

ESTIMATION OF THE EFFECTIVENESS OF LACTIC ACID BACTERIA IN REDUCING THE CONCENTRATIONS OF MYCOTOXINS CONTAMINATING GOAT MILK

Khalaf Nahar Ahmad¹, Ziad Tariq Samir¹,
Adil Abdulrahman Mustafa¹, Ali Mohammed Saadi^{2*}

¹Department of Food science, College of Agriculture,
Tikrit University, University street MMJ2+25H, 34001 Tikrit, Iraq

²Department of Animal Production, Technical Agricultural College,
Northern Technical University, University Hwy street 95H3+JM, 41002 Mosul, Iraq

*e-mail: Ali.mohammed@ntu.edu.iq

Abstract

Goat milk is a type of milk widely used either directly or by processing milk for various dairy products. This study aimed to identify or reduce fungal toxins using lactic acid bacteria and assess their effects on goat milk.

Lactic acid bacteria (*Lactobacillus acidophilus*) were used to remove mycotoxins, aflatoxin M1, aflatoxin B1, and ochratoxin A from goat milk that had been infected with these toxins. The removal process depends on linking mycotoxins to the bacterial cell wall by adsorption of mycotoxins on the bacterial cell wall. Milk samples from purchased dairy goats were used on a diet with quantities of pre-prepared aflatoxins. Produced aflatoxins originated from the development of *Aspergillus parasiticus* cultivated on potato medium; the spore suspension was collected after the incubation process. *Lactobacillus acidophilus* was then activation and isolated in 30 mL of MRS liquid environment at 37 °C for 24 hours under anaerobic conditions, and the dead bacteria were separated from the living bacteria by centrifugation of bacterial culture and were suspended (separately) in test tubes containing 5 mL of sterile milk contaminated with mycotoxins. The tubes were then shaken for two minutes. Determination of toxins aflatoxin M1 and B1 and ochratoxin A in milk samples were determined by ELISA according to the fermentation periods of 2, 6, 12, 24, and 48 hours, and temperatures of 4, 25, and 37 °C, and at the following different pH values: 5, 5.5, 6, 6.5, 7, and 7.5, which were conditions for both, dead and live bacteria.

The results revealed that the longer the fermentation period, the greater the capacity of *Lactobacillus acidophilus* to detoxify goat milk, with removal rates of aflatoxin M1, aflatoxin B1, and ochratoxin A reaching 11.63, 43.33, and 1.98% after 2 hours, and 80.23, 65.33, and 5.87% after 48 hours, respectively. In contrast, the effects of living bacteria were (9.57, 33.83, and 1.27%) after 2 hours, (78.8, 68.03, and 5.53%) after 48 hours for aflatoxin M1, aflatoxin B1, and ochratoxin A, respectively. When talking about the effect of temperature on the ability of *Lactobacillus acidophilus* to detoxify, high temperatures have increased detoxification, and the result for dead bacteria was 28.5, 51.17, and 1.19% when fermentation temperature 40C, while the removal rate reached 83.53, 74.8, and 5.33% when fermentation temperature was 37 °C, for both aflatoxin M1, aflatoxin B1, and ochratoxin A respectively, because of adsorption mycotoxins on the bacterial cell wall. The effect of temperature on living bacteria condition was similar to the state of dead bacteria, where detoxification rises with high temperatures, with the ratios of 32.8, 47.33, and 3.2%, and 75, 70.83, and 5.07% for both 4 and 37 °C, respectively, for aflatoxin M1, aflatoxin B1, and ochratoxin A. pH levels influenced the susceptibility of *Lactobacillus acidophilus* to remove toxins such as mycotoxins, meaning, the lower the pH value the greater toxin removal rate and both kinds of dead and live bacteria status. At pH 5, the highest lactic acid bacteria detoxification rate for aflatoxin B1, ochratoxin A, and aflatoxin M1 was 71.63, 70.47, and 67.1%, respectively, and for dead bacteria 71.63, 70.47, and 67.1%.

This study concludes that *Lactobacillus acidophilus* can eliminate the mycotoxins in goat's milk by adsorption on the bacterial cell wall. Its removal capacity depends on the temperature, time spent incubating, and pH value.

Key words: *Lactobacillus acidophilus*, Mycotoxins, Goat milk, Aflatoxin, Ochratoxin.