Jurnal Gizi dan Dietetik Indonesia
(Indonesian Journal of Nutrition and Dietetics)
Vol. 8, No. 3, 2020: 101-108

Available *online* at: http://ejournal.almaata.ac.id/index.php/IJND
DOI : http://dx.doi.org/10.21927/ijnd.2020.8(3).101-108

Association of central obesity and smoking with HDL level among Indonesian peoples (18 – 59 years)

Mukhlidah Hanun Siregar[1*], Fatmah Fatmah[2], Ratu Ayu Dewi Sartika[3]

[1] Department of Nutrition, Faculty of Medicine, University of Sultan Ageng Tirtayasa,
Jalan Jenderal Soedirman KM 03 Cilegon, Banten
[2] School of Environment Science, University of Indonesia,
Jalan Margonda Raya, Pondok Cina, Kecamatan Beji, Kota Depok, Jawa Barat
[3] Department of Nutrition University of Indonesia,
Jalan Margonda Raya, Pondok Cina, Kecamatan Beji, Kota Depok, Jawa Barat
**Corresponding author* : mukhlidah.hanunsiregar@untirta.ac.id

ABSTRAK

Latar Belakang : *High-Density Lipoprotein (HDL) adalah bagian dari profil lipid yang dianjurkan berada pada level diatas 40 mg/dl. HDL rendah menjadi salah satu kriteria sindrom metabolik. Rendahnya HDL dalam darah akan menyebabkan terjadinya aterosklerosis dan berdampak pada peningkatan risiko penyakit cardiovaskular. Beberapa penelitian menemukan bahwa obesitas sentral, merokok, aktivitas fisik, dan asupan makanan memiliki peran dalam menurunkan kadar HDL.*

Tujuan : *Tujuan dari penelitian ini adalah untuk mengetahui faktor utama yang berhubungan dengan kadar HDL pada masyarakat Indonesia dengan range usia 18-59 tahun.*

Metode : *Desain penelitian menggunakan desain cross sectional. Data penelitian diperoleh dari Riset Kesehatan Dasar tahun 2013. Total responden setelah dilakukan manajemen data sebanyak 21.055 orang. Faktor yang dianalisis adalah usia, jenis kelamin, status menikah, aktivitas fisik, merokok, obesitas sentral, konsumsi buah dan sayur, konsumsi kopi dan konsumsi makanan berlemak. Data dianalisis dengan uji hipotesis multiple regression logistic for the prediction model.*

Hasil : *Hasil penelitian menunjukkan bahwa sebesar 26,2% penduduk Indonesia berusia 18-59 tahun memiliki kadar HDL ≤40 mg/dl. Setelah dianalisis melalui 4 model, ditemukan bahwa obesitas sentral, merokok, konsumsi makanan berlemak, status menikah, dan jenis kelamin memiliki hubungan secara signifikan dengan kadar HDL (berurutan berdasarkan nilai OR).*

Kesimpulan : *Obesitas sentral dan merokok menjadi faktor utama terhadap kadar HDL abnormal setelah dikontrol dengan faktor lain yang berhubungan, dengan nilai OR 1.948 (1.740-2.182; p-value<0.0001) dan 1.284 (1.127-1.462; p-value<0.0001). Obesitas sentral merupakan faktor utama yang berhubungan dengan penurunan kadar HDL. Oleh karena itu, penelitian ini menyarankan untuk menjaga lingkar pinggang selalu berada pada batas <80 cm untuk perempuan dan <90 untuk laki-laki dengan melaksanakan pedoman gizi seimbang (terutama menurunkan konsumsi makanan berlemak dan meningkatkan aktivitas fisik), menjauhi merokok, khususnya pada perempuan menikah.*

