
The Digital-Nutritional Paradox: Screen Time and Eating Disorders Among the Adolescent Population in Kerala

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Abstract

Kerala state has 16.2% adolescents (7.8 Million) in the population. The most affected group in this rapidly changing scenario is adolescents, whose development is increasingly influenced by two converging trends: the widespread use of digital technology and a revolutionary shift in eating habits. The rise of lifestyle diseases in Kerala is not an isolated occurrence but a byproduct of rapid urbanization, digital penetration, and the globalization of food systems. The gadgets that are fueling this trend include mobile phones, which are used by 72.8% of students, followed closely by televisions with a usage rate of 65.4%. The multi-device setting that ensures the adolescents are always connected, moving from academic screen use to recreational activities. The metabolic consequences of screen time can be seen in the increased prevalence of overweight, obese, and metabolic syndrome cases among Kerala's adolescents. Adolescents who stay up late at night using screens often experience sleep problems, which are positively linked to anxiety, depression, and poor academic performance.

Key words

Screen time, Food habit, Digital dependence, Obesity

Introduction

The state of Kerala is a special case study in the realm of international public health, which is generally described by its high indices of social development that reflect the patterns of many Western countries despite lower per-capita income. This pattern of development, referred to as the “Kerala Model,” has allowed the state to progress to an advanced stage of epidemiological transition, where the main health issues are no longer communicable diseases but non-communicable diseases (NCDs) and lifestyle-related diseases. Kerala state has 16.2% adolescents (7.8 Million) in the population. The most affected group in this rapidly changing scenario is adolescents, whose development is increasingly influenced by two converging trends: the widespread use of digital technology and a revolutionary shift in eating habits. The simultaneous presence of excessive screen time and disordered eating patterns has created a complex public health issue that requires a critical investigation of the underlying sociocultural, physiological, and psychological factors.

The Digital-Nutritional Paradox: Screen Time and Eating Disorders Among the Adolescent Population in Kerala

Adolescents and the Digital Environment

The rise of lifestyle diseases in Kerala is not an isolated occurrence but a byproduct of rapid urbanization, digital penetration, and the globalization of food systems. Data from the National Family Health Survey (NFHS-5) and various regional studies highlight a significant uptick in obesity and metabolic disorders among the youth, coinciding with a period of near-universal access to smartphones and high-speed internet. This digital immersion was significantly accelerated by the COVID-19 pandemic, which necessitated a shift toward online education and increased recreational screen dependence. For the adolescent population, defined as individuals aged 10 to 19 years, this period is a critical phase of somatic and reproductive maturation, where the adoption of sedentary behaviors and unhealthy nutritional practices can have long-term health implications.¹

In Kerala, the percentage of the total disease burden attributable to NCDs has already reached 74.6% in the 15-69 age group, a figure significantly higher than the national average in India.⁴ This risk environment is especially evident in urban areas, where "obesogenic" conditions such as a lack of physical activity space and the high density of fast food outlets coexist with digital behavior. The literacy rate and economic development of the state have paradoxically led to earlier and more intense exposure to screens, even in highly educated families, creating a digital-nutritional nexus that defies traditional healthcare paradigms.⁴ In Kerala, the percentage of the total disease burden attributable to NCDs has already reached 74.6% in the 15-69 age group, a figure significantly higher than the national average in India.⁴ This risk environment is especially evident in urban areas, where "obesogenic" conditions such as a lack of physical activity space and the high density of fast food outlets coexist with digital behavior. The literacy rate and economic development of the state have paradoxically led to earlier and more intense exposure to screens, even in highly educated families, creating a digital-nutritional nexus that defies traditional healthcare paradigms.⁴

Quantitative Analysis of Screen Time Prevalence

The prevalence of high screen time (ST) among Kerala's adolescents has exceeded global health standards, which are set to restrict recreational screen time to less than two hours a day for individuals above two years of age. Studies carried out in urban Kerala, specifically targeting high school students, have shown that close to 87.7% of the total adolescent population spends time on screen media beyond the recommended two-hour limit.⁷

