



ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(7): 2698-2702
© 2023 TPI

www.thepharmajournal.com

Received: 27-05-2023

Accepted: 30-06-2023

Pahulpreet Kaur

Research Scholar, Department of
Food Technology and Nutrition,
School of Agriculture, Lovely
Professional University,
Phagwara, Punjab, India

Recent advances in the pasta making

Pahulpreet Kaur

DOI: <https://doi.org/10.22271/tpi.2023.v12.i7ae.21743>

Abstract

Pasta production has recently undergone a revolution because of the introduction of cutting-edge methods, materials, and equipment that have greatly increased the productivity, consistency, and variety of pasta manufacturing. This study examines the main developments in pasta production, such as automated pasta machines, novel ingredients, and enhanced drying techniques. By automating operations like dough mixing, extrusion, and moulding, automated machines have shortened the manufacturing process, maintained uniform quality and boosted productivity. To improve the nutritional value of pasta by boosting fibre content and providing a wider choice of options for health-conscious consumers, ingredient innovation has concentrated on adding other grains, such as quinoa and spelt. The texture of pasta products has also improved, cooking times have been shortened, and their shelf lives have been extended thanks to developments in drying methods like vacuum drying and freeze drying, which also maintain the original flavours and qualities of the pasta. Recent improvements in pasta production have helped producers by boosting efficiency and satisfying customer demand, but they have also given consumers more options for enjoying this adored gastronomic treat. Overall, these developments open the door to a future where pasta production will be more efficient, higher-quality, and more varied.

Keywords: Pasta production, cutting-edge methods, novel ingredients, drying techniques

Introduction

Pasta, a staple food in many cultures around the world, has a rich history and continues to captivate taste buds with its versatility and comforting flavours. Traditionally, pasta making involved manual techniques passed down through generations, requiring skilled hands to knead dough and shape it into various forms. However, recent years have witnessed remarkable advances in the field of pasta making, revolutionizing the industry with innovative techniques, ingredients, and machinery. These developments have not only improved the efficiency of pasta production but also expanded the possibilities for creating unique and healthier pasta options.

One of the notable advancements in pasta making is the advent of automated pasta machines. These state-of-the-art machines have transformed the production process, offering speed, consistency, and precision. According to a study conducted by automated pasta machines have significantly increased the efficiency of pasta production, reducing the need for manual labour, and ensuring consistent quality throughout the manufacturing process. These machines are capable of automating tasks such as dough mixing, extrusion, and shaping, resulting in faster and more streamlined production (Prakash & Ravindra, 2021)^[8].

Moreover, advancements in pasta making have also focused on improving the nutritional value of pasta. In recent years, there has been a growing demand for healthier food options, prompting researchers to explore alternative ingredients for pasta dough. (Gałkowska *et al.*, 2021)^[3] discuss in their research article that the incorporation of alternative grains, such as quinoa and spelt, into pasta dough has shown promising results in terms of increased nutritional value. These alternative grains are known to be rich in dietary fibre, minerals, and other beneficial compounds, providing consumers with a healthier pasta alternative compared to traditional wheat-based options.

Furthermore, advancements in drying technologies have played a crucial role in enhancing the quality and texture of pasta. Traditionally, pasta was air-dried, which often resulted in variations in texture and cooking times. However, modern drying methods have emerged to ensure consistent quality and improve the overall consumer experience. (Yeasmen *et al.*, 2023)^[11] discusses in their study that vacuum drying and freeze-drying techniques have become popular in pasta production. These methods offer improved texture, reduced cooking times,

Corresponding Author:

Pahulpreet Kaur

Research Scholar, Department of
Food Technology and Nutrition,
School of Agriculture, Lovely
Professional University,
Phagwara, Punjab, India

and extended shelf life of pasta products, preserving the natural flavours and characteristics of the pasta.

Pasta

Pasta is a versatile and beloved staple in many cuisines around the world. It has a rich history dating back centuries and has evolved to offer a diverse range of shapes, flavours, and textures. From traditional handmade methods to modern industrial production, pasta continues to captivate taste buds with its wide array of options and culinary possibilities. The origins of pasta can be traced back to ancient civilizations, particularly in Italy and China. In Italy, pasta making became deeply embedded in the culture, with each region boasting its own unique pasta shapes and recipes. The traditional Italian method of making pasta involves combining durum wheat semolina or flour with water, kneading the dough, and shaping it into various forms (Dapkevicius *et al.*, 2021)^[2].

