ORIGINAL ARTICLE

Maternal Height-to-Weight Ratios as Predictors of Emergency Cesarean Section Due to CPD in Chonburi Hospital

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Objective: To evaluate the association between maternal height-to-weight ratio and the occurrence of cesarean section due to cephalopelvic disproportion (CPD).

Material and Methods: A cross-sectional study was conducted on pregnant women later than 28 weeks gestation receiving antenatal care at Chonburi Hospital who met inclusion criteria. Informed consent was obtained. Baseline data were recorded, and participants were followed until delivery. Participants who met the exclusion criteria during follow-up were excluded. Enrollment continued until 97 women who delivered vaginally and 97 women who underwent cesarean section due to CPD were included for comparison.

Results: Based on data collected from 97 women who delivered vaginally and 97 women who underwent cesarean section due to CPD, the study showed that a maternal height-to-pre-pregnancy weight ratio cutoff at 2.89 or less was associated with an increased likelihood of cesarean delivery. This cutoff demonstrated an area under the curve (AUC) of 0.645, with a sensitivity of 67.0% and specificity of 58.8%. For the maternal height-to-weight at delivery ratio, a cutoff value of 2.25 or less was also associated with an increased likelihood of cesarean delivery, with an AUC of 0.67, sensitivity of 68.0%, and specificity of 58.8%. Both ratios demonstrated comparable, moderate discrimination to identify women who required cesarean delivery. Other predictive variables included the maternal height-to-gestational weight gain ratio, with a cutoff value of 3.79 or less indicating a higher likelihood of cesarean delivery with an AUC of 0.596, sensitivity of 71.7%, and specificity of 50.5%.

Conclusion: Maternal height-to-weight ratios can be used to predict the risk of emergency cesarean section due to CPD, using cutoff values of 2.89 or less for the height-to-pre-pregnancy weight ratio and 2.25 or less for the height-to-weight at delivery ratio. These cutoffs demonstrated moderate discriminatory ability, with better performance in predicting women requiring cesarean section than in identifying those who delivered vaginally. These ratios should be used in combination with other clinical factors to improve predictive accuracy.

Keywords: Height/weight; Cephalopelvic disproportion; Cesarean section; Delivery route

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Cephalopelvic disproportion (CPD) refers to a mismatch between the size of the maternal pelvis and the fetal head, resulting in failure of vaginal delivery. This condition may result from true disproportion between fetal size and maternal pelvic dimensions, abnormal fetal position, or abnormal presenting part[1]. Consequently, vaginal delivery cannot be achieved, leading to emergency cesarean section. CPD remains a significant cause of maternal mortality worldwide, accounting for approximately 8%[2]. Previous studies have demonstrated that maternal height reflects pelvic size, which is associated with labor obstruction and shoulder dystocia[3]. Although shorter women tend to deliver smaller infants, they remain at higher risk of labor obstruction, leading to increased use of assisted vaginal delivery and emergency cesarean section[4,5].

Toh-Adam et al. (2011)[3] conducted a retrospective study in Chiang Mai, Thailand (2006 to 2010), focusing on nulliparous women with gestational age of 34 weeks or more. They found maternal height of less than 145 cm was significantly associated with cesarean delivery due to CPD, even after adjusting for maternal weight and parity.

Maternal obesity, defined as a pre-pregnancy or first-trimester body mass index (BMI) of 30 or more, is also a strong risk factor for cesarean delivery due to

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obstructed labor. Obese women have been reported to have up to sixfold increased risk of cesarean delivery due to obstructed labor compared with non-obese women[6].

Furthermore, maternal overweight and obesity are associated with an increased risk of pregnancy-related complications, including preeclampsia, gestational diabetes mellitus, and cesarean delivery[7].

Mogren et al. (2018)[8] conducted a retrospective cohort study in Sweden (1992 to 1993) focusing on nulliparous women, aiming to evaluate the relationship between maternal height and the risk of cesarean section. The study revealed that maternal height was directly associated with cesarean risk. The taller the woman, the lower the likelihood of cesarean delivery. Increased BMI and maternal age were also significant predictors of cesarean section.

