups at the beginning of the study. It can be caused by the division of the first treatment group, the second treatment, and the control group without paying attention to variations.

The analysis of before and after treatment in Table 2 showed a significant increase in the motivation variable to lose weight ( $p \leq 0.001$ ), total physical activities ( $p = 0.001$ ), walking activities ( $p = 0.024$ ), and moderate physical activities ( $p = 0.002$ ) in the P1 group. Furthermore, there was no significant change in the P2 group. There was a significant increase in weight loss motivation ( $p = 0.041$ ) and a significant decrease in moderate physical activities ( $p = 0.011$ ) in the K group.

The difference analysis in the mean change in variables shows a significant difference in the variable total physical activities ( $p = 0.004$ ) and moderate physical activities in the three groups ( $p \leq 0.001$ ). However, there were no significant difference in the mean changes in motivation to lose weight, walking activities, and vigorous physical activities in the three groups.

Table 1. Study subjects' characteristics

Variable	Characteristic	n	%	Mean±SD	Min	Max
Age (years)				20±1.17	18	22
BMI (kg/m <sup>2</sup> )				28.5±2.7	25	37.5
Faculty	Science and technology	26	70.3			
	Social sciences	11	29.7			
Residence	Rented rooms	26	70.2			
	House	11	29.7			
Allowance	≥IDR1,000,000.00	16	43.2			
	<IDR1,000,000.00	21	56.8			

Table 2. Differences in weight loss motivation; total, walking, moderate, and vigorous PA

Variable	P1	P2	K	sig (p)
Weight loss motivation (score)				
Before	109.86±10.3	114.85±16.5	105.30±13.6	0.260 <sup>a</sup>
After	126.43±11.5	121.69±16.6	112.90±13.3	
p	<0.001 <sup>c*</sup>	0.056 <sup>c</sup>	0.041 <sup>c*</sup>	
Δ Motivation to lose weight	16.5±13.1	6.8±11.6	7.6±10.0	0.079 <sup>a</sup>
Total PA (METs)				
Before	1341±947	1761±1553	3404±2394	0.095 <sup>b</sup>
After	2572±1934	2378±1680	1987±1659	
p	0.001d <sup>*</sup>	0.131 <sup>d</sup>	0.066 <sup>d</sup>	
Δ Total PA	1231±1237	617±1914	-1417±2067	0.004 <sup>b*</sup>
Walking PA (METs)				
Before	445±726	198±323	830±1455	0.260 <sup>b</sup>
After	701±1088	410±432	737±1435	
p	0.024 <sup>d*</sup>	0.074 <sup>d</sup>	0.953 <sup>d</sup>	
Δ Walking PA	256±754	213±441	-93±496	0.326 <sup>b</sup>
Moderate PA (METs)				
Before	593±551	984±757	1938±1156	0.008 <sup>b*</sup>
After	1562±1502	1657±1700	989±852	
p	0.002 <sup>d*</sup>	0.05 <sup>d</sup>	0.011 <sup>d*</sup>	
Δ Moderate PA	970±1449	673±1440	-949±1048	<0.001 <sup>b*</sup>
Vigorous PA (METs)				
Before	302±633	593±1627	636±1211	0.907 <sup>b</sup>
After	333±503	322±470	260±310	
p	0.43 <sup>d</sup>	0.386 <sup>d</sup>	0.310 <sup>d</sup>	
Δ Vigorous PA	30±756	-272±1735	-375±994	0.485 <sup>b</sup>

The mean significant changes in the variable total physical activities and moderate physical activities indicate that at least two groups were significantly different. Furthermore, the Mann Whitney test was conducted to determine which group experienced this significant difference. Based on Table 3, it is discovered that there was a significant difference in the mean change in total physical activities and moderate physical activities. This significant difference occurred in the P1 group when compared to the K group, and the P2 group when compared to K. There was no significant difference in the P1 group when compared to P2.

