

Association Between Third-Trimester Maternal Healthy Lifestyle Behaviors and Infant Birth Weight: A Single-Center Observational Study

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Abstract

Background: The relationship between multidimensional healthy lifestyle behaviors during pregnancy and infant birth weight remains uncertain. We examined this association in a third-trimester antenatal sample.

Methods: In this single-center observational study, 115 pregnant women completed the 29-item Healthy Lifestyle Behaviors in Pregnancy Scale during third-trimester antenatal care in Istanbul, Türkiye, between December 16, 2024, and April 16, 2025. Infant birth weight and gestational age at delivery were obtained by postpartum telephone contact. Associations were examined using Pearson correlation and multivariable linear regression with heteroskedasticity-robust standard errors.

Results: Mean maternal age was 30.41 ± 5.71 years, mean scale score was 108.83 ± 18.72 , and mean reported birth weight was 3188.70 ± 574.32 g. The total score correlated with birth weight ($r = 0.436$; $p < 0.001$). The adjusted estimate was 8.75 g per point (95% CI, 1.10-16.40; $p = 0.025$).

Conclusions: Higher third-trimester healthy lifestyle scores were associated with higher reported infant birth weight after adjustment for measured characteristics. Unmeasured confounding and maternal reporting of birth outcomes limit causal interpretation.

Keywords: pregnancy; birth weight; healthy lifestyle; prenatal care; observational study

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Received: 24.06.2026 Accepted: 30.09.2026

Cite this article as: Kurtal M., Kovalak E. E. & Altuntas M. Association Between Third-Trimester Maternal Healthy Lifestyle Behaviors and Infant Birth Weight: A Single-Center Observational Study Eur J Hum Health.2026;6(3): 34-40.

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Introduction

Birth weight is a routinely recorded indicator of conditions during pregnancy and of health risks around birth. Low birth weight remains common globally, and progress in reducing its prevalence has been insufficient [1]. The same birth weight may have different implications for an infant born preterm and one born at term: a low value can reflect shortened gestation, restricted fetal growth, or both [2]. Consequently, weight should also be considered in relation to gestational age and infant sex when assessing size at birth [3]. These distinctions matter when a study examines birth weight as a continuous outcome, because an association with heavier birth weight does not necessarily imply improved neonatal health across the entire distribution.

Antenatal care offers a setting in which maternal nutrition, activity, and other health-related behaviors can be discussed and supported [4]. Systematic reviews of maternal dietary patterns have reported associations between healthier patterns and several birth outcomes, including infant size, but the included studies differ in the populations studied, timing of assessment, definitions of diet, and handling of potential confounders [5,6]. Dietary behavior is also only one part of everyday life during pregnancy. A combined measure may capture how several behaviors occur together, although it can be more difficult to identify which component, if any, accounts for an observed association.

Experimental evidence calls for caution in interpreting observational lifestyle findings. A meta-analysis of individual participant data from randomized trials found that diet- and physical-activity-based interventions reduced gestational weight gain, while effects on offspring outcomes were less clear [7]. A separate systematic review of randomized physical activity trials found a lower risk of macrosomia but no significant associations for its other examined birth-weight outcomes [8]. These findings suggest that the direction and clinical meaning of an association between self-reported healthy behaviors and infant weight cannot be inferred from the scale score alone. Gestational duration, maternal characteristics, and the possibility of both small and large infant size must also be considered.

The Healthy Lifestyle Behaviors in Pregnancy Scale was developed and validated in Turkish pregnant women. Its 29 items assess six domains: pregnancy responsibility, hygiene, nutrition, physical activity, travel, and acceptance of pregnancy [9]. The total

score provides a multidimensional description of reported behavior rather than a measure of dietary intake or exercise dose. Education and household income may be related to both opportunities for healthy behavior and pregnancy outcomes; socioeconomic inequalities in adverse pregnancy outcomes have been documented in a systematic review [10]. Accounting for measured social characteristics is therefore relevant, although it cannot remove confounding by factors that were not collected.

