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RESEARCH ARTICLE

Effects of Cinnamon Supplementation on Reducing Blood Glucose Levels in Patients with Type 2 Diabetes Mellitus on Barrang Lompo Island, Indonesia

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ABSTRACT

Diabetes is a chronic metabolic disease characterised by elevated blood glucose (or blood sugar) levels. Treatment of diabetic patients can be done with nonpharmacological and pharmacological treatments. cinnamon contains antioxidants contained in it that have insulin-like effects so that it can reduce blood glucose levels. Objective. This study aims to determine the effect of cinnamon supplementation on reducing blood sugar levels in patients with type 2 diabetes mellitus. Methods. This study used qualitative research methods with experimental research type and pretest-posttest research design with control group design. The research location is in the working area of the Barrang Lompo Health Centre. Sampling using purposive sampling technique, with a total sample of 60 respondents, 30 main intervention groups and 30 comparison intervention groups. Data analysis using Wilcoxon and t-Independent tests. Results. This study shows that there are differences in blood sugar levels in patients with diabetes mellitus before and after taking cinnamon supplements (p=0.000), and there are differences in blood sugar levels in patients with diabetes mellitus before and after taking bay leaf supplements (p=0.000) with an average decrease in blood sugar levels in the main intervention group of 32.20 mg/dL and the comparison intervention group of 24.43 mg/dL. Conclusion. There is an effect of cinnamon supplementation on blood sugar levels of patients with diabetes mellitus in the Barrang Lompo Health Centre Working Area.

INTRODUCTION

Diabetes mellitus is a chronic disease that can last throughout life. The disease occurs due to metabolic disorders in the pancreas resulting in decreased insulin production. This is characterised by elevated blood sugar levels or hyperglycaemia. Diabetes mellitus is a serious disease that can lead to various complications, including cardiovascular disease, kidney disorders, inflammation, obesity, and even increase the risk of death. Major risk factors in the development of diabetic complications include age, gender, and ethnic background. The high prevalence of diabetes mellitus and the variety of complications that occur are caused by unhealthy living behaviours, lack of physical activity, and unhealthy diets, such as consumption of high-fat and low-fibre ready-to-eat foods that can increase blood sugar levels.[1]

According to the International Diabetes Federation in 2021, the number of adults with diabetes aged 20 to 79 has more than tripled from 151 million (4.6%) to 537 million (10.5%) at present. If no action is taken to address this issue, it is estimated that 643 million people will have diabetes by 2030 (11.3%), and the number will increase to 783 million (12.2%) by 2045. In addition, IDF estimates the number of people suffering from diabetes in people aged between 20 and 79 years in several

countries around the world, including the 10 countries with the highest number of diabetes cases. The United States, India, and China rank third with the highest number of patients at 116.4 million, 77 million, and 31 million, respectively. [2]

American Diabetes Association (ADA) prevalence in 2018, 34.2 million Americans, or 10.5% of the population, had DM nearly 1.6 million Americans had type 1 diabetes, including about 187,00 thousand children and adolescents. Of the 34.2 million adults with diabetes 26.8 million are diagnosed, and 7.3 are undiagnosed. New cases of 1.5 million Americans are diagnosed with the disease each year. In 2015, 88 million Americans were diagnosed with diabetes each year. DM is the seventh leading cause of death in the United States where diabetes is listed as a cause of death with a total of 270,702 certificates.[3]

According to the Indonesian Ministry of Health (2020), the diagnosed prevalence of Diabetes Mellitus in Indonesia is 1.5% and the diagnosed prevalence plus people with symptoms is 2.1%. The prevalence of diagnosed Diabetes Mellitus at all ages is highest in DKI Jakarta (2.6%), then D.I. Yogyakarta (2.4%), North Sulawesi (2.3%), East Kalimantan (2.3%) and East Java (2.0%). Meanwhile, the prevalence of diagnosed Diabetes Mellitus plus patients with symptoms in the population ≥ 15 years is highest in DKI Jakarta with 3.4% (Riskesdas, 2018). The increasing prevalence of Diabetes Mellitus brings a change in the position of Diabetes Mellitus, which is included in the list of the top 10 diseases (disease leading cause of disease trends), and contributes to the mortality rate due to Diabetes Mellitus. [3].

