A Comprehensive Review on Shalgam (Şalgam), a Traditional Turkish Beverage

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Abstract

Shalgam (şalgam) beverage is a traditional Turkish drink produced through the lactic acid fermentation of root vegetables, such as black carrots and turnips. The drink is especially popular in southern regions of Türkiye and is now widely consumed across the country. In recent years, Shalgam beverage has gained popularity beyond its traditional cultural context and now holds growing commercial potential internationally. This review provides a comprehensive overview of the traditional production methods of Shalgam beverage, including both conventional and direct fermentation techniques, and presents a detailed example of a representative production process. The chemical composition and nutritional attributes of the beverage are also examined. Due to its content of anthocyanins, phenolic compounds, and lactic acid bacteria with potential probiotic properties, Shalgam beverage might have functional benefits. However, concerns regarding alcohol content, shelf life, use of preservatives, and a lack of standardization are also discussed. Traditional knowledge should be integrated with modern food technologies, and innovative approaches—such as controlled fermentation, starter cultures, and non-thermal preservation methods—should be promoted to improve product safety and quality. This review can be classified as an experience-based narrative review, combining practical knowledge with scientific literature to evaluate the benefits of traditional Shalgam beverage.

Keywords: Shalgam beverage, Şalgam, Traditional beverage, Lactic acid fermentation.

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1. Introduction

Traditional foods reflect a society's historical heritage, cultural memory, and life practices shaped by geographical conditions. These foods have been conserved for generations and have been enriched by knowledge, experience, and production techniques. Owing to its diverse geography and cultural richness, Türkiye hosts a variety of traditional foods, including beverages unique to different regions, such as ayran, boza, kefir, hoşaf, compote, salep, Turkish coffee, Turkish tea, lemonade, hardaliye, kımız, gilaburu juice, unripe grape juice (koruk suyu), şıra, sherbet, pickle juice, and Shalgam beverage. These beverages are not only appreciated for their taste, but also valued as cultural assets due to their historical background, production techniques, functional properties, and social significance. Produced in various ways throughout the country, these foods are unique to local raw materials, climate conditions, and traditional knowledge (Başlar, 2023).

Shalgam beverage is a traditional Turkish drink that is widely consumed across Türkiye, particularly in the southern provinces. The drink is produced by lactic acid fermentation of root vegetables, such as black carrots and turnips. With its distinct color, sour flavor, and refreshing nature, Shalgam beverage is commonly consumed alongside kebab dishes. Further to being a fermented beverage, Shalgam beverage is also described as a functional drink due to its high antioxidant potential and the presence of carotenoids, chlorogenic acids, anthocyanins, phenolic compounds, and lactic acid bacteria that have potential probiotic properties (Tanrıseven et al., 2018; Kafkaskıray, 2020).

According to the Turkish Standards Institute (TSE), Shalgam beverage is defined as: "a product obtained by fermenting a mixture of bulgur flour, sourdough, potable water, and edible salt through lactic acid fermentation, then blending the resulting extract with turnips (*Brassica rapa*), black carrots (*Daucus carota*), and optionally hot pepper powder, and subjecting the mixture to a second lactic acid fermentation; if desired, the product can be made shelf-

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stable by thermal processing" (TSE, 2003). Although the standard allows for thermal treatment to extend shelf life, it is not common in traditional production due to the sensory changes the process could cause (İrkilmez, 2017).

This review was prepared by combining the author's longstanding practical experience of Shalgam beverage production with the academic knowledge gained during graduate studies and research projects. Informed by relevant literature, this review critically examines practical knowledge within a scientific framework, and therefore qualifies as an experience-based narrative review.

2. Production of Shalgam Beverage

Shalgam beverage is a fermented drink that can be produced in various ways depending on regional traditions. In addition to variations in traditional methods, the industrialization of Shalgam beverage production has also led to significant changes in production processes. With advancing technologies, such variations are expected to continue evolving. At present, two main production methods are widely recognized: the traditional method and the direct method. To understand these methods, it is essential to first examine the ingredients used in this unique fermentation process, as the selection and preparation of raw materials play a crucial role in the quality and safety of the final product.