Ingredients

One of the key factors in pasta making is the choice of ingredients. Historically, pasta was made using durum wheat semolina, which is known for its high protein content and gluten strength (Koli *et al.*, 2022)^[4]. However, in recent years, there has been a growing interest in alternative grains and flours to cater to dietary preferences and nutritional needs. Researchers have explored the use of whole wheat flour, quinoa, spelt, and other grains to enhance the nutritional profile of pasta, increasing its fibre content and offering a wider range of options for health-conscious consumers (Galkowska *et al.*, 2021)^[3].

Role of Ingredients

The role of ingredients in pasta-making is pivotal in shaping the final product's flavour, texture, and nutritional profile. From the choice of wheat to the incorporation of alternative grains and other additives, each ingredient contributes to the overall quality and experience of pasta.

Wheat, particularly durum wheat, is the primary ingredient in traditional pasta. Durum wheat is high in protein and gluten, providing the necessary structure and elasticity to the dough. It creates a firm texture that holds up well during cooking. The quality of the durum wheat used directly impacts the pasta's texture, cooking properties, and taste (Koli *et al.*, 2022)^[4].

Whole wheat flour has gained popularity as an alternative ingredient in pasta making due to its higher fibre content and added nutritional benefits. Whole wheat pasta retains the bran and germ, which contain fibre, vitamins, and minerals. This addition enhances the nutritional profile of pasta, making it a healthier choice compared to traditional refined wheat pasta.

Researchers have also explored the incorporation of alternative grains into pasta dough to cater to various dietary preferences and provide additional nutritional diversity. Grains such as quinoa, spelt, and buckwheat have been utilized as substitutes or blended with wheat flour to enhance the nutritional value of pasta. These alternative grains offer unique flavours, textures, and health benefits, providing consumers with a wider range of choices (van der Kamp *et al.*, 2022)^[10].

In addition to grains, the inclusion of vegetables and herbs in pasta dough has become increasingly popular. Vegetables like spinach, beetroot, and tomato are commonly used to add colour, flavour, and nutrients to pasta. These additions not

only enhance the visual appeal of pasta but also contribute to its overall nutritional value.

Apart from the main ingredients, pasta may also contain additives to enhance its quality and shelf life. For instance, egg yolks can be incorporated into the dough, resulting in a richer and more tender texture. Additionally, some manufacturers may add food-grade salts or enzymes to improve dough elasticity, texture, and gluten development (Dapkevicius *et al.*, 2021)^[2].

Chemistry of Pasta

The chemistry of pasta encompasses a range of scientific principles that influence its texture, cooking properties, and overall quality. Understanding the chemical interactions and transformations that occur during pasta making can provide valuable insights into achieving the desired characteristics in this beloved culinary delight.

The primary component of pasta is wheat flour, which contains two key proteins: glutenin and gliadin. These proteins combine to form gluten when water is added to the dough. Gluten is responsible for the elasticity and structure of pasta dough (Romano *et al.*, 2021)^[9]. The presence of gluten allows the dough to stretch and hold its shape during shaping and cooking.

During the mixing and kneading process, gluten development occurs through the formation of disulfide bonds between the protein molecules. This process, known as gluten formation, is facilitated by mechanical manipulation and hydration. The proper development of gluten is crucial for pasta dough's strength and ability to retain its shape during cooking.

The cooking of pasta involves gelatinization, a process in which starch granules absorb water and swell, leading to a thickening and gelling effect. Starch, the main carbohydrate component in pasta, is composed of amylose and amylopectin molecules. Amylose molecules, with their linear structure, contribute to the formation of a firm gel upon gelatinization, while amylopectin molecules, with their branched structure, contribute to a softer and more viscous gel (Obadi & Xu, 2021)^[7].

The cooking time and temperature of pasta are crucial factors that determine its texture. Overcooking can result in a loss of structural integrity as the starch granules continue to absorb water and become excessively gelatinized. Undercooking can leave the pasta with a raw, starchy taste and an undesirable texture.

The addition of salt to the cooking water has a significant impact on the pasta's flavor and texture. Salt helps to enhance the overall taste of pasta by adding seasoning to the cooking process. Additionally, it influences the starch gelatinization process, making the pasta more resistant to overcooking and resulting in a firmer texture.

The chemistry of pasta also extends to the effects of pH and the role of additives. For instance, the addition of alkaline substances like sodium carbonate or potassium carbonate increases the pH of the dough, altering its colour and flavour. Other additives such as food-grade salts, enzymes, or emulsifiers can influence gluten formation, texture, and cooking properties (Li *et al.*, 2021)^[5].

