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YOGURT IS EFFECTIVE IN REDUCTION OF FASTING BLOOD GLUCOSE LEVELS OF PREDIABETES IN EMPLOYEES

Rusana*, Ida Ariani, Ahmad Subandi
Nursing Program, STIKES Al Irsyad Al Islamiyyah Cilacap, Jl. Cerme No.24, Wanasari, Sidanegara, Kec. Cilacap Tengah, Kabupaten Cilacap, Jawa Tengah, Indonesia 53223
*rusanarofiq@gmail.com

ABSTRACT
Prediabetes is a state of increasing a person's blood glucose level before become the Diabetes Mellitus or DM category. Untreated prediabetes, within 3-5 years can change to type 2 DM. Prediabetes blood glucose levels in the fasting state are 100-125 mg/ dL. The aim of this study was to determine the effectiveness of yogurt on 2 hours after meals blood glucose levels. The method used is quasi experiment pre and post test with control group. The total sample size is 30. The sampling technique is purposive sample. Data were collected by means of a questionnaire for the characteristics of respondents (sex, ages, Body Mass Index (IMT) and checking glucose levels. The data analysis using univariate analysis and independent t-test for bivariate analysis. The results of data analysis with independent-t showed a significant difference where respondents who were given yogurt experienced a decrease in 2 hours after meals/ PP blood glucose levels (p= 0,000). Blood glucose levels 2 hours after meals in respondents who were given yogurt in this study decrease/ lower (16%) than blood glucose levels 2 hours after meals on respondents who were not given yogurt.

Keywords: blood glucose levels; employees; yogurt

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INTRODUCTION

Before people develop type 2 diabetes, they almost always have "prediabetes" blood glucose levels that are higher than normal but not yet high enough to be diagnosed as diabetes. The World Health Organization (WHO) has defined prediabetes as a state of intermediate hyperglycemia using two specific parameters, impaired fasting glucose (IFG) defined as plasma glucose of 110 to 125 mg/dL and impaired glucose tolerance (IGT) defined as 2 h plasma glucose of 7.8-11.0 mmol/L (140-200 mg/dL). The American Diabetes Association (ADA), on the other hand has the same cut-off value for IGT (140-200 mg/dL) but has a lower cut-off value for IFG (100-125 mg/dL) (Bansal, 2015).

Prediabetes will become diabetes within 5-6 years by 30% and will develop type 2 diabetes mellitus within 3 years without any lifestyle modification. Prediabetes increases the risk of type 2 Diabetes Mellitus (T2DM) (Sulistiowati & Sihombing, 2018). Indonesia In Central Java Province, the highest number of diabetes cases was in Cilacap Regency (3.9%), followed by Tegal Kota District (3.1%), Surakarta (2.8%), and Pemalang (2.1%) (Riskesda, 2007) (European Environment Agency (EEA), 2019). The

number of DM sufferers according to Riskesdas has increased from 2007 to 2013 by 330,512 patients (*Infodatin-Diabetes.Pdf*, n.d.).

Several risk factors which increases the likelihood of someone suffering from prediabetes are obesity, lack of physical activity, age, family history, lack of sleep, history of diabetes in pregnancy, and polycystic ovary syndrome (Deyasningrum, 2014). The characteristics of prediabetes in the mountainous region were female sex, age 40-54 years, hypertension, and obesity . In coastal areas are female sex, age 40-54 years, hypertension. In urban areas are female sex, age 40-54 years, obesity, and not active activity. Risk factors in mountainous regions are uric acid and cholesterol ($p < 0.05$), in coastal areas are uric acid, choles- terol and other vascular diseases ($p < 0.05$), whereas in urban areas are his- tory of heredity and cholesterol ($p < 0.05$) (Noventi, Rusdianingseh, & Khafid, 2019).

