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Lipid Profile Abnormalities and Cardiovascular Risk among Hypertensive Patients in Al-Hussein Teaching Hospital in Al-Samawa, Iraq, 2023-2024

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Abstract: Background: Hypertension is a major public health challenge globally and in Iraq, serving as a primary risk factor for cardiovascular disease (CVD). The coexistence of dyslipidemia significantly amplifies this risk. Understanding the local pattern of lipid abnormalities and the aggregated cardiovascular risk is crucial for effective preventive strategies. This study aimed to assess the prevalence of lipid profile abnormalities and estimate the 10-year cardiovascular risk among hypertensive patients attending Al-Hussein Teaching Hospital in Al-Samawa, Iraq. Methods: A cross-sectional study was conducted at the outpatient cardiology clinic of Al-Hussein Teaching Hospital from January 2023 to December 2024. A total of 384 adult patients with a confirmed diagnosis of essential hypertension were enrolled. Data on sociodemographics, clinical characteristics, and lifestyle factors were collected through interviews and medical records. Fasting blood samples were analyzed for total cholesterol (TC), triglycerides (TG), low-density lipoprotein cholesterol (LDL-C), and high-density lipoprotein cholesterol (HDL-C). The 10-year risk of fatal and non-fatal CVD was calculated using the WHO/ISH risk prediction charts for the Eastern Mediterranean Region. Statistical analysis was performed using SPSS version 26, with a p-value <0.05 considered significant. Results: The prevalence of dyslipidemia among hypertensive patients was 78.1%. The most common abnormality was low HDL-C (54.9%), followed by high LDL-C (48.7%), hypertriglyceridemia (41.1%), and hypercholesterolemia (35.9%). According to the WHO/ISH risk stratification, 28.9% of patients were in the high to very high 10-year CVD risk category (>20%). A significant association was found between increasing age, male gender, smoking, obesity, and higher CVD risk categories (p<0.05). Conclusion: Lipid profile abnormalities, particularly low HDL-C, are highly prevalent among hypertensive patients in Al-Samawa, leading to a substantial proportion being at high risk for future cardiovascular events. These findings underscore the urgent need for routine screening and integrated management of both blood pressure and lipid levels in this population to mitigate the burgeoning burden of CVD in Iraq.

Keywords: Hypertension, Dyslipidemia, Cardiovascular Risk, Lipid Profile, Iraq, WHO/ISH Risk Chart.

Introduction

Cardiovascular diseases (CVDs) remain the leading cause of mortality and morbidity worldwide, accounting for an estimated 17.9 million deaths each year (1). This global burden is disproportionately shouldered by low- and middle-income countries, where over three-quarters of CVD deaths occur (1). The epidemiological transition in these regions, characterized by urbanization, adoption of sedentary lifestyles, and changing dietary patterns, has fueled a sharp rise in key cardiovascular risk factors (2). Among these, hypertension and dyslipidemia stand out as two of the most potent and prevalent modifiable risk factors, often coexisting and synergistically accelerating the atherosclerotic process (3,4).

Hypertension, or persistently elevated blood pressure, affects more than one billion people globally and is a major independent risk factor for coronary artery disease, heart failure, stroke, and chronic kidney disease (5). Its pathophysiological link to atherosclerosis is multifaceted, involving endothelial dysfunction, increased oxidative stress, and vascular inflammation (6). When hypertension coexists with dyslipidemia—an imbalance in lipid parameters such as elevated total cholesterol (TC), low-density lipoprotein cholesterol (LDL-C), triglycerides (TG), and depressed high-density lipoprotein cholesterol (HDL-C)—the risk of adverse cardiovascular events is not merely additive but multiplicative (4,7). Elevated LDL-C particles infiltrate the arterial intima, where they become oxidized and promote the formation of foam cells, the hallmark of early atherosclerotic plaques (8). Hypertension-induced hemodynamic stress and endothelial injury facilitate this process, creating a perfect storm for plaque development, progression, and eventual rupture (9).