Table 3. Differences in mean changes of total and moderate PA on the three groups

Variable	P1-P2	P1-K	P2-K
	sig ( <i>p</i> )	sig ( <i>p</i> )	sig ( <i>p</i> )
Δ Total PA (MET)	0.286 <sup>a</sup>	0.002 <sup>a*</sup>	0.015 <sup>a*</sup>
Δ Moderate PA	0.437 <sup>a</sup>	<0.001 <sup>a*</sup>	0.001 <sup>a*</sup>

<sup>a</sup>Mann Whitney test

\*significant

#### 4. Discussion

Students have an important role in social life because they can influence the next generation through their knowledge and experiences as educated individuals. This period is a transitional period that requires the subject to make decisions independently. Health behaviour is one pattern of life formed during this period. However, based on previous studies, students were included in the group that is susceptible to a sharp decrease in physical activity. This behaviour would continue, and it was difficult to change once it is started (Abraham *et al.*, 2018; Aleksovskav-velickovska *et al.*, 2019). Based on their age, students were included in the category of Women of Reproductive Age (WRA). They are women of 15-49-year-olds who have mature and functioning reproductive organs. The decrease in physical activities over a long time can lead to obesity. Obesity occurs due to a positive energy balance that lasts for a long time, and thus, the body experiences large amounts of fat accumulation (Dieny, 2014; Noer *et al.*, 2018).

A total of 45 female students were obtained through the screening stage. However, eight people dropped out, and therefore the subjects studied were thirty-seven (n = 37) people. The causes were that four people resigned, three people could not be contacted again during the intervention period, and one person had incomplete data. Subjects were obese female students with a mean age of 21 years, with a mean BMI of 28.5±2.7 kg/m<sup>2</sup>. Thus, subjects were included in the category of Women of Reproductive Age (WRA). As many as 70.3% of subjects came from the faculty of sciences and

technology (Science and technology), 67.6% of subjects resided in boarding houses, and 56.8% of subjects had an allowance of <IDR 1,000,000.00 per month.

At the beginning of the study, the results of the analysis show that there were no significant differences in the motivation variables to lose weight, walking, vigorous physical activities, and total physical activities. It shows that the three groups were in the same condition at the beginning. However, there was a significant difference in the moderate physical activities variable before the intervention.

#### 4.1 Changes in motivation to lose weight

Before the intervention, the P2 group had the highest motivation score to lose weight, and the K group had the least score. However, a significant increase in weight loss motivation occurred in the P1 group compared to the P2 and K groups. The increase in weight loss motivation in the P1 group was due to nutritional education provision for 30 consecutive days via Instagram, accompanied by motivational interviewing four times, which was conducted once a week. The previous study showed that MI could increase an individual's motivation to fight barriers, the ability to care for oneself and strengthen a willingness to adopt a healthy lifestyle (Lin *et al.*, 2016).

After the intervention, there was an increase in weight loss motivation in the P2 group, but it was not significant. This finding is following a study by Barnes *et al.* (2018) which provided five interventions for MI and Nutrition Psychoeducation (MINP) with a duration of 20 minutes per session, showing that there was no significant change in individual motivation to lose weight. It was because subjects already had the motivation to undergo a weight loss program, and hence, subjects felt satisfied with the treatment undertaken before (Barnes *et al.*, 2018).

The choice food types consumed shows an increase in fruit and vegetable intakes and a decrease in the high-fat food intake that could be caused by an increase in motivation to be healthy eating (Naughton *et al.*, 2015). Based on the previous study, subjects who put health factors as the main reason for diet tended to perceive that the lifestyle, they have applied so far was good. This results in the assumption that the interventions provided did not provide more benefits. Another factor that can cause an insignificant increase in dietary motivation in this study was food selection considerations such as price, sensory appeal (colour, aroma, taste), and natural food content (Rankin *et al.*, 2018).

There was an increase in the motivation score to lose weight significantly in the K group after giving the

intervention. K group experienced a change in score ( $7.6\pm 10.0$ ), which was higher than the P2 group score ( $6.8\pm 11.6$ ) but lower than the score for the P1 group ( $16.5\pm 13.1$ ). However, the motivation score for weight loss in the k group ( $112.9\pm 13.3$ ) was lower when compared to the score for the P1 group ( $126.4\pm 11.5$ ) and the score for the P2 group ( $121.69\pm 16.6$ ). One factor that led to an increase in the motivation score to lose weight in the K group was the leaflet's provision to increase personal knowledge and attitudes (Meidiana *et al.*, 2018). The leaflet contained information on balanced nutrition and the importance of maintaining body weight. Good nutritional knowledge is a strengthening factor in implementing a healthy lifestyle, allowing an increased weight loss motivation in the K group.

