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# Social media use and foetal growth restriction among pregnant women: a cross-sectional study

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## Abstract

# Background

Social media use is increasingly prevalent during pregnancy and may influence maternal and foetal health through behavioural and psychological pathways. Its effects on sleep patterns, stress levels, and lifestyle behaviours may be particularly relevant to pregnancy outcomes. However, evidence regarding the association between social media use and foetal growth restriction (FGR) remains limited and inconsistent. This study aimed to evaluate the relationship between social media usage duration, usage patterns, and social media addiction in pregnant women and FGR.

# Methods

This analytical cross-sectional study included 200 pregnant women, of whom 93 (46.5%) were diagnosed with FGR. Demographic and obstetric characteristics, along with social media usage data, were collected using structured questionnaires. Daily social media use was categorised as < 2 hours, 2–<4 hours, and ≥ 4 hours. Social media addiction was assessed using the Bergen Social Media Addiction Scale (BSMAS) and analysed both as a continuous variable and categorically using a threshold of ≥ 19. Multivariate logistic regression analysis was performed to identify independent predictors of FGR.

# Results

In unadjusted analyses, daily social media use and BSMAS scores were not significantly associated with FGR ($p = 0.661$ and $p = 0.936$, respectively). However, in multivariate analysis, social media use of 2–<4 hours per day was identified as an independent factor associated with increased FGR risk compared to < 2 hours of use (adjusted odds ratio [aOR] = 2.39, 95% CI: 1.17–4.91; $p = 0.017$). No significant association was observed for ≥ 4 hours of use ($p = 0.938$). BSMAS scores, platform type, sleep changes related to social media use, and self-reported stress/anxiety were not independently associated with FGR. Maternal age and low parity were identified as significant predictors.

# Conclusions

Moderate social media use was independently associated with FGR, whereas total usage duration and addiction levels were not. These findings suggest that the relationship between social media use and pregnancy outcomes may be non-linear, with usage patterns potentially more relevant than total exposure. The results should be interpreted as hypothesis-generating and warrant confirmation in prospective studies.

# Trial registration:

Not applicable.

# BACKGROUND

With the widespread adoption of digital technologies, social media usage has increased significantly, particularly among women of reproductive age, and has become an integral part of daily life(1). Today, social media is used as an important resource during pregnancy for accessing health-related information, sharing experiences and providing social support. However, although the potential effects of behavioural and psychological impacts arising from the duration, intensity and form of social media use on the pregnancy process and perinatal outcomes have been the subject of numerous studies, they have not been sufficiently elucidated(2) .

It has been demonstrated that social media use influences lifestyle factors such as sleep patterns, psychological stress, anxiety levels and physical activity(3, 4). It has been shown that these factors may affect foetal development via maternal neuroendocrine responses and placental hormone metabolism(5–7). In particular, it has been suggested that sleep disturbances and increased stress levels may have adverse effects on foetal growth via neuroendocrine responses and uteroplacental blood flow(6) .

FGK is a pathological condition characterised by the foetus failing to reach its biological growth potential, typically defined as an estimated foetal weight below the 10th percentile for gestational age and/or accompanied by signs of uteroplacental insufficiency(8). FGK is one of the leading causes of perinatal morbidity and mortality, arising primarily as a result of uteroplacental perfusion disorders associated with chronic hypoxia, inadequate nutrient and oxygen transfer(9) .

The aetiology of FGR is multifactorial, involving a complex interaction of maternal, placental and foetal factors. Advanced maternal age, low socioeconomic status, smoking, malnutrition and chronic maternal illnesses are among the well-established risk factors(10). However, the impact of behavioural factors related to maternal lifestyle on foetal growth has attracted increasing attention in recent years. In particular, it has been demonstrated that impaired sleep quality during pregnancy may have a direct effect on foetal biometric parameters; significant associations have been reported between poor sleep quality and reductions in growth indicators such as abdominal circumference and femur length(11, 12). Furthermore, a sedentary lifestyle associated with increased screen time may negatively affect uteroplacental perfusion and foetal nutrient transfer by influencing maternal cardiometabolic status. Indeed, high mobile device usage and the accompanying low levels of physical activity have been shown to be an independent risk factor for low birth weight(13, 14). On the other hand, it has been reported that increased psychological stress associated with social media addiction may indirectly affect foetal development via maternal neuroendocrine responses, and that increased stress levels during pregnancy may negatively affect prenatal attachment processes(15). When all these findings are considered together, it becomes clear that digital exposure is not merely a behavioural habit, but a multidimensional exposure capable of exerting biological effects on the maternal-foetal axis. However, current data

regarding the relationship between modern lifestyle components, such as social media use, and FGK are limited, and the clinical significance of this relationship has not yet been clearly established.

