

A REVIEW OF QUALITY PRACTICES IN DEVELOPING AND IMPROVING FUNCTIONAL CEREAL-BASED NON-ALCOHOLIC BEVERAGES

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ABSTRACT

Non-alcoholic beverages made from cereals are still among the most popular indigenous drinks around the world. It is widely consumed in African countries as a refreshing, hydrating, and simple way to transport multiple nutrients into the body. The majority of these non-alcoholic Cereal-based beverages have a short shelf life and are produced locally under unsanitary conditions by local residents. Concerns have also been raised about inconsistencies in taste and flavor from different producers. These are significant constraints to the mass production, standardization, and commercialization of such products. There are also many concerns about the sanitation of products sold on the street. Several quality practices must be in place to ensure safe, healthy, and wholesome food, taking into account sensory properties, consumer awareness of eating healthy foods, and production methods. This paper focuses on the quality practices used in the manufacture of cereal-based non-alcoholic beverages. Following an in-depth review of previous publications, current practices for improving the quality of cereal-based non-alcoholic beverages are presented. These quality practices have the potential to aid in the production of high-quality non-alcoholic cereal beverages. This would be advantageous in terms of safety as well as nutritional value. As a result, such practices will be required to improve and develop local non-alcoholic beverages.

1.0 INTRODUCTION

Beverages are liquids that are produced for human consumption. They cover a huge part of the food industry and are typically consumed during celebrations or served based on personal preferences (Tireki, 2021). Beverages are an excellent vehicle for transporting nutrients. Phytochemicals, Dietary fibre, vitamins, fatty acids, probiotics, and minerals, can be incorporated into beverages. The presence of these compounds offers the prospect of using food as a valuable element in disease prevention strategies, particularly in the early stages of the disease (Tofană et al., 2021). Alcoholic, non-alcoholic, and dairy-based beverages are the three types of beverages. Non-alcoholic beverages are those that do not contain alcohol. They are one of the most popular foods in modern diets. It provides consumers with refreshment, hydration, enjoyment, consumption convenience, and other functions (Nanasombat et al., 2015; Tireki, 2021). Some of the examples include; Soft drinks, fruit juices, milk derivatives etc. Consumer lifestyles are constantly changing as a result of globalization, advances in food science and technology, and/or lifestyle choices and religious restrictions. In terms of these lifestyle changes, sensory acceptance remains the primary factor for consumers. It is heavily influenced by cultural backgrounds as well as prior sensory exposure to existing food products (Phan & Chambers IV, 2016; Salanță et al., 2020; Tofană et al., 2021). Modern lifestyles, combined with changing dietary patterns, have increased the prevalence of diseases such as type 2 diabetes, coronary heart disease, cancer, periodontal disease, and obesity. This trend has resulted in growing consumer

interest in more health-conscious and wholesome nutrition (Urala & Lähteenmäki, 2007). This desire to make food more nutritious has resulted in a demand for foods that provide health benefits, also known as functional foods (Nanasombat et al., 2015; Tofană et al., 2021).

As reported by Siro *et. al.*, (2008), Whole grains are concentrated in nutrients and bioactive compounds. There is enough scientific evidence to suggest that regular consumption has a positive effect on health. Therefore, a multigrain beverage from a variety of grains can be an excellent form of functional food. For this reason, food is now viewed by consumers not only as a source of satisfaction, but also as a means of disease prevention and control (Siro et al., 2008). This shift in perspective has allowed a vast number of processed food products with specific health benefits to enter the market. These foods are known as functional foods. Functional foods are simply "foods and food components that provide a health benefit in addition to basic nutrition" (Corbo et al., 2014). Functional foods should at least be a thorough source of the bioactive components based on which functional claims are made. Bioactives are biologically active substances found in a variety of plant and animal foods. They do not provide nutrition but play specific roles in physiological functioning and thus have an effect on human health. Dietary fiber, vitamins, minerals, carotenoids, fatty acids, prebiotics, probiotics, phytochemicals, enzymes, and antioxidants are examples of bioactive components.

