EFAD CONGRESS

THE SCIENCE OF DRY PASTA

ITALIAN STYLE DURUM WHEAT SEMOLINA PASTA

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INTRODUCTION

Pasta is a beloved food worldwide, valued for its versatility, flavor, and cultural significance.
But beyond its culinary appeal, pasta offers important health benefits that deserve closer examination.

As global pasta consumption rises, understanding its distinct characteristics among carbohydrate-rich foods becomes increasingly relevant, particularly in relation to metabolic health, weight management, and athletic performance.

This booklet consolidates scientific research on Italian-style durum wheat semolina dry pasta's nutritional properties and health impacts. It aims to provide health professionals with evidence-based insights into its unique role in a balanced diet, dispel misconceptions, and offer practical guidance for incorporating it into healthy dietary recommendations.
For simplicity, throughout this booklet, "Italian-style durum wheat semolina dry pasta" will be referred to as "durum wheat semolina dry pasta".

STRUCTURE OF THE BOOKLET

The booklet is divided into seven chapters, each focusing on a distinct aspect of durum wheat semolina dry pasta and its connection to a healthy diet.

1 PRODUCTION STORY

This chapter explores the production of durum wheat semolina dry pasta and its impact on pasta quality. It explains how each stage of production, from ingredient selection to drying, influences the final product's characteristics.

2 GLYCEMIC SECRETS

This chapter explores how the production process influences the glycemic index and the content of slowly digestible starch, both of which are crucial in determining pasta's effect on blood sugar and metabolic health. It also discusses how glycemic load influences diet quality and how this information should be incorporated into a healthy diet.

3 UNIQUE CARBOHYDRATE

This chapter explores what distinguishes durum wheat semolina dry pasta from other staple foods like rice, bread, and potatoes. It examines pasta's structure and unique characteristics to show why it is a healthy carbohydrate choice.

4 PASTA AND HEALTH

This chapter explores the important role of durum wheat semolina dry pasta in the Mediterranean diet, renowned for its health benefits.It reviews studies on pasta's impact on body weight, metabolic health, and the risk of chronic diseases, such as diabetes and cardiovascular disease, while comparing it to other staple foods.

5 WHOLE-GRAIN ADVANTAGE

This chapter explores the additional health benefits of whole-grain pasta, which are attributed to its higher fiber content and other essential nutrients. It examines the evidence supporting the advantages of choosing whole-grain pasta over traditional durum wheat semolina dry pasta varieties.

6 GLUTEN-FREE AND NON-WHEAT PASTA OPTIONS

This chapter explores a range of gluten-free and alternative pasta options for individuals with dietary restrictions or those seeking variety.
It examines the composition, processing, and nutritional profiles of these non-traditional pasta products, exploring the challenges and opportunities in creating palatable and texturally acceptable alternatives to durum wheat semolina dry pasta.

7 CARBOHYDRATES, PASTA, AND SPORT

This chapter explores the essential role of carbohydrates, including pasta, in physical performance.
It highlights the function of pasta in enhancing athletic performance and aiding recovery, while also explaining how pasta can improve endurance and overall physical performance.

1.

PRODUCTION STORY

Pasta, a staple in many diets worldwide, is the result of a carefully controlled production process that transforms simple ingredients into a versatile and nutritious product. This chapter will explore the key steps involved in the durum wheat semolina dry pasta production and their impact on the final quality of the pasta.

1.1 INGREDIENTS AND DOSING

The foundation of high-quality pasta begins with the selection of raw materials. Pasta is made from dough using ingredients such as semolina (course ground durum wheat), durum flour (fine ground durum wheat), whole-grain flour, farina (soft wheat flour), corn flour, rice flour, pulse flour, or combinations thereof, mixed with water (Bresciani et al., 2022; Fuad & Prabhasankar, 2010). It may be enriched (returned nutrients lost in the process of production), fortified (added nutrients not originally present in flour), supplemented (added nutrients for reasons other than fortification purposes), gluten-free, or left conventional (Bresciani et al., 2022; Fuad & Prabhasankar, 2010).

In Europe and North America, pasta types such as classic spaghetti and macaroni are typically made from durum wheat. The core ingredients are semolina flour and water, with all other additions being optional. Semolina, ground from hard durum wheat, creates firm, elastic dough due to its high gluten content. This makes the dough easily shapeable and suitable for machine processing (Fuad & Prabhasankar, 2010). Thus, the ideal Italian-style dry pasta utilizes semolina, characterized by its high protein content and strong gluten, which can withstand the physical stresses of extrusion, drying, and cooking (Mariani, 2014). Italian law proscribes that dried pasta must be produced with water and durum wheat (Triticum durum Desf.) (i.e., semolina, coarse semolina, or whole-meal semolina) (Decreto del Presidente della Repubblica, 2001).

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The products obtained from the extrusion, rolling, and subsequent drying of doughs prepared respectively and exclusively with the following ingredients are referred to as 'durum wheat semolina pasta': durum wheat semolina and water

Decreto del Presidente della Repubblica, 2001

It is important to note that fresh pasta can be made with soft wheat flour and optionally with the addition of eggs, which makes it nutritionally different and is not the primary focus of this booklet.

Durum wheat (Triticum durum) stands out as the perfect grain for pasta production due to its unique attributes. Its high yellow pigment content imparts an attractive color to the pasta, while its low lipoxygenase activity helps maintain this color during processing (Gómez et al.,2025). Furthermore, durum wheat's high protein content is crucial for achieving superior cooking quality and texture. These distinctive characteristics combine to make durum wheat the preferred choice for crafting exceptional pasta products (Aalami et al., 2007). Durum wheat semolina produces dough with rheological properties perfectly adapted to pasta manufacturing. The protein content and composition, particularly gluten strength, play a crucial role in determining pasta's cooking quality (Cubadda et al., 1992).
The first step in pasta production is precisely dosing the ingredients. Typically, 27-29 grams of water are added per 100 grams of semolina, resulting in a mixture with approximately 30-32 % moisture.

This level of hydration is crucial for proper protein solubility while only partially developing the gluten network at this stage (Bresciani et al., 2022).

1.2 MIXING AND KNEADING

Once dosed, semolina and water are blended in a mixing phase. This step aims to evenly distribute water throughout the semolina particles, ensuring proper hydration of starch and proteins. The quality of mixing has a significant impact on the final pasta quality, as mistakes made at this stage are difficult to correct later in the process (Bresciani et al., 2022; Mariani, 2014).

Several factors can affect semolina hydration, including water temperature, semolina particle size, and the content of protein, ash, fiber and starch. Today, innovations in mixing technology have led to a more uniform and rapid hydration compared to conventional mixing methods (Bresciani et al., 2022).

1.3 EXTRUSION

After mixing, the hydrated semolina moves to the extrusion phase. During extrusion, the dough is kneaded further and forced through a die to give the pasta its shape. This step is critical in forming the pasta's structure and texture (Bresciani et al., 2022; Mariani, 2014). Between the mechanical processes of mixing and extrusion, the dough rests, allowing it to relax and making it easier to work with in the next phase.

Key extrusion parameters influencing dry pasta quality include extrusion pressure, specific mechanical energy (SME), and dough temperature (Bresciani et al., 2022). The hydration level of the dough has a significant mpact on these extrusion parameters. Higher hydration levels (32-34 %) are associated with lower extrusion pressure and SME, resulting in dry pasta with a smaller diameter and lower density (Bresciani et al., 2022; Fuad & Prabhasankar, 2010). Extrusion is crucial because the correct process ensures protein formation that can withstand cooking (Bresciani et al., 2022).

For pasta, the shape, dimensions of the individual piece, including its thickness, smooth or rough surface, and whether it is ridged or not, are not merely cosmetic aspects or traditions, but actual gastronomic parameters. The palatal sensations evoked by chewing spaghetti radically differ from those given by a fusilli or penne. Thus, the shape design of pasta is also very important.

1.4 DRYING

The final important step in dry pasta production is drying. This process removes excess moisture from the pasta, reducing its final moisture content to 12.5 % or less. Proper drying is crucial for maintaining the pasta's stability, shape, texture, nutritional value and cooking quality (Bresciani et al., 2022; Mariani, 2014).
Drying conditions, including temperature, humidity and time, must be carefully controlled. The drying process typically involves alternating phases of actual drying with "resting" periods that allow for moisture redistribution within the pasta (Bresciani et al., 2022).
Recent innovations in drying technology have led to the development of high-temperature drying methods, which can improve the quality of dry pasta and reduce production time. However, care must be taken to avoid heat damage that could negatively impact the color and nutritional value of dry pasta (Bresciani et al., 2022; Fuad & Prabhasankar, 2010).

1.5 CONCLUSION

The durum wheat semolina dry pasta production process is a delicate balance of variables, each playing an important role in determining the product's final quality.
From the initial selection and dosing of ingredients to the final drying step, each phase must be carefully controlled to produce pasta that meets the high standards consumers expect (Mariani, 2014).

As Mariani (2014) notes, the secret of the uniqueness of Italian durum wheat semolina dry pasta, handed down from generation to generation since the dawn of pasta production in Italy, lies in the deep knowledge of the product by its creators and therefore in the careful selection of national and foreign grains most suitable for pasta-making and in the ability to transform them into pasta. Despite being a one primary ingredient product, durum wheat semolina dry pasta is not the result of the ingredient alone, but rather the result of the know-how acquired over a hundred years of production history.

If you are interested in the detailed history and production of pasta, you are invited to watch the Pasta Academy documentary “Wheat and Pasta: A Long Journey” at YouTube *https://www.youtube.com/watch?v=RkRa4TgNai4*

1.6 LITERATURE

1. Aalami, M., Leelavathi, K., & Prasada Rao, U. J. S. (2007). Spaghetti-making potential of Indian durum wheat species concerning their protein, yellow pigment, and enzyme contents. Food Chemistry, 100(3), 1243-1248.

2. Bresciani, A., Pagani, M. A., & Marti, A. (2022). Pasta-Making Process: A Narrative Review on the Relation between Process Variables and Pasta Quality. Foods, 11(3), 256. https://doi.org/10.3390/foods11030256

3. Cubadda, R., Carcea, M., & Pasqui, L. (1992). Suitability of the gluten index test for assessing gluten strength in durum wheat and semolina. Cereal Foods World, 37(12), 866-869.

4. Decreto del Presidente della Repubblica n.146. Regolamento per la revisione della normativa sulla produzione e commercializzazione di sfarinati e paste alimentari, a norma dell'articolo 50 della legge 22 febbraio 1994. Gazz. Uff. No. 187. 2001, 117, 6–12.

5. Fuad, T., & Prabhasankar, P. (2010). Role of ingredients in pasta product quality: A review on recent developments. Critical Reviews in Food Science and Nutrition, 50(8), 787-798. https://doi.org/10.1080/10408390903001693 5

6. Mariani, M. (2014). La pasta alimentare "italiana": eccellenza nazionale. Alimenta, 22(5), 101-106.

7. Gómez, M., Braojos, M., Fernández, R., & Parle, F. (2025). Utilization of by-products from the fruit and vegetable processing industry in pasta production. Applied Sciences, 15(4), 2189. https://doi.org/10.3390/app15042189

2.