Whilst current data highlight the effects of social media use on mental well-being during pregnancy, studies evaluating the relationship between duration and pattern of use and direct obstetric and perinatal outcomes are limited, and findings are inconsistent. Furthermore, it has been reported that social media use may not exhibit a linear effect, and that different levels of use may be associated with different maternal and foetal outcomes(16). Therefore, it is necessary to assess not only the temporal dimension of social media use but also the usage pattern and level of addiction. The aim of this study is to investigate the relationship between the duration of social media use, usage pattern and social media addiction in pregnant women and foetal growth restriction, and to identify the independent determinants of this relationship.

# METHODS

## Study design and participants

This cross-sectional study was conducted at Silvan State Hospital between May 2025 and February 2026. The study included 200 women with singleton pregnancies who presented for routine obstetric follow-up. Multiple pregnancies, cases with known foetal anomalies, patients with diagnosed placental invasion anomalies, pregnant women with a diagnosis of pre-gestational or gestational diabetes or hypertension, and cases with amniotic fluid anomalies were excluded from the study. Additionally, patients with missing data were excluded from the study.

Pregnant women assessed between 28 and 32 weeks of gestation were included in the study. It was confirmed that all participants were covered by social security and had a monthly household income within the range of 50,000–100,000 TL. Consequently, the sample was considered homogeneous in terms of gestational age, access to healthcare and household income, and confounding effects associated with these variables were minimised.

## Definition of foetal growth restriction

The diagnosis of FGR was based on the estimated foetal weight (EFW) being below the 10th percentile for the gestational week and/or the presence of findings indicative of uteroplacental insufficiency. Assessment of uteroplacental insufficiency was based on the presence of findings such as an increased pulsatility index (PI) and reduced or absent diastolic flow on umbilical artery Doppler examination. Where necessary, middle cerebral artery (MCA) Doppler measurements and the cerebropulmonary ratio (CPR) were assessed.

Gestational age was determined based on the last menstrual period and/or first-trimester ultrasound measurements. In the foetal biometric assessment, estimated foetal weight was calculated using

measurements of biparietal diameter, head circumference, abdominal circumference and femur length. All ultrasound assessments were performed by the same experienced obstetrician in accordance with standard protocols.

## Data collection

Demographic and clinical data were obtained from patient records. Participants' age, body mass index (BMI), gravidity, parity, history of abortion, educational level, income level, smoking status, alcohol consumption and presence of chronic diseases were recorded.

Data regarding social media use were collected via structured questionnaires. Participants were asked about their daily social media usage time, daily mobile phone usage time, the most frequently used social media platform, the impact of social media use on sleep patterns, and stress/anxiety levels associated with social media use.

The questionnaire used in this study was developed by the authors based on the study objectives and relevant literature regarding social media use during pregnancy. The Bergen Social Media Addiction Scale (BSMAS), a previously validated instrument, was incorporated into the questionnaire to assess social media addiction. The English-language version of the questionnaire is provided as Supplementary Material 1(17).

## Assessment of social media use and addiction

Daily social media usage duration was categorised into three groups: <2 hours, 2–<4 hours, and ≥ 4 hours. Social media addiction was assessed using the Bergen Social Media Addiction Scale (BSMAS). The scale consists of six items, each scored on a scale of 1–5. The total score ranges from 6 to 30. In the analyses, the BSMAS was evaluated both as a continuous variable and as a categorical variable using a threshold value of ≥ 19.

# Statistical Analysis

All statistical analyses were performed using Python (version 3.11; Python Software Foundation) with the scipy, statsmodels, and scikit-learn libraries. Continuous variables were tested for normality using the Shapiro–Wilk test. As none of the continuous variables met the assumption of normality, they are presented as the median and interquartile range (IQR) and compared between groups using the Mann–Whitney U test. Categorical variables are expressed as frequencies and percentages and were compared using Pearson's chi-square test or Fisher's exact test, as appropriate.

Daily social media usage duration was categorised into three groups: less than 2 hours, 2 to less than 4 hours, and 4 hours or more per day. Crude odds ratios (OR) with 95% confidence intervals (CI) were calculated for each category using binary logistic regression, with the less-than-2-hours group as the

reference. Bergen Social Media Addiction Scale (BSMAS) scores were analysed both as a continuous variable and as a binary categorical variable using a validated cut-off of 19, with scores of 19 or above classified as indicating high addiction.

Platform type was analysed as a dummy variable in logistic regression models, with Instagram designated as the reference category. Crude and adjusted odds ratios were calculated for TikTok and WhatsApp relative to Instagram.

