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Hubungan antara Asupan Zat Gizi Makro dan Tingkat Konsumsi Makanan Ultra Proses dengan Kejadian Status Overweight pada Remaja Awal: Tinjauan Literatur

The Relationship between Macro Nutrient Intake and Ultra Processed Food Consumption Level With The Incidence of Overweight Status in Early Adolescents : Literature Review

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Abstrak

Masa remaja merupakan periode kritis yang ditandai dengan peningkatan tinggi badan dan berat badan yang berlangsung secara cepat, disertai dengan meningkatnya kebutuhan zat gizi. Perubahan ini dipengaruhi oleh berbagai faktor, termasuk asupan zat gizi makro dan tingginya konsumsi makanan ultra-proses (ultra-processed foods/UPF). Penelitian ini bertujuan untuk menganalisis hubungan antara asupan zat gizi makro dan konsumsi makanan ultra-proses dengan risiko kejadian overweight pada remaja.Penelitian ini menggunakan desain literature review dengan penelusuran artikel melalui basis data ilmiah, yaitu PubMed, ScienceDirect, dan Scopus. Sebanyak sepuluh artikel jurnal internasional yang dipublikasikan pada tahun 2015 hingga 2024 dimasukkan dalam kajian ini.Hasil penelitian menunjukkan secara konsisten bahwa konsumsi makanan ultra-proses yang berlebihan pada remaja awal berhubungan dengan penurunan kualitas pola makan, peningkatan asupan energi total, serta meningkatnya risiko overweight dan obesitas. Analisis lebih lanjut menunjukkan bahwa tingginya konsumsi UPF mengganggu keseimbangan zat gizi makro dan berkontribusi signifikan terhadap terjadinya gangguan metabolik, bahkan sebelum munculnya manifestasi klinis obesitas.Secara keseluruhan, tinjauan naratif ini menegaskan bahwa tingginya konsumsi makanan ultra-proses pada masa remaja awal berkaitan erat dengan peningkatan asupan energi, rendahnya kualitas diet, serta meningkatnya risiko overweight dan gangguan metabolik. Oleh karena itu, intervensi dini melalui edukasi gizi yang komprehensif, keterlibatan aktif keluarga, serta dukungan kebijakan kesehatan masyarakat sangat diperlukan untuk mencegah dampak kesehatan jangka panjang.

Kata kunci: Remaja, Asupan Zat Gizi Makro, Makanan Ultra-Proses, Overweight, Gangguan Metabolik.

Abstract

Adolescence is a critical period characterized by rapid increases in height and body weight, accompanied by higher nutritional requirements. These changes are influenced by various factors, including macronutrient intake and the high consumption of ultra-processed foods (UPFs). This study aims to analyze the relationship between macronutrient intake and ultra-processed food consumption with the risk of overweight status among adolescents.This study employed a literature review design, with articles retrieved from scientific databases including PubMed, ScienceDirect, and Scopus. A total of ten international journal articles published between 2015 and 2024 were included in this review.The findings consistently demonstrate that excessive consumption of ultra-processed foods among early adolescents is associated with decreased diet quality, increased total energy intake, and a higher risk of overweight and obesity. The analysis further indicates that high UPF consumption disrupts macronutrient balance and significantly contributes to the development of metabolic disorders, even before the clinical manifestation of obesity.Overall, this narrative review emphasizes that high intake of ultra-processed foods in early adolescence is strongly linked to increased energy consumption, poor dietary quality, and a greater risk of overweight and metabolic disturbances. Therefore, early intervention through comprehensive nutrition education, active family involvement, and supportive public health policies is essential to prevent long-term adverse health outcomes.

***Keywords**:* Adolescents, Macronutrient Intake, Ultra-Processed Foods, Overweight, Metabolic Disorders

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1. INTRODUCTION

Adolescence is a transitional period characterized by rapid physiological and behavioral changes and represents a critical stage for the establishment of healthy behaviors. During this period, significant increases in height, weight, and bone mass occur, leading to higher nutritional requirements [1]. Eating behaviors in adolescents are influenced by various factors, including lifestyle, social environment (peers and family), food availability, parental income, and biological aspects such as habitual dietary patterns. Limited awareness of healthy eating practices may contribute to overweight and obesity, conditions characterized by excessive fat accumulation resulting from an imbalance between energy intake and expenditure [2].

