ARTERI : Jurnal Ilmu Kesehatan p-ISSN 2721-4516
Vol. 6, No. 3, Mei 2025, hlm. 120 -125 e-ISSN 2715-4432

Association between Physical Activity and Vitamin C Intake with HDL and LDL Levels among Overweight Students: A Cross-Sectional Study

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ABSTRAK

Kegemukan adalah penyakit yang ditandai dengan penumpukan jaringan lemak tubuh yang berlebihan. Kegemukan adalah masalah yang harus ditangani karena dapat menyebabkan penyakit dengan morbiditas dan mortalitas degenerative, diantaranya yaitu dislipidemia. Analisis dilakukan untuk menganalisis hubungan antara aktivitas fisik dan vitamin C dengan kadar HDL dan LDL pada remaja yang kegemukan. Subjek penelitian ini adalah mahasiswi overweight dengan usia 17-25 tahun yang dipilih menggunakan purposive sampling sebanyak 50 responden. Lokasi penelitian bertempat di UNIDA Gontor dan Laboratorium Widodo Medika. Instrumen yang digunakan adalah clinical chemistry analyzer, reagenesia, timbangan berat badan, dan microtoise tinggi badan. Studi potong lintang dengan uji Korelasi peringkat Spearman digunakan dalam penelitian ini. Uji analisis menunjukkan bahwa aktivitas fisik dan kadar HDL tidak memiliki hubungan yang bermakna dengan nilai p 0,49, dan untuk aktivitas fisik dengan kadar LDL tidak memiliki hubungan yang bermakna dengan nilai p 0,619. Hasil uji analisis menunjukan ada hubungan yang bermakna antara asupan vitamin C dengan kadar HDL pada mahasiswi overweight dengan p-value 0,020 dan kekuatan korelasi yang cukup yaitu r = 0,327. Sedangkan asupan vitamin C dengan kadar LDL pada mahasiswi overweight tidak memiliki hubungan yang signifikan dengan p-value 0,744 dan kekuatan korelasi yang sangat lemah yaitu r = 0,047. Hasil dari studi ini menunjukkan hubungan signifikan antara asupan vitamin C dan kadar HDL pada mahasiswi yang kegemukan. Sedangkan asupan vitamin C dengan kadar LDL pada mahasiswi yang kegemukan tidak memiliki hubungan yang signifikan. Serta tidak ada hubungan antara aktifitas fisik dengan kadar HDL maupun LDL.

***Kata kunci**: HDL, LDL, kegemukan, aktivitas fisik, vitamin C*

ABSTRACT

Obesity is a medical condition characterized by the excessive accumulation of body fat tissue. It is a significant health concern because it can lead to degenerative diseases with high morbidity and mortality rates, such as dyslipidemia. This study aimed to analyze the relationship between physical activity, vitamin C intake, and High-Density Lipoprotein (HDL) and Low-Density Lipoprotein (LDL) levels in overweight adolescents. The subjects were 50 overweight female university students aged 17-25, selected via purposive sampling. The research was conducted at UNIDA Gontor and the Widodo Medika Laboratory. Instruments used included a clinical chemistry analyzer, reagents, weight scales, and a microtoise for height measurement. A cross-sectional study design was employed, and data were analyzed using the Spearman rank correlation test. The analysis indicated no significant relationship between physical activity and HDL levels (p=0.490), nor between physical activity and LDL levels (p=0.619). In contrast, the results revealed a significant correlation between vitamin C intake and HDL levels in the overweight female students (p=0.020), with a moderate correlation strength (r=0.327). However, no significant association was found between vitamin C intake and LDL levels (p=0.744), which demonstrated a very weak correlation (r=0.047). In conclusion, this study shows a significant relationship between vitamin C intake and HDL levels in overweight female students. Conversely, no significant correlation was found with LDL levels, and physical activity did not have a significant association with either HDL or LDL cholesterol.

***Keywords**: HDL, LDL, overweight, physical activity, vitamin C*

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I. INTRODUCTION

Overweight and dyslipidemia began to become a public health problem throughout the world. The worldwide reported that obesity is one of the global epidemics and causes of noncommunicable diseases, so it has become a health problem that must be handled immediately [1,2]. Overweight can increase

various diseases, one of which is dyslipidemia [3]. The World Health Organization (WHO) says that dyslipidemia is linked to more than half of the causes of ischemic heart disease around the world [4,5].

Overweight is a factor in many diseases, one of which is the increased risk of dyslipidemia which is indicated by a shrinkage in HDL cholesterol levels (High-Density lipoprotein) [6]. Elevated levels of LDL (Low Density Lipoprotein), resulting from excessive fat consumption, can lead thepatient to a stage where their body may develop obesity [7].

