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# Impact of Screen Time and Sleep Duration on Adults' Body Mass Index– A Cross-Sectional Study

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## Abstract:

**Background**

Excessive screen exposure and inadequate sleep are increasingly common behaviours that may contribute to adult obesity through sedentary time, altered energy intake, and metabolic dysregulation. This study assessed the independent and combined associations of daily screen time and habitual sleep duration with body mass index (BMI) among adults.

**Methods**

This community-based cross-sectional study included 308 adults aged 18–60 years selected through systematic random sampling. Sociodemographic characteristics, screen exposure, habitual sleep duration, physical activity, dietary practices, and clinical history were recorded using a structured questionnaire. Height and weight were measured using standard procedures, and BMI was classified according to Asian adult thresholds. Group differences were examined using the independent-samples *t* test, one-way ANOVA, and chi-square test. Spearman's correlation and multiple linear regression were used to identify independent relationships with BMI.

**Results**

The mean age was 37.9±11.5 years, 53.6% were male, and 47.7% had BMI ≥23 kg/m². Mean BMI increased from 21.9±3.3 kg/m² among participants reporting <2 hours/day of screen time to 25.6±4.0 kg/m² among those reporting ≥6 hours/day ($p<0.001$); obesity increased from 11.8% to 42.9% ($p=0.003$). Short sleepers had higher mean BMI than those sleeping 7–9 hours (25.2±4.0 versus 23.0±3.7 kg/m²) and a higher prevalence of obesity (40.6% versus 16.5%; both $p<0.001$). Screen time correlated positively with BMI ($r=0.34$), whereas sleep duration correlated inversely ($r=-0.23$; both $p<0.001$). Each additional hour of screen time was associated with a 0.30 kg/m² increase in BMI, while short sleep was associated with a 0.91 kg/m² higher BMI after adjustment. Participants with screen time ≥4 hours and sleep <7 hours had 5.63-fold higher crude odds of BMI ≥23 kg/m².

**Conclusion**

Higher screen exposure and short sleep were independently and jointly associated with greater BMI. Adult obesity-prevention strategies should integrate screen reduction, adequate sleep, increased physical activity, and interruption of prolonged sedentary periods.

## Keywords:

body mass index; obesity; screen time; sedentary behaviour; sleep duration

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## Introduction

Excess body weight is a major public-health concern because of its association with type 2 diabetes mellitus, cardiovascular disease, musculoskeletal disorders, several cancers, and premature mortality. Globally, approximately 880 million adults were living with obesity in 2022; age-standardised obesity prevalence reached 18.5% among women and 14.0% among men [1]. India is also experiencing a rapid nutritional transition. The National Family Health Survey-5 reported that 24.0% of women and 22.9% of men aged 15–49 years were overweight or obese, compared with 20.6% and 18.9%, respectively, in NFHS-4 [2].

The widespread use of smartphones, computers, televisions, and other digital devices has substantially increased screen-based sedentary behaviour. Prolonged screen time may contribute to increased body mass index (BMI) by reducing energy expenditure, displacing physical activity, encouraging distracted eating and exposure to food advertising, and promoting consumption of energy-dense snacks [3]. Although adult evidence remains heterogeneous, screen-based sedentary behaviour—particularly television viewing—has demonstrated more consistent associations with obesity than total sitting time [3]. Among young adults, greater leisure screen time has also been associated with higher BMI, waist circumference, fat mass, and adverse cardiometabolic markers, independent of overall sedentary time and physical activity [4].

Sleep duration represents another potentially modifiable determinant of body weight. Evidence syntheses suggest that seven to eight hours of sleep per night is most consistently associated with favourable adult health outcomes [5]. A dose–response meta-analysis found that, below seven hours, each one-hour reduction in sleep duration was associated with an approximately 9% higher risk of obesity [6]. Sleep restriction may alter leptin and ghrelin signalling, increase hunger and hedonic food intake, impair glucose metabolism, prolong opportunities for eating, and reduce motivation for physical activity [7].

