REPORT 04

Food and Children

DATA, POLICIES AND TOOLS FOR MITIGATING THE RISKS OF ULTRA-PROCESSED FOODS AND DANGEROUS FOOD STYLES

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Abstract

This report focuses on proper nutrition for children, a fundamental factor in their development that results in healthy growth. In fact, a balanced meal represents a crucial brick in the construction of the future of the young generations and the society to come. Exploring the issue of nutrition at a young age means reflecting on a fundamental right, which crosses geographical boundaries and social barriers. So, not only analysing data and policies, but also asking what it really means to guarantee children and adolescents the proper nutrition they need.

In today's society, often characterised by an overabundance of food resources and easy access to high-calorie and high-processed foods, overnutrition has become increasingly prevalent (at least in the Western world), leading to higher rates of being overweight and obese. The health costs of poor nutrition are also not to be underestimated. Overall in Italy, the economic impact attributable to obesity exceeds 13.3 billion euro per year, of which 59% is represented by direct health costs for the treatment of certain correlated diseases such as cardiovascular diseases, diabetes, cancers and other surgeries.

Hidden behind excess weight are multifactorial aspects, such as genetics, the surrounding environment, family, social backgrounds and much more. As a result, eating habits play an important role. In particular, the rise in the consumption of ultra-processed foods among children and adolescents is a growing concern. This type of food is increasingly present in the young people's diets due to their wide availability and convenience, high palatability, sweetness and practicality in consumption.

Numerous scientific evidences suggest that ultra-processed foods, due to their high content of additives, emulsifiers and preservatives, can negatively affect an infant's immune system through direct and indirect mechanisms, such as the alteration of the intestinal barrier and the microbiome, a key element in the regulation of immune tolerance.

This drift towards incorrect eating habits can be stemmed through virtuous habits to be promoted first and foremost in school canteens.

According to the latest available data, 418 million children worldwide benefit from school meals on a daily basis, 30 million more in the last 5 years. Overall, 41% of children enrolled in primary school have access to a free or subsidised daily school meal, a percentage that rises to 61% in high-income countries.

Investing in school canteens leads to benefits in the medium- to long-term. This is what the study published in “Frontiers in Public Health” and conducted in 14 low- and middle-income countries by some researchers from leading universities worldwide tells us: every dollar invested in school catering can generate an average return of $17 up to a maximum of $35 depending on the social context analysed.

When talking about infant nutrition, another recurring and discussed topic concerns restrictive diets and, in particular, the exclusion of foods of animal origin. The growing diffusion of vegetarian and vegan diets, observed in recent years also in the paediatric population, requires careful reflection in the nutritional and clinical fields.

In order to counteract the spread of excess weight and incorrect eating habits among the population, it is essential to focus on a holistic approach capable of converging different tools aimed at a common goal: the wellbeing of citizens with particular attention to the youngest. It is thus essential to promote preventive strategies to reduce the negative impact of ultra-processed foods on health, through a multidisciplinary approach that integrates education and awareness of citizens and institutions as well as a reformulation of the nutritional offer in schools and school canteens. All this can help reduce the negative impact of poor nutrition on the health of children and adolescents, with positive effects on public budgets as well. Prevention and early intervention are key to countering negative trends and to promote a healthier and more sustainable diet.

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Preface

Proper nutrition in children and adolescents results in healthy growth. A balanced meal represents a crucial brick in the construction of the future of every child and the society to come. Exploring the issue of nutrition at a young age means reflecting on a fundamental right, which crosses geographical boundaries and social barriers. Thus, not only analysing data and policies, but also asking what it really means to guarantee children and adolescents the proper nutrition they need. The objective of this report is precisely this and starts from one certainty: food is not only sustenance, but also a tool as necessary as it is fundamental to live better and healthier. By eating well and eating healthy, we potentially reduce the risk of getting sick or having to live with chronic non-communicable diseases in the future.

Attention to healthy and correct nutrition from infancy and
adolescence also enshrined in the International Convention on the Rights of the Child over 35 years ago which, in Article 24 and Article 27 enshrined the commitment of States to guarantee adequate nutritional assistance to children and their families, thus recognising the indissoluble link between nutrition and physical, mental, spiritual, moral and social development [1].

In fact, nutrition is a key element in the development of an individual from the first days of life. The youthful evolutionary path, from childhood to adolescence, is characterised by significant anatomical and physiological changes that influence nutritional needs, making an adequate and integrated food approach essential at every stage of growth.

Proper nutrition accompanies and supports physical and cognitive growth, being essential for strengthening the immune system and, consequently, for preventing metabolic diseases [2]. Generally, the first two years of a child's life are particularly important and optimal nutrition during this period reduces morbidity, mortality and the risk of developing chronic diseases, as well as promoting better overall development [3].

Although on the one hand, DNA plays a non-negligible role in the development of some diseases such as dementias and cancers, on the other hand some studies show how daily choices related to diet, physical activity, sleep and exposure to

environmental risk factors have a significant impact on the duration and quality of life. In particular, factors such as smoking, stress, sedentary lifestyle and an unbalanced diet are strongly associated with a higher incidence of cardiovascular, lung and liver diseases.

In particular, a recent study conducted by researchers at the University of Oxford on a sample of almost 500,000 individuals from the UK Biobank database [4] shows that lifestyles play a central role in preventing certain types of diseases. In fact, the results of the research show that environmental and behavioural factors contribute decisively to the risk of premature mortality and biological ageing.

The importance of lifestyles is not limited to adulthood but begins much earlier as children and even during pregnancy. In fact, as demonstrated by the Dutch Famine study [5], the exposure of the foetus to conditions of maternal malnutrition has effects that occur with growth, increasing the risk of obesity, hypertension and even psychopathological disorders. Over the past decade, developments in epigenetics[1] have provided strong evidence that the pregnant person's diet and lifestyles during pregnancy can result in permanent changes in the genome of the foetus, a process known as “feotal programming”. These epigenetic changes are then passed on to subsequent generations, affecting the health of offspring and increasing susceptibility to chronic or degenerative diseases, including obesity and cardiovascular disease.

The epigenetic evidence shown suggests that a healthy and
proper diet during pregnancy can reduce the risk of contracting chronic diseases, conferring protection that also extends to future generations. However, proper nutrition should not be limited solely to pregnancy – it is important that children and adolescents maintain a healthy profile at the table throughout the growth and development process. But also later on.

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[1] Sector of genetics that studies the set of cellular activities responsible for DNA modulation (and which therefore contribute to determining the phenotype) without causing gene mutations.

1. When food becomes a problem

In the collective imagination, the term “malnutrition” is often associated exclusively with malnutrition by default, that is, the lack of essential nutrients that leads to states of malnutrition and deterioration [6]. This is likely a social and cultural legacy linked to a time when hunger and food scarcity were the main nutritional problems. However, in today's society, often characterised by an overabundance of food resources and easy access to high-calorie and high-processed foods, overnutrition has become increasingly prevalent (at least in the Western world), leading to higher rates of being overweight and obese.

In Italy, almost 1 adult[2] in 2 carries “excess weight”, a state that includes both overweight people (34.6%) and people affected by a more serious condition of obesity (11.8%) [7]. In this context, it is the age group of children and young people that is of particular concern. Childhood obesity is recognised by the World Health Organization (WHO) as one of the major health emergencies of the 21st century. The implications of the “obesity epidemic” are manifold – it not only involves a general poor state of health, with implications that have a multifactorial impact on the state of health, but also affects the country's economy by burdening public spending. Overall in Italy, the economic impact attributable to obesity exceeds 13.3 billion euro per year, of which 59% is represented by direct health costs for the treatment of certain correlated diseases such as cardiovascular diseases, (6.6 billion euro), diabetes (0.65 billion), cancers (0.33 billion) and bariatric surgery (0.24 billion) [8].

