

# UNDERSTANDING HEALTHY NUTRITION DURING LATE ADOLESCENCE AND YOUNG ADULTHOOD IN THE UNIVERSITY SETTING

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Adolescence and young adulthood represent a dynamic developmental stage in life characterized by rapid physical, cognitive, and emotional changes, accompanied by increased nutritional and energy requirements. Nevertheless, dietary habits among young people are frequently inadequate, contributing to both undernutrition and a growing prevalence of overweight and obesity, which represent risk factors for the development of non-communicable diseases later in life. The transition to university is a particularly sensitive period as individuals begin to make independent dietary choices, often influenced by social, economic, and environmental factors, as well as limited nutrition-related knowledge. During this stage, healthy eating should emphasize varied and balanced meals, adequate hydration, appropriate portion sizes and the consumption of nutrient-dense foods, while limiting added sugars and highly processed foods. The implementation of targeted educational initiatives, accessible tools and supportive university food environments is essential for encouraging sustainable healthy eating behaviors and improving long-term health outcomes.

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## 1 Introduction

Adolescence constitutes one of the most rapid and multifaceted developmental phases across the human lifespan. This stage is characterized by profound physical, cognitive, and emotional maturation, accompanied by substantially increased nutritional and energy requirements, while adolescent nutrition continues to be regarded as a largely overlooked public health concern (Best and Ban, 2021). During this period, accelerated brain development occurs, influencing emotional control, cognitive processing, and decision-making capacities (Johnson, Blum and Giedd, 2009).

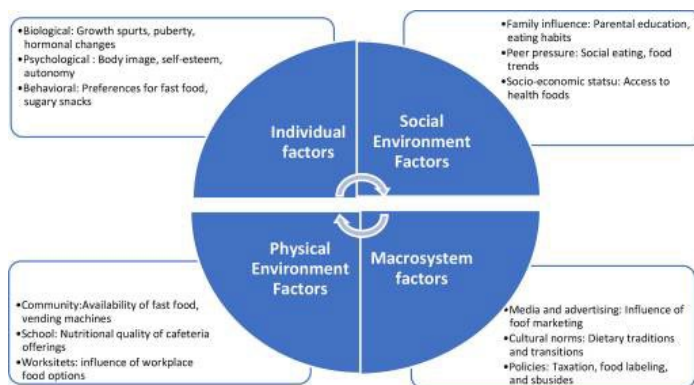
At the same time, adolescents increasingly develop peer-oriented social relationships and commonly engage in exploratory and risk-taking behaviors (Johnson, Blum and Giedd, 2009; Spear, 2000). Another pitfall of this period is that young people consider themselves healthy, and are therefore less motivated to protect their health, take care of their diet and engage in physical activity. Concurrently, intense physical growth increases the demand for nutrients such as energy, protein, calcium, iron, and other essential micronutrients, with required intake levels frequently surpassing those recommended for adults (Norris, Frongillo, Black et al., 2022; NCD Risk Factor Collaboration, 2017; Golden, Steven; Committee on Nutrition, 2014). Nutritional status during adolescence plays a critical role in shaping physical growth, cognitive function, and long-term socioeconomic potential.

Despite its importance, insufficient dietary intake remains widespread worldwide. This includes both undernutrition—manifesting as micronutrient deficiencies and growth impairment—as well as overnutrition, developed as a consequence of excessive energy intake leading to overweight and obesity (Khara and Mates, 2015).

Although adequate nutrition is vital throughout the lifespan, it is especially crucial during adolescence, as it supports accelerated growth processes and contributes to the establishment of long-term health trajectories. Notably, unhealthy eating behaviors adopted during this period often track into adulthood, thereby substantially increasing the risk of non-communicable diseases (NCDs) later in life (The Lancet Child & Adolescent Health, 2022).

## 2 University studying period as a critical transition period

As late adolescence is inherently a complex stage of life, the transition from the parental home to university represents a critical period for many young adults. This transition introduces new challenges, including the responsibility for independently managing dietary behaviors. Eating behaviors during this stage are shaped by a combination of individual characteristics and external factors such as food availability, cultural and inherited norms, financial constraints, institutional environments but also factors like policies and influence of peer pressure, media and advertising (Figure 1).



