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# Study of the Effect of Gender on Some Biochemical Parameters in Elderly Patients with Cardiovascular Diseases in Thi Qar, Iraq

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***Abstract.*** *Cardiovascular diseases (CVD) are among the most well-known causes of death in the elderly. These conditions include ischemic heart disease, stroke, and several other cardiac and vascular diseases, all affecting the heart and circulatory system. This study aimed to evaluate the effect of sex on levels of oxidized low-density lipoprotein (OxLDL), malondialdehyde (MDA) in elderly patients (ages 60-79) with CVD, compared with other patients (ages 20–59) with the same disease, as well as control groups of the elderly and others. Samples of blood were collected from sixty patients of both sexes with CVD. These patients were divided into two age groups: the first group consisted of thirty elderly patients (15 males/15 females), while the second group comprised thirty other patients (18 males/12 females). The study also included a control group of apparently healthy individuals, who were similarly divided into 30 elderly individuals (15 males/15 females) and 30 other individuals (14 males/ 16 females). The results showed a significant increase in MDA concentration in the serum of elderly female cardiovascular patients compared to male patients of the same age group ($p<0.05$). However, there was no significant difference in serum concentration of OxLDL between the sexes in the other patient and healthy groups. Within each sex, significant differences were found between patients and healthy individuals across all age groups ($p\leq0.05$). Assessing oxidative stress parameters in each age group, in both females and males, may contribute to predicting cardiovascular disease and help determine the level of risk.*

***Keywords:*** *Cardiovascular diseases, Elderly, Malondialdehyde, Oxidized LDL.*

## Introduction

Cardiovascular diseases (CVDs) are among the most common health problems worldwide leading the way in death and contributing significantly to disability[1], [2] . Since the 1990s, the burden of these diseases has been steadily increasing in most countries due to changing patterns of exposure to risk factors, as well as population growth and ageing [1].

CVD includes a variety of disorders, such as cardiomyopathy, ischemic heart disease, coronary artery disease, stroke, atrial fibrillation, and atrial flutter [3], [4]. These diseases caused approximately 19.8 million deaths in 2022, representing nearly a third (32%) of all deaths worldwide, according to the World Health Organization (WHO). The vast majority of these deaths, approximately 85%, resulted from heart attacks and strokes [5].

With aging, the vasculature progressively undergoes pathological changes, such as reduced distensibility, increased stiffness, fibrotic remodeling, microvascular rarefaction, lipid deposition, and calcification, which increases the risk of serious cardiovascular complications [6]. In addition, aging is one of the most important factors that exacerbate oxidative stress, defined as “an imbalance between reactive oxygen species (ROS) production and the antioxidant defense system” [7], [8]. If ROS increases due to the accumulation of mitochondrial dysfunction and impaired DNA repair

mechanisms, this dysfunction increases the accumulation of oxidized proteins and damaged lipids [7]. This imbalance is further exacerbated by smoking, chronic exposure to oxidative stress, and harmful environmental factors [9].

Peroxidation of membrane lipids is a primary pathway for cellular damage generating reactive byproducts primarily aldehydes. A key aldehyde produced malondialdehyde (MDA) forms covalent complexes with proteins, disrupting their function. These aldehydes have a longer half-life than free radicals, accumulate with age, and act as secondary mediators of oxidative stress [10]. Notably, MDA reacts with lysine residues in apolipoprotein B within LDL particles resulting in the formation of oxidized low-density lipoprotein (OxLDL). This makes OxLDL an important biomarker associated with the risk of coronary artery disease [11].

Both men and women are affected by CVD, but women usually develop them at a later age, attributed to the preventive influence of estrogen throughout their reproductive years. Nonetheless, this protection diminishes after menopause due to the natural reduction in sex hormones such as estrogen and testosterone, resulting in a notable rise in incidence rates among older women. Similarly, the risk of heart disease in males escalates with age as a result of the same hormonal decline [12], [13]. Thus, the aim of this study was to investigate the potential effects of sex on the OxLDL levels in elderly patients with CVD as well as malondialdehyde.

## I. MATERIALS AND METHODS

### A. Design of the study

The study was conducted at "AL-Nasiriyah Heart Center" and the "Biochemistry Laboratory in the College of Science /University of Thi-Qar", between the beginning of October 2024 and the end of March 2025. This research included 120 samples: 60 patients with CVD and 60 healthy individuals in the control group. The samples were classified according to age and sex, as shown in Table 1.

**Table 1: Characteristics of studied groups.**

| *Groups* | *NO.* | *Age (Year)* | *Sex (M/F)* |
|---|---|---|---|
| *Elderly patient* | *30* | *60-79* | *15/15* |
| *Others patient* | *30* | *20-59* | *18/12* |
| *Elderly control* | *30* | *60-79* | *15/15* |
| *Others control* | *30* | *20-59* | *14/16* |

We used SPSS version 23.0 for Windows to perform the statistical analysis of the data. The results were expressed as mean ± standard deviation, using the least significant difference ( LSD) test. Independent t-tests and analysis of variance (ANOVA) were also used to compare variables between the different groups under study. A p-value less than 0.05 was considered statistically significant.