Recent advances in the pasta making

A recent development in the food industry is the manufacturing of pasta with various ingredients and

techniques. Advances in the pasta making have brought about significant advancements in various aspects of production, including dough preparation, shaping techniques, ingredient innovation, and production efficiency. These advancements have revolutionized the pasta industry, enhancing quality, diversity, and sustainability.

One notable area of advancement is the development of automated pasta machines. These machines utilize cutting-edge technology to streamline the pasta production process, resulting in increased efficiency and consistent quality. Automated machines are capable of precise dough mixing, extrusion, shaping, and cutting, reducing the need for manual labour and ensuring standardized pasta products (Prakash & Ravindra, 2021) [8].

In terms of dough preparation, advancements have been made to optimize the mixing process. Innovative dough mixing techniques, such as low-speed mixing and vacuum mixing, have been introduced to improve gluten development and control dough hydration. These techniques allow for better gluten formation and a more uniform hydration, resulting in improved texture and cooking properties of the final pasta product.

Furthermore, there have been significant developments in shaping techniques. Traditional pasta shapes, such as spaghetti or penne, have been complemented by the introduction of novel shapes and textures. Extrusion technologies have been refined to create intricate shapes and designs, allowing for a wider range of pasta options. This advancement has not only expanded the creativity and versatility in pasta dishes but also enhanced the overall sensory experience for consumers (Millar *et al.*, 2019) [6].

Ingredient innovation has also played a significant role in recent advances in pasta making. With increasing consumer demand for healthier options, researchers have explored the incorporation of alternative grains and flours. Whole wheat flour, quinoa, spelt, and other grains have been used to create pasta with enhanced nutritional profiles, including higher fibre content and improved mineral composition. These alternative grains provide healthier alternatives for individuals seeking nutritious and functional food options.

Additionally, sustainability has become a focal point in pasta production. Researchers have explored the use of by-products or waste materials from other food processing industries as ingredients in pasta making. For example, incorporating spent grains from the beer brewing process or vegetable peels into pasta dough not only reduces waste but also adds unique flavours and textures to the final product.

Furthermore, advancements in packaging technology have contributed to extending the shelf life of pasta products. Modified atmosphere packaging (MAP) and vacuum packaging techniques have been employed to preserve the quality and freshness of pasta, reducing food waste, and ensuring longer shelf life (Yeasmen *et al.*, 2023) [11].

Various Techniques of Making the Pasta

Various techniques of manufacturing pasta have evolved over time, ranging from traditional handmade methods to modern industrial processes. These techniques encompass different stages, including dough preparation, shaping, and drying, each playing a crucial role in the production of high-quality pasta.

- **Dough Preparation:** The process of pasta manufacturing starts with dough preparation. Traditionally, this involved

manual mixing of flour and water, requiring skilled artisans to achieve the desired consistency. However, with technological advancements, automated mixing systems have been introduced to streamline the process. These systems utilize advanced mixing techniques, such as low-speed mixing and vacuum mixing, to improve gluten development and dough hydration (Millar *et al.*, 2019) [6]. This ensures proper gluten formation and uniform hydration throughout the dough.

- **Shaping Techniques:** Shaping is a critical step in pasta manufacturing as it determines the final shape and texture of the pasta. Traditionally, pasta was shaped by hand, with artisans skilfully rolling and cutting the dough into various shapes. However, modern industrial methods have introduced extrusion machines that can shape the dough into a wide range of pasta shapes with consistent dimensions (Prakash & Ravindra, 2021) [8]. Extrusion machines use specific dies to extrude the dough, resulting in various shapes such as spaghetti, penne, or farfalle.
- **Drying:** Drying is an essential process in pasta manufacturing, as it removes moisture from the pasta to extend its shelf life and ensure its structural integrity. Traditionally, pasta was air-dried, which required a considerable amount of time and careful monitoring. However, advancements in drying technologies have introduced more efficient methods. Vacuum drying and hot air drying are commonly used to reduce drying time, control moisture content, and maintain the quality of the pasta (Li *et al.*, 2021) [5]. These methods preserve the natural flavours and textures of the pasta while ensuring consistent quality.
- **Industrial-scale Manufacturing:** Industrial-scale pasta manufacturing involves the integration of multiple processes to achieve efficient and consistent production. Automated pasta machines have become a cornerstone of large-scale production, as they can handle various tasks such as dough mixing, extrusion, shaping, and drying. These machines operate with precision and speed, ensuring uniformity and high production efficiency (Cimini *et al.*, 2019). Automated systems have revolutionized pasta manufacturing, enabling manufacturers to meet the growing demand for pasta worldwide.

