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ORIGINAL RESEARCH

Changes in High-Density Lipoprotein Cholesterol Levels in Relation to Coffee Consumption Among Taiwanese Adults

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Purpose: High-density lipoprotein cholesterol (HDL-C) is essential for cardiometabolic health. Coffee consumption influences the body's ability to regulate serum lipid profile. Although there is extensive information on coffee and cholesterol, not much is known whether changes in HDL-C concentrations are affected by coffee with or without flavoring substances.

Materials and Methods: Using historical data collected from 1272 participants in Li-Shin (Landseed) International Hospital in Northern Taiwan, we examined the relationship between HDL-C and consumption of plain black coffee with and without additives. Data on coffee consumption between 2006 and 2019 were collected based on self-reported questionnaires while HDL-C measurements were obtained from the electronic medical records of the hospital. *t*-test, chi-square test and multivariate linear regression analysis were used for analysis.

Results: In our primary analysis, we found that coffee consumption of ≥5 cups per week was positively associated with HDL-C (β = 1.9586, p=0.0442) compared with the lowest level (<1 cup/week) of consumption. We found in a separate model that higher (≥5 cups/week) or lower (1–4 cups/week) consumption of plain black coffee without additives was associated with higher HDL-C. The corresponding β values were 4.0674 (p = 0.0007) and 4.1253 (p = 0.0008), respectively. However, HDL-C levels were not affected by coffee with additives.

Conclusion: We found that consumption of black coffee without additives was associated with higher concentrations of HDL-C among Taiwanese adults over the age of 30. However, HDL-C levels did not change significantly among individuals who consumed black coffee with additives.

Keywords: coffee, cardiometabolic health, caffeine, lipid

Introduction

High-density lipoprotein cholesterol is one of the major components of metabolic syndrome that have been greatly associated with several conditions including cardiovascular diseases (CVD).[1] Managing dyslipidemia (defined as high concentrations of triglyceride (TG) and low-density lipoprotein cholesterol (LDL-C), and/or low HDL-C)[2] is an important step aimed at reducing CVD risk.[2,3] In recent years, lipid therapy had been seen as an appropriate means of preventing coronary heart diseases.[4] Of the serum lipids, HDL-C has been widely investigated and found to be influenced by several lifestyle variables including exercise, alcohol drinking,

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diet, coffee consumption, and body mass index.[5] However, its association with coffee consumption has remained inconsistent.[6–8]

Coffee consumption is increasing rapidly in many parts of the world including Taiwan. Observational studies have suggested that drinking 1–4 cups of coffee a day may help to reduce the risk of MetS.[9–11] According to evidence from previous epidemiological studies, moderate coffee drinking appears to be beneficial to cardiovascular health.[12–14] On the other hand, contrary findings have also emerged.[15,16] Because of the variability previously observed across studies, more investigations are required to clarify these associations.

Associations between normal coffee drinking and cardiometabolic risk factors or biomarkers (such as HDL-C, total cholesterol, and LDL-C) have so far been described.[17] Nonetheless, results have been conflicting. With attention directed towards HDL-C, it remains debatable whether its concentration is altered by coffee as some have suggested that possible increases may depend on the type of coffee consumed.[18] So far, no study to our knowledge has attempted to describe such an association in Taiwan. To clarify this, we compared changes in HDL cholesterol levels among Taiwanese adults who consumed plain black coffee with no additives versus plain black coffee with additives.

Materials and Methods

Study Population

Data used in this study were from Li-Shin Outreach Neighborhood Screening (LIONS) project that was established in 2005 by the Landseed International Hospital in Pingzhen District, Taoyuan, Taiwan. The major objective of this project was to survey chronic disease and the potential risk factors among Taiwanese adults resident in PinZhen District.[19] Eligible participants included those over 30 who had lived in the City for at least 30 years.[20] These participants provided written informed consent. A self-administered questionnaire on medical history, lifestyle, and diet was completed by each participant before going through physical examinations. The LIONS project was conducted in accordance with the Declaration of Helsinki, and approval for this study was by the Institutional Review Board of Li-Shin Hospital (LSHIRB No./Protocol No 17–019).

In this study, the overall data were from 1272 participants who were recruited between 2006 and 2019.

Assessment of Coffee Consumption

Information on coffee consumption and other lifestyle variables was collected based on self-reported questionnaires. Participants responded "yes" to having a habit of drinking coffee. They reported drinking either plain black coffee alone or together with additives, and the number of cups consumed each week. Each cup had a capacity of approximately 240 mL. Alcohol drinkers were those who consumed on average 350 cc of wine, or 150 cc of beer, or 10 cc of spirit or distilled liquor (whiskey, vodka, rum, etc.) per day. Details of the other lifestyle variables in our model have been previously described.[21]

Assessment of Blood Lipids

Blood samples were collected from patients (n = 1272) at Li-Shin hospital. Serum concentrations of HDL-C and other lipids were measured using the Hitachi 7600/7180 automated biochemical analyzer (Hitachi, Tokyo, Japan).