GLYCEMIC SECRETS

Pasta is often at the center of nutritional debates. While some view it as a healthy carbohydrate, others consider it a refined food to avoid. Understanding the actual nutritional value and health impact of durum wheat semolina dry pasta requires examining its glycemic index (GI), glycemic load (GL), and slowly digestible starch (SDS) content.

Dietitians and nutritionists can gain a comprehensive understanding of durum wheat semolina dry pasta by investigating the dry pasta-making process and its influences on GI, GL, and SDS content.
The evidence-based knowledge of the nutritional profile, glycemic impact, and potential health benefits of durum wheat semolina dry pasta will empower professionals to offer sound dietary guidance.

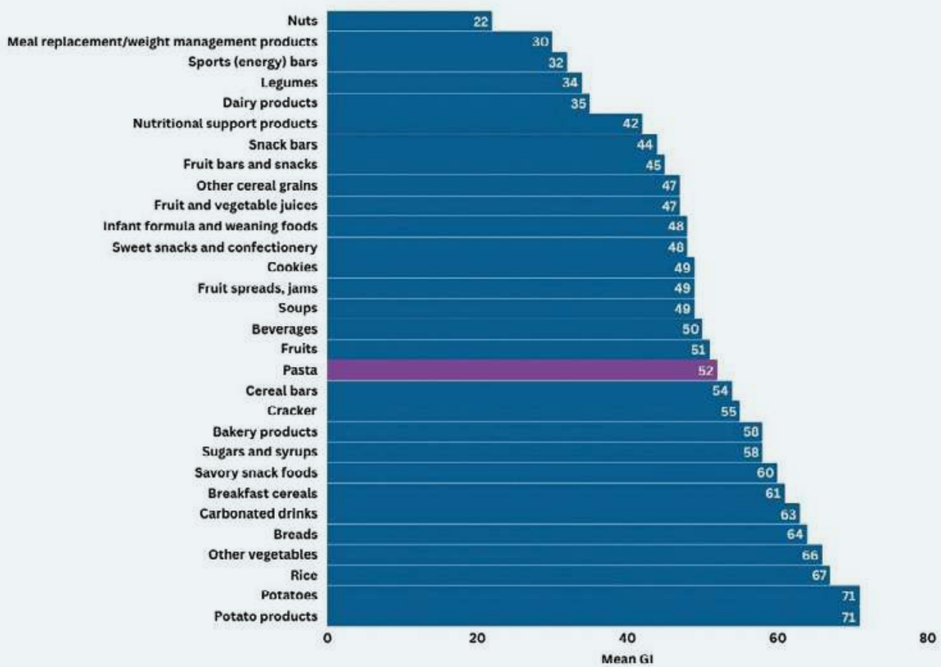
2.1 GLYCEMIC INDEX AND GLYCEMIC LOAD

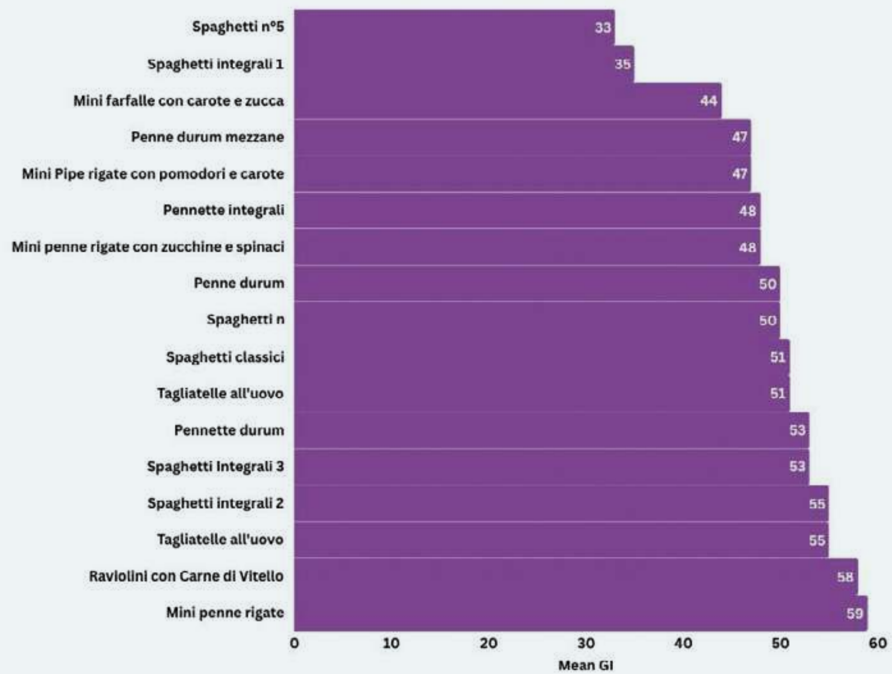
Pasta is typically placed into less healthy plant-based diets because it is considered a "refined carbohydrate."

Augustin et al. (2024) challenged that notion, arguing instead that the unique structure of durum wheat semolina dry pasta slows starch digestion, resulting in a lower glycemic index (GI), an important factor in evaluating its nutritional impact.
The GI measures how much a carbohydrate-containing food raises blood glucose levels compared to a reference food, such as glucose or white bread.
The GI scale classifies foods as high (≥ 70), medium (56–69), or low (≤ 55) (Jenkins et al., 1981; Augustin et al., 2015; Atkinson et al., 2021). Foods with a high GI, like white bread and sugary cereals, cause rapid spikes in blood sugar, while those with a low GI result in a slower, more gradual rise. While GI varies across different products, research consistently demonstrates that all pasta shapes (cuts) generally exhibit low to medium GI (Figure 1) and overall, more favorable glycemic properties compared to other wheat-based and non-wheat-based starchy foods (Augustin et al., 2015; Scazzina et al., 2016; Huang et al., 2017; Di Pede et al., 2021).
For guidance on GI per food category and pasta shape (cut), see Figure 1.

Figure 1. Mean GI per Food Category (data from: Atkinson et al., 2021) and Mean GI of Different Pasta Shapes (Cuts) (data from: Scazzina et al., 2016)

other foods
pasta and different types of pasta





While GI provides valuable information, it does not consider the quantity of carbohydrates consumed.

GL addresses this limitation by incorporating both GI and the amount of available carbohydrates in a typical serving. GL is calculated using the formula: GL = (GI × available carbohydrate/given amount of food) (Augustin et al., 2015) and can be expressed in different units, such as grams per serving or grams per 100 grams of food (Augustin et al., 2015).
Table 1. shows that 100 grams of pasta has a GL of 15.4, categorizing it as a food with a moderate GL (Glycemic Index Foundation, n.d.). Nutritionally, 100 grams of cooked pasta provides 157 kcal (665 kJ), 5.8 grams of protein, 30.6 grams of carbohydrates, 0.93 grams of fat and total fiber 1.8 grams (USDA FoodData Central, n.d.).
For guidance on GL per 100 grams of selected foods, **see Table 1**.
To accurately calculate the GL of pasta, it is important to note that the Italian Society of Human Nutrition (SINU, 2024) recommends a standard portion size of 80 grams for pasta, which translates to even lower GL.

Understanding carbohydrate digestion and the body's glycemic response provides an important foundation for analyzing the metabolic effects of durum wheat semolina dry pasta. Individuals with diabetes and cardiovascular diseases (CVDs) use this knowledge of GI and GL to manage their glycemic response (Augustin et al., 2015; Chiavaroli et al., 2021).
As already mentioned, traditional commercial pasta production, especially in Italy and France, is strictly regulated to ensure the use of durum wheat semolina (Augustin et al., 2024). Durum wheat semolina is favored as the primary ingredient for dry pasta due to its hardness and higher protein content compared to soft wheat (Augustin et al., 2024).
The traditional durum wheat semolina dry pasta-making process, particularly the warm-air drying and cooling phases, plays a crucial role in creating a distinctive starch-gluten protein matrix. This unique structure contributes to slower starch digestion (Augustin et al., 2024), which explains why durum wheat semolina dry pasta, when cooked according to package directions, typically has a lower GI than bread made from the same flour. Indeed, shorter cooking times generally lead to

Table 1. Glycemic Index and Glycemic Load of Selected Foods (data from: Glycemic Index Foundation, n.d)

FOOD	GL PER 100 GR
Instant Rice	65,5
Long-Grain Rice	46,8
White Flour Bread	43,9
Brown Rice	36,8
Bakery Products Wheat	33,9
Basmati Rice	37,5
Wild Rice	33,8
Potato Chips	37,0
Corn Chips	28,8
Buckwheat Pasta	28,4
Ravioli From Soft Wheat	20,8
Risotto	22,1
Baked Potatoes	20,0
Unpeeled Basmati Rice	16,2
Pasta	15,4
Pasta From Durum Wheat	11,6
Whole Wheat Pasta	10,6
Boiled Potatoes	12,3
Grapes	9,6
Mandarin	3,9
Plums Fresh	3,9
Milk	1,6
Yogurt	1,6
Peas Green, Fresh	1,4
Lettuce Fresh	0,5
Spinach	0,3
Egg	0,0
Chicken	0,0

lower glycemic responses across all pasta shapes (Augustin et al., 2024). Dodi et al. (2023) also observed that more compact pasta shapes, like vermicelli and macaroni tend to exhibit slower blood sugar release than more open pasta shapes like spaghetti due to their inaccessibility to digestive enzymes. Adding to this, Vanhatalo et al. (2022) demonstrated that preserving pasta's structure during digestion is key to slower starch hydrolysis and lower postprandial glycemia in healthy adults compared to bread or couscous made from the same durum wheat semolina.

2.2 SLOWLY DIGESTIBLE STARCH

P Slowly Digestible Starch (SDS) refers to the portion of starch that is digested at a slower rate in the small intestine. It has a significant role in controlling post-meal blood sugar levels (EFSA, 2011). Unlike rapidly digestible starch (RDS), which breaks down quickly into glucose and enters the bloodstream, SDS provides a more gradual release of sugar, thereby reducing the overall glycemic response. This makes foods high in SDS particularly valuable for individuals looking to manage their weight, reduce their risk of diabetes, and improve their overall metabolic health. SDS's health benefits include improving insulin sensitivity, lowering cholesterol levels, and promoting satiety, which may aid in weight control. Foods rich in SDS, such as durum wheat semolina dry pasta, can be a valuable addition to a low-GI diet.

Dodi et al. (2023) conducted research that sheds light on the connection between the pasta-making process and SDS content. They found that specific techniques employed during production, including carefully controlled kneading and drying processes, can dramatically influence the amount of SDS formed. In some cases, optimized production methods allowed durum wheat semolina pasta to achieve SDS levels exceeding 40 % of its total starch content. Therefore, durum wheat semolina dry pasta, especially when processed to maximize SDS, can be a valuable addition to a diet focused on healthy carbohydrate choices.

2.3 CONCLUSION

The glycemic impact of durum wheat semolina dry pasta is complex, influenced by factors such as wheat type and processing, as well as cooking methods and portion size. Understanding the interplay of GI, GL, and SDS is essential for dietitians and nutritionists in providing evidence-based dietary recommendations. While often categorized as a refined carbohydrate, research suggests that pasta, particularly durum wheat semolina varieties, cooked al dente and consumed in moderation, can be part of a healthy diet, especially when combined with other low-GI foods. The role of SDS further enhances the potential of durum wheat semolina dry pasta as a valuable source of carbohydrates for managing blood sugar levels and promoting metabolic health.