The management of cardiovascular risk has evolved from treating individual risk factors in isolation to a comprehensive, absolute risk-based approach (10). This strategy recognizes that an individual's risk of a future CVD event is determined by the cumulative interaction of multiple risk factors, including age, sex, blood pressure, cholesterol levels, smoking status, and diabetes (11). Guidelines from the World Health Organization (WHO) and the International Society of Hypertension (ISH) advocate for the use of risk prediction charts to guide clinical decision-making, particularly in resource-limited settings (12). These charts, adapted for different WHO epidemiological sub-regions, allow clinicians to estimate a patient's 10-year risk of a major cardiovascular event (fatal or non-fatal), thereby enabling targeted and cost-effective interventions (12,13).

Iraq, a country in the Middle East, is undergoing a rapid health transition. Emerging from decades of conflict and instability, it faces a double burden of communicable and non-communicable diseases (NCDs) (14). Recent studies indicate a high and rising prevalence of NCD risk factors, with hypertension and diabetes being particularly common (15,16). The Iraqi lifestyle, marked by dietary shifts towards high-fat, high-sugar processed foods and decreasing physical activity, has contributed to escalating rates of obesity and metabolic syndrome (17). The healthcare system, while working towards recovery, faces challenges in delivering comprehensive preventive care and chronic disease management, especially in governorates outside the capital (18).

Al-Muthanna Governorate, with its capital Al-Samawa, is one of the southern governorates of Iraq. It is characterized by a predominantly rural population and faces socio-economic challenges that can impact health outcomes (19). Al-Hussein Teaching Hospital serves as the primary tertiary referral center for the governorate, providing specialist care, including cardiology services, to a large and diverse patient population. While hypertension is a common reason for consultation at its outpatient clinics, there is a significant gap in local data regarding the prevalence and pattern of concomitant lipid abnormalities and the overall cardiovascular risk profile of these patients. Most clinical decisions are based on blood pressure control alone, with lipid management often overlooked until a patient presents with a major cardiovascular event.

Understanding the local epidemiology of this risk factor dyad is crucial for several reasons. First, it will establish the true burden of combined risk within this specific population, informing public

health priorities and resource allocation. Second, it will identify the most prevalent types of lipid abnormalities, allowing for targeted dietary and pharmacological interventions. Third, by stratifying patients according to their absolute 10-year CVD risk using a validated tool like the WHO/ISH chart, we can identify high-risk individuals who would benefit most from intensive multifactorial intervention, including statin therapy. This is particularly important in a resource-constrained setting where a risk-based approach ensures that limited resources are directed to those with the greatest potential for benefit.

Despite the global and national evidence on the interplay between hypertension and dyslipidemia, local data from southern Iraq are scarce. Previous Iraqi studies have primarily focused on Baghdad or the Kurdistan region, leaving a knowledge gap for governorates like Al-Muthanna (20,21). The socio-cultural, dietary, and healthcare access factors in Al-Samawa may differ significantly, potentially leading to unique risk factor profiles. Therefore, extrapolating data from other regions may be misleading for local clinicians and health planners.

This study was conceived to address this critical gap in knowledge. It aims to provide a comprehensive analysis of the lipid profile abnormalities and the estimated 10-year cardiovascular risk among a cohort of hypertensive patients attending Al-Hussein Teaching Hospital in Al-Samawa, Iraq, during the period 2022-2023. By doing so, it seeks to generate evidence that can be used to raise awareness among healthcare providers, advocate for routine lipid screening in all hypertensive patients, and inform the development of locally tailored clinical guidelines for comprehensive cardiovascular risk reduction in Al-Muthanna Governorate.

Materials and Methods

Study Design and Setting: This was a hospital-based, cross-sectional study conducted over a two-year period from January 1, 2023, to December 31, 2024. The research was carried out at the outpatient cardiology clinic of Al-Hussein Teaching Hospital, the main public teaching hospital in Al-Samawa city, which serves as the primary referral center for the entire Al-Muthanna Governorate in southern Iraq.

Study Population: The target population was adult patients (aged 40 years and older) with a confirmed diagnosis of essential hypertension who were attending the cardiology clinic for follow-up or consultation. The age threshold of 40 years was chosen as it is the starting point for the WHO/ISH risk prediction charts for the Eastern Mediterranean Region (EMR D), which formed a core part of our analysis (12).