### B. Collection of Blood samples

Following an approximate 8-hour overnight fast, 5 mL of venous blood samples were drawn from CVD patients and controls. A gel tube was used to separate the serum, which was then allowed to coagulate at room temperature. Serum samples were separated using a ten-minute centrifugation at (3000 ×g), followed by storage at (−20°C) for upcoming biochemical parameter assessments, if the samples weren't used immediately.

Serum was used to estimate the levels of biomarker: oxidized low-density lipoprotein (Ox-LDL) via enzyme-linked immunosorbent assay (ELISA) using a spectrophotometer and serum malondialdehyde (MDA) levels were measured using the method of Fong et al. [14].

## II. RESULTS AND DISCUSSION

### A. Serum Malondialdehyde (MDA)

In Table (2) when comparing males and females within the same group, females in group (A) exhibited significantly higher serum MDA concentration levels than males ($P \leq 0.05$), whereas no significant sex-related differences were detected in groups (B, C and D).

When comparing results within the same sex, the results for males showed significant differences between groups, with group (A) recording significantly higher levels of MDA compared to groups (B, C and D) ($P \leq 0.05$), while no significant difference was observed between groups (C and D). Among females, serum MDA levels varied significantly among the four groups, with significant differences between them ($P \leq 0.05$).

The results of this study indicate gender differences in MDA levels, with these differences becoming clearer in chronic diseases such as CVD, particularly with advancing age. No significant gender differences were observed in the patient <60 years of age and healthy individuals in both age categories. Our results agree with a local clinical study conducted on cardiovascular patients in Thi-Qar Governorate, which found significantly greater MDA levels in females compared to males in the cardiovascular patient group. However, no significant gender differences were observed in healthy individuals [15], suggesting that existence of disease plays a crucial role in highlighting gender-related differences. According to the MARK-AGE study, women in the healthy population generally have lower MDA levels than men, but this relationship changes with age. The study demonstrated a clear dependence of MDA levels on both age and sex, with a gradual and sharp increase in women after age fifty, the period coinciding with menopause. MARK-AGE attributed this increase to the significant decrease in estrogen levels and the loss of its antioxidant effect, making postmenopausal women more susceptible to oxidative stress [16].

**Table 2: Effect of sex on serum MDA concentration among study groups.**

| Sex groups | MDA (µmol/L) Mean ± SD | | | | | | | | LSD |
|---|---|---|---|---|---|---|---|---|---|
| | NO. | A | NO. | B | NO. | C | NO. | D | |
| Male | 15 | 3.96±0.27 a | 18 | 3.37±0.34 b | 15 | 1.81±0.27 c | 14 | 1.69 ±0.31 c | 0.22 |
| Female | 15 | 4.22±0.35 a | 12 | 3.11±0.39 b | 15 | 1.96±0.25 c | 16 | 1.58 ±0.27 d | 0.24 |
| P-Value | -- | 0.036 | -- | 0.068 | -- | 0.131 | -- | 0.331 | -- |

* Means marked with different (a, b, c, etc.) superscript letters are used to indicate significant differences at ($P \leq 0.05$)

A: Elderly patient

B: Others patient

C: Elderly control

D: Others control

**B. Serum Oxidized low-density lipoprotein (OxLDL)**

Table (2) shows no significant difference in serum OxLDL concentration between males and females in all study groups (A, B, C and D) ($P \leq 0.05$). In contrast, the comparison within each sex groups showed significant differences between the four groups, with the highest values recorded in group (A), followed by group (B), while no significant difference was observed between groups (C) and (D) ($P \leq 0.05$).

Ox-LDL is a promising biomarker for predicting cardiovascular risk. It contributes to endothelial dysfunction and atherosclerotic plaque formation by increasing inflammation. This results from LDL oxidation and the formation of foam cells [17]. In one study on CAD patients, researchers found a positive correlation between Ox-LDL levels and both The frequency of ischemic episodes and the number of compromised vessels. This is an indicator of increased oxidative burden and marks the severity of coronary artery injury [18].

**Table 2: Effect of sex on serum OxLDL concentration among study groups.**

| Sex groups | OxLDL (µg/mL) Mean ± SD | | | | | | | | LSD |
|---|---|---|---|---|---|---|---|---|---|
| | NO. | A | NO. | B | NO. | C | NO. | D | |
| Male | 15 | 4.12±0.51 a | 18 | 3.34 ±0.48 b | 15 | 2.32 ±0.45 c | 14 | 2.41 ±0.43 c | 0.34 |
| Female | 15 | 4.48 ±0.54 a | 12 | 3.02 ±0.43 b | 15 | 2.62 ±0.55 c | 16 | 2.24 ±0.56 c | 0.40 |
| P-Value | -- | 0.071 | -- | 0.081 | -- | 0.115 | -- | 0.348 | -- |

* Means marked with different (a, b, c, etc.) superscript letters are used to indicate significant differences at ($P \leq 0.05$)

A: Elderly patient

B: Others patient

C: Elderly control

D: Others control

## I. CONCLUSIONS

The findings demonstrated a significant higher of MDA levels in elderly female patients compared to their male counterparts, highlighting a gender-specific effect. In contrast, no significant differences were detected in OxLDL concentration between the sexes, and comparisons within each gender revealed significant differences between patients and control groups. This confirms that the disease is associated with elevated oxidative stress, and that the effect of sex is more pronounced in some indicators than others, particularly among elderly patients.

### CONFLICT OF INTEREST

Authors declare that they have no conflict of interest.

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