Screen Time Patterns and Distribution

Screen time engagement is more intense on weekends than on weekdays, as expected. On an average, students spend two hours on mobile phones during weekdays, which doubles to four hours on weekends.⁸ A study carried out in Thiruvananthapuram showed that although the mean screen time is moderate during weekdays (1.15 hours), the weekend screen time shows a dramatic rise, with 75.8% of students exceeding the two-hour limit on Sundays.¹⁰

The Digital-Nutritional Paradox: Screen Time and Eating Disorders Among the Adolescent Population in Kerala

Usage Characteristic	Weekday Average	Weekend Average	Percentage Exceeding Limit
Mobile Phone Use (Urban)	2.0 hours	4.0 hours	87.7%
Total Screen Media (Rural/Urban)	1.15 hours	> 2.0 hours	75.8% (Weekends)
Multi-gadget Use	High	High	~90%

The gadgets that are fueling this trend include mobile phones, which are used by 72.8% of students, followed closely by televisions with a usage rate of 65.4%. Other gadgets like video games (20%), computers (9.3%), and tablets (0.8%) also contribute to the cumulative usage.⁹ This is a multi-device setting that ensures the adolescents are always connected, moving from academic screen use to recreational activities.

Sociodemographic Determinants of Digital Dependence

The habits of screen use are greatly impacted by gender, economic status, and family dynamics. Being male has been recognized as a predictor of excessive screen use, with one study showing an odds ratio (OR) of 8.3 (95% CI: 1.7 -) for boys compared to girls.⁸ This is largely due to the increased use of digital gaming and technology-related hobbies among adolescent males. In contrast, girls spend considerable time on social media sites, although their cumulative hours of screen use sometimes trail those of boys in a particular age group.

Economic status has a complex association with digital behavior. Although higher socioeconomic status (Above Poverty Line) is generally associated with increased availability of gadgets, some evidence indicates that low socioeconomic status may be associated with reduced screen use, largely because of reduced smartphone use.⁵ Additionally, the education of parents has been found to have an influence; curiously, children of mothers with postgraduate education reported 80% screen use, while those with less-educated mothers reported nearly 100% screen use, suggesting that digital literacy among parents may act as a moderating variable in regulating screen use.⁵

Factor	Association with High Screen Time (Significance)
Male Gender	OR 8.3 (95%CI:1.7-)-8
Low Socioeconomic Status	OR 0.21 (95%CI:0.21)-8
Short Sleep Duration (< 6 hours)	OR 0.34 (95%CI:0.15)-9
Family Structure (Extended vs. Nuclear)	91% vs. 78% Exposure ⁵

The Digital-Nutritional Paradox: Screen Time and Eating Disorders Among the Adolescent Population in Kerala

Family structure is also a determinant of screen duration, with adolescents in extended families having a higher level of exposure (91%) than those in nuclear families (78%). This could be attributed to the fact that in extended families, there are multiple devices in the possession of adults, as well as different levels of screen viewing, thus increasing the chances of being exposed to screens in the background.⁵

Metabolic Consequences and the Rise of Obesity

The metabolic consequences of screen time can be seen in the increased prevalence of overweight, obese, and metabolic syndrome cases among Kerala's adolescents. Screen time is a strong predictor of sedentary lifestyle, which in turn leads to a decrease in energy expenditure. This, in turn, is associated with an increase in body fat percentage and an increased risk of metabolic disorders, which were hitherto seen in older adults.