2.4 LITERATURE

1. Atkinson, F. S., Brand-Miller, J. C., Foster-Powell, K., Buyken, A. E., & Goletzke, J. (2021). International tables of glycemic index and glycemic load values 2021: A systematic review. The American Journal of Clinical Nutrition, 114(5), 1625-1632. https://doi.org/10.1093/ajcn/nqab233

2. Augustin, L. S. A., Ellis, P. R., Vanginkel, M.-A., & Riccardi, G. (2024). Pasta: Is it an unhealthy refined food? The Journal of Nutrition, Advanced online publication. https://doi.org/10.1016/j.tjnut.2024.11.019

3. Augustin, L. S. A., Kendall, C. W. C., Jenkins, D. J. A., Willett, W. C., Astrup, A., Barclay, A. W., Björck, I., Brand-Miller, J. C., Brighenti, F., Buyken, A. E., Ceriello, A., La Vecchia, C., Livesey, G., Liu, S., Riccardi, G., Rizkalla, S. W., Sievenpiper, J. L., Trichopoulou, A., Wolever, T. M. S., Baer-Sinnott, S., & Poli, A. (2015). Glycemic index, glycemic load and response: An International Scientific Consensus Summit from the International Carbohydrate Quality Consortium (ICQC). Nutrition, Metabolism & Cardiovascular Diseases, 25(9), 795–815. https://doi.org/10.1016/j.numecd.2015.05.005

4. Chiavaroli, L., Lee, D., Ahmed, A., Cheung, A., Khan, T. A., Blanco-Mejia, S., Mirrahimi, A., Jenkins, D. J. A., Livesey, G., Wolever, T. M. S., Rahelić, D., Kahleová, H., Salas-Salvadó, J., Kendall, C. W. C., & Sievenpiper, J. L. (2021). Effect of low glycaemic index or load dietary patterns on glycaemic control and cardiometabolic risk factors in diabetes: Systematic review and meta-analysis of randomised controlled trials. BMJ, 374, n1651. https://doi.org/10.1136/bmj.n1651

5. Di Pede, G., Dodi, R., Scarpa, C., Brighenti, F., Dall'Asta, M., & Scazzina, F. (2021). Glycemic Index Values of Pasta Products: An Overview. Foods, 10(11), 2541. https://doi.org/10.3390/foods10112541

6. Dodi, R., Di Pede, G., Scarpa, C., Deon, V., Dall'Asta, M., & Scazzina, F. (2023). Effect of the pasta-making process on slowly digestible starch content. Foods, 12(10), 2064. https://doi.org/10.3390/foods12102064

7. EFSA, European Food Safety Authority. (2011). Scientific opinion on the substantiation of a health claim related to "slowly digestible starch in starch-containing foods" and "reduction of post-prandial glycemic responses." EFSA Journal, 9(6), 2292. https://doi.org/10.2903/j.efsa.2011.2292

8. Glycemic Index Foundation. (n.d.). Pasta. Retrieved January 24, 2024, from https://glycemic-index.net/pasta/

9. Glycemic Index Foundation. (n.d.). Glycemic Index and Load. Retrieved June 17, 2025, from https://glycemic-index.net/pasta/

10. Huang, M., Li, J., Ha, M.-A., Riccardi, G., & Liu, S. (2017). A systematic review on the relations between pasta consumption and cardio-metabolic risk factors. Nutrition, Metabolism and Cardiovascular Diseases, 27(11), 939–948. https://doi.org/10.1016/j.numecd.2017.07.005

11. Jenkins, D. J., Wolever, T. M., Taylor, R. H., Barker, H., Fielden, H., Baldwin, J. M., Bowling, A. C., Newman, H. C., Jenkins, A. L., & Goff, D. V. (1981). Glycemic index of foods: A physiological basis for carbohydrate exchange. American Journal of Clinical Nutrition, 34(3), 362–366. https://doi.org/10.1093/ajcn/34.3.362

11. Scazzina, F., Dall'Asta, M., Casiraghi, M. C., Sieri, S., Del Rio, D., Pellegrini, N., & Brighenti, F. (2016). Glycemic index and glycemic load of commercial Italian foods. Nutrition, Metabolism and Cardiovascular Diseases, 26(5), 419-429. https://doi.org/10.1016/j.numecd.2016.02.013

12. SINU, Società Italiana di Nutrizione Umana. (2024). LARN - Livelli di Assunzione di Riferimento di Nutrienti ed energia per la popolazione italiana. V Revisione. Coordinamento editoriale SINU-INRAN. Milano: SICS. ISBN 978 88 86154 76 5.

13. Vanhatalo, S., Dall'Asta, M., Cossu, M., Chiavaroli, L., Francinelli, V., Di Pede, G., Dodi, R., Närväinen, J., Antonini, M., Goldoni, M., Holopainen-Mantila, U., Cas, A. D., Bonadonna, R., Brighenti, F., Poutanen, K., & Scazzina, F. (2022). Pasta structure affects mastication, bolus properties, and postprandial glucose and insulin metabolism in healthy adults. The Journal of Nutrition, 152(4), 994–1005. https://doi.org/10.1093/jn/nxab361

14. USDA FoodData Central (n.d.). Retrieved March 25, 2025, https://fdc.nal.usda.gov/food-search?type=Foundation

3.

UNIQUE CARBOHYDRATE

Durum wheat semolina dry pasta is often grouped with other carbohydrate sources, but this categorization overlooks its distinct properties. Thus, this chapter aims to highlight the differences between durum wheat semolina dry pasta and staples, like rice, bread, and potatoes, by exploring the scientific basis for these differences.

3.1 DISTINCTIVE STRUCTURE AND DIGESTION

As discussed in previous chapters, the unique characteristics of durum wheat semolina dry pasta begin with its structure, a primary factor in its favorable glycemic profile.

Vanhatalo et al. (2022) directly investigated this structural aspect and compared durum wheat spaghetti to bread and couscous made from identical durum wheat semolina. Their research emphasized the critical role of pasta's intact structure in slowing starch digestion. According to the authors, pasta's structural integrity is maintained during cooking, which influences its processing in the mouth and stomach and ultimately affects the rate of glucose absorption in the intestines. The dense, compact matrix of properly cooked spaghetti hinders digestive enzymes' access and breakdown of starch, unlike the looser structure of bread or couscous. This slower digestion leads to a more gradual release of glucose into the bloodstream.

Dry pasta, primarily made from durum wheat semolina, undergoes a process of extrusion and drying, resulting in a dense and compact food matrix (Augustin et al., 2024). This matrix is not only a culinary characteristic but also a key factor in its unique digestive behavior and metabolic impact. The compact structure of durum wheat semolina dry pasta contributes to its slower digestion, leading to a lower GI compared to other common carbohydrate staples, such as certain types of rice and potatoes (**Figure 1**) (Atkinson et al., 2021). This distinction is significant for managing blood sugar levels and reducing the risk of insulin resistance.

3.2 FAVORABLE GLYCEMIC RESPONSE

Durum wheat semolina dry pasta offers a significant advantage for metabolic health due to its unique structural properties that contribute to a lower GI compared to dietary staples like rice and potatoes (**Figure 1**). Low-GI foods are digested and absorbed more slowly, gradually increasing blood sugar and insulin levels. This slow release is crucial for maintaining sustained energy and reducing the risk of insulin resistance and type 2 diabetes.

Numerous studies reinforce pasta's favorable glycemic response. For example, a review by Huang et al. (2017) observed that pasta-based meals consistently resulted in a lower postprandial glucose response compared to meals with bread or potatoes. Similarly, Chiavaroli et al. (2021) demonstrated that pasta generally had a lower glycemic impact than white rice in controlled mixed meals. Further supporting this, Zavitsanou et al. (2019) found that pasta made from semolina flour, combined with whole grain and legume flour, led to a more stable postprandial glucose response than white rice in individuals with type 1 diabetes, suggesting a potential benefit of that type of pasta (semolina flour, combined with whole grain and legume flour) for blood sugar management in this population. The benefits of pasta extend across diverse populations, as shown by Camps et al. (2021), who demonstrated that spaghetti had a lower glycemic and insulinemic impact than white rice and rice noodles in Chinese and Indian participants, even those whose traditional diets may not typically include pasta.
Moreover, Deshpande et al. (2020) observed that in individuals with type 1 diabetes, white rice caused a greater postprandial glucose spike than pasta in controlled meal challenges, regardless of the type of insulin therapy. It should be noted that there were no comparisons with other types of rice (brown, wild, etc.).

Additionally, the PREDIMED-Plus study (an ongoing, multicenter, randomized controlled clinical trial in Spain) showed that in overweight/obese older Spanish adults with metabolic syndrome, pasta consumption was linked to reduced weight, BMI, and waist circumference. This suggests that pasta may be a better refined carbohydrate choice than rice, bread, or potatoes for managing obesity in this population (Shyam et al., 2025). However, caution should be exercised when applying these data to other populations. Randomized controlled trials are necessary to examine the impact of pasta consumption on cardiometabolic risk across diverse populations with different dietary habits.

These consistent findings underscore the potential of durum wheat semolina dry pasta as a valuable dietary option for improved blood sugar management, applicable across various cultural dietary patterns.

3.3 DIET QUALITY

Durum wheat semolina dry pasta, a minimally processed product made from only two main ingredients, one of which is water, offers a unique nutritional profile (Table 2). Especially in its whole-grain form (Table 3), it provides a variety of minerals, protein, and fiber that support a higher-quality diet (USDA FoodData Central, n.d.). This nutritional advantage becomes apparent when pasta is compared to other products from refined grains (Table 2). White rice often lacks nutrient density, offering fewer vitamins and minerals and higher GI values. While potatoes provide certain nutrients, like potassium, phosphorus, magnesium, folate and vitamin C, (Table 2), they generally also have a higher GI and GL for a standard portion than durum wheat semolina dry pasta (Atkinson et al., 2021; USDA FoodData Central, n.d.). Similar is with white flour bread (USDA FoodData Central, n.d.). The combination of nutrients (Table 2) and a lower GI (Figure 1) makes durum wheat semolina dry pasta a valuable component of a balanced diet.

