Food Research 7 (Suppl. 5) : 27 - 30 (2023)
Journal homepage: https://www.myfoodresearch.com

FOOD RESEARCH

RESEARCH PAPER

The role of walnuts (*Canarium indicum* L.) towards reducing blood cholesterol levels in hyperlipidemic

*Sukmawati, Sirajuddin and Rauf, S.

Department of Nutrition and Dietitian, Health Polytechnic of Makassar, Makassar City, Postcode 90241, Indonesia

Article history:
Received: 29 June 2023
Received in revised form: 2 December 2023
Accepted: 17 December 2023
Available Online: 25 December 2023

Keywords:
Walnuts,
Cholesterol levels,
Hyperlipidemic mother

DOI:
https://doi.org/10.26656/fr.2017.7(S5).10

Abstract

Hyperlipidemia is a cardiovascular disease that causes about 18% of cerebrovascular disease and about 56% of heart disease worldwide. High cholesterol levels lead to accumulation of cholesterol. Walnuts have the potential to lower cholesterol levels. The purpose of this study was to measure the effect of walnut consumption in hyperlipidemic patients on lowering cholesterol. This is an experimental research with pre-post test control group design. The research sample in the first year was mothers who had blood cholesterol levels of 200 mg/dl (hypercholesterolemia). A total of fifty (50) mothers consisting of 2 (two) groups, with 25 mothers as the treatment group and 25 mothers as the control group. Statistical analysis using test paired t-test was used to see the difference in the cholesterol levels before and after the intervention of each group. Cholesterol levels in the treatment group decreased from 242.60 mg/dl to 208.12 mg/dl and in the control group from 248.60 mg/dl to 243.16 mg/dl. The results of the paired T-Test analysis in the treatment group showed a value of p = 0.00 meaning that there was a significant difference in cholesterol levels before and after the intervention in the treatment group. In the control group the value of p = 0.75 means that there is no significant difference in cholesterol levels in the control group. Feeding 50 grams/day walnuts for 8 weeks give effect to significant reduction of cholesterol levels in hyperlipidemic mothers.

1. Introduction

Hyperlipidemia is a cardiovascular disease that causes about 18% of cerebrovascular disease and about 56% of ischemic heart disease worldwide. The prevalence of hyperlipidemia in Indonesia is increasing from year to year. In 2008 it was recorded at 35.1%, then in 2013 it increased to 35.9%. Hyperlipidemia is characterized by cholesterol levels, low density lipids (LDL) and high triglycerides. High cholesterol levels This results in the accumulation of cholesterol in the cells which can lead to triggers the hardening of the walls of the arteries as an atherosclerotic process that can contribute to disease incidence heart and stroke (El-Tantawy and Temraz, 2019).

The walnut is a typical plant in Indonesia, which is rich in unsaturated fat as indicated by Thomson and Evans (2006). Research conducted on rat tests has demonstrated its capability to lower cholesterol levels, as reported by Pebriani *et al*. (2020). Additionally, walnuts have been identified as a source of fat with no potential for saturation, making them a promising option for improving fat profiles, as highlighted by Rahman *et al*. (2015a).

Consumption of walnuts (42.5-85 g/day) has been shown to lower total cholesterol and LDL-cholesterol, lower blood pressure, improve endothelial function, reduce oxidative stress and markers of inflammation, and increase good cholesterol. Walnuts have antioxidant compounds (polyphenols, flavonoids, phenolics) that play a role in reducing oxidative stress in hyperglycemia (Djarkasih *et al*., 2011; Aryaeian *et al*., 2017). The objective this study was to assess the role of walnuts (*Canarium indicum* L.) in reducing blood cholesterol levels of hyperlipidemic mothers.

2. Materials and methods

This research is experimental research with pre-post test control group design. This study involves mothers who has blood cholesterol rate of 200 mg/dl (hyper cholesterolemia). The 50 mothers were divided into 2 groups, with 25 mothers the treatment group and 25 mothers as control group. The intervention was in the form of giving 50 grams of roasted walnuts to the

*Corresponding author.
Email: *sukmawati@poltekkes-mks.ac.id*

eISSN: 2550-2166
Published by Rynnye Lyan Resources

treatment group every day for 8 weeks. The research was conducted in the public health center of Paccerakang Makassar City. The statistical analysis uses paired t- test to see the difference in the cholesterol rate before and after intervention.