Diabetes Mellitus prevalence in South Sulawesi is 1.6 per cent. DM diagnosed by a doctor or based on symptoms was 3.4%. The highest prevalence of doctor-diagnosed diabetes was in Pinrang District (2.8%), Makassar City (2.5%), North Toraja District (2.3%) and Palopo City (2.1%). The prevalence of diabetes diagnosed by a doctor or based on symptoms was highest in Tana Toraja Regency (6.1%), Makassar City (5.3%), Luwu Regency (5.2%) and North Luwu Regency (4.0%). Based on non-communicable disease surveillance data from the P2PL Division of the South Sulawesi Provincial Health Office in 2017, there were 27,470 new cases of Diabetes Mellitus, 66,780 old cases with 747 deaths.[3]

Most patients with type 2 diabetes mellitus (T2DM) face challenges in managing physical activity, maintaining a healthy diet, medication use, blood glucose monitoring, and stress management. From a clinician's perspective, many patients on insulin therapy do not achieve therapeutic targets due to unhealthy lifestyles, medication non-adherence, and concerns about out-of-pocket medication costs. Some common drug-related problems in T2DM patients include use of drugs without indication (such as proton pump inhibitors or H2 blockers prescribed in the absence of gastritis or ulcer indications), inappropriate use of drugs by patients, selection of drugs that are not appropriate for the indication (e.g., patients with HbA1c below 7,5% are prescribed insulin instead of oral antidiabetics), contraindications with physiological conditions (such as prescribing metformin in elderly patients which is not recommended for people over 70 years old), non-compliance (the drug is not taken), drug interactions, drug dosage problems (too low or too high), and drug side effects.[4]

Treatment to lower blood glucose levels in patients with type II diabetes mellitus may include both pharmacological and non-pharmacological treatments. Oral antidiabetic drugs such as sulfonylurea, biguanide, and acarbose are examples of pharmacological treatment. For non-pharmacological treatment, there are many methods that can be used, one of which is using herbal plants. WHO has given permission for the use of medicinal plants or herbs for various diseases, including diabetes mellitus. Soursop leaves, guava leaves, advocate, afrika, ciplukan, and bay leaves are plants or herbal medicines that can reduce blood glucose levels in patients with type II diabetes mellitus.[5]

The use of herbal medicine from spices has been commonly used to treat various diseases, including Diabetes Mellitus. Herbal spices used by the community empirically include garlic (Allium Sativum Linn), turmeric (Curcuma Domestica), cinnamon (Cinnamon Burmanni), red ginger (Zingiber Officinale), bay leaves or known as (Syzygium Polyanthum), and cloves (Syzygium Aromaticum). The use of these spices in Diabetes Mellitus patients is usually in small amounts because they contain allicin and curcuminhich stimulate the production of insulin hormones in the body compared to exercise in diabetic patients. Cinnamon and red ginger have been shown to reduce blood glucose levels close to normal values. Cinnamon is commonly utilised on its bark for food or beverage

additives, and its leaves can be processed into essential oil. Cinnamon plants have various compounds, as mentioned by Fatmalia & Muthoharoh (2017). According to Anderson (2006), cinnamon contains essential oil, safrole, sinamaldehyde, tannin, calcium oxalate, resin, and tanning agents. Antioxidants contained in it include eugenol and methylhydroxychalcone polymer (MHCP). MHCP is a polyphenol (flavonoid) that has insulin-like effects that can reduce blood glucose levels.[6]

According to Mexsi Mutia Rissa (2022) of the five articles evaluated on medicinal plants, bay leaf extract was considered to have greater benefits than other plants. Bay leaf (Syzygium polyanthum) has many antidiabetic properties due to its active compounds, including quaretin, tannins, and flavonoids; its anti-oxidant properties also help with diabetes as it allows the body to better process insulin.[5]

The incidence of Diabetes Mellitus at the Barrang Lompo Health Centre fluctuates every year and in 2022 there was a high increase with an incidence of 276 cases or 6.2%. The age group of people with Diabetes Mellitus at the Barrang Lompo Health Centre is highest in the adult age group which according to the Ministry of Health is 19-59 years old. From these data, researchers are interested in analysing the effectiveness of cinnamon capsules on reducing blood glucose levels in patients with diabetes mellitus on Barrang Lompo Island in 2024.