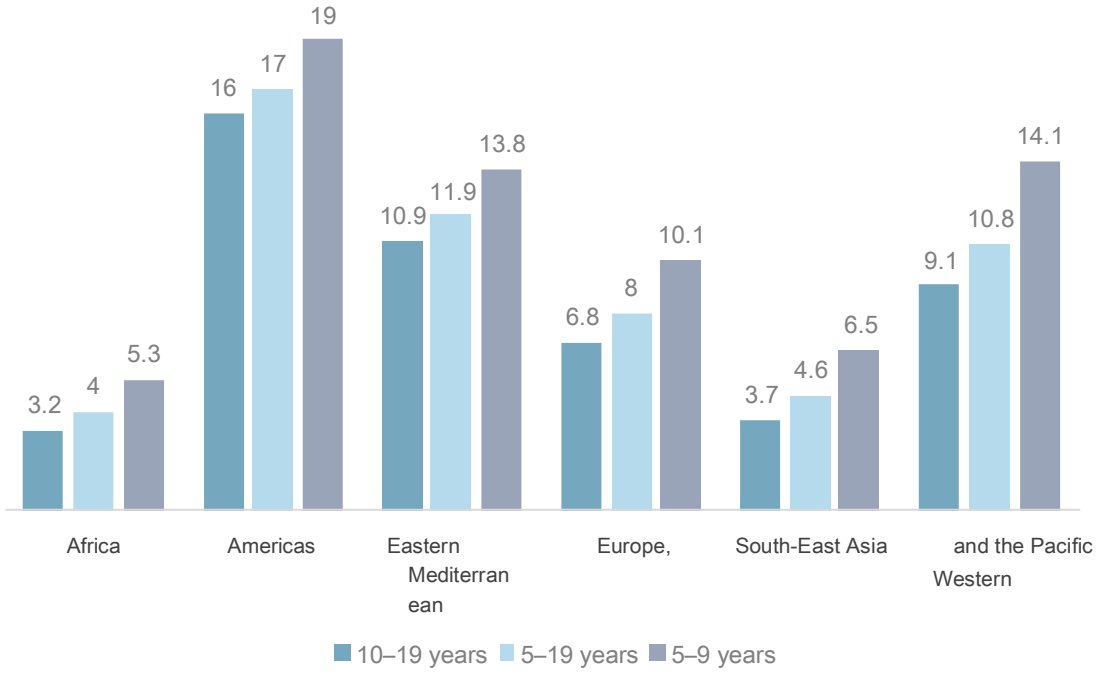
According to the latest data from the Global Health Observatory for 2022, the number of children and adolescents who are obese in the world has grown at worrying rates, with a particularly marked increase in middle- and high-income countries. From a data analysis, it emerges that among children and adolescents, the obesity rate in 2022 was four times higher than that of 1990 [9]. Currently, it is estimated that, worldwide, 8.2% of children between 5 and 19 years of age are

[2] From the age of 18 upwards – Year 2024

affected by obesity, with a higher percentage for the 5–9 age group (10.2%) than for the 10–19 age group (7.2%) [10].

Among the WHO regions, the prevalence of obesity in Europe among the same age group (5–19 years) is 8%, one of the best figures when compared with the American (17%), Eastern Mediterranean (11.9%) or Western Pacific (10.8%) rates. A lower prevalence is recorded only in Africa (4%) and Southeast Asia (4.6%).

Graph 1.1: Prevalence of obesity among children and adolescents (2022, % values)



Sources: Processing of WHO data by the Fondazione Aletheia

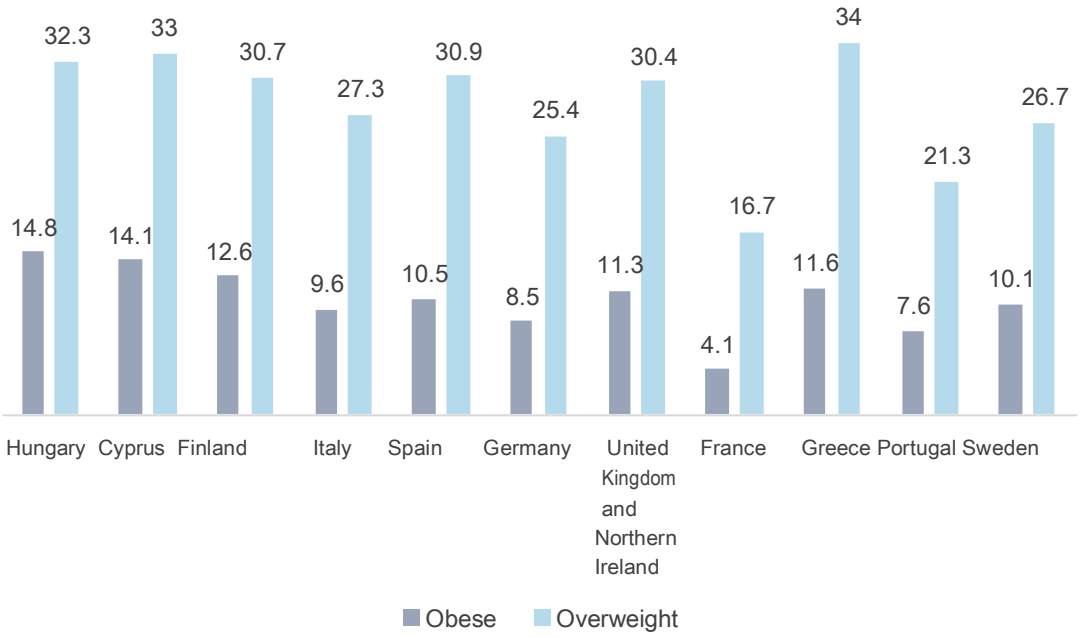
In particular, among the EU countries, Hungary (14.8%), Cyprus (14.1%) and Finland (12.6%) are at the top of the ranking with the highest rates of youth obesity [3]. Italy ranks 13th by percentage of the youth population affected by obesity [4] with 9.6% and in 11th place by percentage of the youth population in a state of being overweight [5] with 27.3% [10] [11].

[3] Consider the age range of 5–19 years.

[4] Obesity: BMI > +2 standard deviations above the median of the Body Mass Index.

[5] Overweight: BMI > +1 deviation above the median of the Body Mass Index.

Graph 1.2: Obesity and overweight among children and adolescents – European countries (2022, % values)



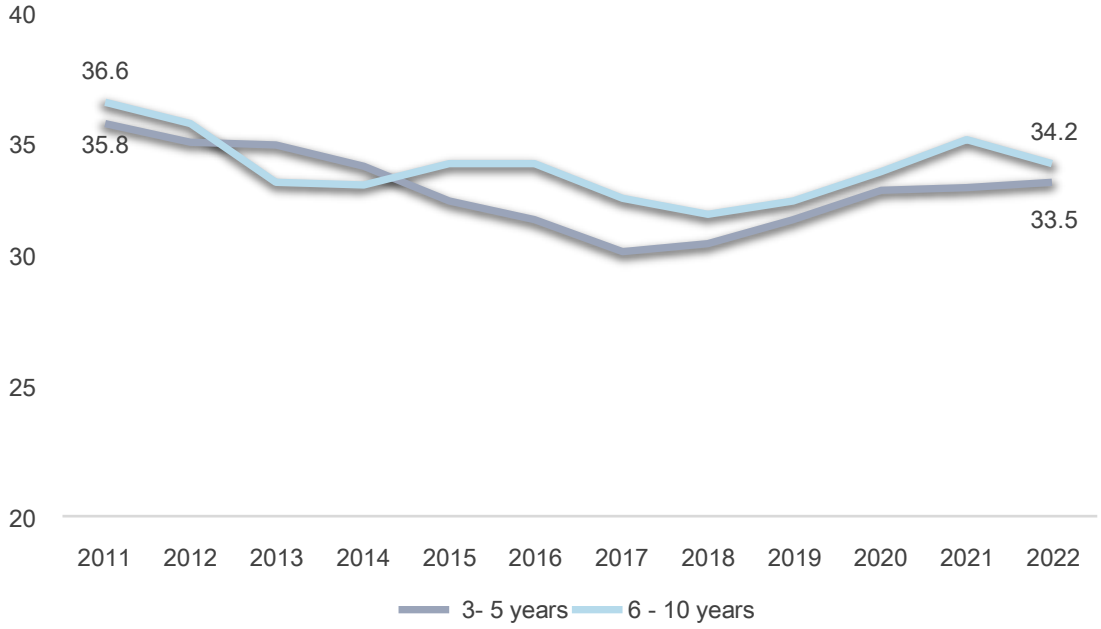
Sources: Processing of WHO data by the Fondazione Aletheia

Excess weight in the youth population of Italy

Referring to younger people, Italian National Institute of Statistics (ISTAT) data confirms the trend of a fairly widespread phenomenon at a national level, albeit in slight decline or in any case stable in recent years. In fact, 27.2% of children (3–17 years) are overweight or affected by obesity, of which males seem to be more exposed to the phenomenon (29.5% of males vs 24.8% of females). In particular, the age groups most sensitive to the problem of excess weight are those between 3–5 years and 6–10 years, where about one in three children is overweight or obese (33.5% for the age group 3–5 years; 34.2% for 6–10 years).

