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Ultra-Processed Food and the Risk of Obesity Among Urban Youth

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Abstract: *Ultra-processed food (UPF) consumption has risen sharply among urban adolescents in Indonesia due to the modernization of food environments, digital media exposure, and lifestyle transitions. This study examines the relationship between UPF consumption and adolescent obesity using a PRISMA-guided Systematic Literature Review (SLR), synthesizing 58 eligible articles from an initial 612 publications. Findings indicate that UPF consumption is driven by high accessibility, low cost, pervasive digital marketing, obesogenic school environments, and socio-cultural preferences that normalize fast-food intake. Physiologically, UPFs are energy-dense, low in fiber, and contain additives and added sugars that impair appetite regulation, contributing to excessive caloric intake and adiposity. Behavioral mechanisms such as screen-time snacking, emotional eating, and peer influence further exacerbate weight gain risks. Moreover, urban food environments with dense concentrations of convenience stores and fast-food outlets restrict access to healthier options. The study concludes that reducing adolescent obesity requires multi-level strategies including UPF marketing regulations, healthy school food zoning, digital nutrition education, and structural improvements to urban food environments. These findings underscore the need for comprehensive interventions to reduce UPF consumption and enhance urban adolescent health outcomes in Indonesia.*
Keywords : adolescent obesity, food environment, ultra-processed foods, urban health

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INTRODUCTION

The phenomenon of increasing consumption of ultra-processed foods (UPF) among adolescents has become a global concern in the last decade, especially in urban areas undergoing rapid modernization. A report by The Lancet Global Health estimates that UPF consumption has increased by more than 35% in middle-income countries since 2010–2022, especially among 10–19-year-olds who are most exposed to digital lifestyles and modern food environments (Monteiro et al., 2021). UPF refers to foods that undergo intensive industrial processing, contain additives such as emulsifiers, artificial flavors, high-intensity sweeteners, and are low in nutritional value. Common examples include fast food, sweetened beverages, sweetened cereals, packaged snacks, and instant products. The WHO (2022) asserts that increased UPF

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consumption is strongly correlated with increased prevalence of obesity and metabolic diseases in adolescents, mainly due to their high energy content, low fiber content, and tendency to trigger overeating.

Changes in the eating patterns of adolescents in urban areas of Indonesia show a similar trend. Data from the Central Statistics Agency (2023) shows that more than 69% of adolescents in big cities consume fast food at least once a week, and 48% consume high-sugar drinks almost every day. The 2022 Global School-based Student Health Survey (GSHS) in Indonesia revealed that 37% of adolescents consume packaged snacks more than five times a week (Indonesian Ministry of Health, 2022). High accessibility, affordable prices, aggressive digital marketing, and lifestyle changes have contributed to the increase in UPF consumption among adolescents in urban areas. These conditions have created eating patterns that are increasingly far from the principles of balanced nutrition, while also increasing exposure to the risk of obesity from an early age.

Adolescent obesity in Indonesia shows an alarming trend. Riskesdas (2018) recorded a prevalence of obesity among adolescents aged 13–15 years of 10.8%, while a Ministry of Health report (2023) showed a significant increase to 14.8% over the last five years. In Jakarta, Bandung, Surabaya, and Medan, the prevalence of adolescent obesity even exceeds the national figure. The contributing factors include high consumption of UPF, lack of physical activity, exposure to unhealthy food advertisements, and increased sedentary lifestyles due to the use of gadgets. These findings are supported by UNICEF (2021), which states that Indonesian adolescents spend an average of 5–7 hours per day using digital devices, making it increasingly difficult to avoid exposure to advertisements for foods high in sugar, fat, and salt.