METHODS

The type of research is a *quasy experiment with the design of The Non Randomize Pretest-Posttest With control group design* which aims to compare the results of health programme interventions. In this study, 2 treatment groups were used, namely, the main intervention group, namely patients with diabetes mellitus who took drugs and were given cinnamon supplements. While the comparison intervention group is patients with diabetes mellitus who take drugs and are given bay leaf supplements. Aiming to see the effect of cinnamon supplements and bay leaf supplements on patients with Type 2 Diabetes Mellitus at Barrang Lompo Health Centre. This study was conducted in September 2024 with the population in this study were all patients with Type 2 Diabetes Mellitus at the Barrang Lompo Health Centre, while the sample size was 30 people in each group, so based on the study there were 2 groups, the total number of samples needed was 60 people. This study was conducted by giving a pre-test questionnaire before checking blood sugar levels and intervening with cinnamon supplements and bay leaf supplements. Then the sugar level was measured in the post-test on the 10th day after the intervention to see the level of change in blood sugar levels in respondents.

RESULTS

1. General characteristics of respondents

Table 1: Frequency distribution of general characteristics of respondents between main intervention group and comparison intervention group in 2024

General characteristics of respondents	Main Intervention		Comparison Intervention	
	n	%	n	%
Gender				
Male	10	33,33	7	23,33
Women	20	66,67	23	76,67
Age (Years)				
≤45	21	70,0	12	40,0
>45	9	30,0	18	60,0
Education				
Not in School	0	0,0	0	0,0
Finished primary school	7	23,33	10	33,33
Completed junior high school	7	23,33	9	30,00
Completed high school	10	33,33	10	33,33
D3/D4/S1/S2	6	20,00	1	3,33
Jobs				
Fisherman	6	20,00	6	20,00
Merchants	4	13,33	8	26,67

IRT	18	60,00	16	53,33
PNS	2	6,67	0	0,0
Total	**30**	**100**	**30**	**100**

Source: Primary data, 2024

Based on the table above, the characteristics of respondents based on the gender of respondents in the main intervention group and the comparison intervention group were mostly female with a proportion in the main intervention group of 20 respondents (66.67%) and in the comparison intervention group of 23 respondents (76.67%).

The age group of respondents in this study was the majority in the main intervention group in the age group ≤45 years with a proportion of 21 respondents (70.0%) and while in the comparison intervention group the majority were in the age group >45 years with a proportion of 18 respondents (60.0%). The education of respondents in the main intervention group and the comparison intervention group was mostly in the high school completion category, the proportion between the 2 groups was 10 respondents (33.33%).

The occupation of respondents in the main intervention group and the comparison intervention group was mostly categorised as housewives with the proportion in the main intervention group being 18 respondents (60.00%) and in the comparison intervention group being 16 respondents (53.33%).

2. Clinical characteristics of respondents

Table 2: Frequency distribution of clinical characteristics of respondents between the main intervention group and the comparison intervention group in 2024

Clinical characteristics of respondents	Main Intervention		Comparison Intervention	
	N	%	n	%
Body Mass Index (BMI)				
Normal (18.5-22.9)	12	40,00	12	40,00
Overweight (23-24.9)	10	33,33	12	40,00
Obese (25-29.9)	7	23,33	6	20,00
Obesity II (>30)	1	3,33		
Length of history				
≤ 6 Months	14	46,67	10	33,33
> 6 Months	16	53,33	20	66,67
Type of medication taken				
Gliben	4	13,33	4	13,33
Metaformin	19	63,33	21	70,00
Metaformin, Gliben	7	23,33	5	16,67
Consuming DM Food/Drink				
Yes				
No	30	100	30	100
Family Genetics				
Yes	10	33,33	25	83,33
No	20	66,67	5	16,67
History of other diseases				
None	21	70,00	23	76,67
Hypertension	8	26,67	5	16,67
Cholestrol			2	6,67
Uric Acid	1	3,33		
Smoking Habit				
Yes	4	13,33	8	26,67
No	26	86,67	22	73,33
Eat Vegetables and Fruit				
Yes	18	60,00	18	60,00
No	12	40,00	12	40,00
Physical Activity				