Screen time and sleep are closely interrelated: evening device use may delay bedtime, increase cognitive arousal, suppress melatonin through light exposure, and reduce sleep duration and efficiency [8]. Earlier adult research also suggests that greater television viewing and shorter sleep may coexist with obesity [9]. However, these behaviours are frequently examined independently, and evidence regarding their combined relationship with BMI remains limited and context-specific. Therefore, this study aimed to assess the independent and combined associations of screen time and sleep duration with BMI among adults.

## Material and Methods

### Study design and setting

A community-based cross-sectional study was conducted in the urban field-practice area of the Department of Community Medicine, Medical college and Hospital in North India, between 12 months between June 2024 and May 2025. The study was designed to assess the independent and combined associations of daily screen time and habitual sleep duration with body mass index (BMI) among adults. Reporting of the study was planned in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology guidelines.

### Study population and eligibility criteria

Adults aged 18–60 years who had resided in the selected area for at least six months were eligible. Individuals who provided written informed consent and were able to independently respond to the questionnaire were included. Pregnant women, women within six months postpartum, bedridden individuals, and persons with ascites, generalized oedema, limb amputation, severe spinal deformity,

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or any medical condition preventing reliable measurement of height or weight were excluded. Participants receiving long-term corticosteroid therapy or medications known to cause substantial weight change were recorded, rather than routinely excluded, and considered during adjusted analysis.

**Sample size and sampling procedure**

The sample size was calculated using the single-population-proportion formula, n=Z2p(1−p)/d2. Considering an anticipated overweight/obesity prevalence of 24%, based on the National Family Health Survey-5, a 95% confidence level, and 5% absolute precision, the minimum sample size was 280. After allowing for a 10% non-response or incomplete-data rate, the final required sample was 308 adults. Households were selected through systematic random sampling using an updated household list. The sampling interval was obtained by dividing the total number of households by the required sample. The first household was selected randomly, followed by every kth household. When more than one eligible adult was present, one participant was selected using a simple random method. A maximum of two repeat visits were made when the selected participant was unavailable.

**Data-collection procedure**

Data were collected through face-to-face interviews using a pretested, structured questionnaire administered in the participant's preferred language. The questionnaire included age, sex, marital status, education, occupation, socioeconomic status, tobacco and alcohol use, dietary practices, diagnosed chronic illnesses, medication use, and shift-work status. Physical activity was assessed using the International Physical Activity Questionnaire–Short Form and categorised as low, moderate, or high according to its standard scoring protocol.

Screen exposure was assessed using a modified adult Screen Time Questionnaire covering television, smartphones, tablets, desktop or laptop computers, and gaming devices. Participants reported average device use separately for weekdays and weekends and for occupational/educational and recreational purposes. They were instructed not to double-count simultaneous use of multiple devices. Average daily screen time was calculated as: {(weekday hours×5)+(weekend hours×2)}/7. Total screen time was analysed continuously and categorised as <2, 2 – <4, 4 – <6, and ⩾ 6 hours/day. For the combined-behaviour analysis, high screen time was defined as ⩾4 hours/day.

Habitual sleep duration during the preceding month was assessed from usual bedtime, sleep-onset latency, final awakening time, and wakefulness after sleep onset. Average sleep duration was calculated separately for weekdays and weekends and expressed as a weighted daily average. Sleep was classified as short (<7 hours/day), recommended (7–9 hours/day), or long (>9 hours/day). Information regarding sleep quality, daytime sleepiness, snoring, diagnosed sleep disorders, and use of sleep medication was also recorded as potential covariates.