2.1. Ingredients

The production of Shalgam beverage involves various raw materials that contribute to its unique flavor, aroma, color, and microbiological quality. The main ingredients include black carrot, turnip, bulgur flour, rock salt, and yeast (*Saccharomyces cerevisiae*). These components are essential not only in traditional production, but also in industrial applications.

Black carrot (*Daucus carota L.*): Black carrot is the primary source of Shalgam beverage's characteristic dark red color and distinct aroma. During fermentation, anthocyanins released into the liquid contribute not only to coloration, but also enhance antioxidant capacity. Naturally occurring soluble sugars in the carrot serve as carbon sources for lactic acid bacteria, supporting effective fermentation. Typically, 10–20% of black carrot is used in production (Erten et al., 2008). Sliced or chopped black carrots can be used. Black carrot peels are generally retained or partially peeled; washing with warm water is acceptable while heat treatments, such as blanching should be avoided to preserve microbial activity and fermentation quality.

Bulgur flour (setik): Traditionally known as "setik", bulgur flour acts as a nutrient source for lactic acid bacteria and yeasts during fermentation. Bulgur flour is added at around 3% and plays a considerable role in initiating and sustaining fermentation and might also influence aroma development and the consistency of the beverage (Erten et al., 2008).

Yeast (sourdough or baker's yeast): In Shalgam beverage production, either sourdough or baker's yeast (*Saccharomyces cerevisiae)* is used as a microbial inoculum. Sourdough contains various lactic acid bacteria (eg, *L. plantarum*, *L. brevis*, and *L. fermentum*) and different yeast strains (Tangüler, 2010). Although these microorganisms can originate naturally from the ingredients when using traditional production methods, industrial production often uses starter cultures to enable controlled fermentation.

Rock salt: Salt not only contributes to taste, but also plays a crucial role in controlling the fermentation microbiota and inhibiting undesirable microorganism growth. Typically used at around 1%, rock salt is crucial for ensuring the safety and stability of the fermentation environment (Erten et al., 2008).

Turnip (*Brassica rapa L.*): Although the beverage is named after this root vegetable, its use in production is relatively limited. In some regional recipes, turnip is excluded while in others, it is be added in small amounts (eg, ~1%). Turnip contributes to flavor and aroma because it contains soluble sugars (eg, glucose, fructose, and sucrose) and minerals (Tangüler & Erten, 2009). Although its name comes from the turnip (meaning "şalgam" in Turkish) vegetable, the sensory and fermentation characteristics of the beverage are largely influenced by black carrots (Çakır, 2023).

Water: As in all fermentation processes, potable-quality water is essential in shalgam beverage production. Water ensures the extraction of soluble substances, supports microbial activity, and provides a homogeneous fermentation environment. Environmental factors, such as temperature (20–30°C), salt concentration, oxygen levels, and sunlight exposure significantly influence both microbial composition and the quality of the final product throughout the fermentation process (Erten et al., 2008; Çakır, 2023).

2.2. Traditional production method

The traditional production of Shalgam beverage consists of two main stages: dough fermentation and carrot fermentation (Figure 1).

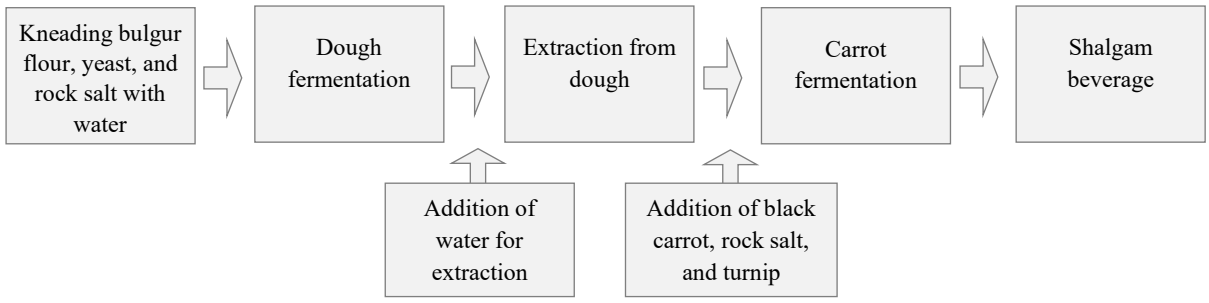

Figure 1. General production process of traditional Shalgam beverage (adapted from Erten et al., 2008)