Pediatric Metabolic Syndrome in Kerala

Metabolic Syndrome (MetS) refers to a group of factors, such as abdominal obesity, hypertension, and abnormal glucose metabolism, that raise the risk of heart disease and diabetes. In a focused study conducted on school-going children aged 11-13 years in Thiruvananthapuram, the prevalence of MetS in children was revealed to be 3.6%.¹¹ Although this is in line with the overall prevalence in India, the particular association with screen time is alarming. Children who spend more than two hours a day on screen time are at a 3.1 times increased risk of developing MetS (OR: 3.102, 95% CI: 1.008-9.57).¹¹

MetS Risk Factor	Adjusted Odds Ratio (OR)	95% Confidence Interval
Screen Time > 2 hours	3.102	1.005 - 9.57
Male Gender	3.842	1.227 - 12.025
Commuting by Vehicle to School	5.30	(Ref: Walking/Cycling)
Organized Physical Activity	12.314	(Absence of activity)

The factor that emerged as a key modifiable risk factor was “eating with screens on.” This habit interferes with the body’s mechanism to detect fullness, resulting in passive calorie overconsumption. Additionally, the absence of moderately vigorous physical activity (MVPA) and the preference for carbonated beverages over water are strongly linked to metabolic dysfunction in this population.¹¹

Adolescent Obesity and the NFHS-5 Perspective

The National Family Health Survey (NFHS-5) paints a grim picture of the obesity epidemic in Kerala. The state has one of the highest rates of overweight and obese populations in the country. For adolescents aged 15-19 years, the national data reveals a sharp increase of 125% and 288% in the prevalence of overweight among girls and boys, respectively, over the past decade.¹² In Kerala, the prevalence of obesity (BMI ≥

The Digital-Nutritional Paradox: Screen Time and Eating Disorders Among the Adolescent Population in Kerala

30.0) among women and men aged 15-49 years is estimated to be 9.8% and 6.7%, respectively.¹³

The rising trend of overweight in children under five years, from 2.1% in NFHS-4 to 3.4% in NFHS-5, is a precursor to the rising incidence of obesity in adolescents and adults. In urban South India, including Kerala, the prevalence of overweight and obesity among boys and girls is as high as 21.4% and 18.5%, respectively.¹¹ This phenomenon of "dual hardship" due to malnutrition, where there is a coexistence of undernutrition and increasing obesity, is characteristic of the present health scenario in the state.¹¹

Changing Food Habits: Ultra-Processed Foods and Digital Influence

The food habits of adolescents in Kerala have undergone a drastic transformation from healthy, fiber-rich foods to a diet dominated by ultra-processed foods (UPFs). These foods, which are high in caloric density and low in nutritional value, are marketed aggressively to the young generation through digital media.

Habits of Junk Food and UPF Consumption

A study done in Calicut among the youth (18-35 years) showed that 52% of the youth eat junk food several times a week, and 79% of them eat late at night.¹⁵ The main reasons for this are taste (77%) and habit (7%), which clearly show that the young generation gives more importance to taste and habit than to health. The health consequences of this are alarming, with 30% of the youth having prediabetic fasting blood sugar and 26% being overweight or obese.¹⁵

In the medical student population in Kozhikode, despite the fact that 98.2% were aware of the effects of unhealthy foods, 66.4% of them confessed to following an unhealthy diet.¹⁶ This is what is known as the "awareness-action gap," which is a significant barrier to public health measures. The consumption of Maida-based snacks and carbonated drinks, which may contain as much as six tablespoons of sugar per serving, is a common practice among adolescents.¹⁷

The Role of Online Food Delivery (OFD) Systems

The rise of online food delivery apps such as Swiggy and Zomato has completely transformed the accessibility of food. These apps provide convenience, diversity, and speed, which are extremely appealing to the tech-savvy generation of teenagers. Studies have shown that 68% of students have ordered food at least once a week, and 45% have shown an increase in fast food consumption because of these apps.¹⁸

The OFD apps make use of advanced digital marketing strategies such as push notifications and personalized discounts to trigger impulsive buying. This is especially seen during late-night sessions, which further aggravates the risks of weight gain and metabolic disorders. The "instant gratification" offered by these apps further decreases the preference for homemade meals and may result in eating alone, which is not very supportive of healthy portion sizes.¹⁸

The Digital-Nutritional Paradox: Screen Time and Eating Disorders Among the Adolescent Population in Kerala

Psychological Mechanisms: Mindless Eating and Distraction

The relationship between screen time and disordered eating is mediated by psychological variables, specifically "mindless eating." When a person is distracted by a screen during eating, the mental attention is diverted from the sensory experience of the food and the internal sensation of fullness.

