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Improvement of functional and sensory properties of fermented dairy drink Narine using raw apricot gum

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ABSTRACT

Background: It has been proven that natural apricot gum and the functional sour milk drink "Narine" fermented by *L. helveticus* MDC 9602, possess health-promoting and healing properties. The combined use of *L. helveticus* and apricot gum in dairy fermentation can create a new functional product with enhanced healing and organoleptic properties.

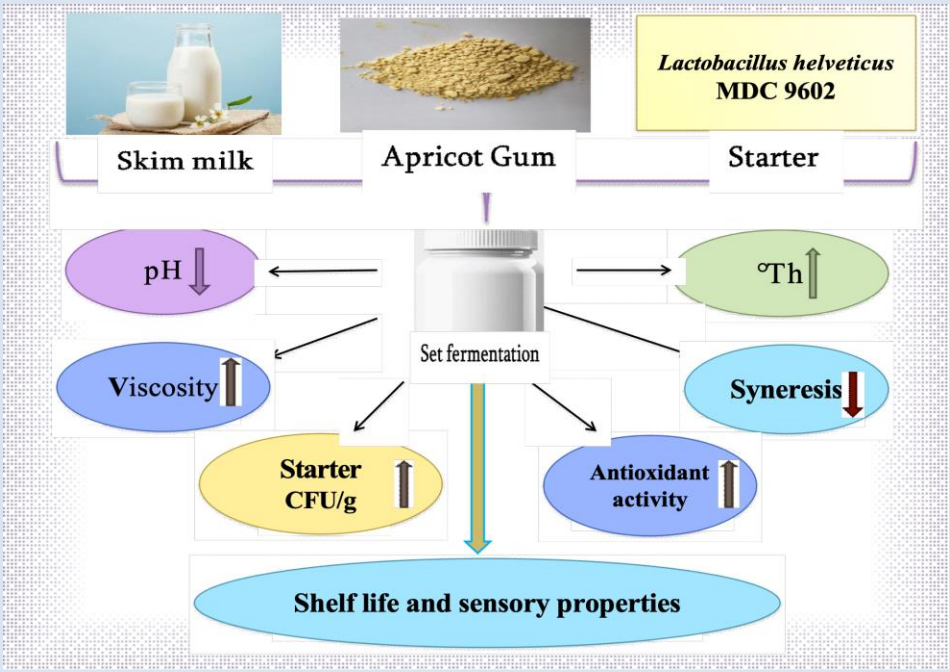
Objective: To create a new functional fermented milk product by combining Apricot gum (AG) and *L. helveticus*, with improved health-promoting and sensory properties.

Methods: For joint fermentation, 0.125%, 0.25%, 0.5%, and 1.0% of raw AG were dissolved in milk preheated to 60°C, pasteurized at 85°C for 15 minutes, and cooled to 45°C. Subsequently, the samples were inoculated with *L. helveticus* culture at a concentration of 5% and incubated at 37°C. The clotted samples were then transferred to 5°C for ripening. Analysis of the samples was carried out at 1, 14, and 28 days of storage. Antioxidant capacity was determined by the DPPH-scavenging assay. The total phenolic content and total flavonoid content were quantified by the Folin-Ciocalteu and $AlCl_3$ colorimetric methods, respectively.

Results: Apricot gum significantly stimulates the growth of the probiotic *L. helveticus* starter culture in microbiological medium and in milk. The stimulation of *L. helveticus* growth leads to a significant increase in the rate of coagulation and acidification of milk, improving the consistency and viscosity of Narine. The addition of AG extends the shelf life of the product in refrigerated storage, maintains a high viability count of the starter culture, and reduces syneresis and acidification. AG also significantly increases the antioxidant activity, which correlates with the viable cell count of *L. helveticus*. A synergistic increase in the viscosity of milk enriched with AG was discovered, depending on the degree of acidification.

Conclusions: The high total phenolic content plays a key role in the biological activity of raw apricot gum. Most of the AG-induced changes, such as increased milk coagulation rate, enhanced antioxidant activity, and improved acidity, were found to be due to the promotion of starter culture growth. Raw AG can be used to increase the yield of bioactive peptides in LAB cultures and to improve the functional and sensory properties of yogurts.

Keywords: Sour milk Narine, apricot gum, milk joint fermentation, synbiotic, sensory properties, antioxidant capacity.



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INTRODUCTION

Narine is the commercial name of a sour milk drink fermented with *Lactobacillus helveticus* MDC 9602 (formerly *L. acidophilus* INMIA 9602), a strain of lactic acid bacteria endemic to Armenia. Narine has been used in clinical trials as a medicinal food to treat symptoms associated with gut dysbiosis. Historically, *L. helveticus*

strains have been mainly used as starter cultures in the milk fermentation process for producing various Italian and Swiss cheeses. Beyond their technological significance, increasing scientific research indicates that *L. helveticus* strains possess health-enhancing properties. *L. helveticus* is also used in combination with Saccharomyces cerevisiae in the production of sour milk drinks, such as Calpis in Japan and Evolus in Sweden.