Seeing the impact that can arise due to overweight, it is necessary to prevent physical activity and consumption of vitamin C. If you do enough physical activity every day, you will expend more daily energy, so that your fat and weight will decrease periodically [7]. Vitamin C itself has the effect of helping the hydroxylation reaction in the formation of bile acids, causing an increase in cholesterol excretion and lowering total cholesterol levels in the blood [8]. Vitamin C intake from a diet is one of the main determinants of body status, with the amount consumed and frequency of consumption correlated with plasma status and prevalence of deficiency[9]. This objective study was to analize the relationship between physical activity and vitamin C with HDL and LDL levels in overweight adolescents.

II. MATERIALS AND METHODS

Design, Time, and Place

The research design used the Cross-sectional. The research location is located at University of Darussalam and the location of blood check is located at the Widodo Medika Laboratory from November 2022 to March 2023.

Population and Sample

The population of this study was overweight female students at Darussalam Gontor University ranging in age from 18-25 years. This study looked at 50 overweight female college students between the ages of 18 and 25. The sampling technique used is using purposive sampling. The inclusion criteria contained in this study are respondents must have BMI (Body Mass Index) >25,0 – 27,0, respondents were in good health at the time of the study, respondents came from the class of 2019-2022 with a final adult age of 18-25 years, respondent included students of University of Darussalam Gontor, respondents are willing to be research subjects as evidenced by informed consent, respondents are willing to fast for 8-10 hours before returning blood samples. The exclusion criteria is respondents are afraid of needles when taking blood, respondents is running a diet program, respondents was taking dietary supplements, respondents have a history of blood-related illness (anemia, hypertension, diabetes, leukemia, hemophilia).

Experiment Design

Physical activity measurements were carried out using the IPAQ (Physical Activity Questionnaire) questionnaire which contains seven questions about respondents' physical activity during the last seven days. The interview results received were then processed using IPAQ scoring methodology guidelines combined with IPAQ automated reports to generate physical activity data.

Measurement of micronutrients (vitamin C) is carried out by conducting the SQ-FFQ (Semi-Quantitative Food Frequency Questionnaire). This method is used to determine the picture of micronutrient intake retrospectively, where it can be known the range of micronutrient intake, such as vitamin C intake, asked in the last 1 month. This method is the same as the food frequency method, both in format and how to do it, the difference is that respondents are also asked about the size or size (can be in URT or weight) of each food consumed during a certain period, such as days, weeks, or months [10].

For measurement HDL levels and LDL levels using a clinical chemistry analyzer brand pictus 400 diatron. First, the identity of the patient, specimen (sample) is given to the blood draw. The best specimen for lipid profile examination is a serum sample from venous

blood, blood is taken as much as 3 cc. Venous blood collection is performed on the median cubital vein, saphenous magna vein or other supervision that is large enough to obtain a blood sample that suits the needs [11].

Data Processing and Analysis

The subjects in this study were overweight female students with BMI >25.0–27.9, age range 17-25 years, and in the class of 2019-2022 at the women's campus of University of Darussalam Gontor, Mantingan, Ngawi, East Java, with a dormitory system. The subjects of this study amounted to 50 people who met the inclusion and exclusion criteria. The study subjects were checked for their physical activity scores in 1 week using the IPAQ form (Light physical activity <600 MET-minutes/week, Moderate physical activity ≥600 MET-minutes/week, Strong physical activity 1500-3000 MET-minutes/week), vitamin C intake in 1 month using the SQ-FFQ form (Normal: 75 mg Abnormal: <75 mg), as well as measurements of HDL levels (Normal = >60 mg/dl Abnormal = <50 mg/dl) and LDL levels (Normal = <100 mg/dl Abnormal = >100 mg/dl) [25] of respondents using a blood sampling device and preparing reagents and using a pictus 400 brand clinical chemistry analyzer.

This research carried out according to a letter of approval from the research ethics section at the UNNES ethics committee (No: 548/KEPK/EC/2022). Participants provided their informed consent to participate before the commencement of the study. Participants' privacy was properly protected

III. RESULTS AND DISCUSSION

Characteristics of research subject at University of Darussalam Gontor (based on table 1) who are the most physical activity categories, namely light physical activity (56%), and the most normal vitamin C intake (64%). As for the results of HDL levels, respondents mostly entered normal criteria (70%). And respondents' LDL levels mostly entered abnormal criteria (58%).