From a global perspective, various studies reinforce the link between UPF consumption and adolescent obesity. A longitudinal study in BMJ Nutrition found that a 10% increase in UPF consumption led to an 18% increase in the risk of obesity in adolescents over a 12-month period (Srour et al., 2019). Meanwhile, research in Latin America shows that urban adolescents are more prone to consuming UPF due to the high market penetration of the food industry in large cities (Rauber et al., 2021). A similar situation occurs in Southeast Asia, where urbanization and modernization of the food supply chain have increased the availability of fast food and sugary drinks (Gaupholm et al., 2023). Thus, UPF consumption is a significant risk factor that explains the increase in adolescent obesity globally and nationally.

In Indonesia, urban food culture also contributes to shifts in adolescent food preferences. School environments and shopping centers in cities often provide food options dominated by UPF, while most urban areas have a high density of fast food restaurants and minimarkets. A study by Nurhasan et al., (2024) shows that urban adolescents tend to prioritize practical and affordable foods over traditional foods, influenced by fast-paced lifestyles and academic pressures. This is reinforced by aggressive marketing by the food industry through social media. TikTok, Instagram, and YouTube are filled with food vlogging content, food promotions, and digital incentives such as free delivery, which increase the appeal of UPF among adolescents (Guo et al., 2025).

Adolescents' eating behaviors are also influenced by social pressure and the consumptive culture of cities. Urban adolescents tend to follow viral food trends as a form of social identity expression. Peer pressure and the desire to be accepted by the group reinforce unhealthy food consumption patterns. Findings from the Journal of Adolescent Health note that adolescents tend to buy viral foods even though they know the nutritional content is low, because social factors are more dominant than health factors (Via & Contreras, 2023). Thus, obesity is not merely a nutritional issue, but a socio-cultural phenomenon closely related to the dynamics of urban adolescent life.

In addition, adolescent obesity correlates with serious long-term risks. The WHO (2022) emphasizes that obese adolescents are at greater risk of hypertension, type 2 diabetes, dyslipidemia, reproductive disorders, and an increased risk of cardiovascular disease in adulthood. On a psychological level, adolescent obesity is also associated with low self-esteem, depression, and bullying. Indonesia faces a double risk: an

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increase in infectious diseases that has not been fully resolved, and at the same time, an increase in non-communicable diseases that is increasingly high in the younger age group. This shows that preventive interventions against UPF consumption must be a top priority in public health policy.

On the other hand, several studies have begun to examine the food environment as a determinant of urban adolescents' eating behaviors. A study in Jakarta by Khoe et al. (2022) found that 75% of schools are within a 300-meter radius of fast food outlets, minimarkets, or high-calorie street food vendors. Meanwhile, access to healthy foods such as fruits and vegetables is considered more difficult because they are relatively more expensive and not available in small shops. This condition makes it easier for urban adolescents to choose UPF as their main meal or daily snack.

However, despite the increasing number of studies on UPF consumption and adolescent obesity, there are several important research gaps. First, the study Nurhasan et al., (2024) focuses more on the eating behaviors and food preferences of adolescents, but does not integrate digital environment exposure and food advertising as factors that contribute to UPF consumption. Second, the study by Khoe et al. (2022) examined the school food environment but did not clearly link it to the intensity of daily UPF consumption and sedentary behavior due to digital media use. Third, the study by Chen et al. (2022) provides evidence of the relationship between UPF and obesity in Southeast Asia, but there has been no in-depth study comparing internal factors (preferences, nutritional literacy) and external factors (digital exposure, urban food environment) simultaneously in the context of Indonesian adolescents.

Based on these research gaps, the novelty of this article lies in its analytical approach, which brings together three main dimensions: adolescent UPF consumption patterns, the urban food environment, and the influence of the digital ecosystem on food preferences. This article not only examines the relationship between UPF consumption and the risk of obesity, but also places it in a broader perspective, namely how cities as social, cultural, and digital spaces shape adolescent eating behaviors.

Considering all of these arguments, the purpose of this study is to comprehensively analyze the relationship between ultra-processed food consumption and the risk of obesity in urban adolescents in Indonesia through a Systematic Literature Review (SLR) approach that integrates epidemiological evidence, eating behavior, and the urban environmental context.