Inclusion Criteria:

1. Patients aged 40 years or older.
2. A documented diagnosis of essential hypertension for at least six months prior to the study. Hypertension was defined as a systolic blood pressure (SBP) ≥ 140 mmHg and/or diastolic blood pressure (DBP) ≥ 90 mmHg on at least two separate occasions, or current use of antihypertensive medication (22).
3. Willingness to provide informed consent to participate in the study.

Exclusion Criteria:

1. Patients with secondary hypertension (e.g., due to renal artery stenosis, pheochromocytoma, or chronic kidney disease).
2. Patients with a history of overt cardiovascular disease, including prior myocardial infarction, stroke, transient ischemic attack, or revascularization procedures (coronary artery bypass grafting or percutaneous coronary intervention), as the WHO/ISH charts are designed for primary prevention risk estimation.
3. Patients with diagnosed diabetes mellitus, as this automatically places them in a higher risk category and the WHO/ISH charts have separate charts for diabetics.
4. Pregnant women.
5. Patients with known thyroid disorders, liver disease, or those taking lipid-lowering medications (e.g., statins or fibrates), as these can significantly alter lipid profiles.
6. Patients who were critically ill or unable to provide informed consent.

Sample Size and Sampling Technique: The sample size was calculated using the single population proportion formula. Based on a previous study in Iraq reporting a prevalence of dyslipidemia among hypertensives to be around 70% (20), with a 95% confidence level and a 5% margin of error, the minimum required sample size was 323. To account for potential non-response and incomplete data, the sample size was inflated by 20%, targeting 388 patients. A systematic random sampling technique was employed. Every third patient attending the cardiology clinic who met the inclusion criteria was approached and invited to participate until the target sample size was achieved. Out of 388 approached patients, 4 declined to participate or had incomplete data, resulting in a final sample of 384 patients.

Data Collection:

Data were collected by two trained physicians using a pre-designed, structured questionnaire. The questionnaire was pilot-tested on 20 patients to check for clarity and feasibility, and modifications were made accordingly. The data collection process had two main components:

1. Interview and Clinical Examination:
 - a. Sociodemographic data: Age (in years), sex, residence (urban/rural), educational level (illiterate/primary/secondary/higher), and occupation.
 - b. Lifestyle factors: Smoking status (current smoker: those who smoked any tobacco product daily; former smoker: those who had quit for at least six months; never smoker). Physical activity was assessed based on self-report (sedentary vs. active).
 - c. Anthropometric measurements: Weight (in kilograms) was measured using a calibrated scale with patients wearing light clothing and no shoes. Height (in meters) was measured using a stadiometer. Body mass index (BMI) was calculated as weight/height² (kg/m²) and categorized according to WHO criteria: underweight (<18.5), normal (18.5-24.9), overweight (25-29.9), and obese (≥30).
 - d. Blood pressure measurement: Blood pressure was measured using a standardized mercury sphygmomanometer with an appropriate cuff size after the patient had rested for at least 10 minutes in a seated position. Two readings were taken 5 minutes apart, and the average was recorded.
2. Laboratory Investigations:

A venous blood sample (5 mL) was drawn from each participant after a 12-hour overnight fast. The samples were centrifuged, and the serum was separated. Lipid profile analysis was performed on the same day in the hospital's central laboratory using an automated chemistry analyzer (Cobas Integra 400 plus, Roche Diagnostics). The following parameters were measured:

- a. Total Cholesterol (TC)
- b. Triglycerides (TG)
- c. High-Density Lipoprotein Cholesterol (HDL-C)
- d. Low-Density Lipoprotein Cholesterol (LDL-C) was calculated using the Friedewald formula: $LDL-C = TC - HDL-C - (TG/5)$, provided TG levels were below 400 mg/dL. For samples with $TG \geq 400$ mg/dL, LDL-C was measured directly.

Dyslipidemia was defined according to the National Cholesterol Education Program Adult Treatment Panel III (NCEP ATP III) guidelines (23) as the presence of one or more of the following:

- a. Hypercholesterolemia: $TC \geq 200$ mg/dL
- b. Hypertriglyceridemia: $TG \geq 150$ mg/dL
- c. High LDL-C: $LDL-C \geq 130$ mg/dL
- d. Low HDL-C: $HDL-C < 40$ mg/dL in men and < 50 mg/dL in women.

