



Enhancing the microbiological, physicochemical and sensory properties of fresh ovine “Tuma” cheese through the addition of feeding prickly pear by-product silage in the ewe’s diet



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INTRODUCTION

In the Mediterranean region, the incorporation of agro-industrial by-products into the diets of small ruminants represents a traditional and sustainable practice. In Sicily, local by-products such as citrus pulp, olive cake, grape marc, and tomato peels can contribute to reducing feeding costs, mitigating competition with human food sources, and improving environmental sustainability (Vastolo et al., 2022). These materials are rich in bioactive compounds, particularly polyphenols, which may enhance ruminal metabolism, animal health, and the quality of dairy products. Building on preliminary studies on silages derived from prickly pear by-products (Gannuscio et al., 2024), the present study evaluated their inclusion in the diet of lactating Valle del Belice ewes. Specifically, the effects on cheese quality were investigated by analyzing microbiological properties using both culture-dependent and culture-independent approaches, as well as physico-chemical and sensory characteristics.

MATERIALS AND METHODS

• Silage preparation and experimental design

The trial was conducted on a farm in Menfi (Sicily) with 500 Valle del Belice ewes. Prickly pear peels (PPP) and prickly pear “pastazzo” (PPS), each mixed with 12% of wheat bran were ensiled for 50 days and incorporated in diets of twelve lactating ewes (≈ 90 days into lactation) using a 3×3 Latin square design (three periods of 14 days: 9 days of adaptation + 5 days of sampling).

Control (CTR): 900 g/head/day concentrate + 3000 g/head/day of sulla hay.

Prickly pear peels (PPP): 1500 g/head/day of PPP silage + 500 g/head/day of concentrate + 2700 g/head/day of sulla hay.

Prickly pear pastazzo (PPS): 1000 g/head/day of PPS silage + 500 g/head/day of concentrate + 2300 g/head/day of sulla hay.



• Experimental cheesemaking

The production of Tuma cheese took place as described in the flowsheet (Fig.1) at a dairy factory located in Santa Margherita di Belice (Sicily).

