

# Dietary Patterns in Paediatric Age: What Role for Obesity Prevention?

This leaflet has been developed by the Committee of Nutrition and its Special Interest Group on childhood obesity, with the support of the Public Affairs Committee

## What are dietary patterns?

Non-communicable diseases (NCDs), including obesity, diabetes, and cardiovascular diseases, are complex conditions with multifactorial aetiologies. The study of the interaction between diet and health is highly complex and is now focused on evaluating nutrition in its totality and complexity, going beyond the study of individual nutrients or foods. This has led to the concept of 'dietary patterns', which allows the study of the combination and potential synergistic effect that comes from consuming a cluster of foods within one's habitual diet<sup>1</sup>.

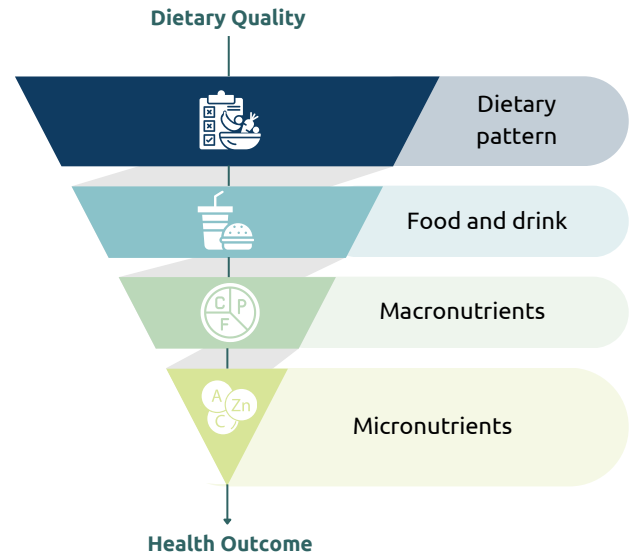


Figure 1: Relationship between dietary patterns and health outcome, adapted from [1].

In the paediatric population, various dietary patterns, either healthy or unhealthy, have been identified, which may influence the risk of developing childhood obesity. When discussing dietary models, the most renowned example is undoubtedly the Mediterranean Diet. This diet is rich in plant-based foods (fruits, vegetables, whole grains, legumes, and olive oil) and features a moderate intake of animal-based proteins (fish, poultry, eggs, and cheese). However, this pattern is not the only one; several other healthy dietary patterns exist based on cultural contexts, such as the Nordic Diet, the Atlantic Diet, and the Washoku Diet (traditional Japanese diet).



Opposite to these models is the Western Diet, typical of industrialised countries and shaped by lifestyle changes. The Western Diet is characterised by a high intake of red and processed meats, foods rich in saturated fats, sweets, and sugar-sweetened beverages, and a limited consumption of plant-based foods. Moreover, the Western Diet has been associated with a high intake of ultra-processed foods (UPFs). As defined by the NOVA food classification system, UPFs are formulations of food substances with little, if any, whole foods content. They typically contain added flavours, colours, additives, and advanced glycation end-products (AGEs)<sup>4</sup>, and their consumption has been prospectively associated with the occurrence of obesity and related cardiometabolic alterations, including in children<sup>5,6</sup>.

Thanks to prospective European studies evaluating the development of children’s dietary patterns from early childhood to adolescence, researchers have identified a window of opportunity during which dietary patterns are established<sup>7-10</sup>. All studies seem to agree that this window falls between 1–3 years of age. During this period of transition, dietary patterns are not only established but are also more easily modifiable, highlighting the need for early intervention to promote the adoption of healthy dietary patterns. Beyond this time frame, the dietary patterns adopted tend to remain relatively stable throughout childhood. Additionally, some studies have shown that less healthy dietary patterns (e.g., rich in processed/industrial foods, ready-to-eat meals, and snacks) are the most persistent and difficult to modify<sup>9,10</sup>.