3. Results

3.1 Characteristics of the subject

This study specifically focused on macronutrient intake, as a variable that affects cholesterol levels. It was found that the intake of carbohydrates, protein, fat in the intervention group did not differ between baseline and endline with all P-values > 0.05. The same thing happened in the control group. Total energy of food consumed and nutrient intake (carbohydrates, proteins and fats) in the intervention group was sufficient (>100 RDA). When compared to all RDA values between the baseline and the endline, there is no significant difference, with a P-value >0.05 (Table 1).

3.2 Impact of intervention on cholesterol level

It was found that there was a decrease in cholesterol levels in the treatment group from 242.60 mg /dl with a standard deviation of 22.11 to 208.12 mg/dl with a standard deviation of 20.77. In the control group there was also a decrease in cholesterol levels but the decrease was relatively very small, from 248.60 mg/dl with a standard deviation of 22.38 to 243.16 mg/dl with a standard deviation of 17.19. The results of the Shapiro-Wilk normality test showed that cholesterol level data was normally distributed so that it met the requirements for statistical tests using the paired test (T-Test). The results of paired analysis (T-Test) in the treatment group showed a value (p = 0.00) meaning that there was a significant difference in cholesterol levels in the treatment group. In the control group the value (p = 0.75) means that there is no significant difference in cholesterol levels in the control group (Figure 1).

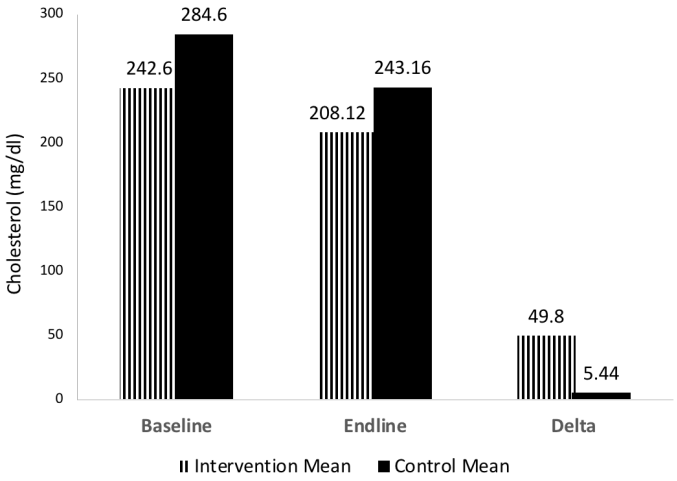

Figure 1. The intervention group n = 25 and the control group n = 25. The paired t-test of delta cholesterol (mg/dl) had a significance value in the intervention group p = 0.000 while in the control group p = 0.750.

4. Discussion

This research examined the differences in cholesterol levels of hyperlipidemic mothers before and after the intervention of giving walnuts 50 grams/day. The results of the study using paired T-Test statistical analysis in the treatment group, showed a p-value of 0.00, meaning that there was a significant difference in cholesterol levels in the treatment group. There was a decrease in the average cholesterol level in the treatment group from 242.60 mg/ dl with a standard deviation of 22.11 to 208.12 mg/dl with a standard deviation of 20.77. The decrease in cholesterol levels after the intervention was due to a decrease in fat intake from 127.40% RDA to 122.42% RDA. Fat intake of many samples from the unsaturated fat group obtained from the consumption of walnuts. Based on a qualitative literature study, it shows that walnuts are very rich in bioactive substances or antioxidants such as flavonoids, saponins, tannins, treptonoids and alkaloids (Alshahrani *et al.*, 2022).