Multivariable binary logistic regression was performed to identify independent predictors of foetal growth restriction. Variables with $p < 0.20$ in the univariate analysis, together with clinically relevant confounders identified a priori (maternal age, body mass index, smoking status, parity, and education level), were included in the adjusted models. Three separate models were constructed: Model 1 included categories of social media usage duration; Model 2 included the BSMAS total score as a continuous variable; and Model 3 included platform type as dummy variables. Adjusted odds ratios (aOR) with 95% CIs are reported.

The discriminative performance of continuous predictors for foetal growth restriction was evaluated using receiver operating characteristic (ROC) curve analysis. The area under the curve (AUC) was calculated for daily social media usage, the BSMAS total score, and BMI. The optimal cut-off value for each variable was determined by maximising the Youden index (J = sensitivity + specificity − 1).

Correlations among social media-related variables were assessed using Spearman's rank correlation coefficient. Differences in BSMAS scores across platform groups were evaluated using the Kruskal–Wallis H test.

A two-tailed p-value of less than 0.05 was considered statistically significant in all analyses.

## RESULTS

# Demographic and Clinical Characteristics

The study included 200 pregnant women; 93 of these (46.5%) were diagnosed with foetal growth restriction (FGR), whilst 107 (53.5%) formed the control group. Smartphone ownership was almost universal in both groups (98.0%; n = 196) and no significant difference was observed between the groups ($p = 1.000$). Women in the FGR group were older (median 28.0 years, IQR 24.0–33.0; $p = 0.016$), had a higher BMI (27.3 kg/m², IQR 24.6–29.0; $p = 0.008$) and had a lower parity ($p = 0.023$)(Table 1). Educational level showed a significant difference between the groups; the proportion of primary school graduates was markedly higher in the FGK group (61.8% vs. 38.2%; $p = 0.015$).

Table 1
Demographic and Clinical Characteristics

| Variable | FGK Present (n = 93) Median (IQR) | No FGK (n = 107) Median (IQR) | p-value |
|---|---|---|---|
| **Continuous Variables** | | | |
| Age (years) | 28.0 (24.0–33.0) | 25.0 (22.5–30.0) | 0.016* |
| BMI (kg/m²) | 27.3 (24.6–29.0) | 24.8 (22.8–27.9) | 0.008** |
| Gestational age | 2.0 (1.0–3.0) | 3.0 (1.0–4.0) | 0.504 |
| Parity | 1.0 (0.0–2.0) | 1.0 (0.0–2.0) | 0.023* |
| Daily telephone usage (hours) | 3.0 (2.0–4.0) | 4.0 (2.0–5.0) | 0.322 |
| Daily social media time (hours) | 2.0 (1.0–3.0) | 2.0 (1.0–3.0) | 0.661 |
| Total BSMAS score | 9.0 (6.0–12.0) | 9.0 (6.0–14.0) | 0.936 |
| **Categorical variables — n (%)** | | | |
| Primary school graduate | 34 (61.8%) | 21 (38.2%) | |
| Secondary school graduate | 22 (46.8%) | 25 (53.2%) | |
| High school graduate | 19 (31.7%) | 41 (68.3%) | |
| University graduate | 18 (47.4%) | 20 (52.6%) | 0.015 |
| Smoking (yes) | 2 (11.8%) | 15 (88.2%) | 0.006** |
| Alcohol consumption (yes) | 7 (50.0%) | 7 (50.0%) | 0.297 |
| Chronic illness (yes) | 19 (67.9%) | 9 (32.1%) | 0.023 |
| SM sleep effect (yes) | 29 (45.3%) | 35 (54.7%) | 0.395 |
| SM stress report (yes) | 9 (40.9%) | 13 (59.1%) | 0.346 |

Mann–Whitney U test (continuous variables); chi-square test (categorical variables). *p < 0.05 **p < 0.01 ***p < 0.001. IQR: interquartile range.

## Categorical Analysis of Social Media Usage Duration

The median daily social media usage duration did not differ between women with and without FGK (2.0 hours in both groups; p = 0.661). When usage duration was divided into three categories (< 2 hours per

day, 2–<4 hours, ≥ 4 hours), no statistically significant difference was found between the groups in the raw analysis ($\chi^2 = 3.705$; $p = 0.157$)(Table 2).

Table 2
Social Media Usage Duration Categories and Their Relationship with FGS (Univariate)

| Social Media Duration Category | n | FGK Present n(%) | No FGK n(%) | Crude OR (95% CI) | p (Fisher) | Total $\chi^2$ |
|---|---|---|---|---|---|---|
| < 2 hours (reference) | 96 | 43 (44.8%) | 53 (55.2%) | 1.00 (reference) | — | |
| 2–4 hours | 72 | 39 (54.2%) | 33 (45.8%) | 1.46 (0.79–2.69) | 0.275 | $\chi^2$=3.705 |
| ≥ 4 hours | 32 | 11 (34.4%) | 21 (65.6%) | 0.65 (0.28–1.49) | 0.409 | p = 0.157 |

Fisher's exact test (pairwise OR). Reference category: <2 hours/day.