**Figure 1: Graphical Chart showing key factors affecting adolescent nutrition, adopted from Parajuli and Prangthip (2025).**

Attempts to adopt healthier eating behaviors are frequently impeded by various perceived or experienced barriers, including culinary traditions, social influences, entrenched habits, and limited availability or the higher cost of nutritious foods (Sogari et al., 2018; Mc Morrow et al., 2017). Furthermore, insufficient nutritional knowledge or access to relevant information, along with a general lack of motivation to modify dietary practices, may further compromise adherence to healthy eating patterns (Mc Morrow et al., 2017). Although the provision of highly technical or detailed nutritional information alone has shown limited effectiveness as an intervention strategy (Sogari et al., 2019) the development and implementation of easily accessible, student-oriented tools may facilitate knowledge dissemination within this population and support the integration of healthy dietary principles into daily routines.

An example of such an approach is the EDU-FIT project which focuses on promoting healthy lifestyle behaviors and preventing obesity among young adults through interdisciplinary and educational strategies. Information about the EDU-FIT project are available at the official website listed in the literature.

## **2.1 Obesity among adolescents**

Adolescent obesity represents one of the major global public health concerns, with high and often increasing prevalence. In Europe, approximately one in four adolescents is affected by overweight or obesity, although prevalence varies greatly by country, gender and socioeconomic status. Key drivers include poor dietary patterns (such as frequent consumption of fast food and highly sugary and salty foods) and insufficient physical activity, with excessive time spent in front of screens. Structural factors, such as low income limiting access to healthier options, along with influences like social media and mental health, also contribute to the creation of an obesogenic environment. According to the World Health Organization (WHO) "in 2022, over 390 million children and adolescents aged 5–19 years were overweight. The prevalence of overweight (including obesity) among children and adolescents aged 5–19 has risen dramatically from just 8% in 1990 to 20% in 2022. The rise has occurred similarly among both boys and girls: in 2022, 19% of girls and 21% of boys were overweight" (NCD Risk Factor Collaboration, 2024).

As mentioned before, the health consequences of obesity are extensive and well documented. Excess body weight during childhood and adolescence is associated with a greater risk and earlier onset of various NCDs, such as arterial hypertension, type 2 diabetes, cardiovascular disease, musculoskeletal disorders, neurodegenerative diseases, as well as malignant diseases. In addition to physical health effects, childhood and adolescent obesity also have adverse psychosocial consequences, including stigmatisation, discrimination, and bullying, thus negatively affecting school performance and quality of life (World Health Organization, 2025).

## **2.2 Prevalence and associated factors of overweight and obesity among students**

Upon entering university, students often adopt new lifestyle behaviors that may negatively impact their health. According to Sahadeo et al. (2025), students understand the components of a healthy diet, recognize the impact of dietary habits on health, and show awareness of sustainable eating practices. However, several factors hinder their ability to maintain healthy diet, including challenges in avoiding unhealthy food options and the higher cost of healthier choices. Limited awareness of the Sustainable Development Goals further contributes to the prevalence of unhealthy and unsustainable dietary behaviors among university students. Meals are often irregular frequently consisted of high-energy foods rich in salt and sugar, such as bakery products, cured meats, fast food, snacks and sweets. Along with a lack of physical activity, described dietary pattern can have a negative effect on health.

The global prevalence of overweight among university students ranges from 20% to 40%, highlighting the scale of the issue, according to Peltzer et al. (2014). Various factors have been associated with overweight and obesity in this population. They include sedentary behaviour, better socioeconomic status, living in rural origin, drug, tobacco and alcohol abuse, as well as negative social impacts such as family, peers, and social media (Ilić et al., 2024).

## **3 Methodology**

This paper work is based on a systematic review of relevant literature concerning the dietary habits of adolescents and young adults, with a particular focus on the transitional university period. The review includes scientific articles, reports from the World Health Organization, recommendations from the European Food Safety Authority (EFSA) and projects and initiatives aimed at promoting healthy dietary patterns among students. Key sources were selected based on relevance, currency and methodological quality. Special attention was given to dietary patterns, intake of macro- and micronutrients and the introduction of practical recommendations for healthy eating habits in the university setting. The results and guidelines were synthesized into practical recommendations that can serve as a foundation for further research and implementation in university nutrition policies.

## 4 Results

### 4.1 Basics of proper nutrition during late adolescence and young adulthood

Given current trends, the growing body of scientific evidence linking diet and health, as well as the fact that healthy eating habits are acquired from an early age, it is important to recognize that education about proper nutrition is essential throughout all stages of life. Scientific literature highlights an insufficient level of knowledge about healthy lifestyle habits among younger generations, including knowledge related to food choices (Buyuktuncer et al., 2018).