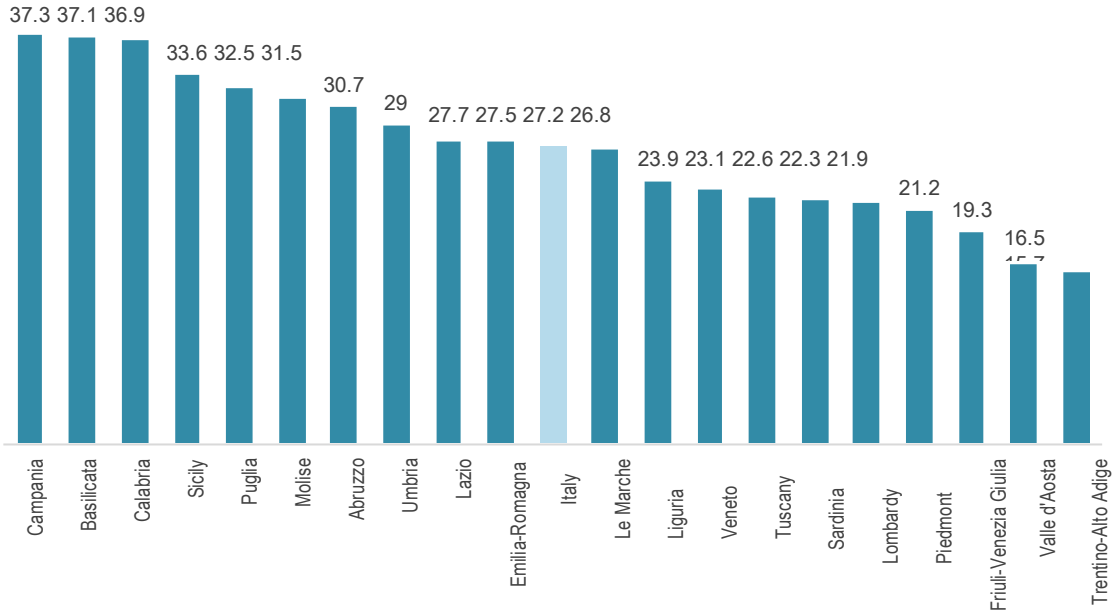
In the last 10 years, however, there has been a reduction in the rate of overweight and obese among young people, which has fallen – albeit slightly – compared to the level of 28.5% recorded in 2011.

Graph 1.3: Prevalence of overweight and obesity in Italian children (% values)



Sources: Processing of 2025 Italian National Institute of Statistics (ISTAT) data by the Fondazione Aletheia

Graph 1.4: Overweight or obesity among children aged 3 to 17 by Region (2022, % values)



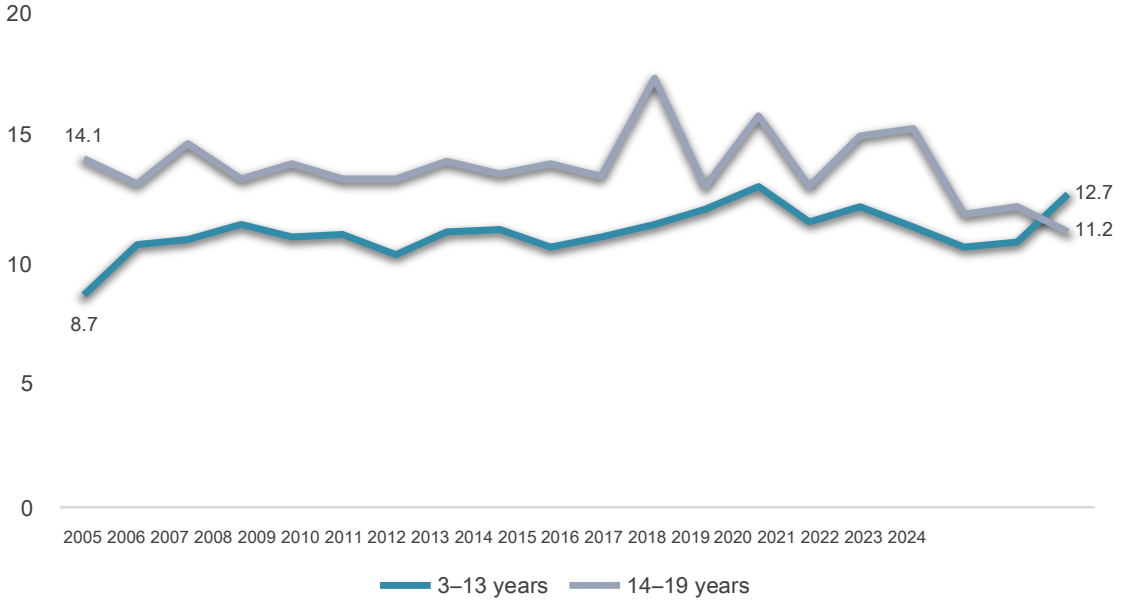
Sources: Processing of 2025 Italian National Institute of Statistics (ISTAT) data by the Fondazione Aletheia

At a regional level, although the difference between the country's geographical areas has partly diminished, the Southern Regions – and to a lesser extent, some of the Centre – continue to have rates above the national average.

Childhood obesity, in particular, is one of the most important challenges due to the consequences it entails, such as the risk of type 2 diabetes, asthma, musculoskeletal problems, cardiovascular issues plus psychological and social problems. In addition, excess weight in childhood is closely related to obesity in adulthood, with consequences on quality of life and overall life expectancy [12]. Of concern is the fact that only a minimum proportion of boys and girls between the ages of 3 and 19 follow a healthy diet on a daily basis, focused on the consumption of at least four portions of fruit or vegetables per day, in a country where the gastronomic culture is based on the principles of the Mediterranean Diet. Whereas twenty years ago, the percentage of adolescents (14–19 years old) who adequately consumed [6] fruits and vegetables was equal to 14%, in 2024 it fell to 11.2%. This is a worrying decline among the new generations, evidently also driven by the substitution effect with UPFs. It is a slightly different, albeit still worrying, situation for children from 3 to 13 years, since in 2005, only 8.7% ate enough fruits or vegetables, while today that figure has grown to 12.7%. Probably, this different trend for the two age groups analysed could be explained both by the fact that parents are able to better control their children's food choices and because the youngest often consume at least one meal at school during their day, unlike the older age groups [13].

[6] Appropriately understood as daily consumption of at least four portions of fruit – Fair and Sustainable Wellbeing indicator of the Italian National Institute of Statistics (ISTAT).

Graph 1.5: Adequate nutrition among young people by age group from 3 to 19 years (% values)



Sources: Processing of 2025 Italian National Institute of Statistics (ISTAT) data by the Fondazione Aletheia

In short

- Globally, the number of children and adolescents (5–19 years old) suffering from obesity continues to grow, with a percentage four times higher than in 1990.
- It is currently estimated that 8.2% of children are affected by obesity globally. 8% in Europe.
- In Italy, almost 1 in 2 adults is in conditions of “excess weight”, which includes being both overweight (34.6%) and obese (11.8%).
- Among EU countries, Italy ranks 13th for levels of youth obesity (5–19 years) with 9.6% and 11th for overweight (5–19 years) with 27.3%.
- In the last twenty years, there has been a drop from 14% to 11.2% of adolescents (14–19 years) who consume at least four servings of fruit and vegetables per day.

2. Causes of malnutrition

Hidden behind excess weight are multifactorial aspects, such as genetics, the surrounding environment, family, social backgrounds and much more. As a result, eating habits play an important role and today we are witnessing some worrying drifts [14].