# Bergen Social Media Addiction Scale (BSMAS) Analysis

Total BSMAS scores were similar in the FGK and control groups (median 9.0, IQR 6.0–12.0 and 9.0, IQR 6.0–14.0, respectively; p = 0.936). Only 11 participants (5.5%) fell into the high dependence category with a BSMAS threshold of ≥ 19(Table 3).

Table 3
BSMAS Categorical Analysis and Relationship with FGK

| BSMAS Category | n | FGK Present n(%) | No FGK n(%) | Crude OR (95% CI) | p (Fisher) | Continuous (p) |
|---|---|---|---|---|---|---|
| Low (< 19) — reference | 189 | 89 (47.1%) | 100 (52.9%) | 1.00 (reference) | — | |
| High (≥ 19) | 11 | 4 (36.4%) | 7 (63.6%) | 0.64 (0.18–2.27) | 0.549 | p = 0.936 |

Fisher's exact test. Continuous BSMAS: Mann–Whitney U test. As n = 11 in the high-dependency group, caution should be exercised when interpreting the findings.

# Platform Analysis

A total of 184 participants who used Instagram (n = 114), TikTok (n = 31) or WhatsApp (n = 39) as their primary social media platform were assessed. The prevalence of FGK was found to be 45.6%, 61.3% and 56.4%, respectively. In the crude analysis, the overall $\chi^2$ was not significant (p = 0.215). Following multivariate adjustment, platform type was not identified as an independent risk factor(Tablo 4).

Table 4
Relationship between FGK and Platform Type — Comparison of Raw and Adjusted ORs

| Platform | n | FGK Present n(%) | No FGK n(%) | Crude OR (95% CI) | Crude p | Adjusted OR (95% CI) | Adjusted OR p |
|---|---|---|---|---|---|---|---|
| Instagram (ref) | 114 | 52 (45.6%) | 62 (54.4%) | 1.00 (ref) | — | 1.00 (ref) | — |
| TikTok | 31 | 19 (61.3%) | 12 (38.7%) | 1.89 (0.84–4.25) | 0.157 | 1.28 (0.49–3.31) | 0.612 |
| WhatsApp | 39 | 22 (56.4%) | 17 (43.6%) | 1.54 (0.74–3.21) | 0.270 | 0.95 (0.38–2.37) | 0.916 |
| Overall $\chi^2$ | | | | $\chi^2$=3.077 | p = 0.215 | — | — |

Crude OR: 2×2 Fisher's exact test. aOR: adjusted logistic regression for age, BMI, smoking, parity and educational level. Reference: Instagram users.

# Multivariate Logistic Regression

After adjusting for age, BMI, smoking, parity and educational level, social media use of 2–4 hours per day was identified as an independent risk factor for FGK **(aOR = 2.39, 95% CI 1.17–4.91; p = 0.017)** as shown in Table 5 and illustrated in Fig. 2. Those using social media for ≥ 4 hours per day did not reach the threshold of statistical significance (aOR = 0.96; p = 0.938). Among the covariates, age, parity and educational level emerged as consistent independent predictors. The total BSMAS score was not found to be independently associated (aOR = 1.01; p = 0.740).

Table 5
Multivariate Logistic Regression — SM Duration Model

| Variable | aOR | 95% CI | p-value | Significance |
|---|---|---|---|---|
| **Social Media Variables (ref: <2 hours)** | | | | |
| 2–4 hours/day of social media use | 2.39 | 1.17–4.91 | 0.017 | * |
| ≥ 4 hours/day of SM use | 0.96 | 0.38–2.44 | 0.938 | n.s. |
| **Covariates** | | | | |
| Age (years) | 1.14 | 1.06–1.23 | < 0.001 | *** |
| BMI (per kg/m²) | 1.07 | 0.98–1.17 | 0.115 | n.s. |
| Smoking (yes) | 0.17 | 0.03–0.82 | 0.028 | * |
| Parity | 0.59 | 0.44–0.79 | < 0.001 | *** |
| Level of education | 0.56 | 0.40–0.78 | < 0.001 | *** |

Model: FGK ~ SM duration category + age + BMI + smoking + parity + education. aOR: adjusted odds ratio. n.s.: not significant. *p < 0.05 ***p < 0.001.

# ROC Curve Analysis

ROC curve analysis revealed that the predictive performance of daily social media usage time (AUC = 0.482) and the total BSMAS score (AUC = 0.497) for predicting FGK remained at chance level as summarised in Table 6 and illustrated in Fig. 1. BMI demonstrated moderate discriminatory performance (AUC = 0.609; optimal threshold = 25.2 kg/m²). These findings suggest that social media variables do not function as clinical predictors of FGK on their own.