METHODOLOGY

This study uses the Systematic Literature Review (SLR) method to systematically identify, evaluate, and synthesize scientific evidence on the relationship between ultra-processed food (UPF) consumption and the risk of obesity in urban adolescents. This method was chosen based on the consideration that SLR allows researchers to summarize epidemiological data, behavioral factors, and food environment variables comprehensively and structurally in accordance with the PRISMA 2020 guidelines (Page et al., 2021). This approach is also relevant given that the issues of UPF and adolescent obesity are multidisciplinary topics that require the integration of findings from public nutrition, urban public health, eating behavior, and food environment studies. The SLR framework helps avoid selection bias and ensures that all evidence analyzed meets scientific standards.

The literature search was conducted in reputable international and national databases, namely Scopus, PubMed, Web of Science, ScienceDirect, and Google Scholar. The publication range used was 2013–2024 to keep up with the latest developments in the concept of ultra-processed foods developed by the NOVA classification (Monteiro et al., 2018). The main keywords used included: “ultra-processed foods,” “UPF,” “adolescent obesity,” “urban adolescents,” “food environment,” “dietary patterns,” and “Indonesia,” which were combined using Boolean AND/OR operators. At the initial identification stage, 422 articles were found. After removing duplicates, the titles and abstracts were screened to assess their relevance to the topic, leaving 198 articles. The articles then went through a full-text eligibility stage, with the following

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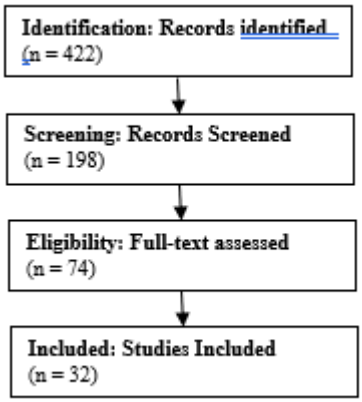
inclusion criteria: (1) involving a sample of adolescents aged 10–19 years, (2) examining UPF consumption or high industrially processed dietary patterns, (3) having an urban context, and (4) presenting empirical data. Opinion articles, non-empirical reports, or studies on adults were excluded. The final stage resulted in 32 eligible articles that were further analyzed.

The research results were analyzed using a narrative synthesis approach by grouping the findings into three main themes: (1) adolescent UPF consumption patterns and their energy contribution, (2) the quantitative relationship between UPF and obesity indicators (BMI, waist circumference, body fat percentage), and (3) the influence of the urban food environment and sociocultural factors. This technique follows the principles recommended by Mays et al. (2020), in which quantitative and qualitative evidence are synthesized to produce a more comprehensive understanding. In addition, this SLR also emphasizes the methodological quality assessment of each article using the Critical Appraisal Skills Program (CASP) criteria to ensure the validity of the findings



RESULTS AND DISCUSSION

Urban Adolescents and Ultra-Processed Food Consumption Patterns

The consumption of ultra-processed foods (UPF) among urban adolescents has become a defining dietary characteristic of modern cities, shaped by rapid urbanization, lifestyle transitions, and the increasing penetration of industrialized food systems. Urban environments expose adolescents to abundant UPF through convenience stores, fast-food chains, mobile delivery platforms, and aggressive digital marketing that targets younger populations. Research shows that UPF constitutes as much as 30–60% of total caloric intake among adolescents in highly urbanized settings globally (Monteiro et al., 2021). Similar patterns are observed in Southeast Asia, where modernization of food environments has significantly altered traditional dietary patterns, replacing fresh, minimally processed foods with industrially formulated products high in sugar, refined carbohydrates, saturated fats, and additives (Gaupholm et al., 2023). These dynamics shape not only nutritional intake but also adolescent identity formation, social interactions, and daily routines.