Distraction-Induced Overeating

The presence of a screen during meals hinders the brain's capacity to register the amount and quality of food being ingested. This disruption in interoceptive awareness results in the consumption of higher amounts of food without the accompanying sensation of fullness. It has been observed that television viewing not only results in higher food intake during the same meal but also during the subsequent meal, as the memory of the first meal is not well developed.²¹

Mechanism of Mindless Eating	Impact on Intake	Physiological Outcome
Reduced Satiety Perception	High caloric intake	Weight gain
Impaired Memory of Meal	Increased next-meal hunger	Obesity risk
Habitual Snacking	Chronic overconsumption	Insulin resistance
Emotional Escapism	Binge eating triggers	MetS risk

Among Kerala's adolescents, 39.4% reported consuming food when stressed, sad, or bored states that are frequently accompanied by screen use as a form of escapism.¹⁷ This interplay between digital distraction and emotional eating creates a reinforcing cycle that is difficult to break, as both behaviors trigger the brain's reward centers.

The Impact of Social Media on Body Image

Social media sites are not only communication tools but also strong forces that shape body image and self-esteem. For adolescents, particularly girls, the "upward social comparison" made easy by the edited images on Instagram and Snapchat may result in body dissatisfaction. This is a known precursor to disordered eating, such as restrictive eating or binge eating.²³

In a study of adolescents in Kerala, only 43.6% of the group was satisfied with their body weight.¹⁷ The internalization of "thin" or "fit" ideals encouraged by social media influencers may result in drastic weight management practices. What is interesting is that even "body-positive" messages may sometimes have the opposite effect, as they still center on appearance rather than function.²³

Eating Disorders: Anorexia, Bulimia, and Binge Eating Risk

The Digital-Nutritional Paradox: Screen Time and Eating Disorders Among the Adolescent Population in Kerala

The psychological toll of digital immersion and dietary shifts has led to an increased risk of clinically significant eating disorders (EDs) among the youth in Kerala. These disorders, once considered rare in the Indian context, are becoming increasingly prevalent.

Prevalence of ED Risk Among Kerala Students

With the help of standardized instruments such as the Eating Attitudes Test-26 (EAT-26), the risk of eating disorders has been measured in different districts of Kerala. In a cross-sectional study conducted on 823 college students aged 18-22 years in Kollam and Kozhikode, the prevalence of risk of ED was found to be 29.4%.⁴ This implies that almost one-third of the students have abnormal eating attitudes.

The EAT-26 test measures the symptoms of eating disorders, which include "preoccupation with calories, the urge to vomit after meals, and the drive for thinness." A high risk is indicated by a score of 20 or more. The risk factors that are significantly associated with this include:

- **Socioeconomic Status:** Students in the highest income group (Social Class I) had a 9.60-fold higher likelihood of ED risk.⁴
- **Social Media Disorder (SMD):** Students addicted to social media were 1.69 times more likely to be at risk for an eating disorder.⁴
- **Body Mass Index (BMI):** Both underweight (APR 1.60) and overweight/obese students (APR 2.42) showed significantly higher risks, reflecting the psychological burden of body dissatisfaction across the weight spectrum.⁴

Assessment Tool	Population	Risk/Prevalence	Key Association
EAT-26	College Students (Kerala)	29.4% at risk	Social Media Disorder
BSMAS	College Students (Kerala)	~ clinical cut-off	High ED risk correlation
BMI Screening	Adolescents (Kerala)	26% Overweight	Body dissatisfaction

Gender and Diagnostic Evolution

Although eating disorders have been documented more among females, there is an increasing awareness of their effect on males. The diagnostic ratio is 1:10 in clinical settings, but in non-clinical settings, it is as close as 1:4.¹⁷ In the case of adolescents, boys are more likely to be affected by "Muscle Dysmorphia," a type of disordered eating and exercise behavior aimed at enhancing muscle mass, particularly due to "fitspiration" materials available on YouTube and Instagram.²³