For over six decades, the sour milk drink Narine, fermented by the strain *L. helveticus* MDC 9602 isolated from an infant in Armenia, has been renowned globally and embraced in countries like Japan, South Korea, Poland, the USA, Canada, and former Soviet republics as a functional food aiding in the prevention and treatment of various intestinal disorders, often stemming from infections and antibiotic treatment [3, 4]. Narine boasts a unique viscous gel texture, forming threads exceeding 0.5 meters in length. After a short period of intense stirring, Narine becomes irreversibly liquid and retains this consistency without phase separation for more than two weeks when stored in the refrigerator.

Certain strains of L. helveticus, including MDC 9602, produce four types of cell envelope proteases, distinguishing them among lactic acid bacteria (LAB) [3, 5, 6]. This enzymatic activity facilitates the release of numerous bioactive peptides from milk proteins [7]. Additionally, the extensive hydrolysis of milk caseins by MDC 9602 renders Narine highly digestible, even for newborns, serving as a potential substitute or supplement to breast milk without adverse effects. Thousands of children fed with Narine have demonstrated weight gain similar to breastfeeding.

Unlike strains of *L. helveticus* used in cheese production, strain MDC 9602 does not undergo autolysis, thus maintaining a substantial population of viable probiotic cells throughout its shelf life. Major brands such as Dannon and Chobani incorporate *L. helveticus* in their drinking or traditional yogurts to enhance gastrointestinal functionality and restore gut microbiota balance. Apart from health benefits, sensory characteristics such as texture, smell, appearance, and taste play a crucial role in consumer acceptance.

Meanwhile, the quality of fermented milk products can be further enhanced by incorporating additional ingredients such as milk proteins, prebiotics, and herbs [8]. In recent times, there has been exploration into incorporating plant extracts recognized for their beneficial health properties, including antimicrobial and antioxidant effects [9]. Plant-based gums are preferred over those derived from animal and microbial sources due to their wider acceptance among consumers. To achieve optimal sensory properties and mouthfeel, there is a growing interest in utilizing natural polymers as stabilizers in milk-based beverages. An outstanding characteristic of gums is their ability to enhance both the organoleptic qualities and the nutraceutical potential of food products. They affect rheology, taste, texture, mouthfeel, and overall food quality and stability [8, 9, 10, 11].

Gum *Prunus armeniaca* (L.), commonly known as apricot gum (AG), has been utilized for centuries in folk medicine to address various health concerns, including gastrointestinal disorders, fever, colds, coughs, asthma, bronchitis, laryngitis, constipation, anemia, bleeding, and some tumors [12]. This gum, as a natural colloid, can be used to improve the texture of fermented dairy foods, reduce syneresis, and extend shelf life. Raw apricot gum primarily comprises of polysaccharides from the arabinogalactan family (65-68%) and various organic compounds, predominantly polyphenols (27-30%), which represent the highest content of phenolic compounds among the Rosaceae family, playing a crucial role in its biological activity [13, 14, 15,16, 17]. Despite its promising potential, studies have not yet been conducted to examine the effect of raw apricot gum on the functional and sensory characteristics of yogurts.

This study aimed to create of new functional fermented milk product by combined use of raw apricot gum and *L. helveticus* MDC 9602 with improved health promoting and sensory properties.

MATERIALS AND METHODS

The starter culture *Lactobacillus helveticus* MDC-9602 [listed in NCBI GenBank under accession numbers HQ379170 and HQ379179, Pashayan MM, Hovhannisyan HG, 2010] was obtained from the Depository Center for Microorganisms (MDC) at SPC "Armbiotechnology" of the National Academy of Sciences of the Republic of Armenia. Skimmed milk powder and LAPTg medium (consisting of 1.5% peptone, 1% tryptone, 1% yeast extract, 1% glucose, and 0.1% tween 80, with a pH of 6.5) were utilized for the cultivation of lactic acid bacteria (LABs).

Collection and fully water-soluble raw AG preparation: The fresh AG was harvested in June from a Yerevan district, collected as partially dried, soft, transparent tears from the tree trunk, and subsequently stored in sealed polypropylene jars at ambient temperature until transported to the laboratory. Upon arrival at the laboratory, samples were weighed, and impurities were eliminated from the raw material by rinsing under running water for 2-3 minutes. Water was added in a ratio of 1 part to 3 parts by weight/volume (w/v), and the mixture was left to swell overnight at room temperature. The fully dissolved gum was then filtered through a silicone filter to eliminate any mechanical impurities. Moisture was subsequently removed from the AG suspension via vacuum, spray, or freeze-drying methods. The resulting AG powder was stored in sealed containers at room temperature under dry conditions. AG powder produced through this procedure demonstrated resilience to repeated drying and dissolution, providing a 100% yield of AG (see Figure 1).

