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THE EFFECT OF SOY MILK WITH BOILED MORINGA LEAVES ON BLOOD SUGAR LEVELS IN TYPE 2 DIABETES MELLITUS PATIENTS: STUDY IN BENGKULU, INDONESIA

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ABSTRACT

Diabetes mellitus is a significant threat to society and even results in death. The content of soybeans that can lower blood glucose levels are protein, isoflavones, fiber, and a low glycemic index. Moringa leaves contain antioxidants such as flavonoids, vitamin A, E, C, and selenium, which help lower blood glucose levels. However, it is unknown whether combining soy milk with boiled moringa leaves is also beneficial in reducing blood sugar levels. This study aimed to determine how combining soy milk and boiled moringa leaves affects blood sugar levels in type 2 diabetes mellitus patients at Posbindu Puskesmas Nusa Indah. Bengkulu city in 2023. The design used in this study is a pre-experimental design with a pre-test and post-test design. Fifteen pre-elderly samples aged 45 to 59 years with blood sugar levels of 140 to 199 mg/dL were randomly selected as intervention targets in this study. The treatment combined 200 ml of soy milk with 150 mL of Moringa leaf decoction, and then 350 mL of soymilk was produced. The intervention was given twice daily, as much as 175 mL for seven days. Data analysis using the Paired T-test showed that there was a significant relationship between intervention and the sugar level of type 2 diabetes mellitus ($p < 0.001$). There was a substantial decrease in blood glucose levels after administering the soymilk intervention with Moringa leaf decoction after seven days of intervention with $p < 0.001$. This combination product can be used as a functional food ingredient as an alternative for lowering blood glucose levels.

Keywords: Soymilk, Moringa Leaves, Blood Sugar Levels, Pre-elderly

INTRODUCTION

Diabetes mellitus (DM) is a significant threat to society because it can cause complications from heart disease, obesity and even death. Many epidemiological studies show an increase in the prevalence of type 2 diabetes mellitus in the world (Hermawan et al., 2021). Bad eating habits cause sugar and fat levels in the body to increase excessively. This forces the pancreatic gland to work hard to produce the hormone insulin to process the incoming sugar. Lifestyle changes appear to be an essential cause of this problem. It is estimated that there are still many (around 50%) undiagnosed diabetes in Indonesia. DM complications that often occur, especially in the nervous system or neuropathy, will cause an increase in morbidity and mortality so that the financial impact on DM becomes high and the productivity of DM patients decreases (Perkeni, 2021).

The International Diabetes Federation IDF (2021) estimates that at least 537 million people aged between 20 and 79 years suffer from diabetes worldwide in 2021, representing a prevalence of 1 in 10 of the total population of the same age. The IDF estimates that the global diabetes population is expected to increase to 643 million by 2030 and 783 million by 2045. Undiagnosed diabetes affects nearly 1 in 2 adults. As many as 541 million people are at higher risk of developing type 2 diabetes as they get older; the prevalence of diabetes increases to 19.9% or 111.2 million at the age of 65-79 years.

Globally, countries in the Arab region, North Africa and the West Pacific are ranked first and second with a prevalence of diabetes in the population aged 20-79 years of 12.2% and 11.4%; Southeast Asia is ranked third with 11.3% of sufferers. Indonesia is ranked 7th among ten countries with a high number of Diabetes Mellitus sufferers, so it can be estimated that Indonesia's contribution to the prevalence of Diabetes cases in Southeast Asia (Ministry of Health of the Republic of Indonesia, 2020). The 2018 Basic Health Research (*Riset Kesehatan Dasar – Riskesdas*) results show that the prevalence of diabetes

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mellitus in Indonesia based on a doctor's diagnosis at age >15 years is 2%. This figure shows an increase compared to the prevalence of diabetes mellitus in the population aged >15 years in the 2013 *Riskesdas* results of 1.5%. However, the prevalence of diabetes mellitus, according to blood sugar examination results, increased from 6.9% in 2013 to 8.5% in 2018.

Based on the profile of the Bengkulu City Health Service, in 2021, 17,419 people were suffering from Diabetes Mellitus and the prevalence was obtained based on doctor's diagnosis in the population aged 15 years in Bengkulu Province, 1.26%, the highest prevalence is in Bengkulu City with 1.77%, with female gender being more suffer from diabetes with the number of 1.13% compared to the number of men of 0.69%. Based on the service profile of the Bengkulu City Community Health Center, the highest community health center is the Nusa Indah Community Health Center, which had an incidence of DM of 140 people in 2021. One method of treating Diabetes Mellitus is non-pharmacological in the form of diet therapy, exercise, education, and counselling (Partika et al., 2018).

Soymilk is a highly nutritious drink. It contains lecithin compounds for metabolic balance and the amino acid arginine, which can maintain the balance of the insulin hormone (Rahadiyantie et al., 2017). Apart from soy milk, several plants can also be used as alternative treatments for Diabetes Mellitus, such as Moringa leaves. Moringa leaves (*Moringa oleifera*) are one of the readily available plants in Indonesia. Moringa leaves contain antioxidants such as flavonoids, vitamin A, E, C, and selenium, which help lower blood glucose levels. Inhibition of the glucosidase enzyme causes a decrease in the rate of carbohydrate digestion into monosaccharides, which can be absorbed by the small intestine, thereby reducing postprandial hyperglycemia (Safitri, 2018). Based on the problems regarding Diabetes Mellitus, non-pharmacological treatments seem more efficient to use; besides being easy to find, they are also effortless to obtain with their benefits, such as soy milk and Moringa leaf decoction. Therefore, researchers researched the effect of boiled Moringa leaves and soy milk on reducing blood sugar levels in people with type 2 diabetes mellitus at *Posbindu*, Nusa Indah Health Center, Bengkulu City, in 2023.