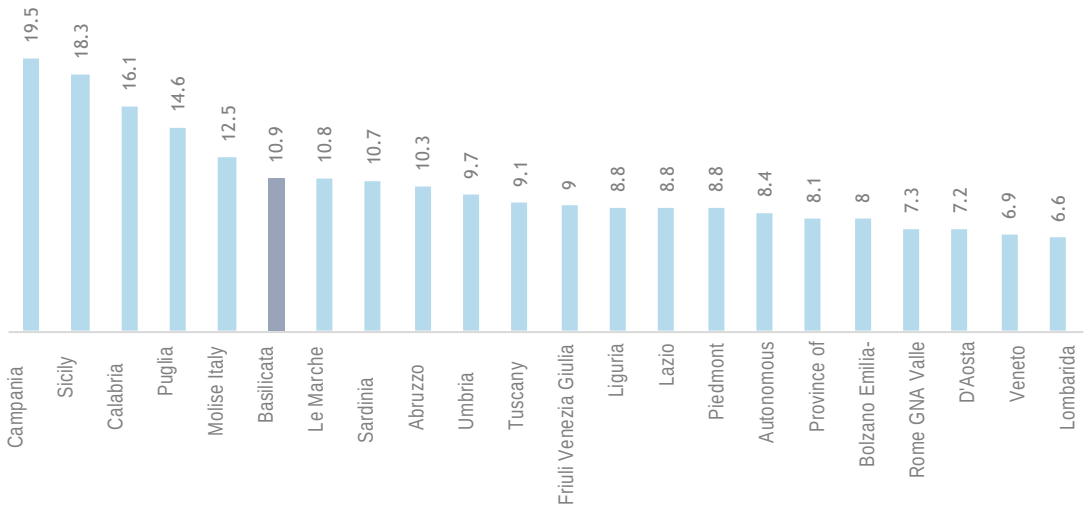
From a study carried out by the Higher Health Institute on a sample of 46,559 school-age children (8–9 years), a slight worsening is observed starting from those who skip breakfast (8.7% in 2019, 10.9% in 2023) and from those who consume it inadequately, not taking all the recommended nutrients (35.6% in 2019, 36.5% in 2023). Often, these behaviours are compensated by a hearty mid-morning snack, a growing habit, counting 67% of children in 2023, compared to 55% in 2019 [15]. In addition, the daily intake of sugary and carbonated beverages remains high (from 25.4% to 24.6%).

Legumes – important foods for a balanced diet – were consumed less than once a week by 37% of children in 2023, down from 38.4% in 2019.

Finally, data on snack consumption are of concern, with sweets consumed more than three days a week by 53% of children in 2023 (48.3% in 2019) and savoury snacks by 12% (9.4% in 2019) [14].

This data underlines that the main risk factors are a high-calorie diet rich in sugars and saturated fats, a reduced consumption of fruit and vegetables, as well as a highly sedentary lifestyle.

Graph 2.1: Children skipping breakfast by Region (2023 percentage values)



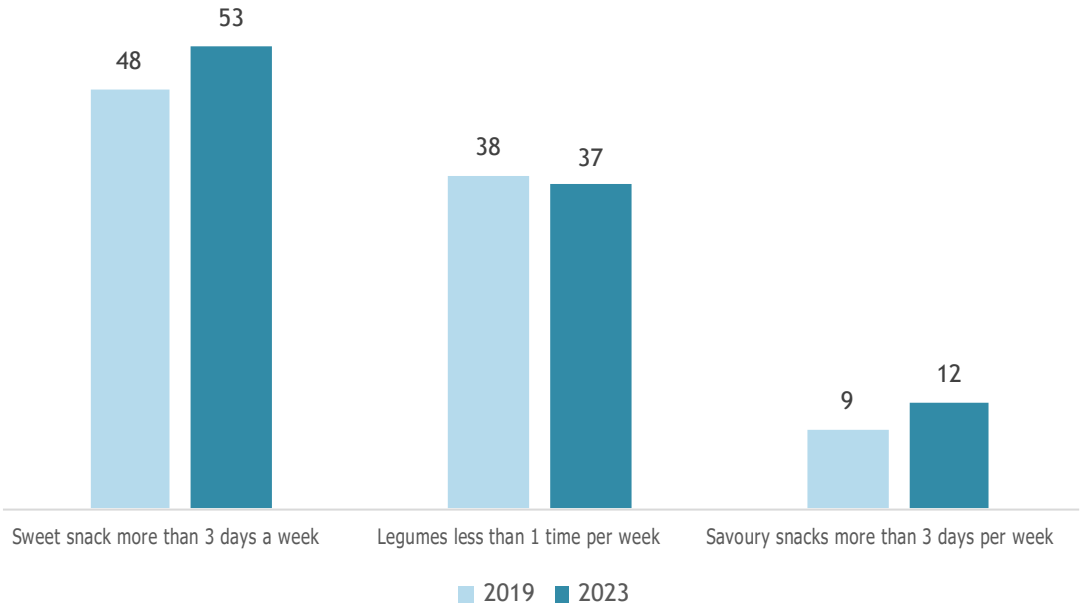
Sources: Processing of Italian Institute of Health (ISS) - OKkio alla SALUTE data by the Fondazione Aletheia

Added to all this is a distorted perception of the health status of overweight children by their parents: 40.3% in 2019 considered them underweight, a percentage that rose to 45% in 2023. In addition, 70% in 2019 did not consider the amount of food their children ate excessive, a value that increased to 73% in 2023.

In 2019, 59.1% of parents of inactive children believed that their children carried out adequate physical activity, rising slightly in 2023 to 59.6%, despite the increase in time spent in front of screens. Children who exceed two hours a day between TV, video games, tablets and mobile phones went from 44.5% to 45.1% [15].

Data that shows a distorted view of reality and that in some cases, starts precisely from families.

Graph 2.2: Consumption of legumes and snacks (Italy, % values)



Sources: Processing of Italian Institute of Health (ISS) - OKkio alla SALUTE data by the Fondazione Aletheia

In this context, therefore, nutrition is a determining factor from the early stages of life. In fact, the latter have a significant impact with respect to the training and future of children.

In short

- More than 1 in 10 children skip breakfast, up from 8.7% in 2019 to 10.9% in 2023, and 1 in 3 consume it inadequately.
- 1 in 4 children drink sugary and carbonated drinks daily.
- The percentage of those who consume legumes less than once a week remains at sustained levels of 37%.
- More than 1 in 2 children consume sweet snacks on more than 3 days a week and more than 1 in 10 savoury snacks.

3. Ultra-Processed Foods

3.1. What are they?

As the name suggests, Ultra-Processed Foods (UPFs) derive from multi-ingredient formulations and are generated by the breakdown, modification and synthesis of original food components that are then mixed with ingredients not common ot the kitchen. They are products that generally contain numerous additives, including colourants, preservatives, artificial flavourings, stabilisers, emulsifiers, foaming agents and other substances that enhance their palatability. This ultra-processing process compromises the structural and nutritional bond with the original plant or animal source. These are generally long-lasting products, packaged and ready to be heated or consumed, often at low cost. Just to mention a few examples, we talk about carbonated and energising drinks, packaged snacks, some sweets and cookies, packaged ice-creams, industrially produced cakes and pastries [16] [17].

The NOVA model, designed by the University of São Paulo in 2009,
classifies products into four categories, focusing on the nature, complexity and degree of food processing: (i) natural, unprocessed, or minimally processed culinary ingredients, such as fruit, vegetables, eggs, meat and milk, but also pasta and peeled tomatoes; (ii) processed culinary ingredients, the result of processes that are intended to prolong the life of the products and concern in particular fats, such as oil, butter, sugar and salt and other ingredients mainly intended for use in recipes; (iii) processed foods, a group to which processed foods obtained by combining foods of the first and second groups belong, that usually have a limited number of ingredients, such as bread, jams, ready-made sauces, canned fish and other products of this type; (iv) ultra-processed foods, including all products that use a higher number of ingredients, including food additives, processed ingredients – hydrogenated fats, modified starches – and other substances that we would not normally find in our kitchens [18].

