Urine Dipstick Protein By Obesity Class Among Pregnant Women In Medan

Nabilla Calulla[1], Irfan Darfika Lubis[2]

[1]Faculty of Medicine, Universitas Muhammadiyah Sumatera Utara, Medan, Indonesia
[2]Department of Anatomy, Faculty of Medicine, Universitas Muhammadiyah Sumatera Utara, Medan, Indonesia
*Corresponding author:
Email: co.nabilla@gmail.com

Abstract.
Introduction Maternal obesity is associated with hypertensive disorders of pregnancy. Urine dipstick testing provides a rapid assessment of urinary protein, but the frequency of positive readings across obesity classes is less well described in Indonesia. Objective To compare the prevalence of positive urine dipstick protein results between pregnant women in obesity classes I and II. Methods This cross-sectional study included 67 pregnant women aged 20–29 years in Medan Deli, Indonesia. Obesity was classified as class I (body mass index 25.0 to <30.0 kg/m²) or class II (≥30.0 kg/m²). The primary outcome was a dipstick reading ≥1+. We estimated the absolute prevalence difference and used modified Poisson regression to estimate the prevalence ratio (PR) adjusted for maternal age. Readings ≥2+ and the full grade distribution were examined in exploratory analyses. Results A reading ≥1+ was found in 24 of 26 participants in class II (92.3%) and 20 of 41 in class I (48.8%). The prevalence difference was 43.5 percentage points (95% confidence interval [CI], 21.4–59.1). The age-adjusted PR was 1.89 (95% CI, 1.34–2.66). A 1+ reading was similarly common in both classes. Readings ≥2+ occurred in 14 of 26 participants in class II (53.8%) and 3 of 41 in class I (7.3%). The age-adjusted PR at this threshold was 4.96 (95% CI, 1.44–17.10).Conclusion Positive urine dipstick results were more common in obesity class II than in class I after adjustment for maternal age. Quantitative urine testing is needed to clarify the clinical significance of this difference.
Keywords: *Proteinuria, Obesity, Pregnant Women, Urinalysis and Cross-Sectional Studies.*

I. INTRODUCTION

Maternal obesity is associated with a higher frequency of hypertensive disorders of pregnancy, including preeclampsia. Reviews of cohort studies have shown that preeclampsia becomes more common as prepregnancy body mass index (BMI) increases. International guidance recommends assessing weight before conception or early in pregnancy.[1–4] In Indonesia, the 2023 national health survey reported that 23.4% of adults older than 18 years had obesity using the survey threshold of BMI ≥27 kg/m². This estimate describes the general adult population. A separate multicentre study of pregnancies complicated by preeclampsia in Indonesia documented substantial maternal and neonatal morbidity and regional differences in outcomes.[5,6] Together, these findings make it important to understand what antenatal measurements capture in specific Indonesian settings.

Urinary protein is one component of the evaluation for hypertensive disorders during pregnancy. Its interpretation depends on gestational age, blood pressure, and other clinical findings. Normal pregnancy changes kidney blood flow and urinary protein excretion. Proteinuria can also occur in women with normal blood pressure.[7–10] Reagent strips provide a rapid, semiquantitative reading that can be used in settings with limited access to laboratory tests. However, the reading depends on urine concentration as well as protein content. Diagnostic reviews have documented variable agreement with quantitative measures, particularly at the 1+ threshold.[11–13] A positive strip result is a screening finding that can guide further assessment.

Studies of maternal BMI have often compared women with obesity and women with normal BMI or focused on preeclampsia as the outcome. A UK cohort, for example, found higher odds of a positive urine dipstick result among women with prepregnancy obesity than among those with normal BMI.[14] Less is known about how often positive dipstick readings occur across obesity classes among pregnant women who already meet the study definition of obesity. Comparing the classes can show how large that difference is and which dipstick grades account for it.

The primary objective was to compare the prevalence of a positive urine dipstick result (≥1+) between obesity classes I and II among pregnant women aged 20–29 years in Medan Deli. We estimated the absolute and relative differences in prevalence and examined whether the comparison changed after

adjustment for maternal age. We also examined readings ≥2+ and the distribution of grades from negative to 4+.

II. METHODS

Study design and setting

We conducted a cross-sectional study in Medan Deli District, Medan, North Sumatra, Indonesia. Fieldwork was documented from 3 to 14 December 2024.[15] A previous publication reported the unadjusted comparison of dipstick positivity by obesity class in the same 67 participants.[16] We used the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidance for cross-sectional studies to structure this report.[17,18]

Participants and study size

We enrolled pregnant women aged 20–29 years who lived in Medan Deli, met the study definition of obesity, and consented to participate. Participants were selected purposively. The exclusion criteria included difficulty obtaining anthropometric or urine measurements, participation in a special dietary programme, and disability as specified in the original protocol. The available records did not include screening or refusal counts.[15,16]

Sample size was based on a single-proportion calculation with an assumed proportion of 0.50, a 90% confidence level, and an absolute precision of 0.10.[15] We enrolled 67 participants and included all records with maternal age, obesity class, and dipstick grade in the analysis.

