

Association Between Total Cholesterol Levels and Hypertension Among Medan Customs Office Employees

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ABSTRACT

Blood pressure elevation may coexist with disturbances in lipid metabolism. We investigated whether total-cholesterol categories were related to blood-pressure classifications in staff members at the Medan Customs and Excise Office. This analytic cross-sectional study randomly selected 51 employees from a workforce of 105. Total cholesterol was determined with an Autocheck meter, and blood pressure was recorded with a digital sphygmomanometer. Categorical data were summarized by frequency and proportion; the relationship between the two variables was evaluated using Pearson's chi-square test. Of the participants, 26 (51.0%) had desirable cholesterol, 19 (37.3%) had borderline-high values, and 6 (11.8%) had high values. Blood-pressure classification was normal for 12 employees (23.5%), prehypertensive for 16 (31.4%), stage I hypertensive for 18 (35.3%), and stage II hypertensive for 5 (9.8%). Four of the six employees in the high-cholesterol group had stage II hypertension. A significant relationship was found between total-cholesterol and blood-pressure categories ($\chi^2(6)=39.583$; $p<0.001$). These results support incorporating both measurements into periodic occupational health assessments.

Keywords: blood pressure, total cholesterol, hypertension, employees, cross-sectional analysis

INTRODUCTION

Hypertension can remain clinically silent until blood pressure is checked, even though it raises the likelihood of heart disease, stroke, renal disease, and early death [1]. Measurements obtained in the 2018 Indonesian Basic Health Research (Riskesdas) indicated that 34.1% of the country's adult population had hypertension [2]. This substantial burden makes it important to investigate variables related to blood pressure in occupational populations with different characteristics [3].

Cholesterol is an essential constituent of cell membranes and a precursor for steroid hormones. Disturbances in lipid metabolism, however, can occur alongside atherosclerotic change and impaired vascular function [4]. An association between low-density lipoprotein (LDL) concentration and hypertension has also been observed in health-screening populations [5]. Because the present examination quantified total cholesterol rather than individual lipid fractions, it cannot determine separately the roles of triglycerides or the low- and high-density lipoprotein fractions.

Food consumption patterns, habitual activity, and occupational conditions may influence both lipid status and blood pressure. Previous work has documented differences in the average values of these measures between village-office personnel and farmers [6]. Other investigators have explored cholesterol-hypertension

relationships in older people [7] and the role of medication education in antihypertensive adherence [8]. Together, these studies justify an employee-based assessment of cholesterol and blood pressure, while not implying that the occupation itself alters either measurement.

Accordingly, the present cross-sectional investigation used measurements obtained at one visit to characterize total-cholesterol and blood-pressure distributions among Medan Customs and Excise Office employees and determine whether their categorical classifications were related.

RESEARCH METHODS

This analytic observational investigation used a cross-sectional approach and took place at the Medan Customs and Excise Office between February and July 2026 [9]. The source population comprised 105 employees. Applying Slovin's formula with a 10% error tolerance produced a minimum sample of 51, who were then chosen through simple random sampling [10].

Current employees aged at least 18 years could participate after giving informed consent and agreeing to cholesterol and blood-pressure testing. We excluded employees who routinely used antihypertensive or lipid-lowering drugs, had an illness or other condition capable of influencing the measurements, were

unavailable at the time of data collection, or had incomplete or invalid results.

An Autocheck analyzer provided the total-cholesterol values. Following NCEP ATP III [11], readings were grouped as desirable (<200 mg/dL), borderline high (200-239 mg/dL), or high (≥ 240 mg/dL). Blood pressure was obtained twice with a digital sphygmomanometer and classified under JNC 7 [12]: normal when systolic pressure was <120 and diastolic pressure was <80 mmHg; prehypertension when systolic pressure was 120-139 or diastolic pressure was 80-89 mmHg; stage I hypertension when systolic pressure was 140-159 or diastolic pressure was 90-99 mmHg; and stage II hypertension when systolic pressure was ≥ 160 or diastolic pressure was ≥ 100 mmHg. If the systolic and diastolic readings corresponded to different groups, the more severe classification was assigned.

