



# Relationship of angiotensin converting enzyme (I/D) polymorphism (rs4646994) and coronary heart disease among a male Iraqi population with type 2 diabetes mellitus

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## Abstract

**Background** Insertion deletion (I/D) polymorphism (rs4646994) in the angiotensin-converting enzyme (ACE) has a substantial effect on coronary heart disease (CHD). The amplification of an Alu repetitive element in an intron of the ACE has shown three potential genotypes of I/I and D/D as homozygous, and I/D as heterozygous.

**Objective** The objective of this study was to investigate the association between the ACE gene polymorphism and CHD among male Iraqi patients with and without type 2 diabetes mellitus (T2DM).

**Methods** A case-control study of total 217 male subjects participated in this study, divided into three groups; Group 1 including 86 CHD patients with T2DM, group 2 including 78 CHD patients without T2DM, and group 3 including 53 age and sex-matched healthy individuals (as a control group). Genotyping of ACE (I/D) gene was performed using polymerase chain reaction (PCR) technique.

**Results** The II allele was significantly more frequent in CHD patients without T2DM compared to the control population, but not from those patients with T2DM ( $p < 0.05$ ). Nonetheless, the ID allele was significantly more frequent in each of CHD with T2DM and control populations compared to the CHD without T2DM. The DD allele was significantly more frequent in CHD patients with T2DM compared to each of CHD patients without T2DM and control populations ( $p < 0.05$ ).

**Conclusion** We conclude that the D/D and I/D genotypes are implicated as risk factors for development of CHD with T2DM, but not CHD without T2DM among the male Iraqi population. However, larger sample sizes are needed to monitor the CHD patients and to validate this study.

**Keywords** Ischemic heart disease · Coronary heart disease · Angiotensin converting enzyme · Type 2 Diabetes Mellitus

## Introduction

The coronary heart disease (CHD) is associated with fat accumulation at the end of the atrium, reducing the arteries' cavity, retarded blood flow, and consequently ischemic heart failure. Because of the high morbidity rate, the CHD has become one

of the most life-threatening cardiovascular diseases with more than one-third of death cases among those with  $\geq 35$  years [1–4]. It may affect individuals at all ages, though being significantly more common in the elderly with higher rate among males. Noticeably, common risk factors include smoking, familial history, hypertension, overweightness, diabetes, alcohol consumption, lack of exercise, stress, and hyperlipidemia [5]. Symptoms of Ischemic Heart Disease (IHD) or CHD include angina (severe chest pain during exertion) and heart palpitation due to decrease or lack of exercise. The CHD is diagnosed using an electrocardiogram, cardiac stress test, blood tests, or coronary angiography. For symptomatic patients, a stress echocardiogram is used to diagnose obstructive coronary artery disease [6, 7]. Partial or complete blocked arteries cause angina or heart attack, respectively, due to the gradual death of heart cells [8, 9]. Each year, approximately 790,000 adults suffer from myocardial infarction (MI), and

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