Figure 1. Preparation of fully water-soluble raw AG.

Bacterial growth stimulation assay: Ten test tubes were prepared by filling each with 2 mL of LAPTg broth. Subsequently, 2 mL of a 1.0% AG solution was added to the first tube and after thorough mixing, 2 ml was transferred to the next tube. This procedure was repeated until the tenth tube, where 2 ml was discarded. All test tubes were then inoculated with 0.1 mL (~ 10^7 CFU/mL) of *L. helveticus* culture and incubated for 6 hours under static conditions. The choice of a 6-hour growth period aimed to allow 6-7 generations of *L.*

helveticus culture in the logarithmic phase. The proposed method can be used to quickly determine the stimulating effect of any compounds on the growth of microbial cells.

Total phenolic content assessment: The total phenolic content was determined using the Folin-Ciocalteu reagent method following the procedure described by Wong et al., with adaptations [18]. A 0.5mL portion of the extract was placed into test tubes, followed by the addition of 2.5mL of 10% Folin-Ciocalteu reagent and 2mL of 7.5% Na_2CO_3. The mixtures were agitated on a shaker, allowed to incubate for 30 minutes, and the absorbance was measured at 765nm. Total phenol content was expressed as milligrams of gallic acid equivalent per gram of dry matter extract (mg GAE/g).

Total flavonoid content assessment: The total flavonoid content was assessed using the colorimetric method devised by Chang et al., which employs aluminum chloride ($AlCl_3$) [19]. Initially, 0.2mL of 10% $AlCl_3$ was combined with a 0.2mL aliquot of AG solution, followed by the sequential addition of 0.2mL of 1M potassium acetate and 1.12mL of distilled water. The mixture was thoroughly mixed and allowed to incubate at room temperature. After a 30-minute incubation period, the absorbance was measured at 415nm against the reagent blank. Quercetin (0–1000µg/mL) served as the standard, and the results were quantified as mg of quercetin equivalents per gram (mg QE/g).

Preparation of fermented milk supplemented with AG: AG powder was dissolved in preheated milk at 60°C, and then the mixtures were pasteurized at 85°C for 15 minutes and then cooled to 45°C. Following this, they were inoculated with *L. helveticus* MDC 9602 starter at a concentration of 5%. The incubation was carried out at 37°C until clot formation occurred. Subsequently, the fermented milks were transferred to 5°C for maturation over an 8-hour period. Analysis of both the plain sample and those supplemented with AG was conducted immediately after production following 1, 14, and 28 days of refrigerator storage.

pH and titratable acidity determination: The pH of the fermented milk was measured using a pH meter (Checker® HANNA Instruments, Romania) at room temperature. Titratable acidity was determined by mixing 10 mL of Narine with 20 mL of distilled water, followed by adding 3 drops of 10% phenolphthalein indicator solution. The mixture was titrated with 0.1 N NaOH solution until a pink color appeared, signifying the endpoint. Titratable acidity was expressed in Thorner degrees (°Th).

Viable bacterial cell count determination: Narine samples underwent serial dilutions in peptone water, and from these dilutions, 0.1 mL aliquots were plated on LAPTg agar and incubated at 37°C for 48 hours. The titer (CFU/mL) was established by enumerating the observable colonies.

DPPH free radical scavenging activity: Each 100 mL sample of fermented milk was briefly vortexed at 3000 rpm for 30 seconds and then centrifuged at 14,000 × g at 4°C for 30 minutes. The supernatants were stored at 4°C for subsequent analysis. To 2.5 mL of the experimental sample, 3 mL of ethanol and 0.5 mL of DPPH solution (55 µM) were added. The mixture was agitated and left to incubate in the dark at room temperature for 30 minutes. The absorbance of the resulting solution was measured at 517 nm, using DPPH in methanol as the blank. Ascorbic acid served as the standard antioxidant. The radical scavenging activity was calculated as follows:

Radical scavenging activity (%) = [1 − (absorbance of sample / absorbance of blank)] × 100.

Determination of syneresis: The susceptibility of fermented milk to syneresis was assessed by centrifuging 20 g of the sample at 500 rpm for 5 minutes, followed by measuring the volume of the supernatant [20, 21]. The percentage of syneresis was determined using the formula:

Syneresis (%) = supernatant weight/sample weight x 100

Viscosity determination: The dynamic viscosity of Narine was determined using a Hoeppler falling ball viscometer and expressed as mPa•s.