METHODS

The design used in this study was a pre-experimental design with a pre-test and post-test design. The treatment was a combination of 200 mL of soy milk with a decoction of 150 mL of moringa leaves, producing as much soy milk as 350 mL. The intervention was given twice daily, as much as 175 mL for seven days. Purposive technique sampling was used to conduct this study. The sample size was calculated by using the Lemeshow formula (Lameshow, 1997) :

$$n = \frac{z^2 1 - \alpha/2 P(1-P)}{d^2}$$

Where:
n = sample size
z= z score at 95% confidence = 1.96
P=maximum estimate = 0.5
D = alpha 0.10 or sampling error 10%

Based on the formula above, 15 people were obtained as subjects. Then, the subjects were selected according to the inclusion criteria in this study, including pre-elderly people aged 45 - 59 who have a current blood sugar level range between 140 - 199 mg/dL, do not take diabetes mellitus medication, and are willing to become a respondent by signing an informed consent paper.

A validated questionnaire and a reliability test measured knowledge. Knowledge was good if 8 out of 15 questions were correctly answered. According to Louis et al. (2007), Sedentary activity can be categorized as high if ≥ 5 hours per day and as low if ≤ 5 hours per day (ASAQ, 2007). Current blood sugar levels were measured by Easy Touch Test Strip 25S, with is followed these steps: preparing an easy touch device, cleaning your finger with an alcohol swab and frick it, and pushing and taking a sample of blood with a stick trip inaccessible touch equipment. See the blood glucose level result on the screen of an easy-touch display.

Bivariate analysis of the results used the Paired T-Test and Independent T-Test to compare the control group and treatment group regarding

the average value of blood sugar levels before and after the intervention. Before data analysis is carried out, it is necessary to test the normality of the data first. The Ethics Committee of the Bengkulu Ministry of Health Poltekkes No. KEPK. BKL/471/07/2023 approved this research.

RESULTS AND DISCUSSIONS

Characteristics of Respondents

Respondent characteristics assessed in this study include gender, physical activity, education, knowledge, and occupation. Table 1 presents the results of these characteristics.

Table 1 shows the results of the characteristic test for all pre-elderly ages, totalling 15 people 100%, women 9 people 60%, and men 6 people 40%. The physical activity of the respondents who worked amounted to 9 people 60% and those who did not work 6 people 40%.

Bivariate analysis result

The significant value of the intervention group <0.05, it can be concluded that the data is not normally distributed and the bivariate analysis used is the Wilcoxon Signed Rank Test to compare the differences between the two paired groups > 0.05, it can be concluded that the data are normally distributed, so bivariate analysis uses the Paired Sample T Test to test the average difference between the two samples (before and after) as in Table 2.

Table 1. Respondents Characteristics

Characteristics Respondents	n	%
Gender		
Woman	9	60.0
Man	6	40.0
Physical Activity		
Not Sedentary	9	60.0
Sedentary	6	40.0
Education		
Elementary-junior high school	9	60.0
Senior high school-university level	6	40.0
Knowledge		
Good	7	46.7
Not good	8	53.3
Occupation		
Working	8	53.3
Not Working	7	46.7

Table 2. The effect of soymilk with boiled moringa leaves on blood sugar level.

Random blood sugar level	**Before** Mean ± SD	**After** Mean ± SD	p-Value
	159.67±11.721	126.33 ±9.904	<0.001

In Table 2, it is found that the average value before being given treatment is 159.67 with a standard deviation of 11.72; after being given soy milk with moringa leaves, a decrease in blood sugar level changed with the average value of 126.33 with a standard deviation of 9.904. The P-value is <0.001, which is a significant value, so the results obtained show the effect of giving soy milk with boiled leaves moringa.

Based on research that has been conducted on 15 respondents with the administration of a combination of soymilk with boiled moringa leaves for seven days a week, given two times in the morning and evening, where there is a decrease in blood sugar level, the change in blood sugar level after and before with a p-value of <0.005 where this indicates that there is an influence from the intervention given done. The intervention decreased blood sugar level by 126.33 mg/dL.

Previous research that aligns with this research was conducted by Sartika (2019), who found that giving as much as 10 gram of soy milk daily can reduce sugar level. In the blood, it was found that there were differences in blood sugar levels before and after administration intervention. Blood sugar level decreased by 126.33 mg/dL. In line with Septian study, Wijaya (2019) shows the results of the effect of giving moringa leaf decoction lowering blood sugar level in diabetes mellitus; this is because soymilk contains isoflavone, saponin, lecithin and phytosterol which can lower blood sugar level.