Proper (healthy) nutrition can be defined as a dietary pattern that supports overall health, reduces disease risk and ensures adequate intake of essential nutrients in line with individual energy requirements (Neufeld et al., 2021). There are some principles of properly balanced diet:

- Variety – involves the consumption of diverse foods from different food groups to meet individual energy and nutritional needs. Nutritionally dense foods ensures significant amounts of micronutrients (vitamins and minerals) with a relatively low energy content;
- Balance – refers to the proportion of different food groups in individual's overall food intake. Imbalances occur when certain groups are consumed in either excessive or insufficient amounts relative to the total diet. World Health Organization (2025) advises that a healthy diet should emphasize foods such as vegetables, fruits, legumes (like chickpeas, lentiles, beans), nuts, and whole grains (for example oats, millet, barley, bulgur, brown rice), with a daily intake of minimally 400 g (approximately five portions) of fruits and vegetables including starchy varieties. Also, it is recommended to limit intake of food that may have negative impact on health if consumed in amounts greater than recommended. Such food include salt (no more than 5 to 6 g of salt per day, or about one teaspoon), alcohol (up to one alcoholic drink per day for women and two for men), saturated fatty acids (less than 10% of total daily energy intake), trans fatty acids (less than 1% of total daily energy intake), cholesterol (under 300 mg per day), and added sugars (less than 10% of total daily energy intake);

- Moderation – refers to consuming an amount of food that meets, but does not exceed, the body's daily energy requirements (Lawrence, 2024).

Daily energy needs are individual and depend on age, gender, body composition and physical activity. The daily energy needs of young adults (aged from 18 to 29 years) are defined depending on gender and the amount of physical activity. The European Food safety Agency (EFSA) provides the recommendations stated in table 1 (EFSA, 2017).

**Table 1: Average daily energy requirements of young adults according to gender and amount of physical activity**

Level of physical activity	Male (kcal)	Female (kcal)
Low level of physical activity	2341	1888
Moderate level of physical activity	2675	2149
High level of physical activity	3009	2412
Very high level of physical activity	3344	2675

The food we consume represents a source of energy necessary for everyday functioning. Nutrients are chemical compounds found in food. Some of them cannot be produced by the body and must be obtained through food. These are known as essential nutrients and include vitamins, minerals, fatty acids and some amino acids. In contrast, non-essential nutrients can be synthesized within the body. Nutrients are also classified based on the amounts required: macronutrients are needed by the body in larger amounts, whereas micronutrients are required in much smaller amounts. A deficiency of nutrients may result in the development of specific symptoms or disorders. Excessive intake of macronutrients can lead to obesity and related conditions, while excessive intake of micronutrients may be toxic to the body. For these reasons, it is important to maintain a balanced diet. Carbohydrates, fats and proteins are macronutrients that provides energy to the body, which is quantified in kilojoules (kJ) or kilocalories (kcal). According to EFSA, the recommended proportion of carbohydrates and fats in the diet, as well as the Population Reference Intake (PRI) for protein for a healthy population over 18 years of age, are presented in table 2.

**Table 2: Reference Intake (RI) range for carbohydrates, fats and proteins with Population Reference Intake (PRI) for proteins for healthy population older than 18 years**

Macronutrient	Reference Intake range
Carbohydrates	45 - 60 % of total daily energy intake
Fats	20 – 35 % of total daily energy intake
Proteins	20 % of total daily energy intake or 0.83 g/kg of body weight

Water is often considered a fourth macronutrient because the body needs it in large quantities for survival, acting as a solvent, temperature regulator, and transport medium for nutrients. However, unlike proteins, carbohydrates and fats, it provides no energy. Proper hydration involves regular fluid intake and appropriate fluid choices. Water, as well as unsweetened herbal teas, represents the best option; however, beverages such as milk and dairy products, as well as foods—primarily fresh fruits and vegetables—also contribute to total water intake.

Water intake requirements are individual and depend on age, gender, season, and amount of physical activity. According to EFSA (2010), the average recommended daily intake is approximately 2 L for women and 2.5 L for men. With increased physical activity, fluid requirements rise by 400–800 mL per hour of activity (exercise or physical labor).

The global increase in the consumption of high-calorie beverages has highlighted the crucial role of water and other unsweetened beverages in supporting health and reducing disease risk. Sugar-sweetened beverages, such as soda, sweetened fruit beverages, sport drinks and energy drinks are major sources of added sugars like sucrose and high-fructose corn syrup (HFCS). These beverages provide large amounts of calories without significant nutrients, often referred to as “empty calories”, with the exception of 100% fruit juice or freshly squeezed juice. Along with sweets, sugar-sweetened beverages represent the most significant source of added sugar in Western diets, making their consumption a major contributing factor to the development of overweight and obesity among both children and adults (Nguyen et al., 2023). Consuming half a liter of a carbonated soft drink provides approximately 50 g of sugar, which is equivalent to about ten sugar packets typically served with coffee, and contributes roughly 200 kcal of energy.