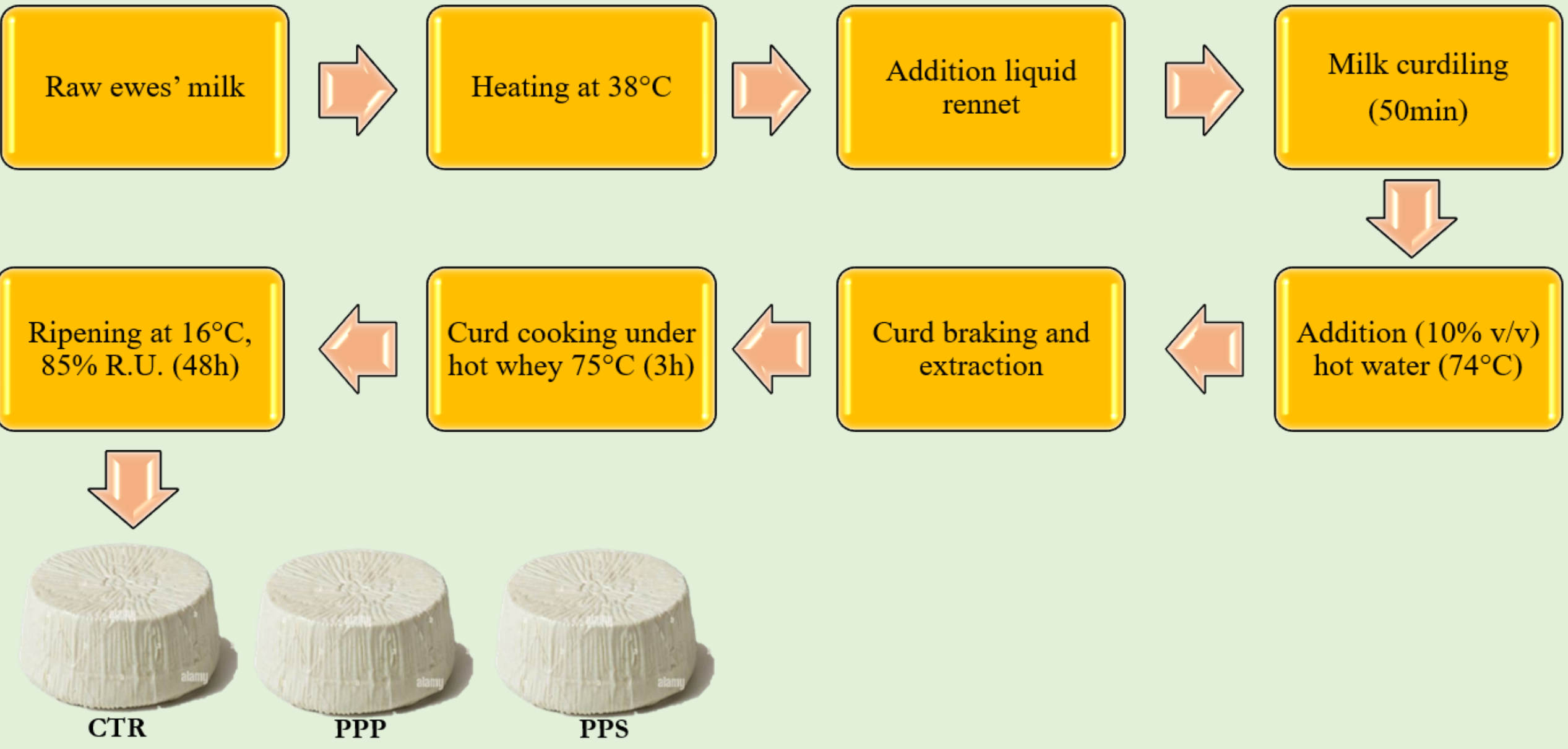