The other major soybean bioactive compound are isoflavones, associated with protein. Soy isoflavones are phytochemical, often referred to as phytoestrogen because they are structurally sound, resemble ÿ-estradiol, and can bind to the estrogen receptor, but have a higher affinity, have estrogenic and anti-estrogenic properties as shown in cell culture and clinical studies. Most of the isoflavones naturally occur in soybeans as

glycoside, genistein, diazine, and glycerin; after being digested or fermented by ÿ- glucosidase, they are converted into bioactive forms, aglycones: genistein, daidzein, and glycerin (Rizzo et al., 2018). the considerable variation in the abundance of the respective isoflavones in soy and soy foods and their bioavailability resulted in inconsistent physiological functions found among different studies (Chatterjee et al., 2018). Some evidence suggests that Estrogen receptor (ER) binding is only part of the effects of isoflavones. Genistein and daidzein (and their metabolite equals) improve glycemic control and significantly alter homeostasis glucose through insulin secretion by inhibiting tyrosine kinase (TK) (Liu et al., 2013). Isoflavones activate adenosine 5-monophosphate (AMP)--activated protein kinase (AMPK). This results in a decrease in hepatic blood glucose while stimulating glucose uptake independent of insulin in skeletal muscle and modulating glucose transport in peripheral tissues.

In addition, isoflavones can also regulate lipid metabolism without the mediation of estrogen receptors, increase expression of peroxisome proliferator-activated receptor gamma (PPARÿ) and activate activated protein kinase (AMPK), which results in increased activity of the yang gene involved in lipoprotein metabolism reduces the production of triglyceride-rich particles and increasing its lipolysis promoting the metabolism of High-Density Lipoprotein promote absorption, utilization and catabolism of fatty acids (Kim et al, 2021). Isoflavones can also inhibit the expression and activity of sterol-regulatory elements and protein-binding proteins (HDL), which bind to carbohydrate-regulatory elements. These proteins increase the expression of lipogenic genes and enzymes. Another key involved mechanism may be that soy isoflavones may modulate lipoprotein metabolism, including its effect on several enzymes necessary in lipid transformation, including lipoprotein lipase (LPL), hepatic lipase (HL) also called hepatic triglyceride lipase (HTGL), and alpha-hydroxylase (Mendonça et al., 2020). It contains soy milk *Lactobacillus plantarum*, which can improve lipid profiles and slow the development of nephropathy in diabetic patients (Abbasi et al., 2018). In addition, the structural similarities between soy isoflavones and endogenous 17-ÿ-estradiol suggest that isoflavones, by binding to the estrogen receptor, cause gene activation and beneficial effects on glucose and lipid (Vargas-Sánchez et al., 2019)

Phytochemical analysis of Moringa leaves has revealed that Moringa leaves are rich in minerals such as potassium, calcium, iron and phosphorus and various antioxidants such as flavonoids and vitamin C. Moringa plants have been studied comprehensively in the treatment of multiple diseases such as typhoid fever, arthritis, malaria, swelling, skin diseases, parasitic diseases, hypertension, diabetes (Anwar et al., 2021). The protein obtained from Moringa leaves, Mo-LPI, reduces blood glucose levels and is a promising alternative or complementary agent for treating diabetes (Paula et al., 2017).

Moringa leaves have been shown to inhibit the activity of ÿ-glucosidase, ÿ-amylase pancreas, and intestinal sucrose, contributing to its antihyperglycemic properties. This inhibitory effect is possible thanks to phenols, flavonoids, and tannins in Moringa leaves. A delay in the digestion of carbohydrates, caused by inhibiting this enzyme, causes a decrease in post-prandial hyperglycemia and hemoglobin A1C (HbA1C) (Vargas-Sánchez et al., 2019). The antidiabetic activity of flavonoids supports the regulation of carbohydrate digestion, insulin signaling, insulin secretion, glucose uptake, and deposition of adipose (Sangeetha, 2019). Flavonoids target many of the molecules involved in regulating several pathways, such as increasing ÿ cell proliferation, increasing insulin secretion, reducing apoptosis, and repairing hyperglycemia by regulating glucose metabolism in the liver (Pandey et al., 2009).

Flavonoids hydrolyze and conjugate significant enzymes in the intestine, colon and liver. In the gut, Hydrolyzed and conjugated enzymes convert flavonoid monomer units into glucuronides, esters sulphate, and methyl esters (Al-Ishaq et al., 2019). Flavonoid conjugation occurs in two phases of the small intestine (phase one) and then in the liver, at the end of phase one and the beginning of phase two. In the liver, metabolites the conjugated conjugates undergo further processing to produce sulphate and glucuronide derivatives facilitated and excreted via bile and urine. Flavonoids that are not absorbed move to the colon, where they

undergo hydrolysis or fermentation by the colonic microbiota. The microbiota hydrolyses flavonoid glucuronides in the liver into aglycones, then breaks down into lower molecular compounds that are easily absorbed (Thilakarathna et al., 2013).

The major limitation of this research is that it does not consider other factors that might confound the effects of the intervention on blood sugar levels, as it might bias the analysis crucial to conclude the results. Nonetheless, this study could be used as a pilot study and developed further with a better study design.

CONCLUSION

There is an effect of giving a combination of soy milk with boiled moringa leaves on blood sugar levels in patients with type 2 diabetes mellitus at *Posbindu,* Nusa Indah Health Center, Bengkulu City, in 2023. For further research, apart from being given drinks, the raw materials of Moringa leaves and soy milk can be processed into other food forms, for example, Moringa leaf pudding with soymilk, thus reducing the boredom of diabetes mellitus sufferers.