2.0 REVIEWS

Cereal Based Non-Alcoholic Beverages

Cereals are staple foods that provide a significant source of affordable calories all over the world. They are available all year and are high in bioactive compounds. Cereals have long been consumed around the world, particularly in Asia, Africa, South America, and parts of Central America. Rice, rye, maize barley, millets sorghum, and wheat are the seven major kinds of cereal consumed by humans. They are good sources of macro and micronutrients, phytochemicals, and antioxidants (McKevith, 2004). Cereal grains are important and acceptable food sources in most cultures, and the global food trade has made them widely available. They are known to supply 56 % population's food energy and 50 percent of its protein (Basinskiene & Cizeikiene, 2020). Generally, Cereal grains are major sources of nutrients (e.g carbohydrates, proteins, lipids), micronutrients (vitamins and minerals), and other phytochemicals (carotenoids and phenolic compounds) (Arendt & Zannini, 2013; Basinskiene & Cizeikiene, 2020; Serna-Saldivar, 2016). Although most plant foods can be consumed raw, cereals must be processed before they can be consumed. This transformation into food products is accomplished through both traditional and non-traditional methods (steeping, malting, roasting, fermentation, boiling, baking, frying, nixtamalization, micronization, extrusion, etc.). Grain processing into finished food products usually necessitates a combination of methods. Various cultures have created various cereal-based foods and beverages over the centuries, but the majority of processes involve some baking or secondary processing. Different processing methods affect the content and composition of bioactive compounds and antioxidant activity in cereals (Basinskiene & Cizeikiene, 2020; Beta et al., 2005; Giordano et al., 2016). The qualities of these cereal-based products can be greatly altered by the addition of various functional constituents. Cereal drinks are made from a grain suspension. An extract of grain suspension can already be drunk as a dietary fiber-rich food supplement, but sifting and filtering the extract opens up new possibilities for creating interesting beverages. By fermenting the extract with microorganisms, new flavors can be created. Fermenting cereals with lactic acid bacteria (LAB) improves sensory and nutritional properties as well as food microbial shelf life (Leroy and De Vuyst, 2004; Ma^ortensson et al., 2000; Zannini et al.,

2012). It also causes a decrease in carbohydrate levels as well as some non-digestible poly- and oligosaccharides. Certain amino acids may be synthesized, and the availability of B group vitamins in Cereal-Based Nonalcoholic Beverages may be improved. Fermentation also provides optimal pH conditions for phytate enzymatic degradation. This can sometimes result in an increase in the amount of soluble Fe, Zn, and Ca. Furthermore, organic acids produced during fermentation give the drink a fresh, fruity flavor. The fermentation products also give you a good feeling and stimulate your metabolism when consumed.

Some non-alcoholic beverages are presented in Table 1. They are commercially available, with various scales of production, while others are mainly homemade beverages, produced for individual consumption using traditional methods. *Kunun-zaki* and *Mahewu*, are produced in both rural and urban areas. Their production is essentially a home-based industry as for now, there is no large-scale factory production. *Amazake* is commercially available in Japan and it is classified as a soft drink. *Bors* is also industrially produced and used as a flavour enhancer in Romanian gastronomy or it is consumed as a refreshing drink. *Shalgam* is a traditional beverage of southern Turkish cities and it is commercialized in various markets of European cities.

Table 1. Non-alcoholic cereal beverages and their sensory properties, nature of use, and production status

| BEVERAGE/ COUNTRY | SENSORY PROPERTIES | FUNCTIONAL PROPERTIES | HEALTH BENEFIT | NATURE OF USE | PRODUCTION STATUS |
|--|--|--|---|--|---|
| Mahewu – maize, sorghum, millet (Botswana, South Africa) | creamy colour, sour taste | Na, K, Ca, Fe, Zn, Mn; dietary fibre, carbohydrates, group B vitamins | bacteriostatic and bactericidal properties against enteric pathogens | Weaning food for infants, consumed in schools, farms, mines, etc. | homemade, Commercially produced in African countries |
| Kunun-zaki – millet, maize (Nigeria, Niger) | low viscosity, creamy appearance; sweet-sour taste | minerals (Fe, Ca, Mg, K) | provides micro- and macronutrients, improves nutritional status | refreshing drink; For personal use, festivities and sold for extra income | homemade, local producers |
| Amazake – rice (Japan) | cloudy appearance, sour-sweet taste | amino acids; vitamins B1, B2, B6; pantothenic acid, vitamin E, flavonoids, dietary fibre, polysaccharides, sterols; | improves digestion; mitigates hypertension, skin- enhancing action, | dessert, snack, natural sweetening agent, baby food, salad dressing | homemade and industrialized |
| Bors,/Borsht – wheat bran (Europe, Romania) | sour-bitter taste; odour | lipophilic and hydrophilic antioxidants (tocopherols, tocotrienols), phenolic | Alleviates respiratory and digestive diseases (indigestion, vomiting), , potentially | used as a souring ingredient in soups, nutritious drink | homemade and industrialized |

| | | | |
|-------------------------------------|---|---|--|
| <i>Shalgam</i> wheat (Turkey) | – red colour; sour taste home-scale level | compounds, group B vitamins, vitamin E, | beneficial in cancer treatment |
| | | carotene, group B vitamins, Ca, Na, Fe; | antiseptic agent; used as a small scale probiotic food; medicine producers regulates the because of its digestive system's antiseptic pH; agents |