Exposure and outcome measurement

At the study visit, weight was measured without shoes to the nearest 0.1 kg, and standing height was measured with a wall-mounted microtoise to the nearest 0.1 cm. BMI was calculated as weight in kilograms divided by squared height in metres. The study used the Asia-Pacific thresholds in its operational definition. Class I corresponded to BMI 25.0 to <30.0 kg/m² and class II to BMI ≥30.0 kg/m².[15,19] The analysis used the recorded BMI categories. Individual weight, height, BMI, and gestational week at measurement were unavailable, so we could not assess gestational weight gain.

Urine specimens were examined with protein reagent strips at the Clinical Pathology Laboratory of the Faculty of Medicine, Universitas Muhammadiyah Sumatera Utara. The documented protocol used a 5-mL aliquot, a 1-second dip, and assessment of the colour change at 60 seconds against the reference scale. Strip brand and use of an automated reader could not be verified from the available study records. One result per participant was available as negative, 1+, 2+, 3+, or 4+.[15,16] The primary outcome was a positive urine dipstick result, defined as a reading of ≥1+. We used ≥2+ as an exploratory threshold and analysed all five grades as ordered categories. Quantitative urine protein measurements and repeat strip readings were unavailable.

Data preparation and statistical analysis

We derived dipstick positivity from the original grades and tabulated the counts by obesity class. We summarised maternal age using the mean and standard deviation (SD) and the median and interquartile range (IQR). Categorical variables were reported as counts and percentages. The analysis included records with complete data on maternal age, obesity class, and dipstick grade.

We compared the prevalence of dipstick readings ≥1+ between obesity classes using a two-sided Pearson chi-square test. We repeated the comparison using Fisher's exact test. Class I was the reference group. We estimated the absolute prevalence difference in percentage points with a 95% confidence interval (CI) using Newcombe's method. We estimated crude and age-adjusted prevalence ratios (PRs) using modified Poisson regression with a log link, robust variance, and Wald 95% CIs. Maternal age in years was included as a continuous covariate.[20–22]

We used the same effect measures for the exploratory comparison at ≥2+. For the comparison across all five grades, we estimated the probability that a randomly selected participant in class II had a higher grade than one in class I, counting ties as one-half. We calculated a percentile 95% CI from 20,000 bootstrap resamples drawn separately within each class.[23] The comparison of dipstick positivity by obesity class was part of the original design. The prevalence estimates, age adjustment, and exploratory analyses were added

after data collection. The primary cross-tabulation, Pearson chi-square test, and Fisher's exact test were performed using IBM SPSS Statistics 25. Additional estimates were calculated in Python 3.12.

Ethics approval and participant consent

The Health Research Ethics Committee of the Faculty of Medicine, Universitas Muhammadiyah Sumatera Utara, approved the original protocol on 10 October 2024 (No. 1319/KEPK/FKUMSU/2024) with reference to CIOMS guidelines. Participants provided written informed consent, and direct identifiers were excluded from the analysis.[15,24] The Declaration of Helsinki guided reporting on consent and confidentiality.[25] Ethics coverage for the additional analyses could not be confirmed.

III. RESULTS

Participants

All 67 participants in the source dataset had complete information on the three analytic variables and were included. Of these, 41 (61.2%) were in class I and 26 (38.8%) were in class II. The mean maternal age was 26.16 years (SD 2.69). Class II participants were older on average, with a mean age of 27.15 years compared with 25.54 years in class I (Table 1).

Table 1. Maternal age by obesity class

Maternal age	Class I (n = 41)	Class II (n = 26)	All participants (N = 67)
Mean (SD), years	25.54 (2.62)	27.15 (2.54)	26.16 (2.69)
Median (IQR), years	26 (24–28)	28 (26–29)	27 (24.5–29)
20–23 years, n (%)	10 (24.4)	2 (7.7)	12 (17.9)
24–26 years, n (%)	15 (36.6)	6 (23.1)	21 (31.3)
27–29 years, n (%)	16 (39.0)	18 (69.2)	34 (50.7)

Percentages are within columns. IQR, interquartile range. SD, standard deviation.

Primary outcome

A dipstick reading ≥1+ was recorded in 44 of 67 participants (65.7%). It occurred in 24 of 26 women in class II (92.3%) and 20 of 41 in class I (48.8%). The prevalence difference was 43.5 percentage points (95% CI, 21.4 to 59.1), and the crude PR was 1.89 (95% CI, 1.36 to 2.64). The age-adjusted PR was 1.89 (95% CI, 1.34 to 2.66). The Pearson chi-square test yielded $P < .001$ ($\chi^2 = 13.37$, 1 degree of freedom). Fisher's exact test also yielded $P < .001$ (Table 2).