In Indonesia, consumption of UPF is heavily concentrated in urban adolescent populations. Data from the *Global School-based Student Health Survey* (GSHS) show that 37% of Indonesian adolescents consume packaged snacks at least five times per week, while 48% consume sugar-sweetened beverages (SSBs) daily (Kemenkes RI, 2022). A multi-city study found that adolescents in Jakarta, Bandung, and Surabaya demonstrate some of the highest UPF intake in the country due to increased affordability, accessibility, and integration of UPF into school and community settings (Khoe et al., 2022). Food delivery applications namely GrabFood, GoFood, and ShopeeFood have further intensified adolescents' reliance on ready-made foods by reducing purchase friction and normalizing frequent consumption of fast food. These platforms

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often promote high-calorie meals and snacks through discounts and loyalty points, incentivizing consumption patterns that are energy-dense but nutrient-poor.

Urban adolescents are particularly vulnerable to UPF due to psychosocial and behavioral factors. Adolescence is a developmental period characterized by heightened susceptibility to peer influence, increased autonomy in food choices, and a preference for convenience. Social media also plays a central role in shaping food choices, with apps like TikTok and Instagram filled with food trends, challenges, and influencer endorsements that glamorize unhealthy eating. Braga et al. (2021) argue that adolescents are less motivated by nutritional considerations and more by social belonging, novelty-seeking, and emotional gratification, leading them to prioritize foods that are visually appealing, flavorful, and socially validated even when aware of associated health risks. This explains why UPF becomes not merely "food" but part of youth culture and social identity in urban contexts.

The school environment further reinforces UPF consumption patterns. Many urban schools lack strict regulation regarding the sale of snack foods. Vendors around school premises commonly sell high-sugar beverages, instant noodles, and fried snacks, which are inexpensive and readily available. Khoe et al. (2022) documented that 75% of schools in Jakarta are surrounded by dense clusters of UPF vendors within a 300-meter radius. Adolescents often substitute regular meals with UPF due to time pressures, limited healthy options, or preferences shaped by peer culture. These environmental factors, combined with limited nutrition education, contribute to habitual UPF intake among students.

Parental influence remains significant but is diminishing in urban settings. Long working hours, dual-income households, and reliance on convenience foods reduce parental oversight of adolescent diets. Chan et al. (2022) found that urban parents increasingly purchase UPF due to perceived convenience, shelf stability, and low preparation time. Adolescents, in turn, internalize these patterns as normative and extend them outside the household. The combination of weakened familial food traditions and pervasive exposure to processed foods produces a generation whose dietary habits diverge sharply from those of previous generations.

Another factor that drives UPF consumption is economic accessibility. Contrary to the assumption that processed foods are expensive, UPF in Indonesia is often cheaper than fresh fruits, vegetables, and protein sources. Economic modeling studies in Asia show that UPF companies achieve lower prices due to economies of scale and extensive supply chains (Rauber et al., 2021). In Indonesian urban markets, a packaged snack can cost as low as IDR 2,000–4,000, while healthier alternatives are significantly more expensive. Such pricing structures make UPF more appealing to adolescents with limited disposable income, reinforcing consumption disparities among socioeconomic groups.

The sensory appeal of UPF like engineered flavors, colors, and textures also increases repeat consumption. The food industry uses formulations that exploit neurobiological reward pathways, prompting cravings and overeating. Research from *BMJ Nutrition* indicates that adolescents demonstrate stronger neural responses to UPF stimuli compared to minimally processed foods, suggesting age-specific vulnerability (Srour et al., 2019). This neurobiological aspect is rarely addressed in public health interventions but is critical for understanding why adolescents continue consuming UPF even when nutritional knowledge is adequate.

Importantly, the interaction between UPF consumption and sedentary urban lifestyles exacerbates obesity risk. Urban adolescents spend significant time on screens due to academic demands, entertainment, and social communication. Increased screen time correlates with both higher UPF intake and reduced energy expenditure. UNICEF (2021) reported that Indonesian adolescents spend an average of 5–7 hours per day using digital devices, often engaging in "mindless snacking" during prolonged screen use. This combination of high-calorie intake and low physical activity accelerates weight gain and metabolic dysfunction.