Yes	15	50,00	16	53,33
No	15	50,00	14	46,67
Total	**30**	**100**	**30**	**100**

Source: Primary data, 2024

Based on the table above, the characteristics of respondents based on BMI of respondents in the main intervention group and comparison intervention were mostly in the Normal category (18.5-22.9) with a proportion in the main intervention group of 12 respondents (40.0%) and in the comparison intervention group of 12 respondents (40.0%). The majority of respondents in the main intervention group were in the > 6 months category with a proportion of 16 respondents (53.33%) and while in the comparison intervention group the majority were in the > 6 months category with a proportion of 20 respondents (66.67%).

The type of drug consumed in the main intervention group and the comparison intervention group was mostly Metaformin with a proportion of 19 respondents (63.33%) in the main intervention group and 21 respondents (70.0%) in the comparison intervention group. All respondents between the main intervention and comparison intervention groups had never consumed diabetes mellitus-reducing foods/drinks with the proportion between the 2 groups being 30 respondents (100%).

Family genetic history in this study, the main intervention group was in the category of no family genetic history with a proportion of 20 respondents (66.67%) and while in the comparison intervention group had a family genetic history with a proportion of 25 respondents (83.33%). The majority of respondents in the main intervention group and the comparison intervention group did not have a history of other diseases with a proportion in the main intervention group of 21 respondents (70.0%) and while in the comparison intervention group 23 respondents (76.67%).

The majority of respondents smoked in this study in the main intervention group in the smoking category with a proportion of 26 respondents (86.67%) and while in the comparison intervention group 22 respondents (73.33%). Respondents who consumed vegetables and fruits in this study in the main intervention group were in the consuming category with a proportion of 18 respondents (60.0%) and while in the comparison intervention group 18 respondents (60.0%).

Physical activity carried out by respondents in this study in the main intervention group with a proportion of 15 respondents (50.0%) who did physical activity and the comparison intervention group with a proportion of 16 respondents (53.33%) who did physical activity.

Analysis of the mean difference in blood sugar levels of the main intervention group and the comparison intervention group before and after the intervention

Table 3: Distribution of mean blood sugar levels of main intervention group and comparison intervention group before and after treatment in 2024

Group	Variables	Min	Max	Mean	Standard Deviation
Main Intervention	Pretest	132	352	206,37	55,38
	Posttest	120	300	174,17	48,97
Comparison Intervention	Pretest	148	301	184,23	37,32
	Posttest	137	265	159,80	31,37

Source: Primary data, 2024

Based on the table above, it can be seen that the average blood sugar level in the main intervention group before treatment was 206.37 with Standard Deviation = 55.38 and after treatment decreased to 174.17 with Standard Deviation = 48.97. While the average blood sugar level in the comparison intervention group before treatment was 184.23 with Standard Deviation = 37.32 and after treatment decreased to 159.80 with Standard Deviation = 31.37.

Analysis of mean differences in blood sugar levels based on respondent characteristics in the main intervention and comparison intervention groups

Table 4: Differences in pre-posttest blood sugar levels based on respondent characteristics in the cinnamon group in 2024

Variables	Blood Sugar Level of Cinnamon Supplement Group				
	n	Pretest Mean	*p-value*	Posttest Mean	*p-value*
Gender					
Male	10	219,10	0,382	188,0	0,282
Women	20	200,0		167,25	
Age (Year)					
≤45	21	202,52	0,571	167,43	0,257
>45	9	215,33		189,89	
Family Genetics					
Yes	10	204,90	0,920	177,60	0,791
No	20	207,10		172,45	
Smoking Habit					
Yes	4	198,25	0,759	180,50	0,787
No	26	207,61		173,19	
Eat Vegetables and Fruit					
Yes	18	212,33	0,479	177,39	0,667
No	12	197,42		169,33	
Physical Activity					
Yes	15	207,80	0,890	174,80	0,945
No	15	204,93		173,53	

Notes: Independent t-test

Source: Primary data, 2024

Based on the table above, it shows that in the main intervention group the average value of blood sugar levels in the male gender, namely the pre-test of 219.10 mg/dL and the post-test dropped to 188.0 mg/dL. As for the female gender, the pre test was 200.0 mg/dL and the post test dropped to 167.25 mg/dL. Furthermore, the difference test based on gender, the p value is 0.282> 0.05, which means there is no difference in blood sugar levels before and after cinnamon supplementation based on gender.