**Anthropometric assessment and outcome definition**

Body weight was measured to the nearest 0.1 kg using a calibrated digital weighing scale, with participants wearing light clothing and no footwear. Standing height was measured to the nearest 0.1 cm using a portable stadiometer, with the participant's head positioned in the Frankfort horizontal plane. Two measurements were obtained, and their mean was used; a third measurement was taken when the first two differed by more than 0.5 kg for weight or 0.5 cm for height. BMI was calculated as weight in kilograms divided by height in metres squared. Using Asian adult cut-offs, participants were classified as underweight (<18.5 kg/m$^2$), normal weight (18.5 – 22.9 kg/m$^2$), overweight (23.0 – 24.9 kg/m$^2$), or obese (⩾25.0 kg/m$^2$).

**Statistical analysis**

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Data were entered into Microsoft Excel, checked for completeness, and analysed using IBM SPSS Statistics, version 20.0. Continuous variables were summarised as mean±standard deviation or median with interquartile range, whereas categorical variables were presented as frequency and percentage. BMI across screen-time and sleep-duration categories was compared using independent-samples t test or one-way analysis of variance with appropriate post-hoc testing. Categorical BMI status was compared using the chi-square test. Pearson's or Spearman's correlation was used to examine relationships between screen time, sleep duration, and BMI.

Multiple linear regression was performed with BMI as the continuous dependent variable. Screen time and sleep duration were entered simultaneously, with adjustment for age, sex, socioeconomic status, occupation, physical activity, diet, tobacco and alcohol use, chronic illness, medication use, and shift work. Binary logistic regression was additionally used to estimate adjusted odds ratios and 95% confidence intervals for overweight/obesity. An interaction term between screen time and sleep duration was examined, and participants were compared across combined exposure categories. Multicollinearity, normality and homoscedasticity of residuals, and influential observations were assessed before interpretation. A two-sided p value <0.05 was considered statistically significant.

**Ethical considerations**

Ethical approval was obtained from the Institutional Ethics Committee before commencement of the study. Written informed consent was obtained from every participant. Privacy was maintained during interviews and anthropometric measurements, and all records were anonymised and stored securely with access restricted to the research team.

## Results

Among 308 participants, the mean age was 37.9 ± 11.5 years, 53.6% were male, and 147 (47.7%) had BMI ⩾23 kg/m². Participants with BMI ⩾23 kg/m² were significantly older than those with BMI <23 kg/m² (40.4 ± 10.9 versus 35.7 ± 11.6 years; p<0.001) and were more frequently married (76.9% versus 64.6%; p=0.026). Sedentary occupation (49.0% versus 28.6%; p<0.001), low physical activity (55.8% versus 29.2%; p<0.001), family history of obesity (35.4% versus 22.4%; p=0.016), diabetes mellitus (15.0% versus 5.6%; p=0.011), and hypertension (20.4% versus 8.7%; p=0.006) were more common in the higher-BMI group. Screen exposure also differed significantly: 34.0% of participants with BMI ⩾23 kg/m² reported ⩾6 hours/day compared with 16.8% in the lower-BMI group (p<0.001). Short sleep was more frequent in the higher-BMI group (53.1% versus 31.1%), while recommended sleep was less frequent (42.9% versus 62.7%; p<0.001). Gender and education were not significantly associated with BMI status (Table 1).

***Table 1. Sociodemographic, clinical, and behavioural characteristics of participants according to BMI status (N=308).***

| Characteristic | Total (N=308) | BMI <23 kg/m² (n=161) | BMI ≥23 kg/m² (n=147) | p value |
|---|---|---|---|---|
| | frequency (%)/mean±SD | | | |
| **Age, years** | **37.9±11.5** | **35.7±11.6** | **40.4±10.9** | **<0.001** |
| **Gender** | | | | |
| **Male** | **165 (53.6)** | **92 (57.1)** | **73 (49.7)** | **0.23** |

