

The Effect Of Combination Syrup Of Date (Phoenix Dactilyfera) And Bee Pollen On Blood Glucose Levels And Weight Gain Of Normal And Non-Diabetic Pregnant Rats

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Abstract: Dates and bee pollen contain of bioactive compounds in the form of flavonoids, polyphenols, magnesium, carbohydrates, proteins, and fats which allow them to affect blood glucose levels and weight gain. This study aims to determine the effect of the combination syrup of date and bee pollen on blood glucose levels and weight gain of pregnant Wistar rats. The combination of date and bee pollen syrup is made of 20.6% w/v of dates and 1.035% w/v of bee pollen in 100 ml of syrup. Then the rats were divided into 4 groups, namely the CMC solution as a control group, date syrup with a dose of 413.2 mg/200 g of rats' weight, bee pollen syrup at a dose of 20.7 mg/200 g of rats' weight and combination syrup of dates and bee pollen at a dose of 413.2 mg dates and 20.7 mg bee pollen /200 g BW of rats as the intervention group which were given for 20 days. Furthermore, the examination was carried out 3 times, on day 0, day 13, and day 20. The average of blood glucose levels after the intervention was 87.29 g/dl in the control group, date syrup 78.14 g/dl, bee pollen syrup 84.14 g/dl and the combination syrup 83.29 g/dl, while the average of body weight was 240.57 in the control group, 256.86 date syrup, 244.14 bee pollen syrup, and 265.00 for combination syrup. The results of statistical analysis showed $P>0.05$, it means that there was no significant difference in the value of glucose levels among each group, but there was a significant difference in the body weight of rats in which $P<0.05$, so the combination syrup of date and bee pollen is safe to be consumed by pregnant women because it does not affect the blood glucose levels significantly and it can increase their weight.

Keywords: Dates Syrup, Bee Pollen, Blood Glucose Levels, Weight Gain

1. INTRODUCTION

Based on the data of International Diabetes Federation, there are 199 million women in the world have diabetes and it was projected to be 313 millions in 2040. Based on the research by Melchior (2007) ¹, in Germany the prevalence of diabetes mellitus cases toward pregnant women is 13.2% and it will increase to be 26% toward pregnant women of 45 years old or more.

The case of malnutrition in women is also a big challenge to be faced especially by countries that have low income to face global progress ². Africa and Southeast Asia still become the highest position of malnutrition case in women ³.

As the solution nowadays, there have been many developments of phytotherapy. It is a treatment and prevention of disease using plants, parts of plant, and medicine which is made of plants. However in phytotherapy, it is very important to watch the active ingredients, dosage and allergic reaction caused by it⁴.

Bee pollen and dates have good benefit for human. Bee pollen contains of magnesium which is useful to activate the insulin receptors in order to prevent the insulin resistance. Bee pollen also contains of vitamins C, E and flavonoid which can be secondary antioxidants to help decreasing the free radical as the cause of the damage of pancreatic beta cells⁵.

The research by Saada (2012)⁶ also proved that consuming 100 mg dates in a day is still safe for the diabetics, because the fructose in it is higher than the glucose. Jenkins et al (2008)⁷ stated that the content of magnesium, manganese and zinc in dates can also stimulate insulin synthesis and secretion. In addition, dates can also be used as food supplements to add nutritional intake (Di Cagno et al, 2017).

Based on this background, researcher is interested in examining the effects of the combination syrup of date and bee pollen on blood glucose levels and weight of pregnant Wistar rats.

2. METHODS

Research Category

This study belongs to quantitative research with laboratory experiment. The research design used Randomized Post Test Control Group Only Design.

Research Tools and Materials

The tools used are a glucometer and a digital scale, while the materials used are CMC solution, date syrup, bee pollen syrup, combination syrup of date and bee pollen.

Research Flow

Syrup Making

CMC solution

10 g CMC powder is dissolved in warm water, then it is mixed using mixer until it becomes 100 ml mucilago.

1. CMC solution

10 g CMC powder is dissolved in warm water, then it is mixed using mixer until it becomes 100 ml mucilago.

2. Date Syrup

The date of challas is separated from its seed as much as 20 g. They are mashed with aquadest using a blender until they are completely smooth. Then, add 0,25 g sodium benzoate in it until the syrup becomes 100 ml..

3. Bee Pollen Syrup

Mix 1 g of smooth bee pollen with CMC solution, add 0,25 g sodium benzoate, and mix them to be homogeneous. The syrup must be 100 ml.