The Digital-Nutritional Paradox: Screen Time and Eating Disorders Among the Adolescent Population in Kerala

The "Hidden Hunger" and Micronutrient Deficiencies

One of the most important aspects of the dietary transition in Kerala is the idea of "Hidden Hunger," which refers to the deficiency of vital minerals and vitamins despite an adequate or even excessive intake of calories. Adolescence is a stage of rapid growth, and as such, there is a need for more macro and micronutrients. However, the current diet of energy-dense but nutrient-poor UPFs results in a deficiency of iron, iodine, zinc, and vitamin A.²⁶

Impact on Physical and Cognitive Development

Micronutrient deficiencies in Kerala are most common in adolescent girls, causing anemia. In the Calicut study, 43% of the youth surveyed had anemia, which can cause fatigue, poor cognitive ability, and poor academic performance.¹⁵ This is alarming as micronutrient deficiencies can be passed down to the next generation.²⁶

The high intake of sugary drinks and junk food also contributes to the displacement of fruit and vegetable consumption. Only 14.2% of the medical students in Kozhikode eat fruits daily.¹⁶ This unbalanced diet weakens the immune system and contributes to the long-term risk of cardiovascular diseases and diabetes, which are already at epidemic proportions in the state.¹⁷

Digital Marketing and the Obesogenic Environment

The digital environment is heavily saturated with marketing for unhealthy foods. Teenagers, who spend between 7.6 to 10.2 hours in front of various screens daily, are the primary targets for these campaigns.²⁸

Influencers, Mukbang, and Food Vlogging

The emergence of food-related online content, such as "Mukbang" or "binge-eating" videos, has a significant effect on the eating habits of adolescents. Mukbang videos feature individuals eating large amounts of calorie-dense foods, which may lead to unhealthy eating practices and the consumption of larger portions of food.²⁹

For some adolescents, watching these videos may be a source of "vicarious satisfaction," which may decrease their own desire to overeat. But the regular viewing of these videos is more likely to stimulate their appetite and favor the consumption of food delivery and late-night meals.³¹ Influencers, who are trusted more than health professionals by teenagers, play a crucial role in determining their food preferences and the consumption of junk food.³²

Targeted Advertising and Neuromarketing

Food advertising on digital media is also hard for adolescents to distinguish as advertising, as it is embedded in entertainment content. Social media sites use the personal information of users to target advertising messages, ensuring that high-calorie, low-nutrient foods are always visible to the teenager on his or her feed.³³ Neuromarketing research indicates that these ads stimulate the pleasure centers

The Digital-Nutritional Paradox: Screen Time and Eating Disorders Among the Adolescent Population in Kerala

of the brain, making it hard for adolescents, whose prefrontal cortex (the area of the brain that controls impulses) is still developing, to resist these messages.³⁵

Academic Performance and the Cognitive Burden

The link between high screen time and poor diet has a direct impact on academic performance. The cognitive development of adolescents needs a steady supply of glucose and essential fatty acids, which are not provided by a diet of UPFs and sweet beverages.

Screen Time and Focus

High screen time is a strong predictor of poor focus and "sleep debt." Adolescents who stay up late at night using screens often experience sleep problems, which are positively linked to anxiety, depression, and poor academic performance.³⁷ The cognitive burden of "compulsive scrolling" and social comparisons leaves less mental capital for academic pursuits.

UPF Diet and Academic Outcomes

A strong dose-response relationship has been found between UPF diet and academic performance. Adolescents who consume the highest levels of ultra-processed foods have significantly poorer grades in basic subjects such as math and language. For instance, those in the highest tertile of UPF consumption had a GPA of 5.6 compared to 6.6 in the lowest tertile.⁴⁰

Subject Area	GPA (Low UPF Intake)	GPA (High UPF Intake)
Overall GPA	6.6	5.6
Language	7.0	6.0
Mathematics	6.2	5.2
English	6.6	5.7

This performance gap underscores the importance of nutritional quality during critical developmental periods. The lack of omega-3 fatty acids, vitamins, and minerals in the typical fast-food diet can hinder the formation of neural connections and executive function.⁴⁰

State Policy Interventions and the Path Forward

The Government of Kerala has recognized the escalating threat of lifestyle diseases and digital addiction, leading to the formulation of several key policies and programs.

