



Nutritional intake, physical activity and lipid profiles in Minangkabau patients with coronary heart disease

Eva Yuniritha^{1*}, Aulia Rahmadini Saputri², Hasneli¹, Defriani Dwiyantri¹, Diva Dwi Aizeti¹, Muthi Nafisa³, Arlen Devitri Nazar¹, Safyanti¹, Elsie Yuniarti¹

¹Department of Nutrition, Health Polytechnic of the Ministry of Health, Padang, Simpang Pondok Kopi Nanggalo, Sumatera Barat, 25146, Indonesia

²Department of Public Health, Faculty of Medicine, Public Health and Nursing, Universitas Gadjah Mada, Jalan Farmako Sekip Utara, Yogyakarta, 55281, Indonesia

³Awal Bros Hospital, Jl. Jend. Sudirman No.117, Riau, 28282, Indonesia

*Correspondence: evayuniritha364@gmail.com

ABSTRAK

Latar Belakang: Penyakit jantung koroner (PJK) masih menjadi penyebab utama kematian dan kecacatan di dunia, dengan sekitar 254,3 juta kasus prevalen dan 9 juta kematian secara global pada tahun 2021. Kebiasaan makan dan tingkat aktivitas fisik dapat memengaruhi faktor risiko yang dapat dimodifikasi, termasuk dislipidemia. Kebiasaan makan tertentu, seperti ketergantungan tinggi pada makanan tradisional yang kaya lemak jenuh, mungkin dipengaruhi oleh faktor budaya dan dapat menyebabkan profil lipid yang abnormal.

Tujuan: Menganalisis hubungan antara asupan karbohidrat, lemak jenuh, lemak trans, serat, dan aktivitas fisik dengan profil lipid pada pasien PJK etnis Minangkabau.

Metode: Penelitian ini menggunakan desain cross-sectional dengan sampel (n=45) pasien PJK di RSUD Achmad Mochtar. Asupan makanan diukur menggunakan SQFFQ dan tingkat aktivitas fisik dievaluasi menggunakan IPAQ-SF. Analisis dilakukan secara univariat dan bivariat (Chi-Square dan Fisher's exact test).

Hasil: Sebagian besar responden memiliki asupan karbohidrat yang kurang (46,7%), asupan lemak jenuh dan lemak trans yang berlebih (masing-masing 82,2% dan 73,3%), serta asupan serat yang kurang (91,1%). Sebanyak 75,6% responden memiliki tingkat aktivitas fisik dalam kategori sedang. Asupan lemak jenuh dan lemak trans berhubungan secara signifikan dengan kadar LDL, trigliserida, dan kolesterol total ($p < 0,05$). Asupan serat juga berhubungan signifikan dengan kadar LDL dan kolesterol total ($p < 0,05$), tetapi tidak dengan kadar HDL maupun trigliserida ($p > 0,05$). Tidak ditemukan hubungan antara asupan karbohidrat maupun aktivitas fisik dengan profil lipid ($p > 0,05$).

Kesimpulan: Dislipidemia dikaitkan dengan pola makan tinggi lemak jenuh dan trans serta rendah serat pada individu etnis Minangkabau yang menderita penyakit jantung koroner; namun, tidak terdapat hubungan yang signifikan antara konsumsi karbohidrat dan aktivitas fisik.

KATA KUNCI: aktivitas fisik; lemak jenuh; lemak trans; penyakit jantung koroner; profil lipid; serat

ABSTRACT

Background: Coronary heart disease (CHD) remains the leading cause of death and disability worldwide, with approximately 254.3 million prevalent cases and 9 million deaths globally in 2021. Dietary habits and exercise levels are modifiable risk factors, including dyslipidemia. Certain dietary habits, such as heavy reliance on traditional foods high in saturated fats, may be influenced by cultural factors and lead to aberrant lipid profiles.

Objectives: To analyze the relationship between carbohydrate intake, saturated fat, trans fat, fiber, and physical activity and lipid profiles in Minangkabau ethnic patients with coronary heart disease.

Methods: This study uses a cross-sectional design with a sample ($n=45$) of CHD patients at Achmad Mochtar Hospital. Food intake was measured using the SQFFQ, and physical activity was evaluated using the IPAQ-SF. We conducted univariate and bivariate analyses (Chi-square and Fisher's Exact Test).

Results: Most respondents had insufficient carbohydrate intake (46.7%), excessive saturated and trans fat intake (82.2% and 73.3%, respectively), and insufficient fibre intake (91.1%). As many as 75.6% of respondents had moderate physical activity. The intake of saturated fats and trans fats is significantly associated with levels of LDL, triglycerides, and total cholesterol ($p<0.05$). Fibre intake is also significantly associated with levels of LDL and total cholesterol ($p<0.05$), but not with levels of HDL or triglycerides ($p>0.05$). No relationship was found between carbohydrate intake or physical activity and lipid profile ($p>0.05$).

Conclusions: Dyslipidemia is linked to a diet high in saturated and trans fats and low in fiber in Minangkabau ethnic individuals with coronary heart disease; however, there is no significant association between carbohydrate consumption and physical activity.

KEYWORDS: coronary heart disease; fiber; lipid profile; physical activity; saturated fat; trans fat

Article info: Received April 23, 2026; 1st revision June 08, 2026; 2nd revision June 26, 2026; accepted August 03, 2026; available online September 30, 2026; published September 30, 2026.