Sensory evaluation: Trained evaluators conducted a comprehensive assessment of Narine samples, focusing on texture, flavor, and overall quality. The sensory panel consisted of 12 members from the lactic acid bacteria laboratory at the S&P Center of "Armbiotechnology." Panelists received detailed guidance on the assessment procedures to ensure consistency. To mitigate bias, the sequence of yogurt sampling was randomized for each panelist, and water was provided for rinsing between tastings. Panelists were instructed to evaluate six specific attributes: appearance, aroma, color, taste, acidity, and overall acceptance. They used a hedonic scale from 1 (indicating strong aversion) to 10 (indicating strong preference) to score each attribute.

Statistical analysis: The data were presented as mean values with standard deviations (SD). Statistical significance between groups was determined using Duncan's multiple range tests. All statistical analyses were conducted using IBM SPSS Statistics software version 22 (IBM Corp., USA). A significance level of $p < 0.05$ was used to indicate statistical significance.

RESULTS AND DISCUSSION

Influence of AG on the growth of L. helveticus MDC 9602 in LAPTg: Plant exudates can exert various effects on microorganisms, ranging from stimulation to inhibition. To elucidate the mechanism of action of apricot gum on the viability of the Narinestarter, the impact of different concentrations of AG on the growth of *L. helveticus* was investigated. The optical density (OD_{600}) of cultures obtained after 6-hour exponential growth is depicted in Figure 2.

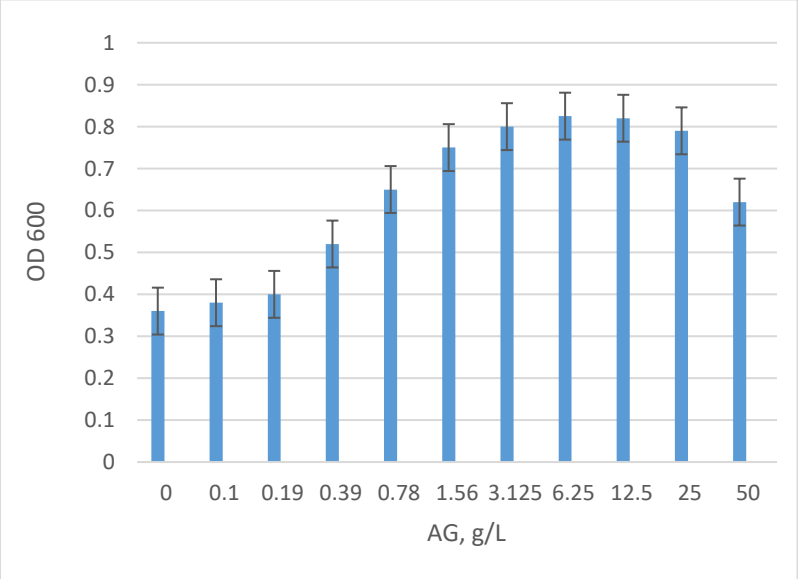

Figure 2. Growth of *L. helveticus* MDC 9602 depending on the concentration of AG in LAPTg medium at 37°C, for 6 hours, under static condition. n =3, $p<0.05$

As depicted in Figure 2, the addition of AG at concentrations ranging from 0 to 25 µg/mL to LAPTg medium leads to accelerated growth of *Lactobacillus helveticus* MDC-9602 ($p < 0.05$). However, further increases in AG concentration gradually inhibit growth due to medium gelation. Research has shown that the polyphenolic component plays a critical role in the biological activity of raw plant exudates [22]. Our experiments also revealed high phenolic and flavonoid contents of 214.38 mg GAE g^{-1} and 13.67 mg CE g^{-1}, respectively, in raw apricot gum. This is consistent with previous gas chromatography/mass spectrometry (GC/MS) studies, which showed that crude AG contains approximately 30% low molecular weight compounds, primarily polyphenols [15]. Through qualitative analysis among low molecular weight compounds, catechol (7.58%), hydroquinone (4.27%), and pyrogallol (5.69%) were identified. The arabinogalactan component of AG had no effect on bacterial growth promotion (data not shown). Thus, the data presented confirm the significant stimulating effect of phenolic components of AG on the growth of *L. helveticus* MDC 9602.

Effect of raw AG on milk fermentation rate and physicochemical properties of Narine: The study investigated the impact of different concentrations of raw apricot gum (AG) on the rate of milk coagulation by the *Lactobacillus helveticus* MDC 9602 culture, as well as on the microbiological and physicochemical properties of the fermented milk product (refer to Table 1).