Statistical Analysis

We performed statistical analysis using the SAS 9.4 (SAS Institute Inc., Cary, North Carolina, USA) version. Coffee consumption was categorized as <1, 1–4, and ≥5 cups per week. We compared categorical variables using the Chi-square test. Paired samples were compared using the Student's *t*-test. Results were represented as mean ± standard deviation (SD) or as n (%). Multivariate linear regression analysis was performed to evaluate the effect of coffee on HDL-C. Independent parameters included age, sex, cigarette smoking, alcohol intake (betel nut chewing, body mass index, determined as weight (kg)/height (m^2), vegetarian diet, exercise, and non-HDL cholesterol, defined as total cholesterol minus the HDL-C (<130 mg/dl representing normal values, and ≥ 130 mg/dl representing higher values). The β-coefficients and p-values were reported.

Results

Demographic characteristics of the study participants are presented in Table 1. The mean HDL-C was 57.43 mg/dL among participants who consumed black coffee with additives and 60.37 mg/dL among those who consumed only plain black coffee (p = 0.0007). Association of HDL-C with overall coffee consumption is presented in Table 2. Compared with the lowest level of coffee consumption (<1 cup/week), coffee consumption of ≥5 cups/week was associated with higher HDL-C (β = 1.9586, p=0.0442). However, coffee consumption of 1–4 cups/week was not

Table 1 Demographic Characteristics of Study Participants

Variables	Black Coffee with Additives (n=773)	Black Coffee with No Additives (n=499)	*p*-value
HDL-C, mg/dL	57.43±0.5278	60.37±0.6923	0.0007
Coffee consumption (cups/wk)			<0.0001
<1	247(31.95)	57(11.42)	
1–4	299(38.68)	232(46.49)	
≥5	227(29.37)	210(42.08)	
Sex			0.0337
Women	445(57.57)	257(51.50)	
Men	328(42.43)	242(48.50)	
Age (year)	51.55±0.3933	47.43±0.4626	<0.0001
Cigarette smoking			0.6975
Never	563(72.83)	358(71.74)	
Former	58(7.50)	34(6.81)	
Current	152(19.66)	107(21.44)	
Alcohol drinking			0.0003
Never	677(87.58)	397(79.56)	
Former	22(2.85)	17(3.41)	
Current	74(9.57)	85(17.03)	
Betel nut chewing			0.1010
Never	705(91.20)	471(94.39)	
Former	35(4.53)	13(2.61)	
Current	33(4.27)	15(3.01)	
BMI (kg/m^2)			0.4796
< 18.5	21(2.72)	17(3.41)	
18.5–23.9	340(43.98)	222(44.49)	
24.0–26.9	241(31.18)	138(27.66)	
≥ 27.0	171(22.12)	122(24.45)	
Vegetarian diet			0.4908
No	709(91.72)	463(92.79)	
Yes	64(8.28)	36(7.21)	
Exercise			<0.0001
No	335(43.34)	144(28.86)	
Yes	438(56.66)	355(71.14)	
Non-HDL			0.5883
<130 mg/dL	292(37.77)	181(36.27)	
≥130 mg/dL	481(62.23)	318(63.73)	

Note: Variables are presented as numbers (percentages) or means (SD).
Abbreviations: SD, standard deviation; BMI, body mass index.

associated with HDL-C (β = 1.5635, p=0.0919). HDL-C levels were lower (β = −2.3558, p=0.0021) in participants with higher levels of non-HDL (≥ 130 mg/dl) compared with the lower levels (≤130mg/dl). We also observed that men had lower HDL-C than women (β = −11.7347, p<0.0001).

Table 2 Changes in HDL-C Concentrations Based on Coffee Consumption

Variables	β-Coefficient	p-value
Coffee consumption (cups/wk) (Ref: <1)		
1–4	1.5635	0.0919
≥5	1.9586	0.0442
Sex (Ref: Women)		
Men	−11.7347	<0.0001
Age (year)	0.0337	0.3214
Cigarette smoking (Ref: Never)		
Former	0.7722	0.6133
Current	−2.3824	0.0304
Alcohol drinking (Ref: Never)		
Former	5.7309	0.0083
Current	5.7832	<0.0001
Betel nut chewing (Ref: Never)		
Former	−.3.4260	0.0853
Current	−1.5094	0.4491
BMI, kg/m^2 (Ref: 18.5–23.9)		
<18.5	5.1591	0.0166
24.0–26.9	−5.0620	<0.0001
≥27.0	−9.8979	<0.0001
Vegetarian diet (Ref: No)		
Yes	0.6056	0.6492
Exercise(Ref: No)		
Yes	1.4178	0.0593
Non-HDL(Ref: <130 mg/dL)		
≥130 mg/dL	−2.3558	0.0021

Abbreviations: β, beta; wk, week; ref, reference; BMI, body mass index.

