Relationship of Cytokines Concentration With Mastitis Infection Degree in Holstein Cows Reared in The Middle of Iraq

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Abstract

The study conducted by using ninety-five Friesian cows in the 3rd parity reared in private ruminant's farm in the middle of Iraq (AL-Dewanya province) during the year 2020. All cows that used in this study were infected with mastitis in different degree to investigate the relationship between TNFα and IL-6 cytokines with the degree of mastitis. Results showed a significant relationship (P≤0.01) of mastitis degree with TNF-α concentration, the highest concentration of TNFα was recorded in cows with acute infection in whole udder namely, 102.11 Pg/ml while the lowest concentration was noticed in cows with simple mastitis infection. Results showed a significant difference (P≤0.01) in IL-6 concentration according to the degree of mastitis infection, the highest IL-6 level was in cows suffered from acute mastitis to reached as 58.3 pg/ml compared with the lowest level which noticed in cows with simple mastitis infection which was 15.82 pg/ml.

Key words: Holstein cows, Mastitis, Cytokines.

1. Introduction

Cows are the most important large animal species that distribute widely and characterized with crucial role in human being's life around history. The most breed widespread around the world is Holstein which can be considered as unique breed for it contribution in a true and important amount of milk production [1]. Mastitis is one of the most common dairy cow diseases which cause considerable losses to dairy quantities [2,3]. The losses accrue from several sources [4], one of which is decreased milk yield. Several studies have found that clinical mastitis has a detrimental effect on milk yield while subclinical mastitis or high SCC has also been associated with decreased milk yield [5]. The effect of mastitis and high SCC from one lactation to the next has been found to be, in general, statistically significant but small only if the cow had three or more infected quarters was her yield affected in the next lactation [6]. Many studies reported that the mastitis degree infection related truly and strongly with some of the cytokines concentrations in blood serum therefore we can predict the mastitis infection depending on cytokines level.

The role of TNFα in the pathogenesis such as E. coli mastitis has been studied widely and TNFα seems to have a critical role in initiating host response e.g. by possibly inducing the production of IL-1, IL-6 and IL-8 [7,8]. TNFα is not a potential chemoattractant but it can prime neutrophils to express adhesion molecules and thus support PMN migration [9]. Increased concentrations of IL-6 have been detected in both the milk and blood of cows with naturally acquired and experimentally induced mastitis as well as those infused with bacterial or other pathogens [10,11]. An extremely important advantage of IL-6 is its ability to persist in the circulation for a longer period of time than other proinflammatory cytokines [12]. The major aim of the current study is to investigate the relationship of TNFα and IL-6 cytokines concentration with mastitis degree in Holstein cows that reared in the middle of Iraq and finally use the results as guidelines or indicators to predict the mastitis infection early to avoid the more losses in milk yield or cow's health.

2. Materials and Methods

The current study included ninety-five Friesian cows reared in private ruminant's farm in the middle of Iraq (AL-Dewanya province). All cows that used in this study were infected with mastitis in different degree, three degrees of infection were determined Acute, moderate and simple infection. The cows were in 3rd parity. Blood samples collected from the udder vein and centrifuged directly in the lab of station to obtained blood serum and then the samples send to the another lab to measure the TNF and IL-6 concentrations by ELISA and special kits was used for this purpose.
2.1 Statistical analysis

Data were analyzed using SAS computer program [13] by general linear model procedure (GLM) according to the following model:

\[ Y_{ijk} = \mu + T_i + e_{ijk} \]

Where: \( \mu \): the overall mean

\( T_i \): effect of TNF\( \alpha \) or IL-6 level on mastitis infection degree

\( e_{ijk} \): is a random error.

Chi-square test was used to determine the significant differences in sample distribution:

\[ X^2 = \sum \frac{(\text{Observed No.} - \text{Expected No.})^2}{\text{Expected No.}} \]

Significant differences among groups were detected by general linear model (GLM) and Duncan’s multiple range test [6] was used to compare differences among means.

3. Results and Discussion:

Results showed a significant distribution (P \( \leq \) 0.01) among cow’s groups according to the mastitis degree (Table-1), the number of cows with acute infection was 28 (29.47%) while the highest number was in cows with midd. Infection degree (51 cows) and the least number of cows was recorded with a simple mastitis infection namely, 16 cows with 16.84%.

| Mastitis degree | No.  | %    |
|----------------|------|------|
| Acute          | 28   | 29.47|
| Midd.          | 51   | 53.68|
| Simple         | 16   | 16.84|
| \( X^2 \)      |      | 20.19** |

** (P \( \leq \) 0.01)

Results showed a significant relationship (P\( \leq \)0.01) of mastitis degree with TNF\( \alpha \) concentration (Fig.1). The highest concentration of TNF\( \alpha \) was recorded in cows with acute infection in whole udder namely, 102.11 Pg/ml while the lowest concentration was noticed in cows with simple mastitis infection.

![Figure 1. Relationship of mastitis degree with TNF\( \alpha \) concentration.](image)

Results showed a significant difference (P\( \leq \)0.01) in IL-6 concentration according to the degree of mastitis infection, the highest IL-6 level was in cows suffered from acute mastitis compared with the lowest level which noticed in cows with simple mastitis infection namely, 58.3 and 15.82 respectively (Fig.2). Many of studies referred to considerable correlation among TNF\( \alpha \) levels and mastitis degree dairy cows. [14], reported that the interleukins such as IL-6 and IL-10 are very effective substances in the beginning of inflammatory while [15], referred, the cytokines with epithelial cells identify the
invading pathogens through Toll-like receptors in the mammary gland. The current study results were exactly disagreed with the studies of [16], who reported that the increased levels of TNFα, and IL-1b in subclinical mastitis suggesting their role in the early stage of the development of mastitis and striking increase in the levels of the pro-inflammatory cytokines was observed in lactating cows suffering from clinical mastitis. Variations in the concentrations of these pro-inflammatory cytokines coincided with development of clinical signs of disease and transformation in the mammary gland tissue, increase in pH which effect of cytokines concentration during infection [17]. Another studies demonstrated non-significant increase in IL-6 markers in cows suffering from subclinical mastitis which is in contradict to earlier.

![Figure 2. Relationship of mastitis degree with IL-6 concentration.](image)

The current results explain partially the relationship of cytokines concentration with mastitis infection degree because the past studied reported that the cytokines concentrations are differs depending on the cow response for mastitis or other inflammations types [18]. In addition, the studies in these filed recorded that the serum cytokines may differ from milk cytokines concentration in case of mastitis infection [4,9].

**Conclusion**

cytokines including innate or adaptive types are considerable indicators to detect or predict of mastitis in dairy cows and its useful tool to avoid more losses in milk yield especially in cows with high production, the results of the current study are might possibly exploited to increase the resistance of acute ore subclinical mastitis under farming conditions among daily cows flocks that reared in environmental pressure such as heat stress or bad management and poor nutrition.

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