Table 2. Prevalence of urine dipstick protein at two thresholds by obesity class

Dipstick threshold	Class I (n = 41)	Class II (n = 26)	Prevalence difference (95% CI)	Crude PR (95% CI)	Age-adjusted PR (95% CI)
≥1+	20 (48.8%)	24 (92.3%)	43.5 (21.4–59.1)	1.89 (1.36–2.64)	1.89 (1.34–2.66)
≥2+	3 (7.3%)	14 (53.8%)	46.5 (24.5–64.6)	7.36 (2.34–23.15)	4.96 (1.44–17.10)

The prevalence difference is in percentage points (class II minus class I). Class I is the reference for PRs. The ≥2+ comparison was exploratory. CI, confidence interval. PR, prevalence ratio.

Dipstick grade distribution and exploratory analyses

A reading of 1+ was the most frequent result in the overall sample (27 of 67, 40.3%). This grade was similarly frequent in class I and class II (41.5% and 38.5%, respectively). The main distributional difference occurred at the negative and higher reading categories. Negative readings accounted for 51.2% of class I and 7.7% of class II. In class II, 9 participants had a 2+ reading, 3 had 3+, and 2 had 4+. In class I, 2 participants had a 2+ reading and 1 had 3+ (Table 3).

Table 3. Full distribution of urine dipstick readings by obesity class

Dipstick grade	Class I (n = 41)	Class II (n = 26)	All participants (N = 67)
Negative	21 (51.2)	2 (7.7)	23 (34.3)
1+	17 (41.5)	10 (38.5)	27 (40.3)
2+	2 (4.9)	9 (34.6)	11 (16.4)
3+	1 (2.4)	3 (11.5)	4 (6.0)
4+	0 (0.0)	2 (7.7)	2 (3.0)

Values are n (% within each column).

At the ≥2+ threshold, the proportions were 53.8% (14 of 26) in class II and 7.3% (3 of 41) in class I. The prevalence difference was 46.5 percentage points (95% CI, 24.5 to 64.6). The crude PR of 7.36 (95% CI, 2.34 to 23.15) decreased to 4.96 after adjustment for age (95% CI, 1.44 to 17.10). In the comparison across all five grades, the probability of a higher reading in class II, with half-weight assigned to ties, was 0.82 (bootstrap 95% CI, 0.71 to 0.90).

IV. DISCUSSION

Among pregnant women aged 20–29 years with study-defined obesity in Medan Deli, class II was associated with a higher prevalence of a urine dipstick reading ≥1+ than class I. Adjustment for maternal age had little effect on this estimate. The main difference was a greater share of readings of 2+ or higher and a smaller share of negative readings in class II. The comparison across all grades supported this pattern. The difference at ≥2+ was less precise because only three class I participants had a reading at or above that threshold.

Our primary finding was consistent with a UK birth cohort, the Avon Longitudinal Study of Parents and Children. In that cohort, Macdonald-Wallis and colleagues reported an adjusted odds ratio of 1.75 (95% CI, 1.34 to 2.28) for a dipstick reading ≥1+ at any point in pregnancy in women with prepregnancy obesity compared with women with normal BMI. Their analysis used repeated testing in term pregnancies and excluded several maternal disorders, including preeclampsia.[14] The present study used one recorded reading per participant and compared two classes within a sample selected for obesity. The UK findings suggest that BMI is associated with urine protein findings even among women without diagnosed preeclampsia. In Medan Deli, the available data did not show whether preeclampsia or other kidney conditions explained part of the difference between classes.

A small hospital study in Manado reported positive results in 9 of 39 third-trimester participants (23.1%). It examined a different clinical population and did not use the same within-obesity comparison.[26] In a US longitudinal study, Kattah and colleagues reported quantitative isolated proteinuria at delivery in 19 of 142 normotensive pregnancies (13.4%) using a spot protein-to-creatinine ratio.[10] Differences in enrolment, timing of sampling, reference groups, and measurement methods prevent direct comparisons between these proportions. The 65.7% prevalence in this report describes dipstick positivity in the selected Medan Deli sample.

Diagnostic studies further help explain why strip findings and confirmed proteinuria can diverge. In a prospective study of pregnant women, Baba and colleagues found more false-positive strip results in concentrated urine. In a systematic review of women with suspected preeclampsia, Teeuw and colleagues estimated a sensitivity of 68% and specificity of 85% for protein-only strips at the 1+ threshold. A later review showed that accuracy estimates differed according to the quantitative reference standard and method of reading the strip.[11–13] The Medan Deli study measured neither urine concentration nor a quantitative reference standard. The proportion of positive readings due to concentration, transient protein excretion, or persistent proteinuria remains unknown.

