ABSTRACT

Lactic acid production from whey presents an attractive opportunity to reduce environmental waste and promote sustainable bioprocessing. This project addresses the worldwide issue of underutilized dairy by-products by turning them into compounds with added value that can be used in food additives, pharmaceuticals, and biodegradable plastics. Its importance resides in advancing the circular economy by converting industrial waste into products that are both economically viable and environmentally advantageous.

The main objectives of this study were to isolate and identify lactic acid bacteria (LAB) from dairy sources (labneh, cheese whey, and yogurt). In addition, to generate a growth rate curve, and to evaluate lactic acid yield using both pure LAB strain and mixed microbial cultures across various substrates.

Key aspects of the study include analytical validation and microbial strain isolation. The assessment of fermentation parameters, including pH, nutrient supplementation, the choice of carbon and nitrogen sources, and the contribution of native proteins to the enhancement of lactic acid production, was given particular attention. An economic feasibility study was also incorporated into the project to evaluate the possibility of practical implementation.

In this context, LAB were successfully isolated from labneh, cheese whey, and yogurt using De Man Rogosa and Sharpe (MRS) agar and confirmed through Gram staining and biochemical testing. Growth dynamics were monitored via optical density (600 nm). Lactic acid was produced by pure strains of LAB and mixed cultures through fermentation at 37°C, and lactic acid was quantified through UV spectrophotometry and titrimetric analysis.

It was found that, yogurt is a more efficient source of *Lactobacillus* strain. In mixed culture fermentation, a maximum lactic acid yield of 35 g/L was achieved when pH adjustment to near-neutral levels and nutrient supplementation were used. Whereas lactose led to decreased productivity, native proteins in cheese whey increased microbial activity. Labneh whey was verified as the most stable and effective substrate in pure strain fermentation. Glucose and lactic acid calibration curves confirmed analytical reliability, and economic analysis projected a net profit of 199,150 ILS/year, supporting the industrial scalability and sustainability of whey valorization.