Globally, approximately 390 million children and adolescents aged 5–19 years are classified as overweight, and 160 million are obese [3]. Overweight in adolescents is defined as a body mass index (BMI)-for-age Z-score >1.0 to 2.0 standard deviations, while obesity is defined as a Z-score >2.0 standard deviations [3]. In Indonesia, the 2018 Basic Health Research (Riskesdas) reported that 16% of adolescents had excess nutritional status, consisting of 11.2% overweight and 4.8% obese. Furthermore, the 2023 Indonesia Health Survey indicated an increased prevalence among adolescents aged 13–15 years, with 16.2% classified as having excess nutritional status (12.1% overweight and 4.1% obese) [4].The primary contributor to excess nutritional status is excessive macronutrient intake. Consumption of energy, carbohydrates, and protein beyond physiological needs may result in fat accumulation and an increased risk of non-communicable diseases. Previous research demonstrated a significant association between macronutrient intake and nutritional status among adolescent girls [5]. Such imbalances are often linked to inadequate nutritional knowledge and unhealthy eating habits [6].

Adolescents frequently choose practical and convenient breakfast options without considering nutritional value. This behavior is further compounded by high consumption of sugar-sweetened beverages and fast food, commonly categorized as ultra-processed foods (UPFs), which are increasingly accessible due to advances in food technology [7]. Ultra-processed foods are industrial formulations typically high in sugar, salt, and fat, and often contain additives such as artificial sweeteners, flavor enhancers, and preservatives. These products are widely available in supermarkets and small retail shops, relatively affordable, and classified as obesogenic foods due to their association with increased risk of excess nutritional status [8].If not properly managed, overweight and obesity may lead to long-term health consequences, including type 2 diabetes mellitus, hypertension, and cardiovascular diseases. Adolescence also marks the onset of puberty, and poor nutritional status may affect reproductive health, such as menstrual irregularities in girls and disturbances in secondary sexual development in boys, as well as dermatological issues including acne [9].

Adopting a healthy lifestyle through balanced and diverse dietary intake, including adequate consumption of fruits and vegetables and limiting foods high in sugar, salt, and fat, is essential to support optimal growth and development. Adequate nutritional intake plays a fundamental role in influencing body composition changes, including body weight, height, and overall physical development [2].Similarly, a study conducted among junior high school students in Makassar demonstrated a positive correlation between the frequency and quantity of ultra-processed food consumption and the incidence of overweight [10]. Based on these findings, this study aims to analyze the relationship between macronutrient intake and the level of ultra-processed food consumption with the incidence of excess nutritional status among early adolescents.

2. METHODOLOGY

Type and Research Design

This study employed a **literature review** method using a **narrative review approach**. The narrative review design was selected to comprehensively describe and explain findings from previous studies related to ultra-processed food (UPF) consumption, macronutrient intake, and overweight among early adolescents. This approach allows the integration of research findings from diverse methodologies, populations, and countries in a descriptive and thematic manner without quantitative synthesis such as meta-analysis.

Research Location and Period

This study did not involve a specific primary research location, as it was based on secondary data obtained from international scientific databases, namely **PubMed, ScienceDirect, and Scopus**. The reviewed articles were published between **2015 and 2024** and represented studies conducted in various countries, including Brazil, the United States, China, South Korea, Iran, Germany, and several European countries.

Population and Sample

The population in this study consisted of previously published international research articles examining ultra-processed food consumption and its association with nutritional status or body weight. The final sample included **10 international journal articles** that met the inclusion criteria. These studies covered diverse populations, including children, adolescents, young adults, and adults, with a primary focus on early adolescents and their risk of overweight.

Data Analysis Method

Data were analyzed using a **thematic analysis approach**. The selected studies were reviewed to identify recurring patterns and key themes related to UPF consumption, macronutrient intake, and overweight incidence. The findings were synthesized narratively and comparatively to highlight similarities and differences across studies. No quantitative statistical pooling was performed, as the objective was to provide a comprehensive descriptive interpretation of existing evidence.

3. RESULTS

A total of ten international scientific articles published between 2015 and 2025 met the inclusion criteria and were analyzed in this narrative review [10]–[19]. The studies were conducted in various countries, including the United States, South Korea, Germany, Brazil, China, Iran, and several European nations. The research designs varied and included cross-sectional studies, longitudinal studies, observational analyses, simulation modeling, controlled feeding trials, and narrative reviews.

Across all studies, a consistent association was found between high ultra-processed food (UPF) consumption and increased total energy intake, poor dietary quality, macronutrient imbalance, higher body mass index (BMI), central adiposity, and increased risk of overweight and metabolic disorders among children and adolescents.

Several cross-sectional studies demonstrated that adolescents with higher UPF intake had significantly greater energy consumption, particularly from added sugars, saturated fats, and refined carbohydrates [11], [15], [16], [19]. A multicountry study further confirmed that high UPF consumption was associated with poorer overall dietary profiles and greater intake of empty calories [16], [19].

Longitudinal evidence from Germany showed that children with higher UPF consumption were more likely to present increased BMI and waist circumference during adolescence and early adulthood, even after adjusting for physical activity and socioeconomic status [14]. Similarly, a national simulation model in the United States suggested that reducing UPF intake could substantially decrease obesity prevalence among youth [10].