Evidence directly relating this multidimensional scale, assessed in the third trimester, to subsequent infant birth weight is limited. We examined the association between the total scale score and reported birth weight among women attending a single antenatal clinic. We also explored correlations for the individual scale domains. We expected higher total scores to be associated with birth weight after adjustment for gestational age at delivery, infant sex, maternal age, education, and income. Because the study was observational and key maternal factors were not available, these analyses were designed to estimate associations rather than causal effects.

Methods

Study design and participants

This single-center observational study recruited pregnant women attending the antenatal follow-up clinic of Istanbul Bağcılar Training and Research Hospital, University of Health Sciences, Istanbul, Türkiye, from December 16, 2024, through April 16, 2025. Eligible women were aged 18-45 years, in the third trimester, registered with the clinic, without a pregnancy-related complication under the study eligibility criteria, and willing to provide written informed consent. Women outside these criteria or declining participation were excluded. The sample comprised 115 women. The thesis described a target minimum sample of 111 based on a prior study; its original power calculation should not be interpreted as a calculation for the adjusted regression reported here.

Data collection and measures

At the antenatal visit, participants completed a researcher-designed sociodemographic and obstetric form and the Healthy Lifestyle Behaviors in Pregnancy Scale in a face-to-face interview. The validated Turkish scale has 29 items scored from 1 to 5, six domains, and a possible total score of 29-145; higher scores indicate more favorable self-reported behaviors [9]. After delivery, the researcher contacted mothers by telephone and recorded reported infant sex, gestational age at birth, and birth weight. Birth weights were not independently verified against delivery records in the available

dataset. Dates of later electronic transcription of questionnaires were not treated as interview dates.

Outcomes and statistical analysis

The primary outcome was birth weight in grams. The primary exposure was the total lifestyle score. Descriptive statistics were calculated for continuous and categorical variables. Pearson correlations were used for exploratory unadjusted analyses. An adjusted ordinary least squares model included the total score, gestational age at birth, infant sex, maternal age, education (four categories), and household income (three categories); HC3 robust standard errors were used. The primary coefficient is presented with a 95% confidence interval and two-sided p value. Model R² is descriptive. Exploratory domain correlations were not adjusted for multiple comparisons and should not be interpreted as independent effects.

The available records did not support adjustment for prepregnancy body mass index, gestational weight

gain, smoking, or detailed diet.

Ethics

The Istanbul Medipol University Non-Interventional Clinical Research Ethics Committee approved the study on December 6, 2024 (E-10840098-202.3.02-7470). Written informed consent was obtained for antenatal participation, according to the thesis.

Results

The 115 participants had a mean age of 30.41 ± 5.71 years. Mean gestational age at the antenatal interview was 32.17 ± 2.77 weeks; mean gestational age at delivery was 38.00 ± 1.51 weeks. Mean reported infant birth weight was 3188.70 ± 574.32 g. There were 59 male and 56 female infants (Table 1).

Table 1. Participant and infant characteristics

Characteristic	Value
Participants	115
Maternal age, years	30.41 ± 5.71
Gestational age at interview, weeks	32.17 ± 2.77
Gestational age at birth, weeks	38.00 ± 1.51
Male infants	59 (51.3%)
Female infants	56 (48.7%)
Birth weight, g	3188.70 ± 574.32
Total lifestyle score	108.83 ± 18.72

Values are mean ± standard deviation or n (%). Infant outcomes were reported by mothers after delivery.

The total lifestyle score showed a moderate positive unadjusted correlation with birth weight (r = 0.436; p < 0.001; Table 2 and Figure 1). All six domain scores also showed positive unadjusted correlations (Table

2). Because domains were analyzed separately without multiplicity adjustment, the domain findings are exploratory.

Table 2. Unadjusted correlations between lifestyle scores and birth weight

Scale score	Pearson r	p value
Pregnancy responsibility	0.312	<0.001
Hygiene	0.243	0.009
Nutrition	0.397	<0.001
Physical activity	0.349	<0.001
Travel	0.385	<0.001
Acceptance of pregnancy	0.374	<0.001
Total score	0.436	<0.001

n = 115. Domain analyses are exploratory; p values are two-sided and unadjusted for multiple comparisons.