Employees need to check blood glucose level. Consuming yogurt can improve blood glucose consumption and can provide significant benefits in reducing the risk of diabetes by 18% (Barengolts, Smith, Reutrakul, Tonucci, & Anothaisintawee, 2019). Probiotic consumption, compared with placebo, significantly reduced fasting glucose (MD = -0.31 mmol/L; 95% CI 0.56, 0.06; p = 0.02), fasting plasma insulin (MD = -1.29 μU/mL; 95% CI -2.17, -0.41; p = 0.004), and HOMA-IR (MD = 0.48; 95% CI -0.83, -0.13; p = 0.007) (Ruan et al., 2015). There was a significant difference in mean blood glucose levels between the control group and the intervention group after giving banana sinbiotic yogurt to mice with metabolic syndrome (Rahmawati, Djamiatun, & Suci, 2017). Probiotic yogurt is suggested as a nutritional approach in type 2 diabetes (T2D) and obesity (Barengolts et al., 2019). The aim of this study was to determine the effectiveness yogurt of blood glucose levels on 2 hours after meals. Type of quantitative research with a quasi-experimental approach.

METHOD

The method used is quasi experiment pre and post test with control group. The total sample size is 30 with intervention and control groups of 15 respondents each. The sampling technique is purposive sample. The data analysis using univariate analysis for the characteristics of respondents (sex, ages, Body Mass Index (IMT) and Blood glucose level on 2 hours after meals and independent t-test for bivariate analysis. The study was conducted on employees who the sample inclusion criteria, namely the results of blood glucose levels 2 hours after meals were in the range of 140-199 mg/ dL, had not been diabetes diagnosed by doctor and willing to be a respondent. The intervention group was given of yogurt 100 ml/day for 2 weeks. Performed from August 20 to September 1, 2018. Examination of blood glucose 2 hours after meals is done with a gluco-Dr.

RESULTS

Characteristics of respondents are in the following tables 1 and 2. Table 1, the highest sex distribution of respondents in both the control and intervention groups was men, 12 (80%) and 10 (66.7%). Table 2, the results of the analysis of the BMI distribution of respondents between the control group and the intervention group had an average BMI in the same range. The BMI range of the intervention group was 12.2, higher than the control group BMI range of 12.1. Interval estimation results can be concluded that 95%

is believed to be the average BMI in the control group between 21.56 to 25.49 while in the intervention group 23.42 to 27.36. The homogeneity test in the control and intervention groups has the same variant as p = 0.100. The results of the analysis of the age distribution of respondents between the control group and the intervention group had the mean age in the range almost the same. The age range of the intervention group is 20 years, higher than the age range of the control group, which is 18 years. Interval estimation results can be concluded that 95% is believed to be the average age in the control group between 35.61 to 42.12 years while in the intervention group 30.14 to 37.46 years. Homogeneity test in the control and intervention groups has the same variant with p=0.167.

Table 1.
Distribution of Respondents in Control and Intervention Groups by Gender (n = 30)

Group	Gender	f	(%)
1. Control	a. male	12	80
	b. female	3	20
2. Intervention	a. male	10	66,7
	b. female	5	33,3

Table 2
Distribution Respondent of Age and BMI in the Control and Intervention Groups (n = 30)

Group	Mean	SD	Min-Maks	95% CI	p *value*
BMI					
Control	23,53	3,56	18,8-30,9	21,56-25,49	0,100
Intervension	25,39	3,55	19,4-31,6	23,42-27,36	
Ages					
Control	38,87	5,878	31-49	35,61-42,12	0,167
Intervension	33,80	6,614	23-43	30,14-37,46	

Table 3
Distribution of Blood Glucose Level 2-Hour After Meals on Prediabetes Respondents (n = 30)

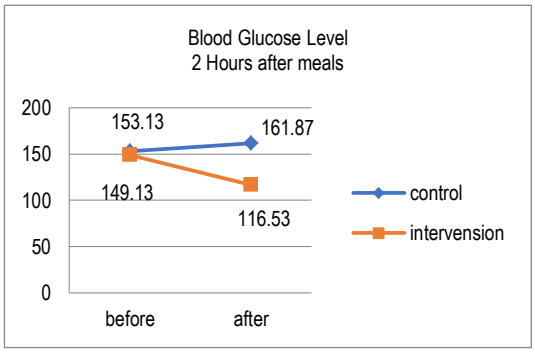
Blood Glucose level	Group	Mean	SD	Min-Maks	95% CI
Pre test	Control	153,13	10,19	140-172	147,49-158,78
	Intervension	149,13	5,48	142-158	146,10-152,17
Post test	Control	161.87	9,33	145-174	156,7-167,03
	Intervension	116,53	13,49	90-135	109.06-124.01