The average value of blood sugar levels in the main intervention group based on the age group ≤45, namely the pre-test of 202.52 mg/dL and the post-test dropped to 167.43 mg/dL. As for the >45 age group, the pre test was 215.22 mg/dL and the post test decreased to 189.89 mg/dL. Furthermore, the difference test based on age group, the p value is 0.257> 0.05, which means there is no difference in blood sugar levels before and after cinnamon supplementation based on age group.

The average value of blood sugar levels in the main intervention group based on genetic history, for respondents who have a family history of diabetes, the pre-test was 204.90 mg/dL and the post-test decreased to 177.60 mg/dL. As for respondents who did not have a family history of diabetes, the pre-test was 207.10 mg/dL and the post-test dropped to 172.45 mg/dL. Furthermore, the difference test based on a genetic history of hypertension, the p value is 0.791> 0.05, which means that there is no difference in blood sugar levels before and after giving cinnamon supplements based on a family history of diabetes.

The average value of blood sugar levels in the main intervention group based on smoking habits, for respondents who smoke, the pre-test is 198.25 mg/dL and the post-test drops to 180.50 mg/dL. As for respondents who did not smoke, the pre-test was 207.61 mg/dL and the post-test decreased to 173.19 mg/dL. Furthermore, the difference test based on smoking behaviour, the p value is 0.787> 0.05, which means there is no difference in blood sugar levels before and after giving cinnamon supplements based on smoking habits.

The mean value of blood sugar levels in the main intervention group based on vegetable and fruit consumption, in respondents who consumed the pre-test of 212.33 mg/dL and post-test dropped to

177.39 mg/dL. As for respondents who did not consume, the pre-test was 197.42 mg/dL and the post-test decreased to 169.22 mg/dL. Furthermore, the difference test based on consuming vegetables and fruits, the p value is 0.667> 0.05, which means that there is no difference in blood sugar levels before and after giving cinnamon supplements based on consuming vegetables and fruits.

The average value of blood sugar levels in the main intervention group based on physical activity, for respondents who do physical activity, the pre-test is 207.80 mg/dL and the post-test drops to 174.80 mg/dL. As for respondents who did not do physical activity, the pre-test was 204.93 mg/dL and the post-test decreased to 173.53 mg/dL. Furthermore, the difference test based on physical activity, the p value is 0.945> 0.05, which means there is no difference in blood sugar levels before and after giving cinnamon supplements based on physical activity.

Table 5: Differences in pre-posttest blood sugar levels based on respondent characteristics in the hail leaf supplement group in 2024

Variables	Blood Sugar Levels of the Bay Leaf Supplement Group				
	n	Pretest Mean	*p-value*	Posttest Mean	*p-value*
Gender					
Male	7	194,14	0,432	177,0	0,098
Women	23	181,22		154,56	
Age (Years)					
≤45	12	186,25	0,814	160,08	0,969
>45	18	182,89		159,61	
Family Genetics					
Yes	25	185,0	0,806	160,76	0,715
No	5	180,40		155,0	
Smoking Habit					
Yes	8	190,62	0,581	173,37	0,157
No	22	181,91		154,86	
Eat Vegetables and Fruit					
Yes	18	180,89	0,557	157,11	0,574
No	12	189,25		163,83	
Physical Activity					
Yes	16	183,37	0,896	160,37	0,917
No	14	185,21		159,14	

Notes: Independent t-test

Source: Primary data, 2024

Based on the table above, it shows that in the comparison intervention group the average value of blood sugar levels in the male gender, namely the pre-test of 194.14 mg/dL and the post-test dropped to 177.0 mg/dL. As for the female gender, the pre-test was 181.22 mg/dL and the post-test dropped to 154.56 mg/dL. Furthermore, the difference test based on gender, the p value is 0.098> 0.05 which means there is no difference in blood sugar levels before and after supplementing bay leaves based on gender. The average value of blood sugar levels in the comparison intervention group based on the age group ≤45, namely the pre-test of 186.25 mg/dL and the post-test dropped to 160.08 mg/dL. As for the >45 age group, the pre test was 182.89 mg/dL and the post test decreased to 159.61 mg/dL. Furthermore, the difference test based on age group, the p value is 0.969 > 0.05 which means there is no difference in blood sugar levels before and after supplementing bay leaves based on age group.