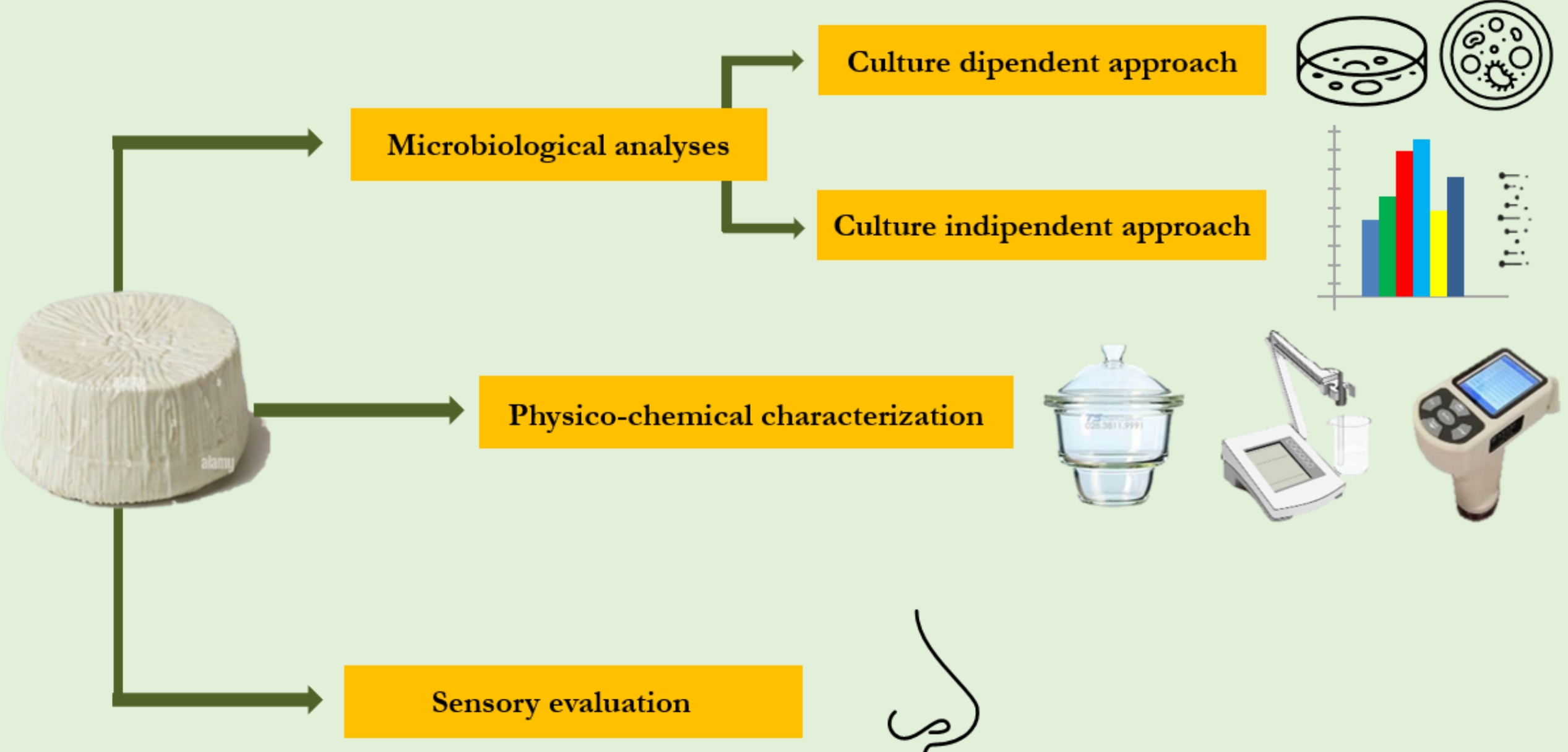