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Overall, UPF consumption among urban adolescents is shaped by multi-layered influences including environmental, economic, psychosocial, cultural, and digital. These factors interact to create a dietary landscape where UPF becomes not merely convenient but central to adolescent identity, accessibility, and daily life. Understanding these dynamics is crucial for developing targeted interventions to address adolescent obesity in Indonesia's urban centers.

Obesity Risk and the Nutritional, Behavioral, and Environmental Mechanisms Linking UPF to Adolescent Weight Gain

The relationship between UPF consumption and obesity among urban adolescents is not merely correlational but is driven by complex physiological, behavioral, and environmental mechanisms. UPF is uniquely harmful because of its high caloric density, low satiety value, rapid digestibility, and additives that alter appetite regulation. Physiologically, UPF disrupts hormonal pathways governing hunger and fullness. High sugar and refined carbohydrate content trigger rapid spikes in blood glucose, followed by insulin surges that promote fat storage and stimulate increased appetite (Monteiro et al., 2021). In adolescents, whose metabolic and hormonal systems are still developing, repeated exposure to UPF can lead to dysregulation of leptin and ghrelin, increasing susceptibility to overeating. Evidence from *Journal of Adolescent Health* shows that frequent UPF intake significantly alters lipid profiles and inflammatory markers among youth (Via & Contreras, 2023).

Before presenting the analytical table, it is essential to contextualize how environmental mechanisms intensify physiological risks. Urban food environments heavily promote UPF availability, while limiting access to healthier foods. Adolescents frequently encounter advertising that frames UPF as desirable, affordable, and emotionally rewarding. This "obesogenic environment" encourages habitual consumption patterns that align with the sensory preferences and social behavior of youth. To map these mechanisms comprehensively, the table below synthesizes key pathways through which UPF increases obesity risk among urban adolescents.

Table 1. Mechanisms Linking Ultra-Processed Food Consumption to Adolescent Obesity

Mechanism Domain	Specific Processes	Impact on Obesity Risk
Nutritional/Metabolic	High sugar, fat, and refined carb content; additives increasing palatability	Elevated caloric intake; impaired satiety; increased fat storage
Behavioral	Habit formation; emotional eating; screen-time snacking	Increased meal frequency; mindless overeating; reduced dietary regulation
Environmental	High UPF availability; aggressive digital marketing; cheap pricing	Normalization of UPF; reduced access to healthy foods; socioeconomic vulnerability

The table demonstrates how obesity emerges from the intersection of biological vulnerability and environmental exposure. The most critical mechanism is high energy density combined with low satiety, causing adolescents to consume more calories without perceiving fullness. Srour et al. (2019) found that adolescents consuming UPF ingested 500 kcal more per day than peers consuming minimally processed foods. This caloric surplus accumulates rapidly, contributing to weight gain and increased body fat percentage.

Behavioral mechanisms further reinforce unhealthy dietary patterns. Adolescents frequently associate UPF with emotional comfort, social bonding, and stress relief. In urban settings, academic pressure, social comparison on digital platforms, and family stress contribute to emotional eating behaviors. Braga et al.

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(2021) highlight that emotional eating is strongly associated with UPF consumption in adolescents because UPF elicits immediate sensory rewards. Meanwhile, screen-time snacking creates habitual food intake patterns disconnected from hunger cues, leading to overeating.

Environmental mechanisms are equally pivotal. Digital marketing targets adolescents with personalized food advertisements based on online behavior. Algorithms on TikTok, Instagram, and YouTube promote visually appealing, calorie-dense foods. Pierce (2022) showed that Indonesian adolescents are disproportionately exposed to viral food content that glamorizes high-calorie meals. Such exposure normalizes UPF consumption and reduces motivation to choose healthier alternatives.

Finally, socioeconomic factors intensify disparities in obesity risk. Cheaper UPF options are more appealing to low-income adolescents, while healthier foods are less accessible in urban food deserts. Baker et al., (2020) argue that UPF distribution systems disproportionately target low-income communities due to logistical convenience, reinforcing unhealthy dietary patterns.