Table 6
Summary Table of ROC Analysis

| Variable | AUC | 95% CI (boot.) | Optimal Threshold | Comment |
|---|---|---|---|---|
| Daily SM duration (hours) | 0.482 | — | 0.5 hours | Luck level (low) |
| BSMAS total score | 0.497 | — | 7.0 | Probability level (low) |
| BMI (kg/m²) | 0.609 | — | 25.2 kg/m² | Moderate level |

# Correlations Among Social Media Variables

Spearman's correlation analysis revealed a moderate positive relationship between daily social media usage time and the total BSMAS score (r = 0.443; p < 0.001)(Table 7). High BSMAS scores were associated with social media-related sleep disturbance (r = − 0.400; p < 0.001). This negative sign stems from the variable being coded as 1 = yes / 2 = no and corresponds to a positive relationship from a clinical perspective.

Table 7
Spearman Correlations Among SM Variables

| Variable pair | r (Spearman) | p-value | Strength | Interpretation |
|---|---|---|---|---|
| SM duration ↔ Total BSMAS | + 0.443 | < 0.001 | *** | Moderate-to-strong positive |
| SM duration ↔ Sleep disorder | −0.176 | 0.013 | * | Weak (code: 1 = yes) |
| SM duration ↔ SM stress | −0.183 | 0.010 | * | Weak (code: 1 = yes) |
| BSMAS ↔ Sleep disorder | −0.400 | < 0.001 | *** | Moderate (code: 1 = yes) |
| BSMAS ↔ SM stress | −0.325 | < 0.001 | *** | Moderate (code: 1 = yes) |
| Sleep disorder ↔ SM stress | + 0.285 | < 0.001 | *** | Weak-moderate positive |

Spearman's rho for all variables. Negative r values: as the relevant variables are coded as 1 = yes/2 = no, a high score is coded in the opposite direction to high risk; in clinical interpretation, this indicates a positive relationship.

# Distribution of BSMAS Scores by Platform Type

BSMAS scores showed a significant difference according to primary platform type as illustrated in Fig. 3(Kruskal–Wallis H = 26.740; p < 0.001). TikTok users had the highest median BSMAS score (12.0; IQR 9.0–15.5). This was followed by Instagram users (10.0; IQR 7.0–13.0). WhatsApp users' scores were found to be significantly lower (6.0; IQR 6.0–8.5).

# DISCUSSION

There are few studies in the current literature examining the effects of social media use on pregnancy outcomes. Studies have primarily focused on prenatal depression, anxiety and social support, and there is little data assessing the direct association with obstetric outcomes. In this regard, our study contributes to the literature by establishing a link between social media use and preterm birth, a clinical obstetric outcome.

The most striking finding of our study is that social media use of 2–4 hours per day increases the risk of FGA by approximately 2.4 times compared to the low-use group. Notably, the fact that this association did not reach statistical significance in univariate analyses but became significant when potential confounding variables such as age, educational level, BMI and parity were controlled for suggests that the relationship between social media use and FGK has a complex and multifactorial structure. This suggests that the association may have been masked in the raw analyses, particularly because younger women and those with higher levels of education tend to be both heavier social media users and have a lower baseline obstetric risk profile. The finding in our study that smoking is inversely associated with FGR is contrary to biological expectations and can be explained by the low number of smokers and potential selection bias.

The adverse effects of social media use on foetal growth can be explained by several key mechanisms. The first of these is the deterioration in sleep quality during pregnancy(11) **.** The literature indicates that poor sleep quality throughout pregnancy leads to a direct reduction in foetal growth parameters such as abdominal circumference and femur length(12). Social media use may trigger this process by suppressing melatonin secretion, particularly through screen exposure extending into the late hours of the night. The significant association identified in our study between social media usage duration and sleep disturbance supports this biological mechanism.

The second critical mechanism is a sedentary lifestyle and reduced physical activity. Prolonged screen exposure may increase inactivity in pregnant women, thereby paving the way for cardiometabolic changes that affect foetal development. The CHAT study conducted in Australia reported that sedentary behaviours associated with high mobile phone usage are an independent risk factor for low birth weight(13). The findings of our study contribute to the literature by demonstrating this association not only in terms of birth weight but also through clinically defined FGR.

In our study, platform-based analyses revealed that the prevalence of FGK was numerically higher among TikTok users; however, this association did not retain its significance as an independent risk factor in multivariate analyses. Furthermore, the significantly higher BSMAS addiction scores among TikTok users align with the addictive effects of platform designs such as ‘endless scrolling’ and ‘algorithmic recommendations’ described in the literature. It is known that increased psychological stress associated with social media addiction may indirectly affect foetal development via maternal neuroendocrine responses. This psychological burden may exert indirect yet persistent effects on the maternal-foetal axis(15) .