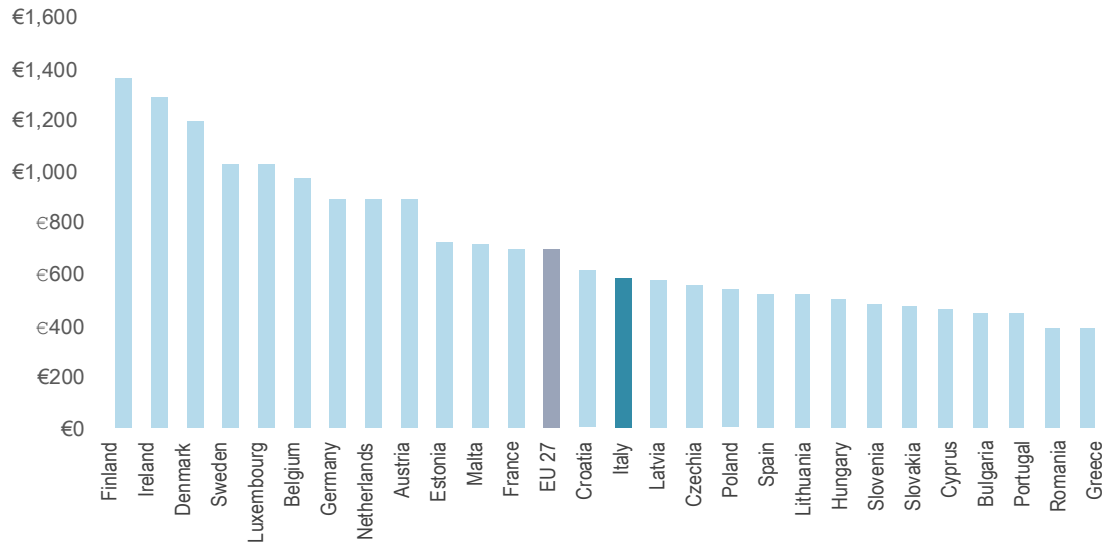
A healthy and balanced diet should include a variety of foods from different categories, especially foods from the first category, such as fruits and vegetables that provide a much higher intake of essential nutrients such as fibre and micronutrients than UPFs that, on the contrary, tend to be rich in additives, such as sugar, refined starch, fats, sodium and preservatives [19].

3.2. The rapid rise

The increased consumption of UPFs among children and adolescents is a growing concern. This type of food is, in fact, increasingly present in young people's diets due to their wide availability and convenience, high palatability, sweetness and practicality in consumption [20]. These characteristics make them particularly attractive, but also responsible for improper eating behaviour and an overall increase in daily energy intake [21].

Ultra-processed foods (UPFs) and beverages (UPBs) are now present in supermarkets around the world, representing a significant part of recent food models, with global sales reaching $2 trillion in 2023. At an EU level, total annual spending was €310 billion (+29% in 5 years), equal to €690 per person, with peaks in Nordic countries such as Finland (about €1,357 per capita), then Ireland (€1,283), but lower figures in Mediterranean countries, such as Italy (€580) and Greece (€386), as well as in Eastern countries like Romania (€387).

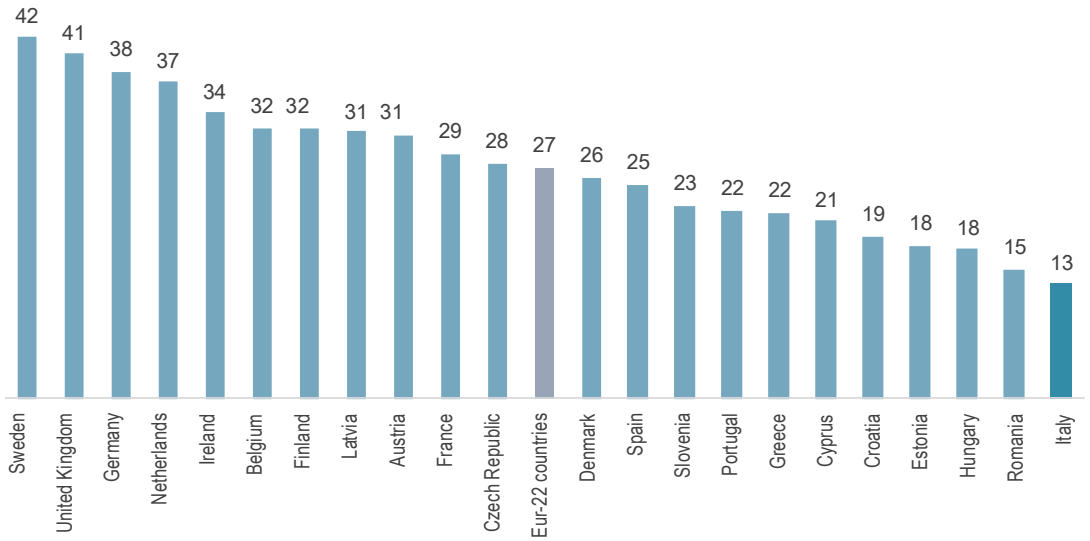
Graph 3.2.1 - Per capita purchases of ultra-processed foods in the EU (2023, in euro)



Sources: Processing of Food System Dashboard and World Bank data by the Fondazione Aletheia

Based on data on the levels of UPFs compared to the total calories assumed in the various countries in the EU, there was great variability in the levels of daily calories from UPFs. Sweden has the highest percentage of daily calories from UPBs (42.4%), while Mediterranean countries, such as Italy, show the lowest level (13.4%). In general, in Europe, UPFs represent about 27% of daily calories, while if we extend the range of analysis worldwide, in the United States it is even close to 60%, or even worse 70% if we consider only the youngest in the population [22] [23] [24]. These results are in line with previous evidence suggesting that adherence to the Mediterranean Diet is inversely associated with the consumption of UPFs [25] [26].

Graph 3.2.2: Percentage of daily calories from ultra-processed foods and beverages (2022, % values)



Sources: Processing of Efsa data by the Fondazione Aletheia[7]

3.3. What effects do they have? Chronic diseases and allergies

Much scientific evidence shows that the consumption of UPFs is associated with an increased risk of chronic Non-Communicable Diseases (NCDs), including obesity, diabetes, cardiovascular diseases and neurobehavioural disorders. These diseases have a complex and multifactorial etiology, with risk factors including age, family history, body weight, diet, physical activity and habits related to smoking and alcohol. Among these, diet is considered the modifiable factor with the greatest impact on public health [27].

[7] Analysis of 22 countries, given that data is not available for other European countries.

UPFs can negatively affect several aspects of health. In fact, numerous scientific evidences suggest that these foods, due to their high content of additives, emulsifiers and preservatives, can negatively affect an infant's immune system through direct and indirect mechanisms, such as the alteration of the intestinal barrier and the microbiome, a key element in the regulation of immune tolerance [28].

Lately, the concept of Dietary Inflammatory Index (DII) was also introduced, used to evaluate the inflammatory potential of diets. The latter has shown how diets rich in UPFs can activate pro-inflammatory pathways, aggravating allergic conditions, in particular asthma [29]. For example, high consumption of sugar-sweetened beverages – such as fruit juices and other beverages with added sugars – has been associated with changes in circulating metabolites derived from the gut microbiome. Even the intake of artificially-sweetened beverages during pregnancy generates changes in the structure and variety of the intestinal bacterial flora in newborns, with a depletion of beneficial bacterial species such as Bacteroides [28]. These changes, combined with certain dietary habits, have been associated with an increased risk of asthma, allergic rhinitis and atopic dermatitis in children.

It should be noted that in recent years, there has been a growing focus on the role of UPFs in the development of allergic diseases in children. Allergic reactions (hypersensitivity) are defined as inadequate immune responses to usually harmless substances, such as pollen, mites, foods or drugs. The immune system, which has the task of defending the body from pathogens, can in some cases overreact, producing antibodies against certain molecules (allergens), causing inflammation and even serious symptoms [30]. In children, allergies are among the most common non-communicable diseases and affect 5% in the 0–14 age group, with an increasing onset also due to environmental and dietary factors [31].

An important confirmation comes from a recent Italian study conducted by the Federico II University of Naples published in the “Journal of Allergy and Clinical Immunology”: in the conclusions, it is recommended to promote lifestyle changes that include a reduction in the consumption of UPFs as a promising strategy to prevent food allergies [32]. In another study conducted on over 105,000 Italian children, a progressive increase in the incidence and prevalence of food allergies was also observed from 2009 to 2021, respectively of 34% and 113.6% [33], also due to a change in the eating habits of children.