Table 4.
Analysis of differences in blood glucoase levels 2 hours after meals before and after intervention in the control and intervention group (n = 30)

Group	Blood Glucose Level 2 Hours after meals			P *value*	Intervension effect (%)
	Mean				
	Pre	Post	Gain score		
Control	153,13	161,87	8,74	0,000	16%
Intervension	149,13	116,53	32,6	0,000	
P *value* 0,000					

Table 3, the results of the analysis of the distribution of blood glucose levels 2 hours after meals in the respondents before the intervention in the control group had an average of 32 mg / dL in the range of 16 mg / dL. The results of the interval estimation can be concluded that 95% is believed to be average fasting blood glucose levels in the control group between 147.49 mg/ dL up to 158.78 mg/ dL, whereas in the intervention group 146.10 mg/ dL up to 152.17 mg/ dL. The results of the analysis of the distribution of blood glucose levels 2 hours after meals in the respondents after the intervention in the intervention group had an average of 45 mg/ dL higher than the control group range of 29 mg/ dL. The results of the interval estimation can be concluded that 95% is believed to be an average fasting blood glucose level in the control group between 156.7 mg/ dL up to 167.03 mg/ dL, whereas in the intervention group 109.06 mg/ dL up to 124.01 mg/ dL.

Table 4, the average difference in blood glucose levels 2 hours after meals between before and after being given intervention in the control group was 8.74 mg/ dL while in the intervention group it was 32.6 mg/ dL. The results of the independent t test showed that there were significant differences in blood glucose levels 2 hours after meals after intervention (p = 0,000). Blood glucose levels 2 hours after meals, after the intervention between the control group and the intervention group was 16%. This means that blood glucose levels 2 hours after meals on respondents who were given yogurt in this study decreased/ lower (16%) than blood glucose levels 2 hours after meals on respondents who were not given yogurt. The difference in blood glucose levels 2 hours after meals can be seen in graph 1. the following:



Graph 1.
The difference in mean blood glucose levels 2 hours after meals, before and after intervention in the control group and intervention group

DISCUSSION

Sampling in this study were 30 respondents with fasting blood glucose levels (IFG) 100-125 mg / dL and blood glucose levels 2 hours after meals (IGT) 140-199 mg / dL. Initially a large sample was obtained by 34 employees and lecturers, but 2 subjects withdrew in the first week of intervention on the grounds that they were unable to eat yogurt. Two people in the control group at the time of the inspection after the intervention concerned are not in the place / outside service so that they cannot be examined at the same time.

The results showed the average age of respondents in the two groups was almost the same, where the age range of the control group (35.61 to 42.12 years) while in the

intervention group (30.14 to 37.46 years). The average age of respondents in the control group (38.87 years) and the intervention group (33.80 years). Prediabetes in Indonesia is mostly experienced at the age of 38-47 years and risk factors for prediabetes include age (Darah & Wanita, 2014). The results of the research by Wulandari and Wirawanni (2014) showed the age of respondents with prediabetes in the range of 36 to 55 years (Darah & Wanita, 2014). According to (Dany et al., 2013)that the proportion of prediabetes increases at the age of 30 years, and blood glucose levels increase from> 30 years. This was found in the results of research on risk factors for prediabetes, namely multivariate analysis showed that significant risk factors included age> 30 years (Dany et al., 2013). The results of this study are in accordance with the research about the dominant factors on the incidence of pre diabetes mellitus at the age of <45 years (Deyasningrum, 2014).

The results of this study showed that respondents with male gender were more than females, where males in the control group were 80% and the intervention group was 66.7%. Overall the number of male versus female respondents is 73.3% while the remaining female is 26.7%. Male gender has a risk of developing type 2 diabetes compared to women (Kautzky-Willer, Harreiter, & Pacini, 2016) and the results showed differences in the proportion of sex in prediabetes where men (29.3%) were higher than female gender (20%) (Deyasningrum, 2014). According to (Dany et al., 2013) stated that men are more at risk of experiencing i-IFG than women. The adult population in the world who suffer from metabolic syndrome based on the International Diabetes Federation (IDF) is 20-25%, namely 8-24.2% in the male population and 7-46.5% in the female population (Rahmawati et al., 2017).