KATA KUNCI: *gizi seimbang; kadar HDL; merokok; obesitas sentral*

ABSTRACT

Background: *High-Density Lipoprotein (HDL) is a part of the lipid profile and it is recommended to be above 40 mg/dl. Low HDL is one of the criteria of metabolic syndrome. Low HDL in the blood will cause atherosclerosis and affect the increased risk of cardiovascular disease. Some research found that central obesity, smoking, physical activity, and dietary intake have a role in lowering HDL levels.*

Objectives: *The purpose of this research is to know the main factors associate to HDL levels in Indonesian society with range age 18-59 years.*

Methods: *Design research was using cross sectional design. Research data obtained from Basic Health Research in 2013. Total respondents after doing data management were 21.055 people. The analyzed factors are age, gender, married status, physical activity, smoking, central obesity, dietary of fruit and*

vegetable, coffee consumption and dietary of fatty foods. The data was analyzed by multiple regression logistic for the prediction model.

***Result**: The results showed that 26.2% of the Indonesian population aged 18-59 years had HDL levels ≤ 40 mg/dl. After being analyzed through 4 models, it was found that central obesity, smoking, dietary of fatty foods, married status, and sex associated significantly with HDL levels (sequentially based on OR value). Central obesity and smoking are becoming a major factor related with abnormal HDL levels after adjustment with other significant associated factors, with OR 1.948 (1.740-2.182; p-value < 0.0001) and 1.284 (1.127-1.462; p-value < 0.0001).*

***Conclusions:** Central obesity was a major factor associated with decreasing levels of HDL. Therefore, this research suggested to keep the waist circumference always under 80 cm for women and 90 for men, by applied the balanced nutritional guidelines (decreasing of fatty foods and increasing physical activity), avoiding smoking, especially for married women.*

KEYWORDS: *balance nutrition; central obesity; HDL levels; smoking*

Article info:
Article submitted on August 05 , 2020
Articles revised on September 02, 2020
Articles received on September 28, 2020

INTRODUCTION

HDL (High Density Lipoprotein) is one of lipoprotein, it is a combination of fat and high protein levels, less triglycerides and phospholipids, has protein general characteristic, found in the blood plasma, and called as “good fats” because it is helping to clean plaque on blood vessels. Together with obesity, raised triglycerides, raised blood pressure, raised fasting plasma glucose, and reduced HDL cholesterol is a component of the metabolic syndrome/MS (1,2). The manifestation of MS is diabetes mellitus, another effect of low HDL level is trigger an increase of LDL level and become a risk factor for cardiovascular disease (3).

The population in South Asia showed a trend of increasing triglyceride levels and low HDL levels in different ethnic groups (3–5). In 2007, prevalence of low HDL level in Indonesia was 35% and decreased to 22.9% in 2013 (6,7). But, it still a problem to identify the risk factors of low HDL level.

The aims of the present study were to determine the main factors for reduced HDL levels between selected HDL risk factors namely age and sex (3,8), marital status (9,10), central obesity (11–13), smoking (14–16), stress (17), physical activity (18), dietary of fatty food (19), dietary of fruit and vegetable(16), and coffee consumption (20).

MATERIALS AND METHODS

All participants were of Indonesian and lived in Indonesia when Basic Health Research 2013 study implemented. Basic Health Research 2013 study was a survey with cross sectional design to describe the health problems of population in all regions of Indonesia represented by subjects at the national, provinces, and district/city level. The participants consist of rural and urban populations, total household were 294,959 households and 1,027,763 people consisting of all age ranges.

In this study, the population was people with age range 18-59 years i.e 310,671 men and 338,954 women (total were 649,625). This total was for the measurement of all research variables, and biomedical samples were representing the province. The inclusion criteria were 18-59 years old, conducting blood sampling for a complete examination of blood lipid profiles, and complete data of all variables. Total subject we found from Ministry of Health were 28,300, and 21,055 after applied the inclusion criteria. Sample size was accounting by formula of different categories difference test based on study of HDL level in Indonesia (16), minimum sample were 493.

