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A COMPARISON OF HbA1c IN PREGESTATIONAL DIABETES PATIENTS WITH OBESITY

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ABSTRACT : This research analyze the differences in the effect of obesity on HbA1c levels in pregestational diabetes patients (DMPg). This was a retrospective observational study that involved the medical records of pregestational diabetic patients at RSUD Dr. Soetomo, Surabaya. Furthermore, the subjects were pregnant women with pregestational diabetes from 2013 to 2018, selected using the total sampling technique, and the variables evaluated were BMI (Body Mass Index) and HbA1c levels. In addition, the inclusion criteria were pregnant women with pregestational diabetes, possessing BMI and HbA1c data, while incomplete medical records were excluded. Out of the 48 participants with DMPg studied, only 30 met the inclusion criteria. Also, those with obesity and overweight tend to have HbA1c levels that were higher (6.46%) than normal weighted patients (6.25%), at a difference that was not significant ($p = 0.6249$).

Key words : Pregestational diabetes, pregnancy, obesity, HbA1c, BMI.

INTRODUCTION

Pregestational diabetes mellitus (DMPg) is a type of diabetes that is detected before or within the first 14 weeks of pregnancy. Furthermore, its incidence tends to increase through the years in developed countries (Hermanto, 2014) and this is related to the escalating cases of obesity. In addition, the American Diabetes Association stated the occurrence of a rising incidence of DMG and type 2 diabetes in the United States and the rest of the world, also attributed to obesity, due to uncontrolled blood sugar (ADA, 2014). This measurement is performed by evaluating fasting and postprandial blood sugar, as well as HbA1c (ADA, 2014, 2018; Rudijanto *et al*, 2015).

Obesity has been strongly associated with diabetes, as most of these patients tend to possess a relatively higher number of lipid cells than normal people, which is responsible for the production of proinflammatory cytokines. These are needed for improving the condition of insulin resistance in diabetic patients, attained through the resulting inflammatory process, as well as the dysfunction of pancreatic β cell (Abbas *et al*, 2013). In addition, the upsurge of insulin resistance has been known

to cause difficulty in controlling blood sugar in obese diabetic patients, which subsequently leads to bad outcomes in both mother and fetus. This explanation ignited the interest to compare the HbA1c levels in pregestational diabetes patients with obesity, overweight, and normal weight conditions in RSUD Dr. Soetomo. Furthermore, the parameter was chosen because of its ability to provide indices for the blood sugar control over several months, in accordance with the age of erythrocytes (Diabetes.co.uk, 2018).

MATERIALS AND METHODS

This was an observational retrospective study conducted at Dr. Soetomo Hospital, Surabaya from November 2018 to April 2019.

In addition, sampling required the medical record of pregnant women with pregestational diabetes at Dr. Soetomo Hospital, Surabaya, from 2013 to 2018. Furthermore, diagnosis was taken based on IADPSG consensus 2008 and the inclusion criteria encompassed those with weight, height, and HbA1c data, while incomplete data and patients with a BMI < 18.5 Kg/m² (Underweight) were excluded. Therefore, the research subjects were taken by total sampling method and 30 out

of the 48 samples met the criteria.

These patients were then divided into 3 groups, based on BMI (IADPSG consensus 2008): obesity (BMI ≥ 30 Kg/m²), overweight (BMI 25-29,9 Kg/m²) and normal weight (BMI 18,5-24,9 Kg/m²). In addition, the BMI (kg / m²) was determined by dividing the body weight (kg) by the square of height (m), and each group was examined for HbA1c levels, where they were subdivided into controlled HbA1C ($\leq 6.5\%$) and uncontrolled ($> 6.5\%$). Moreover, all research protocols have been approved by the Ethics Commission of RSUD Dr. Soetomo.

Furthermore, the mean of the HbA1c data was compared between the two groups and subsequently analyzed using ANOVA and T-test for BMI, performed at a confidence level of 95% with a value of $\alpha = 5\%$.

RESULTS AND DISCUSSION

Subject characteristics

Table 1 shows the characteristics of pregestational diabetic patients in RSUD Dr. Soetomo Surabaya in 2013 - 2018, illustrating the data of 30 patients that fulfilled the inclusion criteria. Furthermore, grouping was conducted according to body mass index (BMI) and HbA1c data, where most were measured in the third trimester. From the data obtained, it was established that most pregnant women with pregestational diabetes (18 people) had overweight BMI, while the rest were obese (6 people) and normal weight (6 people). This shows a trend towards the disease prevalence in overweight women, which is consistent with previous studies that reported a close relationship between diabetes and obesity in the United States and other countries (Gale, 2003; Mokdad *et al*, 2003). In addition, 13 patients received insulin therapy, while 1 was administered OAD and 16 were not provided any blood sugar-lowering therapy.

Table 2 shows the HbA1C data distribution for pregestational diabetes patients, including 6 (20%) with obesity, 18 (60%) overweight and 6 (20%) normal

weighted. Furthermore, from the first category, 2 (33.33%) had uncontrolled HbA1C ($> 6.5\%$) and 4 (66.67%) were controlled ($\leq 6.5\%$). Meanwhile, in the second category, 7 (38.89%) had uncontrolled HbA1C ($> 6.5\%$) and 11 (61.11%) were controlled ($\leq 6.5\%$). Moreover, in the third category, 2 (33.33%) had uncontrolled HbA1C ($> 6.5\%$) and 4 (66.67%) were controlled HbA1C ($\leq 6.5\%$). Therefore, the total number with uncontrolled level was 11 (36.67%), while the total for those controlled were 19 (63.33%). This data indicates that a larger pregnant of women with pregestational diabetes at RSUD Dr. Soetomo had controlled HbA1C, which is related to daily blood sugar control tactics, in terms of diet, exercise, and therapy adherence.