Cardiovascular Risk Assessment:

The 10-year risk of a fatal or non-fatal major cardiovascular event (myocardial infarction or stroke) was estimated for each participant using the WHO/ISH risk prediction charts for the Eastern Mediterranean Region, sub-region D (EMR D), which includes Iraq (12). These charts are based on the following variables: age, sex, smoking status (yes/no), systolic blood pressure (in mmHg), and total cholesterol (in mmol/L). Diabetes was an exclusion criterion for this study. For each patient, the total

cholesterol value was converted from mg/dL to mmol/L by dividing by 38.6. The risk was categorized as:

- a. Low: <10%
- b. Moderate: 10% to <20%
- c. High: 20% to <30%
- d. Very High: ≥30%

For the purpose of analysis, these categories were sometimes merged into <10%, 10-19%, and ≥20% (high/very high).

Data Analysis:

Data were entered into a Microsoft Excel spreadsheet and analyzed using IBM SPSS Statistics for Windows, Version 26.0 (Armonk, NY: IBM Corp). Categorical variables were presented as frequencies and percentages. Continuous variables were tested for normality and presented as mean ± standard deviation (SD). The prevalence of different types of lipid abnormalities was calculated. The association between categorical variables (e.g., CVD risk categories and demographic/clinical factors) was assessed using the Chi-square (χ^2) test or Fisher's exact test, as appropriate. A p-value of less than 0.05 was considered statistically significant.

Ethical Considerations:

The study protocol was reviewed and approved by the Scientific and Ethical Committee of the Al-Muthanna Directorate of Health (approval number: 145/2021). Permission was obtained from the hospital administration at Al-Hussein Teaching Hospital. All participants were provided with detailed information about the study's objectives, procedures, and their rights. Written informed consent was obtained from each participant prior to enrollment. Confidentiality was maintained throughout the study by assigning unique codes to each participant, and data were anonymized during analysis. Patients found to have significantly abnormal lipid profiles or high CVD risk were counseled and referred to the consulting physician for appropriate management.

Results and Discussion

Results

A total of 384 hypertensive patients were enrolled in this study. Their ages ranged from 40 to 85 years, with a mean age of 56.2 ± 10.5 years. The majority of participants were female (230, 59.9%) and resided in urban areas (234, 60.9%). The demographic and clinical characteristics of the study population are summarized in Table 1.

Table 1. Sociodemographic and Clinical Characteristics of Hypertensive Patients (N=384)

Characteristic	Category	Frequency (n)	Percentage (%)
Age Group (Years)	40-49	112	29.2
	50-59	138	35.9
	60-69	88	22.9
	≥70	46	12.0
Sex	Male	154	40.1
	Female	230	59.9
Residence	Urban	234	60.9
	Rural	150	39.1
BMI Category	Normal (18.5-24.9)	68	17.7
	Overweight (25-29.9)	158	41.1

	Obese (≥30)	158	41.1
Smoking Status	Never Smoker	264	68.8
	Current Smoker	88	22.9
	Former Smoker	32	8.3

The overall prevalence of dyslipidemia (at least one lipid abnormality) among the study participants was 78.1% (300 out of 384). As detailed in Table 2, the most frequently observed abnormality was low HDL-C, found in over half of the patients (54.9%), followed by high LDL-C (48.7%). Hypertriglyceridemia was present in 41.1% of patients, while hypercholesterolemia was the least common but still prevalent in more than one-third of the participants (35.9%). The mean values for the lipid parameters are also presented.

Table 2. Prevalence and Mean Values of Lipid Profile Abnormalities (N=384)

Lipid Parameter	NCEP ATP III Criteria	Prevalence n (%)	Mean ± SD (mg/dL)
Hypercholesterolemia	TC ≥200 mg/dL	138 (35.9)	198.5 ± 42.3
Hypertriglyceridemia	TG ≥150 mg/dL	158 (41.1)	168.7 ± 55.1
High LDL-C	LDL-C ≥130 mg/dL	187 (48.7)	128.4 ± 38.6
Low HDL-C	Men: <40 mg/dL; Women: <50 mg/dL	211 (54.9)	44.1 ± 11.5*
Any Dyslipidemia	Presence of ≥1 abnormality	300 (78.1)	-

*Mean HDL-C value for the whole population.