In nonpregnant populations, obesity has been linked to glomerular hyperfiltration and increased protein excretion. Work on obesity-related glomerulopathy describes intraglomerular pressure, glomerular

enlargement, and podocyte stress as potential contributors.[27–29] Pregnancy itself changes renal blood flow, filtration, and urinary protein handling. Hypertensive disorders introduce additional renal and placental pathways.[7–9] These pathways may help explain the association. The study lacked the data needed to determine which mechanisms were involved.

Timing provides another explanation. Maternal weight and urinary protein excretion can both change over pregnancy. If women in class II were assessed later on average, differences in gestational stage could have moved them into the higher BMI category and contributed to higher dipstick readings.[3,8,10] Adjustment for maternal age did little to change the ≥1+ estimate and attenuated the ≥2+ estimate. Gestational age, parity, documented blood pressure, diabetes, kidney disease, urinary infection, medications, and prior preeclampsia were not available as linked variables for adjustment. The estimates may still reflect differences in these factors between the groups.

The analysis used participant-level grades and retained all 67 records. Reporting the absolute difference alongside prevalence ratios showed both the frequency difference in the sample and the relative association. Tabulation of each grade showed where the distributions diverged, while the ordinal analysis preserved information that was lost when readings were divided into positive and negative.

Several limitations affect interpretation. First, cross-sectional measurements did not establish whether the exposure preceded the urine finding. Purposive enrolment, the absence of screening counts, the restriction to ages 20–29 years, and sampling within one district limit generalisability. The comparison applies to the two study-defined obesity classes. Because there was no individual BMI or prepregnancy weight in the analytic dataset, the extent of adiposity and the role of gestational weight gain could not be separated. The Asia-Pacific class labels also differ from other BMI classification systems, which matters when comparing published groups.[19,30]

Second, a single semiquantitative result was subject to measurement error and did not establish persistent proteinuria. Without paired quantitative testing, gestational timing, or blood pressure, the study could not distinguish isolated gestational proteinuria from proteinuria associated with hypertension, infection, or pre-existing renal disease. If specimen concentration or handling varied by obesity class, error could have altered the measured difference in either direction. Third, the sample was small and the class I count at ≥2+ was sparse. The wide intervals highlight uncertainty in the exploratory relative estimate. The confidence intervals describe statistical precision. Selection and measurement bias could affect the estimates beyond what these intervals suggest.

A positive strip result should be interpreted alongside gestational age, blood pressure, symptoms, and kidney history. In the evaluation of hypertensive disorders of pregnancy, the National Institute for Health and Care Excellence recommends quantitative testing with a spot protein-to-creatinine or albumin-to-creatinine ratio after a positive dipstick screen of ≥1+. ISSHP recommends quantitative confirmation where available and allows a dipstick value ≥2+ as a fallback in the appropriate diagnostic setting.[7,31–33] The study did not validate either threshold against a quantitative reference standard. These findings cannot establish a new screening schedule, an obesity-specific referral rule, or a basis for diagnosing preeclampsia.

Longitudinal studies have shown that confirmed isolated gestational proteinuria can precede preeclampsia in some women. These results concern women with defined blood pressure and gestational timing and support clinical follow-up in that context.[34–37] A prospective multicentre study in Indonesian antenatal settings could establish BMI before pregnancy or early in gestation, collect blood pressure and urine samples at specified weeks, and pair dipstick readings with quantitative urine testing. Follow-up during pregnancy and after delivery would allow investigators to distinguish transient results, persistent proteinuria, and confirmed hypertensive disorders. Those data could also clarify whether differences between BMI classes persist after adjustment for obstetric and renal factors.

V. CONCLUSION

Among pregnant women aged 20–29 years with obesity in Medan Deli, urine dipstick readings ≥1+ were more common in class II than class I. The difference remained after adjustment for maternal age. Readings ≥2+ were also more common in class II, but the size of that difference was less precise.

Quantitative urine testing and information on gestational timing and blood pressure are needed to clarify the clinical significance of these findings.

Declarations

Ethics approval and consent to participate

The Health Research Ethics Committee of the Faculty of Medicine, Universitas Muhammadiyah Sumatera Utara, approved the original study (Ref. No. 1319/KEPK/FKUMSU/2024). Participants provided written informed consent before study procedures began.

Consent for publication

The manuscript contains no identifiable participant information. Individual consent for publication was therefore not applicable.

Author contributions

Nabilla Calulla led the original study, collected the data, and drafted the initial research report. Irfan Darfika Lubis supervised the study and provided critical feedback.

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Competing Interests

No competing interests are declared by any of the authors.

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