INTRODUCTION

Coronary heart disease (CHD) is a major cardiovascular disease caused by atherosclerosis, a condition characterized by the accumulation of lipids within the arterial walls (1). CHD remains a major global health burden, with an estimated 254.3 million prevalent cases and approximately 9 million deaths worldwide in 2021 (2). Cardiovascular diseases collectively account for approximately 32% of all deaths globally, equivalent to 17.9 million deaths annually (3). In Indonesia, the 2023 National Health Survey reported a CHD prevalence of 0.85%, with West Sumatra Province ranking among the ten provinces with the highest prevalence at 0.87% (4). Dyslipidaemia plays a central role in the pathogenesis of coronary heart disease (CHD), characterised by increased levels of low-density lipoprotein (LDL), triglycerides, and decreased levels of high-density lipoprotein (HDL). Various factors influence this condition, including diet, physical activity, and lifestyle (5). In West Sumatra Province, specifically at Dr. Achmad Mochtar Bukittinggi Hospital, the number of CHD cases

increased from 918 in 2023 to 1,126 in 2024, accounting for approximately 28% of patients in the heart ward. This high disease burden also aligns with the Indonesia health insurance system report, which shows that CHD is one of the diseases with the highest service costs in 2022 (6). Coronary heart disease requires long-term management and continuous medical care, which may reduce patients' quality of life, making prevention through risk factor management essential (7).

Dietary intake is one of the modifiable risk factors of CHD; inadequate dietary intake and an imbalanced proportion of each macronutrient are found to increase the risk of CHD. The proportion of consumption among the Indonesian population reaches around 60–70% of total daily energy (8). In addition, excessive intake of saturated and trans fats may adversely affect the lipid profile, including increasing total cholesterol and LDL and, particularly for trans fats, increasing triglycerides and reducing HDL. These unfavorable lipid changes may promote atherogenic processes and

contribute to the development of atherosclerosis and cardiovascular disease (9,10). However, a preventive impact is achieved by lowering LDL levels and improving the lipid profile through sufficient fiber intake (25-30 g/day). Reportedly, the risk of coronary heart disease events and death is lowered in those whose fiber intake is higher. Preventing and managing coronary heart disease (CHD) involves regular physical activity, which has been shown to improve lipid profiles, lower blood pressure, and reduce cardiovascular risk (11). Physical activity also plays an important role in lipid metabolism by increasing lipoprotein lipase activity and improving insulin sensitivity, thereby promoting triglyceride reduction and increasing HDL-C levels (12,13).

Dietary patterns are influenced by culture, traditions, and local eating habits, resulting in regional variations in food consumption. The Minangkabau ethnic group is known for its distinctive dietary pattern, characterized by the frequent consumption of coconut milk-based dishes and fried foods, which contributes to high saturated fat and trans fat intake. In contrast, the consumption of fruits and vegetables, the main sources of dietary fiber, remains relatively low. These dietary habits may adversely affect lipid profiles, increase blood pressure, and increase the risk of coronary heart disease (14–16). However, evidence regarding the associations between carbohydrate, saturated fat, trans fat, and fiber intake, physical activity, and lipid profiles among Minangkabau patients with coronary heart disease remains limited. Preliminary data from Dr. Achmad Mochtar Bukittinggi Hospital in 2024 showed that 27.9% of patients admitted to the cardiac ward were diagnosed with coronary heart disease (CHD), and most had abnormal lipid profiles. Therefore, this study aimed to examine the associations between carbohydrate, saturated fat, trans fat, and fiber intake, physical activity, and lipid profiles among Minangkabau patients with CHD treated at Dr. Achmad Mochtar Bukittinggi Hospital in 2025.

MATERIALS AND METHODS

This research is a descriptive, cross-sectional study. The independent variables studied are carbohydrate intake, saturated fat, trans fat, and fibre. Physical activity and Minangkabau ethnicity.

The dependent variable being studied is the Lipid Profile of Coronary Heart Disease Patients. This research was conducted at Dr. Achmad Mochtar Hospital.

The study population consisted of 1,126 patients attending the cardiac outpatient clinic at Dr. Achmad Mochtar Bukittinggi Hospital who were aged 40–70 years. Based on preliminary hospital data, 315 patients were diagnosed with coronary heart disease (CHD), corresponding to a prevalence of 27.9%. The minimum sample size was calculated using the finite population correction formula with a margin of error of 10%, resulting in a minimum sample size of 45 participants. The sample approach adhered to the predetermined inclusion and exclusion criteria via the use of purposive sampling. Data collection was conducted in June 2025.

The sampling technique was carried out using purposive sampling, which is the determination of samples based on specified criteria. The inclusion criteria for this study are patients who have a good communication skills and being willing to participate as a study sample; aged of 40 and 70 years; Having Minangkabau ethnicity (belonging to the Minangkabau tribe, residing in West Sumatra for ≥ 5 years) diagnosed with a coronary heart disease (CHD) without complications; registered at a Dr. Achmad Mohctar Bukittinggi Hospital outpatient. As for the Exclusion Criteria: There is a history of other diseases (complications); Currently not following a special diet; Respondent is not present.

Primary data were collected through face-to-face interviews using a Semi-Quantitative Food Frequency Questionnaire (SQ-FFQ) to assess dietary intake and the International Physical Activity Questionnaire-Short Form (IPAQ-SF) to assess physical activity. The frequency and portion size of food consumption reported in the SQ-FFQ were converted into daily intake values. Nutrient intake, including carbohydrate, saturated fat, trans fat, and fiber, was analyzed using NutriSurvey software based on the Indonesian Food Composition Database. The adequacy of nutrient intake was then categorized according to the percentage of individual daily requirements. Secondary data were obtained from patients' medical records, including demographic characteristics (age and sex), lipid profile

parameters, history of coronary heart disease, medical diagnosis, and medication history in 2025.