The results showed that the average BMI of the respondents in the control group was between 21.56 to 25.49 while in the intervention group 23.42 to 27.36. According to Laaksonen et al. (2010) and Trisnawati, et.al. (2013) the strongest factor causing type 2 DM is someone with a BMI> 25 kg / m2. The results of the research by Deyasningrum and Utari (2014) showed that respondents who included prediabetes had an average BMI> 27 kg / m2 or classified as obese (Deyasningrum, 2014).

Blood glucose or blood glucose levels are terms that refer to the level of glucose in the blood. Prediabetes is defined as blood glucose levels above normal but still below diabetes blood glucose levels. Increased levels of glucose in the blood occur in patients with Impaired Fasting Glucose (IFG) and Impaired Glucose Tolerance (IGT). Prediabates is located between normal glucose levels and diabates ie fasting conditions 100-125 mg / dL (IFG) and 2 hours after meals 140-199 mg / dL (IGT) (Auliya, Oenzil, & Dia Rofinda, 2016); (Syamsurizal, 2018) (Štechová, 2018).

The results of the study of blood glucose levels 2 hours after meals in the respondents before intervention on average in the control group between 147.49 mg / dL up to 158.78 mg / dL, whereas in the intervention group 146.10 mg / dL up to 152.17 mg / dL. Results after intervention mean blood glucose levels 2 hours after meals in the control group were between 156.7 mg / dL and 167.03 mg / dL, whereas in the intervention group 109.06 mg / dL to 124.01 mg / dL. The results of Auliya, Oenzil and Rofinda's (2016) study included a group of i-IGT where blood glucose levels showed an average of 148.5 mg / dL with the lowest range of 145 mg / dL and the highest of 155

mg / dL. Respondents with a BMI> 25 kg / m2 (overweight) increased blood glucose levels by 20%. In this study, the respondents' BMI were in the mean range of IGT blood glucose 23.53 kg / m2 and 25.39 kg / m2 (Auliya et al., 2016) (Arif, 2014). The National Heart, Lung and Blood Institute, stated that those included in the overweight category are individuals with a BMI of ³ 25kg / m2 (Tumiwa & Langi, 2013). Obesity can cause insulin resistance which is manifested by an increase in blood glucose levels. This if it is not immediately addressed by regular treatment or intervention the risk of IGT being diabetic is greater than that of IFG (Tabák, Herder, & Kivimäki, 2017). Within one year can increase by 6-10% (Štechová, 2018).

Yogurt is one of the fermented milk products with a porridge-like or ice cream form but with a rather sour taste. Yogurt plays a role in the case of children with lactose intolerance, is able to reduce blood cholesterol, maintain healthy stomach and prevent cancer of the digestive tract (Fatmawati, Prasetyo, T.A, & Utami, 2013). Research published in the "Journal of Medicinal Food" in 2006 said that consuming yogurt can improve blood glucose consumption and can provide significant benefits in reducing the risk of diabetes by 18%.

Analysis of the results of the effect of yogurt on blood glucose levels 2 hours after meals (IGT) showed that there were significant differences in fasting blood glucose levels before and after the intervention in both the control and intervention groups (p = 0,000). Based on the graph that in the group given yogurt there was a decrease in IGT blood glucose levels, whereas in the group without yogurt there was a blood glucose level. GI in yogurt varies depending on what is added to it, most yogurt has a low GI, averaging about 33 or GI less than 55 so it requires a longer time to be absorbed which results in a small and gradual increase in blood glucose (Tumiwa & Langi, 2013).

Analysis of the effect of yogurt on respondents with prediabetes showed a significant difference in blood glucose levels after the intervention between the control group and the intervention group (p = 0,000). IGT blood glucose levels in respondents who were given yogurt in this study decreased / decreased (16%) than fasting blood glucose levels in respondents who were not given yogurt. The results of the study are consistent with the research which showed that there were significant differences in mean blood glucose levels between the control group and the intervention group after giving banana sinbiotic yogurt to mice with metabolic syndrome (Rahmawati et al., 2017).

CONCLUSION

The age characteristics of respondents were the control group (31-49 years) and intervention (23-43 years) with male gender (73.3%), minimum BMI 31.8 and maximum 31.6. Analysis with independent t-test showed that there were significant differences in blood glucose levels 2 hours after meals (IGT) after intervention (p = 0,000). IGT blood glucose levels in respondents who were given yogurt in this study decreased / decreased (16%).

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