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| | | | | |
|---|---|---|---|---|
| **Female** | **143 (46.4)** | **69 (42.9)** | **74 (50.3)** | |
| **Marital status** | | | | |
| **Unmarried** | **91 (29.5)** | **57 (35.4)** | **34 (23.1)** | **0.026** |
| **Married** | **217 (70.5)** | **104 (64.6)** | **113 (76.9)** | |
| **Education** | | | | |
| **No formal/primary** | **44 (14.3)** | **19 (11.8)** | **25 (17.0)** | **0.481** |
| **Secondary** | **76 (24.7)** | **38 (23.6)** | **38 (25.9)** | |
| **Higher secondary/diploma** | **91 (29.5)** | **49 (30.4)** | **42 (28.6)** | |
| **Graduate or above** | **97 (31.5)** | **55 (34.2)** | **42 (28.6)** | |
| **Occupation** | | | | |
| **Non-sedentary** | **190 (61.7)** | **115 (71.4)** | **75 (51.0)** | **<0.001** |
| **Sedentary** | **118 (38.3)** | **46 (28.6)** | **72 (49.0)** | |
| **Physical activity** | | | | |
| **Low** | **129 (41.9)** | **47 (29.2)** | **82 (55.8)** | **<0.001** |
| **Moderate** | **139 (45.1)** | **82 (50.9)** | **57 (38.8)** | |
| **High** | **40 (13.0)** | **32 (19.9)** | **8 (5.4)** | |
| **Family history of obesity** | | | | |
| **Present** | **88 (28.6)** | **36 (22.4)** | **52 (35.4)** | **0.016** |
| **Absent** | **220 (71.4)** | **125 (77.6)** | **95 (64.6)** | |
| **Present** | **31 (10.1)** | **9 (5.6)** | **22 (15.0)** | |
| **Absent** | **277 (89.9)** | **152 (94.4)** | **125 (85.0)** | |
| **Hypertension** | | | | |
| **Present** | **44 (14.3)** | **14 (8.7)** | **30 (20.4)** | **0.006** |
| **Absent** | **264 (85.7)** | **147 (91.3)** | **117 (79.6)** | |
| **Daily screen-time category** | | | | |
| **<2 hours** | **34 (11.0)** | **25 (15.5)** | **9 (6.1)** | **<0.001** |
| **2–<4 hours** | **86 (27.9)** | **54 (33.5)** | **32 (21.8)** | |
| **4–<6 hours** | **111 (36.0)** | **55 (34.2)** | **56 (38.1)** | |
| **≥6 hours** | **77 (25.0)** | **27 (16.8)** | **50 (34.0)** | |
| **Sleep duration, hours** | **6.8±1.2** | **7.0±1.1** | **6.6±1.2** | **0.002** |
| **Sleep-duration category** | | | | |
| **Recommended sleep, 7–9 hours** | **164 (53.2)** | **101 (62.7)** | **63 (42.9)** | **<0.001** |
| **Long sleep, >9 hours** | **16 (5.2)** | **10 (6.2)** | **6 (4.1)** | |
| **BMI, kg/m²** | **24.0±4.2** | **20.6±1.8** | **27.7±2.8** | **<0.001** |

Mean BMI increased progressively across screen-time categories, from 21.9±3.3 kg/m² among participants reporting <2 hours/day to 25.6±4.0 kg/m² among those reporting ≥6 hours/day ($p<0.001$). Correspondingly, obesity increased from 11.8% to 42.9% across these categories ($p=0.003$). Participants with short sleep had a higher mean BMI than those obtaining the recommended 7–9 hours of sleep (25.2±4.0 versus 23.0±3.7 kg/m²), and obesity was substantially more frequent among short sleepers (40.6% versus 16.5%; both $p<0.001$). The combined-exposure analysis demonstrated the highest mean BMI and obesity prevalence among participants with screen time ≥4 hours/day and sleep <7 hours/day (26.0±4.0 kg/m² and 51.8%, respectively), compared with 22.5±3.4 kg/m² and 13.0% among those with lower screen time and sleep ≥7 hours. Relative to this reference group, the crude odds of BMI ≥23 kg/m² were 1.69-fold with short sleep alone, 1.89-fold with high screen time alone,

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and 5.63-fold when high screen time and short sleep coexisted (Table 2).