Source: Tofană et al. (2021)

Systemic Intervention to Improve Cereal-Based Non-Alcoholic Beverage

Nutrient enrichment

Considering the significance of non-alcoholic beverages in the diet, it is critical to examine the sources of energy and nutrients in this category of foods to ensure the nutritional quality of the products. According to Petraccia *et al.* (2006), Non-alcoholic beverages provide approximately 800-1500 mL of daily fluid intake in the diet. Fluid intake in the diet is necessary for life and maintaining optimal levels of hydration, digestion and absorption of ingredients, excretion of metabolic products and toxins, and nerve transmission in order for humans to function properly (Benelam & Wyness, 2010; Petraccia *et al.*, 2006). Various ingredients have been added over time to improve the taste of non-alcoholic beverages and to make their consumption more appealing and, more recently, beneficial to the consumer's health (Rejman *et al.*, 2020). The current non-alcoholic beverage market is dynamic, expanding rapidly, and highly innovative, allowing consumers to make choices based on their specific needs and preferences.

The dietary and sensory qualities of cereal products are sometimes thought to be inferior to those of milk and milk-based foods. Smaller protein amounts, a lack of certain amino acids (lysine), the presence of anti-nutrients (phytic acid, tannins, and polyphenols), and the coarse nature of grains are some of the reasons for this (Blandino *et al.*, 2003). Several methods have been used to improve the nutritional qualities of cereals. Genetic enhancement and amino acid supplementation with protein concentrates or other protein-rich sources, such as grain legumes or defatted oil seed meals of cereals, are examples of these. Additionally, several processing technologies, including cooking, sprouting, milling, and fermentation, have been used to improve the nutritional properties of cereals, with fermentation being the most effective. Certain amino acids can be synthesized through fermentation, and the availability of B group vitamins can be improved (Nkhata *et al.*, 2018). Fermentation also provides optimum pH conditions for the enzymatic degradation of phytate. Such a reduction in phytate may result in a several-fold increase in the amounts of soluble Fe, Zn, and Ca (Blandino *et al.*, 2003; Nout & Motarjemi, 1997).

Previous studies on the nutritional composition of *Kunun-zaki* (a cereal-based non-alcoholic) have shown that the protein content is relatively low (J. C Anounye *et al.*, 1995; Bankole & Olatunji, 2001). This led to a great deal of fruitful research, where there was the fortification of the product with protein. Soybean was successfully added to *Kunun-zaki* to improve its nutritional profile to meet the daily protein, vitamins, and mineral requirements of vulnerable groups of the population in Nigeria. Soybean among other legumes, has the highest protein content (about 40%), whereas other legumes have 20-30% and cereals have a protein content of 8-15%. It is also one of the most excellent sourced and affordable source of protein for developing countries (Sowonola *et al.*, 2005).

The technology serves as a cheaper alternative for the food industry in the production of high protein drinks using local sources (Adelekan et al., 2013; J C Anounye, 1997; Danbaba et al., 2014; Olufunke & Oluremi, 2015). Fortifying *kunun-zaki* with soybean gave a nutritious beverage, but had no challenges of organoleptic acceptance (Anounye, 1997).

Safety practices

Pre-Treatment of Raw Materials

The cleaning process allows for the removal of various impurities, depending on the raw material types. The most common grain impurities are shrivelled grains, other cereals, grains damaged by pests, grains with discoloured germs, and sprouted grains. There are also miscellaneous impurities, including extraneous seeds, damaged grains, extraneous matter, husks, ergots, decayed grains, and insects. The conditioning or tempering of grains is performed using the monitored addition of water, which turns the endosperm softer and the bran harder. Doing this prevents the bran from breaking up, aids gradual separation throughout milling, and enhances sieving efficiency.