Physical activity data obtained from the IPAQ-SF were converted into MET-minutes/week and categorized into low, moderate, and high physical activity levels according to the IPAQ scoring protocol. Data processing included data cleaning, data entry, and data editing prior to analysis. Univariate analysis was used to describe the distribution of variables, while bivariate analysis using the Chi-square test was performed to examine the association between dietary intake, physical activity, and lipid profile parameters (LDL, HDL, Triglycerides and total cholesterol). A p-value of less than 0.05 was considered statistically significant. Ethical approval for this study was obtained from the Health Research Ethics Committee of Poltekkes Kemenkes Padang (No. EC-001/KEPK-PDG/VII/2025), issued on June 2, 2025. All participants provided written informed consent before participating after receiving an explanation of the study objectives and procedures.

RESULTS AND DISCUSSIONS

Description of Respondent Characteristics

The respondents in this study were outpatient patients with coronary heart disease who underwent examinations at Dr. Achmad Mochtar

Bukittinggi Hospital. A total of 45 participants were enrolled in this study, with a mean age of 57.1 ± 6.4 years (range: 43–69 years). Most participants (73.3%) were aged 50–64 years (**Table 1**).

Proximate Composition and Energy Content

Table 1 presents the proximate composition and energy content of processed sago grub and smoked tilapia products, expressed on a wet basis per 100 g. Protein content varied considerably across products, with smoked tilapia-based products showing the highest levels (up to $18.05 \pm 0.09\%$). This reflects the intrinsic composition of fish muscle, which is rich in complete proteins and essential amino acids (4,8). In contrast, sago grub-based products exhibited higher fat and energy content due to lipid accumulation in insect larvae, which serves as an energy reserve during development. This characteristic has been consistently reported in edible insect studies, highlighting their high caloric density and lipid contribution (2,3). Carbohydrate content was highest in sago grub meatballs ($39.27 \pm 0.06\%$) and lowest in smoked tilapia meatballs ($14.14 \pm 0.11\%$). Energy values reflected these macronutrient differences, with sago grub nuggets providing the highest energy (231.79 ± 0.97 kcal/100 g) and smoked tilapia meatballs the lowest (133.63 ± 0.62 kcal/100 g).

Table 1. Frequency distribution based on respondent characteristics

Variable	Category	n	%
Age (years)	40-49	6	13.3
	50-64	33	73.3
	65-80	6	13.3
Sex	Male	24	53.3
	Female	21	46.7
Nutritional status	Underweight	1	2.2
	Normal	18	40.8
	Overweight	14	31.1
	Obese	12	26.7
Use of Lipid-Lowering Drugs	Yes	11	24.4
	No	34	75.6
Ethnic	Piliang	9	20.0
	Sikumbang	7	15.6
	Patopang	2	4.4
	Jambak	6	13.3
	Koto	7	15.6
	Guci	3	6.7
	Tanjung	4	8.9
	Caniago	5	11.1
	Melayu	2	4.4

Note: Underweight ≤ 17.0 - 18.4, Normal 18.5 – 25.0, Overweight 25.1 – 27.0, Obese ≥ 27.0 (17)

From a nutritional perspective, tilapia-based products function primarily as protein sources, while sago grub-based products contribute energy and essential fatty acids. Such complementarity is particularly relevant in addressing protein and energy deficiencies in resource-limited settings, where combining fish and insect-based ingredients can provide balanced dietary contributions to support both energy needs and protein requirements.

The 50–64 age group accounted for 73.3% of coronary heart disease patients, as shown in **Table 1**. Just over half of the participants were male, while the other half were female (53.3%).

The majority of participants (57.8%) were overweight or obese. Approximately 24.4% of participants were receiving lipid-lowering medication, and all respondents were of Minangkabau ethnicity.

Intake and Physical Activity of Respondents

Nutrient intake and physical activity were obtained through interviews using the SQ-FFQ and IPAQ questionnaires. Nutrient intake was categorized by adequacy level against daily needs, while physical activity was grouped by intensity level. The distribution of each variable can be seen in **Table 2**.

Table 2. Distribution of frequency of intake and physical activity of respondents

Variable	Category	n	%
Carbohydrates	Inadequate	22	48.9
	Adequate	23	51.1
Saturated fats	Adequate	8	17.8
	Excessive	37	82.2
Trans Fats	Adequate	12	26.7
	Excessive	33	73.3
Fiber	Inadequate	41	91.1
	Adequate	4	8.9
Physical Activity	Low	11	24.4
	Moderate	34	75.6

Note: Carbohydrate intake: Inadequate (<70%), Adequate (70–119%), Excessive ($\geq 120\%$) of individual requirements (18); Saturated fat intake: Adequate ($\leq 10\%$) and Excessive ($>10\%$) of total energy intake; Trans fat intake: Adequate ($\leq 1\%$) and Excessive ($>1\%$) of total energy intake; Fiber intake: Adequate (≥ 25 g/day) and Inadequate (<25 g/day)(19); Physical activity: Low (<600), Moderate (600–1499), and High (≥ 1500 MET) (21).

Table 2 demonstrates that inadequate dietary quality was common among respondents. Although more than half of the respondents achieved adequate carbohydrate intake (51.1%), excessive consumption of saturated fat (82.2%) and trans fat (73.3%) was highly prevalent. In addition, the vast majority of respondents had inadequate fiber intake (91.1%).

These findings suggest a dietary pattern characterized by excessive intake of unhealthy fats and insufficient consumption of dietary fiber. Regarding physical activity, most respondents engaged in moderate levels of physical activity (75.6%), while nearly one-quarter (24.4%) reported low physical activity levels.