Cnattingius et al. (1998)[9] studied cesarean risk factors in a low-cesarean population (1992 to 1995). They found maternal age, height, and pre-pregnancy BMI were significant predictors. Women shorter than 145 cm had a 4.5-fold higher cesarean risk compared to women taller than 175 cm. Women with BMI greater than 30 had twice the cesarean risk compared to those with BMI 20 to 24.9. Maternal age 20 to 29, 30 to 34, and 35 years or older was associated with 1.5, 2.6, and 4.4-fold higher cesarean risk compared to those younger than 19 years, respectively.

Marbaniang et al. (2021)[10] analyzed data from the Indian National Family Health Survey-4 (2015 to 2016). They found that shorter mothers were more likely to undergo cesarean delivery and that neonatal mortality was also higher in shorter women. Mothers with a height of 120 cm had a 5-fold increased risk of cesarean section, whereas those at 180 cm had a 23% lower risk compared to women at 150 cm. Other associated factors included maternal age, parity, birth weight, socioeconomic status, place of delivery, and healthcare coverage.

Alshammari et al.[11] conducted a retrospective cohort study of 500 women in Hail, Saudi Arabia, and found that higher maternal BMI, especially in the obese and morbidly obese categories, was significantly associated with increased rates of cesarean delivery. Other common indications for cesarean section included fetal distress, malpresentation, and placental abruption, highlighting BMI and related metabolic conditions as important maternal risk factors.

Previous studies showed that risk factors for CPD include maternal age, maternal height, pre-pregnancy BMI, and the height difference between father and mother. However, current evidence in Thailand remains limited due to variations in maternal body habitus across different regions, as most studies were conducted in European populations. Furthermore, many studies did not explicitly state the indication for cesarean delivery. Therefore, the authors conducted a study at Chonburi Hospital, Thailand, between October 2024 and March 2025, to evaluate maternal height, weight, mode of delivery, and indications for cesarean section. The present study findings suggested that the maternal height-to-weight ratio was associated with emergency cesarean section due to CPD. The simplicity of this metric may help standardize surveillance and improve risk prediction.

Materials and Methods

The present study was designed as a cross-sectional study and received approval from Chonburi Hospital Institutional Review Board (CBH-IRB No. 140/66/R/h1). The present study was registered in the Thai Clinical Trials Registry (TCTR), TCTR20251226001.

Study population

Inclusion criteria were Thai and non-Thai women of any age, gestational age of 28 weeks or more, able to communicate in Thai, singleton pregnancy, planned vaginal delivery at gestational age of 37 weeks or more, gestational age confirmed by ultrasound before 20 weeks, and first antenatal visit before 20 weeks.

Exclusion criteria included prior cesarean section, multiple gestation, abnormal presentation, hypertensive disorders of pregnancy, gestational diabetes after gestational age 28 weeks, incomplete data, delivery before gestational age 37 weeks, or other indications requiring cesarean section such as macrosomia and severe preeclampsia.

Withdrawal criteria included participant who requested for withdrawal.

Procedures

All low-risk pregnant women at 28 weeks or more of gestation attending antenatal clinic at Chonburi Hospital and planning vaginal delivery were screened. Exclusion criteria included prior cesarean delivery, multiple gestation, abnormal presentation, hypertensive disorders of pregnancy, gestational diabetes, incomplete data, preterm delivery, or cesarean section for other indications. Participants were recruited by antenatal clinic nurses or non-primary-investigator staff. After enrollment, participants were followed during antenatal care

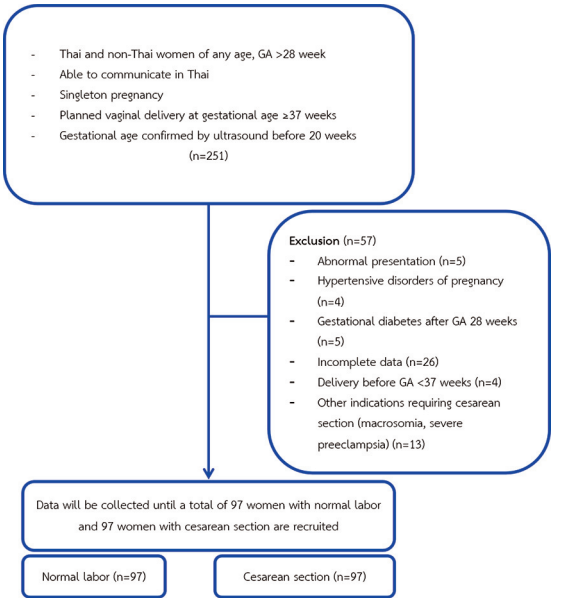

Figure 1. Study flowchart.