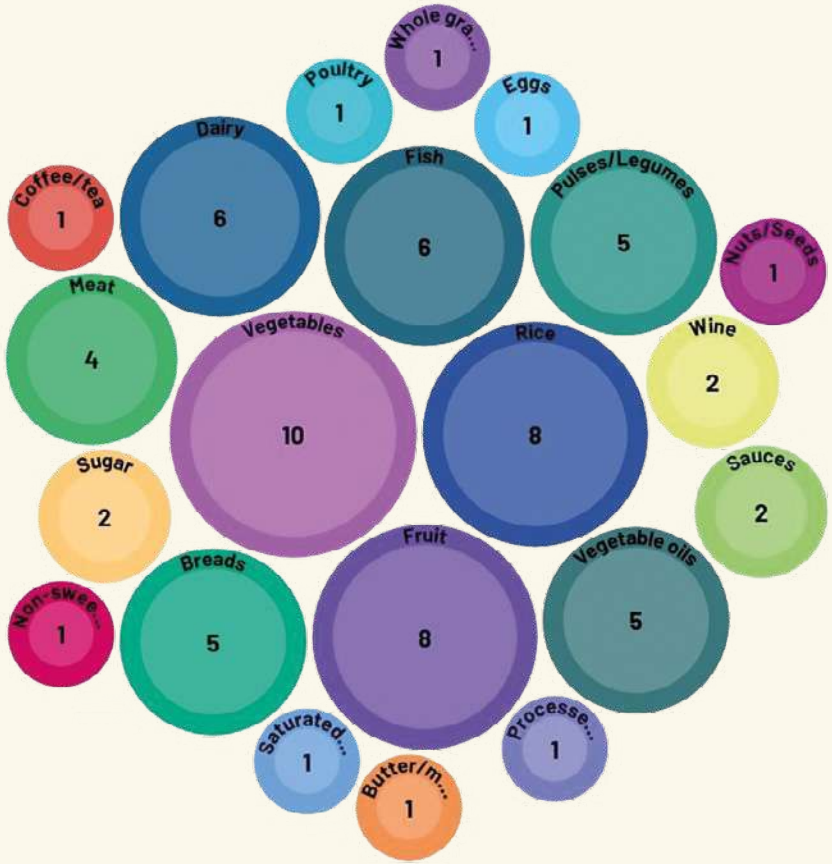
Table 2. Nutritional Comparison of Pasta, Rice and Potatoes (data from: USDA FoodData Central, n.d.)

Nutrient	Unit	Pasta, cooked, unenriched, with added salt	Wheat flours, (white) bread, unenriched	Potatoes, white, flesh and skin, baked	Rice, white, glutinous, unenriched, cooked
Water	g	62.1	13.4	75.4	76.6
Energy	kcal	157	361	92	97
Energy	kJ	655	1510	385	406
Protein	g	5.8	12	2.1	2.02
Total Lipid (Fat)	g	0.93	1.66	0.15	0.19
Ash	g	0.55	0.47	1.24	0.07
Carbohydrate, by Difference	g	30.6	72.5	21.1	21.1
Fiber, Total Dietary	g	1.8	2.4	2.1	1
Total Sugars	g	0.56	0.31	1.53	0.05
Starch	g	26	-	18	-
Calcium, Ca	mg	7	15	10	2
Iron, Fe	mg	0.5	0.9	0.64	0.14
Magnesium, Mg	mg	18	25	27	5
Phosphorus, P	mg	58	97	75	8
Potassium, K	mg	44	100	544	10
Sodium, Na	mg	131	2	7	5
Zinc, Zn	mg	0.51	0.85	0.35	0.41
Copper, Cu	mg	0.1	0.182	0.127	0.049
Manganese, Mn	mg	0.322	0.792	0.189	0.262
Selenium, Se	µg	26.4	39.7	0.5	5.6
Vitamin C, total ascorbic acid	mg	0	0	12.6	0
Thiamin	mg	0.02	0.08	0.048	0.02
Riboflavin	mg	0.02	0.06	0.043	0.013
Niacin	mg	0.4	1	1.53	0.29
Pantothenic Acid	mg	0.112	0.438	0.383	0.215
Vitamin B-6	mg	0.049	0.037	0.211	0.026
Folate, Total	µg	7	33	38	1

When it comes to overall diet quality, Sandres and Slavin (2023) found, in their literature review, that most dietary patterns higher in pasta were also higher in vegetables, fruits, rice, dairy, and fish than dietary patterns lower in pasta (**Figure 2**).

However, it's important to note that this literature review primarily analyzed observational studies, which cannot establish causality and often rely on self-reported data.

Figure 2. Food groups found within dietary patterns high in pasta (data from: Sanders and Slavin, 2023)



Number of times food group was included with higher pasta consumption - dietary pattern

Fulgoni and Bailey's 2017 analysis of NHANES data further supports the nutritional benefits of pasta consumption (**Figure 3**). Their findings revealed a positive association between the consumption of pasta and noodles and improved diet quality. They found that consuming pasta and noodles was not associated with increased daily calorie intake, while pasta mixed dishes and macaroni and cheese were associated with increased calorie intake. Furthermore, both pasta mixed dishes and pasta and noodle dishes were associated with increased dietary fiber intake. It is worth noting that while consuming "macaroni and cheese" was also examined, it was linked to lower diet quality, highlighting the importance of considering the overall dish composition rather than just the pasta itself.

Figure 3. Statistically significant differences in energy and nutrient intakes between pasta consumers and non-consumers (data from: Fulgoni & Bailey, 2017)

PASTA MIXED DISHES (EXCLUDES MACARONI AND CHEESE)

Category	Consumers (mean±SD)	Non-Consumers (mean±SD)	Key Differences: Consumers vs Non-Consumers
Number of Participants	**877**	**9,820**	Smaller consumer group
Energy (kcal)	**2323 ± 42**	2154 ± 11	More energy intake
Sodium (mg)	**3775 ± 58**	3589 ± 19	Higher sodium intake
Dietary Fiber (g)	**19.7 ± 0.4**	17.3 ± 0.2	More fiber intake
Potassium (mg)	**2920 ± 65**	2771 ± 18	Higher potassium intake
Vitamin D (D2 + D3, µg)	4.3 ± 0.2	5.0 ± 0.1	Lower vitamin D intake

PASTA, NOODLES AND COOKED GRAINS

Category	Consumers (mean±SD)	Non-Consumers (mean±SD)	Key Differences: Consumers vs Non-Consumers
Number of Participants	**232**	**10,465**	Smallest consumer group
Energy (kcal)	**2134 ± 70**	2170 ± 11	Smaller energy intake
Dietary Fiber (g)	**19.8 ± 0.9**	17.5 ± 0.2	More fiber intake

MACARONI AND CHEESE

Category	Consumers (mean±SD)	Non-Consumers (mean±SD)	Key Differences: Consumers vs Non-Consumers
Number of Participants	**406**	**10,291**	Smaller consumer group
Total Saturated Fat (g)	2426 ± 54*	2159 ± 12	More energy intake
	31.6 ± 1.1*	26.1 ± 0.3	More saturated fat intake

These results suggest that pasta can be effectively integrated into a dietary pattern that includes other nutritious foods, such as vegetables, lean proteins, and healthy fats, to create balanced and wholesome meals.

3.4 CONCLUSION

Durum wheat semolina dry pasta possesses a unique combination of structural and nutritional properties that distinguish it from other common carbohydrate sources.

Its dense structure contributes to slower digestion and a favorable glycemic response, making it a valuable component of a balanced diet, particularly for managing blood sugar. Although often grouped with other carbohydrates, pasta's distinct characteristics warrant its recognition as a unique and versatile food with potential benefits.

3.5 LITERATURE

1. Atkinson, F. S., Brand-Miller, J. C., Foster-Powell, K., Buyken, A. E., & Goletzke, J. (2021). International tables of glycemic index and glycemic load values 2021: A systematic review. The American Journal of Clinical Nutrition, 114(5), 1625-1632. Durum wheat semolina dry pasta possesses a unique combination of structural and nutritional properties that distinguish it from other common carbohydrate sources. Its dense structure contributes to slower digestion and a favorable glycemic response, making it a valuable component of a balanced diet, particularly for managing blood sugar. Although often grouped with other carbohydrates, pasta's distinct characteristics warrant its recognition as a unique and versatile food with potential benefits.

2. Augustin, L. S. A., Ellis, P. R., Vanginkel, M.-A., & Riccardi, G. (2024). Pasta: Is it an unhealthy refined food? The Journal of Nutrition. Advanced online publication. https://doi.org/10.1016/j.tjnut.2024.11.019

3. Camps, S. G., Lim, J., Koh, M. X. N., & Henry, C. J. (2021). The glycemic and insulinaemic response of pasta in Chinese and Indians compared to Asian carbohydrate staples: Taking spaghetti back to Asia. Nutrients, 13(2), 451. https://pubmed.ncbi.nlm.nih.gov/33572918/

4. Chiavaroli, L., Di Pede, G., Dall'Asta, M., Cossu, M., Francinelli, V., Goldoni, M., Scazzina, F., & Brighenti, F. (2021). The importance of glycemic index on post-prandial glycaemia in the context of mixed meals: A randomized controlled trial on pasta and rice. Nutrition, Metabolism & Cardiovascular Diseases, 31(2), 615-625. https://doi.org/10.1016/j.numecd.2020.09.025

5. Deshpande, S., Pinsker, J. E., Church, M. M., Piper, M., Andre, C., Massa, J., Doyle III, F. J., Eisenberg, D. M., & Dassau, E. (2020). Randomized crossover comparison of automated insulin delivery versus conventional therapy using an unlocked smartphone with scheduled pasta and rice meal challenges in the outpatient setting. Diabetes Technology & Therapeutics, 22(12), 865–874. https://doi.org/10.1089/dia.2020.0022

6. Fulgoni, V. L., & Bailey, R. (2017). Association of pasta consumption with diet quality and nutrients of public health concern in adults: National Health and Nutrition Examination Survey 2009–2012. Current Developments in Nutrition, 1(10), e001271. https://pmc.ncbi.nlm.nih.gov/articles/PMC5998777/

7. Huang, M., Li, J., Ha, M.-A., Riccardi, G., & Liu, S. (2017). A systematic review on the relations between pasta consumption and cardio-metabolic risk factors. Nutrition, Metabolism and Cardiovascular Diseases, 27(11), 939–948. https://doi.org/10.1016/j.numecd.2017.07.005

8. Sanders, L. M., & Slavin, J. (2023). Impact of Pasta Intake on Body Weight and Body Composition: A Technical Review. Nutrients, 15(12), 2689. https://doi.org/10.3390/nu15122689

9. Shyam, S., Nishi, S. K., Ni, J., Martínez-González, M. Á., Corella, D., Schröder, H., Martínez, J. A., Alonso-Gómez, Á. M., Warnberg, J., Vioque, J., Romaguera, D., López-Miranda, J., Estruch, R., Tinahones, F. J., Lapetra, J., Serra-Majem, L., Bueno-Cavanillas, A., Tur, J. A., Sánchez, V., Martín-Pinto, X., ... Salas-Salvadó, J. (2025). Pasta Consumption and Cardiometabolic Risks in Older Adults with Overweight/Obesity: A Longitudinal Analysis. Journal of the American Nutrition Association, 1–13. Durum wheat semolina dry pasta possesses a unique combination of structural and nutritional properties that distinguish it from other common carbohydrate sources. Its dense structure contributes to slower digestion and a favorable glycemic response, making it a valuable component of a balanced diet, particularly for managing blood sugar. Although often grouped with other carbohydrates, pasta's distinct characteristics warrant its recognition as a unique and versatile food with potential benefits.

10. USDA FoodData Central. (n.d.). Retrieved February 31, 2025, https://fdc.nal.usda.gov/food-search?type=Foundation

11. Vanhatalo, S., Dall'Asta, M., Cossu, M., Chiavaroli, L., Francinelli, V., Di Pede, G., Dodi, R., Närväinen, J., Antonini, M., Goldoni, M., Holopainen-Mantila, U., Cas, A. D., Bonadonna, R., Brighenti, F., Poutanen, K., & Scazzina, F. (2022). Pasta structure affects mastication, bolus properties, and postprandial glucose and insulin metabolism in healthy adults. The Journal of Nutrition, 152(4), 994–1005. https://doi.org/10.1093/jn/nxab361

14. Zavitsanou, S., Massa, J., Deshpande, S., Pinsker, J. E., Church, M. M., Andre, C., DoyleIII, F. J., Michelson, A., Creason, J., Dassau, E., & Eisenberg, D. M. (2019). The Effect of Two Types of Pasta Versus White Rice on Postprandial Blood Glucose Levels in Adults with Type 1 Diabetes: A Randomized Crossover Trial. Diabetes Technology &Therapeutics, 21(9), 485–492. https://pmc.ncbi.nlm.nih.gov/articles/PMC6708265/

4.