The scientific literature then reports that UPFs activate the brain's reward system, inducing dynamics similar to addiction, with intense cravings, loss of control and continued consumption even in the presence of adverse consequences. In addition, such foods can alter appetite regulation, result in overeating, nutritional deficiencies that have a critical impact on cognitive development, and even negatively affect the gut-brain axis by modifying the gut microbiome [20].

The ingredients present in UPFs – such as sugars, saturated and trans fats, additives, artificial sweeteners and preservatives – contribute to inducing high glycemic responses, low satiety and metabolic alterations, which increase the risk of being overweight or obese and eating disorders [21]. In addition to the metabolic and cognitive effects, recent studies indicate that regular exposure to UPFs is associated with an increased absorption of harmful chemicals released during the production processes of food and packaging materials. For example, acrylamide, acrolein and nitrosamine are contaminants found in heat-treated processed foods and are associated with an increased risk of cardiovascular disease, cancer and insulin resistance. Bisphenol A, an industrial chemical used in some plastic packaging for UPFs, interferes with cellular pathways related to weight and glucose homeostasis and its intake has already been associated with an increased risk of obesity and a number of chronic diseases [34].

In paediatric age, the frequent consumption of UPFs, in addition to a higher prevalence of obesity, is also related to odontostomatological diseases, such as, for example, dental caries [35]. Nutrition plays a fundamental role in their onset, because the bacteria present in the mouth ferment the simple sugars contained in foods, producing acids that attack tooth enamel. This process, if repeated frequently, leads to demineralisation and thus the formation of caries. For this reason, it is important to prevent them through a balanced diet. Reducing the excessive consumption of sugars, especially those added and present in UPFs, limits the production of harmful acids and protects oral health over time [37].

In short

- Worldwide sales of UPFs reached $2 trillion dollars in 2023, with Europe reaching €310 billion (+29% compared to 2019).
- In Europe, UPFs foods account for 27% of daily calories.
- Italy shows the lowest ever level of daily calories from UPFs (13.4%).
- In the United States, more than half (about 60%) of daily calories are consumed through UPFs, which increases further if we consider only the younger population.
- There is a strong association between UPF consumption and increased risk of chronic non-communicable diseases (obesity, diabetes, cardiovascular diseases and neurobehavioural disorders).
- UPFs can negatively affect children's health by altering their immune system, intestinal barrier and microbiome.
- The onset of allergic diseases in children is on the rise, affecting 5% of children in the 0–14 age group.

4. The role of school canteens

According to the latest available data, 418 million children worldwide benefit from school meals on a daily basis, 30 million more in the last 5 years. Overall, 41% of children enrolled in primary school have access to a free or subsidised daily school meal, a percentage that rises to 61% in high-income countries. Investments by national governments for school feeding programmes amount globally to around $48 billion (2023), an increase of 12% compared to 2020 [37]. In the European Union alone, investments in school refurbishment programs sit at around 12 billion euro annually (2023) and reach over 25 million children and adolescents [38]. These numbers allow us to understand the importance and scope of the phenomenon, with school canteens today representing a strategic tool for promoting health and social equality. This is not just an ancillary service but a fundamental lever to combat malnutrition, social inequalities, sedentary lifestyles and educational poverty. The meal consumed at school is for many children – especially in the most vulnerable groups – the only time of the day when a balanced, warm, complete and safe meal is guaranteed [39].

The results of a study, published in “Frontiers in Public Health” and conducted in 14 medium-to-low-income countries[8] by certain researchers from leading universities worldwide[9], show that each dollar invested in school catering can generate a return 17 times greater, with a range from 7 to 35 depending on the social context analysed [40].

According to the National Guidelines for School Dining, the canteen is an educational setting in which children learn to recognise and appreciate new flavours, adopt proper eating habits and respect time and conviviality. It is thus also in the canteen that true food education can be done, through

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8 Botswana, Brazil, Cape Verde, Chile, Ivory Coast, Ecuador, Ghana, India, Kenya, Mali, Mexico, Namibia, Nigeria and South Africa

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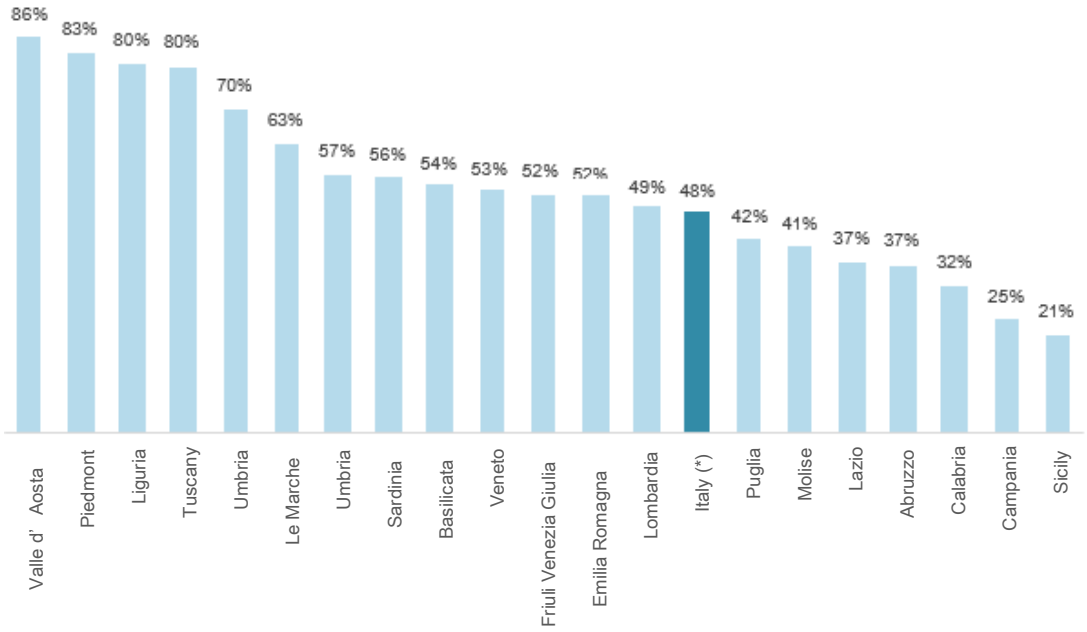
balanced menus, a variety of proposals, the presence of wholefoods, vegetables, legumes and fish, but also thanks to dedicated initiatives [41]. In its *Report on School Meal Programmes in the EU*, the European Commission stresses the importance of school canteens in integrating educational activities, such as cooking workshops and themed days, into school curricula [42].

Some official estimates warn us that without a better governance strategy, adequate investments and food policies aimed at prevention, school catering and food education of the youngest, there is a risk that by 2035 some 400 million children will be affected by obesity in the world, a figure that is almost double the levels recorded in 2020 [43]. In the EU, cases of overweight and obesity already represent a significant public health problem. Indeed, children are growing up in contexts that make it difficult to maintain healthy eating habits and engage in physical activity. Projections on future obesity trends indicate an increase of 61% among boys and 57% among girls living with obesity by 2035.

The supply of food for school catering cannot disregard sustainability and safety criteria. The quality of school menus is still patchy. The most recent survey by FoodInsider (2023–2024) “9th Rating of School Menus” shows a strong polarisation: the most virtuous menus stand out for their attention to organic foods, seasonality, variety and the total quality of the dishes. In other contexts, rather, dishes obtained with semi-prepared products, poor use of whole grains, lack of seasonal vegetables and repetitiveness in weekly menus dominate [44].

According to the latest data from the Ministry of Education, in Italy 48% of pre-school, primary, lower secondary and state comprehensive schools (excluding those in Trentino Alto Adige) have a canteen with a rather uneven distribution along the boot that sees very low percentages in southern regions such as Campania (25%) or Sicily (21%) and, conversely, higher in northern regions such as Valle d'Aosta (86%) or Piedmont (83%) [45].