Vision-2031 and the Comprehensive Nutrition Policy

Kerala is developing a comprehensive nutrition policy as part of its "Vision-2031" program. The objective is to transition the state from "food security" to "nutritional

The Digital-Nutritional Paradox: Screen Time and Eating Disorders Among the Adolescent Population in Kerala

security".²⁷ This policy aims to address the "nutrition paradox" by focusing on the dual burden of obesity and micronutrient deficiencies.

Key strategies include:

- **Nutrition as a Right:** Ensuring access to balanced, nutrient-rich food rather than just rice-based meals.²⁷
- **Age-Specific Dietary Guidelines:** Introducing guidelines to manage nutritional needs across different life stages, with a focus on adolescents.
- **School Midday Meal Enhancements:** Adding milk, eggs, meat, and pulses to improve protein and micronutrient intake.²⁷
- **Subhiksha Hotels:** Expanding affordable meal outlets to serve as "nutrition support hubs."

The 2023 Public Health Act and "Vibe 4 Wellness"

The Kerala Public Health Act, 2023, stresses the importance of the "One Health" concept and aims to reduce or eliminate conditions that lead to lifestyle diseases.⁶ In this context, the "Health and Happiness - Vibe 4 Wellness" campaign encourages four key pillars: healthy eating, physical activity, sound sleep, and self-care.⁴²

The campaign is aimed at school and college-going students, as well as young individuals and even food bloggers to spread the culture of wellness. The government also has plans to organize thousands of yoga clubs and popular wellness clubs to spread the message of leading an active lifestyle.⁴²

The Role of Community-Led Programs (Kudumbashree)

The "AmruthamNutrimix" project, which is managed by the Kudumbashree community network, is a successful example of a decentralized and community-managed nutrition program. Although it is currently implemented for children between 6 months and 3 years of age, and for pregnant and lactating women, the existing infrastructure of 241 women-managed units can be utilized for providing healthy and fortified food options to adolescents.⁴³

The Supplementary Nutrition Programme (SNP) under the Integrated Child Development Services (ICDS) also aims to provide nutritional support to out-of-school adolescent girls.¹

Synthesizing the Digital-Nutritional Nexus

The problem of youth health in Kerala is a complex phenomenon that cannot be addressed by working on screen time or eating habits alone. These two are inextricably linked, as digital platforms are the main distribution channels for the promotion of unhealthy foods, and the act of engaging with these platforms is the main driver of sedentary behavior and mindful distraction.

The Digital-Nutritional Paradox: Screen Time and Eating Disorders Among the Adolescent Population in Kerala

The evidence suggests that:

1. **Screen time prevalence is extremely high**, with over 87% of urban students exceeding recommended limits, driven by mobile phone usage and social media.⁷
2. **Nutritional transitions are toward UPFs and junk food**, facilitated by the convenience of online delivery apps and digital marketing.¹⁵
3. **Metabolic syndrome and obesity are rising**, with screen time acting as an independent risk factor for metabolic dysfunction.¹¹
4. **Disordered eating risk is significant**, affecting nearly 30% of college students, with a strong correlation to social media addiction and body image concerns.⁴
5. **State policies are evolving**, but the "awareness-action gap" remains a significant challenge for health education efforts.¹⁶

In order to ensure that the demographic dividend in Kerala remains protected, it is necessary that multi-sectoral interventions are carried out, which include digital wellness curriculum in schools, more stringent regulation of digital food advertising to children, and community-based initiatives that encourage healthy eating habits. The shift from food security to nutritional security, as planned in the 2031 vision, needs to focus on the adolescent group to ensure that the future generation remains healthy and productive.

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The Digital-Nutritional Paradox: Screen Time and Eating Disorders Among the Adolescent Population in Kerala

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