REFERENCES

Abbasi, B. et al. (2018) 'Effects Of Probiotic Soy Milk On Lipid Panel In Type 2 Diabetic Patients With Nephropathy: A Double-Blind Randomized Clinical Trial', Progress In Nutrition, 20(1), Pp. 70–78. Available At: Https://Doi.Org/10.23751/Pn.V20i2-S.5342.

Afitasari, DR, Yusuf, A. And Effendi, F. (2017) 'Guava Juice Reduces Cholesterol Level For Elderly With Nurses, Hypertension', Journals 10–14. Https://Doi.Org/10.20473/Jn.V5i1.3918. 5(1), Pp.

Al-Ishaq, RK et al. (2019) 'Flavonoids And Their Anti-Diabetic Effects: Cellular Mechanisms And Effects To Sugar Improved BlooAdt:HBitotpmso:/l/eDcouil.eOsr,gA/1v0a. i3la3b9l0e/Biom909L0e4v3e0ls', 9(9).

Aminah, S. (2020) 'Components and Functional Characteristics of Soybean Sprouts', Proceedings of the Unimus National Seminar, 3, Pp. 1–5. Ansar J, Dwinata I, MA (2019) 'Determinants of Hypertension Occurrence in Posbindu Visitors in the Work Area of the Ballaparang Health Center, Makassar City', Health Sciences, 1(3), Pp. 28–35. Antioxidants-10-01064.Pdf'.

Anwar, T. et al. (2021) 'Original Research Article Moringa Oleifera Lam's Antidiabetic Potential. Extract and Leaves in Type 2 Diabetic Rats , Mechanism of Action', 20(1), Pp. 97–104.

Ardiyanto, I., Nuraeni, A. and Supriyono, M. (2017) 'The Effectiveness of Carambola Juice on Lowering Blood Pressure in the Elderly in Tawangmas Baru Village, West Semarang District', Scientific Journal of Nursing and Midwifery (Jikk), Pp. 1–8.

Ayudya LN. and Rustanti, N. (2012) 'The Effect of Giving Soy Milk on Fasting Blood Glucose Levels in Prediabetic Women', Journal Of Nutrition College, 1(1), Pp. 382–387. Available At: Https://Media.Neliti.Com/Media/Publications/185001-Id-Pengaruh-Asupan Makan- Energy-Karbohidrat.Pdf%0a.

Azizah (2022) 'Pharmacotherapy Of Diabetic Mellitus: A Review Review: Pharmacotherapy of Diabetes Melitus', Journal Of Pharmacy And Science), 5(2), Pp. 80–91.

Bara, A. et al. (2021) 'Effects of Soy Isoflavones on Glycemic Control and Lipid Profile in Type 2 Diabetes Patients: A Systematic Review and Meta-Analysis of Randomized Controlled Trials'.

Bhatt, H., Saklani, S. And Upadhayay, K. (2016) 'Anti-Oxidant And Anti-Diabetic Activities Of Ethanolic Extract Of Primula Denticulata Flowers', Indonesian Journal Of Pharmacy, 27(2), Pp. 74–79. Available At: Https://Doi.Org/10.14499/Indonesianjpharm27iss2pp74.

Bulu, A., Wahyuni, TD And Sutriningsih, A. (2019) 'Relationship Between Level of Compliance with Taking Medication and Blood Sugar Levels in Patients with Type I Diabetes Mellitus', Nursing News, 4(1), Pp. 181–189.

Chakrabarti, S., Guha, S. And Majumder, K. (2018) 'Food-Derived Bioactive Peptides In Human Health: Challenges And Opportunities', Nutrients, 10(11), Pp. 1–17. Available At: Https://Doi.Org/10.3390/ Nu10111738.

Chao, WX (2008) 'Health Effects Of Soy Protein And Isoflavones In Humans', Journal Of Nutrition, 138(6), pp. 4–9. Available At: Https://Doi.Org/10.1093/Jn/138.6.1244s.

Chatterjee, C., Gleddie, S. And Xiao, CW (2018) 'Soybean Bioactive Peptides And Their Functional Properties', Nutrients, 10(9), 8–11. Https://Doi.Org/10.3390/Nu10091211. Pp.Available At:

Denta, AO And Fauziyah, E. (2022) 'Moringa Leaf Powder Effectively Lowers Blood Glucose

Levels and Cholesterol Levels in Obese Individuals', Wiraraja Medika: Journal of Health, 12(1), Pp. 10–16. Available AtHttps:// Ejournalwiraraja.Com/Index.Php/Fik/Article/ View/1712%0ahttps:// Ejournalwiraraja.C om/ Index.Php/Fik/Article/Download/1712/1359.

Diana, A. (2022) 'The Use of Moringa Leaves as Anti-Thesis By':, State Islamic University of Maulana Malik Ibrahim Malang [Preprint], (Relationship between Knowledge Level and Behavior of Using Moringa Leaves as an Anti-Hypercholesterolemia in Gondanglegi District, Malang Regency).

Ekasari, E. And Dhanny, DR (2022) 'Factors Affecting Blood Glucose Levels in Type II Diabetes Mellitus Patients Age 46-65 Years In Wakatobi District', Journal Of Nutrition College, 11(2), Pp. 154–162. Available At: Https://Doi.Org/10.14710/Jnc.V11i2.32881.