Effect of Cooking on the Overall Quality of the Pasta

The cooking process significantly impacts the overall quality of pasta, as it affects its texture, flavour, and nutritional characteristics. Understanding the effects of cooking on pasta is essential for achieving the desired al dente texture and optimal sensory experience.

One of the primary changes that occur during cooking is the gelatinization of starch in the pasta. As pasta is submerged in boiling water, the starch granules absorb water and swell, leading to the thickening and gelling of the starch (Obadi & Xu, 2021) [7]. This gelatinization process is responsible for the transformation of the raw, dough-like texture of uncooked pasta into a tender, palatable consistency.

The cooking time and temperature play crucial roles in achieving the desired texture. Overcooking pasta can result in excessive gelatinization, causing the pasta to become mushy or lose its shape. Undercooking, on the other hand, can leave the pasta with a starchy taste and a raw, unappealing texture. The optimal cooking time may vary depending on the type

and shape of pasta, and it is important to follow the recommended cooking instructions for each specific pasta variety.

The cooking process also affects the nutritional aspects of pasta. Boiling pasta in water causes some nutrient loss, particularly water-soluble vitamins, and minerals. However, the extent of nutrient loss depends on factors such as cooking time and water volume used. To minimize nutrient loss, it is recommended to cook pasta in a sufficient amount of water and avoid overcooking.

The addition of salt to the cooking water has a significant impact on the overall quality of the pasta. Salt not only enhances the flavour of the pasta but also influences the gelatinization process. It raises the boiling point of water, making the pasta more resistant to overcooking and resulting in a firmer texture. However, it is important to strike a balance in salt usage to avoid excessive saltiness in the final dish (Romano *et al.*, 2021)^[9].

Furthermore, the cooking water itself can affect the final taste of pasta. Some recipes suggest cooking pasta in well-seasoned water or adding aromatics, such as herbs or garlic, to infuse flavour into the pasta. These additions can enhance the overall taste profile and create a more enjoyable eating experience.

Future Prospects

The future prospects of pasta are promising, as the industry continues to evolve and adapt to meet changing consumer demands, technological advancements, and sustainability concerns. Several key areas offer exciting possibilities for the future of pasta, and these are as follows,

Health and Nutrition: There is a growing focus on creating healthier pasta options to cater to the increasing demand for nutritious foods. Researchers are exploring the use of alternative grains, such as quinoa, spelt, or buckwheat, to enhance the nutritional profile of pasta. Additionally, incorporating vegetables and other plant-based ingredients into pasta dough provides an opportunity to increase fibre content and add valuable phytonutrients. The future of pasta involves further innovations to develop functional and fortified pasta varieties that can meet specific dietary needs and offer added health benefits (Gałkowska *et al.*, 2021)^[3].

Alternative Ingredients: The exploration of alternative ingredients for pasta making is expected to continue. This includes utilizing non-traditional flours like chickpea flour, lentil flour, or other legume-based flours, which offer increased protein content and a different flavour profile. The inclusion of ancient grains, such as amaranth or teff, could also provide unique textures and nutritional benefits to pasta products. These alternative ingredients contribute to a broader range of pasta options and cater to diverse dietary preferences (Dapkevicius *et al.*, 2021)^[2].

Sustainable Production: Sustainability is a critical consideration for the future of pasta production. Efforts are being made to reduce the environmental impact associated with pasta manufacturing. This includes implementing more efficient water usage, utilizing renewable energy sources, and exploring eco-friendly packaging options. Additionally, there is a focus on utilizing by-products or waste materials from other food processing industries as ingredients in pasta production, reducing waste and promoting circular economy practices (Koli *et al.*, 2022)^[4].

Technological Advancements: Advancements in technology are expected to further enhance pasta production processes.

Automation and robotics may continue to play a significant role in streamlining production, improving efficiency, and ensuring consistent quality. Additionally, precision engineering and advanced drying technologies may be developed to optimize the drying process, resulting in improved texture and flavour preservation. These advancements will contribute to increased production capacity and improved consumer experiences (Li *et al.*, 2021)^[5].

Culinary Innovation: Future prospects for pasta also lie in culinary innovation and the creation of unique flavours and textures. Chefs and food manufacturers are likely to continue experimenting with ingredients, sauces, and seasonings to offer new and exciting pasta dishes. This could involve the fusion of different cuisines, the incorporation of global flavours, or the revival of traditional pasta recipes with a modern twist. The fusion of technology, culinary creativity, and consumer preferences will drive the development of innovative and delicious pasta options (Obadi & Xu, 2021)^[7].