until delivery at the hospital. If a participant went into preterm labor before 37 weeks gestation, she was excluded from the study. Informed consent was obtained, with participants able to withdraw at any time without affecting the standard care (Figure 1).

Sample size calculation

Pilot study using 20 participants suggested that maternal height was inversely associated with CPD (beta coefficient –0.17). To achieve 80% power at significant level of α=0.05, minimum sample size was 194 with 97 CPD cases and 97 vaginal delivery cases.

Data collection

Patient information was collected from interviews, antenatal care record books, and hospital electronic medical records between October 2024 and March 2025.

General data: Age, underlying diseases, pre-pregnancy weight, maternal height, paternal height, and weight were recorded using a standardized XPERT-SC20 scale.

Gynecologic data: The last menstrual period, gravidity, parity, abortions, gestational age, pregnancy risk factors such as underweight, obesity, history of abortion, family history of genetic abnormality, family history of diabetes mellitus, and history of adverse outcome were also recorded.

Upon labor onset, with contractions or rupture of membranes, gestational age was re-confirmed. Women whose gestational age was less than 37 weeks or had other exclusion criteria were excluded. Data were collected in the labor room while awaiting delivery. Labor progression was charted using ACOG 2019 criteria for failure to progress:

After cervical dilation of 4 cm and 75% effacement:

- Secondary arrest: less than 2 cm per hour dilation with adequate contractions for four hours and ruptured membranes, or no further dilation after six hours despite inadequate contractions, with oxytocin.
- Prolonged active phase: The labor was prolonged, with cervical dilatation crossing the action line on the partograph.
- Prolonged second stage: longer than two hours in nulliparas, longer than one hour in multiparas

Cases meeting these criteria were classified as "failure of vaginal delivery" and underwent emergency cesarean section performed by obstetrics and gynecology first to third year residents or faculty physician.

Data analysis

Descriptive statistics were presented as mean ± standard deviation. Group comparisons were performed using the independent t-test for continuous variables and the chi-square test for categorical variables. Logistic regression analysis was conducted to identify predictors of cesarean delivery due to CPD, including univariate logistic regression for individual predictors and multivariate logistic regression to adjust for potential confounders. Receiver operating characteristic (ROC) curve analysis was used to evaluate predictive performance, with the area under the curve (AUC) calculated, and optimal cut-off values determined using the Youden index; sensitivity and specificity were subsequently reported.

Results

The data collected from 97 women who delivered vaginally, and 97 women who underwent cesarean section due to CPD at Chonburi Hospital, which include the baseline characteristics of these two groups, are presented in Table 1.

Overall, the study population exhibited significant differences between the vaginal delivery group and the cesarean section group due to CPD. Significant factors included gravidity, parity, maternal pregestational weight, maternal weight at delivery, maternal height-to-pregestational weight ratio, maternal height-to-weight ratio at delivery, maternal BMI, and paternal weight.