2.2.1. First stage: Dough fermentation

The first stage, known as dough fermentation, begins with the mixing of bulgur flour, rock salt, and yeast. These ingredients are kneaded with water and left to ferment at room temperature for approximately 3–5 days. During this process, starch, proteins, vitamins, organic acid, and aroma compounds are released, supporting microbial growth. The activity of lactic acid bacteria and yeasts considerably increases the acidity of the dough and reduces the pH. Following dough fermentation, the extraction from dough process is performed where the fermented mass is subjected to sequential additions of water—typically three to five times—to obtain a liquid rich in microorganisms and soluble nutrients (Erten et al., 2008; Tangüler, 2010).

2.2.2. Second stage: Carrot fermentation

The second stage, known as carrot fermentation, begins with the use of the extraction liquid obtained from the dough fermentation stage. This extract, enriched with sourdough microbiota, provides a favorable microbial environment that initiates and supports carrot fermentation. Black carrots are added to the extracted liquid, along with rock salt and, optionally turnips. Fermentation is performed at ambient temperatures (25–30 °C) and in dark environments or in containers shielded from light (eg, wooden, plastic, or stainless steel tanks). Depending on fermentation conditions and temperature, this stage can take 1–3 weeks. The progress of fermentation can be monitored via the increase in acidity and the process is considered complete once the acidity levels stabilize. Upon completion of fermentation, separating the Shalgam beverage from the solids and storing it at refrigeration temperature is considered optimal for shelf life. Some producers choose to leave the fermented black carrots in the beverage to emphasize its traditional and natural characteristics (Erten et al., 2008; Tangüler, 2010).

2.2.3. Detailed example of a traditional production formulation

A detailed method and formulation based on the traditional approach for the production of 10 L of shalgam beverage is presented (Figure 2):

1-Preparation of ingredients: All raw materials required for production are procured. Among these, sourdough is of particular importance. If sourdough is not available, it should be prepared one day in advance. For 10 L of Shalgam beverage, 100 g of sourdough is used. To produce this amount, 61.6 g of flour, 1.2 g of salt, 3.2 g of fresh baker's yeast, and 34 g of water are mixed and kept at 25°C for 1 day.

2-Dough fermentation: The first fermentation stage begins by mixing 300 g of bulgur flour (48.4%), 20 g of rock salt (3.2%), 100 g of sourdough (16.1%), and approximately 200 mL of water (32.3%) until a semi-liquid dough is formed. This mixture is then left to ferment at 25°C for 3 days.

3-Extraction: After fermentation, the dough is subjected to four successive water extractions to recover both the microbial load (ie, yeasts and lactic acid bacteria) and water-soluble components (ie, starches, proteins, vitamins, minerals, aroma compounds, organic acids, etc.). The resulting liquid from this extraction is transferred to a separate container for further fermentation (eg, carrot fermentation or main fermentation).

4-Carrot fermentation: 1500 g of black carrot (15%), 117 g of rock salt (1.2%), and 100 g of turnip (1%) are added to the liquid obtained from the first fermentation. Water is added to reach a total volume of 10 L and the mixture is then allowed to ferment in a dark environment at 25°C. The progression of fermentation is monitored by titratable acidity, and fermentation is continued until the increase in acidity plateaus, typically lasting between 15 and 21 days.

5-Packaging: Once fermentation is complete, the Shalgam beverage is cooled to 4°C, filtered, and bottled for storage or consumption.