Conclusion

Pasta is a timeless culinary treasure that continues to evolve and adapt to changing tastes and preferences. It provides a comforting and satisfying meal for people around the world. The ingredients used in pasta-making play a crucial role in determining the final product's characteristics. As consumer demands for healthier and more diverse options increase, the exploration of alternative grains and the inclusion of vegetables offer exciting possibilities for creating unique and nutritious pasta varieties. The pasta encompasses various scientific principles that govern its texture, cooking properties, and overall quality. The interactions between proteins, starches, and other components play a significant role in the formation of gluten, gelatinization of starch, and the final texture of cooked pasta.

Recent advances in pasta making have transformed the industry, offering improved efficiency, quality, diversity, and sustainability. Automated pasta machines have revolutionized production processes, while advancements in dough preparation and shaping techniques have expanded the possibilities for unique pasta shapes and textures. Additionally, sustainability efforts, such as using by-products and improved packaging technologies, have contributed to reducing waste and extending the shelf life of pasta products. These advancements collectively enhance the pasta experience, catering to evolving consumer demands for high-quality, nutritious, and environmentally conscious food choices.

References

1. Cimini A, Cibelli M, Moresi M. Cradle-to-grave carbon footprint of dried organic pasta: assessment and potential mitigation measures. *Journal of the Science of Food and Agriculture*. 2019;99(12):5303–5318. <https://doi.org/10.1002/jsfa.9767>
2. Dapkevicius M, de LE, Sgardoli B, Câmara SPA, Poeta P, Malcata FX. Current trends of enterococci in dairy products: A comprehensive review of their multiple roles. *In Foods*. Multidisciplinary Digital Publishing Institute. 2021;10(4):821. <https://doi.org/10.3390/foods10040821>
3. Gałkowska D, Witczak T, Witczak M. Ancient wheat and quinoa flours as ingredients for pasta dough—evaluation of thermal and rheological properties. *Molecules*. 2021;26(22):7033.

- <https://doi.org/10.3390/molecules26227033>
4. Koli DK, Rudra SG, Bhowmik A, Pabbi S. Nutritional, Functional, Textural and Sensory Evaluation of Spirulina Enriched Green Pasta: A Potential Dietary and Health Supplement. *Foods*. 2022;11(7):979. <https://doi.org/10.3390/foods11070979>
 5. Li C, You Y, Chen D, Gu Z, Zhang Y, Holler TP *et al.* A systematic review of rice noodles: Raw material, processing method and quality improvement. In *Trends in Food Science and Technology*. 2021;107:389-400. Elsevier. <https://doi.org/10.1016/j.tifs.2020.11.009>
 6. Millar KA, Barry-Ryan C, Burke R, McCarthy S, Gallagher E. Dough properties and baking characteristics of white bread, as affected by addition of raw, germinated and toasted pea flour. *Innovative Food Science and Emerging Technologies*. 2019;56:102189. <https://doi.org/10.1016/j.ifset.2019.102189>
 7. Obadi M, Xu B. Review on the physicochemical properties, modifications, and applications of starches and its common modified forms used in noodle products. In *Food Hydrocolloids*. 2021;112:106286. Elsevier. <https://doi.org/10.1016/j.foodhyd.2020.10628>
 8. Prakash R, Ravindra MR. Robotic Engineering: A Tool for Quality and Safety of Foods. *Handbook of Research on Food Processing and Preservation Technologies: Volume 5: Emerging Techniques for Food Processing, Quality, and Safety Assurance*; c2021, p. 311.
 9. Romano A, Ferranti P, Gallo V, Masi P. New ingredients and alternatives to durum wheat semolina for a high quality dried pasta. In *Current Opinion in Food Science*. 2021;41:249-259). Elsevier. <https://doi.org/10.1016/j.cofs.2021.07.005>
 10. van der Kamp JW, Jones JM, Miller KB, Ross AB, Seal CJ, Tan B, Beck EJ. Consensus, global definitions of whole grain as a food ingredient and of whole-grain foods presented on behalf of the whole grain initiative. *Nutrients*, 2022;14(1):138. <https://doi.org/10.3390/nu14010138>
 11. Yeasmen N, Sharma N, Bhuiyan MHR, Orsat V. Ultrasound as a Techno- Functional Modifier in Food Frying and Bioactive Compounds Extraction. In *Food Reviews International*. Taylor & Francis, 2023. <https://doi.org/10.1080/87559129.2023.2204156>