PASTA AND HEALTH

Pasta is an element of the Mediterranean diet alongside vegetables and fruits, which are its key components. The Mediterranean diet is recognized for its association with longevity and reduced risk of chronic disease. When consumed in moderation with individually tailored portions, pasta can be incorporated into a healthy Mediterranean diet. Consequently, this chapter will explore the relationship between mainly durum wheat semolina, dry pasta consumption, and various health outcomes, including body weight, metabolic health, diabetes, cardiovascular health, and emotional well-being.

4.1 BODY WEIGHT

Before we proceed, it is important to repeat that 100 grams of cooked pasta provides a lot of energy, 157 kcal (665 kJ) (USDA FoodData Central, n.d.). This, with a suggested 80-gram portion size, should be considered when discussing moderate pasta consumption.

Concerns about carbohydrate intake have traditionally led to the exclusion of pasta from weight-loss diets. However, research examining pasta within the context of the Mediterranean diet presents a different perspective. Studies, such as the one by Agnoli et al. (2018) and Rosi et al. (2020), have shown that moderate pasta consumption, when part of a Mediterranean dietary pattern rich in vegetables, fruits, and olive oil, is not linked to weight gain and may even contribute to a lower BMI in some instances. A systematic review and meta-analysis by Chiavaroli et al. (2017) further supports this conclusion, finding that incorporating pasta into a low-GI diet can lead to reductions in body weight and BMI compared to higher-GI diets. Although the observed weight loss may be modest, these results suggest that pasta does not contribute to weight gain when consumed as part of a low-glycemic index (GI) dietary pattern. These findings are relevant for individuals with overweight or obesity in middle age, including those with diabetes, who are following a high-carbohydrate diet based on low-GI foods, regardless of whether weight loss is their primary goal.

Large-scale studies of Mediterranean populations, including Moli-sani and INHES, have shown a negative correlation between pasta consumption and BMI, with Moli-sani also reporting a negative correlation with waist-to-hip ratio, suggesting pasta intake is associated with lower obesity prevalence (Pounis et al., 2016). Moreover, the PREDIMED-Plus (ongoing, multicenter, randomized controlled clinical trial in Spain) showed that in metabolic syndrome, pasta consumption was associated with reduced weight, BMI, and waist circumference over a two-year period, even after accounting for other dietary aspects (Shyam et al., 2025).

Finally, a systematic review of 38 studies by Sanders and Slavin (2023) concluded that observational and limited clinical data indicate pasta is either inversely or not associated with overweight or obesity in healthy children and adults and does not promote weight gain when included in a healthy dietary pattern.

Several factors may explain why pasta, despite being carbohydrate-rich, does not necessarily lead to weight gain, especially when consumed as part of a healthy dietary pattern.

GLYCEMIC INDEX AND SATIETY

Pasta, especially durum wheat semolina dry pasta when cooked al dente, has a lower glycemic index compared to other refined carbohydrates, such as white bread.

This low GI results in a slower, more gradual rise in blood sugar, promoting feelings of fullness and satiety, which may help prevent overeating (Vanhalo et al., 2022).

PASTA STRUCTURE, STARCH DIGESTION AND FIBER

Pasta's compact structure, SDS and fiber, inherently slows gastric emptying.

This effect is amplified by the durum wheat semolina dry pasta-making process, where gluten proteins encapsulate starch, limiting enzyme access (Vanhalo et al., 2022).

Further, cooking and cooling promote starch retrogradation, generating digestion-resistant starch, which additionally contributes to slowed gastric emptying and reduced postprandial sugar spikes (Hodges, 2019).

OVERALL DIETARY PATTERN SYNERGY

The Mediterranean diet, which often features pasta, emphasizes pairing pasta with fiber-rich vegetables and legumes. This dietary synergy further reduces the overall glycemic impact of the meal and minimizes insulin surges (Agnoli et al., 2018; Sanders and Slavin, 2023).Durum wheat semolina dry pasta's lower GI, unique structure, and starch properties, when included in a balanced diet such as the Mediterranean diet, can support overall health. The Mediterranean diet's holistic approach, encouraging a variety of nutrient-dense foods (Agnoli et al., 2018), is more likely to facilitate balanced eating habits than restrictive diets that eliminate entire food groups.

4.2 METABOLIC HEALTH

The Mediterranean diet, which typically includes moderate pasta consumption, appears to have a positive impact on various metabolic markers. Bergia et al. (2022) found that following a Mediterranean-style healthy eating pattern reduced daily glycemia and when combined with low-GI foods, it also improved daily glycemic variability. Research by Costabile et al. (2024) indicated that a low-GI Mediterranean diet may help reduce postprandial plasma triglycerides in individuals at high cardiometabolic risk. This finding aligns with the broader benefits of the Mediterranean diet and highlights pasta's role as a carbohydrate source that can contribute to overall health.

As previously mentioned, compared to many other carbohydrate sources, pasta (durum wheat semolina dry pasta) generally has a lower GI, which helps maintain more stable blood glucose levels (Di Pede et al., 2021; Huang et al., 2017). This is particularly important for metabolic health, as high-GI foods can cause rapid and significant spikes in blood sugar and insulin.

Building on this, Chiavaroli et al. (2021) suggest that dietary patterns characterized by a low GI and GL can lead to small but meaningful improvements in the key indicators of glycemic control, blood lipid profiles, adiposity, blood pressure, and inflammation. These benefits are observed even when individuals are already undergoing treatment with hyperglycemia medications or insulin, particularly in adults with moderately managed type 1 and type 2 diabetes.

4.3 CHRONIC DISEASE RISK

Researchers have explored the relationship between pasta intake and the risk of chronic diseases, including diabetes and cardiovascular disease. A large prospective study by Huang et al. (2021) analyzing data from the Women's Health Initiative followed postmenopausal women for up to 20 years. The findings indicated that pasta consumption did not negatively impact diabetes risk and may be associated with a significantly reduced risk of stroke and atherosclerotic cardiovascular disease.

This potentially beneficial effect could be attributed to pasta's fiber content, particularly in the whole-grain varieties, and its typical inclusion within balanced diets rich in vegetables, olive oil, and lean proteins. The authors also suggested substituting pasta for other commonly consumed starchy foods, such as fried potatoes or white bread, as a practical dietary modification to improve cardiometabolic outcomes. These results suggest that pasta can be a heart-healthy diet component when consumed in moderation and combined with nutrient-dense foods. This does not imply that replacing fried potatoes or white bread with boiled potatoes and whole-grain bread is not also advantageous.

The TOSCA.IT study (Vitale et al., 2020) further explored pasta consumption in individuals with type 2 diabetes. The study found that when pasta intake was within the recommended carbohydrate limits (45 %-60 % of total energy), it was not associated with worsened glucose control, increased adiposity, or major cardiovascular risk factors. Interestingly, the study even observed an inverse relationship between pasta intake and HDL cholesterol levels.

Furthermore, research into different types of Mediterranean diets, such as that by Costabile et al. (2024), indicates that consuming a low-GI Mediterranean diet, compared to a high-GI version, does not significantly alter major fasting cardiometabolic risk factors in individuals at increased risk. However, a lower GI approach may help reduce postprandial plasma triglycerides.

Supporting these findings, a systematic review of 61 studies by Huang et al. (2017) demonstrated that pasta-based meals generally result in lower postprandial glucose responses compared to other carbohydrate-rich foods common in Western diets, such as white bread and potatoes.

Pasta consumption may also lead to a less pronounced postprandial insulinemic response. However, this aspect has been less studied, likely due to its variability and dependence on the progression of diabetes (Huang et al., 2017).

4.4 EMOTIONAL AND MENTAL HEALTH

Healthy dietary patterns, such as the Mediterranean diet, are increasingly recognized for their positive impact on mental well-being, including a reduced risk of depression and anxiety (Sánchez-Villegas et al., 2013). Beyond its nutritional components, the Mediterranean Diet offers less-appreciated benefits to well-being and healthy lifestyles through conviviality and shared meals, as highlighted by Bernardi and Visioli (2024).

Pasta, a common element within this dietary pattern, may contribute to these mental health benefits. As a source of carbohydrates and protein, including tryptophan, pasta can influence serotonin levels, a neurotransmitter that plays a crucial role in mood regulation (Fernstrom, 2013).

Furthermore, the balanced energy release from pasta, particularly whole-grain varieties, may help stabilize mood by preventing fluctuations in blood sugar, thus providing a consistent fuel source for the brain and body. Supporting this, a study by Grosso et al. (2025) exploring the relationship between pasta consumption and happiness indicated that pasta can indeed contribute to feelings of well-being and satisfaction, especially when consumed in social settings.

While further research is needed to understand these mechanisms fully (e.g. are feelings of happiness solely due to the satisfying effects of eating pasta or solely due to the social environment, or do both support the feelings of joy), the evidence suggests that pasta's moderate inclusion in healthy dietary patterns, such as the Mediterranean diet, aligns with broader dietary approaches that support mental well-being.

4.5 CONCLUSION

Pasta's enduring appeal lies in its ability to harmonize tradition with modern nutritional science. Its moderate inclusion in the Mediterranean diet, based on various vegetables and fruits, supports weight management and metabolic health and reduces the risk of chronic diseases. Additionally, pasta contributes to emotional and mental well-being, making it a valuable component of a healthy diet.

By incorporating durum wheat semolina dry pasta into a balanced eating pattern, individuals can reap its numerous benefits while supporting their overall health, performance, and quality of life.