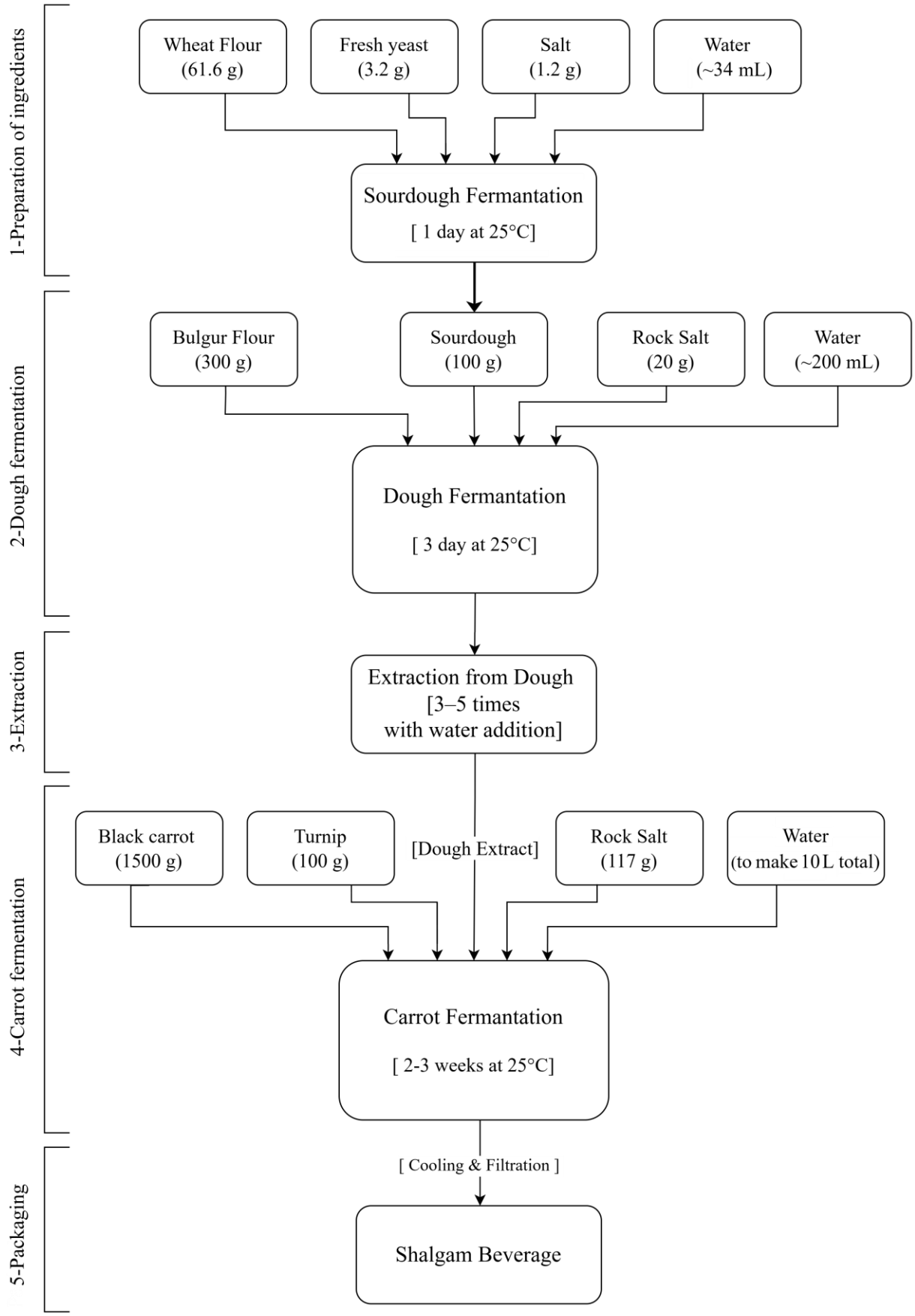

Figure 2. Detailed production process of traditional Shalgam beverage (developed by the author based on practical experience)

2.3. Direct production method

Direct fermentation is a more practical production method that omits the first stage (dough fermentation) used in the traditional process of Shalgam beverage production. With this method, all ingredients are added simultaneously into the fermentation vessel without a separate pre-fermentation step. In practice, chopped black carrots, bulgur flour, salt, turnip, water, and a microbial starter—either baker's yeast (Saccharomyces cerevisiae) or sourdough—are combined directly in the fermentation tank. After thorough mixing, the mixture is left to ferment at room temperature (typically between 20–30°C) for an appropriate duration (Öztürk, 2009). During this period, anthocyanins released from the black carrot color of the beverage, while lactic acid bacteria and yeasts contribute to the development of the desired acidic taste and aroma. A schematic representation of the direct fermentation process is provided in Figure 3. The primary advantage of this method is its ability to shorten the production time and reduce processing steps. However, since the process lacks a dough fermentation phase, there is a greater dependency on the microbial starter and environmental conditions, which can lead to variations in product quality. The microbial load introduced at the beginning of the process might be lower compared with the traditional method, necessitating stricter control during fermentation (Erten et al., 2008).