Furthermore, HDL-C levels of current smokers were lower than in never smokers (β = −2.3824, p = 0.0304). Compared with nondrinkers, alcohol drinking was significantly associated with higher HDL-C among former (β = 5.7309, p = 0.0083) and current (β = 5.7832, p<0.0001) drinkers. We also examined changes in HDL-C levels based on consumption of coffee brewed with and without additives (Table 3). When the category, <1 cup/week of black coffee with additives was used as the reference category, the corresponding β-coefficients for categories of 1–4 and ≥5 cups/week of black coffee with additives were 0.4995 (p = 0.6488) and 0.8860 (p=0.4543), respectively. Those for categories of <1, 1–4, and ≥5 cups/week of black coffee without additives were 1.9295 (p = 0.3052), 4.0674 (p = 0.0007), and 4.1253 (p = 0.0008), respectively.

Table 3 Changes in HDL-C Based on Consumption of Plain Black Coffee with and without Additives

Variables	β-Coefficient	*p*-value
Coffee consumption (Ref: coffee with additives (<1 cup/wk)		
Coffee with additives, 1–4 cups/wk	0.4995	0.6488
Coffee with additives, ≥5 cups/wk	0.8860	0.4543
Black coffee only/<1 cup/wk	1.9295	0.3052
Black coffee only, 1–4 cups/wk	4.0674	0.0007
Black coffee only, ≥5 cups/wk	4.1253	0.0008
Sex (Ref: Women)		
Men	−12.0459	<0.0001
Age (year)	0.0570	0.0966
Cigarette smoking (Ref: Never)		
Former	1.0855	0.4756
Current	−2.2314	0.0419
Alcohol drinking (Ref: Never)		
Former	5.2311	0.0157
Current	5.3071	<0.0001
Betel nut chewing (Ref: Never)		
Former	−2.7443	0.1677
Current	−0.8676	0.6626
BMI, kg/m^2 (Ref: 18.5–23.9)		
<18.5	5.0816	0.0178
24.0–26.9	−4.9592	<0.0001
≥ 27.0	−9.8681	<0.0001
Vegetarian diet (Ref: No)		
Yes	0.6096	0.6453
Exercise(Ref: No)		
Yes	0.9313	0.2184
Non-HDL(Ref: <130 mg/dL)		
≥130 mg/dL	−2.4446	0.0013

Abbreviations: β, beta; wk, week; ref, reference; BMI, body mass index.

Discussion

In this study, we observed that coffee consumption of ≥5 cups per week was greatly associated with higher levels of HDL-C among Taiwanese adults 30 years and older. However, there was no association between HDL-C and coffee consumption of 1–4 cups per week. Prior clinical studies have suggested that higher consumption of coffee may improve HDL-C.[22,23] On the contrary, other studies have found no association between coffee consumption and HDL-C.[17,24,25]

In this study, we performed more analysis to determine whether changes in HDL-C are affected by coffee brewed with or without additives. When we used the lowest category, <1 cup/week of black coffee with additives as the reference group, we found that the association between coffee and HDL-C was stronger only among those that consumed 1–4 (β = 4.0674, p = 0.0007) and ≥5 cups (β = 4.1253, p = 0.0008) of plain black coffee without additives. Higher (≥5 cups/week) or lower (1–4 cups/week) consumption of plain black coffee with additives did not have any substantial effect on HDL-C levels. Findings from a randomized cross over study showed that HDL-C levels of patients who consumed a single 6-oz cup of black coffee with no flavoring substances significantly rose from 43.2 mg/dL to 44.8 mg/dL (p<0.001).[26] However, no significant changes were observed among patients who consumed coffee with creamer and sugar. The biological mechanism by which black coffee may alter HDL-C levels is not clear. However, according to Cheung and his colleagues, such an increase may be associated with the concomitant decrease in triglycerides.[26] Further investigations are required to support or clarify these findings.

In the primary analysis, we observed that HDL-C values were relatively lower in men than women. Another interesting finding was that higher concentrations of non-HDL-C (≥130 mg/dl) were greatly associated with lower HDL-C (β = −2.3558 (p = 0.0021). Higher values of non-HDL cholesterol are predictive of cardiovascular disease: Decreased levels have been associated with a lower risk of cardiovascular diseases among older adults.[27] In our study, overweight and obesity also showed a strong but negative association with HDL-C. Physical exercise was weakly associated with HDL-C whereas the association did not differ by diet and betel nut chewing.

Despite these preliminary findings, it is wise stating our limitations. First, information on coffee consumption was collected based on a self-reported questionnaire. This might have introduced misclassification bias. Second, we could not determine the brew mechanism, the amount of coffee used, and the roasting time, which in part are believed to influence serum lipids. Next, data were not available on the exact ranges of cream, milk, sugar, or other flavoring substances that might have been used. Finally, data were from participants who were resident only in the Pingzhen District. Therefore, our findings may not be generalized.

Conclusions

Taken together, our findings indicated that consumption of black coffee without additives was associated with higher concentrations of HDL cholesterol among Taiwanese adults over the aged over 30 years. However, HDL-C levels were not affected by consumption of coffee with additives. We believe that these preliminary findings may be useful for future investigations on coffee drinking and cardiometabolic health.

Disclosure

The authors report no conflicts of interest in this work.

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