## **4.2 Healthy dietary patterns**

Healthy dietary patterns can generally be described as those in which nutrient-dense foods are consumed in significant amounts. This usually includes a large proportion of plant-based foods such as fresh fruits and vegetables, nuts, seeds, legumes, plant-derived fats, fish and fermented dairy products. These foods provide important anti-inflammatory and antioxidant compounds that help protect the body against stress-related damage which can contribute to the onset of various diseases.

Healthy dietary patterns naturally exist in certain parts of the world, where they are closely tied to local traditions and rely on regionally available foods, as seen in traditional Mediterranean or some Asian diets. Research has shown that these diets provide significant health benefits through their nutrient composition and related health outcomes. However, in recent years, adherence to these dietary patterns has declined, particularly in countries traditionally associated with the Mediterranean diet and among younger populations. Recent scientific evidence highlights the importance of developing strategies to promote adherence to the Mediterranean diet among adolescents and young adults in university settings, where education and access to information through courses and lectures can play a key role. Greater adherence to the Mediterranean diet has been linked to lower rates of suicidal behavior, emotional difficulties, and compulsive internet use, accounting for 7.7% of the variance according to Tomás-Gallego et al. (2025). It is therefore recommended to incorporate regular nutrition courses into the academic curriculum, complemented by postgraduate lectures and awareness campaigns that encourage the consumption of various food groups, as well as strategies promoting fruit and vegetable intake within the university environment, tailored to the cultural context of each population.

Given that university cafeterias serve a large number of students, implementing policies to improve the quality of food offered in these canteens is essential (Antonopoulou et al., 2025).

### 4.3 Meal frequency and timing

Currently, scientific literature presents numerous conflicting findings regarding the optimal distribution of meals throughout the day. In Western culture, it is generally recommended to distribute total energy intake across 3 main meals, including 2 to 3 smaller snacks that help maintain stable blood glucose levels and thereby prevent excessive food consumption. While the health benefits of fasting have long been recognized, primarily in religious contexts, a growing body of research is investing how different forms of fasting affect body measurements and physiological functions, even when total energy intake remains the same. Intermittent fasting, which involves avoiding food intake for a minimum of 12 up to 16 to 18 hours, is often applied among the general population. Individuals frequently choose their eating window based on personal preferences and habits (so-called “morning” and “evening” types), thereby concentrating daily energy intake in either the morning or afternoon/evening. For the student population, which is exposed to considerable physical and mental demands associated with academic obligations, abstaining from food for such prolonged periods may result in fatigue, weakness, and an inability to perform normal daily tasks. Therefore, extended fasting is not recommended for this group.

The current scientific consensus on the recommended number and distribution of meals can be summarized as follows:

- **Do not skip breakfast.** Consuming a greater share of daily calories earlier in the day, rather than in the evening, is linked to several physiological benefits.
- **Lengthening the daily fasting period beyond the usual overnight fast or adopting intermittent fasting can provide health benefits, particularly in terms of weight management and the regulation of blood glucose and insulin levels.** To combine these approaches effectively, it is suggested that food consumption be concentrated between breakfast and mid- to late-afternoon (Paoli et al., 2019).

#### 4.4 Meal composition – The healthy plate model

Meal composition is often arbitrary, based on taste preferences, without consideration of the nutritional and energy content of foods. Despite the reintroduction of the pyramid-like-graphic into dietary guidelines (US Department of Agriculture, 2025), simple visual models such as the healthy plate model introduced by the U.S. Department of Agriculture (USDA) in 2011, remains a simple visual tool for illustrating optimal meal composition (Figure 2). A healthy plate includes foods from different food groups and illustrates their optimal proportions to meet daily nutrient intake recommendations. The plate model emphasizes that all consumed foods are important, highlighting the need to focus on variety, portion size, and nutrient density. Key messages can be summarized as follows:

- **Dietary changes are a lifelong decision**, not a short-term regimen. Therefore, healthy eating recommendations should be individualized to ensure long-term adherence.
- **Meals should be based on non-starchy vegetables**, with seasonal vegetables constituting half of the plate at main meals (lunch and dinner).
- **Fresh fruit should be the preferred source of dietary sugars**. Daily consumption of up to 500 g of fruit is recommended, distributed across three servings: one at breakfast and one in each snack.
- **Starchy sides should preferably include whole grains** (for example oatmeal, millet, barley, buckwheat, bulgur, rice) and starchy vegetables (beans, peas, chickpeas, lentils, potatoes, sweet potatoes), rather than processed foods (bread, pastries, pasta, dumplings, gnocchi, etc.). Starchy sides should constitute one-quarter of the plate.
- **Protein sources should also occupy one-quarter of the plate**. Recommended sources include lean poultry, fish, lean red meat, eggs, low-fat fresh cheese, or plant-based proteins (for example, lentil patties or other legumes).
- **When selecting dairy products** (milk and fermented dairy), low-fat options (1.5–2.8% milk fat) should be preferred (USDA, 2011).