2.4. Storage and shelf life

After production, Shalgam beverage should be stored under refrigeration to slow down the microbial activity and extend its shelf life. Subsequently, the drink is bottled using an appropriate method depending on the production scale. The most common methods used to extend shelf life are thermal processing and the addition of preservatives. Many small-scale producers of commercial Shalgam beverage continue to use natural or traditional methods, often without applying heat treatment or adding preservatives, instead primarily focusing on cold storage. In contrast, large-scale manufacturers—those distributing nationwide or exporting internationally—tend to use heat treatment, preservatives, or cold chain logistics to ensure extended shelf life and microbiological stability.

According to the Turkish Food Codex (2011), the maximum total amount of preservatives, such as E210 (benzoic acid), E211 (sodium benzoate), E212 (potassium benzoate), and E213 (calcium benzoate), allowed in Shalgam beverage is 200 mg/L. However, some producers report that even this amount is insufficient to prevent spoilage over time.

Due to its low effect on pH, pasteurization can extend the shelf life of Shalgam beverage by up to 1 year. However, while thermal treatment provides microbiological stability, it can negatively affect sensory attributes and damage the beverage's characteristic natural aroma. As alternatives, non-thermal preservation methods have been investigated. İrkilmez (2017) reported that ultrasound treatment could be used, while Erol et al. (2024) proposed ultraviolet treatment as a promising method to enhance shelf life without compromising product quality.

According to a market analysis conducted by Öztürk (2009), the microbiological characteristics of commercial Shalgam beverages are presented in table 1. Due to the high microbial activity in Shalgam produced using traditional methods, the product typically has a shelf life of only 1–2 months and gradually loses its desirable sensory characteristics.

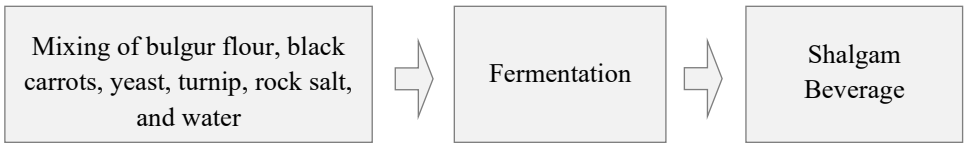

Figure 3. Direct production process of Shalgam beverage (adapted from Erten et al., 2008)

Table 1. Microbiological characteristics of commercial Shalgam beverages

Microbial group	*Min (log cfu/mL)*	*Max (log cfu/mL)*
Total mesophilic aerobic bacteria	3.26	7.66
Lactic acid bacteria	5.32	7.97
Total yeast count	5.72	8.15

Source: Öztürk (2009)

3. Composition of Shalgam Beverage

The approximate composition of Shalgam beverage, compiled from various sources, is presented in table 2. According to this data, Shalgam beverage is low-calorie because of low protein, fat, and carbohydrate content—providing approximately 2–4.6 kcal per 100 mL. The total dry matter content ranges between 20.7 and 31.9 g/L, with most of the weight for ash and salt (Öztürk, 2009). In particular, the salt content varies from 11.2 to 17.9 g/L, which is relatively high. The low pH value (pH 3.3–3.8) and high titratable acidity (66.40–99.10 meq/L) contribute to the beverage's characteristic sour taste (TSE, 2023; Deryaoğlu, 1990).