The estimated 10-year cardiovascular risk, calculated using the WHO/ISH charts, is shown in Table 3. The largest proportion of patients (39.8%) fell into the moderate-risk category (10-19%). However, a substantial 28.9% of patients were classified as having high or very high risk (≥20%). When stratified by sex, a higher proportion of males (39.0%) were in the high/very high-risk category compared to females (22.2%).

Table 3. 10-Year Cardiovascular Risk Stratification by WHO/ISH Chart (N=384)

10-Year CVD Risk Category	Total n (%)	Male n (%)	Female n (%)
Low (<10%)	120 (31.3)	32 (20.8)	88 (38.3)
Moderate (10-19%)	153 (39.8)	62 (40.3)	91 (39.6)
High (20-29%)	79 (20.6)	44 (28.6)	35 (15.2)
Very High (≥30%)	32 (8.3)	16 (10.4)	16 (7.0)

Table 4 demonstrates the association between different patient characteristics and the 10-year CVD risk categories (collapsed into three groups for statistical validity). There was a highly significant association between increasing age and higher CVD risk (p <0.001). Similarly, male sex (p <0.001), current smoking (p <0.001), and obesity (p = 0.002) were all significantly associated with being in the high/very high-risk category (≥20%). The relationship between urban residence and higher risk approached but did not reach statistical significance (p = 0.056).

Table 4. Association between Patient Characteristics and 10-Year CVD Risk Category

Characteristic	Category	<10% Risk (n=120)	10-19% Risk (n=153)	≥20% Risk (n=111)	p-value
Age Group	40-49	82 (73.2%)	28 (25.0%)	2 (1.8%)	<0.001
	50-59	34 (24.6%)	80 (58.0%)	24 (17.4%)	
	60-69	4 (4.5%)	38 (43.2%)	46 (52.3%)	
	≥70	0 (0%)	7 (15.2%)	39 (84.8%)	
Sex	Male	32 (20.8%)	62 (40.3%)	60 (39.0%)	<0.001
	Female	88 (38.3%)	91 (39.6%)	51 (22.2%)	
Residence	Urban	67 (28.6%)	95 (40.6%)	72 (30.8%)	0.056
	Rural	53 (35.3%)	58 (38.7%)	39 (26.0%)	
Smoking	Never	101 (38.3%)	103 (39.0%)	60 (22.7%)	<0.001
	Current	10 (11.4%)	36 (40.9%)	42 (47.7%)	
	Former	9 (28.1%)	14 (43.8%)	9 (28.1%)	
BMI	Normal	30 (44.1%)	24 (35.3%)	14 (20.6%)	0.002
	Overweight	53 (33.5%)	66 (41.8%)	39 (24.7%)	
	Obese	37 (23.4%)	63 (39.9%)	58 (36.7%)	

Discussion

This study, conducted at a major teaching hospital in southern Iraq, reveals a substantial burden of lipid abnormalities and a high predicted cardiovascular risk among patients with hypertension. The findings underscore a critical gap in the current management of these patients, who are often treated solely for elevated blood pressure without adequate attention to their overall cardiovascular risk profile.

The prevalence of dyslipidemia among our hypertensive cohort was strikingly high at 78.1%. This figure is consistent with, and in some cases higher than, reports from other regions in the Middle East and globally. A large multinational study, the PURE study, also demonstrated a high prevalence of dyslipidemia in conjunction with hypertension across various countries (24). A study conducted in neighboring Iran reported a prevalence of dyslipidemia in hypertensives at around 70.5% (25), while research from Saudi Arabia found rates exceeding 70% as well (26). Our finding is also comparable to a previous study from Baghdad, which reported a prevalence of 74% among hypertensive patients attending a primary care center (20). This consistency suggests a region-wide pattern of coexisting risk factors, driven by shared environmental and lifestyle factors.