HACCP (Hazard Analysis Critical Control Point)

HACCP is such an important component of modern food safety management applications. The design, implementation, control, and management of HACCP systems are critical to the production of safe food products. The HACCP system is a very good way to ensure the safety from the farm to the final consumption. It is aimed at reducing all hazards associated with food production, as well as developing preventive measures to ensure that the production process is monitored (Shalaby et al., 2018). Past research has shown that it is also applicable in the production of non-alcoholic beverages; HACCP was also conducted on *Soykunun-zaki* which further revealed a significant amount of critical points physically and microbiologically that may have public health implications. This showed that *Soykunun-zaki* will require strict monitoring during production to ensure safety of the product (Danbaba et al., 2014).

Hurdle technology

Hurdle technology is practiced in the food industry in order to provide safe, stable and nutritious foods and it is usually used in combination with HACCP (Hazard Analysis Critical Control Point) (Singh & Shalini, 2016). It entails the use of a number of preservative factors in situations where microorganisms present in the food. It causes the food to overcome microbial instability and the safety of most traditional and novel foods (Rajendran & Bharathidasan, 2018). Studies conducted to standardize and preserve sugar cane juice by using some hurdle treatments which involved pasteurization of juice at 70 °C for 10 min after addition of 0.6 ml ginger, 0.3 ml lemon, 0.7 ml mint, 1.0 gm salt and addition at the rate of 225 ppm of potassium metabisulfite (KMS) per 100 ml of sugarcane juice (Rajendran & Bharathidasan, 2018). The hurdles were good in preventing the growth of microorganisms in sugarcane but the sensory scores reduced significantly with the advancement of storage time in the sugarcane juice.

Technologies Used in Fortifying Cereal-Based Non-Alcoholic Beverages with Legumes

Improving colloidal product stability

The particle size of the dispersed phase influences the stability of plant-based dairy beverages. These are colloidal systems formed by the dispersion of large particles such as fat globules, raw material particles, proteins, and starch granules (Jeske et al., 2018). Due to the diversity of particles, the product is susceptible to sedimentation. This results in product instability (Jeske et al., 2018).

Fortification with legumes may also result in a lack of creaminess due to fat separation, which may be unacceptable to consumers (Maria & Victoria, 2018). The stability of plant-based dairy beverages is governed by three factors: particle size, the formation of an emulsion, and the protein's solubility (McClements et al, 2019). The effectiveness of stabilizers, however, is dependent on the type of beverage, processing conditions, particularly temperature, and pH. (Ozturk & McClements, 2016).

Off-flavour reduction

Plant-based foods, particularly those fortified with legumes, are gaining popularity among consumers. This is due to a low-cost source of high-quality protein and bioactive components. The presence of off-flavors or beany flavors, on the other hand, limits their acceptability. To improve taste and flavor, these should be eliminated or reduced (Zhu & Damodaran, 2018). Oxidation of unsaturated fatty acids is the main reason of off-flavors in legume-based products. This is due to the activity of lipoxygenase (LOX), which acts as an enzyme inactivator. By adding artificial or natural flavorings, off-flavors can be eliminated through deodorization and/or masking. These are the most common techniques used in the manufacture of plant-based milk substitutes. Thermal treatments such as blanching and pasteurization have traditionally been used to inactivate LOX and improve the flavor of soy-based beverages (Guerrero-Beltran et al., 2009).

Shelf-life extension

Cereal beverages provide better nutrition, digestibility, and some food stability modification. This is common in areas where refrigeration is unavailable due to rising energy costs. The challenge with these types of products is their rapid deterioration, which renders them unfit for consumption. The ongoing activities of a microorganism after production cause fermentation and flavor release within two to four days of production (Mashau et al., 2020). Basic preservation methods, such as low-temperature storage, irradiation, and heat treatment are some of the techniques employed in shelf life extension. Some practices include the use of chemical and natural preservatives to extend shelf life. studies were carried out to extend the shelf life of *kunun zaki* for about 8 days by steeping the grains in warm water, addition of 15% sodium metabisulphite and pasteurization at 80°C for 30 minutes before refrigeration at 4-8 °C (Gaffa & Ayo, 2002). The addition of Aloe Vera Powder had an effect on the shelf-life of home-made *mahewu*. It increased the shelf-life of home-made *mahewu*, which is normally less than four days to fifteen days (Mashau et al., 2020).

Improving Local Cereal-Based Non-Alcoholic Beverage

The quality and safety of food and beverages have become of utmost importance over the years since it has become everyday food coupled with the busy life schedules warranting their consumption. The awareness of consuming healthy foods encourages its increased consumption. The manufacture of non-alcoholic beverages is done under poor hygienic conditions which results in short shelf-life and variable quality parameters which in turn affects the product's acceptability for standard commercialization. The knowledge of non-alcoholic beverage production has not been fully investigated and with technologies evolving especially in areas of preservation, there is a need to conduct further scientific research to determine the microbial and biochemical changes that may occur during and after the production of the beverage.