*Table 2. Association of screen time, sleep duration, and their combined exposure with BMI categories (N=308).*

| Parameter | BMI, kg/m² | Underweight (n=36) | Normal weight (n=125) | Overweight (n=65) | Obese (n=82) |
|---|---|---|---|---|---|
| | mean±SD | Frequency (%) | | | |
| **Daily screen time** | | | | | |
| <2 hours | 21.9±3.3 | 7 (20.6) | 18 (52.9) | 5 (14.7) | 4 (11.8) |
| 2–<4 hours | 23.1±3.6 | 10 (11.6) | 44 (51.2) | 18 (20.9) | 14 (16.3) |
| 4–<6 hours | 24.2±3.8 | 13 (11.7) | 42 (37.8) | 25 (22.5) | 31 (27.9) |
| ≥6 hours | 25.6±4.0 | 6 (7.8) | 21 (27.3) | 17 (22.1) | 33 (42.9) |
| p value | <0.001 | 0.003 | | | |
| **Sleep duration** | | | | | |
| Short sleep, <7 hours | 25.2±4.0 | 10 (7.8) | 40 (31.3) | 26 (20.3) | 52 (40.6) |
| Recommended sleep, 7–9 hours | 23.0±3.7 | 24 (14.6) | 77 (47.0) | 36 (22.0) | 27 (16.5) |
| Long sleep, >9 hours | 23.5±4.1 | 2 (12.5) | 8 (50.0) | 3 (18.8) | 3 (18.8) |
| p value | <0.001 | <0.001 | | | |
| **Combined exposure category** | | | | | |
| Screen time <4 hours and sleep ≥7 hours | 22.5±3.4 | 10 (13.0) | 44 (57.1) | 13 (16.9) | 10 (13.0) |
| Screen time <4 hours and sleep <7 hours | 23.4±3.6 | 7 (16.3) | 18 (41.9) | 10 (23.3) | 8 (18.6) |
| Screen time ≥4 hours and sleep ≥7 hours | 23.7±3.8 | 16 (15.5) | 41 (39.8) | 26 (25.2) | 20 (19.4) |
| Screen time ≥4 hours and sleep <7 hours | 26.0±4.0 | 3 (3.5) | 22 (25.9) | 16 (18.8) | 44 (51.8) |
| p value | <0.001 | <0.001 | | | |
| Crude OR (95% CI) | – | 1 | 1.69 (0.78–3.68) | 1.89 (1.02–3.54) | 5.63 (2.87–11.07) |

*BMI categories were defined as underweight <18.5 kg/m², normal weight 18.5–22.9 kg/m², overweight 23.0–24.9 kg/m², and obesity ≥25.0 kg/m². Crude odds ratios were calculated for BMI ≥23 kg/m², using screen time <4 hours/day with sleep ≥7 hours/day as the reference. BMI: body mass index; SD: standard deviation; OR: odds ratio; CI: confidence interval.*

Daily screen time demonstrated a moderate positive correlation with BMI ($r=0.34$, $p<0.001$), whereas sleep duration ($r=-0.23$, $p<0.001$) and physical activity ($r=-0.20$, $p<0.001$) were inversely correlated with BMI. Screen time was also inversely related to sleep duration ($r=-0.29$, $p<0.001$) and physical activity ($r=-0.18$, $p=0.002$), indicating that greater screen exposure was associated with both shorter sleep and lower activity levels. The correlation between sleep duration and physical activity was weak and statistically non-significant ($r=0.09$, $p=0.116$) (Table 3).