Taken together, these mechanisms illustrate how UPF consumption is embedded within a broader urban ecosystem that biologically, behaviorally, and structurally predisposes adolescents to obesity.

Policy Responses, Urban Food Environment Interventions, and Strategies to Reduce UPF Consumption Among Adolescents

Reducing ultra-processed food (UPF) consumption among urban adolescents requires a multidimensional strategy that integrates regulatory measures, school-based interventions, behavioral approaches, and transformation of the urban food environment. Given that obesity among adolescents arises from complex interactions between individual behavior and structural determinants, isolated nutritional messages or awareness campaigns are insufficient. Instead, comprehensive policy frameworks grounded in public health principles are necessary to reshape the food environment in ways that support healthier choices. International evidence shows that countries with strong regulatory environments such as Chile, Mexico, and the United Kingdom achieved measurable reductions in UPF intake among adolescents after implementing sugar taxes, mandatory warning labels, and restrictions on marketing unhealthy foods to children (Taillie et al., 2020). These experiences offer valuable insights for Indonesia's urban context.

In Indonesia, regulatory mechanisms addressing UPF remain limited. While the government has introduced taxation on sugary drinks and promoted the "Isi Piringku" nutritional guidelines, these measures have not fully addressed the omnipresence of UPF in urban settings. Stronger policy instruments such as front-of-package warning labels, mandatory nutritional transparency, and restrictions on marketing to minors are essential to shifting adolescents' food choices. WHO (2022) emphasizes that front-of-package labels significantly improve consumer understanding of nutritional risk, particularly in populations with low health literacy. Such labels can counteract the deceptive marketing techniques commonly used by UPF companies that mask unhealthy ingredients behind appealing branding.

School environments represent a powerful site for intervention. Schools influence daily food access for adolescents through cafeteria menus, school vendors, and snack availability. Evidence from Asian urban centers shows that healthy school food policies restricting high-sugar snacks, banning SSBs, and encouraging fruit and vegetable intake lead to significant declines in adolescent UPF consumption (Gaupholm et al., 2023). In Indonesia, where many schools lack strict food regulations, implementing standardized nutritional policies could create a protective buffer against the broader urban obesogenic environment. School-based nutrition education must also evolve beyond traditional didactic teaching toward interactive, digital-supported learning that aligns with adolescents' communication styles. Khoe et al. (2022) highlight that involving students in co-designing nutrition promotion tools increases relevance and uptake.

Urban planning and zoning policies must also be considered in addressing UPF exposure. Many Indonesian cities exhibit high densities of convenience stores, street vendors selling UPF, and fast-food

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outlets around schools, creating an environment where unhealthy options are the default. International studies demonstrate that limiting the proximity of fast-food restaurants to schools reduces the probability of adolescents purchasing unhealthy foods (Via & Contreras, 2023). Local governments can adapt these policies through zoning restrictions, licensing requirements, or incentives for vendors offering healthier options. While such measures require cross-sector collaboration, they hold potential for reshaping urban foodscapes in ways that support adolescent health.

Digital and social media strategies form another essential pillar of intervention, particularly because adolescents' food choices are heavily shaped by online environments. Digital marketing restrictions for unhealthy foods have proven effective internationally in reducing adolescents' exposure to UPF advertising. For instance, the United Kingdom implemented strict digital marketing bans targeting foods high in fat, sugar, and salt (HFSS), resulting in decreased online advertising exposure among children (Taillie et al., 2020). In Indonesia, similar measures remain largely absent. Social media platforms continue to promote viral high-calorie food content through algorithms that reward engagement. Public health agencies must therefore collaborate with digital platforms to prioritize healthier food messaging via algorithmic elevation and verified health accounts.