### Factors influencing the establishment of dietary patterns during paediatric age

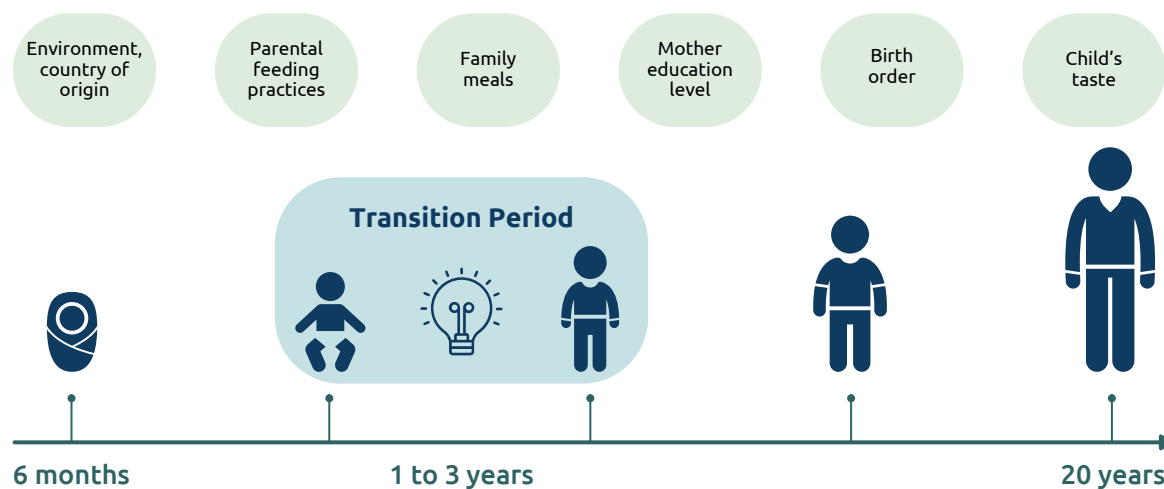


Figure 2: Factors influencing the establishment of dietary patterns during paediatric age, adapted from [1].

Specific evidence regarding the risk of developing overweight and obesity during childhood has been reported<sup>10-14</sup>.



The higher adherence to the Mediterranean Diet, one of the most studied patterns, at age 4, has been associated with a lower risk of overweight, obesity, and visceral obesity (defined as the waist-to-height ratio) at 8 years old<sup>11,12</sup>.



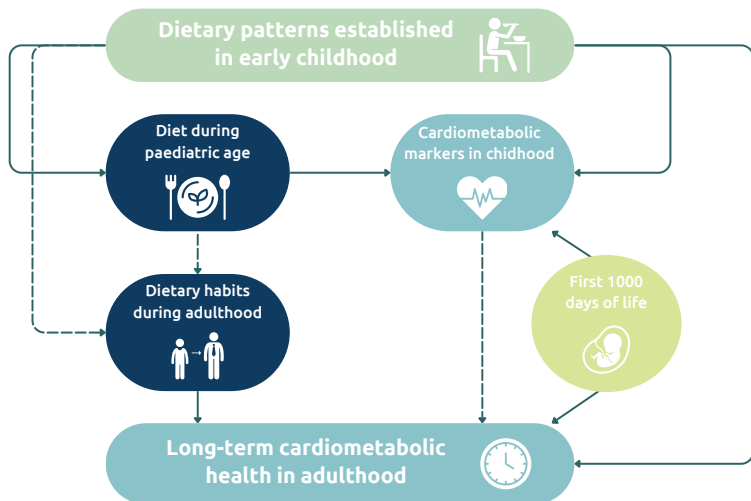
A persistent dietary pattern rich in processed foods or sugary products shows a greater trend toward increased BMI z-scores, waist circumference (WC), and fat mass (FM) during childhood compared to the adoption of healthier patterns<sup>10,14</sup>.



The adoption and maintenance, starting from age 2, of dietary patterns rich in vegetables, fish, olive oil, and meat, and low in snacks, sugar, and sweets, have been linked to better insulin profiles (lower HOMA-IR) and improved blood pressure outcomes at 8 years old<sup>13</sup>.

Diet itself could influence health during developmental age through two synergistic pathways:

- Nutritional programming during the first 1,000 days of life.
- The acquisition of unhealthy dietary patterns, which could continue to affect cardiovascular health later in adulthood.



**Figure 3: The metabolic programming according to dietary pattern and healthy diet exposure during early life, adapted from [13].**

There are several strategies to promote the adoption of healthy dietary patterns. First of all, it is necessary to target the window of opportunity between 1–3 years for lifestyle promotion interventions while also emphasising the role of parental imprinting<sup>15-17</sup>. Parents play a guiding role in shaping children's taste preferences during the first 1,000 days of life. Preferences for healthy foods can be developed and conditioned through repeated and early exposure to fruits and vegetables, which can increase acceptance of these foods with effects persisting up to 6 years of age<sup>18</sup>. Likewise, indirect dietary factors, such as shared family meals and parents' eating habits, can foster the adoption of healthy dietary patterns<sup>19</sup>.