4. Dates Combination Syrup with Bee Pollen

Mix the mashed dates and bee pollen pollen in their dose and add 0.25 g sodium benzoate in it. Mix them to be homogeneous and add 100 ml of distilled water.

The Analysis of Chemical Content in Combination Syrup of Date and Bee Pollen

Chemical analysis was conducted in Biopharmaca Laboratory of Faculty of Mathematics and Natural Sciences, University of Hasanuddin.

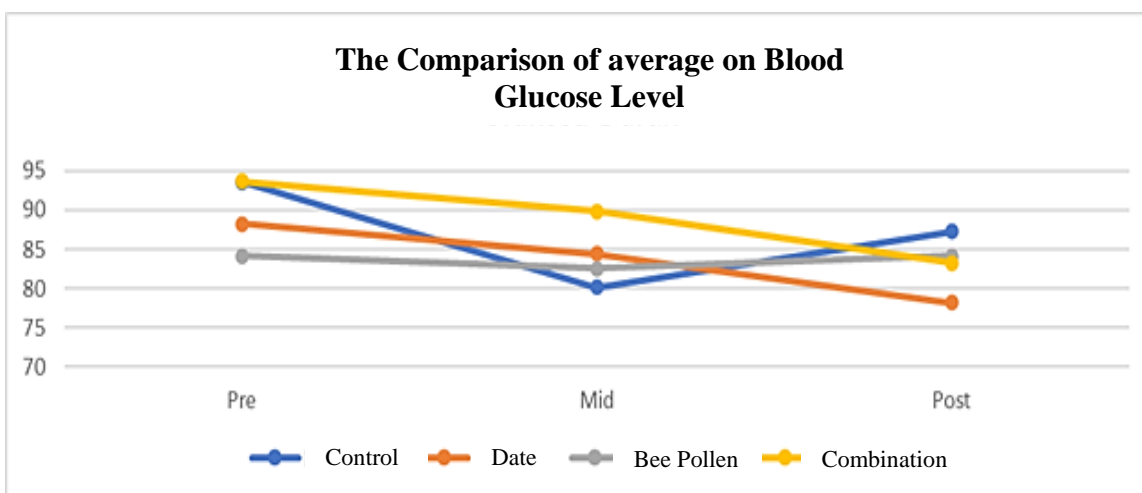


Figure 1: The Comparison Average on Blood Glucose Level

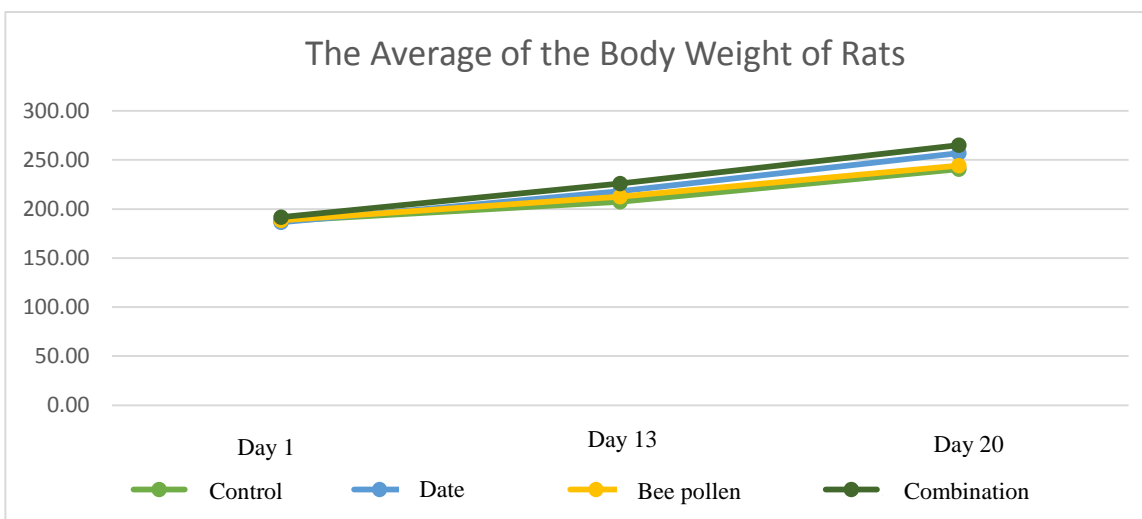


Figure 2: The Average of the Body Weight of Rats

Research Implementation:

The sample is 28 non-diabetic normal pregnant rats, each of which was divided into 4 groups, namely 1 control group and 3 intervention groups in the form of date syrup, bee pollen syrup and combination syrup of dates and bee pollen (Figure 1). Then check the blood glucose levels using glucometer and weight measurement using digital scales for 3 times: pre (day 0), mid (day 13) and post (day 20). During the intervention, the rats were given date syrup at dose of 2.066 g/200 g BW of rats, bee pollen syrup at dose of 0.103 g/200 g BW of rats and combination syrup of dates and bee pollen at doses of 413.2 mg of date and 20.7 mg of bee pollen /200 g BW of rats (Figure 2).