Another notable finding of our study is that the relationship between social media use and FGK is not linear. This may be explained by a possible threshold effect or differing patterns of user behaviour. The fact that usage of 2–4 hours per day is associated with an increased risk, whereas usage of ≥ 4 hours is not found to be significant, suggests that the effects of social media usage are not homogeneous and that different levels of usage may lead to different biological and behavioural outcomes.

# LIMITATIONS

The limited number of participants with a BSMAS score of ≥ 19 (n = 11) may have restricted the ability to establish a statistically significant relationship between social media addiction and FGK. The cross-sectional study design does not allow for the establishment of a causal relationship between variables. Furthermore, the fact that data on social media use are self-reported may lead to measurement error and recall bias. The low discriminatory power of social media-related variables in the ROC analysis indicates that these parameters are not suitable for use as a standalone screening tool in clinical practice. Additionally, the fact that the study was conducted at a single centre may limit the generalisability of the results. Although the sample was homogeneous in terms of health insurance and income level, unmeasured lifestyle factors such as dietary habits, physical activity levels and psychosocial support may act as sources of residual confounding.

## CONCLUSION

It was observed that moderate social media use during pregnancy is independently associated with restricted fetal growth; however, no significant association was found between total usage time and social media addiction and FGR. These findings suggest that the effect of social media use on pregnancy outcomes may not be linear, and that usage patterns may be more determinative than total exposure. As highlighted in the literature, social media usage duration is associated with foetal growth via maternal sleep quality, sedentary behaviour and prenatal stress(11, 15, 17). These findings point to the potential importance of digital lifestyle factors during pregnancy for maternal-foetal health and necessitate more comprehensive clinical research in this area. However, prospective studies with larger sample sizes are needed to confirm this association.

## Abbreviations

FGR
Fetal growth restriction
BSMAS
Bergen Social Media Addiction Scale
BMI
Body mass index
EFW
Estimated foetal weight
PI
Pulsatility index
MCA
Middle cerebral artery
CPR
Cerebroplacental ratio
ROC
Receiver operating characteristic
AUC
Area under the curve
IQR
Interquartile range
OR
Odds ratio
aOR
Adjusted odds ratio
CI
Confidence interval

# Declarations

### Ethics approval and consent to participate

As Silvan State Hospital does not have an independent clinical research ethics committee, ethical approval for this study was obtained from the Clinical Research Ethics Committee of Gazi Yaşargil Training and Research Hospital, the authorised regional ethics committee for surrounding state hospitals. This study was approved by the Clinical Research Ethics Committee of Gazi Yaşargil Training and Research Hospital (Approval No: 150, Date: 07/04/2026), and all procedures were conducted in accordance with the Declaration of Helsinki. Written informed consent was obtained from all participants.

### Consent for publication

Not applicable.

## Conflicts of interest

The authors declare that they have no competing interests.

## Funding

No financial support was received for this study.

## Author Contribution

G.K. conceived and designed the study, collected the data, and drafted the manuscript.Y.B. contributed to the study design, data interpretation, and critical revision of the manuscript.K.U. contributed to data analysis and manuscript revision.All authors read and approved the final manuscript.

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## Data Availability

The datasets generated and analysed during this study are not publicly available due to privacy restrictions but are available from the corresponding author on reasonable request.

