

The effect of Hsp90 gene polymorphism on the beef cattle production: a review paper



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ABSTRACT Beef cattle production is a worthwhile worldwide industry that faces many challenges, such as environmental heat stress, which leads to severe economic losses. As part of the heat shock proteins group, Heat Shock Protein 90 (HSP90) is a molecular chaperone common to all eukaryotic cells. It helps to protect cells from damage caused by heat shock. Reviewing polymorphisms of the HSP90 gene and their relationship with beef production was the purpose of this article. We described the structure of the HSP90 and its functions on living cells during adaptation to stress conditions. We also evaluated the HSP90 gene expression role and its polymorphisms on heat stress reaction in livestock. In conclusion, all livestock, especially cattle, are sensitive to heat stress depending on the amount of polymorphism in the hsp90 gene. Under heat stress conditions, HSP 90 and its polymorphism increase cell survivability and regulate body temperature.

KEYWORDS Hsp90 gene; polymorphism; heat stress; beef cattle

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Introduction

In general, livestock production is one of the main pillars of the economy in developed and developing countries, including Iraq, especially the meat production sector, in which the production of beef cattle accounts for the largest share. However, this sector suffers from many problems, which means that it does not meet the needs of consumers (Al-Samea and Ali 2014). These problems are certainly not limited to developing countries; in the United States, for example, the beef cattle industry is worth more than 60 billion, but it also suffers from many problems that cause losses (USDA 2015). One of the most important problems this industry faces is the various climatic changes that have caused high temperatures in many regions worldwide, leading to heat stress on animals and thus lower productivity (Rotz et al 2015). Interestingly, numerous recent studies have been conducted on molecular markers to find more effective methods for selecting animals with more resistance to different stress conditions. This is a stable, inherited change in genetic material that can be detected and measured and thus used later to identify a particular phenotype or genetic pattern, making it possible to predict the future production performance of the animal (Reshma and Das 2021).

Noticeably, heat shock proteins (HSP) are proteins considered molecular markers for tolerance to different stress conditions, especially high temperatures (Alard et al 2014). Members of this family are classified according to their molecular weight, it consists of HSP10, HSP20, HSP30, HSP40, HSP70, HSP90, HSP100, and HSP110 (Datta et al 2017). Several studies have shown that the effectiveness of these proteins is related to the polymorphisms of the genes responsible for them (Habib et al 2018; Badri et al 2018; Onasanya et al 2020a). However, the importance of HSP90 and its polymorphism in animals is closely related to its ability to withstand various stress conditions, especially high temperatures (Onasanya et al 2017).

There is a dearth of studies highlighting the significance of HSP for the livestock industry. Therefore, this review aimed to provide an overview of the polymorphisms of the HSP90 gene and their relationship with cattle production.