The average value of blood sugar levels in the comparison intervention group based on genetic history, for respondents who have a family history of diabetes, the pre-test was 185.0 mg/dL and the post-test decreased to 160.76 mg/dL. As for respondents who did not have a family history of

diabetes, the pre-test was 180.40 mg/dL and the post-test dropped to 155.0 mg/dL. Furthermore, the difference test based on a genetic history of hypertension, the p value is 0.715> 0.05, which means there is no difference in blood sugar levels before and after supplementing bay leaves based on a family history of diabetes. The average value of blood sugar levels in the comparison intervention group based on smoking habits, for respondents who smoke, the pre-test is 190.62 mg/dL and the post-test drops to 173.37 mg/dL. As for respondents who did not smoke, the pre-test was 181.91 mg/dL and the post-test dropped to 154.86 mg/dL. Furthermore, the difference test based on smoking behaviour, the p value is 0.157> 0.05 which means there is no difference in blood sugar levels before and after giving bay leaf supplements based on smoking habits.

The average value of blood sugar levels in the comparison intervention group based on vegetable and fruit consumption, in respondents who consumed the pre-test of 180.89 mg/dL and post test dropped to 157.11 mg/dL. As for respondents who did not consume the pre-test of 189.25 mg/dL and post test dropped to 163.83 mg/dL. Furthermore, the difference test based on consuming vegetables and fruits, the p value is 0.574> 0.05, which means there is no difference in blood sugar levels before and after supplementing bay leaves based on consuming vegetables and fruits.

The mean value of blood sugar levels in the comparison intervention group based on physical activity, in respondents who did physical activity, the pre-test was 183.37 mg/dL and the post-test decreased to 160.37 mg/dL. As for respondents who did not do physical activity, the pre-test was 185.21 mg/dL and the post-test dropped to 159.14 mg/dL. Furthermore, the difference test based on physical activity, the p value is 0.917> 0.05, which means there is no difference in blood sugar levels before and after supplementing bay leaves based on physical activity.

Analysis of differences in blood sugar levels before and after the intervention in the intervention and control groups

Table 6: Differences in blood sugar levels before and after intervention in the main intervention group and comparison intervention group in 2024

Blood sugar levels	Variables	Mean	SD	The difference		*p-value*
				Mean	SD	
Main Intervention	Pretest	206,37	55,38	32,20	6,41	0,000
	Posttest	174,17	48,97			
Comparison Intervention	Pretest	184,23	37,32	24,43	5,95	0,000
	Posttest	159,80	31,37			

Description: Wilcoxon test

Source: Primary data, 2024

Based on the table above, it can be seen that the mean value of blood sugar levels in the main intervention group has decreased before and after giving cinnamon supplements, namely the difference is 32.20 with a p value of 0.000 <0.05, which means that there is a significant difference in blood sugar levels before and after giving cinnamon supplements to the main intervention group. The mean value of blood sugar levels in the comparison intervention group also decreased, namely the difference of 24.43 with a p value of 0.000 <0.05, which means there is a significant difference in blood sugar levels before and after supplementing bay leaves in the comparison intervention group.

Mean and difference in blood sugar level reduction in intervention and control groups

Table 7: Analysis of mean and difference of blood sugar level before and after intervention in main intervention group and comparison intervention group in 2024

Variables	Group	Mean	SD	The difference		*p-value*
				Mean	SD	
Pre-Posttest	Main Intervention	32,20	16,26	7,77	4,9	0,036
	Comparison Intervention	24,43	11,36			

Notes: Independent t-test

Source: Primary data, 2024

Based on the table above, it shows that the average value of the difference in blood sugar levels in the main intervention group is 32.20 and the comparison intervention group is 24.43 and the results of statistical tests between the main intervention group and the comparison intervention obtained a p value of 0.036 <0.05, meaning that there is a significant difference between the main intervention group and the comparison intervention group.