## Practical tips to encourage the development of healthy dietary patterns

There are various traditional Dietary Patterns based on cultural contexts, and these models should be encouraged over a Western dietary model or "Western Diet", which should be discouraged.

Promoting the principles of the Mediterranean Diet from an early age is beneficial for fostering healthy eating habits and preventing overweight and obesity in childhood.

Consider the age between 1–3 years as a window of opportunity and optimal period to encourage parents and children to adopt healthy dietary patterns, laying the foundation for future cardiometabolic health.

Preferences for healthy foods can be encouraged by guiding taste development: in the early years, introduce a variety of fresh, natural flavours, such as seasonal fruits and vegetables, to influence preferences toward healthy foods.

To promote the development of healthy dietary patterns, regularly share family meals and raise parental awareness about their guiding role in shaping children's food preferences.

Society, institutions, and policymakers must invest in promoting healthy dietary models by developing interventions targeting children during early childhood and preschool age, as well as their caregivers.

## References

- Santaliestra-Pasias A.B., Verduci E., Fiore G., Moreno Aznar L.A., "Dietary patterns and childhood obesity" in *Childhood Obesity. From Basic Knowledge to Effective Prevention*. 1st Edition, 2024. Editor: Luis Moreno. ISBN: 9780443219757.
- Verduci E, Bronsky J, Embleton N, Gerasimidis K, Indrio F, Köglmeier J, de Koning B, Lapillonne A, Moltu SJ, Norsal L, Domellöf M; ESPGHAN Committee on Nutrition. Role of Dietary Factors, Food Habits, and Lifestyle in Childhood Obesity Development: A Position Paper From the European Society for Paediatric Gastroenterology, Hepatology and Nutrition Committee on Nutrition. *J Pediatr Gastroenterol Nutr*. 2021 May 1;72(5):769-783.
- Juul F, Martínez-Steele E, Parekh N, Monteiro CA, Chang VW. Ultra-processed food consumption and excess weight among US adults. *Br J Nutr*. 2018 Jul;120(1):90-100. doi: 10.1017/S0007114518001046.
- Monteiro CA, Cannon G, Levy RB, Moubarac JC, Louzada ML, Rauber F, Khandpur N, Cediel G, Neri D, Martínez-Steele E, Baraldi LG, Jaime PC. Ultra-processed foods: what they are and how to identify them. *Public Health Nutr*. 2019 Apr;22(5):936-941. doi: 10.1017/S1368980018003762.
- De Amicis R, Mambrini SP, Pellizzari M, Foppiani A, Bertoli S, Battezzati A, Leone A. Ultra-processed foods and obesity and adiposity parameters among children and adolescents: a systematic review. *Eur J Nutr*. 2022 Aug;61(5):2297-2311. doi: 10.1007/s00394-022-02873-4.
- Mambrini SP, Menichetti F, Ravella S, Pellizzari M, De Amicis R, Foppiani A, Battezzati A, Bertoli S, Leone A. Ultra-Processed Food Consumption and Incidence of Obesity and Cardiometabolic Risk Factors in Adults: A Systematic Review of Prospective Studies. *Nutrients*. 2023 May 31;15(11):2583. doi: 10.3390/nu15112583.
- Northstone K, Emmett PM. Are dietary patterns stable throughout early and mid-childhood? A birth cohort study. *Br J Nutr*. 2008;100(5):1069-76. Epub 20080401. doi: 10.1017/S0007114508968264. PubMed PMID: 18377690; PubMed Central PMCID: PMC2629612.
- Northstone K, Smith AD, Newby PK, Emmett PM. Longitudinal comparisons of dietary patterns derived by cluster analysis in 7- to 13-year-old children. *Br J Nutr*. 2013;109(11):2050-8. Epub 20121015. doi: 10.1017/S0007114512004072. PubMed PMID: 23068994.