The implementation of data collection from Basic Health Research 2013 was conducted in May-

June 2013, in 33 provinces and 497 districts/cities. The enumerator was recruited by the local health department and trained. There were 3 types of data collection tools namely: Household questionnaire (RKD13.RT) asked to family head or housewife; Individual questionnaire (RKD13.IND) asked to each household member; and form (BM01-BM05) and a set of field laboratories for the retrieval of blood specimens.

The enumerator interviewed the household head, then to all the family members, alternately. Then the measurement of body weight and height and other examinations. Biomedical examination carried out field laboratories that can be laboratory clinics, hospitals and other facilities are possible. In this study, researcher collected data from Ministry of Health in 2015 and analyzed in the same year. Basic Health Research 2013 has registered in Ethics Committee from Health Research Ethics Commission (KEPK) National Institute of Health Research and Development (Balitbangkes) of Health Ministry number LB.02.01/5.2/KE.006/2013.

HDL level was defined according to the criteria containing in the report of National Education Programe (NCEP) Adult Treatment Panel (ATP)-III 2001, which defines as abnormal HDL level (≤40 mg/dl) and otherwise as normal. Age was defined to 4 categories as 18-25 years, 26-35 years, 36-44 years and 45-59 years. Marital status was defined by living alone (unmarried or divorced) or living with couple (married) (9). Central obesity was defined at waist circumference (WC) WC≥90 cm in males and WC≥80 cm female, as use in Hoppin and Ministry of Health Recomendation.

A dietary questionnaire was developed on the basis of food habits practiced each day over a period of least 1 week. Dietary of fatty food was classified as "yes" if a person eating it ≥3 times a weeks, otherwise, "no". This classification same with consumption of coffee. Dietary of fruits and vegetables defined at recommendation from Indonesia Ministry of Health; adequate is eating fruit and/or vegetables ≥5 portion every day in a week; and otherwise "low".

Smoking was classified as "yes" if a person smoked daily or occasionally when Basic Health Research'2013 implementation, and otherwise "no". Physical activity was classified as "active" if a person doing heavy and/or moderate activity 3 days over a period of least 1 week; (The activities was listed in Basic Health Research'2013 questionnaire); otherwise "less-active". Last, stress was classified as "yes" if a person answer ≥6 from 20 questions with yes; and otherwise "no".

Data were analyzed using statistical software. The prevalence of abnormal HDL level were adjusted to the ATP III standard population. Logistic regression used to investigate the association between HDL level and determine major factor after adjusting (i.e., age, sex, central obesity, smoking, physical activity, marital status, and dietary of fatty food). The estimates and 95% confidence interval (CI) of the coefficients were displayed. A p-value of ≤0.05 or 95% CI was considered statistically significant. The factor was considered statistically significant insert to multivariate analyze. Multivariate analyze to predict the main factor lowering HDL level.

RESULTS AND DISCUSSIONS

Table 1 shows the prevalence of abnormal HDL level in subject adjusted to NCEP III standard population. Five thousand five hundred and twelve subjects (26.2%) classified as abnormal HDL level with CI 95% (25.2 – 27.2%). In characteristics, women more than men, married more than unmarried/divorced. In life style, smoker less than non-smoker, but less-active more than active subjects and most of subject was not stress. In dietary, subjects have eaten fatty food more than 3 times a week (65.8%), and found mostly subjects have low level in dietary of fruit and vegetable in a week (92.9%). Last, subjects consumed coffee more than 3 times a week were less than others.