Table 1. Characteristics of Research Subjects at Darussalam Gontor University

Characteristic	Category	n (∑ = 50)	%	Mean ± SD
Class	Class of 2022	18	36	5,20 ± 2,587
	Class of 2021	1	2	
	Class of 2020	14	28	
	Class of 2019	17	34	
Physical Activity	Light (MET <600)	28	56	935,41 ± 1046,97
	Currently (MET ≥600)	13	26	
	Heavy (MET 1500 – 3000)	9	18	
Vitamin C	Normal (75 mg)	32	64	137,16 ± 1,686
	Abnormal (<75 mg)	18	36	
HDL Levels	Normal (>60 mg/dl)	35	70	65,22 ± 11,980
	Abnormal (<50 mg/dl)	15	30	
LDL Levels	Normal (<100 mg/dl)	21	42	100,58 ± 16,26
	Abnormal (>100 mg/dl)	29	58	

Table 2. Analysis of the Relationship of Physical Activity with HDL Levels and LDL Levels

	HDL Levels	LDL Levels
Physical Activity Score	r = -0,100 p = 0,491* n = 50	r = 0,072 p = 0,619* n = 50

The correlation test used is the Spearman rank correlation test because the data normality test shows that the data is not normally distributed (after data transformation). It can be seen from table 2, that there is no significant correlation between the relationship between respondents' physical activity and the average low category with HDL levels and the

average results of normal respondents tested with the Spearman correlative test (p >0.05) with a p-value result of 0.491 and a very weak correlation strength (r = -0.100). Negative sign, indicating the opposite direction of correlation, the higher the value of the physical activity, the lower the HDL level, and vice versa.

Table 3. Analysis of the Relationship of Vitamin C Intake with HDL Levels and LDL Levels

	HDL Levels	LDL Levels
Vitamin C Intake	r = 0,327 p = 0,020* n = 50	r = 0,047 p = 0,744* n = 50

In table 3, it can be seen that there is a significant correlation between the value of vitamin C intake and HDL levels tested by the Spearman rank correlation test (p < 0.05) with a p-value result of 0.020 and sufficient correlation strength (r = 0.327).

The response of HDL levels in the blood is different for each individual depending on the intensity, duration and frequency of physical activity, the initial condition of cholesterol and the length of the period of physical activity, showing how it affects the relationship of physical activity to the ratio of HDL. Light or heavy physical activity of a person, generally influenced by many internal factors such as lifestyle, individual characteristics including clinical interventions, and external factors such as social environment and physical environment [12].

The results of this study align with those cited by Widiastuti et al. (2017), which stated that there was no significant correlation between physical activity and HDL cholesterol levels (p > 0.05) (p = 0.522), with a very weak correlation (r = 0.119). This study also aligns with the results of a study cited by Adha (2014), which stated that there was no significant relationship between physical activity and respondents' HDL ratios, with statistical tests showing a p value > 0.05 or p = 0.072. However, these results, when viewed from statistical tests, do not align with those cited by Pratama et al. (2019), which stated a significant relationship between physical activity and HDL ratios, with a p value of 0.020. This difference in results may be due to the differences in the study, which consisted of 86 subjects, both men and women, aged 45 years and older. The sample selection used accidental sampling and the chi-square test. In this study, the majority of research subjects had a moderate physical activity category with excessive fat intake[22, 23, 24].

Based on the results of statistical tests there is no significant relationship between the physical activity of respondents and the HDL ratio of respondents who have low physical activity scores. It is suspected that there are other factors that affect HDL levels that can be caused by age, especially in women. Women have the hormone estrogen which is a determinant factor for changes in the blood lipid profile. There is an increase in HDL levels in women that increase high in the middle of the menstrual cycle and after ovulation. The role of estrogen in making HDL level go up almost 15% of how cholesterol is made and managed. This occurs in women who are of reproductive age but are still actively menstruating [13].

In Thristy's research [14], she explained that there are other factors that can affect HDL levels, namely stress factors. This study state that there is a significant increase in the hormone cortisol, adrenaline, total cholesterol and, LDL cholesterol and a decrease in HDL cholesterol after exposure to stress. Stress factors can affect a person's mentality but also affect metabolic processes in the body [14]. And it can be seen in table 1, that there is no significant correlation between the relationship between physical activity values and LDL levels (p >0.05) with p-value results of 0.619 and a very weak correlation strength (r = 0.072). Based on the results of statistical tests, there is no significant relationship between respondents' physical activity and LDL ratio. It is suspected that there are other factors that affect LDL levels in the blood, such as clinical interventions such as the use of cholesterol- lowering drugs, or the blood lipid condition of previous respondents who may not be in good health, as well as individual diseases that do not allow for more

strenuous physical activity than before [15]. Consumption of fatty acids can also increase LDL cholesterol levels, which will result in cholesterol accumulation in peripheral tissues, including bloodvessels [16].