*Table 3. Correlations among daily screen time, sleep duration, physical activity, and BMI (N=308).*

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| Variable | Daily screen time | Sleep duration | Physical activity | BMI |
|---|---|---|---|---|
| Daily screen time | 1 | −0.29 (<0.001) | −0.18 (0.002) | 0.34 (<0.001) |
| Sleep duration | −0.29 (<0.001) | 1 | 0.09 (0.116) | −0.23 (<0.001) |
| Physical activity | −0.18 (0.002) | 0.09 (0.116) | 1 | −0.20 (<0.001) |
| BMI | 0.34 (<0.001) | −0.23 (<0.001) | −0.20 (<0.001) | 1 |

*Spearman's correlation coefficients; Screen time and sleep duration were measured in hours/day, physical activity in metabolic equivalent task-minutes per week, and BMI in kg/m². BMI: body mass index.*

After multivariable adjustment, each additional hour of daily screen time was associated with a 0.30 kg/m² increase in BMI (95% CI 0.15–0.45; β=0.21; p<0.001), making screen time the strongest standardised predictor. Short sleep was independently associated with a 0.91 kg/m² higher BMI compared with recommended sleep duration (95% CI 0.22–1.60; p=0.010). BMI also increased by 0.46 kg/m² for every 10-year increase in age (p=0.003). Low physical activity (B=1.17; p=0.003), sedentary occupation (B=0.66; p=0.037), and family history of obesity (B=0.79; p=0.021) remained significant independent predictors. Female sex, long sleep duration, and moderate physical activity were not independently associated with BMI (all p>0.05) (Table 4).

***Table 4. Multiple linear regression analysis of independent predictors of BMI among adults (N=308).***

| Predictor | Adjusted B | 95% CI | Standardised β | p value |
|---|---|---|---|---|
| Age, per 10-year increase | 0.46 | 0.16 to 0.76 | 0.16 | 0.003 |
| Female sex | 0.54 | −0.18 to 1.26 | 0.07 | 0.142 |
| Screen time, per additional hour/day | 0.3 | 0.15 to 0.45 | 0.21 | <0.001 |
| Short sleep, <7 hours | 0.91 | 0.22 to 1.60 | 0.12 | 0.01 |
| Long sleep, >9 hours | 0.26 | −1.49 to 2.01 | 0.01 | 0.771 |
| Low physical activity | 1.17 | 0.39 to 1.95 | 0.14 | 0.003 |
| Moderate physical activity | 0.44 | −0.24 to 1.12 | 0.06 | 0.205 |
| Sedentary occupation | 0.66 | 0.04 to 1.28 | 0.08 | 0.037 |
| Family history of obesity | 0.79 | 0.12 to 1.46 | 0.09 | 0.021 |

*BMI was entered as a continuous dependent variable. B represents the unstandardised regression coefficient, β the standardised coefficient, and CI the confidence interval. Reference categories were male sex, recommended sleep duration of 7–9 hours, high physical activity, non-sedentary occupation, and absence of a family history of obesity. BMI: body mass index; CI: confidence interval.*

## Discussion

The present study demonstrates a substantial burden of excess body weight and identifies screen exposure and insufficient sleep as independent correlates of BMI among adults. Nearly half of the participants (47.7%) had BMI ⩾23 kg/m², including 21.1% who were overweight and 26.6% who were obese. This burden is higher than the 28.6% prevalence of generalised obesity reported by the nationally representative ICMR–INDIAB study, although the difference is partly attributable to the present study's use of lower Asian BMI thresholds and its urban sampling context [10]. Participants with higher BMI were older and more frequently married, sedentary, physically inactive, hypertensive, diabetic, or had a family history of obesity. These characteristics reflect the clustering of age-related, behavioural, hereditary, and metabolic determinants of adiposity.

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A clear dose – response pattern was observed between screen exposure and BMI. Mean BMI increased from 21.9±3.3 kg/m² among participants with <2 hours/day of screen time to 25.6±4.0 kg/m² among those reporting ≥6 hours/day, while obesity increased from 11.8% to 42.9%. Each additional hour of screen exposure remained associated with a 0.30 kg/m² increase in BMI after adjustment (β=0.21, p<0.001). Hu et al. similarly reported that every additional 2 hours/day of television viewing was associated with a 23% higher risk of incident obesity among 50,277 women [11]. In the EPIC-Norfolk study, the difference in adjusted BMI between the most active/lowest-viewing and least active/highest-viewing groups was 1.92 kg/m² in women and 1.44 kg/m² in men [12]. Kolovos et al. also found significant associations of screen time, sleep, and physical activity with overweight and obesity in Mexican adults [13]. Prolonged screen use may lower energy expenditure, displace active behaviour, encourage prolonged sitting and mindless snacking, and increase exposure to food cues. Bedtime device use may additionally impair sleep initiation and efficiency, as demonstrated among 844 adults by Exelmans and Van den Bulck [14].

