SURABAYA INTERNATIONAL HEALTH CONFERENCE
"Empowering Community For Health Status Improvement"
Novotel Samator East Surabaya Hotel, July, 13-14 2019

Association Between Physical Activity and Body Mass Index in Non-Insulin-Dependent Type 2 Diabetes Mellitus Patients

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Abstract: For type 2 diabetes mellitus (T2DM) patients, lifestyle modification intervention including physical activity intervention is one of key points to improve BMI and other metabolic markers which can delay complications development. Nevertheless, modifying physical activity to meet recommendation is not easy. We tried to explore physical activity practice of T2DM patients from 3 public health services in Kota Yogyakarta and investigate the association between physical activity and body mass index. This study was a cross sectional study which conducted on 29 non-insulin-dependent type 2 diabetes mellitus patients. Physical activity was measured using IPAQ. The association between physical activity and body mass index was analyzed using Spearman's Rank correlation test by STATA 13. Our study found that 96,55% participants had moderate and high level physical activity. The mean of participants BMI and IPAQ score were 27,13 ± 3,45 kg/m2 and 4463,94 ± 2324,19. The correlation between physical activity and body mass index was negative or protective (r = -0,02) but not significant (p=0,87). We suggest T2DM patients should not only do moderate or high physical activity but also do regular exercise and or maintain diet to achieve BMI improvement.
Keywords: T2DM, type 2 diabetes mellitus, physical activity, body mass index, BMI.

1. Introduction

Diabetes is growing larger in Indonesia. Guariguata *et al.* (2013) predicted that the diabetes prevalence in Indonesia would be growing about 65,4% from 2013 to 2035[1]. Mostly, the patients are type 2 diabetes mellitus (T2DM) patients and they have at least one complications[2]. In order to prevent complications to those patients, conducted therapies such healthy lifestyle modification and drug therapy are needed. For T2DM patients, both lifestyle modification and drug therapy shall be done together to meet effective results. In many cases, modifying lifestyle is difficult because it is created from several aspects such as habit, automatic responses to environments, conscious choice, and calculation[3].

One of the lifestyle which hard to modify is physical activity. Based on Perkeni Guideline, diabetes mellitus patients without nephropathy complication should do physical activity and exercise at least 3-5 times for about 30-45 minutes per week or 150 minutes per week in total[4]. T2DM patients should also decrease the amount of time doing sedentary behavior. Besides, do bouts of light activity every 30 minutes of prolonged sitting [5]. In fact, research in Central Java Indonesia showed that only 16 of 35 patients who did physical activity and exercise according to the guideline[6]. Until now, physical activity data from scientific research in Indonesia remains low. Whereas, based on a meta-analysis research, physical activity and exercise are associated with improvement in BMI [7]. Until now study in physical activity and its effect on weight management or body mass index is remain low so we decided to conduct this study.

2. Methods

This research was a cross sectional study conducted on 29 subjects. The subjects were recruited using purposive sampling from 3 public health services in Kota Yogyakarta. We applied inclusion and exclusion to recruit subjects. The inclusion criteria were 1) 30-70 years old patients with T2DM 3) non-insulin injection 4) residence in Kota Yogyakarta 5) willing to participate in this study. The exclusion included 1) having complications such as cardiovascular disease, renal disease, hepatic

disease, pulmonary disease, inflammation disease, impaired thyroid function and/ or chronic disease in gastrointestinal based on interview 2) pregnant and/or breastfeeding 3) smoking. Subject recruited were only patients who met these criteria.

At the beginning of the study, demographic data were collected from the subjects by questionnaire. Height of the subjects was measured using microtoise while weight of the subjects was measured using digital scales. Physical activity of the subjects was measured using International Physical Activity Questionnaire (IPAQ) for 30 days. Subjects guided by research assistants to complete the IPAQ every week. Body mass index (BMI) of the subjects was calculated after height and body weight data of the subjects completed. The association between physical activity and BMI was analyzed by Spearman`s Rank. All data were analyzed using STATA 13.