Analysis of HbA1C data distribution in pregestational diabetes patients with obesity, overweight and normal weight

From the medical record data analysis involved the use of ANOVA and the results obtained are given in Table 3.

Table 3 shows that the HbA1C level in obese, overweight, and normal weighted patients was $5.8\% \pm 1.103\%$, $6.68\% \pm 1.133\%$ and $6.25\% \pm 0.918\%$, respectively, indicating non-significant differences ($p = 0.86$) across groups. Previous studies reported the higher occurrence of pregestational diabetic in overweight patients, as the excess increase in weight affects the rising HbA1C levels to $6.68\% \pm 1.088\%$ (in the uncontrolled HbA1C category) within trimester 3. This value tends to be reduced in patients with non-excess weight gain (Egan *et al*, 2014). Therefore, it is suggested that excess body weight is associated with insulin resistance and poor blood sugar control in patients with pregestational diabetes. Also, pregnant women with this condition and obesity tend to have lower values based on the comparably smaller number of samples. In addition, one of the obese DMpG patients had a low HbA1C (4.5%) level, which reduced the average value. Also, three overweight patients with

Table 1 : Characteristics of diabetes pregestational patient in RSUD dr. Soetomo, Surabaya 2013- 2018.

Characteristic	Obesity (n=6)	Overweight (n=18)	Normal Weight (n=6)	p- value
Mother's age (year) *	32,43 \pm 4,04	35,08 \pm 5,65	32,15 \pm 6,17	0.295
Age of pregnancy when BMI was measured (weeks)*	28,167 \pm 5,269	33,938 \pm 3,941	33,167 \pm 5,269	0.035
Age of pregnancy when HbA1C was measured (weeks)*	28,167 \pm 5,269	33,188 \pm 5,076	27,500 \pm 9,482	0.073
Therapy [†]				
Insulin	3	8	2	
OAD	0	0	1	
Without therapy	3	10	3	

* data is presented in average form.

[†]data is presented in total value form.

Table 2 : Distribution of HbA1C data in pregestational diabetes patients with obesity, overweight and Normal weight in RSUD dr. Soetomo in 2013- 2019.

BMI	HbA1C	Total
Obesity (n=6)	Uncontrolled HbA1C	2 (33,33%)
	Controlled HbA1C	4 (66,67%)
Overweight (n=18)	Uncontrolled HbA1C	7 (38,89%)
	Controlled HbA1C	11 (61,11%)
Normal Weight (n=6)	Uncontrolled HbA1C	2 (33,33%)
	Controlled HbA1C	4 (66,67%)
Total		30

Table 3 : ANOVA table of HbA1C Pregestational diabetes patients with obesity, overweight and normal weight in RSUD dr. Soetomo from 2013 – 2018.

Group	Average of HbA1C (%)	P -value
Obesity (n=6)	5.8 ± 1.103	0.86
Overweight (n=18)	6.68 ± 1.133	
Normal weight (n=6)	6.25 ± 0,918	

Table 4 : T-test table of HbA1C pregestational diabetes patients with obesity or overweight and normal weight in RSUD dr. Soetomo from 2013 – 2018.

Group	Average of HbA1C (%)	P -value
Obesity or overweight (n=24)	6.46 ± 1.168	0.62
Normal weight (n=6)	6.25 ± 0.918	

high or uncontrolled HbA1C (8.8%; 8.3%; 8.8%) tend to increase the average value, and another cause was that the value was not measured in similar trimester. In addition, adherence to taking drugs, dietary patterns and exercise was observed to also affect HbA1C levels.

Analysis of HbA1C data distribution in pregestational diabetes patients with obesity or overweight and normal weight

Patients that were overweight possessed a tendency to be closer to obesity than to normal BMI. Therefore, the HbA1C data distribution was analyzed in pregestational diabetes patients with obesity, overweight and normal weight and the medical record data and its analysis was performed using T-test method are given in Table 4.

From the data obtained, it was established that HbA1C levels for patients with obesity or overweight was 6.46%±1.168%, while those with normal weight was 6.25%±0.918%. Table 4 demonstrates the non-significant differences in HbA1C amongst (p = 0.62). Therefore, a combination into 1 variable is compared with the normal weighted, obese or overweight patients, in contrast

with patient’s that possess normal weights (6.25% ± 0.918%). This is because pregestational diabetes occurred in overweight patients with higher levels of HbA1C than in other groups. Previous studies also provided insignificant results, for those that suffered the conditions and also the excess weight gain. However, the reverse was the case in trimester 3, where HbA1C in patients with excess weight gain was higher in contrast to those with non-excess weight gain (Kim *et al*, 2010). However, the weakness of this study was based on fact that dietary factors, diabetic drugs and physical activity that were not measured. In addition, the use of secondary data, HbA1C and patient BMI was also not evaluated at the same time.

CONCLUSION

Based on the results and discussion, the HbA1C of pregestational diabetic patients with obesity and overweight tend to be higher than the pregestational diabetic patients value with the normal weight.

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