Table 2 shows the p-value non-adjusted and adjusted association between factors with HDL level. In bivariate analysis with Chi-square analysis found that sex, marital status, smoking, physical activity, dietary of fatty food and coffee consumption significantly associated with HDL level. But when adjusted all factors with p-value>0.25 into model

Table 1. Prevalence of abnormal HDL level among indonesian people (18-59 years)

Variabel	Total (n=21055)	Persentase (95% CI)
HDL level		
Abnormal	5512	26.2 (25.2 – 27.2)
Normal	15543	73.8 (72.8 – 74.8)
Age		
45 – 59 years	8090	38.4 (37.4 – 39.5)
36 – 44 years	6154	29.2 (28.3 – 30.2)
26 – 35 years	4511	21.4 (20.6 – 22.2)
18 – 25 years	2300	10.9 (10.4 – 11.5)
Sex		
Women	13192	62.7 (61.7 – 63.6)
Men	7863	37.3 (36.4 – 38.3)
Marital status		
Unmarried/Divorced	3472	16.5 (15.8 – 17.2)
Married	17583	83.5 (82.8 – 84.2)
Central Obesity		
Yes	8518	40.5 (39.3 – 41.6)
Normal	12537	59.5 (58.4 – 60.7)
Smoking		
Yes	6631	31.5 (30.6 – 32.4)
No	14424	68.5 (67.6 – 69.4)
Physical Activity		
Less-active	13400	63.6 (62.5 – 64.8)
Active	7655	36.4 (35.2 – 37.5)
Stress		
Yes	1395	6.6 (6.0 – 7.3)
No	19660	93.4 (92.7 – 94.0)
Dietary of fatty food		
Yes	13846	65.7 (62.5 – 70.2)
No	7209	34.3 (32.1 – 36.6)
Dietary of fruit and vegetable		
Low	19550	92.9 (92.2 – 93.5)
Adequate	1505	7.1 (6.5 – 7.8)
Coffee Consumption		
Yes	8282	39.3 (37 – 41.8)
No	12773	60.7 (58 – 63.4)

found different p-value in central obesity. In bivariate analysis, central obesity was not associated with HDL Level (p-value>0.05), but in logistic regression, it was associated and become main factor to predicte HDL level. Central obesity become the main factor because has highest OR than others [1.948 (95% CI 1.740-2.182; p-value=0.000)]. The second was smoking with OR 1.284 (95% CI 1.127-1.462; p-value=0.000). The fourth or the last model found after confounding analysis for all adjusted factors.

HDL Level

Preliminary data showed that the average HDL level of subjects was 48.66 mg/dl (±12.444, min-max 10-219 mg/dl). In this study, found that subjects (18-59 years) with abnormal HDL level is 26.2% with standar ≤40 mg/dl for abnormal. This found higher than population prevalence in Basic Health Research 2013 (>15 years) namely 22.9% as abnormal HDL level. Higher prevalence showed in Mamat as 76.9% because the standard for abnormal HDL level was <50 mg/dl. Means, with standard <50 mg/dl, the prevalence of abnormal HDL Level will be higher. In other study, Sartika found that 25% subjects have abnormal HDL level with average of age 46.1±10.02 (16,21). The limitation of this study, was used the old standard to define the abnormal HDL level. If we use the last standard from IDF 2006 -abnormal was < 1.03 mmol/l or 40 mg/dl in males and < 1.29 mmol/l or 50 mg/dl in females- we found that prevalence of abnormal HDL level was 43%, higher than before (22).

Second limitation was data availability of risk factor. We only analyzed the variables available in the Basic Health Research 2013, there were variables not available such as the history of dyslipidemia, energy intake (carbohydrate, protein, fat), consumption of antioxidants (A and C vitamins) and history of cardiovascular diseases. So, factors analyzed not represented of all factors were associated with HDL level.

In multivariate analysis, found that sex, marital status, central obesity, smoking and dietary of fatty food was included in prediction model for HDL Level. Central obesity and smoking were higher OR value and had become risk factor because OR>1. Than dietary of fatty food, marital status, and sex become protection factor because OR<1. But, in this study we focused to major risk factors.