Vitamin C is one of the antioxidants that have an important component in the process of breaking down cholesterol. Vitamin C is a water-soluble vitamin that works as an antioxidant to protect cell from damage cause by oxidation. Antioxidants themselves function to capture peroxyl radicals that can protect HDL from oxidative damage. Vitamin C can improve lipid profile by turning cholesterol from liver extracts into bile [17]. The most important functions of vitamin C associated with overweight are as an electron donor, reducing agent and antioxidant. Antioxidants neutralize free radicals and prevent damage by giving away one or two electrons [18].

Vitamin C effects the hydroxylation reaction in the formation of bile acids so that there is an increase in cholesterol excretion, which makes cholesterol levels in the blood decrease. Vitamin C or ascorbic acid, has long been known as one of the antioxidants that serve to help hydroxylation reactions in the formation of bile salts. If the formation of bile salts increases, then the excretion of cholesterol also increases so that it can lower blood cholesterol levels and increase HDL levels in the blood [19].

And in table 2 above, it can be seen that there is no significant correlation between the value of vitamin C intake with LDL levels (p >0.05) and a p-value of 0.744, and very weak correlation strength (r = 0.047). Based on the results of statistical tests, there is no significant relationship between vitamin C intake and LDL levels, it is suspected that there are other factors that affect LDL levels in the blood such as respondents who consume a lot of coffee for a long time, this factor can affect LDL levels in the body because the ingredients contained in coffee, namely caffeinated, which are suspected to increase total cholesterol, LDL, triglycerides, and alanine aminotransferase [20]. This can also be influenced by vitamin E intake [21].

Other factors that can cause an increase in LDL levels are heredity, mutations in the LDL receptor gene (R-LDL), where there is a change in the structure and function of the receptor that binds plasma LDL cholesterol so that it can result in high levels of LDL cholesterol in the blood. Another factor that can influence the increase in LDL cholesterol levels is the occurrence of stress factors. Lack of dietary fiber can also cause an increase in LDL because dietary fiber has the potential to lower cholesterol levels by binding to fat in the small intestine, binding bile acids and increasing their excretion into feces [11].

IV. CONCLUSION

There is a relationship between vitamin C intake with HDL levels but there is no relationship between vitamin C intake and LDL levels, and there is no relationship between physical activity and HDL also LDL levels.

Some things that can be suggested include that individuals who are overweight should increase increase consumption of vitamin C that can be obtained from fruits, vegetables, tubers, and grains to improve their nutritional status and blood lipid profiles to normal.

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REFERENCES

1. Du Z, Qin Y. Dyslipidemia and Cardiovascular Disease: Current Knowledge, Existing Challenges, and New Opportunities for Management Strategies. J Clin Med. 2023 Jan 3;12(1):363.
2. Jonathan Q, Purnell M. Definitions, Classification, and Epidemiology of Obesity - Endotext - NCBI Bookshelf [Internet]. [cited 2024 Feb 5]. Available from: https://www.ncbi.nlm.nih.gov/books/NBK279167/
3. Mauliza M. Obesitas Dan Pengaruhnya Terhadap Kardiovaskular. Averrous J Kedokt Dan Kesehat Malikussaleh. 2018 Nov 5;4(2):89.
4. Pengusul T, Handayani P. Analisis Faktor Yang Berhubungan Dengan Kejadian Dislipidemia Pada Pekerja Di Perusahaan Minyak Dan Gas X (Studi Deskriptif Menggunakan Data Sekunder Tahun 2017-2018).
5. WHO. Cardiovascular diseases (CVDs) [Internet]. 2021. Available from: https://www.who.int/news-room/fact-sheets/detail/cardiovascular-diseases-(cvds)