4.6 LITERATURE

1. Agnoli, C., Sieri, S., Ricceri, F., Giraudo, M. T., Masala, G., Assedi, M., ... & Krogh, V. (2018). Adherence to a Mediterranean diet and long-term changes in weight and waist circumference in the EPIC-Italy cohort. Nutrition & Diabetes, 8(1). https://www.nature.com/articles/s41387-018-0023-3

2. Bergia, R. E., Giacco, R., Hjorth, T., Biskup, I., Zhu, W., Costabile, G., Vitale, M., Campbell, W. W., Landberg, R., & Riccardi, G. (2022). Differential glycemic effects of low- versus high-glycemic index Mediterranean-style eating patterns in adults at risk for type 2 diabetes: The MEDGI-Carb randomized controlled trial. Nutrients, 14(3), 706. https://doi.org/10.3390/nu14030706

3. Bernardi, E., & Visioli, F. (2024). Fostering wellbeing and healthy lifestyles through conviviality and commensality: Underappreciated benefits of the Mediterranean Diet. Nutrition Research, 126, 46–57. https://doi.org/10.1016/j.nutres.2024.03.007

4. Chiavaroli, L., Kendall, C. W. C., Braunstein, C. R., Blanco Mejia, S., Leiter, L. A., Jenkins, D. J. A., Sievenpiper, J. L. (2017). Effect of pasta in the context of low glycemic index dietary patterns on body weight and markers of adiposity: A systematic review and meta-analysis of randomised controlled trials in adults. BMJ Open, 8(3). https://doi.org/10.1136/bmjopen-2017-019438

5. Chiavaroli, L., Di Pede, G., Dall'Asta, M., Cossu, M., Francinelli, V., Goldoni, M., Scazzina, F., & Brighenti, F. (2021). The importance of glycemic index on post-prandial glycaemia in the context of mixed meals: A randomized controlled trial on pasta and rice. Nutrition, Metabolism & Cardiovascular Diseases, 31(2), 615-625. https://doi.org/10.1016/j.numecd.2020.09.025

6. Costabile, G., et al. (2024). Effects on cardiovascular risk factors of a low- vs high-glycemic index Mediterranean diet in high cardiometabolic risk individuals: the MEDGI-Carb study. European Journal of Clinical Nutrition. https://doi.org/10.1038/s41430-024-01406-y

7. Di Pede, G., Dodi, R., Scarpa, C., Brighenti, F., Dall'Asta, M., & Scazzina, F. (2021). Glycemic Index Values of Pasta Products: An Overview. Foods, 10(11), 2541. https://doi.org/10.3390/foods10112541

8. Fernstrom, J. D. (2013). Large neutral amino acids: Dietary effects on brain neurochemistry and function. Amino Acids, 45(3), 419–430. https://doi.org/10.1007/s00726-012-1330-y

9. Grosso, F., Bonanomi, A., & Pagnini, F. (2025). Pasta, what a feeling! A multi-method study on the relationship between pasta consumption and happiness. International Journal of Behavioral Nutrition and Physical Activity 13:e70240,https://doi.org/10.1002/fsn3.70240

10. Hodges, C., Archer, F., Chowdhury, M., Evans, B. L., Ghelani, D. J., Mortoglou, M., & Guppy, F. M. (2019). Method of food preparation influences blood glucose response to a high-carbohydrate meal: A randomised cross-over trial. Foods, 9(1), 23. https://doi.org/10.3390/foods9010023

11. Huang, M., Li, J., Ha, M.-A., Riccardi, G., & Liu, S. (2017). A systematic review on the relations between pasta consumption and cardio-metabolic risk factors. Nutrition, Metabolism and Cardiovascular Diseases, 27(11), 939–948. https://doi.org/10.1016/j.numecd.2017.07.005

12. Huang, M., Lo, K., Li, J., Allison, M., Wu, W.-C., & Liu, S. (2021). Pasta meal intake concerning risks of type 2 diabetes and atherosclerotic cardiovascular disease in postmenopausal women: findings from the Women's Health Initiative. BMJ Nutrition, Prevention & Health, 4(1), 195–205.

http:// dx. doi. org/ 10.1136/ bmjnph- 2020- 000198

13. Pounis, G., Castelnuovo, A., Costanzo, S., Persichillo, M., Bonaccio, M., Bonanni, A., Cerletti, C., Donati, M. B., de Gaetano, G., & Iacoviello, L. (2016). Association of pasta consumption with body mass index and waist-to-hip ratio: Results from Moli-Sani and INHES studies. Nutrition & Diabetes, 6(7), e218. https://doi.org/10.1038/nutd.2016.20

14. Rosi, A., Tesan, M., Cremonini, A., Biasini, B., Bicchieri, L., Cossu, M., Brighenti, F., Dall'Aglio, E., & Scazzina, F. (2020). Body weight of individuals with obesity decreases after a 6-month high-pasta or low-pasta Mediterranean diet weight-loss intervention. Nutrition, Metabolism and Cardiovascular Diseases, 30(6), 984–995. https://doi.org/10.1016/j.numecd.2020.02.013

15. Sánchez-Villegas, A., Martínez-González, M. A., Estruch, R., Salas-Salvadó, J., Corella, D., Covas, M. I., Arós, F., Romaguera, D., Gómez-Gracia, E., Lapetra, J., Pintó, X., Martínez, J. A., Lamuela-Raventós, R. M., Ros, E., Gea, A., Wärnberg, J., & Serra-Majem, L. (2013). Mediterranean dietary pattern and depression: the PREDIMED study. BMC medicine, 11(1), 208. https://doi.org/10.1186/1741-7015-11-208

16. Sanders, L. M., & Slavin, J. (2023). Impact of Pasta Intake on Body Weight and Body Composition: A Technical Review. Nutrients, 15(12), 2689. https://doi.org/10.3390/nu15122689

17. Shyam, S., Nishi, S. K., Ni, J., Martínez-González, M. Á., Corella, D., Schröder, H., Martínez, J. A., Alonso-Gómez, Á. M., Wärnberg, J., Vioque, J., Romaguera, D., López-Miranda, J., Estruch, R., Tinahones, F. J., Lapetra, J., Serra-Majem, L., Bueno-Cavanillas, A., Tur, J. A., Martín Sánchez, V., Pintó, X., ... Salas-Salvadó, J. (2025). Pasta Consumption and Cardiometabolic Risks in Older Adults with Overweight/Obesity: A Longitudinal Analysis. Journal of the American Nutrition Association, 1–13. https://doi.org/10.1080/27697061.2025.2463454

18. USDA FoodData Central (n.d.). Retrieved March 25, 2025, https://fdc.nal.usda.gov/food-search?type=Foundation

19. Vitale, M., Masulli, M., Rivellese, A. A., Bonora, E., Babini, A. C., Sartore, G., Corsi, L., Buzzetti, R., Citro, G., Baldassarre, M. P. A., Bossi, A. C., Giordano, C., Auciello, S., Dall'Aglio, E., Iannarelli, R., Tonutti, L., Sacco, M., Di Cianni, G., Clemente, G., ... Vaccaro, O. (2020). Pasta consumption and connected dietary habits: Associations with glucose control, adiposity measures, and cardiovascular risk factors in people with type 2 diabetes—TOSCA.IT study. Nutrients, 12(1), 101. https://doi.org/10.3390/nu12010101

20. Vanhatalo, S., Dall'Asta, M., Cossu, M., Chiavaroli, L., Francinelli, V., Di Pede, G., Dodi, R., Närväinen, J., Antonini, M., Goldoni, M., Holopainen-Mantila, U., Cas, A. D., Bonadonna, R., Brighenti, F., Poutanen, K., & Scazzina, F. (2022). Pasta structure affects mastication, bolus properties, and postprandial glucose and insulin metabolism in healthy adults. The Journal of Nutrition, 152(4), 994–1005. https://doi.org/10.1093/jn/nxab361

5.

WHOLE-GRAIN ADVANTAGE

While all pasta offers certain nutritional advantages, whole-grain pasta provides an extra layer of benefits due to its higher fiber and nutrient content.

> “
>
> A food may be labelled as ‘whole grain’ if it contains at least 30 % whole-grain ingredients in the overall product and more whole grain than refined grain, both on a dry weight basis.
>
> Healthgrain Forum, n.d.

5.1 POWERHOUSE OF FIBER

Whole-grain pasta offers several significant health advantages, primarily due to its high fiber content. The fiber in whole-grain pasta slows digestion and prolongs glucose release into the bloodstream, promoting stable blood sugar levels and enhancing energy stability throughout the day (Seal et al., 2021). Di Pede et al. (2021) demonstrated that whole-grain pasta varieties consistently exhibit low postprandial glycemic responses compared to refined pasta.

The low GI makes whole-grain pasta a better choice for individuals aiming to stabilize blood sugar levels. Glycemic control is crucial for managing and preventing type 2 diabetes. Reynolds et al. (2020) showed in their meta-analysis that higher-fiber diets are an important component of diabetes management, improving glycemic control, blood lipids, body weight, and inflammation while also reducing premature mortality.

Furthermore, studies have shown that the intake of whole grains rich in fiber is associated with positive impacts on weight management, anthropometric measures (including weight, BMI, and waist circumference), plasma lipids (total and LDL cholesterol), and 2-hour glucose levels (Newby et al., 2007).

These benefits extend beyond digestion, as adequate fiber intake reduces the risk of chronic diseases, including type 2 diabetes, cardiovascular disease, and certain types of cancer (Seal et al., 2021). Giacco et al. (2010) also found that three weeks of whole-meal wheat consumption significantly reduced fasting plasma and LDL cholesterol in a small group of healthy individuals.

5.2 POWERHOUSE OF NUTRIENTS

Beyond fiber, whole-grain pasta offers a richer micronutrient profile (Table 3). The retained bran and germ are excellent sources of essential vitamins and minerals, including B vitamins (thiamin, riboflavin, niacin, pyridoxin, folate), iron, magnesium, phosphorus and selenium (Mayo Clinic, n.d.). These nutrients are vital for energy production, oxygen transport, muscle and nerve function, and antioxidant defense.

The nutrients present in greater quantities in the whole-grain pasta contribute to overall health and well-being, so whole-grain intake is associated with reduced total cholesterol and 2-hour glucose (Newby et al., 2007). As a versatile staple, whole-grain pasta can promote balanced meals. While whole grains offer numerous benefits, portion control remains essential for a healthy diet.

Table 3. Nutritional Comparison of Whole Grain and Regular Pasta (data from: USDA FoodData Central, n.d.)

Nutrient per 100g	Unit	Pasta, cooked, whole grain 51%, semolina unenriched	Pasta, cooked, unenriched, with added salt
Water	**g**	**60.7**	62.1
Energy	**kcal**	159	157
Energy	**kJ**	665	655
Protein	**g**	5.82	5.8
Total lipid (fat)	**g**	1.5	0.93
Ash	g	0.45	0.55
Carbohydrate, by difference	g	31.5	30.6
Fiber, total dietary	g	4.6	1.8
Total Sugars	g	0.85	0.56
Starch	g	26.4	26
Calcium, Ca	mg	12	7
Iron, Fe	mg	1.65	0.5
Magnesium, Mg	mg	45	18
Phosphorus, P	mg	110	58
Potassium, K	mg	77	44
Sodium, Na	mg	6	131
Zinc, Zn	mg	1.12	0.51
Copper, Cu	mg	0.199	0.1
Manganese, Mn	mg	1.03	0.322
Selenium, Se	µg	34.2	26.4
Thiamin	mg	0.157	0.02
Riboflavin	mg	0.103	0.02
Niacin	mg	2.89	0.4
Pantothenic acid	mg	0.23	0.112
Vitamin B-6	mg	0.097	0.049
Folate, total	µg	20	7

5.3 CONCLUSION

Whole-grain pasta provides significant benefits beyond those of refined pasta. Its higher fiber content supports digestive health, promotes satiety, and contributes to a reduced risk of chronic diseases. The richer micronutrient profile, including essential vitamins and minerals, further enhances its nutritional value. Incorporating whole-grain pasta into a balanced diet offers a practical and delicious way to improve overall health and well-being.