Univariate logistic regression analysis was

Table 1. Baseline characteristics of vaginal delivery and CPD group

Variables	C/S (n=97)	NL (n=97)	p-value
Age (years); mean±SD	27.92±5.8	26.3±5.7	0.050
Gravidity; n (%)			0.010*
1	58 (59.8)	37 (38.1)	
2	23 (23.7)	26 (26.8)	
3	12 (12.4)	24 (24.7)	
≥4	4 (4.1)	10 (10.3)	
Parity; n (%)			<0.001*
0	75 (77.3)	39 (40.2)	
1	15 (15.5)	27 (27.8)	
2	6 (6.2)	26 (26.8)	
≥3	1 (1.0)	5 (5.2)	
Abortion; n (%)			0.056
0	73 (75.3)	85 (87.6)	
1	18 (18.6)	8 (8.2)	
≥2	6 (6.2)	3 (3.1)	
Gestational age (weeks); mean±SD	39.19±1.2	39.13±1.1	0.711
Maternal height (cm); mean±SD	158.96±5.6	158.52±5.7	0.590
Maternal pregestational weight (kg); mean±SD	63.35±15.9	56.22±13.6	0.001*
Maternal weight at delivery (kg); mean±SD	77.92±15.3	69.24±13.9	<0.001*
Total weight gain (kg); mean±SD	14.57±6.2	13.02±6.6	0.092
Paternal height (cm); mean±SD	170.15±5.5	169.73±7.5	0.654
Paternal weight (kg); mean±SD	73.23±15.9	68.69±14.2	0.037*
Birth body weight (g); mean±SD	3,182.89±397.6	3,125.23±364.4	0.294
Maternal height/pregestational weight; mean±SD	2.65±0.6	2.95±0.6	<0.001*
Maternal height/weight at delivery; mean±SD	2.11±0.4	2.37±0.4	<0.001*
Maternal height/total weight gain; mean±SD	12.39±8.4	14.94±27.6	0.384
Maternal BMI (pregestational weight); mean±SD	25±5.7	22.29±4.8	<0.001*
Height difference†; mean±SD	11.2±7.4	11.21±7.9	0.989

C/S=cesarean section; NL=vaginal delivery; BMI=body mass index

Values are presented as mean ± standard deviation (SD) for continuous variables, and n (%) for categorical variables. p-values were calculated using the independent t-test for continuous variables, and the chi-square test for categorical variables. * Statistical significance was defined as $p<0.05$.

† Height difference = paternal height – maternal height

performed to identify factors associated with cesarean section due to CPD. Several factors were significantly associated with increased or decreased odds of cesarean delivery, including gravidity of 3 or more, parity of 1 or more, history of one abortion, maternal pregestational weight, maternal weight at delivery, paternal weight, maternal height-to-pre-gestational weight ratio, maternal height-to-weight ratio at delivery, and maternal BMI.

Higher gravidity and parity were associated with reduced odds of cesarean delivery such as gravidity of 3 with OR 0.32 (95% CI 0.14 to 0.7), gravidity of 4 or more with OR 0.26 (95% CI 0.07 to 0.87), parity of 1 with OR of 0.29 (95% CI 0.14 to 0.61), parity of 2 with OR of 0.12 (95% CI 0.05 to 0.32), and parity of 3 or more with OR of 0.10 (95% CI 0.01 to 0.92). A history of one abortion increased the odds of cesarean delivery to OR 2.62 (95% CI 1.08 to 6.38).

Higher maternal pregestational weight and weight at delivery were also associated with increased odds of cesarean section for pregestational weight as OR 1.03 (95% CI 1.01 to 1.06) and weight at delivery for OR 1.04 (95% CI 1.02 to 1.06). Higher paternal weight was marginally associated with increased odds as OR 1.02 (95% CI 0.99 to 1.04).

A lower maternal height-to-pregestational weight ratio was associated with higher odds of cesarean delivery to OR 0.41 (95% CI 0.25 to 0.68), as was a lower maternal height-to-weight at delivery ratio to OR 0.20 (95% CI 0.09 to 0.43). Higher maternal BMI was also significantly associated with increased odds as OR 1.11 (95% CI 1.04 to 1.17) (Table 2).

However, in multivariate logistic regression analysis controlling for confounders, only parity,