Counts and percentages summarized age, sex, duration of employment, cholesterol classification, and blood-pressure classification. We applied Pearson's chi-square test to determine whether the distribution of blood-pressure categories varied by cholesterol category [13]. Statistical significance was set at $p < 0.05$; the software-derived result is reported as $p < 0.001$.

RESULT AND DISCUSSION

Participant profile and measured outcomes

Fifty-one employees were included. The age distribution comprised 25 participants (49.0%) younger than 35 years, 17 (33.3%) aged 36-45 years, and 9 (17.6%) older than 45 years. The sample included men and women in proportions of 84.3% ($n=43$) and 15.7% ($n=8$), respectively. Sixteen employees (31.4%) had worked for less than 5 years, 11 (21.6%) for 5-10 years, and 24 (47.1%) for more than 10 years. Consequently, men and those employed for more than a decade were the largest subgroups. Associations between these characteristics and blood pressure were not analyzed.

Desirable total cholesterol (<200 mg/dL) was recorded in 26 participants (51.0%). Borderline-high values (200-239 mg/dL) occurred in 19 (37.3%), and 6 participants (11.8%) had high values (≥ 240 mg/dL). Overall, 25 of the 51 employees (49.0%) fell into either the borderline-high or high category. These classifications were subsequently cross-tabulated with blood-pressure status.

Twelve employees (23.5%) had normal blood pressure, while 16 (31.4%) were classified as prehypertensive, 18 (35.3%) as stage I hypertensive, and 5 (9.8%) as stage II hypertensive. Stage I was the most common classification. Combining stages I and II yielded 23 employees (45.1%). Table 1 provides the complete descriptive distribution for the study sample.

Table 1. Participant profile and distribution of total cholesterol and blood pressure classifications ($n=51$)

Characteristic	Classification	n (%)
Age group	<35 years	25 (49.0)
	36-45 years	17 (33.3)
	>45 years	9 (17.6)
Sex	Male	43 (84.3)
	Female	8 (15.7)
Employment duration	<5 years	16 (31.4)
	5-10 years	11 (21.6)
	>10 years	24 (47.1)
Total cholesterol category	Desirable (<200 mg/dL)	26 (51.0)
	Borderline high (200-239 mg/dL)	19 (37.3)
	High (≥ 240 mg/dL)	6 (11.8)
	Normal	12 (23.5)
Blood pressure category	Prehypertension	16 (31.4)
	Stage I hypertension	18 (35.3)
	Stage II hypertension	5 (9.8)

Note: Each percentage was calculated using all 51 participants as the denominator; the age intervals follow the categories defined for this study.

Cross-tabulation of cholesterol and blood pressure categories

Blood-pressure profiles varied among the three cholesterol groups. In the desirable category ($n=26$), normal blood pressure accounted for 46.2% ($n=12$), prehypertension for 30.8% ($n=8$), and stage I hypertension for 23.1% ($n=6$); no participant met the criteria for stage II. Among the 19 employees with borderline-high cholesterol, 42.1% ($n=8$) had prehypertension, 52.6% ($n=10$) had stage I hypertension, and 5.3% ($n=1$) had stage II hypertension. Normal blood pressure was not recorded in this group.

Within the six-person high-cholesterol category, stage II hypertension accounted for 66.7% ($n=4$), whereas the remaining 33.3% ($n=2$) had stage I hypertension. Viewed from the blood-pressure categories, every normotensive employee (12/12) had desirable cholesterol, whereas high cholesterol was present in 4 of the 5 employees (80.0%) with stage II hypertension. The two percentages use different denominators: six employees with high cholesterol and five with stage II hypertension, respectively. Percentages displayed in Table 2 are row percentages based on the total in each cholesterol group.

Table 2. Blood pressure classification according to total cholesterol category (n=51)

Cholesterol category	Normal	Prehypertension	Stage I	Stage II	Total
Desirable	12 (46.2)	8 (30.8)	6 (23.1)	0 (0.0)	26 (100)
Borderline high	0 (0.0)	8 (42.1)	10 (52.6)	1 (5.3)	19 (100)
High	0 (0.0)	0 (0.0)	2 (33.3)	4 (66.7)	6 (100)
Total	12	16	18	5	51

Pearson's test confirmed that the two categorical variables were related ($\chi^2(6)=39.583$; $p<0.001$). Stage II hypertension was absent from the desirable-cholesterol group (0/26), present in 1 of 19 employees (5.3%) with borderline-high cholesterol, and present in 4 of 6 employees (66.7%) with high cholesterol. Thus, higher cholesterol classifications contained progressively larger proportions of severe blood-pressure categories. The high-cholesterol estimate is based on only six individuals, so the percentages should be considered alongside their underlying counts.