3.0 CONCLUSION

Quality practices in science and technology have the potential to produce excellent functional Cereal based beverages and deliver consistent product quality, improve shelf life, and enhance nutritional

values to meet the consumers' demands. Upcoming studies need to use such practices to focus on developing and improving local non-alcoholic beverages.

REFERENCES

- Adelekan, A. O., Alamu, A. E., Arisa, N. U., Adebayo, Y. O., & Dosa, A. S. (2013). Nutritional, microbiological and sensory characteristics of malted soy-kunu zaki: an improved traditional beverage.
- Anounye, J. C. (1997). *Development and Evaluation of Soybeans-Millet blend for Soy-kununuzaki preparation*. MSc Thesis, Department of Food Science and Technology, University of Makurdi.
- Anounye, J. C., Ndaaji, C. F., & Osho, S. M. (1995). The Effect of Soybean Incorporation and Temperature on the Nutritional Status and Shelf-life of Kunuzaki. *Postharvest Technology and Commodity Marketing*.
- Arendt, E. K., & Zannini, E. (2013). *Cereal grains for the food and beverage industries*: Elsevier.
- Bankole, A., & Olatunji, O. (2001). Development of unfermented malted cereal–Soy beverage. *Nigerian Food Journal* 19, 106-114.
- Basinskiene, L., & Cizeikiene, D. (2020). Cereal-based nonalcoholic beverages. *Trends in Non-alcoholic Beverages*, 63-99.
- Benelam, B., & Wyness, L. (2010). Hydration and health: a review. *Nutrition Bulletin*, 35(1), 3-25.
- Beta, T., Nam, S., Dexter, J. E., & Sapirstein, H. D. (2005). Phenolic content and antioxidant activity of pearled wheat and roller-milled fractions. *Cereal chemistry*, 82(4), 390-393.
- Blandino, A., Al-Aseeri, M., Pandiella, S., Cantero, D., & Webb, C. (2003). Cereal-based fermented foods and beverages. *Food Research International*, 36(6), 527-543.
- Danbaba, N., Oyeleke, S., Maji, A., Kolo, I., Hauwaau, H., & Kolo, I. (2014). Chemical and microbiological characteristics of Soy-Kununuzaki (a nonalcoholic beverage) produced from millet (*Pennisetum typhodeum*) and soybean (*Glycine max*). *International Journal of Current Microbiology and Applied Sciences*, 3(11), 649-656.
- Gaffa, T., & Ayo, J. (2002). Innovations in the traditional kunun zaki production process. *Pakistan Journal of Nutrition*, 1(5), 202-205.
- Giordano, D., Reyneri, A., & Blandino, M. (2016). Folate distribution in barley (*Hordeum vulgare* L.), common wheat (*Triticum aestivum* L.) and durum wheat (*Triticum turgidum durum* Desf.) pearled fractions. *Journal of the Science of Food and Agriculture*, 96(5), 1709-1715.
- Guerrero-Beltran, J. A., ESTRADA-GIRÓN, Y., Swanson, B. G., & BARBOSA-CÁNOVAS, G. V. (2009). Inactivation kinetics of lipxygenase in pressurized raw soymilk and soymilk from high-pressure treated soybeans. *Journal of food processing and preservation*, 33(2), 143-158.
- Jeske, S., Zannini, E., & Arendt, E. K. (2018). Past, present and future: The strength of plant-based dairy substitutes based on gluten-free raw materials. *Food Research International*, 110, 42-51.
- Jeske, S., Zannini, E., Cronin, M. F., & Arendt, E. K. (2018). Impact of protease and amylase treatment on proteins and the product quality of a quinoa-based milk substitute. *Food & function*, 9(6), 3500-3508.
- Maria, M., & Victoria, A. (2018). Influence of processing treatments on quality of vegetable milk from almond (*Terminalia catappa*) kernels. *ACTA Sci. Nutr. Health*, 2(6), 37-42.
- Mashau, M. E., Jideani, A. I. O., & Maliwichi, L. L. (2020). Evaluation of the shelf-life extension and sensory properties of mahewu–A non-alcoholic fermented beverage by adding Aloe vera (*Aloe barbadensis*) powder. *British Food Journal*, 122(11), 3419-3432. doi: <https://doi.org/10.1108/BFJ-11-2019-0846>