Table 3. Descriptive statistics of nutrient intake and physical activity among study participants:

Variable	Mean $\pm$ Sd	Min	Max
Carbohydrates (g/day)	197.0 $\pm$ 52.3	121	294
Saturated fats(g/day)	26.4 $\pm$ 9.47	12.64	68.10
Trans Fats (g/day)	3.04 $\pm$ 2.94	1.02	20.80
Fiber (g/day)	17.54 $\pm$ 4.92	9.02	28.32
Physical Activity (MET)	641.38 $\pm$ 65.236	495	785

Table 3 shows that the mean carbohydrate intake among participants was 197.0 ± 52.3 g/day. The mean saturated fat intake (26.4 ± 9.47 g/day) exceeded the recommended limit of less than 10% of total energy intake, while the mean fiber intake (17.54 ± 4.92 g/day) was below the recommended daily intake of ≥ 25 g/day. The mean physical activity level was 641.38 ± 65.24 MET-min/week, indicating that most participants engaged in moderate physical activity.

Profil Lipid responden

Participants' lipid profiles include total cholesterol, triglycerides, low-density lipoprotein (LDL), and high-density lipoprotein (HDL) values. **Table 4** shows the frequency distribution of each lipid profile parameter depending on the number of respondents who fell into the normal or abnormal category. In **Table 4**, most respondents had abnormal lipid profiles. As many as 80% of respondents had high LDL levels, while 66.7% of

respondents had HDL levels below the normal range. Triglyceride levels exceeded the normal limit in 64.4% of respondents, while 73.3% had high total cholesterol levels.

The Relationship Between Intake and Physical Activity with Lipid Profile

To determine how dietary habits and exercise affect lipid profiles in CHD patients, a chi-square test was used for bivariate analysis. Table 5 displays the analysis's findings. Table 5 presents the results of the bivariate analysis between dietary factors, physical activity, and lipid profile parameters. Carbohydrate consumption was not significantly associated with any lipid profile indicator ($p > 0.05$). In contrast, saturated fat consumption was significantly associated with LDL cholesterol ($p = 0.039$), triglycerides ($p = 0.017$), and total cholesterol ($p = 0.022$), whereas it was not significantly associated with HDL cholesterol ($p = 0.095$).

Table 4. Frequency distribution of respondents based on lipid profile

Lipid Profile	Abnormal n (%)	Normal n(%)
LDL	36 (80.0)	9 (20.0)
HDL	30 (66.7)	15 (33.3)
Triglycerides	29 (64.4)	16 (35.6)
Total cholesterol	33 (73.3)	12 (26.7)

Note: LDL cholesterol: Normal (< 100 mg/dL) and Abnormal (≥ 100 mg/dL). HDL cholesterol: Normal (≥ 40 mg/dL) and Abnormal (< 40 mg/dL). Triglycerides: Normal (< 150 mg/dL) and Abnormal (≥ 150 mg/dL). Total cholesterol: Normal (< 200 mg/dL) and Abnormal (≥ 200 mg/dL).

Trans fat consumption was significantly associated with all lipid profile parameters, including LDL cholesterol ($p = 0.006$), HDL cholesterol ($p = 0.010$), triglycerides ($p = 0.002$), and total cholesterol ($p = 0.033$). Fiber consumption was significantly associated with LDL cholesterol ($p = 0.021$) and total cholesterol ($p = 0.003$), but was not significantly associated with HDL cholesterol ($p = 1.000$) or triglycerides ($p = 0.121$). Furthermore, physical activity was not significantly associated with any lipid profile parameter ($p > 0.05$).

The Relationship Between Carbohydrate Consumption and Lipid Profile

Most respondents had adequate carbohydrate intake (51.1%). The mean carbohydrate intake was 197.0 ± 52.3 g/day, which corresponded to approximately 70% of the average daily requirement (290 g/day). Based on

the Indonesian National Workshop on Food and Nutrition (Widyakarya Nasional Pangan dan Gizi) criteria, an intake level of 70–119% of the recommended requirement is considered adequate. This indicates that, in general, respondents' carbohydrate intake meets their needs and does not exceed recommendations for coronary heart disease patients (22). Adequate carbohydrate intake helps manage clinical conditions and prevent disease progression. Several studies also mention that dietary management, including certain low-carbohydrate diet approaches, can benefit weight control and cardiovascular risk factors in patients with coronary heart disease (22). The bivariate analysis shows that carbohydrate consumption is not significantly related to the lipid profile ($p > 0.05$).