Graph 4.1: Share of state schools for Pre-school, Primary, Secondary and Comprehensive Institutes that have a functional area for the canteen (2022–2023 school year, % values)



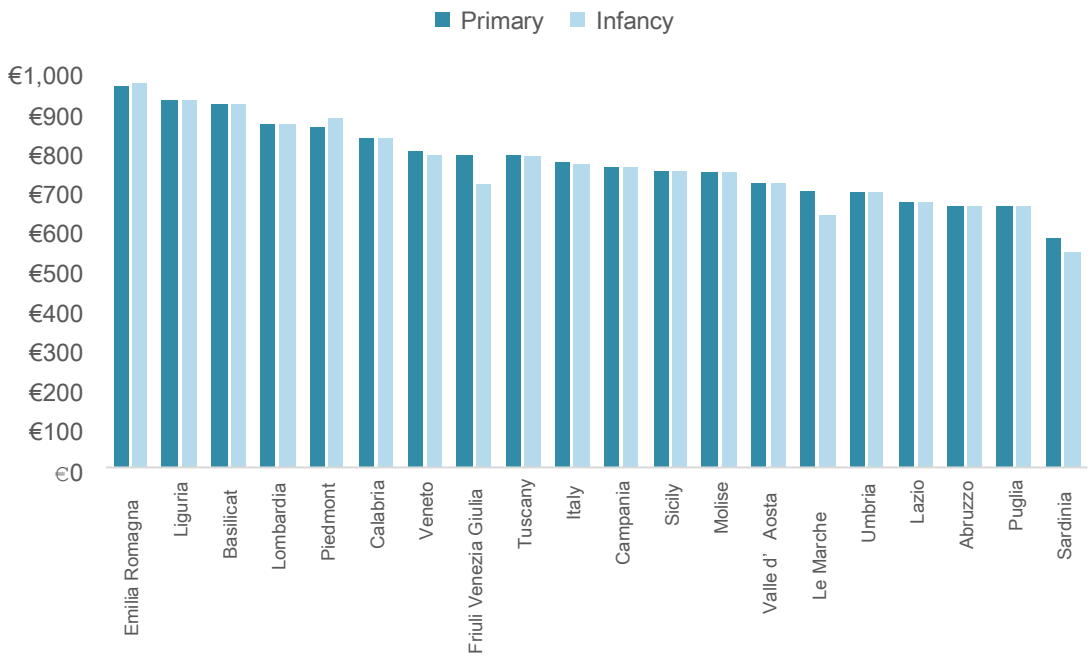
Sources: Processing of open data from the Ministry of Education and Merit by the Fondazione Aletheia

Notes: Data for the provinces of Trento and Bolzano are not released by the Ministry.

(*Individual schools have been considered, regardless of the number of buildings they have)*

Tariffs are also a critical issue. According to some annual surveys on school canteens, in 2023/2024 the average monthly cost for primary school was 85 euro (84 euro for pre-school), while in the last school year, it rose to 86 euro for primary school (85 euro for pre-school). However, the strong disparity between the various regions contributes to increasing inequalities, with a direct impact on the most fragile groups, for which territorial differences are also detected in this case [39] [46].

Graph 4.2: Tariffs for the primary school and pre-school canteen (2024–2025 school year, annual average values)



Sources: Processing of Active Citizenship data by the Fondazione Aletheia

School canteens not only provide a daily meal for children, but also represent a fundamental opportunity to promote healthy eating habits that can prevent the onset of chronic diseases. Scientific studies have shown that access to balanced meals in schools is associated with a reduced risk of chronic non-communicable diseases such as obesity, type 2 diabetes and cardiovascular diseases [47] [48].

The adoption of school food programmes that follow healthy models such as the Mediterranean Diet is also associated with a decrease in risk factors for chronic diseases.

No less important for the promotion of healthy and proper nutrition in young people is the role of vending machines for drinks and food present within school environments. In fact, according to a survey by the surveillance system of the Istituto Superiore di Sanità[10], among the most-sold products in vending machines in primary schools and accessible to children [49] we too often find an offer of unhealthy foods such as sweet snacks (in 77.2% of the cases within the sample analysed) and salty snacks (75.5%). Much lower percentages are recorded for fruit nectars (52.4%), juices with 100% fruit (51.5%) or tea with no added sugars (40.2%) and practically no fruit (1.4%), yoghurt or milk (1.6%) which should actually represent an important nutritional source. In this sense, it is interesting to observe the results of a 2023 pilot project involving three Italian institutes. Within these schools, the food offering in vending machines has been revolutionised, introducing healthier foods such as yoghurt, fruit, non-fried chips and low-calorie biscuits instead of traditional sweet and savoury snacks or sugary drinks. Surprisingly – perhaps even predictably – the results of this initiative reported an average reduction in Body Mass Index (BMI) of 2.1% [39]. As confirmed by the aforementioned studies, some European countries are already enacting ad hoc regulations regarding the nutritional quality of foods that are administered or sold in educational centres, including the imposition of bans on certain types of foods and beverages, such as ultra-processed products, those with a low nutritional intake or with an excessive energy intake in terms of added fats or sugars [50].

[10] OKkio alla SALUTE.

In short

- Around the world, 418 million children worldwide benefit from school meals on a daily basis, 30 million more in the last 5 years.
- According to a study on low- and middle-income countries, for every dollar invested in school catering, a 17 times higher return is generated.
- School canteens represent a fundamental opportunity to promote healthy eating habits that can prevent the onset of chronic diseases.
- In Italy, among the best-selling products in vending machines installed in primary schools and accessible to children, we generally find sweet and savoury snacks, with much lower percentages for fruit nectars, juices with 100% fruit or tea with no added sugar. There is virtually no fruit, yoghurt or milk, with percentages sitting slightly above 1%.

5. Meat and controversies

An increasingly recurrent and long-discussed theme when it comes to infant nutrition is that of restrictive diets and, in particular, the exclusion of foods of animal origin. The growing diffusion of vegetarian and vegan diets, observed in recent years also in the paediatric population, requires careful reflection in the nutritional and clinical fields. Although these dietary models can be adopted for a variety of reasons – from ethical to environmental or health reasons – their application in developmental age requires particular attention.

A vegetarian diet is commonly defined as one that excludes the consumption of meat (both fresh and processed) and fish, including animal-derived foods such as dairy products, cheese, eggs and honey [51] [52]. The vegan diet, rather, is entirely plant-based and is characterised by the total exclusion of any food of animal origin – honey included since it is produced by bees – also often extending to products tested on or derived from animals, as part of a broader ethical-philosophical choice [51] [53]. In addition to the two main categories mentioned above are additional subgroups that have peculiar dietary characteristics:

- Lacto-ovo-vegetarian - excludes foods of animal origin but includes dairy products, eggs and honey [53]. Two other types are derived from this - lacto-vegetarian which allows dairy products and honey but excludes eggs [53] and ovo-vegetarian which includes eggs, but excludes milk and derivatives [52] [54];
- Pesco-vegetarian (pescetarian) - provides for the consumption of plant foods, fish and seafood, sometimes also associated with eggs and dairy products [51] [53];
- Raw foodist - a vegan diet based exclusively on the consumption of raw foods, not subjected to temperatures above 40–45 °C, with potential risks related to the digestibility and energy density of meals [51] [53] [54];
- Fruitarian - an extreme form of veganism based on exclusive consumption or predominantly fresh fruit, nuts, fruiting vegetables and oilseeds. A strongly unbalanced dietary model with no scientific basis [51] [53] [54];

- Macrobiotic - focused on the consumption of whole grains, legumes and vegetables; excludes industrially-processed foods and drastically reduces the intake of foods of animal origin [53] [54].

As mentioned, the application of vegetarian and vegan diets at an evolutionary age requires particular attention to avoid nutritional deficiencies or compromising the correct growth of the individual [55]. There are various critical issues, starting from an insufficient protein intake. The absence of adequate planning, especially in vegan diets, can result in a reduced intake of proteins of high biological value, with consequences on growth and muscle mass. But other concerns also regard micro-nutritional deficiencies, the presence of anti-nutrients – such as phytic acid, oxalates and fibre – which, if consumed in excess, can reduce the bioavailability of essential micronutrients [51] in addition to the high sodium content in substitute foods. In fact, many of the so-called plant-based products can contain high amounts of salt, even over 1 gram per 100 grams of product, contributing to exceeding the daily threshold recommended by the WHO of 5 grams, with negative implications on cardiovascular health and calcium metabolism [53]. In addition, there are concerns about the high level of ultra-processing of these plant-based products.