#### 4.2 Changes in physical activities

The promotion of physical activities becomes a big challenge when carried out on specific groups, where women with obese nutritional status are one of them. Obese women have a more significant barrier than women with normal nutritional status at the same age due to society's social stigma. Based on a previous study conducted on women of 18-55-year-olds using the focus group discussion (FGD) method, there were three main obstacle factors in carrying out physical activities, i.e., intrapersonal barriers (51.3%), environmental barriers (32.1%), and interpersonal barrier (16.6%). Regarding this study, motivational interviewing was provided as a form of support for the subjects, thereby reducing barriers to physical activities (Mcintosh *et al.*, 2016).

Before the intervention was given, the mean subjects' physical activity on the K group ( $3404\pm 2394$  METs) was the highest than P2 ( $1761\pm 1553$  METs) and P1 ( $1341\pm 947$  METs) groups. However, the increased mean physical activity was the highest in the P1 group, followed by the P2 group, while the K group experienced a decrease after the intervention. Physical activities increase in P1 and P2 groups because they provide nutritional education via Instagram for 30 consecutive days. An adequate and repetitive education provision may change an unhealthy lifestyle into the healthy one, though this process needs a long time (Mahmoodabad *et al.*, 2017).

Besides education, the P1 group was also provided with MI four times by a nutritional expert. The finding follows the previous study, where MI was proven to increase physical activities (Lin *et al.*, 2016). The same result was also discovered in a study by Mahmoodabad *et al.*, 2017 showing that MI intervention prevention using the Self Determination Theory (SDT) framework may increase physical activities significantly on Women of Reproductive Age after the intervention and four

months post-intervention. On the other hand, the decreasing mean physical activities in the K group caused by the absence of special monitoring, limited time to perform physical activities, and decreased in all types of physical activities.

Based on Lawrence Green's theory, humans' behaviours are influenced by two primary factors, i.e., behaviour and off-behaviour. Then, three primary factors shape humans' behaviours, i.e., predisposition, enabling, and strengthening. The ED and MI provisions by counsellors were predisposition factors, marked by an increased weight loss motivation that increased physical activities in P1. Counsellors' attitude in providing support through motivational interviewing could be the strengthening factor for subjects to apply higher physical activities than before (Notoatmodjo, 2010).

Before the intervention, the highest walking activity was in the K group ( $830\pm 1455$  METs) compared to the P1 ( $445\pm 726$  METs) and P2 ( $198\pm 323$  METs) groups. After the intervention, it is discovered that there were no significant differences between walking activities in all three groups. However, the P1 group experienced a significant increase from the mean walking activity value, followed by the P2 group, which also increased insignificantly. In contrast, the K group experienced a decrease in the mean walking activity.

The significant increase in mean walking activity of the P1 group follows the previous study that mentioned that motivational interviewing provision increased walking and decreased cholesterol significantly (Hardcastle *et al.*, 2013). Nutrition education provision related to walking activities, tips for a fun walk, and invitations to walk from Instagram were also strengthening factors causing increased walking activities in the P1 and P2 groups.

Compared to other physical activities, walking is comfortable, light, practical, and free to perform. Walking activities were often carried out by the P1 and P2 groups as a means of transportation to the campus and sports. The Universitas Diponegoro area had a walkability value of 66.71, which included in the yellow category, or good enough to walk. Therefore, walking activities around campus are an appropriate choice (Tanan *et al.*, 2017).

However, in Indonesia, the average walking activity is <3500 steps per day and is included in the country's category with a low walking activity (Althoff *et al.*, 2017). The decrease of walking activity in the K group might be caused by several factors such as the distance between residence and campus, tendency to utilize motor vehicles, limited time, and high temperature in Semarang

(Tanan et al., 2017).