DISCUSSION

1. Differences in blood glucose levels before and after intervention in the main intervention and comparison intervention groups

Based on the test results of blood glucose levels before and after treatment in the group given cinnamon supplements, there was a significant change of 32.20 mg/dL and the blood sugar levels of the group given bay leaf supplements also decreased by 24.43 mg/dL.

The results of research by Gupta, Charu, Garg A.P, Uniyal R.C., and Kumari A. (2008) in [8](2008) in (Amirudin et al., 2019), showed that cinnamon essential oil contains sinamaldehyde and sinnamic acid compounds that are very effective in inhibiting the growth of several bacteria including B. Cereus, S. Aureus, E. Coli, P. Aeruginosa and Klebsiella sp. In addition, cinnamon has been studied several times to reduce blood glucose levels, total cholesterol, and triglyceride levels, and can increase HDL. Cinnamon bark contains alkaloids, flavonoids, and essential oils namely chamfer, safrole, eugenol, cinnamaldehyde, cinnamylacetate, terpenes, sineol, citral, citronellal, polyphenols and benzaldehyde.

The results of research conducted (Sya'bani, 2020), on client I (Mrs.A) and client II (Ms.N), with impaired blood glucose instability. After nursing care is given cinnamon brew 2 times a day in the morning and at night for 7 days, the results of the client's blood glucose levels decrease. The results in client 1 were obtained before being given cinnamon tea GDS 310 mg/dL and after being given to GDS 277 mg/dL. While client 2 before being given cinnamon brew GDS 322 mg/dL and after being given 273 mg/dL.

In line with research [10] showed a significant decrease in blood sugar in treatment group 1, and also positive control with p <0.05. The results of the paired t test obtained a mean of 149.983 for treatment 1 and 147.063 in positive control. These results using the Spearman rank test results show a value of p = 0.001. In the study, the error degree α = 0.005 was determined after comparing the p value < α, H0 was rejected, H1 was accepted, meaning that it could be concluded that there was an effect of giving cinnamon bark extract to reduce blood sugar levels in patients with diabetes mellitus. [11].

The results of the t-test statistical test in the control group were p = 0.000 (p <0.05) and the intervention group with p = 0.000 (p <0.05), meaning that there was a significant effect of the two groups. The conclusion is that the administration of cinnamon powder can reduce blood sugar levels in patients with Diabetes Mellitus. (Dafriani et al., 2018)..

In the Paired sample T-Test test results show statistical results with a value of p = 0.00 < α = 0.05 that there is an effect of bay leaf decoction with the incidence of the level of Blood Sugar Time (GDS). [13]. In line with research conducted (S. W. Safitri et al., 2024). The p value obtained is 0.024 <0.05, so as a basis for decision that there is an effect of bay leaf decoction on reducing blood glucose levels in patients with Type 2 Diabetes Mellitus.

Bay leaves can be used for traditional medicine. People are starting to look at traditional medicine because traditional medicine does not require expensive costs and can be concocted by themselves. Various literature states that Eugenia Polyanthum has many medicinal properties, including to treat diabetes, high cholesterol, gastritis, diarrhoea, gout because bay leaves contain essential oils (cirrhosis and eugenol), tannins, and flavonoids. (Ramadhani et al., 2023).. In Indonesia itself, bay leaves are used as one of the famous flavourings. Traditionally, bay leaves are used as a treatment for gastric disorders, haemorrhoids, antidiarrhoea, diabetes mellitus, anti-cholesterol and antihypertensive drugs (Kresnapati et al., 2023). (Kresnapati et al., 2024)..

2. Differences in pre and post test blood glucose levels between the main intervention and comparative intervention groups

Based on the results showed that the average difference in blood sugar levels at the time of the pre-test of the main intervention group was 206.37 mg/dL and the comparison intervention group was 184.23 mg/dL. The average blood sugar level during the post test of the main intervention group was 174.17 mg/dL and the comparison intervention group was 159.80 mg/dL. As with the test results, it shows that the difference in blood sugar levels at the time of the post test shows a decrease in blood sugar levels in the main intervention group, namely the provision of cinnamon supplements.