3. RESULT

The Result of Chemical Analysis

Based on the results of chemical analysis, the contents found in 100 ml of combination syrup of date and bee pollen are: antioxidants of 0.033 g flavonoids and 0.236 g polyphenols, then the nutrient of 13.82 g carbohydrates, 0.13 g crude fat, 0.105 g magnesium, 0.013 g zinc and 0.040 g manganese.

The Average of Blood Glucose Levels and Body Weight of Pregnant Wistar White Rats

The average of blood glucose levels and the body weight of pregnant wistar white rats are presented in the following graph:

Statistical Analysis of the Differences in Blood Glucose Levels (g/dl) and Body Weight (g) Among the Measurement Times

Data analysis were carried out using Statistical Package for Social Sciences (SPSS) with one way ANOVA and Paired T-Test and followed by post-hoc Man Whitney test. The analysis results are presented in the following table :

Table 1: Statistical Analysis of the Differences in Blood Glucose Levels (g/dl) and Body Weight (g)

Among the Measurement Times

Blood Glucose Levels of Pregnant Rats									
Variable	Measurement Times			Δ	P *	Δ	P *	Δ	P *
	Pre	Mid	Post	<i>Pre-Mid</i>		<i>Mid-Post</i>		<i>Pre-Post</i>	
CMC control	93.57 ± 13,831	80.14 ± 5.63	87.29 ± 9.979	13.42 ± 17.877	0.094	-7.14 ± 11.610	0.155	6.28 ± 10.920	0.236
	Date Syrup	88.29 ± 18.688	84.42 ± 13.62	78.14 ± 21.420	3.85 ± 24.113	0.687	6.28 ± 25.486	0.538	10.14 ± 17.430
Bee Pollen Syrup		84.14 ± 7.244	82.57 ± 6.80	84.14 ± 22.996	1.57 ± 5.191	0.454	-1.57 ± 23.726	0.867	0 ± 25.172
	Combination Syrup	93.71 ± 9.707	89.85 ± 7.904	83.29 ± 7.904	3.85 ± 10.090	0.351	5,57 ± 14.351	0.271	10.42 ± 12.61
Body Weight of Pregnant Rats									
Variable	Measurement Times			Δ	P *	Δ	P *	Δ	P *
	Day 0	Day 13	Day 20	Days0-Days13		Days13-Days20		Days0-Days20	
Control cmc	187.86 ± 8.840	207.29 ± 11.368	240.50 ± 513.673	19.249 ± 5.159	0.00	33.286 ± 4.786	0.00	52.714 ± 7.432	0.00
	Date Syrup	186.43 ± 11.178	218.14 ± 20.24	256.86 ± 10.823	31.714 ± 11.368	0.00	38.714 ± 10.735	0.00	70.429 ± 6.161

		4							
<i>Bee Pollen Syrup</i>	Day 0	Day 13	Day 20	24.000 ± 4.796	0.00	31.714 ± 3.094	0.00	55.714 ± 6.317	0.00
	188.43 ± 11.559	212.43 ± 14.965	244.14 ± 15.952						
<i>Syrup Combination</i>	Day 0	Day 13	Day 20	34.286 ± 8.538	0.00	39.143 ± 10.792	0.00	73.429 ± 4.198	0.00
	191.57 ± 10.228	225.86 ± 5.984	265.00 ± 12.069						

Table 2: Post Hoc Test of the Body Weight (g) in Pregnant Rats(g) Among the Measurement Times

Group	Difference in Mean Standard Deviation	Median (Min-Max)	95% CI	P *
Combination Syrup vs CMC Solution	14.07 ± 18.788	12.50 (-20.00-54.00)	3.22-24.20	0.002
Combination Syrup vs Date Syrup	6.642 ± 13.053	5.00 (-17.00-31.00)	-0.89-14.17	0.198
Combination Syrup vs Bee Pollen Syrup	12.00 ± 19.382	16.00 (-25.00-41.00)	0.80-23.19	0.002

In the table and graph above, it can be seen that the highest average of glucose levels is in the pre-intervention group of combination syrup of date and bee pollen (93.71), and the lowest average of blood glucose levels was in the post-intervention group of date syrup (78.14) and the highest increase of body weight is in the combination syrup of date and bee pollen (73.429) and followed by the date syrup (70.043).