Email, SU (2022) 'The Effect of Giving Soy Milk on Blood Glucose Levels in Patients with Type 2 Diabetes Mellitus at the Pagar Jati Health Center, Lubuk Pakam Karmila District Br Proceeding B-ICON 2023, https://doi.org/10.33088/bicon.v1i1.65 www.proceeding.poltekkesbengkulu.ac.id Kaban 5 123 456 Bachelor of Nursing Study Program, Faculty of Nursing and Midwifery, Prima Indonesia University, 3(1), Pp. 107–113.

Fahmi, NF, Firdaus, N. And Putri, N. (2020) 'The Effect of Time Delay on Blood Glucose Levels During the Poct Method in College Students', Journal of Nursing Update, 11(2), Pp.1–11. Available At: Hhttps://Stikes-Nhm.E-Journal.Id.

Febriyanto, DN And Prihatin, S. (2016) 'The Effect of Giving Soybean Milk on Blood Glucose Levels in Patients with Type 2 Diabetes Mellitus Effect Of Soybean Milk Giving Blood Glucose Levels For People By Type 2 Diabetes Dicky Nurwahyu Febrianto 1, Setyo Prihatin 2 ', Nutrition Research Journal, 4(1), Pp. 69– 73.

Fitriani, F. And Sanghati, S. (2021) 'Lifestyle Intervention for Prevention of Type 2 Diabetes Mellitus in Pre- Diabetic Patients', Scientific Journal of Health Sandi Husada, 10(2), Pp. 704–714. Available At: Https://Doi.Org/10.35816/ Jiskh.V10i2.682.

Guo, B. et al. (2022) 'Soybean Genetic Resources Contributing To Sustainable Protein Production', Pp. 4095– Theoretical And Applied Genetics, 135(11), Https://Doi.Org/ 10.1007/S00122-022-04222-9. 4121. Available At:

H, DS (2008) 'Response of Soybean Plants (Glycine Max (L.) Merril) to Acid Soil', Pp. 1– 21.

Hermawan, D., Wahyudi, T. And Djamaludin, D. (2021) 'The Influence of Lifestyle on the Incidence of Diabetes Mellitus at a Productive Age in the Working Area of the Gading Rejo Health Center, Pringsewu Regency, 2019', Journal of Public Health, 10(2) , pp. 145–157.

Husna, DS And Puspita, ID (2020) 'Nutrition Research Journal', Nutrition Research Journal, 8(1), Pp. 76–84. Available At: Http://Ejournal.Poltekkes-Smg.Ac.Id/Ojs/Index.Php/Jrg/Article/View/6273/2008.

Ibrahim, Irviani A, YE (2020) 'Cholesterol Levels in State Civil Apparatus', Journal of Health, 13(1), Pp. 53–Available At: Https://Doi.Org/10.24252/Kesehatan.V13i1.14156.Idf (2017) Eighth Edition 2017, Idf Diabetes Atlas, 8th Edition. Available At: Https://Www.Idf.Org/Aboutdiabetes/ Type-2-Diabetes.Html.

Ismawati, R. (2016) 'Study of Respondents' Preference for Diversity Side Dishes From Moringa Leaves (Moringa Oleivera)', 5(1), Pp. 17–22.

Kabosu, RAS, Adu, AA And Hinga, IAT (2019) 'Risk Factors for Type Two Diabetes Mellitus in Bhayangkara Hospital, Kupang City', Timorese Journal Of Public Health, 1(1), Pp. 11–20. Available At: Https://Doi.Org/10.35508/Tjph.V1i1.2122.

Lemeshow, 1997, Besar Sampel Dalam Penelitian Kesehatan, Yogyakarta, UGM

Ministry of Health (2019) 'Ministry of Health of the Republic of Indonesia', Ministry of Health of the Republic of Indonesia, 1(1), P

Ministry of Health of Republic of Indonesia. (2020) 'Infodatin Remains Productive, Prevents, and Overcomes Diabetes Mellitus 2020', Center for Data and Information of the Ministry of Health of the Republic of Indonesia, Pp. 1–10.

Nursing, J. Et Al. (2021) 'Literature Review: Benson's Relaxation Technique', 7(October 2020), Pp. 49–61.

Kim, IS (2022) 'Current Perspectives On The Beneficial Effects Of Soybean Isoflavones And Their Metabolites On Plants', Food Science And Biotechnology, 31(5), Pp. 515–526. Available At: Https://Doi.Org/10.1007/ S10068-022-01070-7.

Kim, IS, Yang, WS And Kim, CH (2021) 'Beneficial Effects Of Soybean-Derived Bioactive Peptides', International Journal Of Molecular Sciences,

22(16), Pp. 1–23. Available At: Https://Doi.Org/10.3390/ Ijms22168570.

Kondo, S. et al. (2021) 'Antidiabetic Effect Of Taxifolin In Cultured L6 Myotubes And Type 2 Diabetic Model Kk-Ay/Ta Mice With Hyperglycemia And Hyperuricemia', Current Issues In Molecular Biology, 43(3), Pp. Https://Doi.Org/10.3390/Cimb43030092. 1293–1306. Available At:

Kou, X. et al. (2018) 'Nutraceutical Or Pharmacological Potential Of Moringa Oleifera Lam.', Nutrients, 10(3). Available At: Https://Doi.Org/10.3390/Nu10030343.