Central Obesity

Central obesity become the major factors to reduced HDL level in Indonesia adults and older. Its mean, there were significant association between central obesity with HDL Level adjusted for sex,

Table 2. Adjusted coefficient from linier regression analyses of asssociation between factors and HDL Level

Variables	HDL Level		OR adjusted (95% CI)
	Abnormal (n=5512)	Normal (n = 15543)	
Age***			
45 – 59 years	2092	5998	-
36 – 44 years	1613	4541	-
26 – 35 years	1245	3266	-
18 – 59 years	562	1738	-
Sex			
Women	2386	10806	0.299 (0,261-0,343)
Men	3126	4737	
Marital status			
Unmarried/Divorced	778	2694	0,792 (0,696-0,902)
Married	4734	12849	
Central obesity			
Yes	2297	6221	1,948 (1,740-2,182)
Normal	3215	9322	
Smoking			
Yes	2612	4019	1,284 (1,127-1,462)
No	2900	11524	
Physical Activity***			
Less-active	3296	10104	-
Active	2216	5439	
Stress ***	367	1028	
Yes	5145	14515	-
No			
Dietary of fatty food			
Yes	3417	10429	0,814 (0,737-0,899)
No	2095	5114	
Dietary of fruit and vegetable***			
Low	5084	14466	-
Adequate	428	1077	
Coffee Consumption***			
Yes	2601	5681	-
No	2911	9862	

* result from bivariat analyses
** prediction model and confounding analyses from all variabel (except Stress, p>0.25)
***age exit in fourth model, physical activity in first model, dietary of fruit and vegetable and coffee consumption in in third model, all because change of OR>10%, all factor in last model associated with p-value 0.0000

marital status, smoking, and dietary of fatty food. Darmawan and Irfanuddin also found significant association between central obesity with HDL-cholesterol level (13). In other study found that the inverse association between central obesity (waist circumference/ WC) with HDL-cholesterol in men with age 24-54 years. Its mean, bigger WC causes lower HDL level (11). Subjects with obesity, especially central obesity, have a disorder in the regulation of fatty acids. The disorder make increasing the levels of triglycerides and choleethyl ester (23). The increasing of triglycerides and choleethyl ester caused lowering of HDL2. This condition will also be exacerbated by hypertriglyceridemia and insulin resistance (24).

Central obesity has a significant association with HDL levels after adjusting for other factors. In bivariate analyze, we not found the association. Our assumption, this was related with marital status. Hosseinpour-Niazi showed that married

women have lower HDL level than divorced or unmarried (10). In sub-analyze we found the significant association between central obesity with marital status, women subjects with marital status "married" have more central obesity than unmarried/divorced. Several cross-sectional and longitudinal studies also have shown that married subjects are more often overweight and obese than unmarried subject (25–28). In current study, we concluded from multivariate analyze that central obesity was risk factor for abnormal HDL level and unmarried/divorced was protection factor. However, this association can be attributed to differences in personal lifestyle and dietary habits of the subjects in the community, cannot be generalizing for all population (9). This association are areas that await further investigation.

Smoking

The second risk factor was smoking. Smoking has a significant association in bivariate and multivariate, consistently. Our result was in line with several studies (15,16). The acute effects of cigarette smoking is disorder in fat metabolism, which increase of total cholesterol and triglycerides (29). High triglyceride levels make CETP mediate the transfer of triglycerides to HDL, and formed more large-size HDL. This large-size HDL is an ideal substrate for lipase enzyme in liver, it was released increasing HDL in liver and decreasing HDL in plasma (30).

In sub-analyze of smoking, we found that average of cigarettes was 12.39 per day (SD ± 6.97, min-max 1-46). This finding showed that cigarettes/day were associated with lower HDL level ($p<0,05$). This was evidenced by Framingham Heart Study, recruited 2000 men and 2000 women aged 20-49 years. The decrease of HDL level in men was 4 mg/dl and in women 6 mg/dl (31). In current study finding that an important factor was the number of cigarettes have smoked per day, not length of time have smoked. This finding was same as found by several studies (14,16,32). However, effect of smoking for HDL level is acute. In subjects stopped smoking, HDL level have increased rapidly as found by Nashvilles Vanderbit University that after nicotine abstinence smoking in a week, there was increasing in HDL level as 15% or 7 points (32).

