

MEDTEST III

WHEY VALORIZATION INITIATIVE



**WHEY-BASED
AYRAN BEVERAGE**

Implemented by:



UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

SwitchMed is co-funded by:



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● The MED TEST Project

The SwitchMed-MED TEST project is one of Lebanon's most significant programs on resource efficiency. Funded by the European Union, the MED TEST project has, since 2014, under the lead of the United Nations Industrial Development Organization (UNIDO), demonstrated the business case for resource efficiency in over 165 industries across the food, chemical, and plastics sectors in eight countries of the southern Mediterranean.

In Lebanon, the MED TEST II (2014-2018) and MED TEST III (2019-2024) projects identified 257 resource efficiency measures that resulted in an average energy savings of 30%, water savings between 3% to 40% and a reduction in materials use by 1%. Implementing these measures has resulted in annual cost savings of 4.9 million Euros for the 23 participating companies. Additionally, it has helped reduce CO2 equivalent emissions by approximately 13,000 tons per year, solid waste generation by about 5,000 tons per year, and water consumption by more than 80,000 m³/year. Most of these measures have a short payback period averaging 1.4 years.

As part of the MED TEST III project, UNIDO analyzed various whey-based product alternatives that could be produced using existing dairy factory technology in Lebanon while also adding value to the process. The pilot project aimed to develop affordable, low-energy-consuming, and highly nutritious products for Lebanese families while reducing the environmental impact of the dairy sector by transforming customary whey waste into raw material.

● Product Definition

The whey-based Ayran developed by the SwitchMed MED TEST III project is a fermented drinkable yogurt rich in proteins made by fermentation of milk, using a culture of lactic acid bacteria followed by the addition of acid whey, water, and salt. Natural flavors such as mint could also be incorporated into final product. While this beverage shares similarities with Ayran, it is referred to as the Whey-based Ayran instead of Ayran due to national regulations that mandate the use of only water, fermented milk, and salt in the typical formulation of Ayran.

● Raw Materials

Fresh milk, acid whey, drinking water, salt, starter (lactic acid bacteria culture of *Streptococcus thermophilus* and *Lactobacillus delbrueckii* subsp. *Bulgaricus*), and upon preference, mint as a flavor. Acid whey is obtained as a by-product of Labneh production. The proposed product will add value to a material flow that is commonly lost in Lebanese dairy production.



(Credit: Freepik)

● Product Formulation

Twenty-eight formulations of acid whey and milk, including formulations with herbs (mint, ginger), were designed by the MED TEST III project using experimental design methodology. The formulations that were produced at pilot scale following initial laboratory trials and that received the highest sensory acceptability scores were as follows (for each product, salt is added at a concentration of 8 g/l):

SAMPLE	ACID WHEY (% V/V) ¹	MILK (% V/V) ¹	WATER (% V/V) ¹
Control (Ayran) ²	0	50	50
A1	40	60	0
A2	50	50	0
A6	40	50	10
A6 mint (with 0.025% mint)	40	50	10

● Physicochemical Properties

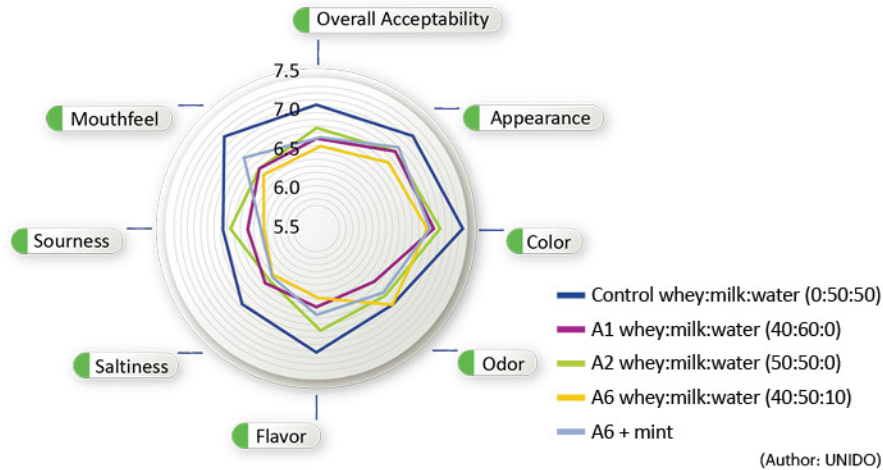
SAMPLE	CONTROL	A1	A2	A6	A6 MINT
Total solids (%)	7.9	10.2	9.7	9.1	9.1
Fat content (%)	2.1	2.2	1.9	1.9	1.9
Ash content (%)	0.7	1.2	1.3	1.2	1.2
Protein (%)	1.1	1.8	1.9	1.7	1.7
Carbohydrates (%)	3.5	5	4.6	4.3	4.3
Calorific value (kcal/100 ml)	39	47	43	41	41
pH at 25°C	4.2	4	4	4	4
Total acidity, as lactic acid (%)	0.55	0.75	0.73	0.64	0.64
Chlorides, as NaCl (%)	0.8	0.7	0.8	0.7	0.7

¹Volumen/Volumen.