Fig. 1. Flowsheet of cheeses production.

• Analyses performed:



BIBLIOGRAPHY

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Gannuscio, R.; Cardamone, C.; Vastolo, A.; Lucia, C.; D'Amico, A.; Maniaci, G.; Todaro, M. 2024. Ensiling as a Conservation Technique for Opuntia ficus indica (L.) By-Products: Peel and Pastazzo. Animal, 14(22), 3196.

FUNDING

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RESULTS

The levels of the microbial groups object of investigation from milk to final cheese are reported in Fig. 2. The major dairy pathogens were not detected in the CTR, PPP and PPS trials.

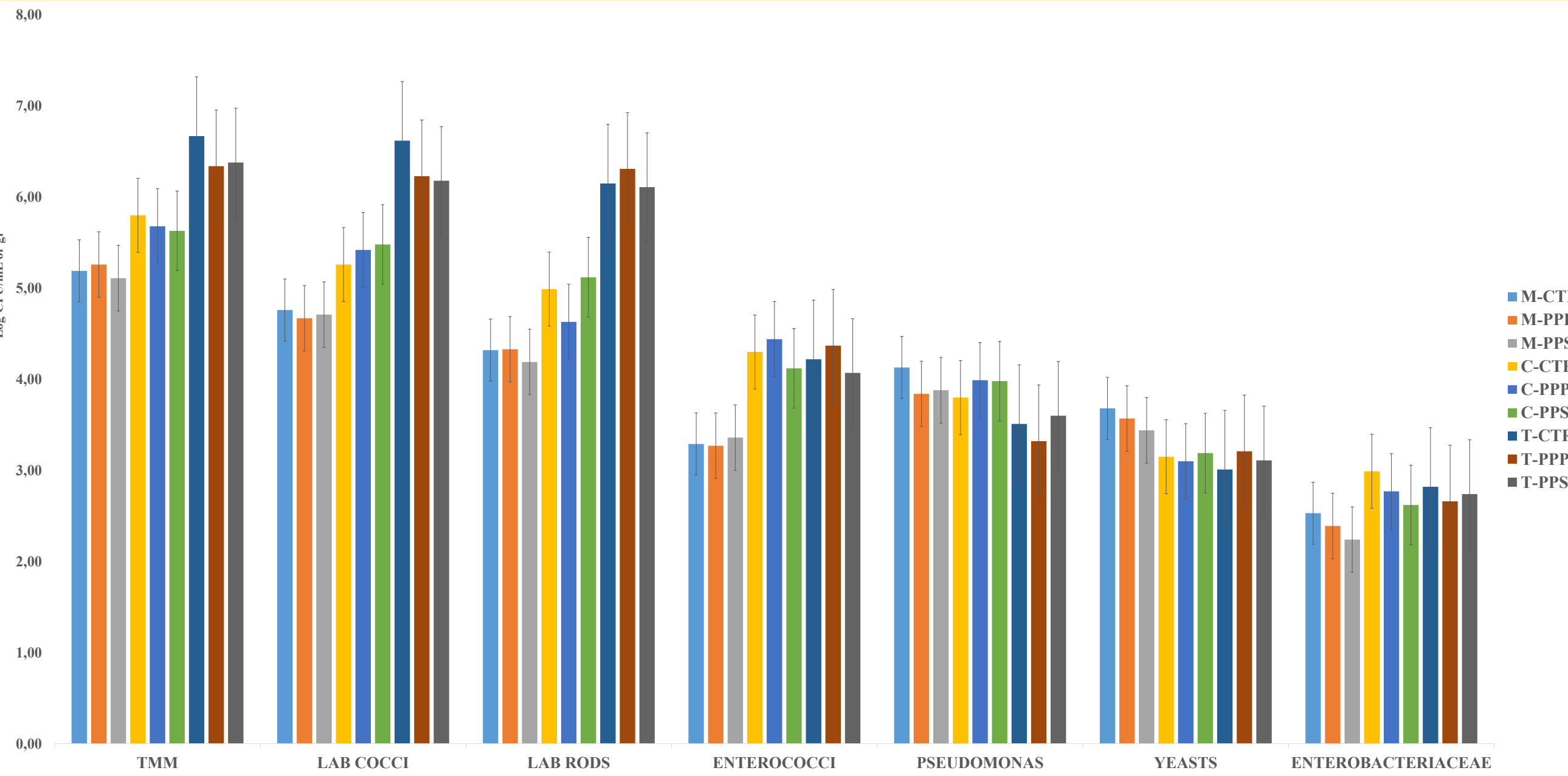


Fig. 2. Impact of diet on microbial levels in samples collected during Tuma cheese making process. Abbreviations: TMM, total mesophilic microorganisms; LAB, lactic acid bacteria; M-CTR, milk control production; M-PPP, milk prickly pear peels production; M-PPS, milk prickly pear pastazzo; C-CTR, curd control production; C-PPP, curd prickly pear peels production; C-PPS, curd prickly pear pastazzo; T-CTR, Tuma cheese control production; T-PPP, Tuma cheese prickly pear peels production; T-PPS, Tuma cheese prickly pear pastazzo.

The relative abundance (%) of OTUs in cheese samples is shown in Fig 3. No DNA from major dairy pathogens (*E. coli*, *Salmonella* spp., *L. monocytogenes*, *S. aureus*) was detected.