Skim milk samples containing various concentrations of AG were pasteurized and, upon cooling to 45°C, inoculated with a 5% *L. helveticus* MDC 9602 starter culture. The samples were then incubated at 37°C until clot formation was observed. Subsequently, the resulting products were stored for 8 hours in the refrigerator to mature and were tested for bacterial count; pH, titratable acidity, and dynamic viscosity (refer to Figures 3-5). Figure 3 shows the rate of milk coagulation and the number of viable cells of *L. helveticus* MDC 9602 in the fermented product as a function of the concentration of raw AG

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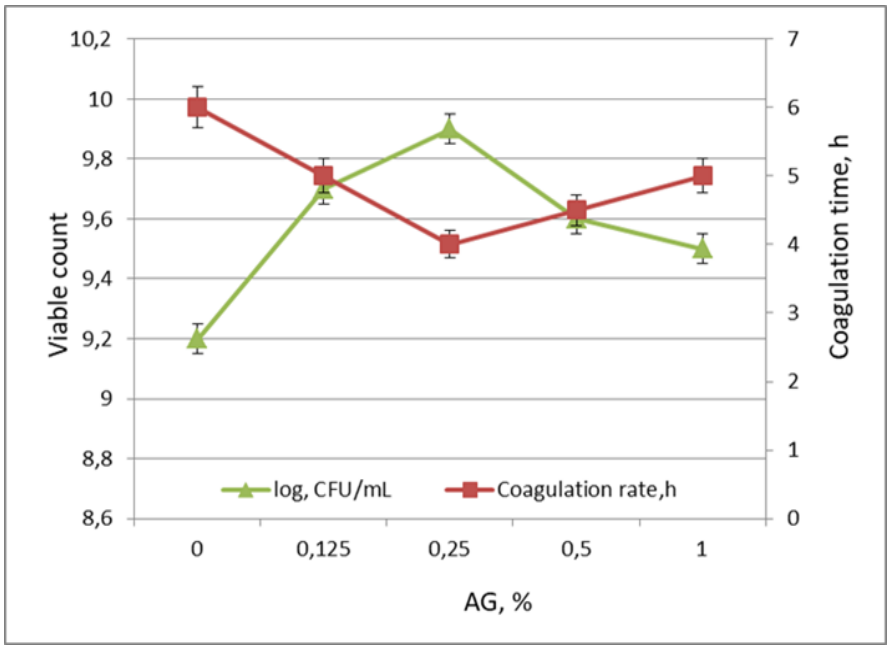

Figure 3. Coagulation rate and viable bacterial count of Narine samples depending of AG concentration

Figure 3 shows the changes in starter counts in Narine depending on AG concentration. The number of *L. helveticus* was significantly increased with the addition of 0.25% AG, but concentrations higher than this had no significant effect. However, further increases in AG concentration above 0.5% led to a limitation of the growth rate of *L. helveticus*. The milk coagulation rate was reduced by 25%, while the count of *L. helveticus* cells increased by 0.6 log, reaching 8.9 x 10^9 CFU/mL ($p < 0.05$). Figure 4 shows the effect of crude AG on the pH and titratable acidity of the fermented product.

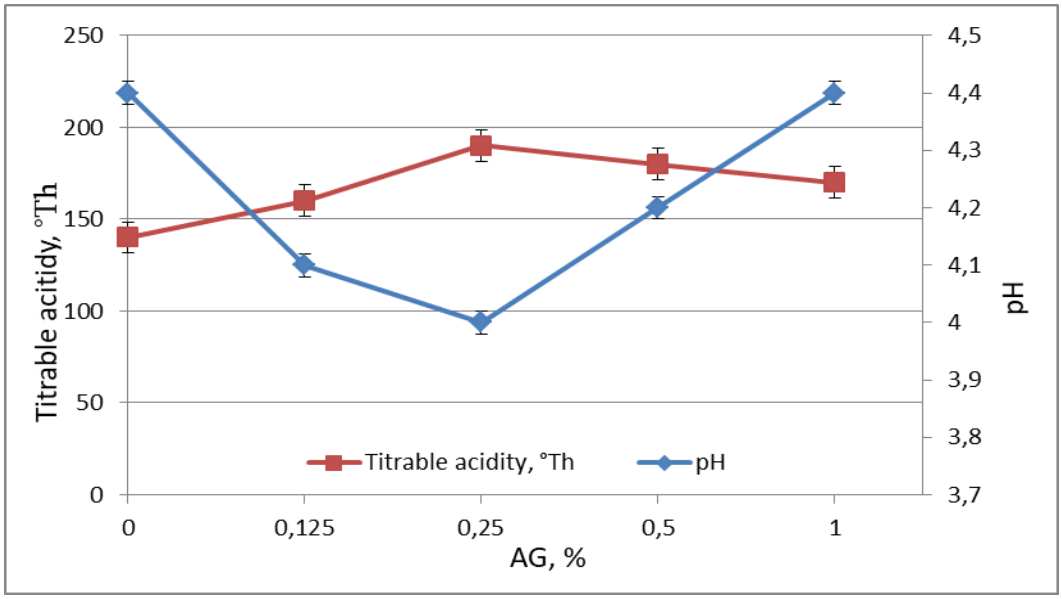

Figure 4. Titrable acidity and pH of Narine samples depending on AG concentration

Narine samples supplemented with AG exhibited relatively lower pH and higher titratable acidity compared to plain Narine (Figure 4). A correlation was observed between the increase in microbial count and titratable acidity in the product. Thus, the data presented in Figures 3 and 4 reveals that samples supplemented with 0.25% AG exhibited the highest amount of *Lactobacillus helveticus*, the highest milk coagulation rate, the lowest pH, and the highest titratable acidity. Our data align with previous research suggesting that bioactive plant extracts can stimulate the growth of lactic acid bacteria (LABs) and enhance their metabolic activity, resulting in decreased pH and increased titrable acidity of the product through intensified production of lactic acid and other organic acids [23, 24, 25]. It should be noted that crude AG itself is slightly acidic with an average pH of 5, and therefore cannot make a significant contribution to the acidification of milk.