Lathifah, NL (2017) 'The Relationship Between Disease Duration And Blood Glucose Related To Subjective Compliance In Diabetes Mellitus', Jurnal Berkala Epidemiologi, 5(2), P. 218. Available At: Https://Doi.Org/ 10.20473/Jbe.V5i22017.218-230.

Lestari, Zulkarnain And Sijid, SA (2021a) 'Diabetes Melitus: Review of Etiology, Pathophysiology, Symptoms, Causes, Methods of Examination, Methods of Treatment and Methods of Prevention', Uin Alauddin Makassar, (November), Pp . 237–241.

Lestari, Zulkarnain And Sijid, SA (2021b) 'Diabetes Melitus: Review of Etiology, Pathophysiology, Symptoms, Causes, Methods of Examination, Methods of Treatment and Methods of Prevention', Uin Alauddin Makassar, (November), Pp . 237–241. Available At: Http://Journal.Uin-Alauddin.Ac.Id/Index.Php/Psb.

Liu, D. And Gilbert, E.. (2013) 'Anti-Diabetic Functions Of Soy Isoflavone Genistein: Mechanisms Proceedings B-ICON 2023 Underlying', 4(2), PpF. Ood funct, 200–212. Available At: Https://Doi.Org/10.1039/C2fo30199g.Anti-Diabetic.

Maryati, H. (2017) 'The Relationship between Cholesterol Levels and Blood Pressure in Hypertension Patients in Sidomulyo Hamlet, Rejoagung Village, Ploso District, Jombang Regency', Journal of Nursing, 8(2), Pp. 128–137. Available At: Http://Ejournal.Umm.Ac.Id/Index.Php/Keperawatan/Issue/View.

De Mendonça, MAA Et Al. (2020) 'Red Propolis And Its Dyslipidemic Regulator Formononetin: Evaluation Of Antioxidant Activity And Gastroprotective Effects In Rat Model Of Gastric Ulcer', Nutrients, 12(10), Pp. 1–17. Available At: Https://Doi.Org/10.3390/Nu12102951. Molecules-22- 00271.Pdf' (No Date).

Morito, K. et al. (2001) 'Interaction Of Phytoestrogens With Estrogen Receptors ÿ Andÿ', Biological And Pharmaceutical Bulletin, 24(4), 351–356. Https://Doi.Org/10.1248/Bpb.24.351. Pp. Available At:

Muliani, U. (2013) 'Intake of Nutritional Substances and Blood Sugar Levels in Type 2 DM Patients at the Internal Medicine Polyclinic of Dr. H. Abdul Moeloek Lampung Province', Journal of Health, 4(2), Pp. 325–Available At: Https://Ejurnal.Poltekkes-Tjk.Ac.Id/Index.Php/Jk/Article/Download/74/67.

Nuraini, HY and Supriatna, R. (2019) 'Relationship between diet, physical activity and family history of type 2 diabetes mellitus', Journal of Public Health Sciences, 5(1), Pp.5–14. Available At: Https://Doi.Org/10.33221/Jikm.V5i1.14.

Nuraisyah, F. (2018) 'Risk Factors for Type 2 Diabetes Mellitus', Journal of Midwifery and Nursing Aisyiyah, 13(2), Pp. 120–127. Available At: Https://Doi.Org/10.31101/Jkk.395.

Nurmawati, T. (2017) 'Study of Physiological Responses and Blood Sugar Levels in White Rats (Rattus Norvegicus) Exposed to Streptozotocin (Stz)', Journal of Nurses and Midwifery, 4(3), Pp . 244–247. Available At: Https://Doi.Org/10.26699/Jnk.V4i3.Art.P244-247.

Pandey, KB And Rizvi, SI (2009) 'Plant Polyphenols As Dietary Antioxidants In Human Health And Disease', Oxidative Medicine And Cellular Longevity, 2(5), Pp. 270–278. Available At: Https://Doi.Org/10.4161/ Oxim.2.5.9498.

Partika, R., Angraini, DI and Fakhruddin, H. (2018) 'The Effect of Doctor's Nutrition Counseling on Increasing Dietary Compliance in Patients with Type 2 Diabetes Mellitus The Effect Of Nutritious Counseling On Increases Diet Compliance Of Patients With Type 2 Diabetes Mellitus', Majority, 7(3), Pp. 276–283.

Pasaribu, KD, Napitupulu, RRJ And Sitepu, JN (2022) 'The Effect of Avocado Extract on Total Cholesterol Levels in Obese Male Wistar Rats', Nommensen Journal Of Medicine, 7(2), Pp. 27–30. Available At: Https:// Doi.Org/10.36655/Njm.V7i2.604.

Paula, PC et al. (2017) 'A Protein Isolate From Moringa Oleifera Leaves Has Hypoglycemic And Antioxidant Effects In Alloxan-Induced Diabetic Mice', Molecules, 22(2). Available At: Https://Doi.Org/10.3390/ Molecules22020271.

Perkeni, 2021 (2021) 'Guidelines for the Management and Prevention of Type 2 Diabetes Mellitus in Adults in Indonesia 2021', Global Initiative For Asthma, P. 46. Available At: Www.

Ginasthma.Org.