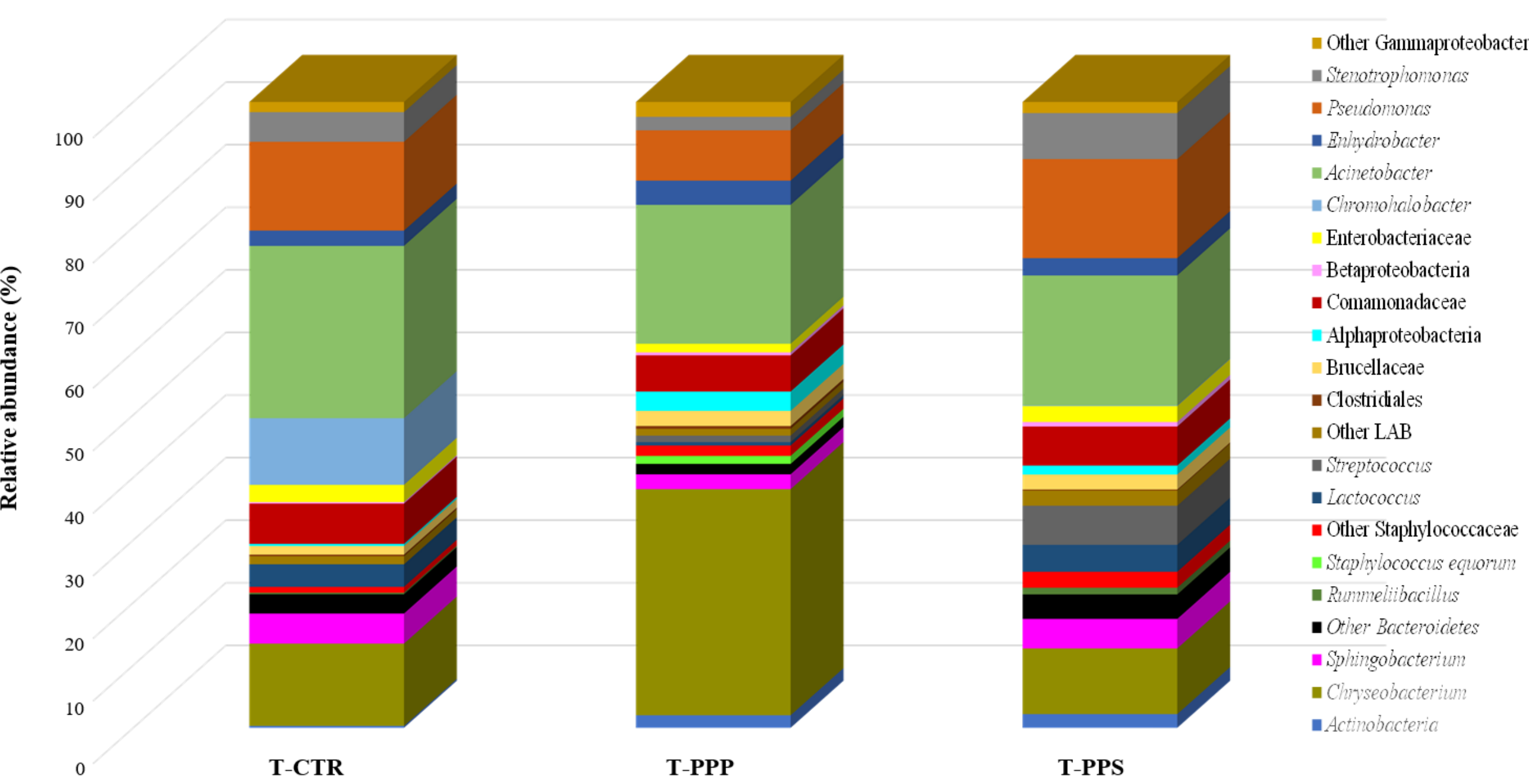


Fig. 3. Relative abundances (%) of bacteria identified by MiSeq Illumina. Abbreviations: T-CTR, Tuma cheese control production; T-PPP, Tuma cheese prickly pear peels production; T-PPS, Tuma cheese prickly pear pastazzo.

Table 1. Total phenols content (TPC) and antioxidant capacity (AOC) of cheese.

Items α	Diet α				P-value α
	CTR α	PPP α	PPS α	SEM α	
Cheeseα					
TPC (mg·GAE/·g·DM) α	1.66·C α	3.33·A α	2.84·B α	0.103 α	0.001 α
DPPH (mmol·TEAC/·100·g·DM) α	1.08·B α	1.64·A α	1.70·A α	0.074 α	0.001 α
ABTS (mmol·TEAC/·100·g·DM) α	0.66·B α	4.12·A α	3.71·A α	0.184 α	0.001 α

CTR: control diet; PPP: diet with the inclusion of prickly pear peels silage; PPS: diet with inclusion of prickly pear pastazzo silage; TPC: Total phenols content; DPPH: 2,2-diphenyl-1-picrylhydrazyl index; ABTS: 2,2'-azino-bis 3-ethylbenzothiazolino-6-Sulphonic acid; SEM: standard error of mean. On the row, values with different superscript letters are significant A, B, C, D, E: $P \leq 0.01$.

The sensory analysis conducted on the cheese samples did not show any statistically significant differences.

CONCLUSIONS

The main hypothesis of this work was verified, since the addition of prickly pear feeding to the ewes' diet did not influence the fermentation activity of LAB and improve the nutritional value of Tuma cheeses.