Since Shalgam beverage is a natural product of lactic acid fermentation, the formation of small amounts of ethanol is expected. These levels can vary depending on the fermentation duration, production conditions, and storage parameters. In Öztürk's (2009) study, the ethanol content ranged from 0.19 to 4.76 g/L, indicating that the alcohol level in Shalgam beverage can approach 5 g/L. To be classified as a non-alcoholic beverage, the ethanol content is required to be below 5 g/L in the USA (Code of Federal Regulations, 2024) and below 3 g/L in Türkiye (Turkish Food Codex, 2007). This classification is not only a legal requirement, but also a matter of cultural and religious significance. The presence of even small amounts of alcohol can be problematic for individuals from religious groups with strict dietary laws, such as Muslims and Jews. Beverages containing ethanol in higher percentages than these thresholds can conflict with halal and kosher dietary standards, which explicitly prohibit the consumption of alcoholic substances.

4. Health implications of Shalgam beverage

Shalgam beverage stands out as a healthy drink due to its sugar-free composition and fermented nature. Fermentation reduces sugar levels to nearly undetectable amounts, resulting in a low-calorie beverage with minimal glycemic impact. While Shalgam beverage contains high levels of lactic acid bacteria (especially *L. plantarum*) that have potential probiotic effects and is occasionally labeled as a probiotic drink, it does not fully meet the scientific criteria required for probiotic classification, such as strain identification, viability, and demonstrated health benefits in human (Kafkaskıray, 2020).

One of the most notable features of Shalgam beverage is its richness in bioactive compounds. Anthocyanins derived from black carrots not only impart the beverage's distinctive color, but also offer potent antioxidant properties. In addition, various phenolic compounds originating from vegetables are transferred into the liquid phase during fermentation, while newly formed phytochemicals contribute additional anti-inflammatory and potentially anticancer properties. With these characteristics, regular and moderate consumption of Shalgam beverage might support immune system health and contribute to the prevention of chronic diseases (Üçok & Tosun, 2012; Toktaş et al., 2018).

Shalgam beverage is exceptionally low in calories and sugars, making it suitable for individuals on calorie-restricted diets or those requiring low sugar intake. The fat and carbohydrate content is negligible. While Shalgam beverage is considered beneficial for health, certain potential risks should also be taken into

Table 2. Approximate composition of traditional Shalgam beverage

Component	*Min*	*Max*	*Reference*
Total solids (g/L)	20.7	31.9	Öztürk (2009)
Protein (g/L)	0.88	1.83	Deryaoğlu (1990)
Carbohydrate (g/L)	11.0	11.5	Label Review (2025)[a]
Sugar (g/L) [c]	0.15	6.48	Öztürk (2009)
Fiber (%)	0.02	0.67	Özler (1995)
Fat (g/L)	<LOD [b]	<LOD [b]	Label Review (2025)[a]
Ash (g/L)	12.9	20.7	Öztürk (2009)
Salt (g/L)	11.2	17.9	Öztürk (2009)
Energy (kcal/100 mL)	2	4.6	Label Review (2025)[a]
pH	3.3	3.8	TSE (2023)
Total acidity (meq/L)	66.40	99.10	Deryaoğlu (1990)
Ethanol (g/L)	0.19	4.76	Öztürk (2009)

[a] The data were obtained by examining the nutritional information declared on the product labels of three different traditional Shalgam beverage brands available on the Turkish market in 2025. [b] The component was reported as "0" by the manufacturer, possibly because it was below the limit of detection (LOD) of the analytical method used. [c] The total amount of sucrose, fructose, and glucose.

account. The amount of rock salt traditionally used during production might be relatively high (it can go up to 2%, according to TSE, 2003), which could be a limiting factor for individuals with salt sensitivity, such as those with hypertension. The drink's acidic nature is another factor that should be considered, particularly for individuals with gastric sensitivity (Surdea-Blaga et al., 2019). Additionally, the use of preservatives to extend shelf life requires careful evaluation. In non-pasteurized products, there is a risk of preservative levels exceeding legal limits, which raises both regulatory and health concerns.

Moreover, with traditional production, shelf life is often monitored visually, which can lead to the oversight of undesirable microbial activity, such as the growth of molds and yeasts. Mycotoxins produced by certain molds can pose major health risks to consumers. Therefore, hygienic production practices, controlled fermentation, cold storage (typically at refrigeration temperatures), and routine microbiological analyses are of crucial importance.