In the adjusted model, each one-point higher total score was associated with 8.75 g higher birth weight (95%

CI, 1.10-16.40; p = 0.025). The complete adjusted model, including all education and income coefficients, is shown in Table 3. The model R² was 0.563. The estimate remains an observational association.

Table 3. Complete adjusted linear regression model for infant birth weight

Predictor	Adjusted difference, g	95% CI	p value
Total lifestyle score, per point	8.75	1.10 to 16.40	0.025
Gestational age at birth, per week	212.26	150.82 to 273.70	<0.001
Male infant vs female	207.21	43.57 to 370.84	0.014
Maternal age, per year	-5.43	-21.41 to 10.55	0.502
Middle school vs primary or less	-6.68	-374.35 to 360.99	0.971
High school vs primary or less	-128.07	-535.12 to 278.98	0.534
University or above vs primary or less	12.10	-454.86 to 479.06	0.959
Income approximately twice minimum wage vs ≤minimum wage	36.15	-217.18 to 289.48	0.778
Income ≥three times minimum wage vs ≤minimum wage	108.30	-200.33 to 416.93	0.488
Intercept	-5776.84	-7850.22 to -3703.45	<0.001

Ordinary least squares regression with HC3 robust standard errors and t inference (residual df = 105); n = 115; R² = 0.563. Education reference: no literacy, basic literacy, or primary school (n = 22); middle school n = 25; high school n = 25; university or higher n = 43. Income reference: below or at minimum wage (n = 60); approximately twice minimum wage n = 33; three times or more n = 22. Coefficients are conditional differences in grams.

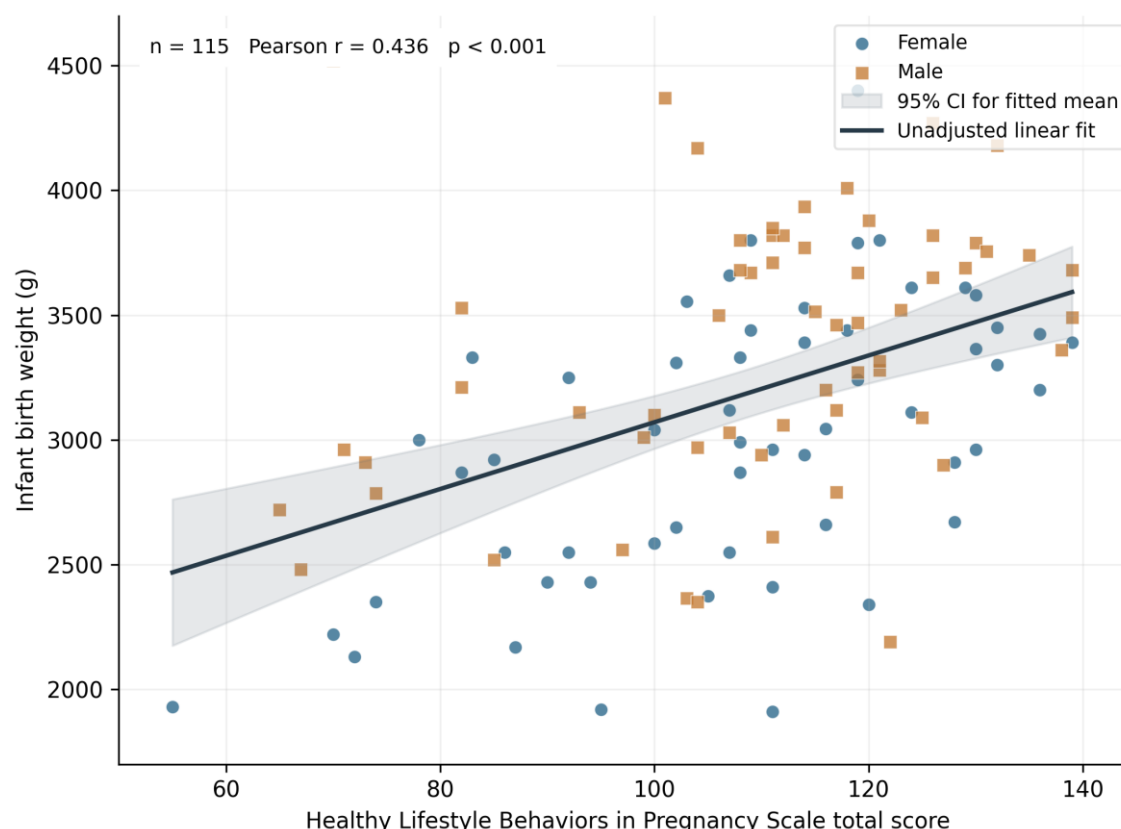


Figure 1. Total healthy lifestyle score and reported infant birth weight. Points represent participants; colors indicate infant sex; the single fitted line and confidence band are unadjusted and pooled across infants.