This result obtained in this study are in agreement with research conducted by Pebriani *et al*. (2021) which revealed that giving walnut extract to test animals (dose

Table 1. Energy, nutrient intake and cholesterol

Energy, Nutrient and Cholesterol	Intervention, n = 25			Control, n = 25		
	Baseline	Endline	P-value	Baseline	Endline	P-value
Carbohydrates (g)	287.82±37.52	286.39±25.78	0.80	274.24±58.76	301.95±46.89	0.00
Carbohydrates RDA (%)	96.98	96.16		93.6	102.92	
Protein (g)	67.04±7.22	64.64±13.41	0.27	67.12±10.61	68.39±7.15	0.39
Protein RDA (%)	111.9	107.89		111.88	113.99	
Fat (g)	68.86±23.69	65.59±11.06	0.35	77.07±46.36	78.15±25.85	0.82
Fat RDA (%)	127.4	122.42		147.9	150.24	
Energy (kcal)	1969.77±328.48	1926.54±210.56	0.27	2047.17±185.59	2034.06±178.91	0.53
Energy RDA (%)	102.52	100.36		109.02	108.23	

Nutrient intake was based on Food Composition Table Indonesia 2019, Ministry of Health Indonesia. RDA was based on Regulation No. 28, Ministry of Health, Indonesia 2019. P-value was evaluated via paired T-test, statistically significantly different (P<0.05).

https://doi.org/10.26656/fr.2017.7(S5).10

of 300 mg/kg BW and 600 mg/kg BW) experienced a significant decrease in total cholesterol levels in hyperglycemic rats. The walnuts can lower lipoprotein cholesterol (LDL) or bad cholesterol, and reduce the likelihood that LDL particles will form plaque on artery walls. Consumption of 42.5-85 g/day walnuts has been shown to lower total cholesterol and LDL-cholesterol, lower blood pressure, improve endothelial function, reduce oxidative stress and markers of inflammation and increase good cholesterol. A study conducted by Mailoa *et al.* (2019) on 24 wistar rats given fresh and roasted walnuts for 4 weeks showed that therapy of fresh walnuts and treatment of roasted walnuts showed potential in curing hypercholesterolemia and minimizing endothelial dysfunction (Mailoa *et al*., 2019).

Cholesterol is a complex fat compound, in which 80% is produced from within the body (liver organs) and the remaining 20% from outside the body (food substances). Cholesterol is in the food substances consumed, can increase cholesterol levels in the blood. Cholesterol is a component of fat. As a source of energy, fat or especially cholesterol is a substance needed by the body, especially to form the walls of cells in the body. Total cholesterol is the amount of cholesterol carried in all cholesterol-carrying particles in the blood, including high density lipoprotein (HDL), low density lipoprotein (LDL), and very low density lipoprotein (VLDL). Cholesterol is widely distributed in all cells of the body, especially in nervous tissue (Naim *et al*., 2019).

Lipid profiles in the form of increased concentrations of very low-density lipoprotein (VLDL) or triglycerides, decreased concentrations of high density lipoprotein (HDL), and formation of low density lipoprotein (LDL) are the main lipid fraction abnormalities. An increase or decrease in the lipid fraction in plasma characterized by abnormalities in lipid metabolism is defined as dyslipidemia (Arsana *et al.*, 2015). In one study it was found that 60% of diabetics had dyslipidemia with LDL cholesterol levels 130 mg/dl and increased with increasing duration of diabetes (Cholil *et al.*, 2019). The state of hyperglycemia itself actually does not directly increase LDL cholesterol levels in the blood, but in DM patients, small-density LDL particles are obtained which are more atherosclerotic, more easily glycated and oxidized so that further LDL cholesterol levels in the blood of DM patients will increase (Monika and Lestariyana, 2014).