5. Industrial Potential of Shalgam Beverage

Shalgam beverage is primarily produced and consumed in the southern provinces of Türkiye, particularly in the Adana, Mersin, and Hatay regions. Since its introduction to the market in packaged form during the 1990s, Shalgam beverage popularity has gradually expanded throughout the country. By the 2000s, Shalgam beverage had become a widely consumed beverage across Türkiye (Üçok & Tosun, 2012). The drink's strong association with traditional kebab culture has secured its place both on restaurant menus and on shelves beside ready-to-drink products.

In line with developments in the food industry and evolving consumer demands, the production of Shalgam beverage has moved beyond traditional boundaries and into industrial-scale manufacturing. Many companies have begun integrating traditional production methods with modern food technology to develop pasteurized, preservative-free, organic, and even functional beverage versions. For industrial production, the use of starter cultures, controlled fermentation temperatures, and cold chain logistics are important techniques to ensure consistent product quality (Çakır, 2023).

In the Shalgam beverage sector, bottled shalgam products are of particular importance in terms of commercial potential. Doğanay stands out as the leading brand in the industry while brands, such as Kilikya, Fersan, and Kemal Kükrer, are also actively involved in production and distribution. Doğanay, which bases its production on thermal processing methods, reports on its official website (2025) that it exports to approximately 40 countries across America, Asia, Africa, and Europe (Doğanay Gıda, n.d.). Similarly, Kilikya states that it exports Shalgam beverage to more than 30 countries, including in Europe, America, Russia, and the Far East (Kilikya, n.d.). According to publicly available data, Doğanay's annual Shalgam beverage production capacity exceeds 500 million L (NTV, 2020), while Kilikya produces over 30 million L per year (Kilikya Shop, n.d.). Both companies play a key role in the globalization of this traditional Turkish fermented drink.

Shalgam beverage also holds significant potential in international markets. Export activities are already underway, particularly to European countries, such as Germany and France, where there are large Turkish communities, and also to Japan (Wikipedia, n.d.). The increasing global interest in fermented beverages with high antioxidant content indicates that Shalgam beverage could find a strong position within the functional beverage market. However, to realize this potential, packaging, labeling, and marketing strategies needs to be aligned with international standards. Nonetheless, several limiting factors are encountered in industrial production. According to the Turkish Food Codex (2007, 2011), there are legal restrictions on the levels of salt and preservatives that could be used in a Shalgam beverage. In an effort to extend shelf life, some producers can occasionally exceed these limits, making this a crucial area for food safety monitoring. Moreover, variations in production practices can lead to differences in taste, color, and turbidity among products, complicating quality standardization.

6. Conclusions and Recommendations

Shalgam beverage stands out as a low-calorie, traditionally produced fermented drink with high probiotic potential. Its rich content of antioxidants and functional compounds offers considerable opportunities for healthy nutrition. However, the drink also poses certain risks, such as high salt content, limited shelf life, and microbiological instability. Standardizing traditional production methods at an industrial scale and ensuring quality control are crucial steps to enhance the competitiveness of Shalgam beverage both in domestic and international markets.

Future research should focus on three key areas: reducing salt content while maintaining sensory properties, enhancing microbiological safety, and improving shelf life with innovative preservation

techniques. To achieve these goals, traditional production methods of Shalgam beverage should be standardized at the industrial level and supported by rigorous quality control systems. Controlled fermentation processes using starter cultures and the application of non-thermal preservation methods (eg, ultrasound or UV treatment) offer promising approaches for ensuring microbial stability. In this context, university–industry collaborations should be encouraged to advance research and development, particularly in starter culture innovation and preservation technologies that retain the beverage's traditional qualities.

Moreover, beyond scientific research and technological advancements, broader strategic initiatives are essential to unlock the full potential of Shalgam beverage in both local and international markets. Efforts should be made to better leverage its geographical indication status to preserve regional identity and distinguish it in competitive global settings. Enhancing industrial competitiveness with branding, marketing strategies, and international trade initiatives can support wider consumer recognition. These efforts, when supported by research and development outcomes, will further reinforce the cultural and economic value of the beverage.

Declaration of Competing Interest

The author declares that they have no financial or non-financial competing interests.

Author's Contributions

M.Ü. İrkilmez (0000-0003-1758-7840): *Conceptualization, Investigation, Methodology, Original Draft, and Editing.*

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