The most common lipid abnormality we identified was low HDL-C, affecting 54.9% of the patients. This is a particularly concerning finding, as low HDL-C is an independent risk factor for atherosclerosis and is often associated with the metabolic syndrome, insulin resistance, and physical inactivity (27). The high prevalence of obesity in our study population (41.1%) likely contributes significantly to this phenomenon. Adipose tissue, particularly visceral fat, releases pro-inflammatory cytokines and free fatty acids that can alter HDL metabolism and function (28). This pattern, where low HDL-C is more prevalent than high LDL-C, is often seen in populations undergoing rapid nutritional transition and is a hallmark of atherogenic dyslipidemia (29).

High LDL-C, the primary target of lipid-lowering therapy, was the second most common abnormality (48.7%). While this prevalence is high, it is notable that a large proportion of patients with hypertension and high CVD risk may not have strikingly elevated LDL-C levels, potentially leading clinicians to underestimate their risk if they focus solely on LDL-C values. The high prevalence of hypertriglyceridemia (41.1%) further reinforces the pattern of a pro-atherogenic lipid profile often linked to obesity and poor dietary habits, such as high consumption of refined carbohydrates and sugars (30).

The application of the WHO/ISH risk charts provides a clinically meaningful synthesis of these risk factors. The finding that 28.9% of our patients have a $\geq 20\%$ risk of a fatal or non-fatal cardiovascular event in the next 10 years is alarming. This means that nearly one in three of these individuals would be considered candidates for statin therapy according to most international guidelines, which recommend treatment for those with a 10-year risk above this threshold (11,31). The fact that these patients were attending a cardiology clinic and were not on lipid-lowering therapy (an exclusion criterion) highlights a major treatment gap. This is likely due to a combination of factors, including a focus on blood pressure management alone, lack of routine lipid testing, and perhaps a lack of awareness among physicians about the benefits of risk-based, rather than lipid-threshold-based, prescribing (32).

Our analysis revealed expected but significant associations. Age was the strongest driver of increased risk, with over 80% of those aged 70 years and above falling into the high/very high-risk category. This reflects the cumulative effect of prolonged exposure to risk factors on the vascular system. Male sex was also a significant predictor of higher risk, consistent with the known cardioprotective effect of estrogen in premenopausal women, although this advantage diminishes after menopause (33). The strong association between smoking and high CVD risk (47.7% of current smokers were in the $\geq 20\%$ risk group) reinforces the urgent need for effective tobacco cessation programs as a core component of cardiovascular prevention in Iraq (34). Furthermore, the significant association between obesity and higher risk ($p=0.002$) highlights the central role of weight management. The high prevalence of obesity in our cohort (41.1%) mirrors the growing obesity epidemic in Iraq, which is fueled by reduced physical activity and the availability of inexpensive, high-calorie foods (17,35).

The predominance of females in our sample (59.9%) is an interesting observation. It may reflect healthcare-seeking behavior, where women in this community may be more likely to attend outpatient clinics for chronic conditions, or it could indicate a higher true prevalence of diagnosed hypertension among women in this age group, a phenomenon seen in some other studies (36).

The clinical and public health implications of this study are profound. Firstly, it provides compelling local evidence that secondary prevention of CVD must begin in the doctor's office. Every hypertensive patient, regardless of their blood pressure control, should undergo routine lipid profiling. Secondly, management strategies must shift from a single-risk-factor approach to a comprehensive, total-risk approach. This involves not only prescribing antihypertensives and statins to high-risk individuals but also providing intensive lifestyle counseling on diet, physical activity, and smoking cessation (37). The WHO/ISH charts, as used in this study, are a simple, inexpensive, and effective tool for implementing this risk-based approach in a busy clinical setting in Iraq.

Conclusion

This study demonstrates a very high prevalence of lipid profile abnormalities, particularly low HDL-C, among hypertensive patients in Al-Hussein Teaching Hospital, Al-Samawa. This leads to a substantial proportion of these patients being classified as having a high or very high 10-year risk for cardiovascular events. The findings highlight a critical window for intervention and reveal a significant gap between current clinical practice and optimal preventive care. There is an urgent need to integrate routine lipid screening and total cardiovascular risk assessment into the standard management protocol for all hypertensive patients in Iraq. Implementing such a strategy, coupled with evidence-based lifestyle and pharmacological interventions, is essential to curbing the escalating burden of cardiovascular disease in Al-Muthanna Governorate and the nation as a whole.

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