- Luque V, Escribano J, Closa-Monasterolo R, Zaragoza-Jordana M, Ferré N, Grote V, et al. Unhealthy Dietary Patterns Established in Infancy Track to Mid-Childhood: The EU Childhood Obesity Project. *J Nutr*. 2018;148(5):752-9. doi: 10.1093/jn/nxy025. PubMed PMID: 29982656.
- Fernández-Alvira JM, Bammann K, Eiben G, Hebestreit A, Kourides YA, Kovacs E, et al. Prospective associations between dietary patterns and body composition changes in European children: the IDEFICS study. *Public Health Nutr*. 2017;20(18):3257-65. Epub 20170907. doi: 10.1017/s1368980017002361. PubMed PMID: 28879834; PubMed Central PMCID: PMC10261439.
- Tognon G, Hebestreit A, Lanfer A, Moreno LA, Pala V, Siani A, Tornaritis M, De Henauw S, Veidebaum T, Molnár D, Ahrens W, Lissner L. Mediterranean diet, overweight and body composition in children from eight European countries: cross-sectional and prospective results from the IDEFICS study. *Nutr Metab Cardiovasc Dis*. 2014 Feb;24(2):205-13. doi: 10.1016/j.numecd.2013.04.013. Epub 2013 Jul 17. PMID: 23870847.
- Notario-Barandiarán L, Valera-Gran D, Gonzalez-Palacios S, Garcia-de-la-Hera M, Fernández-Barrés S, Pareda-Pareda E, Fernández-Somoano A, Guxens M, Iñiguez C, Romaguera D, Vrijheid M, Tardón A, Santa-Marina L, Vioque J, Navarrete-Muñoz EM; INMA Project. High adherence to a mediterranean diet at age 4 reduces overweight, obesity and abdominal obesity incidence in children at the age of 8. *Int J Obes (Lond)*. 2020 Sep;44(9):1906-1917. doi: 10.1038/s41366-020-0557-z. Epub 2020 Mar 9. PMID: 32152497.
- Luque V, Closa-Monasterolo R, Grote V, Ambrosini GL, Zaragoza-Jordana M, Ferré N, Theurich M, Koletzko B, Verduci E, Gruszfeld A, Xhonneux A, Escribano J. Dietary patterns acquired in early life are associated with cardiometabolic markers at school age. *Clin Nutr*. 2021 Jul;40(7):4606-4614. doi: 10.1016/j.clnu.2021.06.001. Epub 2021 Jun 8. PMID: 34292655.
- Kelishadi R, Qorbani M, Motlagh M, Heshmat R, Ardalan G, Bahreynian M. Association of eating frequency with anthropometric indices and blood pressure in children and adolescents: the CASPIAN-IV Study. *J Pediatr (Rio J)*. 2016;92(2):156-67. Epub 20160122. doi: 10.1016/j.jped.2015.05.009. PubMed PMID: 26804012.
- Mikkilä V, Räsänen L, Raitakari OT, Pietinen P, Viikari J. Consistent dietary patterns identified from childhood to adulthood: the cardiovascular risk in Young Finns Study. *Br J Nutr*. 2005;93(6):923-31. doi: 10.1079/bjn20051418. PubMed PMID: 16022763.
- Emmett PM, Jones LR, Northstone K. Dietary patterns in the Avon Longitudinal Study of Parents and Children. *Nutr Rev*. 2015;73 Suppl 3(Suppl 3):207-30. doi: 10.1093/nutrit/nuv055. PubMed PMID: 26395343; PubMed Central PMCID: PMC4586449.
- Lioret S, Betoko A, Forhan A, Charles MA, Heude B, de Lauzon-Guilain B, et al. Dietary patterns track from infancy to preschool age: cross-sectional and longitudinal perspectives. *J Nutr*. 2015;145(4):775-82. Epub 20150128. doi: 10.3945/jn.114.201988. PubMed PMID: 25833780.
- Maier-Nöth A, Schaal B, Leathwood P, Issanchou S. The Lasting Influences of Early Food-Related Variety Experience: A Longitudinal Study of Vegetable Acceptance from 5 Months to 6 Years in Two Populations. *PLoS One*. 2016 Mar 11;11(3):e0151356. doi: 10.1371/journal.pone.0151356. PMID: 26968029; PMCID: PMC4788196.
- Luque V, Mucarzel F, Hertogs A, Seed PT, Flynn AC, Poston L, Dalrymple KV. Associations Between Maternal Diet, Family Eating Habits and Preschool Children's Dietary Patterns: Insights from the UPBEAT Trial. *Nutrition J* 2024; 23(1):115. doi: 10.1186/s12937-024-01023-2.