Before the intervention, the mean moderate-intensity physical activity was the highest on the K group ( $1938 \pm 1156$  METs), followed by the P2 ( $984 \pm 757$  METs) and P1 ( $593 \pm 551$  METs) groups. Pre-intervention data show that all three groups were not homogeneous. That condition caused limitations in the study. Therefore, the three groups' significant mean changes might be caused by varying data between the three groups. Nevertheless, based on the Paired-T test, it is discovered that the P1's moderate-intensity physical activity was increasing significantly. The P2 group was also increasing although insignificant, while the K group was experiencing a significant decrease.

The significant increase in the P1 group was following previous studies which stated that giving MI by telephone for 12 weeks with a duration of 15-30 minutes per subject was able to increase moderate physical activities (Lin et al., 2016). The types of moderate physical activities conducted by subjects were washing clothes, sweeping, and mopping the floor. The ease of access to subjects in carrying out moderate activities caused a behaviour change. The theory of Response Organism Stimulus (SOR) explains that behaviour change can be realized when the existing stimulus is received and can convince subjects, and therefore, attitude changes occur. Attitude changes that are supported by the environment will result in a behaviour change. The provision of ED + MI and ED interventions in this study acted as stimulation in the P1 and P2 groups (Notoatmodjo, 2010).

A significant decrease in moderate physical activities in the K group was made possible by several subjects who were doing temporary, moderate physical activities only at one time. It caused a significant difference in the mean moderate physical activities at the beginning and the end of the study. The types of moderate physical activities conducted by subjects were badminton and cycling with moderate intensity.

Before the intervention, the highest vigorous intensity was provided by the K group ( $636 \pm 1211$  METs) compared to the P2 ( $593 \pm 1627$  METs) and P1 ( $302 \pm 633$  METs) groups. However, the increase only occurred in the P1 group, while the P2 and K groups decreased after the intervention. Vigorous physical activities such as swimming, basketball, volleyball, running, and fast cycling require facilities and infrastructure, but not all subjects had this access. Facilities and infrastructure in carrying out vigorous physical activities were significant obstacles faced by subjects. In line with previous studies, sports facilities had a strong relationship with the subjects' physical

activity. Subjects who had no access to sports facilities tended to be less active (Farradika et al., 2019).

Based on the theory of behaviour change of Kurt Lewin, behaviour change occurs due to an imbalance between the reinforcement strength, which is greater than the holding strength (Notoatmodjo, 2010; Ranitadewi et al., 2018). The strengthening factor was obtained by subjects in the form of support by counsellors to subjects to do physical activities, which had a more significant impact than the obstacles, increased vigorous physical activities in the P1 group. The strengthening factors in the form of ED and leaflet delivery could not exceed the obstacles in carrying out vigorous physical activities in the P2 and K groups so that no change in vigorous physical activity was achieved. Motivational interviewing can be given with a frequency of more than four meeting sessions, and it is necessary to increase the duration of nutrition education via Instagram and motivational interviewing for more than two months (Mirkarimi et al., 2015; Barnes et al., 2018).

Based on different tests for each group, the nutrition education via Instagram collaborated with motivational interviewing, show a significant difference in the motivation to lose weight, total physical activities, walking, and moderate physical activities. Nutrition education only via Instagram did not show a significant difference in the mean weight loss motivation and the mean physical activities. The control group given leaflets showed a significant increasing difference in the mean weight loss motivation and a significant decrease in the mean of moderate physical activities.

After conducting different tests between the three groups, there were significant differences in the mean change in total physical activities and moderate physical activities. There were no significant differences in motivation changes to lose weight, walking activities, and vigorous physical activities between the three groups. The significant differences in the mean change in total physical activities and moderate physical activities were further tested using the Mann Whitney test. The test results show significant differences in the mean change in total physical activities and physical activities between the P1 and P2 groups compared to the K group.

## 5. Conclusion

This study provides evidence that nutrition education via Instagram collaborated with motivational interviewing increases the total physical activities that encouraged weight loss in obese women.

## Conflict of interest

The authors declare no conflict of interest.

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