The impact of apricot gum on the viscosity of skimmed milk before and after fermentation with *L. helveticus* was investigated using dynamic rheometry, the optimal technique for assessing the viscoelastic properties of yogurts. The viscosity of skimmed milk samples enriched with different concentrations of AG is presented in Figure 5.

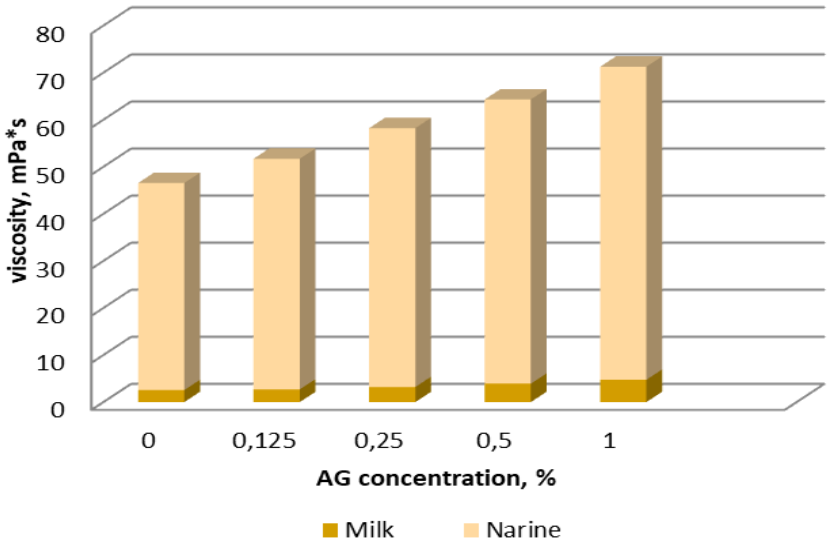

Figure 5. Viscosity of skimmed milk samples enriched with different concentrations of AG before and after fermentation with *L. helveticus*.

As shown in Fig. 5, the addition of 0.125% to 1.0% AG does not significantly alter the rheology of pasteurized milk (2.5 - 4.7 mPa•s) ($p \leq 0.05$). However, during fermentation, viscosity increases dramatically depending on the AG concentration ($p < 0.05$). The addition of AG in concentrations ranging from 0 to 1.0% results in an exponential rise in the viscosity of Narine from 44.0 to 66.8 mPa•s ($p < 0.05$). Given that the viscosity of apricot gum remains relatively stable within the pH range of 4.0–6.0, it is postulated that the heightened viscosity of fermented milk products arises from the synergistic interaction between apricot gum and milk polymers induced by an acidic environment.

Antioxidant assay: The antioxidant assay conducted in previous research has shown that Narine exhibits high antioxidant activity [3]. The DPPH scavenging assay is a commonly employed method for determining the antioxidant capacity of fermented foods and plant gums. The effect of AG on the antioxidant activity of Narine is depicted in Figure 6.

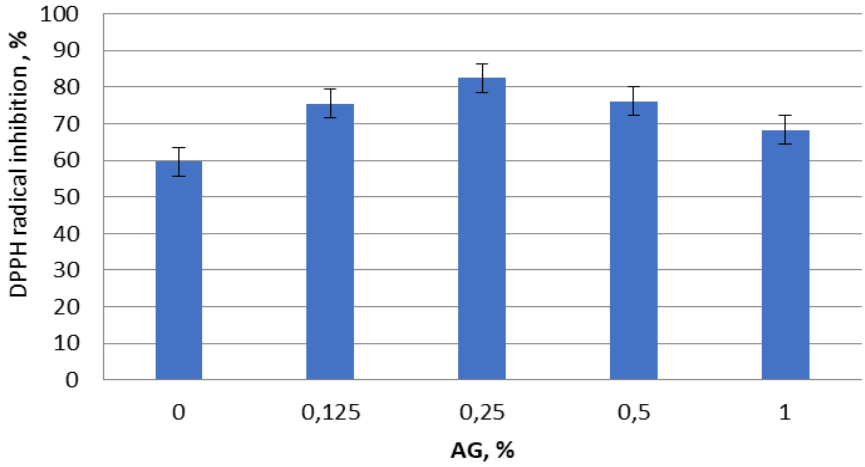

Figure 6. Influence of AG on antioxidant activity of Narine defended by DPPH radical scavenging activity

As depicted in Figure 6, all Narine samples enriched with AG exhibited significantly higher antioxidant activities compared to plain Narine ($p < 0.05$). A positive correlation was observed between antioxidant activity and the viable count of the starter culture.