The analysis compares distributions between categorical measurements; it does not quantify the blood-pressure change associated with a 1 mg/dL difference in cholesterol. Moreover, both measurements were obtained at one point in time, preventing determination of which change occurred first. Accordingly, Table 2 identifies a relationship within this sample but cannot show that elevated cholesterol produced hypertension.

Comparison with previous research

In Sulastris's investigation of 172 individuals with hypertension, cholesterol level was related to hypertension stage [14]. Permatasari et al. likewise reported a significant result ($p=0.001$) in 30 hypertensive patients aged 40 years or older who attended the Posbindu at Batipuh Selatan Community Health Center [15]; elevated blood pressure occurred more often among those with high cholesterol. Although the participants differed from those in the present study, the direction of these reports supports joint consideration of the two measurements.

Solikin and Muradi studied 41 hypertensive patients at Sungai Jingah Community Health Center and identified a relationship between cholesterol and hypertension stage with Spearman analysis ($p=0.004$) [16].

Arif et al. evaluated 97 participants in the Sungai Raya Dalam Community Health Center service area and found a positive correlation ($r=0.353$) [17]. Both this result and the findings of Solikin and Muradi point in the same direction as the cross-tabulation in Medan Customs and Excise Office employees. Their correlation coefficients, however, cannot be interpreted as the magnitude of the relationship in our sample because the statistical approaches were not the same.

Interpretation across studies also requires attention to sampling differences. Permatasari et al. enrolled only hypertensive patients aged at least 40 years [15], while the present study accepted employees aged 18 years or older, including those with normal blood pressure. Solikin and Muradi also recruited hypertensive patients from a health facility [16].

Variations in age, clinical status, recruitment, and blood-pressure classification can alter the observed distribution. Therefore, agreement in direction should not be taken to mean that the strength of the association is identical in each population.

From a physiological perspective, abnormal lipid patterns may coexist with atherosclerotic plaque, loss of arterial elasticity, and endothelial impairment [4], [5]. These mechanisms could partly account for the observed blood-pressure relationship. Nevertheless, neither atherosclerosis nor endothelial function was measured in this study. The use of total cholesterol alone also prevents separate evaluation of LDL, HDL, and triglyceride fractions.

Yogeswara et al. considered body mass index together with cholesterol when examining hypertension [18]. Our analysis included neither body mass index nor salt consumption, activity level, tobacco use, psychosocial stress, or familial hypertension. Although age, sex, and employment duration were described, we did not perform a multivariable model to establish whether the cholesterol-blood pressure relationship remained after controlling for these potential influences.

Occupational health surveillance should measure cholesterol as well as blood pressure. Desirable cholesterol did not invariably coincide with normal blood pressure; six employees in this cholesterol category had stage I hypertension. Regular screening can be paired with counseling on nutrition and physical activity and with clinical follow-up appropriate to each employee's findings [3], [18].

Several limitations constrain interpretation. All 51 participants worked in one office, only bivariate testing was performed, and employees regularly taking antihypertensive or lipid-lowering agents were not eligible. The source data did not specify fasting status for cholesterol measurement, device calibration, or the elapsed time between the two blood-pressure readings. Finally, the single-occasion design provides no estimate of incident hypertension and cannot establish the chronological order of changes in cholesterol and blood pressure.

CONCLUSION

In this sample, total-cholesterol classification was significantly related to blood-pressure classification ($\chi^2=39.583$; $p<0.001$). Four of the six Medan Customs and Excise Office employees with high cholesterol were classified as having stage II hypertension. Because the study was cross-sectional and did not control for potential confounding variables, the result should be interpreted as an association rather than evidence of causation. Routine assessment of both measures may be useful, and future studies that collect additional

covariates could characterize the relationship more fully.

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