Based on the statistical analysis of blood glucose levels (**Table 1**), $P > 0.05$, so it can be concluded that there is no significant difference in the value of blood glucose levels among groups and the measurement times, with the highest difference in reducing blood glucose levels is in the combination syrup of date and bee pollen, (10.42). It is followed by the intervention group of date syrup (10.14). Based on the table above, the results of the statistical analysis of body weight (**Table 1**) can also be seen that the value of $P < 0.05$, it means that statistically, there is a significant difference in the average of body weight before and after the intervention in each group.

The result of the post hoc test on body weight among the groups is $P < 0.05$ (**Table 2**), it means that there is a significant difference in body weight between the combination syrup of date and bee pollen with the bee pollen syrup, as well as the combination syrup of date and bee pollen and the CMC solution. Whereas the combination syrup of date and bee pollen and the date syrup did not show a significant difference in body weight ($P > 0.05$).

4. DISCUSSION

The Chemical Analysis of Combination Syrup Composition of Dates and bee pollen

Based on the result of the composition test of 100 ml combination syrup of dates and bee pollen with a dose ratio of 20 g dates and 1 g bee pollen, was obtained 13.82 g carbohydrates, 1.63 g crude protein, 0, 13 g crude fat, 0.48 g crude fiber, 2.4 mg iron, 10.5 mg magnesium, 1.3 mg zinc, 4.0 mg manganese, 3.303 mg flavonoids, and 23.612 mg polyphenols.

Al-Farsi (2007)⁸ also conducted research on the chemical content of date syrup which combined 3 types of date, namely: Mabseeli, Um-shellah, Shahal. The result showed that carbohydrate is the main content with 70-80% glucose, fructose and sucrose⁹. The highest protein is found in Shalal date (3.62 g/100 g), and the highest fat is in Um-shellah dates (5.90 g/100 g). The highest dietary fiber is also in Um-sellah (8.72 g), and the highest phenolic (246 mg of GAE / 100 g) is in Mabselli date.

Meanwhile, based on the research by Feas et al (2012)¹⁰, the chemical contents tested in 100 g of organic bee pollen from Douro International Natural Park (Portugal) are 67.7% carbohydrates, 21.8% crude protein, and 5,2% crude fat. In addition, Pascoal et al (2014)¹¹ in their research which mixed bee pollen and 1:2 (w/v) methanol, obtained 18.55 - 32.15 mg/g phenolic, and 3.92 - 10.14 mg/g.flavonoids.

Based on the results above, it can be seen that the chemical content of dates and bee pollen is determined by the variety, doses and the making process. Types of dates used in this research is the ripe and dry Khalas. The carbohydrates in bee pollen will be much less than dates due to the small dose, as well as the other chemicals. So that the chemical content of the combination syrup of date and bee pollen is dominated by dates.

The Analysis Result of Blood Glucose Levels in Each Group

Based on the result of statistical analysis, blood glucose levels in each intervention group did not have a significant change in the value of blood glucose levels ($P>0.05$) in each intervention group. According to the researchers' assumptions, this could happen because in the control group, rats were only given CMC (carboxymethyl cellulose)¹². Therefore, It does not cause a significant reduction on blood glucose levels.

The intervention of date, bee pollen, and combination syrup, also did not cause a significant change in blood glucose levels. Ahmed, et al (2017)¹³ gave oral suspension of Aseel dates to 32 Sprague dawley, normoglycemic and hyperglycemic rats at doses (300 and 600 mg/kg). The result showed that normal normoglycemic rats had insignificant glucose lowering effects, while hyperglycemic ones (induced by Alloxan) showed a significant reduction in blood glucose, especially at a dose of 300 mg/kg.

Mia, et al (2020) in their research also proved that dates do not increase the glycemic index and blood glucose levels in diabetic rats and it is potential to reduce the blood glucose levels. This is because the polyphenols, flavonoids and antioxidants in dates can postpone the fission of carbohydrates by inhibiting α -amylase and increasing the activity of α -glucosidase enzyme and reducing the absorption of intestinal glucose.

Saada, et al, (2012)⁶ assessed that the fructose of dates is higher than the glucose. In addition, Jenkins, et al (2008)⁷ said that fructose is not an insulin secreting agent, and its metabolism is not regulated by insulin. On the other hand, the fructose metabolism is also faster than the glucose. Alkabi, et al (2011)¹⁴ also said that consuming 100 g dates can produce 50 - 100% daily fiber¹⁵. Therefore, dates will have no significant effect on postprandial glucose and the patients can consume them without the risk of getting the postprandial glucose. So, it is safe

for diabetics.