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# Figures

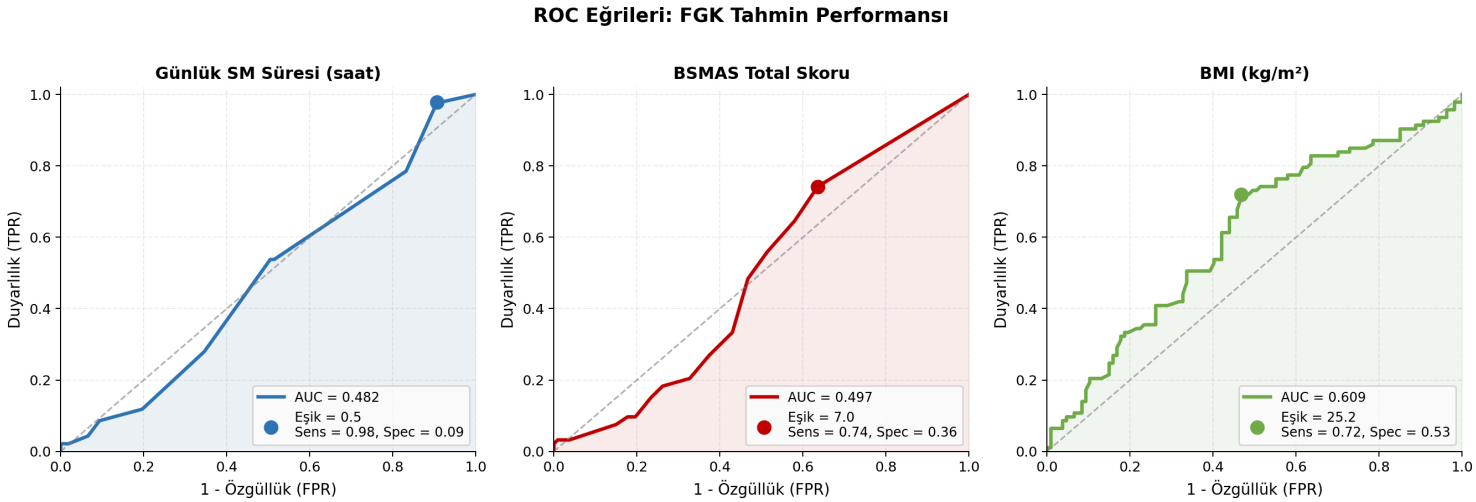



**Figure 1**

**ROC Curves — FGK Prediction Performance**

AUC: Area under the curve. The optimal threshold was determined by maximising the Youden index (J = Sensitivity + Specificity − 1).

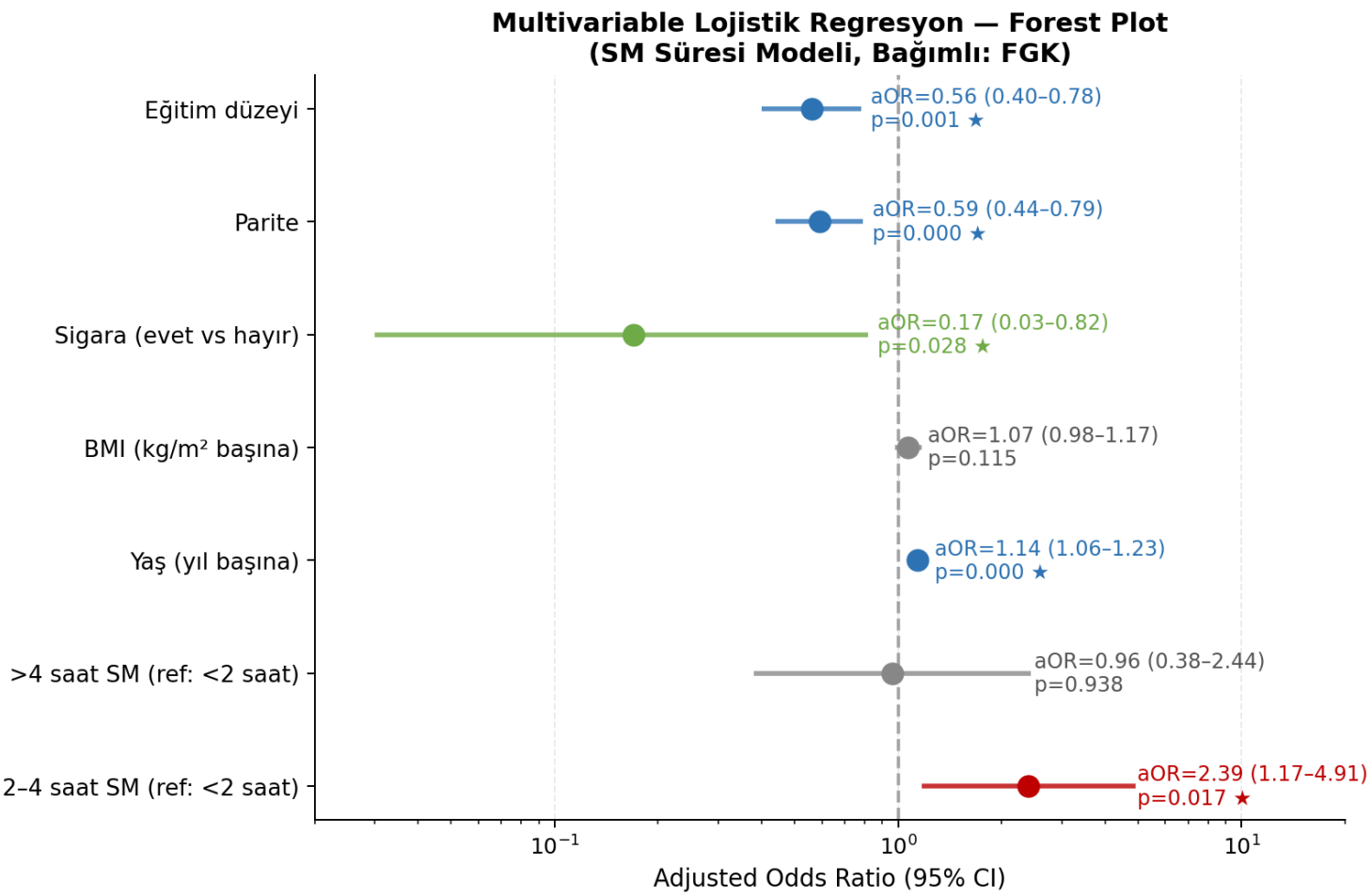



**Figure 2**

**Forest Plot — Multivariate Logistic Regression (SM Duration Model)**

aOR and 95% CI are shown on a logarithmic scale. The vertical dashed line indicates OR=1.0. An asterisk (*) indicates p<0.05.