CONCLUSIONS AND RECOMMENDATIONS

In conclusion, central obesity and smoking were major risk factor for lower HDL level in Indonesia adult and older. We may be find the confounding in the association of central obesity for HDL level, because central obesity was an effects from other lifestyle i.e physical activity and dietary habits and further studies should investigate other risk factors. While, cigarette smoking was direct association and it is strongly recommended to avoid smoking for increasing of HDL level.

REFERENCES

1. WHO-Asia Pasific. The Asia-Pacific Perspective: Redefining Obesity and its Treatment. 2000. 56 p.
2. Hoppin A. Evaluation and Management Obesity. In: Duggan C, Watkins J, Walker W, editors. Nutrition in Pediatrics: Basic Science, Clinical Applications. 4 ed. USA: PMPH-USA; 2008.
3. Baig SA, Asif M, Irfani TM, Hussain A, Cheema AM, Malik A, et al. The association of nutritional profile and prognosis of degenerative diseases associated with carbohydrate and lipid metabolism at high altitude of district Ziarat, Pakistan. Saudi J Biol Sci. 2015;22(1):50–5.
4. McKeigue PM, Marmot MG. Mortality from Coronary Heart Disease in Asian Communities in London. BMJ. 1988;297(6653):903.
5. Miller GJ, Kotecha S, Wilkinson WH, Wilkes H, Stirling Y, Sanders TAB, et al. Dietary and Other Characteristics Relevant for Coronary Heart Disease in Men of Indian, West Indian and European Descent in London. Atherosclerosis. 1988;70(1–2):63–72.
6. Ministry of Health. Basic Health Research (RISKESDAS) 2007. Jakarta; 2008.
7. Ministry of Health. Basic Health Research (RISKESDAS) 2013. Jakarta; 2014.
8. Okęcka-Szymańska J, Hübner-Woźniak E, Piątkowska I, Malara M. Effects of age, gender