6. Rozi P. Hubungan Obesitas Dengan Kolesterol Hdl Dan Trigliserida Pada Mahasiswa Program Studi Pendidikan Dokter Fk Unsri. Fak Kedokt Univ Sriwij. 2020.
7. Kristanti TAY, Rusjiyanto R, Kurniawan A. Hubungan IMT, lingkar pinggang, konsumsi lemak dengan kadar LDL pasien penyakit jantung di RSUD Sukoharjo. Darussalam Nutr J. 2019 Sep 26;3(2):14.
8. Pasaribu KD, Napitupulu RRJ, Sitepu JN. Pengaruh Pemberian Ekstrak Alpukat terhadap Kadar Kolesterol Total Tikus Wistar Jantan dengan Obesitas. 2022;7(2).
9. Carr A, Rowe S. Factors Affecting Vitamin C Status and Prevalence of Deficiency: A Global Health Perspective. Nutrients. 2020 Jul;1963.
10. Rachmania Da. Perbedaan Status Obesitas Berdasarkan Konsumsi Junk Food Pada Anak Sekolah Sd Negeri 3 Serangan Denpasar Provinsi Bali. Poltekkes Denpasar. 2020.
11. Sari RP, Damayanty AE. Pemberian Air Perasan Jeruk Manis (Citrus sinensis) Meningkatkan Kadar LDL Kolesterol Serum. (Studi pada mahasiswa obese FK UMSU). 2018;1(2).
12. Adha A. Jurusan Gizi Politeknik Kesehatan Kemenkes Padang Tahun 2014.
13. Sinaga Yo, Tiho M, Mewo Ym. Gambaran Kadar Kolesterol High Density Lipoprotein Darah Pada Mahasiswa Angkatan 2011 Fakultas Kedokteran Universitas Sam Ratulangi Dengan Indeks Massa Tubuh ≥23,0 Kg/M2. J E-Biomedik [Internet]. 2013 Nov 12 [Cited 2024 Feb 5];1(3). Available From: Https://Ejournal.Unsrat.Ac.Id/Index.Php/Ebiomedik/Article/View/3275
14. Thristy I, Mardia RS, Mampatdi CM, Karim Chan MZ. Gambaran Tingkat Stres dan kadar HDL Kolesterol Darah Pada Mahasiswa Fakultas Kedokteran. J PANDU HUSADA. 2020 Jul 28;1(3):149.
15. Universitas Brawijaya, Hariadini AL, Sidharta B, Universitas Brawijaya, Ebtavanny TG, Universitas Brawijaya, et al. Hubungan Tingkat Pengetahuan Dan Ketepatan Penggunaan Obat Simvastatin Pada Pasien Hiperkolesterolemia Di Apotek Kota Malang. Pharm J Indones. 2020 Jun 1;005(02):91–6.
16. Agung LR. Pengaruh Daun Salam (Syzygium polyanthum) Terhadap Kadar Trigliserida Dan Kolesterol Total Darah Pada Penderita Dislipidemia. J Ilm Kesehat Sandi Husada. 2021 Oct 1;10(2):408–12.
17. Sanggih PRA, Wahyudo R, Ginarana A. Efek Buah Nanas (Ananas comosus L. merr) Terhadap Penurunan Kadar Kolesterol Pada Penyakit Jantung Koroner (PJK).
18. Totan B, Baygut H, Gezmen Karadağ M. Vitamin C Physiology: The Known and the Unknown in Obesity. J Food Nutr Res. 2019 Sep 28;7(8):613–8.
19. Birosma P. Fakultas Kedokteran Universitas Muhammdiyah Sumatera Utara Medan 2018.
20. Meiga TW. Gambaran kadar kolesterol LDL (Low Density Lipoprotein) pada peminum kopi di Dusun Ketapang Lor RT 17/RW 007 Desa Kudubanjar Kecamatan Kudu Kabupaten Jombang. ITSKes Insan Cendekia Med Jombang. 2018.
21. Damayanti AY, Pibriyanti K, Fadila AR. Vitamin E and Fiber Intake with HDL and LDL Levels in Overweight Female Students at Islamic Boarding School University. Int J Hum Health Sci. 2024;8(1):3–7.
22. Ida Ayu Eka Widiastuti,. Et al. Hubungan Nilai Aktivitas Fisik Dengan Kadar Trigliserida dan Kolesterol HDL pada Pegawai Fakultas Kedokteran Universitas Mataram, Jurnal Kedokteran Unram, Vol 6, No 4, Hal 18-21, 2017.
23. Ainil Adha. Hubungan Aktivitas Fisik, Asupan Lemak, Dan Serat dengan Rasio LDL/HDL Darah Klien Yang Memeriksakan Darah Di Balai Laboratorium Kesehatan Provinsi Sumatra Barat. 2014.
24. Ahmad Cipta Pratama,. Et al. Asupan Buah Dan Sayur, Asupan Lemak, Aktivitas Fisik Berhubungan Dengan Rasio LDL/HDL Orang Dewasa, ARGIPA, Vol 4, No 1, Hal 11-18, 2019.
25. Perkumpulan Endokrinologi Indonesia. Panduan Pengelolaan Dislipidemia di Indonesia. 2021. PB PERKENI.