Table 5. Bivariate analysis between independent variable and lipid profile

Lipid Profile	Variable									
	Carbohydrate Consumption		Saturated Consumption	Fat	Trans fat consumption		Fiber consumption		Physical activity	
	Inadequate n (%)	Adequate n (%)	Excessive n (%)	Adequate n (%)	Excessive n (%)	Adequate n (%)	Excessive n (%)	Adequate n (%)	Low n(%)	Moderate n(%)
LDL	16 (69.6)	20 (90.9)	32 (86.5)	4 (50.0)	30 (90.9)	6 (50.0)	35 (85.4)	1 (25.0)	9 (81.8)	27 (79.4)
Abnormal										
LDL Normal	7 (30.4)	2 (9.1)	5 (13.5)	4 (50.0)	3 (9.1)	6 (50.0)	6 (14.6)	3 (75.0)	2 (18.2)	7 (20.6)
p-value	0.135 ^b		0.039 ^{b*}		0.006 ^{b*}		0.021 ^{b*}		1.000 ^b	
HDL	15 (65.2)	15 (68.2)	27 (73.0)	3 (37.5)	26 (78.8)	4 (33.3)	27 (65.9)	3 (75.0)	8 (72.7)	22 (64.7)
Abnormal										
HDL Normal	8 (34.8)	7 (31.8)	10 (27.0)	5 (62.5)	7 (21.2)	8 (66.7)	14 (34.1)	1 (25.0)	3 (27.3)	12 (35.3)
p-value	0.833 ^a		0.095 ^b		0.010 ^{*b}		1.000 ^b		0.726 ^b	
TG	12 (52.2)	17 (77.3)	27 (73.0)	2 (25.0)	26 (78.8)	3 (25.0)	28 (68.3)	1 (25.0)	6 (54.5)	23 (67.6)
Abnormal										
TG Normal	11 (47.8)	5 (22.7)	10 (27.0)	6 (75.0)	7 (21.2)	9 (75.0)	13 (31.7)	3 (75.0)	5 (45.5)	11 (32.4)
p-value	0.079 ^a		0.017 ^{b*}		0.002 ^{*b}		0.121 ^b		0.483 ^b	
TC	15 (65.2)	18 (81.8)	30 (81.1)	3 (37.5)	27 (81.8)	6 (50.0)	33 (80.5)	0 (0.0)	6 (54.5)	27 (79.4)
Abnormal										
TC Normal	8 (34.8)	4 (18.2)	7 (18.9)	5 (62.5)	6 (18.2)	6 (50.0)	8 (19.5)	8 (100.0)	5 (45.5)	7 (20.6)
p-value	0.208 ^a		0.022 ^{b*}		0.033 ^{b*}		0.003 ^{b*}		0.131 ^b	

*p-value < 0.05

^a Pearson Chi-square test; ^b Fisher's Exact Test.

. This may be because respondents' average intake falls within the appropriate, non-excessive range. Excess carbohydrate intake can increase *de novo* lipogenesis, through which circulating carbohydrates are converted into fatty acids that can subsequently be esterified into triglycerides, potentially contributing to elevated triglyceride levels (23). The absence of a relationship between carbohydrate intake and lipid profile in this study is consistent with previous research that also reported non-significant results. This finding may be influenced by the possibility of flat slope syndrome in food intake reporting (24). These findings indicate that the relationship between carbohydrate consumption and lipid profiles is not always direct. The type of carbohydrate, level of physical activity, metabolic status, and overall dietary patterns can influence this relationship. Thus, total carbohydrate intake alone may not be significantly associated with lipid profile parameters.

The Relationship Between Saturated Fat Consumption and Lipid Profile

The majority of respondents (82.2%) had saturated fat intakes above recommended levels, according to the study. Daily, people consumed an average of 26.42 ± 9.47 grams of saturated fat, which is more than the recommended average of 23.38 ± 5.06 grams. In addition to high-fat animal products, the interviewees also said that butter, margarine, palm oil, and other common cooking ingredients are major sources of saturated fat. Another finding from the National Health and Nutrition Examination Survey (NHANES) is that the elderly have a greater risk of death from heart disease and stroke if their total fat consumption is higher in saturated fat percentage. Saturated fat as a percentage of total fat increases the risk of cardiovascular disease mortality by 26% for every 10% rise in this ratio (25). According to the data, saturated fats strongly correlate with total cholesterol, triglycerides, and LDL cholesterol, but not with HDL cholesterol. Consistent with a 2023 study by the World Health Organization (WHO), these results show that consuming saturated fat increases the risk of cardiovascular disease and higher levels of bad cholesterol (LDL), and that improving one's lipid profile is possible by consuming more unsaturated fats (19). Similar findings were reported in an evidence-based

guideline by Johnson et al. (2023), which showed that reducing saturated fat intake was associated with reductions in total cholesterol and LDL-C levels, supporting the adverse effects of high saturated fat intake on lipid profiles and cardiovascular health (10). In addition, evidence from the WHO guideline indicates that trans fat intake may adversely affect lipid profiles by increasing LDL-C and triglyceride levels while reducing HDL-C levels (19).

The Relationship Between Trans Fat Consumption and Lipid Profile

The results show that most respondents, namely 33 people (73.3%), have trans fat intake that exceeds the recommendation. The average trans fat consumption was recorded at 3.04 ± 2.94 grams per day, higher than the average daily requirement of 2.33 ± 0.5 grams per day. Based on the interview results, the main sources of trans fats come from foods fried using oil that has been reused multiple times, as well as factory-processed products such as margarine, filled bread, chocolate pastries, sponge cake, and similar products. In line with the WHO Indonesia report, common dietary sources of trans fat include fried foods and processed or baked foods prepared with margarine or partially hydrogenated oils, such as fried chicken, fried eggs, tempeh mendoan, biscuits, and bakery products. High trans fat intake may adversely affect lipid profiles by increasing LDL cholesterol and decreasing HDL cholesterol, thereby increasing cardiovascular risk (26). Research results show that trans fat consumption is associated with all lipid profile parameters, namely LDL, HDL, triglycerides, and total cholesterol. Physiologically, trans fats affect lipoprotein metabolism by increasing the production of small, dense LDL particles that are more atherogenic, decreasing HDL levels, and triggering a systemic inflammatory response that plays a role in atherosclerosis (27). In addition, trans fats also play a role in the alteration of phospholipid metabolism, including an increase in the levels of long-chain unsaturated phosphatidylcholine, which can worsen cardiovascular conditions (28). These findings are also supported by Magriplis et al (2022), which reported that in the age group ≥ 51 years, the consumption of trans fats exceeding 1%

of total energy is significantly associated with increased LDL, triglycerides, and total cholesterol, as well as decreased HDL, ultimately raising the risk of dyslipidemia and coronary heart disease (29)