Table 2. Univariate logistic regression for C/S

Variables	Univariates	
	OR (95% CI)	p-value
Age	1.05 (1.00 to 1.11)	0.053
Gravidity		
1	Reference	1
2	0.56 (0.28 to 1.13)	0.107
3	0.32 (0.14 to 0.71)	0.005*
≥4	0.26 (0.07 to 0.87)	0.03*
Parity		
0	Reference	1
1	0.29 (0.14 to 0.61)	0.001*
2	0.12 (0.05 to 0.32)	<0.001*
≥3	0.1 (0.01 to 0.92)	0.042*
Abortion		0.056
0	Reference	1
1	2.62 (1.08 to 6.38)	0.034*
≥2	2.33 (0.56 to 9.64)	0.244
Gestational age	1.05 (0.82 to 1.34)	0.709
Maternal height	1.01 (0.96 to 1.07)	0.588
Maternal pregestational age	1.03 (1.01 to 1.06)	0.002*
Maternal weight at delivery	1.04 (1.02 to 1.06)	<0.001*
Total weight gain	1.04 (0.99 to 1.09)	0.096
Paternal height	1.01 (0.97 to 1.05)	0.652
Paternal weight	1.02 (1.00 to 1.04)	0.039*
Birth body weight	1 (0.99 to 1.00)	0.293
Maternal height/pregestational weight	0.41 (0.25 to 0.68)	0.001*
Maternal height/weight at delivery	0.2 (0.09 to 0.43)	<0.001*
Maternal height/total weight gain	0.99 (0.98 to 1.01)	0.405
Maternal BMI	1.11 (1.04 to 1.17)	0.001*
Height difference†	1 (0.96 to 1.04)	0.989

OR=odds ratio; CI=confidence interval; BMI=body mass index
* Statistical significance was defined as p<0.05
† Height difference = paternal height – maternal height

maternal weight at delivery, maternal height-to-pregestational weight ratio, maternal height-to-weight ratio at delivery, and BMI remained significant predictors of cesarean section. Due to multicollinearity among maternal factors, four multivariate models were analyzed (Table 3). Model II was selected as the primary model as it focused on the main variables of interest, particularly the height-to-weight ratios.

In Model II, parity of 1 had an adjusted OR of 0.26 (95% CI 0.11 to 0.56, p=0.001), parity of 2 had an adjusted OR of 0.09 (95% CI 0.03 to 0.27, p<0.001). Maternal weight at delivery had an adjusted OR of 1.06 (95% CI 1.00 to 1.12, p=0.047), BMI had an adjusted OR of 1.12 (95% CI 1.05 to 1.20, p=0.001). Maternal height-to-pregestational weight ratio had an adjusted OR of 0.38 (95% CI 0.21 to 0.69, p=0.002), and maternal height-to-weight at delivery ratio had an adjusted OR of 0.18 (95% CI 0.07 to 0.45, p≤0.001). Other variables, such as gravidity, number of abortions, maternal pregestational weight, and paternal weight, did not remain significant after adjustment, highlighting that parity and maternal anthropometric measures, especially height-to-weight ratios, were important predictors of cesarean delivery risk (Table 3).

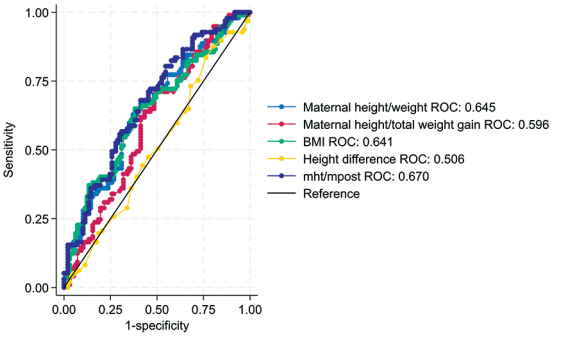

Figure 2. ROC analysis of maternal factors for CPD prediction.

mht=maternal height; mpost=weight at delivery
Height difference = paternal height – maternal height

ROC curve analysis was also performed to determine cutoff values and assess predictive accuracy using the Youden index. The maternal height-to-pregestational weight ratio had a cutoff value of 2.89 or less, associated with a higher risk of cesarean section, with an AUC of 0.645, sensitivity of 67.0%, and specificity of 58.8%. Similarly, the maternal height-to-weight at delivery ratio had a cutoff of 2.25 or less, associated with increased cesarean risk, with an AUC of 0.670, sensitivity of 68.0%, and specificity of 58.8%. Other predictive variables included the maternal height-to-gestational weight gain ratio, with a cutoff of 3.79 or less, with an AUC of 0.596, sensitivity of 71.7%, and specificity of 50.5%, and BMI with a cutoff of 22.54 or less with an AUC of 0.641, sensitivity of 64.9%, and specificity of 61.9% (Table 4, Figure 2).