Short sleep was reported by 41.6% of participants and was strongly related to adiposity. Short sleepers had a higher mean BMI than those sleeping 7–9 hours (25.2±4.0 versus 23.0±3.7 kg/m²), and obesity was more frequent among them (40.6% versus 16.5%). After adjustment, short sleep remained associated with a 0.91 kg/m² higher BMI. Comparable findings were reported by Longo-Silva et al., who observed a 0.40 kg/m² reduction in BMI for every additional hour of sleep among Brazilian adults [15]. A meta-analysis involving 604,509 adults estimated 55% higher odds of obesity among short sleepers and a 0.35 kg/m² reduction in BMI per additional hour of sleep [16]. Watanabe et al. further found that men sleeping <5 hours had 1.91-fold higher odds of developing obesity over one year [17]. Long sleep was not significantly associated with BMI in the present study, but the small number of long sleepers limited statistical precision.

Importantly, screen time and sleep duration were inversely correlated (r=−0.29), and their coexistence showed the greatest association with excess weight. Participants reporting both ≥4 hours/day of screen time and <7 hours of sleep had a mean BMI of 26.0±4.0 kg/m², an obesity prevalence of 51.8%, and 5.63-fold higher crude odds of BMI ≥23 kg/m² compared with those having lower screen exposure and ≥7 hours of sleep. This pattern suggests a potentially compounding relationship, although formal biological or statistical interaction cannot be inferred from cross-sectional data. Sleep restriction may reduce leptin and increase ghrelin, thereby enhancing hunger and preference for calorie-dense foods [18]. Experimental studies have also shown increased energy and fat intake without compensatory energy expenditure during restricted sleep [19], along with late-night caloric consumption and short-term weight gain [20]. Conversely, Tasali et al. found that extending sleep among adults with overweight reduced energy intake by approximately 270 kcal/day [21].

Low physical activity, sedentary occupation, and family history of obesity remained independent predictors of BMI, while screen time correlated inversely with physical activity (r=−0.18). These findings support viewing screen time, sleep, and physical activity as interconnected components of the 24-hour behavioural cycle. Evidence from more than one million adults indicates that higher physical activity can substantially attenuate the adverse consequences of prolonged sitting [22]. Thus, obesity-prevention strategies should integrate screen reduction, adequate sleep, regular activity, and interruption of prolonged sitting. Nevertheless, the observed associations should be interpreted without causal attribution because reverse causality and residual confounding remain possible in a cross-sectional study.

**Limitations**

This study has several limitations. Its cross-sectional design precludes determination of temporality or

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causality and permits reverse causation. Screen time, sleep duration, dietary practices, and physical activity were self-reported and therefore susceptible to recall and social-desirability bias. Residual confounding from unmeasured occupational, psychological, and environmental factors is possible. Finally, recruitment from a single field-practice area and the small long-sleep subgroup may limit generalisability and precision.

## Conclusion

This study identified a high burden of excess body weight, with 47.7% of adults having BMI ≥23 kg/m². Higher screen exposure showed a graded relationship with BMI, while short sleep was independently associated with greater adiposity. Participants reporting both ≥4 hours of screen time and <7 hours of sleep had the highest mean BMI and markedly greater odds of overweight/obesity. Low physical activity and sedentary occupation further increased BMI. These findings highlight screen time, sleep, and physical activity as interconnected modifiable behaviours. Integrated interventions promoting reduced screen use, adequate sleep, regular activity, and interruption of prolonged sitting may support obesity prevention. Longitudinal studies are needed to confirm causality.

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