The Relationship Between Fiber and Lipid Profile

The results were obtained from 45 respondents, of whom 41 people (91.1%) had fiber consumption below the daily requirement. The average fiber consumption was $17.54 \pm 4.92\text{g/day}$. Meanwhile, the daily fiber recommendation according to Perkeni to prevent the risk of cardiovascular disease is $\geq 25\text{g/day}$ (30). Most respondents in this study had inadequate fiber intake. This finding is consistent with previous reports indicating that vegetable consumption among the Minangkabau population remains relatively low. Data from the West Sumatra Socioeconomic Survey (2020–2021) showed that vegetable consumption in the region was below the recommended intake level, contributing to insufficient daily fiber intake. Low fiber consumption has been identified as a risk factor for coronary heart disease, as dietary fiber plays an important role in reducing blood cholesterol levels (31). Low dietary fiber intake has been associated with an increased risk of coronary heart disease, while higher fiber intake may contribute to cardiovascular protection through its cholesterol-lowering effects, particularly by reducing total and LDL cholesterol levels (32,33).

The analysis results showed that fiber consumption was significantly related to LDL and total cholesterol, but not to HDL and triglycerides. In theory, soluble fiber binds bile acids in the intestines, increasing cholesterol excretion and reducing cholesterol absorption. This mechanism explains why fiber consumption has a greater impact on reducing LDL and total cholesterol. The insignificance of the relationship with HDL and triglycerides is likely influenced by the amount and variation of fiber consumption, which has not yet been optimal among the respondents. This also aligns with Sinulingga's 2020 study, which shows that β -glucan found in fiber can reduce Low-Density Lipoprotein (LDL) cholesterol levels without affecting High-Density Lipoprotein (HDL)

levels (34). Meanwhile, other research examining the relationship between Nutrient Intake and Lipid Profile in vegetarians indicates that fiber intake is significantly associated with a decrease in total cholesterol levels in the vegetarian group. Still, the effects on triglycerides and HDL are not significant if daily fiber intake does not reach the recommended level ($\geq 25\text{ grams/day}$) (35).

The Relationship Between Physical Activity and Lipid Profile

Most respondents (75.6%) have moderate physical activity levels. The remaining respondents have low physical activity levels. Respondents with low activity generally no longer work and are more active at home. Since being diagnosed with coronary heart disease, some respondents have limited outdoor activities and tend to use vehicles for short-distance mobility, resulting in lower physical activity levels.

The analysis results show that physical activity is not significantly related to the lipid profile ($p > 0.05$). Theoretically, regular physical activity for at least 150 minutes per week can help lower LDL levels and increase HDL levels through enhanced lipoprotein lipase enzyme activity and improved lipid metabolism. The American Heart Association/American College of Cardiology recommends regular aerobic activity for patients with chronic coronary disease, with at least 150 minutes per week of moderate-intensity activity, preferably distributed throughout the week (36).

However, the lack of a significant relationship in this study is likely due to the relatively homogeneous level of physical activity among respondents and the intensity not reaching the physiological threshold to produce meaningful metabolic changes. These findings are consistent with Yang et al. (2016), who reported that moderate physical activity does not always significantly correlate with changes in lipid profiles if duration and intensity are not optimal (37). These results align with research by Sunu et al. (2017), who also found no significant relationship between physical activity and total cholesterol levels in adults in Kepuharjo Village, Yogyakarta. The study explained that most respondents' activities were leisure activities with light intensity, not structured exercise, so their effect on cholesterol levels did not show a significant

difference (38). Additionally, Smart et al (2025) reported that exercise training significantly reduced total cholesterol levels, although the effect was modest and varied across studies. Evidence also suggests that dietary interventions may complement the effects of exercise in improving lipid profiles (39,40).

This research has several strengths, including its focus on the Minangkabau ethnic group with distinctive dietary patterns and the use of standardized instruments to assess dietary intake and lipid profiles. However, several limitations should be acknowledged. The cross-sectional design precludes causal inference, while self-reported dietary intake may introduce recall bias. In addition, approximately 24.4% of the participants were receiving lipid-lowering medications, which may have influenced lipid profile measurements and, consequently, the observed associations between dietary intake and lipid profile parameters.

CONCLUSION AND RECOMMENDATION

Trans fat consumption is associated with all lipid profile parameters, namely LDL, HDL, triglycerides, and total cholesterol. Saturated fat consumption is associated with LDL, triglycerides, and total cholesterol, while fiber consumption is associated with LDL and total cholesterol. Meanwhile, carbohydrate consumption and physical activity showed no relationship with the lipid profile in this study. Patients are advised to limit saturated and trans fat intake and increase fiber and complex carbohydrate intake as needed. In addition, healthcare institutions are expected to enhance nutritional education on regulating fat and carbohydrate intake for heart disease patients.

ACKNOWLEDGEMENT

The authors would like to thank Dr. Achmad Mochtar Regional Hospital, Bukittinggi, particularly the Cardiology Outpatient Clinic and the Nutrition Installation, as well as all participants who contributed to and supported the implementation of this research.