²The control sample is the typical Ayran formulation used as reference.

● Sensory Properties

The sensory analysis was conducted on a large scale with the participation of around 125 panelists from different Lebanese regions. Using Ayran as the control sample helped establish a reference for consumers in evaluating the sensory attributes of new products. The analysis revealed the whey-based Ayran achieved ratings ranging from 6.6 and 6.8, which closely align with those obtained for the control sample with an acceptability rating of 7.1. Notably, the A2 sample exhibited a significantly higher preference in terms of color, flavor, sourness, and overall acceptability compared to the other developed products.

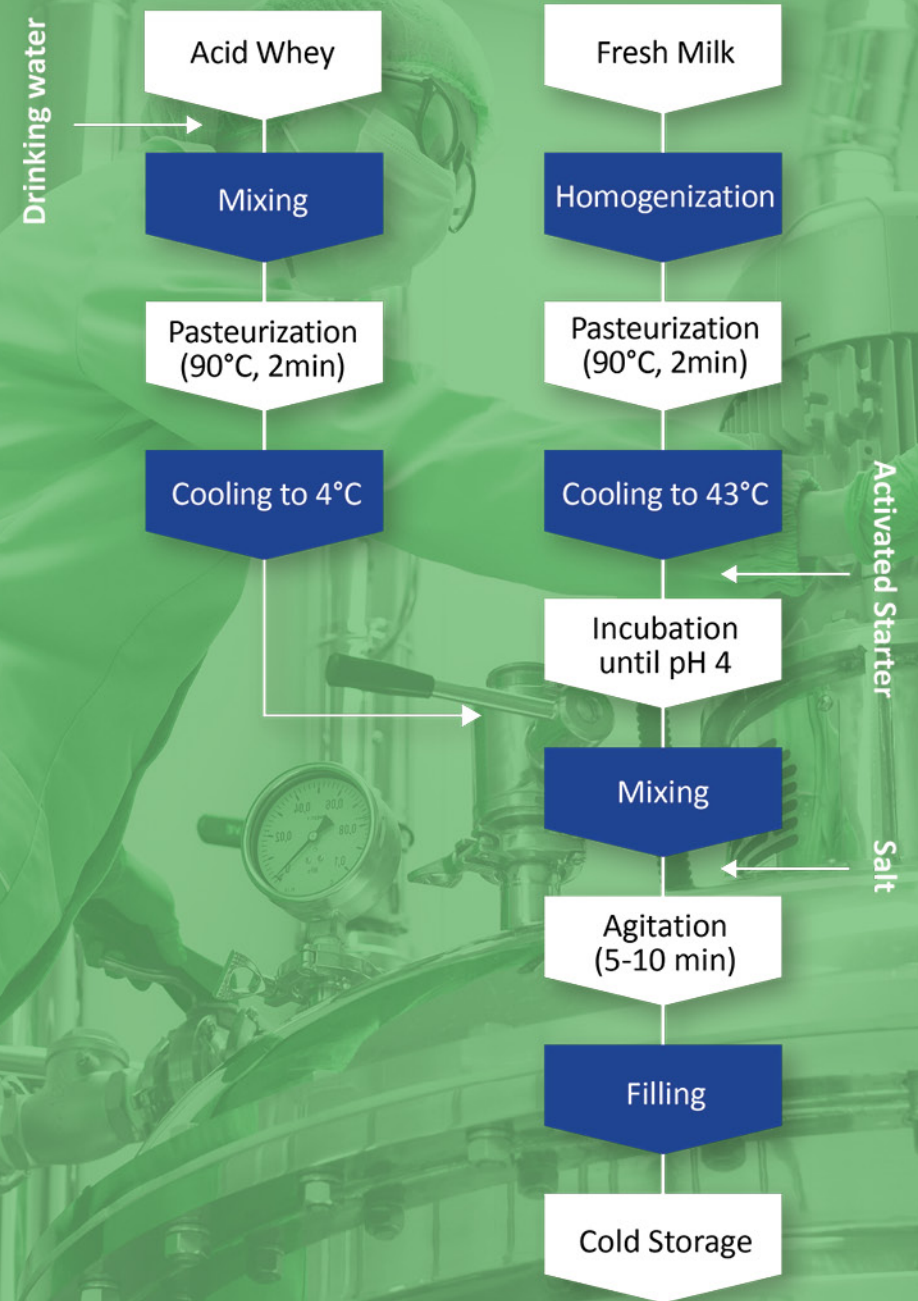


● Production Process

The production process for the proposed product is similar to Ayran production and it does not require any new equipment beyond what is used for the traditional industrial production of Ayran.