5.4 LITERATURE

1. Di Pede, G., Dodi, R., Scarpa, C., Brighenti, F., Dall'Asta, M., & Scazzina, F. (2021). Glycemic Index Values of Pasta Products: An Overview. Foods, 10(11), 2541. https://doi.org/10.3390/foods10112541

2. Giacco, R., Clemente, G., Cipriano, D., Luongo, D., Viscovo, D., Patti, L., Di Marino, L., Giacco, A., Naviglio, D., Bianchi, M., Ciati, R., Brighenti, F., Rivellese, A. A., & Riccardi, G. (2010). Effects of the regular consumption of wholemeal wheat foods on cardiovascular risk factors in healthy people. Nutrition, Metabolism & Cardiovascular Diseases, 20(3), 186-194. https://doi.org/10.1016/j.numecd.2009.03.025

3. Healthgrain Forum. (n.d.). Whole grain. Retrieved March 25, 2025, from https://healthgrain.org/whole-grain/

4. Newby P.K., Maras J., Bakun P., Muller D., Ferrucci L., Tucker K.L. Intake of whole-grains, refined grains, and cereal fiber measured with 7-d diet records and associations with risk factors for chronic disease. Am. J. Clin. Nutr. 2007;86:1745–1753. doi: 10.1093/ajcn/86.5.1745

Mayo Clinic. (n.d.). Whole grains: Hearty options for a healthy diet. Retrieved march 28, 2025, from https://www.mayoclinic.org/healthy-lifestyle/nutrition-and-healthy-eating/in-depth/whole-grains/art-20047826

5. Reynolds, A. N., Akerman, A. P., & Mann, J. (2020). Dietary fibre and whole-grains in diabetes management: Systematic review and meta-analyses. PLoS Medicine, 17(3), Article e1003053. https://doi.org/10.1371/journal.pmed.1003053

6. Seal, C. J., Courtin, C. M., Venema, K., & de Vries, J. (2021). Health benefits of whole-grain: effects on dietary carbohydrate quality, the gut microbiome, and consequences of processing. Comprehensive Reviews in Food Science and Food Safety, 20(3), 2742-2768. https://doi.org/10.1111/1541-4337.12728

7. USDA FoodData Central. (n.d.). Retrieved March 25, 2025, https://fdc.nal.usda.gov/food-search?-type=Foundation

6.

GLUTEN-FREE AND NON-WHEAT PASTA OPTIONS

Pasta has traditionally been synonymous with wheat. However, the rising prevalence and incidence of gluten sensitivities and celiac disease (Singh et al., 2017; King et al., 2020), coupled with a growing interest in dietary diversity, has fueled the development and popularity of gluten-free and alternative-grain pasta options.

This chapter will explore the science behind these non-traditional pasta products, looking at their composition, production challenges, nutritional profiles, and potential health implications.

6.1 NEED FOR ALTERNATIVES

Gluten, a protein complex found mostly in wheat, rye, barley and triticale is responsible for the characteristic elasticity and chewiness of traditional pasta.

For individuals with celiac disease, an autoimmune disorder, consuming gluten triggers an immune response that damages the small intestine (King et al., 2020).

Similarly, those with non-celiac gluten sensitivity (NCGS) may experience adverse symptoms after consuming gluten, although without the same level of intestinal damage (King et al., 2020). Consequently, the demand for gluten-free products, including pasta, has significantly increased. At the same time, individuals seeking dietary variety or incorporating different nutritional profiles into their diets have also contributed to the growth of the alternative pasta market.

These wheat alternative pasta options are crafted from a diverse range of ingredients, including rice, corn, legumes (such as chickpeas and lentils), quinoa, amaranth, and buckwheat (Mishra et al., 2023). Each ingredient contributes unique characteristics to the final product, affecting its texture, flavor, and nutritional value.

6.2 COMPOSITION AND PROCESSING

The production of gluten-free pasta presents unique challenges. Gluten provides the structural network in wheat pasta, contributing to its cohesive dough and firm texture. Replicating this structure in the absence of gluten requires carefully selecting and processing alternative ingredients.

Hydrocolloids, such as xanthan gum and hydroxypropyl methylcellulose (HPMC), are often added to gluten-free pasta doughs to improve their binding properties and create a more desirable texture (Gao et al., 2018; Padalino et al., 2016; Mishra et al., 2023).

These hydrocolloids mimic some of the functions of gluten, providing viscosity and elasticity to the dough (Gao et al., 2018; Padalino et al., 2016; Mishra et al., 2023).

The processing methods used for wheat alternative pasta vary depending on the base ingredient (Gao et al., 2018; Padalino et al., 2016). For instance, rice pasta is typically made by grinding rice into flour, mixing it with water, and then extruding the dough through dies to create various shapes.

Legume-based pasta, such as chickpea pasta, involves milling the legumes into flour, which is then processed similarly to other pasta products (Gao et al., 2018; Padalino et al., 2016). The drying process is also crucial, as it affects the pasta's final texture and cooking properties.

6.3 NUTRITIONAL PROFILES AND HEALTH

The nutritional composition of gluten-free and wheat alternative pasta options varies considerably depending on the ingredients used.

Legume-based pasta products tend to be higher in protein and fiber than traditional wheat pasta and other gluten-free options (Cioffi et al., 2024). They are also good sources of iron, magnesium and zinc. Evidence suggests that eating lentil-based pasta may reduce energy intake (Cioffi et al., 2024). These pasta options have been shown to improve satiety, blood sugar regulation, and weight management. Quinoa pasta provides a good balance of protein, fiber, and essential amino acids. Although rice pasta may contain less protein and fiber, it is suitable for individuals with sensitivities to other grains, though it generally has a higher GI. Vegetable-based pastas, which are typically lower in calories and carbs, also increase intake of various nutrients found in vegetables.

Martini et al. (2018) found that pasta enriched with a combination of fiber and protein may be effective in modulating appetite, suggesting a novel concept for pasta formulation that influences eating behavior. However, Korczak et al. (2016) demonstrated that high-protein or high-fiber pasta does not elicit a greater satiety response than pasta with lower amounts of protein or fiber. Despite this, pasta is inherently a very satiating food, and subjects in the Korczak et al. (2016) study likely could not differentiate between the test conditions.

From a health perspective, gluten-free pasta offers a crucial dietary choice for individuals with celiac disease and NCGS. Nevertheless, it is important to remember that not all gluten-free products are naturally healthier.
Therefore, it is essential to read nutrition labels carefully and choose pasta that is high in fiber, protein, and micronutrients. Still, adding a variety of alternative grain pasta options can help create a more balanced and nutrient-rich diet.

6.4 CHALLENGES AND FUTURE

Despite the advancements in gluten-free and alternative pasta technology, challenges remain. Achieving a texture and flavor comparable to traditional wheat pasta is often difficult.
Some alternative pasta can be mushy, crumbly, or have an undesirable aftertaste (Padalino et al., 2016). Ongoing research focuses on improving the sensory properties of these products through optimized processing techniques and the use of novel ingredients.
Future research should explore the potential of combining different ingredients to create pasta products with improved nutritional profiles and enhanced sensory characteristics.

It is also important to investigate the impact of different processing methods on the nutritional value and digestibility of wheat alternative pasta products. Additionally, studies on the long-term health effects of consuming gluten-free and alternative grain pasta options are needed to provide further dietary guidance.

6.5 CONCLUSION

The development of gluten-free and wheat alternative pasta options has revolutionized the culinary landscape, offering a wider range of choices to individuals with dietary restrictions and those seeking variety.

While challenges remain in replicating the unique qualities of wheat-based pasta, ongoing research and innovation are continuously improving the texture, flavor, and nutritional value of these alternatives. By understanding the science behind these products, consumers can make informed choices and enjoy the diverse world of pasta beyond wheat.

6.6 LITERATURE

1. Cioffi, I., Martini, D., Del Bo', C., Brusamolino, A., Casiraghi, M. C., Porrini, M., & Riso, P. (2024). Lentils based pasta affect satiation, satiety and food intake in healthy volunteers. Current Research in Food Science, 9, 100858. https://doi.org/10.1016/j.crfs.2024.100858

2. Gao, Y., Janes, M. E., Chaiya, B., Brennan, M. A., Brennan, C. S., & Prinyawiwatkul, W. (2018). Gluten-free bakery and pasta products: Prevalence and quality improvement. International Journal of Food Science and Technology, 53(1), 19–32. https://doi.org/10.1111/ijfs.13505

3. King, J. A., Jeong, J., Underwood, F. E., Quan, J., Panaccione, N., Windsor, J. W., ... & Kaplan, G. G. (2020). Incidence of celiac disease is increasing over time: A systematic review and meta-analysis. The American Journal of Gastroenterology, 1 115(4), 507–525. https://doi.org/10.14309/ajg.0000000000000523

4. Korczak, R., Timm, D., Ahnen, R., Thomas, W., & Slavin, J. L. (2016). High protein pasta is not more satiating than high fiber pasta at a lunch meal, nor does it decrease mid-afternoon snacking in healthy men and women. Journal of Food Science, 81(9), S2240–S2245. https://doi.org/10.1111/1750-3841.13406

5. Martini, D., Brusamolino, A., Del Bo', C., Laureati, M., Porrini, M., & Riso, P. (2018). Effect of fiber and protein-enriched pasta formulations on satiety-related sensations and afternoon snacking in Italian healthy female subjects. Physiology & Behavior, 185, 61–69. https://doi.org/10.1016/j.physbeh.2017.12.024

6. Mishra, R., Garg, S. K., & Singh, M. (2023). Gluten-free pasta: A comprehensive review of alternative grains and formulation approaches. Biological Forum-An International Journal, 15(11), 349-354

7. Padalino, L., Conte, A., & Del Nobile, M. A. (2016). Overview on the general approaches to improve gluten-free pasta and bread. Foods, 5(4), 87. https://doi.org/10.3390/foods5040087

8. Singh, P., Arora, A., Strand, T. A., Leffler, D. A., Catassi, C., Green, P. H., ... & Makharia, G. K. (2018). Global prevalence of celiac disease: Systematic review and meta-analysis. Clinical Gastroenterology and Hepatology, 16(6), 823–836.e2. https://doi.org/10.1016/j.cgh.2017.06.037.

7.

CARBOHYDRATES, PASTA AND SPORT

Carbohydrates are essential for optimal physical performance, especially in sports and athletic endeavors. Among carbohydrate sources, pasta, a staple of the Mediterranean diet, offers a unique combination of sustained energy release, valuable nutrients, and culinary versatility, making it an important tool for athletes.

This chapter will explore the role of carbohydrates and pasta in physical performance.

7.1 FUEL FOR ATHLETIC ACTIVITY

Carbohydrates are the body's primary energy source during moderate to high-intensity exercise. Stored primarily as glycogen in the muscles and liver, they provide a readily available source of energy. A meta-analysis by Bourdas et al. (2021), reviewing over 45 years of research, confirms that carbohydrate solution intake during prolonged exercise significantly enhances endurance and reduces performance decline. Adequate carbohydrate intake is crucial for maintaining optimal glycogen stores, which helps delay fatigue and sustain performance during prolonged physical activity (Murray & Rosenbloom, 2018). Glycogen depletion can impair both endurance and high-intensity exercise performance in athletes (Murray & Rosenbloom, 2018).

7.2 PASTA AS THE PREFERRED CARBOHYDRATE

Durum wheat semolina dry pasta, as a source of carbohydrates, offers athletes several key advantages. Its production results in a unique structure that contributes to a lower GI compared to some other carbohydrate sources (Augustin et al., 2024). This translates to a steadier release of glucose into the bloodstream, providing sustained energy without the rapid spikes and subsequent crashes associated with high-GI foods (Huang et al., 2017; Zavitsanou et al., 2019; Chiavaroli et al., 2021; Camps et al., 2021). This characteristic is particularly beneficial for endurance athletes requiring a consistent energy supply.