Puspita, Y. (2021) 'The Effect of Giving Red Dragon Fruit Juice (Hylocereus Polyrhizus) and Education on Cholesterol Levels in Pre-Hypercholesterolemia State Civil Servants in Bengkulu City', P. 12.

Putra, AL, Wowor, PM and Wungouw, HIS (2015) 'Description of Blood Sugar Levels in Class 2015 Students at the Faculty of Medicine, University of Sam Ratulangi Manado', Journal of E-Biomedik, 3(3). Available At: Https://Doi.Org/10.35790/Ebm.3.3.2015.10153.

Rahadiyanti, A. And Mulyati, T. (2017) 'The Effect of Soy Tempeh on Decreasing Blood Glucose Levels in Prediabetes' Introduction Diabetes Mellitus (Dm) Becomes the Most Common Problem in World . Many Developed and Berk Countries', Darussalam Nutrition Journal, 1(2), Pp. 19–30.

Rahayu, KB, Saraswati, LD And Setyawan, H. (2018) 'Factors Associated with Blood Sugar Levels in Patients with Type 2 Diabetes Mellitus (Studies in the Work Area of the Kedungmundu Health Center, Semarang City', Journal of Public Health, 6 (2), Pp 19–28 Available At:Https://Ejournal3.Undip.Ac.Id/Index.Php/Jkm/ Article/Download/20782/19487.

Rahayu, SAD& S. (2020) 'Factors Associated with Diet Compliance in Type II Diabetes Mellitus Patients', Journal of Nursing Science Stikes Hang Tuah Surabaya, 15(1), Pp. 124–138.

Rahman, MA (2018) 'Comparison of the Effectiveness of Tomato Fruit Juice (Lycopersicum Esculantum Mill.) With Red Guava Fruit Juice (Psidium Guajava L.) Against Decreasing Total Cholesterol Levels In Male White Rats Induced By Egg Yolk', Thesis, Pp. 1–86.

Rao, H. et al. (2021) 'Emerging Roles Of Dyslipidemia And Hyperglycemia In Diabetes Proceeding B-ICON 2023, https://doi.org/10.33088/bicon.v1i1.65 www.proceeding.poltekkesbengkulu.ac.id Retinopathy: Molecular Mechanisms And Clinical Perspectives', Frontiers In Endocrinology, 12(March). Available At: Https://Doi.Org/10.3389/Fendo.2021.620045.

Risnawati, R. And Demmalewa, JQ (2022) 'Differences in Therapeutic Effectiveness of Moringa Leaf Decoction and Apple Juice for Reducing Blood Sugar Levels in Patients with Type 2 DM', Manarang Health Journal, 8(1), P. 75. Available At : Https://Doi.Org/10.33490/Jkm.V8i1.514.

Rizzo, G. And Baroni, L. (2018) Soy, Soy Foods And Their Role in Vegetarian Diets, Nutrients. Available At: Https://Doi.Org/10.3390/Nu10010043.

Safitri, Y. (2018) 'The Effect of Giving Moringa Leaf Decoction on Blood Sugar Levels in Patients with Type 2 DM in Bangkinang Village, City Health Center Working Area, 2017', Ners Journal, 2(2), Pp . 43–50. Available At: Https://Doi.Org/10.31004/Jn.V2i2.191.

Sangeetha, R. (2019) 'Luteolin In The Management Of Type 2 Diabetes Mellitus', Current Research 393–398. Nutrition And Food Science In Https://Doi.Org/10.12944/Crnfsj.7.2.09. 7(2), Pp. Available At: Sarafatayat et al. (2018) 'The Effect of Red Dragon Fruit Pudding (Hylocereus Polyrhizus) Against Total Cholesterol Levels Outpatient Hypercholesterolemia in Mataram City Hospital, Journal of Prime Nutrition Journal, 3(2), Pp. 100–107.

Sartika Et Al (2019) 'The Effect of Giving Soy Milk and Dm Dm Type Ii Exercise at Persadia Club Rs Islam Cempaka Putih Jakarta Effect Of Soy Milk To Decrease Blood Glucose Levels In Patients With Type 2 Diabetes In Persadia Club Cempaka Putih Jakarta Islamic Hospital' , (1).

Sela, A. (2023) 'Resource Allocations In The Best-Of-K (K= 2 3) Conte, sts', Journal Of Economics/ Zeitschrift Fur Nationalokonomie, Pp. 146–153. Available AWt: .5(September), Https://Doi.Org/10.1007/S00712-023-00827-

Selviani, S. And Miftahul, F. (2022) 'Application of Star Juice to Reduce Blood Pressure in Hypertension Patients In Rt 004 Rw 015 Cinunuk', Journal of Muhammadiyah University of Tasikmalaya, 1(17), Pp. 142–150.

Shufyani, F., Wahyuni, FS And Armal, K. (2017) 'Evaluation of Factors Affecting Hypoglycemia in Type 2 Diabetes Mellitus Patients Using Insulin', Scientia : Journal of Health, 12 . Pharmacy And 7(1), P Available At: Https://Doi.Org/10.36434/Scientia.V7i1.100.