As shown in Table 1, the addition of AG at concentrations of 0.125% and 0.250% led to significant enhancements in the antioxidant activity of Narine by 75.4% and 82.5%, respectively ($p < 0.05$). However, further increases in AG concentration resulted in a slight reduction in antioxidant activity.

Dairy products fermented with *L. helveticus* typically demonstrate much greater antioxidant activity than commercial yogurts [3, 5, 24]. Various strains of *L. helveticus* have been extensively employed in dairy studies owing to their rapid growth in milk, acid stress tolerance, and high proteolytic activity, which facilitates the release of bioactive peptides from milk proteins [24, 27, 28]. The specificity of LAB proteolytic enzymes on milk proteins plays a crucial role in the production of bioactive peptides [29]. Polysaccharides and phenolic compounds of AG also have DPPH scavenging activity [30], but their contribution to the antioxidant activity of yogurts is negligible due to the low concentrations (≤ 1%) used in the experiments. Bioactive compounds released during milk fermentation through the proteolytic breakdown of milk proteins exhibit not only antioxidant activity but also possess immunomodulatory, anticancer, antibacterial, and antihypertensive properties [27].

Effect of 0.25 % raw AG on maintaining of Narine quality in refrigerator storage: The effect of AG at concentration of 0.25% on starter culture viability, apparent viscosity, syneresis, titratable acidity and pH of Narine in refrigerator storage was monitored after 1, 14 and 28 days (Table 1).

Table 1. Physicochemical, microbiological and sensory properties with and without AG storage time in the refrigerator

Properties	Refrigerator storage, day					
	1		14		28	
	control	+AG	control	+AG	control	+AG
Titer, CFU/mL	2.2×10^9	8.9×10^9	8.8×10^8	5.7×10^9	1.6×10^8	2.2×10^9
pH	4.8	4.5	4.3	4.4	4.0	4.2
Titratable acidity, °Th	82	96	107	113	142	126
Viscosity, mPa·sec	44.2	55.3	45.8	56.6	46.1	58.3
Syneresis, %	25	15	30	20.5	35.5	25

It was observed that the viability of *L. helveticus* in AG-Narine was significantly (>1.2 log) higher than in plain Narine throughout the storage period. The enhanced viability of *L. helveticus* in experimental Narine could stem from the protection of starter cells by AG through spontaneous encapsulation [31] and/or the prevention of further acidification by AG during cold storage. It is assumed that the principal cause of the decline in LAB

viability in fermented milk products during storage is the increase in titrable acidity [21], possibly resulting from the passive production of lactic acid by the starter cultures [25, 32].

It was observed that on the first day of cold storage, the acidity of AG-Narine was higher than that of plain Narine due to the vigorous growth of the starter culture stimulated by AG (Figure 2). However, by the end of refrigerator storage, plain Narine became more acidic than AG-Narine, and this difference was statistically significant ($p < 0.05$) (Table 1). This slowdown in acidification likely results from the hindrance of cell-substrate interaction by AG. A similar finding was reported by Ziaolhagh at al. in their study on the effect of 0.15% xanthan on the change in acidity of the fermented milk product bio-Doogh [33].

Apparent viscosity: Apparent viscosity and syneresis of fermented milk products are crucial factors influencing consumer acceptance [25]. Over the 14-day storage period, apparent viscosity values increased in both the control and AG-Narine, although this increase was not statistically significant ($p > 0.05$). The increase in viscosity of dairy products is linked to the interaction between whey protein and casein micelles, which is influenced by pH fluctuations [34]. This elevation could be ascribed to the agglomeration of certain proteins exposed to aggregation at low temperatures

Moreover, the alteration in viscosity, alongside micelles, is influenced by pH-dependent factors such as particle size and protein deposition in the product.

Changes in viscosity are influenced by fluctuations in the volume of casein micelles during storage, potentially affected by factors such as the presence and quantity of macromolecules like fat, proteins, or micelle-binding factors. The viscosity of AG-Narine remained notably higher even after 28 days, averaging 51.3 mPa•s ($p \leq 0.05$). In contrast, the decline in viscosity observed in plain Narine during refrigerator storage may be attributed to reduced viability of the starter culture, leading to the release of catabolic enzymes during cell lysis.