REFERENCES

1. Roth GA, Mensah GA, Johnson CO et al. Global burden of cardiovascular diseases. J

- Am Coll Cardiol. 2023. 82(25). 2345–2425. <https://doi.org/10.1016/j.jacc.2020.11.021>
2. Yang L, Zheng B, Gong Y. Global, regional and national burden of ischemic heart disease and its attributable risk factors from 1990 to 2021 : a systematic analysis of the Global Burden of Disease study. 2025. 25(1). 1-15. <https://doi.org/10.1186/s12872-025-05022-x>
3. Badan Kebijakan Pembangunan Kesehatan. Survei Kesehatan Indonesia (SKI) 2023 dalam angka. 2023. <https://www.badankebijakan.kemkes.go.id/ski-2023-%0Adalam-angka/>
4. Badan Kebijakan Pembangunan Kesehatan. Survei Kesehatan Indonesia (SKI) dalam angka. Jakarta: Kementerian Kesehatan Republik Indonesia. 2023.
5. Visseren FLJ, Mach F, Smulders YM et al. ESC guidelines. Eur Hear J. 2021. 42 (34). 3227–3337. <https://doi.org/10.1093/eurheartj/ehab484>
6. Kementerian Kesehatan RI. Profil Kesehatan Indonesia Tahun 2022. Jakarta: Kemenkes RI. 2022.
7. Kementerian Kesehatan RI. Profil Kesehatan indonesia 2022. Jakarta: Kementerian Kesehatan Republik Indonesia. 2023.
8. Rizki AA. Hubungan Antara Asupan Total Karbohidrat Dan Total Lemak Terhadap Tekanan Darah Pasien Rawat Jalan PJK di RSI UNISMA Malang. Tugas Akhir. 2020.
9. Christensen JJ, Kristoffer E, Rundblad A, Telle-hansen VH, Narverud I, Blomhoff R, et al. Dietary fat quality, plasma atherogenic lipoproteins , and atherosclerotic cardiovascular disease : An overview of the rationale for dietary recommendations for fat intake. Elsevier. 2024. 389. 1-15. <https://doi.org/10.1016/j.atherosclerosis.2023.117433>
10. Johnson SA, Kirkpatrick CF, Miller NH, Carson JAS, Handu D, Moloney L. Saturated Fat Intake and the Prevention and Management of Cardiovascular Disease in Adults: An Academy of Nutrition and Dietetics Evidence-Based Nutrition Practice Guideline. J Acad Nutr Diet. 2023. 123(12). 1808–1830. <https://doi.org/10.1016/j.jand.2023.07.017>

11. Palupi KC, Anggraini A, Sa'pang M, Kuswari M. Pengaruh Edukasi Gizi "Empire" Terhadap Kualitas Diet Dan Aktivitas Fisik Pada Wanita Dengan Gizi Lebih. *J Nutr Coll*. 2022. 11(1). 62–73. <https://doi.org/10.14710/jnc.v11i1.31924>
12. Ryan AS, Ortmeyer HK. Insulin suppression of fatty acid skeletal muscle enzyme activity in postmenopausal women, and improvements in metabolic flexibility and lipoprotein lipase with aerobic exercise and weight loss. *Int J Obes*. 2019. 43(2). 276–284. <https://doi.org/10.1038/s41366-018-0068-3>
13. Muscella A, Stefàno E, Marsigliante S. The effects of exercise training on lipid metabolism and coronary heart disease. *Am J Physiol Circ Physiol*. 2020. 319(1). 76–88. <https://doi.org/10.1152/ajpheart.00708.201914>
14. Dewi S, Setyowati S, Rachmawati IN, Ayubi D. Understanding Minangkabau Culture and its Impact on Weight Management Strategies in Overweight and Obese Women: A Qualitative Study. *Open Public Health J*. 2024. 17. 1-9. <http://dx.doi.org/10.2174/0118749445300276240327053131>
15. Gusnedi G, Fahmida U, Witjaksono F, Nurwidya F, Mansyur M, Djuwita R, et al. Effectiveness of optimized food-based recommendation promotion to improve nutritional status and lipid profiles among Minangkabau women with dyslipidemia: A cluster-randomized trial. *BMC Public Health*. 2022. 22(1). 21. 1-12. <https://doi.org/10.1186/s12889-021-12462-5>
16. Abu Bakar NAF, Ahmad A, Wan Musa WZ, Shahril MR, Wan-Arfah N, Abdul Majid H, et al. Association between a dietary pattern high in saturated fatty acids, dietary energy density, and sodium with coronary heart disease. *Sci Rep*. 2022. 12(1). 1-11. <https://doi.org/10.1038/s41598-022-17388-5>
17. Kementerian Kesehatan RI. Profil Kesehatan Indonesia 2019. Jakarta: Kemenkes RI; Direktorat Jenderal Bina Gizi dan Kesehatan Ibu dan Anak, Kementerian Kesehatan Republik Indonesia; 2019.
18. Kementerian Kesehatan Republik Indonesia. Peraturan Menteri Kesehatan Republik Indonesia Nomor 28 Tahun 2019 tentang Angka Kecukupan Gizi yang Dianjurkan untuk Masyarakat Indonesia. Kementerian Kesehatan RI.; 2019.
19. World Health Organization. WHO guideline on saturated fatty acid and trans-fatty acid intake for adults and children. Geneva: WHO. 2023;
20. Almitser S. Penuntun Diet (edisi baru). 10th ed. Instalasi Gizi Dr. Cipto Mangunkusumo, editor. Jakarta: PT Gramedia Pustaka Utama. 2020.
21. Prasetyo Kusumo M. Buku Pemantauan Aktivitas Fisik. Yogyakarta: The Journal Publishing. 2021.
22. Husnah, Ramadhan MH. Diet pasien penyakit jantung koroner. *J Kedokt Syiah Kuala*. 2022. 22(4). 376–379. <https://doi.org/10.24815/jks.v22i4.25104>
23. Santos HO, Penha-Silva N. Revisiting the concepts of de novo lipogenesis to understand the conversion of carbohydrates into fats: Stop overvaluing and extrapolating the renowned phrase “fat burns in the flame of carbohydrate.” *Nutrition*. 2024. 130(10). 112617. <https://doi.org/10.1016/j.nut.2024.112617>
24. Utami RW, Sofia SN, Murbawani EA. L Hubungan Antara Asupan Karbohidrat Dengan Profil Lipid Pada Pasien Penyakit Jantung Koroner. 2017. 6(2). 1143–1155. <https://doi.org/10.14710/dmj.v6i2.18627>
25. Zheng Y, Fang Y, Xu X, Ye W, Kang S, Yang K, Cao Y, Xu R, Zheng J WH. Dietary saturated fatty acids increased all-cause and cardiovascular disease mortality in an elderly population 2023. *Natl Heal Nutr Exam Surv Nutr Res*. 2023. 120. 99-114. <https://doi.org/10.1016/j.nutres.2023.10.002>
26. World Health Organization. WHO guideline on saturated fatty acid and trans-fatty acid intake for adults and children. Geneva: WHO. 2023
27. Wang DD, Frank BH. Dietary fat and risk of cardiovascular disease: recent controversies and advances. *Annu Rev Nutr*. 2017. 37. 423–446. <https://doi.org/10.1146/annurev-nutr-071816-064614>