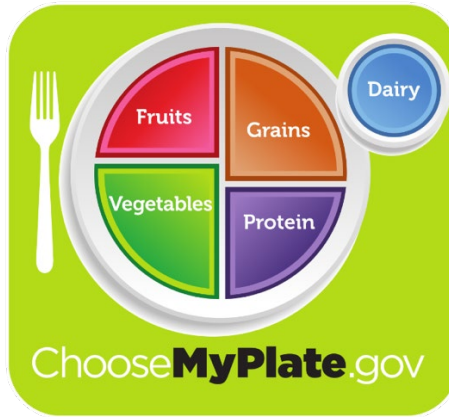


Figure 2: Illustration of the healthy plate model, adopted from USDA (2011).

## 5 Practical recommendations for proper nutrition in university setting

The basics of proper nutrition in an university setting can be presented as simple tips that university students can understand and apply in everyday life.

These include:

- Eat a balanced breakfast. Consuming a nutritionally balanced breakfast is important for maintaining energy levels throughout the day, increasing metabolic rate, regulating appetite and stabilizing blood glucose levels. Skipping breakfast has been associated with lethargy, impaired concentration, increased cravings for energy-dense foods and late-night snacking.
- Keep healthy snacks on hand, such as yogurt, fresh fruit, and nuts. Having nutritious snacks readily available helps reduce the temptation to consume less nutritious foods when hunger occurs. Regular snacking between meals can help maintain energy levels, support cognitive function, and stabilize blood glucose levels.
- Stay hydrated. Adequate hydration is essential for preventing dehydration-related symptoms such as headaches, fatigue, impaired concentration, and dizziness. Students are encouraged to carry a reusable water bottle and drink water regularly throughout the day. High intakes of beverages such as coffee, sugary sodas, fruit juices, and energy drinks should be limited, as they often contain added sugars and calories and do not hydrate as effectively as water.

- Limit the intake of added sugars. Excessive consumption of added sugars has been associated with weight gain, reduced energy levels, impaired glycemic control, and potential hormonal imbalances. Added sugars are commonly found in processed snack foods and sugar-sweetened beverages. Hidden sources of added sugars are also present in foods often perceived as healthy, such as flavored yogurts, instant oatmeal, and granola bars. Developing the habit of reading ingredient labels can help identify added sugars. Whenever possible, sweetened drinks and snacks should be replaced with unsweetened alternatives, while natural sources such as fresh fruit can be used to satisfy sweet cravings.
- When living in a dormitory, preparing meals in advance, such as batch cooking for the week, helps ensure regular consumption of balanced meals during busy academic schedules. Additionally, purchasing pre-cooked or pre-cut foods can save time and facilitate healthier food choices.
- When dining at the university canteen, students are encouraged to select healthier options and customize meals to meet individual nutritional needs. Practical strategies include choosing grilled or baked meats instead of fried options, adding a side salad to meals and practicing portion control by filling approximately half of the plate with vegetables, while allocating the remaining space to high-fiber carbohydrates and a source of lean protein. Incorporating a variety of colorful vegetables can enhance nutrient intake. Dishes prepared with creamy or high-fat sauces should be limited. Water or unsweetened herbal tea is recommended over sugar-sweetened beverages, while fresh fruit juice may be consumed occasionally as a substitute for whole fruit.

## **6 Conclusion**

Adolescent and early adulthood represent a critical period for establishing long-lasting dietary habits that significantly impact health throughout life. Despite increased nutritional needs during this stage, many young people exhibit inadequate dietary patterns, which can lead to both undernutrition and overweight, consequently increasing the risk of non-communicable diseases. The transition to university life further complicates this situation due to the new challenges of independently managing dietary behaviors, exposure to social and economic influences and limited nutrition-related knowledge. The development and implementation of educational programs, user-friendly tools for students and

supportive food environments within universities are essential to promote sustainable healthy eating habits. Applying these strategies can improve students' nutritional status, reduce prevalence of overweight and obesity and enhance the long-term health outcomes of young adults.

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