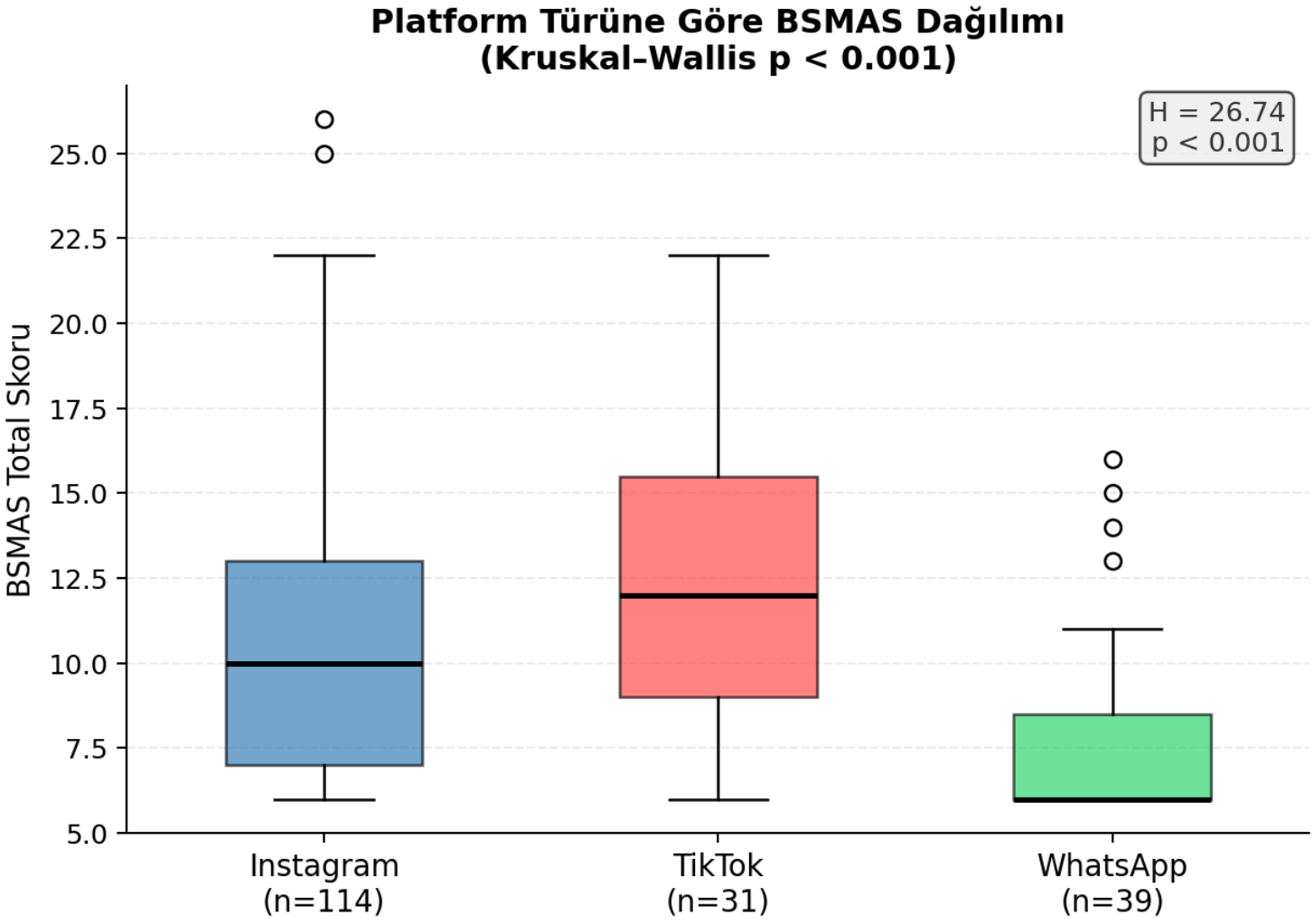



**Figure 3**

**Distribution of BSMAS by Platform Type (Boxplot)**

Kruskal–Wallis H = 26.740; p < 0.001. Horizontal line: median. Box: IQR. Whiskers: 1.5×IQR.

## Supplementary Files

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