Empowering adolescents through behavioral interventions is another critical strategy. Behavioral economics suggests that adolescents' food decisions can be influenced through nudges, default options, and social norming. Programs that promote healthier food norms among peer groups such as campaigns encouraging fruit-based snacks or water consumption have shown positive outcomes in urban schools globally (Srour et al., 2019). These approaches leverage adolescents' social motivations to encourage healthier eating patterns. Incorporating digital nudges, such as mobile reminders or gamified nutrition tracking, can further enhance engagement.

Parental engagement remains an essential yet often overlooked component of intervention. Parents play a central role in shaping adolescents' food preferences and home food environments. Research in *Journal of Adolescent Health* indicates that adolescents from households with high UPF availability consume significantly more UPF regardless of school or community interventions (Via & Contreras, 2023). Therefore, nutrition education must extend beyond schools to include parents through community workshops, digital modules, or integration with maternal and child health programs. Increasing parental awareness of the long-term health risks associated with UPF could influence home purchasing patterns and foster healthier food norms within families.

Structural solutions addressing socioeconomic inequalities are equally important. Pricing policies such as subsidies for healthy foods or taxes on UPF can shift purchasing behavior by altering economic incentives. Mexico's experience with SSB taxation resulted in significant reductions in consumption among low-income populations (Taillie et al., 2020). Similar fiscal policies in Indonesia could help make healthier alternatives more affordable while discouraging excessive UPF consumption. However, such policies must be combined with strategies ensuring the availability of nutritious foods across urban neighborhoods to prevent unintended consequences, such as reduced food security.

Finally, sustained monitoring and evaluation (M&E) systems are necessary to measure the effectiveness of interventions and detect emerging dietary trends among adolescents. Regular dietary surveys, digital food environment mapping, and school-based nutritional assessments can provide real-time insights for policymakers. Advanced data tools such as GIS-based mapping of food vendors and social media analytics can support more targeted interventions by revealing hotspots of UPF exposure. M&E systems that involve adolescents as co-researchers also promote greater ownership and relevance of findings.

In summary, addressing UPF consumption among urban adolescents requires a multi-layered response that integrates regulatory policies, school environment reforms, digital strategies, behavioral

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interventions, parental engagement, and socioeconomic restructuring. Without coordinated action across these domains, the urban food environment will continue to favor UPF consumption and exacerbate adolescent obesity. The next section synthesizes these findings into broader implications for public health policy in Indonesia.

CONCLUSIONS

The consumption of ultra-processed foods (UPF) among urban adolescents is a complex phenomenon influenced by a combination of biological, behavioral, urban food environment, and digital exposure factors. Analysis in this study shows that high UPF consumption is not only caused by individual preferences, but also by the widespread availability of UPF, aggressive digital marketing strategies, and limited access to healthy foods in urban areas. Physiological mechanisms such as low satiety, high energy density, and the influence of additives on appetite regulation further accelerate the risk of obesity in adolescents. These findings confirm that adolescent obesity cannot be viewed as a behavioral problem alone, but rather as the result of interactions between the body, urban food culture, and the economic structures that support the ultra-processed food industry.

Mitigation efforts must go beyond individual education and include structural changes to the urban food environment. Policy-based interventions such as restricting UPF marketing to adolescents, implementing nutrition warning labels, and regulating the zoning of unhealthy food outlets around schools are proven to be important in reducing adolescents' exposure to risky foods. In addition, schools need to function as nutrition-safe spaces by providing healthy foods and restricting the sale of foods high in sugar, salt, and fat. The role of families, especially parents, is also crucial in creating a home environment that supports healthy food choices. Given the high use of digital media among adolescents, digital interventions and collaboration with social media platforms are also important components in reducing exposure to unhealthy food content.

With a comprehensive approach that integrates policy, education, food environment, digital interventions, and community participation, UPF consumption among urban adolescents can be significantly reduced. These strategies not only impact the reduction of obesity risk during adolescence but also lay the foundation for long-term health toward a healthier and more productive younger generation. Sustained and collaborative efforts among stakeholders are key to shaping a healthier eating culture in Indonesia's urban environments.

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