

CONTAMINATION BY *ESCHERICHIA COLI* IN TOTAL MIXED RATIONS WITH A HIGH PROPORTION OF FORAGE CACTUS

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Introduction

Importance of Forage Cactus

- » Highly relevant in arid and semi-arid regions.
- » Source of energy and hydration for ruminants due to:
 - ✓ Low dry matter content.
 - ✓ High non-fibrous carbohydrate concentration.

Nutritional Limitations

- » Low levels of neutral detergent fiber (NDF).
- » Excessive use may cause gastrointestinal disorders in ruminants.

Microbiological Risk & Feed Management

- » High forage cactus inclusion may lead to contamination by pathogenic microorganisms (e.g., *E. coli*).
- » Contamination can occur during:
 - ✓ Mixing of ingredients.
 - ✓ Distribution of the diet.
- » Farm-level feed management directly influences TMR hygienic quality.

Effect of the Ensiling Process

- » TMR silage based on forage cactus and *Gliricidia* showed:
 - ✓ Lower microbial diversity.
 - ✓ Dominance of beneficial bacteria (e.g., *Bacillus* genus).
 - ✓ No detection of harmful microbes like enterobacteria.

Thus, we hypothesize that the fermentation process inhibits the growth of potentially pathogenic microorganisms, such as *Escherichia coli* (*E. coli*), in diets with high proportions of forage cactus.

(Pereira et al., 2025).

Objectives

- 🎯 The aim of this study was to quantify the *E. coli* population in TMR containing high proportions of forage cactus and subjected to different feeding methods: *in natura* and silage.

Materials and Methods

- 📍 **Location:** Forage Laboratory of the Center of Agricultural Sciences (CCA), Federal University of Paraíba (UFPB) – Campus II, Areia, Paraíba, Brazil.

- ➡ **Design:** Completely randomized, $2 \times 2 \times 2$ factorial
 - ✓ Buffel grass (*Cenchrus ciliaris* L.) hay levels: 7.5% and 45%
 - ✓ With/without fecal contamination
 - ✓ Feed type: fresh TMR and TMR silage
 - ✓ Time points: 0, 6, 12, and 24 hours exposure

- ➡ **Replicates:** 4 per treatment

- ➡ **TMR silage pH at opening:** average of 4.7

Fecal Contamination Procedure

- » Feces collected from goat pens to simulate *E. coli* contamination
- » 10 g of fresh feces diluted in 90 mL sterile distilled water
- » Homogenized and filtered through sterile gaze
- » Aqueous extract used to inoculate TMR

Microbial Quantification

- » Method: Based on González and Rodríguez (2003)
- » Medium: EMB Levine Agar (Kasvi, K25 - 1050)
 - ✓ Selective for gram-negative bacteria
 - ✓ *E. coli* identified by metallic green colonies
- » Only plates with 30–300 CFU considered

Complementary Analyses

- ✓ Average pH of silage upon opening: 4.7.
- ✓ Statistical analysis: **Tukey's test at 5% probability.**

Results

E. coli Population

- » **Fresh TMR** showed an overall increase in *E. coli* counts after 24h exposure, exceeding **6.85 Log CFU/g**, regardless of hay level or contamination.
- » **TMR Silage** consistently maintained **lower *E. coli* counts**, indicating the **protective effect of ensiling**.
- » **7.5% Hay Content**
- » **Contaminated Fresh TMR:**
 - ✓ Sharp increase after 6h (+1.35 Log CFU/g from time 0)
 - ✓ Peak at 24h: **6.92 Log CFU/g**
- » **Silage TMR:**
 - ✓ Initial: 3.32 Log CFU/g → reduced to **1.97 Log CFU/g** at 24h
- » **Uncontaminated Fresh TMR:**
 - ✓ Final count at 24h: **7.35 Log CFU/g**
- » **Uncontaminated Silage TMR:**
 - ✓ Final count at 24h: **3.70 Log CFU/g**