Cinnamon plants have various compounds, as mentioned by Fatmalia & Muthoharoh (2017). According to Anderson (2006), cinnamon contains essential oil, safrole, sinamaldehyde, tannin, calcium oxalate, resin, and tanning agents. Antioxidants contained in it include eugenol and methylhydroxychalcone polymer (MHCP). MHCP is a polyphenol (flavonoid) that has insulin-like effects that can reduce blood glucose levels. (Hadinata & Sayidatunnisa, 2024)..

Statistical test results in research [18] in both groups using the Wilcoxon Signed Rank Test. In the intervention group, the significance value of ρ = 0.002 means that there is an effect of giving cinnamon bark infusion on the level of random blood glucose levels in patients with type 2 diabetes mellitus. The results of the Mann-Withney U Test statistical test obtained a mean value in the intervention group of 11.07 and the control group of 17.93, while the significance value (P-value) = 0.012 <0.05. Giving cinnamon bark infusion can reduce blood glucose levels in patients with type 2 diabetes mellitus. Giving cinnamon bark infusion needs to be given as an alternative treatment in patients with type 2 diabetes mellitus.

The results of the analysis in the cinnamon group found that the average blood sugar score after giving cinnamon brew can reduce blood glucose levels during and the p value can be concluded that there is an effect of giving cinnamon brew on reducing blood glucose levels during, meaning that there are differences in blood sugar scores before and after in the cinnamon group. In this study, the cinnamon group was given treatment in the form of giving cinnamon brew and measuring pretest and posttest. [19]. In research [20] It can be concluded that consuming 6 grams of cinnamon brew for two hours can reduce the value of blood sugar statistically significant (p value = 0.0001). The decrease in the value of blood sugar is also quite significant, which is 20.14% of the previous blood sugar value. It is recommended to consume 6 grams of cinnamon daily. However, people who consume cinnamon should still be carefully monitored about their liver health. This is because cinnamon can have hepatotoxic effects if taken in high doses.

The results showed the effect of cinnamon administration on reducing blood sugar levels in patients with diabetes mellitus. This is due to the high content of polyphenols in cinnamon such as cinnamaldehyde and cinnamic acid. When someone consumes cinnamon tea, polyphenols will help insulin to enter blood sugar into cells that accumulate in blood vessels so that the body's metabolic processes are fulfilled. Cinnamaldehyde has an anti-hyperglycaemic effect, the work of Cinnamaldehyde can reduce grelin hormone which can directly increase insulin sensitivity. The flavonoid content contained in cinnamon can increase glucose metabolism and convert glucose into energy, in the process increasing cell sensitivity to insulin. (Vonikartika & Hutapea, 2024)..

3. Mean and difference of blood glucose level reduction between main intervention and comparison intervention groups

Based on table 11 shows the average value of the difference in blood sugar levels in the main intervention group of 32.20 mg/dL and the comparison intervention group of 24.43 mg/dL and obtained a p value of 0.036 <0.05, meaning that there is a significant difference in the main intervention group and the comparison.

It is known that there is a decrease in the average value of blood glucose levels in the main intervention group higher than the comparison intervention in line with research conducted (Arini & Aridiaria, 2016), before being given the intervention the results of the GDP examination got a p value of 0.131, after being given the intervention the results of the GDP examination got a p value of 0.768. There was an effect on the 10 gram group with a p value of 0.000, the 8 gram group with a p value of 0.001, and the control group with a p value of 0.652.

According to observations from researchers, the average blood glucose levels of all respondents before being given the intervention were at high blood glucose levels, and the average blood glucose

levels of all respondents after being given the intervention decreased. Cinnamon supplementation is proven effective to reduce blood glucose levels in patients with type II diabetes mellitus. The highest difference in blood sugar levels is found in the average of the main intervention group compared to the comparison intervention group, which means that taking cinnamon supplements is greater in reducing blood sugar levels than taking bay leaf supplements.

CONCLUSION

There is a significant difference in blood sugar levels in patients with diabetes mellitus before and after supplementation, with cinnamon supplementation showing a notable reduction in blood sugar levels. Similarly, a significant difference was observed in patients with type 2 diabetes mellitus before and after bay leaf supplementation. Furthermore, a comparison between the main intervention group and the comparison intervention group revealed a significant difference, with the main intervention group experiencing an average reduction in blood sugar levels of 32.20 mg/dL, compared to 24.43 mg/dL in the comparison group.

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