Milk is pumped to a plate heat exchanger, where it is preheated to 55-60°C before it continues to the separator, which produces skimmed milk and cream. Skimmed milk is sent to the homogenizer and subsequently standardized for fat content. After standardization, milk is pasteurized at 95°C for 2 minutes and then cooled to a temperature of 43°C. A starter culture is then added, and the blend is incubated for about four hours. When the pH reaches the value of 4.0, fermentation is stopped by cooling the milk to a temperature less than 10°C. In parallel, acid whey, ideally obtained on the same day of Labneh production, is collected in a storage tank.

Then, it is transferred to a mixing tank where drinking water is added. After filtration and homogenization, the blend is pasteurized at 95°C for 2 minutes, cooled to 4°C, then sent to be mixed with the fermented milk. Afterwards, salt is added, and the blend is agitated vigorously. Finally, the whey-based Ayran is filled into sterilized plastic bottles and stored in refrigeration.



(Author: UNIDO)

● Technological Requirements

The following equipment is needed for the implementation of the whey-based Ayran process:

- | | |
|-------------------------------|-------------------------|
| A) Storage Tank For Acid Whey | F) Homogenizer |
| B) Mixing Tank | G) Milk Separator |
| C) Incubation Tank | H) Microfiltration Unit |
| D) Pumps | I) Filling Machine |
| E) Plate Heat Exchanger | J) Labeling Machine. |

● Investment

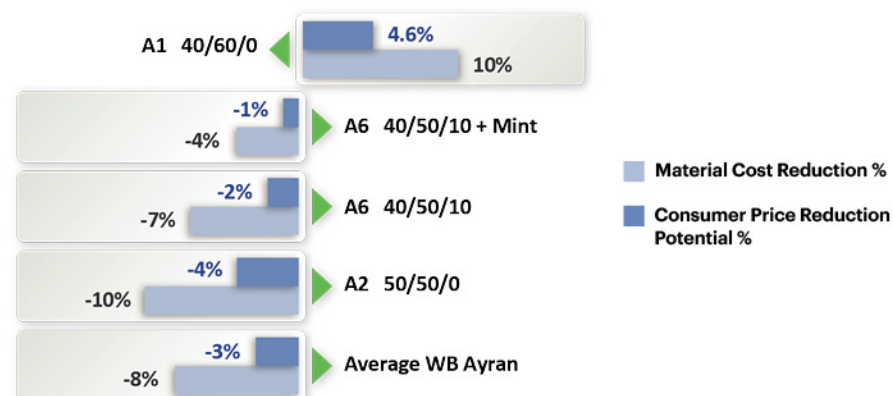
The analysis of this new product was conducted in the context of dairy production facilities where Ayran production is already in place, as an alternative to substitute the use of water in the product formulation. The proposal represents an opportunity to either change the Ayran formulation or develop a new brand for a parallel product. In this context, the manufacturing of whey-based Ayran is seamlessly integrated into the current processing lines of dairy industries. Therefore, no new equipment has been considered necessary, and hence, there is no capital expenditure (CAPEX).



(Credit: Racool_studio)

● Economic Benefits

The whey-based Ayran recipe has two potential sources of economic benefits. First, whey replaces water in at least 80% of the traditional Ayran formulation. Although water is usually available at a minimal cost for most Lebanese industries, this substitution leads to reduced input water treatment expenses. Second, acid whey is either treated within wastewater facilities or transported for external disposal. Adoption of the new recipe results in savings by utilizing whey instead of incurring costs for its treatment or transportation. As these dynamics vary widely among factories, there is no general indicator of cost savings. To illustrate, the provided figure exemplifies the projected economic advantage for one specific factory; the graphic shows the potential reduction on material costs and potential reduction of retail prices considering also savings from disposal and treatment of acid whey.



(Author: UNIDO)

● Recommendations

● COLLECTION AND STORAGE OF ACID WHEY:

Acid whey must be collected under strict hygienic conditions in a refrigerated tank. It must be used the same day to prepare the whey-based Ayran; otherwise, it must be pasteurized at 95°C for 2 minutes and kept refrigerated in a sterile tank until its use. Under these conditions, acid whey may be conserved for one week.

● DOSAGE OF SALT IN WHEY:

Salt concentration in acid whey must be determined prior to the processing of whey-based Ayran and must be considered when adding salt to the final product.

● CONTROL OF MILK FERMENTATION:

The pH of fermented milk must be monitored, and acid whey must be added after the complete fermentation of milk to reach the desired acidity of the final product.