Discussion

In this single-center observational study, higher third-trimester healthy lifestyle scores were associated with higher reported infant birth weight after adjustment for measured characteristics. The adjusted estimate was 8.75 g per point (95% CI, 1.10-16.40). This association does not establish that an intervention increasing the score would change birth weight.

The finding is broadly consistent with systematic reviews reporting associations between healthier maternal dietary patterns and birth outcomes [5,6]. Results across individual studies nevertheless differ. For example, Poon and colleagues found no association between third-trimester dietary pattern scores and birth weight or size for gestational age in their cohort [11]. Our measure combines nutrition with several other behaviors, so the present association cannot be assigned to dietary intake alone.

Gestational weight gain is another important consideration. Both insufficient and excessive gain have been associated with adverse infant-size outcomes [12]. Evidence concerning physical activity likewise requires a distinction between observational associations and intervention effects: an

observational review reported variation by activity volume and study methods [13], whereas a review of randomized trials found a reduction in macrosomia but no significant association for its other examined birth-weight outcomes [8]. The positive, unadjusted correlations between birth weight and individual lifestyle subscales in our study should therefore be treated as exploratory. They do not establish that each behavior has an independent effect.

The adjusted association should be interpreted in the context of established determinants of infant size. Smoking, maternal depression, prepregnancy body mass index, and gestational weight gain have been associated with low birth weight or other infant-size outcomes [14-16]. Their absence from the adjusted model limits the interpretation of its coefficient.

Randomized lifestyle trials also caution against interpreting the present finding as evidence for a clinical intervention. The LIMIT and UPBEAT trials did not demonstrate a consistent reduction in large-for-gestational-age birth through the lifestyle advice evaluated in those trials [18,19]. Their populations and interventions differ from ours, but they illustrate why an association between a self-reported score and birth weight cannot be translated directly into an expected

treatment effect. Higher birth weight is not inherently a better outcome; size must be interpreted in relation to gestational age and sex [3].

Limitations

Several limitations affect interpretation. Prepregnancy body mass index, gestational weight gain, and smoking were not measured in the available dataset and therefore could not be included in the adjusted model. These factors may be associated with both reported lifestyle behaviors and infant birth weight, leaving potential for residual confounding. The observed relationship cannot be interpreted as a causal effect of lifestyle score. Further limitations include recruitment at one center, selection of pregnancies without recorded complications under the study criteria, and a single self-reported lifestyle assessment in late pregnancy. Birth weight and delivery week came from postpartum maternal telephone reports rather than delivery records. Although maternal recall can agree with medical records in some settings [19], its accuracy in this sample remains unverified. Verification of birth outcomes against clinical records would further strengthen the study.

Conclusion

Higher third-trimester healthy lifestyle scores were associated with higher reported infant birth weight after adjustment for measured covariates. Prospective studies with verified birth records and more complete confounder measurement are needed.

Declarations

Author contributions (CRediT): Murat Kurtal: Conceptualization, investigation, data curation, writing - original draft. Evrim Ebru Kovalak: Investigation, data curation, writing - review and editing. Murat Altuntaş: Conceptualization, methodology, supervision, formal analysis, writing - review and editing. All authors read and approved the final manuscript.

Competing interests: The authors declare no competing interests.

Funding: This research received no external funding.

Data availability: The participant-level dataset is not publicly available. Requests for access to a de-identified dataset for a reasonable scientific purpose may be directed to the corresponding author and will be considered subject to applicable ethics and institutional approvals, the Turkish Personal Data Protection Law No. 6698 (KVKK), and appropriate safeguards. Data will be shared only where these conditions permit.

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