Discussion

Previous studies have found that short maternal stature, high maternal weight, and elevated BMI have been associated with increased risk of cesarean delivery due to CPD. Prior research in European and Asian populations suggested that maternal height reflects pelvic capacity and that higher BMI increases the risk of labor obstruction and operative delivery. However, evidence from Thai populations is limited,

Table 3. Multivariate logistic regression for C/S

Variables	Multivariate model I		Multivariate model II		Multivariate model III		Multivariate model IV	
	Adjusted OR (95% CI)	p-value	Adjusted OR (95% CI)	p-value	Adjusted OR (95% CI)	p-value	Adjusted OR (95% CI)	p-value
Parity								
0	Reference	1	Reference	1	Reference	1	Reference	1
1	0.26 (0.12 to 0.59)	0.001*	0.26 (0.11 to 0.57)	0.001*	0.26 (0.12 to 0.59)	0.001*	0.26 (0.11 to 0.58)	0.001*
2	0.11 (0.04 to 0.32)	<0.001*	0.09 (0.03 to 0.27)	<0.001*	0.08 (0.03 to 0.26)	<0.001*	0.1 (0.03 to 0.29)	<0.001*
≥3	0.15 (0.01 to 1.54)	0.110	0.15 (0.01 to 1.47)	0.102	0.15 (0.02 to 1.49)	0.105	0.17 (0.02 to 1.91)	0.152
Abortion								
0	Reference	1	Reference	1	Reference	1	Reference	1
1	2.76 (1 to 7.63)	0.051	2.61 (0.96 to 7.06)	0.059	2.72 (1 to 7.4)	0.051	2.58 (0.93 to 7.17)	0.068
≥2	4.25 (0.75 to 24.06)	0.102	4.04 (0.73 to 22.29)	0.110	3.79 (0.68 to 21.05)	0.128	4.33 (0.75 to 25.09)	0.103
Paternal weight	1.02 (0.99 to 1.04)	0.172	1.02 (0.99 to 1.04)	0.147	1.02 (0.99 to 1.04)	0.140	1.02 (0.99 to 1.04)	0.150
Maternal pregestational weight	0.99 (0.93 to 1.04)	0.595	-	-	-	-		
Maternal weight at delivery	1.06 (1 to 1.12)	0.047*	-	-	-	-		
Maternal height/pregestational weight	-	-	0.38 (0.21 to 0.69)	0.002*	-	-		
Maternal height/weight at delivery							0.18 (0.07 to 0.45)	<0.001*
Maternal BMI	-	-	-	-	1.12 (1.05 to 1.2)	0.001*		

OR=odds ratio; CI=confidence interval; BMI=body mass index

* Statistical significance was defined as p<0.05

Table 4. Cut off by Youden index

Test result variable(s)	AUC	Cut off	TP	FP	FN	TN	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Accuracy (%)	LR+	LR–	Youden index	p-value	95% CI
Maternal height/pregestational weight	0.645	≤2.89	65	40	32	57	67.0	58.8	61.9	64.0	62.9	1.63	0.56	0.258	<0.001*	0.568 to 0.723
Maternal height/weight at delivery	0.670	≤2.25	66	40	31	57	68.0	58.8	62.3	64.8	63.4	1.65	0.54	0.268	<0.001*	0.595 to 0.745
Maternal height/total weight gain	0.596	≤3.79	69	48	28	49	71.1	50.5	59.0	63.6	60.8	1.44	0.57	0.216	0.021*	0.516 to 0.676
BMI	0.641	≥22.54	63	37	34	60	64.9	61.9	63.0	63.8	63.4	1.70	0.57	0.268	0.001*	0.563 to 0.719
Height difference	0.506	≥3.50	85	78	12	19	87.6	19.6	52.1	61.3	53.6	1.09	0.63	0.072	0.879	0.425 to 0.588

AUC=area under the curve; TP=true positive; FP=false positive; FN=false negative; TN=true negative; PPV=positive predictive value; NPV=negative predictive value; LR+=likelihood ratio positive; LR–=likelihood ratio negative; CI=confidence interval; BMI=body mass index

* Statistical significance was defined as p<0.05

and most studies have not focused specifically on emergency cesarean delivery due to CPD.

