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Breaking Up Prolonged Sitting with Light-intensity Walking Attenuated Postprandial Hyperglycemia

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ABSTRACT

Sedentary behaviour is a risk factor for comorbidities and mortality regardless of physical activity level. Experimental data show interrupting prolonged sitting is beneficially associated with metabolic risk. This study therefore investigated the acute effects of interrupting prolonged sitting with light-intensity walking on postprandial hyperglycemia in healthy adults. This study involved thirty normoglycemic participants. Each of the study participants were given a standard 75-grams glucose. The treatment of the participants was divided into two trials. First, the control trial, the participants were instructed to sit for five straight hours. The profile of changes in blood glucose was taken at an inverval of 30 minutes from minutes 0, 30, 90, 120, 180, 240, and 300. Second, the experimental trial where the participants were instructed to take a short walk for 3 minutes then sit for 27 minutes. Data were analyzed using paired T-test. There were no significant data difference at the baseline between trials. There were no significant changes in all the point of blood glucose recordings except at 120 minutes, where the postprandial blood glucose of the experimental trial with light-intensity walking was significantly lower than that of control trial. The main finding of this study was that breaking up sitting time with short bouts of light-intensity activity attenuated postprandial hyperglycemia. The light-intensity walking attenuated the postprandial hyperglycemia albeit not significant statistically except at the 120 minutes time point. Postprandial hyperglycemia is a cardiovascular risk factor in people with Type 2 diabetes and even in nondiabetics. Reducing postprandial hyperglycemia improves inflammation and endothelial function and reduces carotid intima-media thickness. Frequent brief interruptions to prolonged sitting with light-intensity walking, impart beneficial postprandial responses. Further study is recommended on more prolonged light-intensity bouts of activity and shorter period of sitting.

Keywords: Prolonged Sitting, Postprandial Hyperglycemia, Light-Intensity Walking.

INTRODUCTION

Reports say that 60-85% of people in developed and developing countries have increasingly diminished physical activity and likely to lead a more sedentary lifestyle and sedentary lifestyle

may be included among the ten leading causes of death and disability in the world (WHO, 2014). By definition, a sedentary lifestyle comprise of activities that do not increase energy expenditure far above the resting level (Pate et al., 2008). Therefore, passive prolonged siting is component of sedentary lifestyle.

Along with the many forms of passive entertainment, an increasingly large number of adult workers in countries that are technologically advanced work in an office setting involving an increased use of computers and prolonged sitting (Wiesen, 2013). According to Dunstan et al. (2011) a sedentary lifestyle is associated with cardiovascular disease and its complications may eventually lead to death. Researchers have postulated that the increase in the epidemic of type 2 diabetes in young people in accordance with the increase in obesity and a sedentary lifestyle (lack of movement) in this age group (Brashers, 2008).

Since type 2 diabetes is characterized by prolonged hyperglycemia, therefore it is worth investigating whether postprandial hyperglycemia during prolonged sitting can be managed with intermittent light intensity walking. Therefore, this study aimed to determine whether intermittent light-intensity walking activity during prolonged sitting has a significant acute effect on postprandial blood glucose level.

METHODS

Thirty participants consisting of fifteen male and fifteen female studens were selected with random selection method. These participants were the students of Adventist University of Indonesia located in Bandung Barat Regency, Indonesia. The eligibility criteria included normal fasting blood glucose, good health and physical condition, and normotensive. The participants live in the university dormitory, underwent similar daily routines and consumed the same meals served in the university dormitory cafeteria.

The willing candidate for participants were given briefing on the methods of the research where they were to sit for a duration of five hours straight after overnight fasting, with intermittent light-intensity. The willing ones were then asked to sign informed consent. The research method was approved by the Research Ethic Committee of the university.

The participants were asked to fast overnight prior to the day of the each experiment and were asked to come on time at about 4.30 am to get more briefing. Each of the experiment started at 5 am. There were seated in a row and were free to take their laptop with them but not cellphone. During the five-hour of sitting, the participants were free to use their laptop to fill the time and were allowed to rise from their sit only when to go to the toilet.

The experiment were carried out in two sessions separated by a week. The first experiment session was the control and the second session was for the treatment. The first experiment started with checking and recording of fasting blood glucose. After that, each participant was given a standardized glucose tolerance test: 75 grams of food-grade monohydrate glucose diluted in 250 ml of water to be consumed in less than two minutes. The blood glucose was then checked and recorded at 30, 60, 90, 120, 180, 240, and 300-minute postprandial time points afterward.