Research supports the positive impact of pasta on athletic performance within the Mediterranean diet. The key findings from Bianchi et al.'s (2024) review showed that the Mediterranean diet may improve muscle endurance and power, as well as

anaerobic performance, in CrossFit athletes. Furthermore, the Mediterranean diet was associated with enhanced strength performance, including increased vertical jump height, hand-grip strength, and shuttle run performance. Perna et al. (2024) investigated the effects of Mediterranean diet patterns with varying carbohydrate content on physical performance in non-professional strength athletes. They found that athletes consuming a carbohydrate-rich Mediterranean diet, including pasta, have not had negative effects on physical performance, body composition and strength. This highlights pasta's potential to enhance both performance and post-exercise recovery, especially in the context of a balanced dietary pattern.

7.3 PASTA AND ATHLETES' NUTRITION

Beyond its favorable glycemic profile, particularly whole-grain pasta contributes valuable nutrients to an athlete's diet. It provides essential minerals, like magnesium, which play vital roles in energy metabolism, muscle function, and overall health.

Additionally, it is a source of dietary fiber and phytonutrients that support gut health and potentially reduce inflammation, both of which are important factors for athletic recovery and long-term well-being.

This nutrient density makes it a more advantageous choice than many refined carbohydrate options, which offer primarily "empty calories". Furthermore, legume-based pasta is a good source of protein, in addition to carbohydrates and fiber (USDA FoodData Central, n.d.).

7.4 PASTA COMPARED TO OTHER CARBOHYDRATES

While various carbohydrate sources can fuel athletic activity, durum wheat semolina dry pasta offers distinct advantages. Compared to high-GI carbohydrates like white bread or sugary snacks, it provides a more gradual glucose release. This prevents the energy peaks and troughs that can negatively impact performance.

While other sources, such as rice and potatoes, can provide carbohydrates, pasta's unique combination of sustained energy release and nutrient density in whole-grain form makes it a compelling option for athletes (Huang et al., 2017; Zavitsanou et al., 2019; Chiavaroli et al., 2021; Camps et al., 2021).

7.5 CONCLUSION

Carbohydrates are indispensable for athletic performance, and durum wheat semolina dry pasta offers a compelling combination of benefits for athletes. Its favorable glycemic profile and valuable nutrient content of the whole-grain version make it a valuable component of a well-rounded athletic diet, supporting both performance and overall health.

7.6 LITERATURE

1. Augustin, L. S. A., Ellis, P. R., Vanginkel, M.-A., & Riccardi, G. (2024). Pasta: Is it an unhealthy refined food? The Journal of Nutrition. Advanced online publication. https://doi.org/10.1016/j.tjnut.2024.11.019

2. Camps, S. G., Lim, J., Koh, M. X. N., & Henry, C. J. (2021). The glycemic and insulinaemic response of pasta in Chinese and Indians compared to Asian carbohydrate staples: Taking spaghetti back to Asia. Nutrients, 13(2), 451. https://pubmed.ncbi.nlm.nih.gov/33572918/

3. Chiavaroli, L., Di Pede, G., Dall'Asta, M., Cossu, M., Francinelli, V., Goldoni, M., Scazzina, F., & Brighenti, F. (2021). The importance of glycemic index on post-prandial glycaemia in the context of mixed meals: A randomized controlled trial on pasta and rice. Nutrition, Metabolism & Cardiovascular Diseases, 31(2), 615-625. https://doi.org/10.1016/j.numecd.2020.09.025

5. Bourdas, D. I., Souglis, A., Zacharakis, E. D., Geladas, N. D., & Travlos, A. K. (2021). Meta-analysis of carbohydrate solution intake during prolonged exercise in adults: from the last 45+ years' perspective. Nutrients, 13(12), 4223. https://doi.org/10.3390/nu13124223

6. Huang, M., Li, J., Ha, M.-A., Riccardi, G., & Liu, S. (2017). A systematic review on the relations between pasta consumption and cardio-metabolic risk factors. Nutrition, Metabolism and Cardiovascular Diseases, 27(11), 939–948. https://doi.org/10.1016/j.numecd.2017.07.005

7. Murray, B., & Rosenbloom, C. (2018). Fundamentals of glycogen metabolism for coaches and athletes. Nutrition Reviews, 76(4), 243–259. https://doi.org/10.1093/nutrit/nuy001

8. Perna, S., Doria, C., Trezza, A., Tucci, M., Martini, D., Del Bo', C., Bianchi, E., Borrelli, M., Vinelli, V., Leone, A., Mambrini, S., Bertoli, S., Cè, E., Battezzati, A., Porrini, M., Esposito, F., & Riso, P. (2024). Effect of acute meal and long-term intake of a Mediterranean Diet providing different amounts of carbohydrates on physical performance and biomarkers in non-professional strength athletes. International Journal of Food Science and Technology. Carbohydrates are indispensable for athletic performance, and durum wheat semolina dry pasta offers a compelling combination of benefits for athletes. Its favorable glycemic profile and valuable nutrient content of the whole-grain version make it a valuable component of a well-rounded athletic diet, supporting both performance and overall health.

9. USDA FoodData Central (n.d.). Retrieved February 31, 2025, https://fdc.nal.usda.gov/food-search?-type=Foundation

10. Zavitsanou, S., Massa, J., Deshpande, S., Pinsker, J. E., Church, M. M., Andre, C., DoyleIII, F. J., Michelson, A., Creason, J., Dassau, E., & Eisenberg, D. M. (2019). The Effect of Two Types of Pasta Versus White Rice on Postprandial Blood Glucose Levels in Adults with Type 1 Diabetes: A Randomized Crossover Trial. Diabetes Technology &Therapeutics, 21(9), 485–492. https://pmc.ncbi.nlm.nih.gov/articles/PMC6708265/

CONCLUSION

Durum wheat semolina dry pasta is more than just a culinary delight; it is a nutritional powerhouse deeply rooted in the Mediterranean diet.
This booklet has uncovered the science behind durum wheat semolina dry pasta's notable properties and explored its unique qualities as a valuable component of a healthy diet.

When consumed in moderation, durum wheat semolina dry pasta, with its low GI, can be beneficial for weight management and metabolic health while reducing chronic disease risk.
Whole-grain varieties amplify these benefits with their superior nutrient density, making them particularly well-suited for today's health-conscious consumers.

Pasta, whether refined, whole grain, gluten-free, or made from grain alternatives, can be adapted to suit diverse dietary needs and preferences.
Its inclusion in balanced meals fosters a sense of satisfaction and emotional well-being, further reinforcing its status as a dietary staple for individuals of all ages. Beyond everyday nutrition, pasta is an athletic fuel source that supports both daily activities and peak physical performance.

Compared to other staple foods, durum wheat semolina dry pasta stands out as a unique and versatile option that seamlessly bridges taste and nutrition. Ultimately, the enduring appeal of durum wheat semolina dry pasta lies in its ability to harmonize tradition with modern nutritional science.

By incorporating it into a Mediterranean-style eating pattern, individuals can reap its numerous benefits while supporting their overall health, performance, and quality of life.

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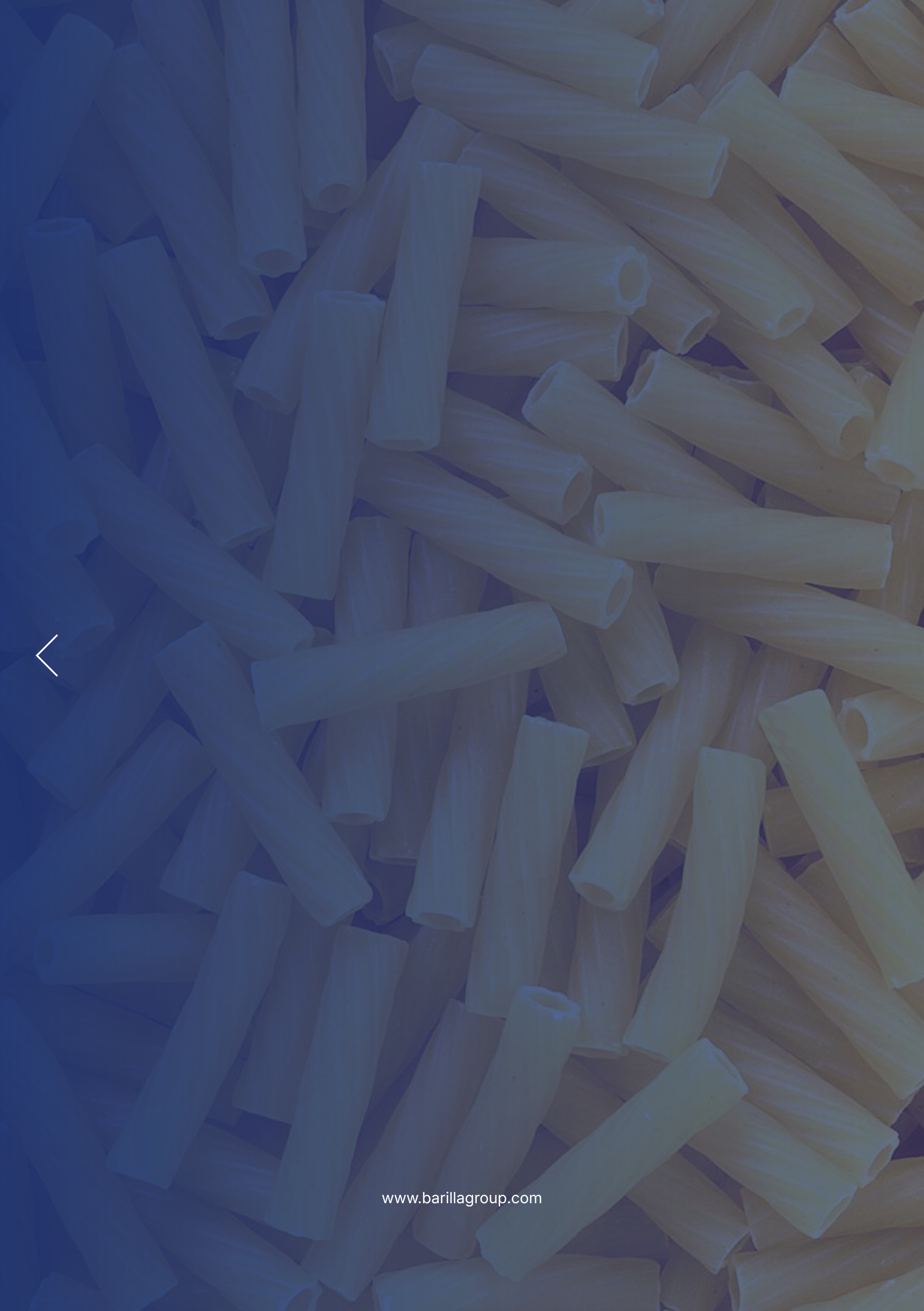
EFAD

The European Federation of the Associations of Dietitians (EFAD)
De Molen 93, 3995AW Houten, The Netherlands

e-mail: secretariat@efad.org



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