and physical activity on plasma lipid profile. Biomed Hum Kinet. 2011;3:1–5.
9. Atiku M, Yusuf A. Marital status and occupation versus serum total cholesterol and HDL-cholesterol levels in healthy adults from Kano Metropolis, Nigeria. Bayero J Pure Appl Sci. 2011;4(1):110–1.
10. Hosseinpour-niazi S, Mirmiran P, Hosseinpanah F, Fallah- A. Association of Marital Status and Marital Transition With Metabolic Syndrome: Tehran Lipid and Glucose Study. Int J Endocrinol Metab. 2014;12(4):1–9.
11. Priyanto R, Tejoyuwono A, Novianry V. Relationship Between Abdominal Circumference and Levels of High Density Lipoprotein (HDL) Using Precipitation Methods in Male Employees Pamomg Praja Police Unit (Satpol PP) in Pontianak City. J Mhs PSPD FK Univ Tanjungpura. 2013;2(1):1–16.
12. Gotera W, Aryana S, Suastika K, Santoso A, Kuswardhani T. Correlation between Central Obesity and Adiponection in Geratric Coronary Heart Disease Patients. J Intern Med. 2006;7(2):102–7.
13. Darmawan H, Irfanuddin I. Effect of age and sex on the association between lipid profile and obesity among telecomunication workers in Palembang. Med J Indones. 2007;16(4):251–6.
14. Supriyono M, Hadisaputro S, Sugiri, Udiyono A, Adi MS. Risk Factors for Coronary Heart Disease (CHD) in group od aged <45 years (Case Study in Dr. Kariadi Hospital Semarang and Telogorejo Hospital Semarang). Universitas Diponegoro. 2008.
15. Parchwani D, Upadhyah A, Chandan D. Effect of Active Smoking on Glucose Tolerance and Lipid Profile. Int J Med Sci Public Heal. 2013;2(1):20–5.
16. Mamat, Sudikno. Determinant of HDL Cholesterol Level (Indonesian Family Life Survey DATA ANALYSIS 2007/2008). Gizi Indones. 2010;33(2):143–9.
17. Boehm JK, Williams DR, Rimm EB, Ryff C, Kubzansky LD. Relation Between Optimism and Lipids in Midlife. Am J Cardiol. 2013;111(10):1425–31.
18. Onabanjo Oluseye O, Aderibigbe Olaide R, Agbon Chineze A, Clara Oguntona B. Effect of physical activity level on lipid profile of adults working in tertiary institutions in Abeokuta, South-Western Nigeria. Int J Trop Med. 2012;7(2):93–7.
19. Sulastri D, Rahayuningsih S. Fat, Fiber and Antioxidant Consumption Pattern and Its Relation to Lipid Profiles in Minangkabau Ethnic Men. Maj Kedokt Indones. 2005;55(2):61–6.
20. Uto-Kondo H, Ayaori M, Ogura M, Nakaya K, Ito M, Suzuki A, et al. Coffee Consumption Enhances High-Density Lipoprotein-mediated Cholesterol Efflux in Macrophages. Circ Res. 2010;106(4):779–87.
21. Sartika R. Effect of Trans Fatty Acids Intake on Blood Lipid Profile of Workers in East Kalimantan, Indonesia. Malays J Nutr. 2011;17(1):119–27.
22. Alberti KGMM, Zimmet P, Shaw J. Metabolic Syndrome -a new world- wide definition. A Consensus Statement from the International Diabetes Federation. Diabet Med. 2006;23(5):469–80.
23. Brunner EJ, Chandola T, Marmot MG. Prospective effect of job strain on general and central obesity in the Whitehall II Study. Am J Epidemiol. 2007;165(7):828–37.
24. Sniderman AD, Bhopal R, Prabhakaran D, Sarrafzadegan N, Tchernof A. Why Might South Asians be so Susceptible to Central Obesity and its Atherogenic Consequences? The Adipose Tissue Overflow Hypothesis. Int J Epidemiol. 2007;36(1):220–5.
25. Erem C, Arslan C, Hacihasanoglu A, Deger O, Topbaş M, Ukinc K, et al. Prevalence of Obesity and Associated Risk Factors in a Turkish Population (Trabzon City, Turkey). Obes Res. 2004;12(7):1117–27.
26. Janghorbani M, Amini M, Rezvanian H, Gouya M, Delavari A, Alikhani S, et al. Association of Body Mass Index and Abdominal Obesity with Marital Status in Adults. Arch Iran Med. 2008;11(3):274–81.
27. Tur JA, Serra-Majem L, Romaguera D, Pons A. Profile of Overweight and Obese People

in a Mediterranean Region. Obes Res. 2005;13(3):527–36.
28. Tzotzas T, Vlahavas G, Papadopoulou SK, Kapantais E, Kaklamanou D, Hassapidou M. Marital Status and Educational Level Associated to Obesity in Greek Adults: Data from the National Epidemiological Survey. BMC Public Health. 2010;10(732):1–8.
29. Wowor FJ, Ticoalu S, Wongkar D. Perbandingan Kadar Trigliserida Darah Pada Pria Perokok dan Bukan Perokok. J e-Biomedik. 2013;1(2).
30. Craig CL, Marshall AL, Sjöström M, Bauman AE, Booth ML, Ainsworth BE, et al. International physical activity questionnaire: 12-Country reliability and validity. Med Sci Sports Exerc. 2003;35(8):1381–95.
31. Garrison RJ, Kannel WB, Feinleib M, Castelli WP, McNamara PM, Padgett SJ. Cigarette smoking and HDL cholesterol the Framingham offspring study. Atherosclerosis. 1978;30(1):17–25.
32. Oeser A, Goffaux J, Snead W, Carlson M. Plasma Leptin Concentrations and Lipid Profiles during Nicotine Abstinence. Am J Med Sci. 1999;318(3):152–7.