The second experiment was carried out after a one-week interval. The same participants that participated in the first experiment also participated in the second experiment. Just like the first experiment, the second experiment started at 5 am, followed by checking and recording of the fasting blood glucose. After this, the participant was also asked to consume the glucose solution just like what was consumed in the first experiment. This is followed by sitting for a period of sitting for 27 minutes. At the end of the 27-minute of sitting, the participants were asked to engage in light-intensity walking for three minutes. The light-intensity walking a relaxed walking on a cemented even surface at the speed 0.75 second/step measured using metronome with speed of 96 bpm. This is equivalent of walking at a speed of 4 km/h. At the end of the 3-minute light-intensity walking the participant was asked to sit again for another 27 minutes, followed by the same 3-minute light-intensity walking. This set of activity of sitting and walking was done every thirty minutes from the start till the end of the experiment, making a total of ten sets of activity. However, the checking of the blood glucose was done every hour after 120 post-prandial, that was at 180, 240 and 300 post-prandial minutes. The checking of the blood glucose was done using blood glucose test kit (Accu-Chek Performa® of 1 % error).

RESULTS

The anthropometric and physiological characteristics of participants is presented in Table 1. Data in the Table shows that the participant are physiologically normal.

Table 1. **The Anthropometric and Physiological Characteristics of Participants (n = 30).**

	Weight (kg)	**BMI**		**Age (y)**	**Height (cm)**	**Heart Rate /min**	**Blood Pressure**	
		Value	**Category**				**Systole**	**Diastole**
Mean	56.3	21.2	Normal	20.9	162.8	79.8	115.0	80.8
SD	9.2	2.9		1.8	8.0	12.9	14.4	11.5

Table 2 indicates that there was no significant different in the fasting blood glucose in the beginning of both experiments one and two. The blood glucose was lower in the treatment group at 30 and 90 minutes post-prandial however, this decrease was not significant. There were differences in the blood glucose at different time points however, the significant change in the blood glucose was significant at 120 minutes post-prandial. The profile of the post-prandial blood glucose in both experiments is show in Fig. 1 below

Table 2. **Postprandial Blood Glucose Profile (n = 30).**

Group	Postprandial Blood Glucose (minutes) (mg/dL)							
	0	30	60	90	120	180	240	300
Control	89.0±10.0	171.1±43.8	147.6±25.2	135.3±20.5	120.5±24.5	87.1±18.2	84.5±12.7	90.2±12.8
Treament	92.9±17.3	156.9±31.9	156.9±42.3	128.4±28.0	89.7±25.6	87.4±19.9	87.9±12.1	92.5±10.5
p	.288	.172	.238	.174	.000	.955	.177	.170

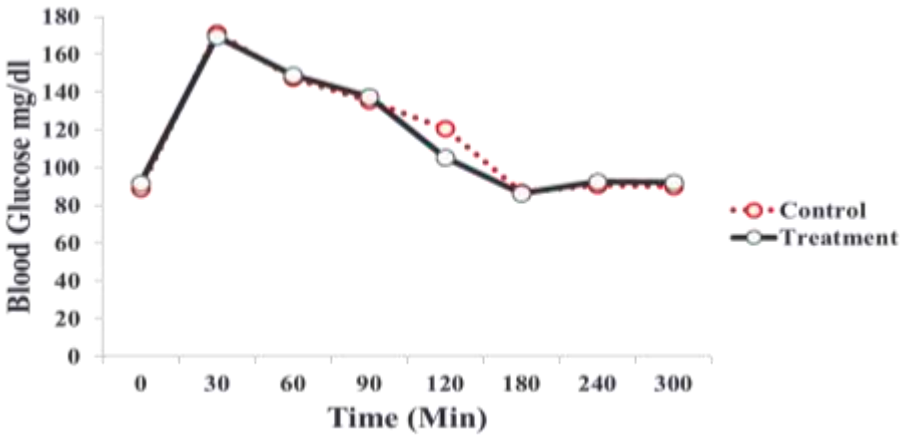

Figure 1. Postprandial blood glucose profile

DISCUSSION

The blood glucose was lower, though not significant, at 30 and 90 minutes post-prandial. Similar result was indicated by a study done by Dustan et al (2011) which shows that a short exercise break for 2 minutes after sitting for 20 minutes is quite effective in reducing postprandial blood glucose levels by 24.1%. One interesting study was done on the effect of walking after meal on the lowering of post-prandial glucose. The result of the study shows that walking after a meal is more effective than walking 45 minutes in the morning or in the afternoon in lowering glucose after eating (DiPietro et al., 2013).

The World Health Organization (2014) even warns the public that a sedentary lifestyle may very well be one of the ten leading causes of disability and death in the world. Prolonged sitting is defined as being sedentary for more than 2 hours at a time.(Biswas, 2015). Physical activity goes feasible for most people and running training programs have been extensively evaluated in patients with type 2 diabetes. It was suggested that for every hour you are sitting, it's vital you get up, walk around, and fully stretch out the body for at least 5 to 10 minutes. (Karstoft et al., 2014).

Conclusion

It is concluded that intermittent light-intensity walking activity during prolonged period of sitting attenuates postprandial blood glucose at minute 120 into the study ($p = .000$).

Recommendation

Given the risks posed by prolonged periods of sedentary activity, it is imperative to conduct further research to determine other types, intensities, and frequencies of activities that can be performed during long periods of sitting decrease blood sugar levels.

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