

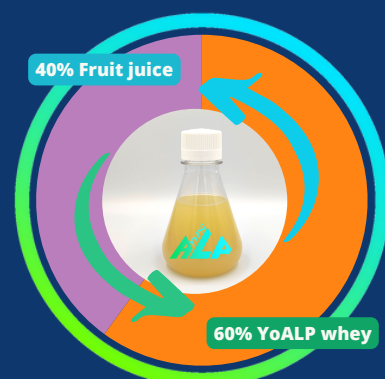
FORMULATION, BIOCHEMICAL CHARACTERIZATION AND SHELF LIFE STUDY OF "YOALP" WHEY BASED BEVERAGE CONTAINING FRUIT JUICES PRODUCED IN AOSTA VALLEY

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INTRODUCTION

In order to increase the sustainability of the dairy industry and to respond to a growing demand of functional foods [1], a whey based beverage has been created using "YoALP" whey. "YoALP" is a fermented milk obtained from Aosta Valley cattle breeds milk and local strains of lactic acid bacteria (*Streptococcus thermophilus* and *Lactobacillus delbrueckii*) which have been isolated during years in Aosta Valley mountain dairy cattle farm. From its filtration, by gravity, it is possible to obtain a similar Greek yogurt. During this process acid whey is also produced which is considered a by-product that must be disposed. The disposal of whey is a cost for dairy industries and a loss of important human nutrients [2].

In the formulation of YoALP whey based beverage, in addition to whey, 40% of local fruit juices (apple-Raspberry, apple-Aronia and Raventse, an autochthonous apple variety) have been used to improve functionality and flavor. This beverage can be considered functional because it contains components or ingredients able to provide specific health effects other than purely nutritional effect. Health promoting effects depend on nutrients such as polyphenols and bioactive peptides, which potential antioxidant and antihypertensive activity, and on microorganisms with probiotic effects (*Bifidobacterium animalis* spp. *lactis* and *Bifidobacterium breve*).



RESULTS & DISCUSSION

MICROBIOLOGICAL ANALYSIS

LACTIC ACID BACTERIA

Microbiological analysis (probiotics – MRS agar and M17 agar medium, and Bifidobacteria – HHD culture method) has been conducted to assess the presence of different categories of microorganisms and to monitor their variations along the shelf life. In particular, "YoALP" starters (*Streptococcus thermophilus* and *Lactobacillus delbrueckii*) and Bifidobacteria were monitored up to three weeks so as to verify the presence and vitality of these probiotic bacteria (Fig. 1).

Spoilers and pathogens were assessed (total count – Petrifilm AC, coliforms – Petrifilm EC, yeasts – Petrifilm YM) in order to avoid the presence during a period of twenty-one days.

PROBIOTIC EFFECTS

Streptococcus thermophilus and *Lactobacillus delbrueckii* stay above the recommended therapeutic level and the legal limitation for yogurt of 10^6 CFU/mL up to the seventh day so as to have the ability to tolerate harsh gastric and intestinal conditions and be able to attach to the gut epithelium [3]. Furthermore, these analyses confirmed the safety of the beverages along the entire shelf life (up to 7 days).

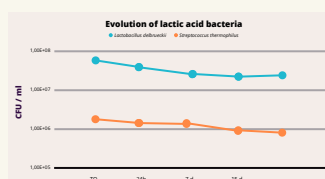


Fig. 1 Evolution of lactic acid bacteria in "YoALP" whey during shelf-life

POLYPHENOLS

Fruit juices contain phenolic compounds known to have a potential antioxidant and free scavenger activity. Normally, a close correlation between the content of phenolic compounds and antioxidant activity should be present in polyphenols rich foods. So, total polyphenolic content and antiradical power (ARP) were determined, respectively by an optimized Folin-Ciocalteu method and a DPPH Antioxidant Capacity Kit (BIOQuochem) which highlighted high values in apple-Aronia whey beverage (Fig. 2).

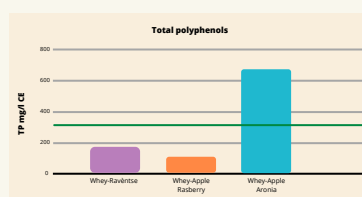


Fig. 2 Total polyphenols content in whey beverages. Mean literature value (—).

ACE INHIBITORY ACTIVITY

In order to verify the Angiotensin Converting Enzyme (ACE) inhibitory activity, potentially exerted by biochemical components, an ACE Activity Assay Kit (Merck-Sigma-Aldrich) was used. Results have shown that this biological activity can be due to ACE inhibitory peptides found in whey and to some polyphenols present in fruit juices. Whey-Raventse beverage has reached the maximum inhibition (Fig. 4). In general, all the "YoALP" beverages show higher ACE inhibitory activity than other data present in similar literature studies [5, 6].

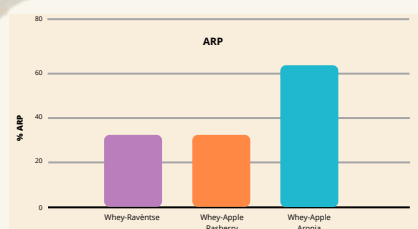


Fig. 3 YoALP whey beverages antiradical power and correlation between total polyphenols and antioxidant activity

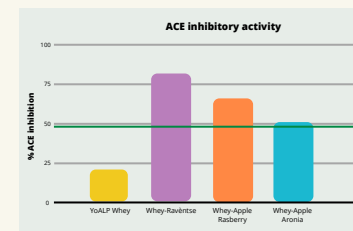
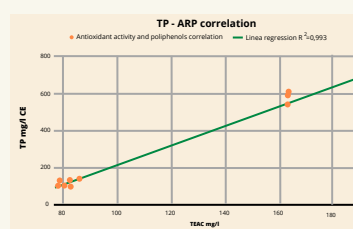


Fig. 4 YoALP whey beverages ACE inhibitory activity. Mean literature value (—).



ANTIRADICAL POWER

High amount of polyphenols was found in all the beverages, in particular, apple-Aronia whey beverage has shown the highest values. As expected, the highest values of ARP have been obtained by apple-Aronia whey beverage. Furthermore, a great correlation between ARP values and polyphenol content was found (Fig. 3) indicating that the antiradical power is mainly due to polyphenols present in fruit juices. Comparing these values with literature, data suggest that YoALP whey based beverages have a good level of potential antioxidant activity [5, 6].

CONCLUSIONS

"YoALP" whey based beverages could represent a huge opportunity for the Aosta Valley's farms to increase their income and competitiveness, creating a circular economy by recovering a by-product like the whey and following the sustainability and healthy trends, which are driving the food sector.