3. Results

After all of the data were collected, we analyzed and displayed them. The mean ages of the participants was 52,48 ± 6,72 years. Mostly the participants were female (75,86) and being diagnosed as T2DM patients for <5 years (65,51%). Distribution of participant characteristics was summarized in Table 1.

Table 1. Distribution of Participant Characteristics

Participant Characteristics	**n (%)**
Age	
30-39 years	2 (6,90)
40-49 years	7 (24,14)
50-60 years	20 (68,96)
Gender	
Male	7 (24,14)
Female	22 (75,86)
Length of being diagnosed	
<24 months	3 (10,34)
1 - <5 years	16 (55,17)
5 - < 10 years	6 (20,70)
> 10 years	4 (13,79)
Hypertension status	
Yes	7 (24,14)
No	22 (75,86)

The mean of participants body mass index was 27,13±3,45 kg/m^2 or categorized as obess. Meanwhile, the mean of IPAQ score of participants was 4463,94±2324,19 or categorized as high intensity physical activity. The distribution of BMI and physical activity based on IPAQ score is presented in Table 2. Based on Spearman's Rank test, the correlation between physical activity and BMI score (physical activity) was very weak and negative (r = -0,02) but it was not significant (p=0,87).

Table 2. Distribution of Physical Activity and Body Mass Index of Participant

Physical Activity	**n (%)**
Low	1 (3,45)
Moderate	5 (17,24)
High	23 (79,31)
Total	29 (100)
Body Mass Index (kg/m^2)	**n (%)**
Underweight (<18,5)	0 (0)
Normal (18,5 – <23)	6 (20,69)
Overweight (23 – <25)	1 (3,45)
Obess (≥ 25)	22 (75,86)
Total	29 (100)

4. Discussion

For overweight and obese diabetes patients, higher BMI increase the risk of complications which lead to mortality. Greater weight loss stimulates greater benefits including blood pressure reduction and blood glucose, LDL cholesterol and HDL cholesterol improvement. Based on American Diabetes Association Guideline, factors which affect weight loss and stimulate lower BMI on diabetes mellitus patients were diet, physical activity and behavioral interventions[58]. We tried to explore the association of physical activity and BMI in this study but we could not explore other factors like diet and smoking because of our limitation.

Participants were mostly obese and overweight (75,86% and 3,45%). 96,55% of participants did moderate physical activity and high physical activity. It is only 3,45% or 1 participant who categorized as low physical activity. When we compared our result to previous study, physical activity of T2DM patients was improving. The previous study found that 79,07% of T2DM patients were categorized as low physical activity[9].

In patients with type 1 diabetes, frequencies of overweight and obesity were significantly lower in active patients than in inactive patients[10]. Our study found that physical activity had a very weak negative or protective correlation (r= - 0,02) to BMI but the correlation was not significant (p=0,87). There were a lot of factors which might affect the correlation of physical activity and BMI of this study.

Hemmingson *et al.* (2017) suggest that diabetes patients should not only do high intensity physical activity but also maintain their diet to achieve glycemic control improvement and other benefits like lowering body weight or BMI[11]. Hence implementing physical activity therapy alone is not significant to improve BMI in T2DM patients. Other evidence exists that physical activity will reduce body weight and improve BMI and glycemic control if it is done with regular exercise[58]. Moreover, regular exercise can improve inflammatory markers in T2DM patients[12]. American Diabetes Association recommend T2DM patients to do daily exercise or at least not allowing more than 2 days to elapse between exercise sessions to achieve optimal health outcomes[58]. Furthermore, evidence exists that interval training is an exercise tool for improving body composition, physical fitness, glycemic control and peripheral glucose disposal in T2DM patients[12]. In consequence, the future study should consider daily exercise and diet as variables which correlated to BMI beside physical activity.

5. Conclusion

This is the first study which explored the association between physical activity and BMI of T2DM patients in Indonesia. Our study found that physical activity had a very weak negative correlation to BMI but the correlation was not significant. We suggest T2DM patients should not only do moderate or high physical activity but also do regular exercise and or maintain diet to achieve BMI improvement.

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