According to current scientific evidence, lacto-ovo-vegetarian and vegan diets do not show significant advantages compared to the Mediterranean Diet in the prevention of chronic non-communicable diseases in children [52]. In addition, there is no scientific evidence that such diets offer specific protection against infectious diseases in children. On the contrary, the adoption of a restrictive diet in early childhood is a particularly critical condition from a nutritional point of view. As highlighted by the Bambino Gesù Children's Hospital, children whose families follow a vegetarian or vegan diet are usually fed according to their parents' dietary guidelines. However, in the delicate phase of growth and psychomotor development, the body has specific nutritional needs. These same children, in fact, are particularly exposed to deficiencies of vitamin B12, vitamin D, iron, calcium, zinc and of

high biological value proteins – nutrients whose bioavailability in plant foods is often lower than that of animal sources [52].

Vitamin B12, for example, is not present in plant foods and must therefore necessarily be supplemented externally. Its deficiency can manifest with several disadvantageous conditions such as megaloblastic anaemia, neurodevelopmental delays and, in severe cases, with irreversible neurological damage. From the point of view of brain development, DHA – docosahexaenoic acid, an omega-3 fatty acid – which is mainly found in fats is also fundamental for the growth of neurons and synaptic transmission. In pregnancy, its deficiency can have negative effects on the brain development of the foetus [52]. Although a direct correlation between DHA supplementation and IQ has not been demonstrated, there are studies that show that a high intake of fish during pregnancy is associated with better cognitive outcomes in children [50]. Similarly, non-heme *iron* contained in plant foods has lower absorbability than heme from meat, and is more easily affected by inhibitory factors such as phytates. A diet free of animal sources should therefore be enriched with fortified foods and specific nutritional strategies. The relationship between iron intake in pregnancy and neurocognitive development of the newborn is well-known since iron is involved in the production of numerous enzymes for brain metabolism and thus its deficiency can easily produce alterations [52].

Zinc and calcium are also fundamental elements. Although breast milk
contains adequate amounts of calcium even in vegan women, the overall dietary intake may be insufficient if it is not carefully balanced [52]. In addition, the risk of zinc deficiency is increased in vegetarian and vegan diets due to the high content of phytates that hinder their absorption [54]. In fact, diets rich in vegetables lead to the intake of a greater amount of anti-nutrients, being substances that, if taken, inhibit the absorption of other specific nutrients [56].

A further critical issue concerns *protein content*. In the first years of life, the requirements in terms of essential amino acids are particularly high. Although present in legumes, cereals and soy derivatives, plant proteins have an incomplete or unbalanced amino acid profile and must therefore be strategically combined to ensure a qualitatively adequate protein intake. In addition, they are characterised by a lower usability (85%) compared to proteins of animal origin. For this reason, numerous studies suggest increasing plant protein intake in vegan children by about 30–35% compared to Dietary Reference Intakes (DRIs) in children between 6 months and 2 years – about 20–30% in children between 2 and 6 years and about 15–20% in children over 6 years [52] [54].

It is important to know that the more restrictive the diet, the greater the risk of deficiency of some nutrients and therefore of damage. What's more, the periods of life most at risk are those characterised by greater metabolic stress, so pregnancy, breastfeeding, childhood up to 3 years and adolescence. In particular, vitamin B12 deficiency [52] or inadequate protein intake [54] in pregnant vegan people can manifest with adverse outcomes such as pre-eclampsia, miscarriage, low birth weight and neural tube malformations. Breast milk from a non-integrated vegan person may also be deficient in vitamin B12, exposing the infant to the risk of growth retardation and neurological damage [52]. In the first year of life, exclusive breastfeeding covers the nutritional needs of the child, but only if the parent has a balanced and adequately integrated diet. After six months, with the introduction of complementary feeding, the risk of deficiencies increases, especially if the diet is vegan. During weaning, choosing high-calorie-density foods – such as non-wholegrains, dried fruit powder or cream, vegetable oils – and distributing meals frequently can help meet energy needs, being particularly critical in vegan diets [52] [54].

This evidence has also been confirmed in scientific literature. A cohort study published in the American Journal of Clinical Nutrition compared nutritional status, bone growth and development in omnivorous, vegetarian and vegan children aged 5 to 10 years. The research highlighted wide differences between vegan and omnivorous children in terms of lower Body Mass Index (BMI), lower bone mineral content and reduced average height, with particular vulnerability in the absence of supplementation. These results underline the need to closely monitor growth parameters and haematochemical markers in vegan children, especially in prepubertal age [57].

The guidelines of the main Italian paediatric hospitals, including Bambino Gesù, therefore agree on a fundamental point: vegan nutrition can be adopted in children only on the condition that it is carefully supervised by paediatric nutrition professionals and that it includes mandatory supplements, fortified foods, family nutrition education and a regular follow-up of growth and development [52].

Therefore, according to the Fondazione AIRC: “The secret to a varied and balanced diet lies above all in the quantities: to reduce the risk of getting sick, it is not necessary to completely eliminate foods of animal origin (such as milk and eggs, but also meat)” [53]. In this case too, it is always a good idea to stick to the concept of balanced consumption while respecting the guidelines of the Mediterranean Diet.

BOX 1 - Other eating disorders related to poor nutrition

6% of the Italian population suffers from eating disorders. Among these, there is a significant increase in access to day hospitals among the paediatric and adolescent sectors, with an increase of 50% in the last 5 years. Although the most common form of malnutrition in middle-high income countries, as we have seen, is excess malnutrition, there are additional and relevant eating disorders that affect children and adolescents, such as anorexia nervosa, bulimia nervosa and Binge Eating Disorder (BED), Avoidant-Restrictive Eating Disorder (ARFID) and Other Specified Feeding and Eating Disorders (OSFED). In addition to negatively affecting physical health, these conditions have a significant impact on psychological and social wellbeing.

According to data from research conducted by Bambino Gesù Children's Hospital, the onset of such disorders is increasingly early, with a lowering of the age to 8–9 years. This worrying situation is linked both to the early pubertal age in girls – who have a greater onset of these problems – and to the increasing use of social media networks that contribute in particular to the creation of models and canons of beauty that are very distant from reality and often unattainable [58].

In short

- The vegetarian diet represents a diet that excludes the consumption of meat (both fresh and processed) and fish, instead including animal-based foods such as dairy products, cheese, eggs and honey.
- The vegan diet, rather, is characterised by the total exclusion of any food of animal origin – honey included since it is produced by bees – also often extending to products tested on or derived from animals, as part of a broader ethical-philosophical choice.
- Inadequate planning, especially in vegan diets, can result in a reduced intake of proteins of high biological value, with consequences on growth, muscle mass and micro-nutritional deficiencies.
- Children oriented towards meat-free diets are exposed to deficiencies in *vitamin B12*, *vitamin D*, *iron*, *calcium*, *zinc* and *proteins* with high biological value.
- 6% of the Italian population suffers from eating disorders. In recent years, there is a significant increase in access to day hospitals among the paediatric and adolescent sectors, with an increase of 50% in the last 5 years.

6. Some barriers, the proposals

In order to counter the spread of excess weight and obesity among the population, it is essential to focus on a holistic approach capable of converging different tools aimed at a common goal: the wellbeing of citizens with particular attention to the youngest. The increase in the consumption of UPFs, in fact, is not only an individual issue but also reflects structural changes in society – urbanisation, globalisation, a faster and faster pace of life and the reduction of time dedicated to the preparation of meals. Such factors have favoured the diffusion of ready-made and pre-packaged foods.

In light of what emerges in the pages of this in-depth study, it is therefore essential to promote preventive strategies to reduce the negative impact of UPFs on health, through a multidisciplinary approach that integrates education along with awareness among citizens and institutions and the reformulation of the nutritional offer in canteens and schools. All this can help reduce the negative impact of poor nutrition on the health of children and adolescents, with positive effects also on public budgets for individual states. Prevention and early intervention are key to countering negative trends and to promote a healthier and more sustainable diet.

The proposals for intervention can be many, starting from the central role of schools through to measures aimed at reducing the consumption of unhealthy foods, awareness-raising activities and interventions with a view to transparency of the agricultural-food chains towards consumers. The role of school canteens is central to promoting proper nutrition and the identification of limits to the supply and consumption of UPFs. Among the awareness-raising activities, mention can also be made of the definition of limits on advertising in the time slots for greatest exposure of children and adolescents to UPFs, following the example of some countries that have already moved in this direction. Finally, the use of transparent labels as a guarantee for consumers remains relevant, in order to orient purchase choices increasingly towards seasonal and as natural and short-chain products as possible.

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