- McClements, D. J., Newman, E., & McClements, I. F. (2019). Plant-based milks: A review of the science underpinning their design, fabrication, and performance. *Comprehensive reviews in food science and food safety*, 18(6), 2047-2067.
- McKevith, B. (2004). Nutritional aspects of cereals. *Nutrition Bulletin*, 29(2), 111-142.
- Nanasombat, S., Thonglong, J., & Jitlakha, J. (2015). Formulation and characterization of novel functional beverages with antioxidant and anti-acetylcholinesterase activities. *Functional Foods in Health and Disease*, 5(1), 1-16.
- Nkhata, S. G., Ayua, E., Kamau, E. H., & Shingiro, J. B. (2018). Fermentation and germination improve nutritional value of cereals and legumes through activation of endogenous enzymes. *Food science & nutrition*, 6(8), 2446-2458.
- Nout, M., & Motarjemi, Y. (1997). Assessment of fermentation as a household technology for improving food safety: a joint FAO/WHO workshop. *Food Control*, 8(5-6), 221-226.
- Olufunke, A., & Oluremi, K. (2015). Assessment of nutritional and sensory quality of Zaki-A home-made traditional Nigerian beverage. *Journal of Nutrition and Food Sciences*, 5(3), 5-8.
- Ozturk, B., & McClements, D. J. (2016). Progress in natural emulsifiers for utilization in food emulsions. *Current Opinion in Food Science*, 7, 1-6.
- Petraccia, L., Liberati, G., Masciullo, S. G., Grassi, M., & Fraioli, A. (2006). Water, mineral waters and health. *Clinical nutrition*, 25(3), 377-385.
- Phan, U. T., & Chambers IV, E. (2016). Motivations for choosing various food groups based on individual foods. *Appetite*, 105, 204-211.
- Rajendran, P., & Bharathidasan, R. (2018). Standardization and Preservation of Sugarcane Juice by Hurdle Technology. *International Journal of Advances in Agricultural Science and Technology*, 5(2), 77-87.
- Rejman, K., Górská-Warsewicz, H., Cieczotko, M., & Laskowski, W. (2020). Nonalcoholic Beverages as Sources of Nutrients in the Average Polish Diet. *Nutrients*, 12(5), 1262.
- Salanță, L. C., Uifălean, A., Iuga, C.-A., Tofană, M., Cropotova, J., Pop, O. L., . . . González, C. V. (2020). Valuable food molecules with potential benefits for human health *The Health Benefits of Foods-Current Knowledge and Further Development*: IntechOpen.
- Serna-Saldivar, S. O. (2016). *Cereal grains: properties, processing, and nutritional attributes*: CRC press.
- Shalaby, M. T., Rabie, M. M., Boraie, N. A. E., & Toyour, M. H. (2018). Application of Haccp System on Guava Nectar Production Line. *Journal of Food and Dairy Sciences*, 9(7), 237-244.
- Singh, S., & Shalini, R. (2016). Effect of hurdle technology in food preservation: a review. *Critical Reviews in Food Science and Nutrition*, 56(4), 641-649.
- Siro, I., Kápolna, E., Kápolna, B., & Lugasi, A. (2008). Functional food. Product development, marketing and consumer acceptance—A review. *Appetite*, 51(3), 456-467.
- Sowonola, O., Tunde-Akintunde, T., & Adedeji, F. (2005). Nutritional and sensory qualities of soymilk kunnu blends. *African Journal of Food, Agriculture, Nutrition and Development*, 5(2).
- Tireki, S. (2021). A review on packed non-alcoholic beverages: Ingredients, production, trends and future opportunities for functional product development. *Trends in Food Science & Technology*, 112, 442-454.
- Tofană, M., Mudura, E., Coldea, T. E., Bors, A., & Pasqualone, A. (2021). Current Functionality and Potential Improvements of Non-Alcoholic Fermented Cereal Beverages. *Qualitative and Nutritional Improvement of Cereal-Based Foods and Beverages*, 19.

- Urala, N., & Lähteenmäki, L. (2007). Consumers' changing attitudes towards functional foods. *Food Quality and Preference*, 18(1), 1-12.
- Zhu, D., & Damodaran, S. (2018). Removal of off-flavour-causing precursors in soy protein by concurrent treatment with phospholipase A2 and cyclodextrins. *Food chemistry*, 264, 319-325.