The results of giving bee pollen at a dose of 1.03 g in this research is also supported by the research of Nurcahyaning (2018)⁵ in which she used DM rats with 0.63 g bee pollen per day and the ones with 1.25 g bee pollen per day. It showed that there was a significant reduction in blood glucose levels at a dose of 0.63 g bee pollen. However, the blood glucose levels increased and was not significantly different in the treatment group at a dose of 1.25 g bee pollen. Mohamed, et al (2018)¹⁶ also said that the treatment with the lowest dose of bee pollen had the effect of reducing the blood glucose levels. However, the treatment with more bee pollen doses caused the increase of blood glucose levels.

Jeon, et al (2018)¹⁷ in their research on diabetic rats that were given 100 mg oral aronia berries, proved that it was very influential in reducing blood glucose levels. It is because aronia berries contains of polyphenols such as anthocyanins, flavonoids, and tannins as antioxidants, thus providing hypoglycemic effect and protecting pancreatic beta cells. If we look at the levels of flavonoids and polyphenols contained in the combination syrup of 0.33 g dates and 0.236 g bee pollen, it will not cause a significant reduction in blood glucose levels.

Due to the nutrient contained in the combination syrup of dates and bee pollen, it can be assumed that it does not significantly affect the blood glucose levels in normal rats. So, the combination syrup is safe to be consumed by pregnant women.

The Analysis of Body Weight in Intervention Group

The analysis result of the body weight in this research showed that there was a significant difference in body weight between the combination syrup of date and bee pollen with the bee pollen syrup as well as the CMC solution ($P < 0.05$). Meanwhile, the combination syrup of date and bee pollen did not show a significant difference in body weight ($P < 0.05$).

According to the researchers' assumptions, this is because the subjects in this research are pregnant white rats. Physiologically, pregnancy will generally cause the weight gain because of the grown fetus in the womb (International Weight Management, 2017). However, the combination syrup of date and bee pollen dominated the largest amount in the value of weight gain. Then, it was followed by the date syrup, bee pollen syrup and the last was the control group using CMC solution.

This is because dates are very rich in nutrients, consisting of carbohydrates, 14 types of fatty acids, 15 salts and minerals, protein with 23 different amino acids, 6 vitamins and the high of dietary fiber with a carbohydrate dose (sugar fructose, 44-88%), fat (0.2-0.5%), protein (2.3-5.6%), and a high percentage of dietary fiber (6.4-11.5%)¹⁵.

Meanwhile, the research by Pascoal, et al (2014)¹¹ showed that the main nutrients found in bee pollen consist of 13% to 55% carbohydrates, 0.3% to 20% crude fiber, 10% to 40% protein and 1% to 10% fat. The nutrients found in dates and bee pollen is not far from the content in the combination syrup of both, so it can affect the weight gain during the pregnancy.

This result is supported by Fadila, et al. (2018) who watched the effect of dates on the body weight of rats, and the result was that dates can increase the body weight of rats with iron deficiency anemia. The weight gain of rats without treatment was very low when compared to them which given dates and FeSO₄ supplement.

Hidayah's research (2018) also proved that giving Ajwa dates to the body weight of pregnant women with prehypertension is very influential because the nutritional intake in Ajwa dates can fulfill the nutritional needs of pregnant women. The comparison of the treated group got

1-2 kg/month and the untreated one got 0.05-1 kg/month.

Salles, et al (2014)¹⁸ also proved that fresh bee pollen can affect the improving of muscle mitochondrial function in malnourished old rats, so it caused the increase of muscle mass, energy and body weight. Peter, et al (2012)¹⁹ also found that bee pollen has a positive effect on the growth of roosters by increasing their body weight significantly. Bee pollen can enhance nutrients without affecting the growth of normal fetus, considering been pollen as a practical and effective nutrient during the pregnancy but they also warn of the side effects of its use.

5. CONCLUSION

The result of the chemical content analysis shows that the combination syrup of date and bee pollen can be used as a food supplement for pregnant women because it can increase the nutritional needs of them during the pregnancy. In addition, the combination syrup of date and bee pollen is also safe for consumption by mothers with gestational diabetes because it does not affect the blood glucose levels significantly, even it tends to decrease it. The combination syrup also potentially increases the body weight because the result shows that it is higher in weight gain than the date syrup and bee pollen syrup.

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