Syneresis is commonly described as the spontaneous release of water from the gel due to gel contraction [35]. Generally, storage time had a significant impact on syneresis. As illustrated in Table 1, the addition of 0.25% AG notably reduced syneresis formation ($p < 0.05$). Consequently, on the first day of refrigerator storage, syneresis for plain Narine was 20%, whereas for AG-Narine, it was only 12%. The difference in syneresis rates, 1.6 times, was statistically significant ($p < 0.05$) and persisted throughout the entire storage period, regardless of variability. By the 14th day, syneresis values were 24% in the control and 15.5% in AG-Narine; with further storage up to 28 days, syneresis did not change significantly, amounting to 25.6% and 16.4%, respectively.

Our findings align with those of other researchers who have demonstrated that samples containing plant gums exhibit lower syneresis. This noteworthy reduction in syneresis can be attributed to the presence of AG fiber, which exhibits a high water-holding capacity [31]. Guar gum has been reported to reduce syneresis and completely stabilize the product at 0.3% [33, 36]. Additionally, soluble tragacanthin adsorbed onto casein prevents whey separation due to electrostatic and steric repulsion [37]. Consequently, based on the data presented in Table 1, it can be concluded that the addition of AG significantly affects the overall properties of the fermented milk product, including the number of viable bacteria, acidity, syneresis, and viscosity, thereby ensuring high quality and an extended shelf life during refrigerator storage.

Sensory evolution of AG-Narine: Incorporating polysaccharides into dairy products serves not only to

manage rheological characteristics but also to attain desirable organoleptic properties and flavor. The sensory attributes of functional yogurt, fermented by the *L. helveticus* MDC 9602 starter supplemented with 0.25% AG, were assessed for appearance, odor, color, aroma, acidity, and overall acceptance. Affective scores obtained for experimental and plain Narine are depicted in Figure 7.

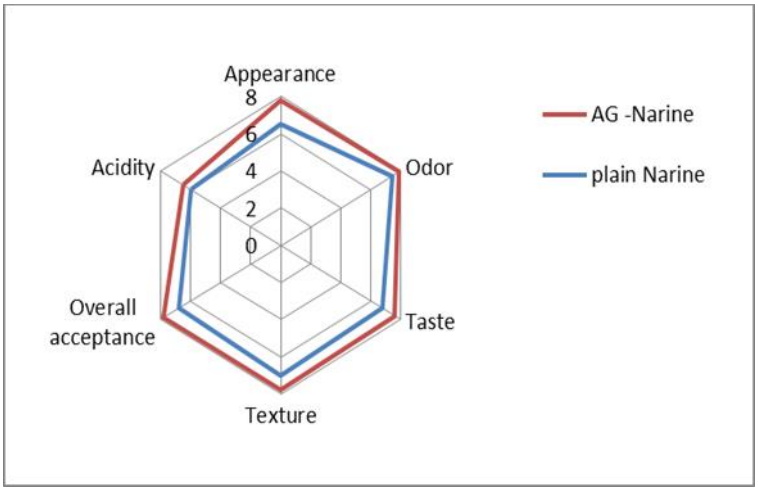

Figure 7. Sensory evaluation of AG -Narine and plain Narine. Mean ± standard deviation.

The results displayed in Figure 7 indicate that AG significantly influences the appearance, odor, color, aroma, acidity, and overall acceptance of the final product. Narine supplemented with AG exhibits a smoother and more delicate texture, rendering it more favorable to consumers. Across most of the assessed characteristics, panel members assigned a higher rating to AG-Narine compared to plain Narine.

The resulting high-quality low-fat functional fermented milk drink with excellent organoleptic properties is recommended for regular consumption, as well as for the prevention and treatment of various gastrointestinal disorders.

CONCLUSION

A new method was developed for the preparation of fully water-soluble apricot gum. The raw apricot gum powder produced through this procedure demonstrated resilience to repeated drying and dissolution.

For the first time, a reliable stimulating effect of raw AG on the growth of *L. helveticus* MDC 9602 ($p < 0.05$) was demonstrated. Thanks to the synergism of apricot gum and the *L. helveticus* strain MDC 9602, a new synbiotic fermented milk drink AG-Narine was created, which has high microbiological, physicochemical, organoleptic and health promoting properties. Moreover, AG-induced elevated levels of viable *L. helveticus* MDC 9602 counts, known for their high proteolytic activity, contributed to a significant increase in the number of bioactive peptides with antioxidant properties. The participation of raw AG in milk fermentation leads to an increase in the viable count of probiotic starter, a reduction in fermentation time, a significant synergistic increase in viscosity, a decrease in syneresis and a significant increase in the antioxidant capacity of Narine. AG ensures high quality and probiotic activity of fermented milk products throughout their shelf life.

List of Abbreviations: LAB, Lactic acid bacteria; AG, apricot gum; DPPP, 2,2-diphenyl-1-picrylhydrazyl; GAE, Gallic acid equivalent; QE, Quercetinequivalent; GC/MS, gas chromatography/mass spectrometry, MDC, Depository Center for Microorganisms; °Th, Thorner.

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