Sicilia, G., Dewi, FST And Padmawati, RS (2018) 'Qualitative Evaluation of Posbindu-Based Non-Communicable Disease Control Programs in the Work Area of the Muara Bungo I Health Center', Policy Journal 88–92 . Health Indonesia Jkki, 7(2),Pp. Available At: Https://Journal.Ugm.Ac.Id/JKki/Article/Download/36117/22614.

Simanullang, K. (2019) 'Giving Avocados Has an Effect on Blood Ldl Cholesterol Levels in Obese Students at the Faculty of Medicine, Hkbp Nommensen University in 2019.', Pp. 1–32.

Sissoko, L. et al. (2020) 'Moringa Oleifera Leaf Powder For Type 2 Diabetes: A Pilot Clinical Trial', African Journal Of Traditional, Complementary And Alternative Medicines, 17(2), Pp. 29–36. Available At: Https://Doi.Org/10.21010/Ajtcam.V17i2.3.

Sry (2020) 'Factors Affecting Blood Sugar Levels in Type Ii Diabetes Mellitus (Dm) Patients Affecting The Blood Sugar Content Of Diabetes Mellitus (Dm) Type Ii', Journal of the World of Nutrition, 3(1), Pp. 23–31. Available At: Https://Ejournal.Helvetia.Ac.Id/Jdg.

Sulistyaning, AR and Wirawanni, Y. (2013) 'The Effect of Giving Angkak (Red Yeast Rice) Against Fasting Blood Glucose Levels in Prediabetic Women', Journal Of Nutrition College, 2(4), Pp. 531–538. Available At: Https://Doi.Org/10.14710/Jnc.V2i4.3736.

Sun, W. et al. (2019) 'Original Article Transcriptome Analysis of the Effects of Moringa Leaf Extract on Db Mice / Db With Diabetes Mellitus Type 2', 12(6), Pp. 6643–6658.

Suryani, W. (2021) 'Moringa Oleifera Leaves Against Disease Final Project Report', (09).

Tan, J. et al. (2019) 'Soy Isoflavones Ameliorate Fatty Acid Metabolism Of Visceral Adipose Tissue By Increasing The Ampk Activity In Male Rats With Diet-Induced Obesity (Dio)', Molecules (Basel, Switzerland), 24(15). Available At: Https://Doi.Org/10.3390/Molecules24152809.

Thilakarathna, SH And Vasantha Rupasinghe, HP (2013) 'Flavonoid Bioavailability And Attempts For Bioavailability Enhancement', Nutrients, 5(9), Pp. 3367–3387. Available At: Https://Doi.Org/10.3390/Nu5093367.

Triandita, N. And Putri, NE (2019) 'The Role of Soybeans in Controlling Degenerative Diseases', J. Agricultural Processing Technology, 1(1), Pp. 6–17.

Utami, GT Et Al. (2022) 'The Effect of Giving Brewing... 134 The Effect of Giving Brewing... 135', 11(1), pp. 134–144. Proceedings B-ICON 2023

Vargas-Sánchez, K., Garay-Jaramillo, E. And González-Reyes, RE (2019) 'Effects Of Moringa Oleifera On Glycaemia And Insulin Levels: A Review Of Animal And Human Studies', Nutrients, 11(12) . Available At: Https://Doi.Org/10.3390/Nu11122907.

Wahyudi, A. (2018) 'The Effect of Variations in Incubation Room Temperature on the Growth Time of Rhizopus Oligosporus in the Production of Soybean Tempe', Agrium Journal, 3(1), Pp. 37–38.

Waruwu, P. et al. (2022) 'The Effectiveness Of Morage Leaf Booking To Reduce Glucose Levels In Type Ii Dm Patients In The Work Area Of The Upt Puskesmas Tanjung Morawa In 2022 The

Effectiveness Of Moringa Leaf Decoction To Lower Blood Sugar Levels In Patients With Type Ii DM In The Area Work', 2(4), Pp. 1963–1978. Available At: Https://Journal.Yp3a.Org/Index.Php/Mudima/Index.

Wati, R. (2019) 'No Titleÿÿÿÿÿ', ÿÿÿÿ, 8(5), P. 55.

Wulandari, FR Et Al. (2018) Table of Indonesian Food Composition 2017, Averrous: Malikussaleh Journal of Medicine and Health. Available At: Https://Doi.Org/10.29103/Averrous.V2i2.412.

Yudiono, K. (2020) 'Increasing the Competitiveness of Local Soybeans Against Imported Soybeans as Raw Materials for Tempe Through Physico-Chemical Mapping', Agrointek, 14(1), Pp. 57–66. Available At: Https://Doi.Org/10.21107/Agrointek.V14i1.6311.

Yusnanda, F., Rochadi, RK And Maas, LT (2018) 'The Influence of Eating Habits on the Incidence of Diabetes Mellitus in Pre-Elderly at Blud Rsu Meuraxa City of Banda Aceh', Journal of Muara Science, Technology, Medicine and Health Sciences, 1 (2), pp. 153–158. Available At: Https://Doi.Org/10.24912/Jmstkik.V1i2.1043.

Zhou, Yang And Wang (2020) 'The Effect of Audio Visual-Based Nutrition Counseling on Dietary Behavior in Patients with Diabetes Mellitus in the Work Area of the Sukamerindu Health Center. Tahun2020',File:/// C:/ Users/ Vera/ Downloads/ Askep_Agregat_Anak_And_Remaja_Print. Docx, 21(1), Pp. 1–9.