28. Given DI. Saturated fats, dairy foods and cardiovascular health: No longer a curious paradox. *Nutr Bull*. 2022. 47(4). 407–422. <https://doi.org/10.1111/nbu.12585>
29. Magriplis E, Marakis G, Kotopoulou S, Naska A, Michas G et al. Trans fatty acid intake increases likelihood of dyslipidemia especially among individuals with higher saturated fat consumption. *Cardiovascular Media*. 2022. 23(4). 130. <https://doi.org/10.31083/j.rcm230413>
30. Aman AM. Panduan Pengelolaan Dislipidemia di Indonesia. Jakarta: PB PERKENI. 2021.
31. Badan Pusat Statistik Provinsi Sumatera Barat. Pola konsumsi makanan penduduk Provinsi Sumatera Barat 2022. Padang: Badan Pusat Statistik Provinsi Sumatera Barat; 2022. <https://sumbar.bps.go.id/id/statistics-table/2/NDMyIzI=rincian-konsumsi-sayur-sayuran-perkapita-perminggu-di-sumatera-barat.html>
32. Hartley L, Loveman E, Ji C, Rees K, Hartley L, Loveman E, et al. Dietary fibre for the primary prevention of cardiovascular disease (Review). 2016. 16(1). <https://doi.org/10.1002/14651858.CD011472.pub2>
33. Ghavami A, Ziaei R, Talebi S, Barghchi H, Nattagh-Eshstivani E, Moradi S, et al. Soluble Fiber Supplementation and Serum Lipid Profile: A Systematic Review and Dose-Response Meta-Analysis of Randomized Controlled Trials. *Adv Nutr*. 2023. 14(3). 465–474. <https://doi.org/10.1016/j.advnut.2023.01.005>
34. Sinulingga BO. Pengaruh Konsumsi Serat dalam Menurunkan Kadar Kolesterol. *J Penelit Sains*. 2020. 22(1). 9–15. <https://doi.org/10.26554/jps.v22i1.556>
35. Kemala, Anak Agung Istri Shania Wihandani DM, Wiryanthini IAD. Hubungan asupan zat gizi dengan profil lipid pada diet vegetarian di kota Denpasar. *J Med Udayana*. 2021. 10(7). 57–62. <https://doi.org/10.24843/mu.2021.v10.i7.p1>
36. Virani SS, Newby LK, Arnold S V, Bittner V, Brewer LC, Demeter SH, et al. AHA/ACC/ACCP/ASPC/NLA/PCNA Guideline for the Management of Patients With Chronic Coronary Disease: A Report of the American Heart Association/American College of Cardiology Joint Committee on Clinical Practice Guidelines. *Circulation*. 2023. 148(9). 109–119. <https://doi.org/10.1161/CIR.0000000000001168>
37. Yang X, Li Y, Wang C, Mao Z, Zhou W, Zhang L et al. Dose-response association between physical activity and risk of dyslipidemia: a systematic review and meta-analysis. *BMJ Open*. 2016. 25. <https://doi.org/10.1186/s12889-025-24568-1>
38. Sunu UFS, Permadi G, Fenty F. Hubungan Antara Aktivitas Fisik Dan Angka Kecukupan Gizi Makronutrien Terhadap Rasio Kolesterol Total/hdl Pada Masyarakat Pedesaan. *J Pharm Sci Community*. 2017. 14(1). 15–24. <https://doi.org/10.24071/jpsc.141558>
39. Smart NA, Downes D, van der Touw T, Hada S, Dieberg G, Pearson MJ, et al. The Effect of Exercise Training on Blood Lipids: A Systematic Review and Meta-analysis. *Sports Med*. 2025. 55(1). 67–78. <https://doi.org/10.1007/s40279-024-02115-z>
40. Khalafi M, Sakhaei MH, Kazeminasab F, Rosenkranz SK, Symonds ME. Exercise training, dietary intervention, or combined interventions and their effects on lipid profiles in adults with overweight and obesity: A systematic review and meta-analysis of randomized clinical trials. *Nutr Metab Cardiovasc Dis*. 2023. 33(9). 1662–1683. <https://doi.org/10.1016/j.numecd.2023.05.024>