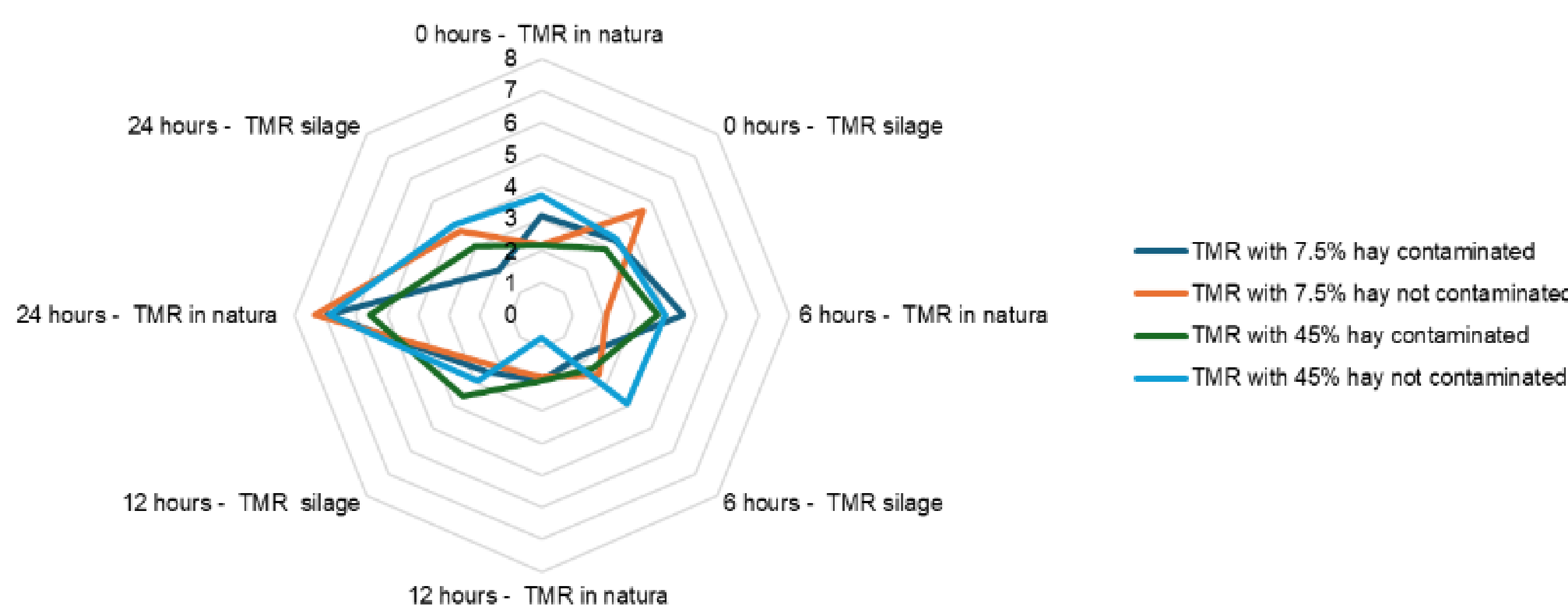


Figure 1. *Escherichia coli* population (Log CFU/g) in a total mixed ration with high proportions of forage cactus, containing different levels of buffel grass hay (7.5 and 45%), contaminated and non-contaminated, evaluated over the time of exposure to the environment (0, 6, 12 and 24 hours) in two forms of feed management: *in natura* and silage.

45% Hay Content

- » **Contaminated Fresh TMR:**
 - ✓ Time 0: 2.18 Log CFU/g → **5.57 Log CFU/g** at 24h
- » **Silage TMR:** Maintained counts **below 3.03 Log CFU/g**
- » **Uncontaminated Samples:** Same trend — **lower counts in silage TMR**

Conclusions

- ✓ The ensiling process plays an important role in reducing microorganisms with pathogenic potential such as *E. coli* in TMR, helping to maintain its hygienic quality. In addition, contamination influences the *E. coli* population, reinforcing the importance of hygiene during the mixing and feeding process. Based on the obtained results, the adoption of TMR silage with 7.5% hay is recommended as the most effective feeding strategy for reducing gastrointestinal tract disorders in ruminants.

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References

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