Experimental evidence also supported these findings. A controlled feeding trial demonstrated that UPF consumption increased calorie intake and altered brain reward mechanisms that regulate appetite, thereby promoting overeating behavior [12].

Furthermore, studies conducted in China and Iran found that high UPF consumption was associated not only with obesity but also with metabolic disturbances such as hypertension, insulin resistance, and adverse lipid profiles, even among adolescents with comparable BMI levels [17], [18]. A European multicountry study also identified early metabolic alterations despite the absence of marked BMI increases [19].Overall, the results consistently indicate that excessive UPF intake is strongly associated with increased risk of overweight and metabolic health impairment in adolescents.

Table 1. Summary of Included Studies

No	Authors (Year)	Country	Population	Study Design	Main Findings
[10]	Livingston et al. (2021)	USA	Children & adolescents (7–18 yrs)	Simulation model	Reducing UPF intake may significantly lower obesity prevalence
[11]	Shim et al. (2022)	South Korea	Adults	Cross-sectional	High UPF intake associated with poor diet quality
[12]	Rego et al. (2023)	Not specified	Adolescents & young adults	Controlled feeding trial	UPF increased energy intake and altered appetite regulation

[13]	Monda et al. (2024)	International	General population	Narrative review	UPF linked to obesity and metabolic disturbances
[14]	Fedde et al. (2025)	Germany	Children & adolescents	Longitudinal (KOPS)	High UPF intake predicted higher BMI and waist circumference
[15]	Menezes et al. (2023)	Brazil	Schoolchildren	Cross-sectional	High sugar and trans fat intake; micronutrient deficiencies
[16]	Neri et al. (2022)	Multicountry	Children & adolescents	Cross-sectional	Higher adiposity and empty calorie intake
[17]	Li & Shi (2025)	China	Children & adolescents	Cross-sectional	Higher risk of obesity, especially urban areas
[18]	Farzam et al. (2024)	Iran	Overweight adolescents	Observational	Poorer metabolic health despite similar BMI
[19]	Lauria et al. (2021)	Europe	Children & adults	Cross-sectional multicountry	Lower diet quality and increased energy intake

4. DISCUSSION

The findings of this narrative review demonstrate consistent global evidence linking high UPF consumption with adverse nutritional and metabolic outcomes in adolescents. Early adolescence (10–14 years) represents a critical developmental period characterized by rapid growth and increased nutritional demands. However, excessive intake of UPFs disrupts dietary balance during this vulnerable stage.

First, UPFs contribute substantially to excessive energy intake. Multiple studies reported that adolescents consuming higher proportions of UPFs had significantly greater caloric intake, primarily from added sugars and saturated fats [11], [15], [16]. Experimental findings further suggest that UPFs may alter neurological reward pathways, increasing cravings and reducing satiety regulation [12]. This mechanism may explain persistent overeating patterns observed in adolescents.

Second, UPFs are associated with macronutrient imbalance and poor micronutrient quality. Diets high in UPFs tend to be energy-dense but nutrient-poor, characterized by low fiber, inadequate protein quality, and insufficient vitamins and minerals [15], [19]. Such imbalance contributes to adiposity accumulation and metabolic dysfunction.

Third, both cross-sectional and longitudinal evidence indicates that UPF intake increases the risk of overweight and central obesity [14], [17]. Importantly, metabolic abnormalities such as insulin resistance and hypertension may occur even before substantial BMI increases are observed [18], [19]. This suggests that UPFs may initiate metabolic disturbances independent of visible obesity.

The consistency of findings across diverse socioeconomic and cultural contexts—including North America, Europe, Asia, and South America—highlights that UPF-related health risks represent a global public health concern. Urbanization, aggressive marketing, affordability, and convenience likely contribute to rising UPF consumption worldwide.

Although most included studies were observational and cannot establish causality, the convergence of longitudinal, experimental, and simulation evidence strengthens the plausibility of a causal relationship between UPF intake and adverse health outcomes [10], [12], [14]

5. CONCLUSION

This narrative review concludes that excessive consumption of ultra-processed foods (UPFs) has a consistently detrimental impact on the nutritional status and health of early adolescents. Across ten international studies, high intake of UPFs was linked with increased total energy intake, poor macronutrient balance, and greater risk of being overweight and developing metabolic disorders. The evidence underscores that UPFs commonly rich in added sugars, saturated fats, and low in essential nutrients disrupt healthy growth patterns during a critical period of development. Therefore, reducing UPF intake through early, multifaceted interventions including school-based nutrition education, family engagement, and supportive public policies is essential to prevent long-term nutritional and health complications among youth**.**

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