The decrease in total cholesterol levels in the treatment group was caused by walnuts containing antioxidants. Based on the literature study conducted qualitatively, it shows that walnuts contain bioactive compounds or antioxidants such as flavonoids, saponins, tannins, treptonoids and alkaloids. The mechanism of flavonoid compounds can reduce total cholesterol levels by inhibiting 3-Hydroxy-3-Methyl-Glutaryl-CoenzymeA (HMG-CoA) reductase which causes a decrease in cholesterol synthesis and increases the number of LDL receptors found in the liver cell membranes and extrahepatic tissues so that levels total cholesterol will decrease, with a decrease in total cholesterol levels, the level of LDL which functions as a means of transporting lipids in the blood will decrease (Millar *et al*., 2017). Other antioxidant compounds that can reduce cholesterol levels in the blood are tannins. Tannin compounds act as antioxidants that can prevent an increase in total cholesterol levels in the blood. Tannin compounds in the body will bind to body proteins and will coat the intestinal wall, so that the absorption of fat in the intestine will be inhibited (Mutia *et al*., 2018). Based on the research by Agustina (2013), tannin compounds can inhibit the activity of HMG-CoA reductase. The inhibition of enzyme activity will reduce cholesterol synthesis in the liver, thereby reducing the synthesis of Apo B-100 (apolipoprotein contained in VLDL) and increasing LDL receptors on the liver surface. As a result, blood LDL cholesterol will be drawn to the liver thereby lowering LDL and VLDL cholesterol.

Walnuts in addition to containing antioxidants also contain unsaturated fatty acids, namely oleic acid, linoleic acid, palmitic (Rahman *et al.*, 2019). Walnuts contain 51.99% oleic acid, 32.97% linoleic acid, 9.82% palmitic (Rahman *et al.*, 2015b). Unsaturated fatty acids can also lower blood sugar levels where when hyperglycemia occurs, mitochondrial dysfunction will automatically occur and stress on the endoplasmic reticulum causes insulin resistance. Insulin resistance can be suppressed by unsaturated fatty acids by modulating mitochondrial bioenergetics and endoplasmic reticulum stress so that insulin sensitivity increases (Lepretti *et al.*, 2018).

The flavonoid and phenolic compounds present in walnuts reduce blood cholesterol levels by increasing the excretion of bile acids and act as antioxidants that can reduce LDL (low density lipoprotein) and triglycerides, thereby inhibiting the buildup of LDL in the walls of blood vessels. Tannins have the ability to bind bile acids in the intestines and are excreted in the feces, which can lower total blood cholesterol. Flavonoids and tannins can also inhibit the work of HMG-CoA reductase and acyl-coenzyme A cholesterol acyltransferase (ACAT) which are enzymes for synthesizing cholesterol and cholesterol absorption and its release into the blood. Tannins are known to stimulate glucose and fat metabolism, so the accumulation of these two sources of calories in the blood can be (Lepretti *et al*., 2018).

https://doi.org/10.26656/fr.2017.7(S5).10

5. Conclusion

Peanut canary, can lower the total cholesterol rate in hyperlipidemic mother with administration of 50 g for 8 weeks.

Conflict of interest

The authors declare no conflict of interest.

Acknowledgments

Thank you to the Health Polytechnic of Makassar for providing financial support for this study.

References

Agustina, D. (2013). Pengaruh Pemberian Jus Biji Pepaya (*Carica papaya* L. terhadap Rasio Kolesterol LDL;HDL Tikus Sparague Dawley Dislipidemia, Indonesia: Universitas Dipanegoro Semarang, BSc. Thesis. [In Bahasa Indonesia].

Alshahrani, S.M., Mashat, R.M, Almutairi, A., Mathkour, A., Alqahtani, S.S., ALasmari, A., Alzahrani, A.H., Ayed, R., Asiri, M.Y., Elsherif, A. and Alsabaani, A. (2022). The Effect of Walnut Intake on Lipids: A Systematic Review and Meta-Analysis of Randomized Controlled Trials. *Nutrients*, 14(21), 4465-4473. https://doi.org/10.3390/nu14214460

Arsana, P.M. (2015). Panduan Pengelolaan Dislipidemia di Indonesia: Jakarta, Indonesia: Perkeni. [In Bahasa Indonesia].

Aryaeian, N., Sedehi, S.K. and Arablou, T. (2017). Polyphenols and their effects on diabetes management: A review. *Medical Journal of the Islamic Republic of Iran*, 31(1), 886-892.

Cholil, A.R., Lindarto, D., Pameyun, T.G.D., Wisnu, W., Kumala, P. and Puteri, P.H.S. (2019). Diabetes management, control, and complications in patients with type 2 diabetes in Indonesia. *Medical Journal of Indonesia*, 28(1), 47-56. https://doi.org/10.13181/mji.v28i1.2931

Djarkasih, G.S.S., Nuraly, E.J.N.S. and Le, M.F.L. (2011). Analysis of Bioactive Compound in Canarium Nut (*Canarium indicum* L.). Manado, Indonesia: Universitas Sam Ratulangi, Thesis. [In Bahasa Indonesia].

El-Tantawy, W.H. and Temraz, A. (2019). Natural products for controlling hyperlipidemia: review. *Archives of Physiology and Biochemistry*, 125(2), 128 -135. https://doi.org/10.1080/13813455.2018.1441315

Lepretti, M., Martucciello, S., Aceves, M.A.B., Putti, R. and Lionetti, L. (2018a). Omega-3 fatty acids and insulin resistance: focus on the regulation of mitochondria and endoplasmic reticulum stress. *Nutrients*, 10(3), 350. https://doi.org/10.3390/nu10030350

Mailoa, M., Widyaningsih, T.D. and Putri, W.D.R. (2019). Fresh and roasted canarium nut (*Canarium vulgare*) altering the lipid profile of hypercholesterolemic rats (*Rattus norvegicus*). *EurAsian Journal of BioSciences*, 13(1), 231-238.

Millar, C.L., Duclos, Q. and Blesso, C.N. (2017). Effects of dietary flavonoids on reverse cholesterol transport, HDL metabolism, and HDL function. *Advances in Nutrition*, 8(2), 226-239. https://doi.org/10.3945/an.116.014050

Monika, A.P. and Lestariyana, W. (2014). Pengaruh Pemberian Kombinasi Kuersetin Dan Glibenklamid Terhadap Kadar Kolesterol LDL Pada Tikus Diabetes Melitus Tipe 2. *Jurnal kedokteran dan kesehatan Indonesia*, 6(1), 28-37. https://doi.org/10.20885/JKKI.Vol6.Iss1.Art5 [In Bahasa Indonesia].

Mutia, S., Fauziah and Thomy, Z. (2018). Pengaruh Pemberian Ekstrak Etanol Daun Andong (*Cordyline fruticosa* (L.) A Chev) terhadap Kadar Kolesterol Total dan Trigliserida Darah Tikus Putih (*Rattus norvegicus*) hiperkolesterolemia. *Jurnal Bioleuser*, 2 (2), 29-35. [In Bahasa Indonesia].

Naim, Muh, R., Sulastri, S. and Hadi, S. (2019). Gambaran Hasil Pemeriksaan Kadar Kolesterol Pada Penderita Hipertensi Di Rsud Syekh Yusuf Kabupaten Gowa. *Jurnal Media Laboran,* 9(2), 33-38. [In Bahas Indonesia].

Pebriani, R., Jafar, N., Hidayanti, H. and Salamah, U. (2020). The Effect of Extract of Canarian Nuts on Reduction of Total Cholesterol Levels of Hyperglicemic Rat. *International Journal Papier Advance and Scientific Review*, 1(2), 72-79. https://doi.org/10.47667/ijpasr.v1i2.61

Rahman, H. (2015). The nutritional fatty acids profile and physicochemical properties of *Canarium indicum* nut oil. *International Journal of Pharmacognosy and Phytochemical Research*, 7(6), 1222-1226.

Rahman, H.R., Anggadiredja, K., Gusdinar, T., Sitompul, J.P. and Ryadin, A.R. (2019). Kajian Komposisi Kimia, Nilai Nutrisi, Dan Etnofarmakologis Tanaman Genus Kenari. *Jurnal Fitofarmaka Indonesia*, 6(1), 325-333. https://doi.org/10.33096/jffi.v6i1.431 [In Bahas Indonesia].

Thomson, L.A.J. and Evans, B. (2006). *Canarium indicum* var. indicum and *C. harveyi* (canarium nut) Burseraceae (torchwood family). *Traditional Tree,* 2 (1), 1-19.