The present study identifies the maternal height-to-weight ratio as novel indicators and significant predictors of emergency cesarean section due to CPD in a large tertiary hospital in Thailand. The cutoff value of 2.89 or less for the maternal height-to-pregestational weight ratio was associated with an increased likelihood of cesarean section. This parameter showed an AUC of 0.645, with a sensitivity of 67.0% and specificity of 58.8%. Similarly, the maternal height-to-weight at delivery ratio had a cutoff value of 2.25 or less also indicating a higher risk of cesarean delivery, with an AUC of 0.67, sensitivity of 68.0%, and specificity of 58.8%. Both ratios demonstrated comparable performance in predicting women at higher risk of cesarean section and moderate performance in identifying those likely to deliver vaginally. This may be partly explained by the study population's heterogeneity at Chonburi Hospital, which serves a diverse range of ethnic groups that could influence generalization.

Additionally, both ratios remained significant risk factors for cesarean section in multivariate analysis, with an adjusted OR of 0.38 (95% CI 0.21 to 0.69, p=0.002) for maternal height-to-pregestational weight ratio and adjusted OR of 0.18 (95% CI 0.07 to 0.45, p<0.001) for maternal height-to-weight at delivery ratio. Other significant predictors included maternal weight at delivery with an adjusted OR of 1.06 (95% CI 1.00 to 1.12, p=0.047) and maternal BMI with an adjusted OR of 1.12 (95% CI 1.05 to 1.20, p=0.001). These findings align with previous research by Young & Woodmansee[6], which showed that women with a pregestational or early pregnancy BMI of 30 or more had a sixfold increased risk of cesarean delivery due to obstructed labor or failed labor progress compared to non-obese women.

Similarly, research by Mogren et al. published in 2018[8] found that higher BMI and increasing maternal age were significant predictors of elevated cesarean section risk.

Other risk factors identified in this study included parity, where having had more deliveries previously was associated with reduced cesarean risk. Specifically, parity of 1 was associated with an adjusted OR of 0.26 (95% CI 0.11 to 0.56, p=0.001), and parity of 2 with an adjusted OR of 0.09 (95% CI 0.03 to 0.27, p<0.001). This is consistent with Williams Obstetrics, twenty-sixth edition[12], which states: "True CPD is rare in women who have previously delivered vaginally, because a successful prior vaginal birth is evidence of pelvic adequacy".

However, other studies reviewed, such as Toh-Adam et al. (2012)[3], Camilleri (1981)[4], Chan & Lao (2009)[5], and Mogren et al. (2018)[8] have reported that shorter maternal stature is a risk factor for increased cesarean delivery rates. These studies used different height thresholds for predicting risk depending on their population characteristics. In the present study, no statistically significant difference was found in maternal height between groups, which may be due to the limited variability in stature among this study's population. Therefore, other predictive factors may be necessary to improve risk assessment.

The present study used real-world clinical data from a large tertiary hospital in Thailand, making the findings highly relevant to local obstetric practice. Because the population consisted primarily of Asian women, the results are applicable to other countries in the region. The use of strict inclusion criteria together with multivariate logistic regression and ROC analysis enhanced the robustness and clinical applicability of the results. However, the single-center, cross-sectional design limits generalizability, precludes causal inference, and may introduce recall bias in pre-pregnancy weight due to reliance on self-reported data.

Conclusion

Using maternal height-to-pregestational weight ratio with a cutoff at 2.89 or less and height-to-weight at delivery ratio with a cutoff at 2.25 or less can help screen for increased cesarean delivery risk. These measures may be used for early identification and counseling of pregnant women at higher risk, potentially helping to prevent complications associated with cesarean sections. However, these ratios alone do not offer sufficient predictive accuracy to serve as standalone predictors of CPD and should be considered alongside other clinical factors.

What is already known about this topic?

From the previous studies, several risk factors for CPD have been identified. However, data from Thailand remain limited, and no direct predictive variable has been established.

What does this study add?

This study identifies two maternal height-to-weight ratio cutoffs of 2.89 or less before pregnancy and 2.25 or less at delivery, as independent predictors of emergency cesarean section due to CPD. These simple, clinically accessible measures may help improve risk stratification and early counseling for women at higher risk.

Authors' contribution

KW conceived and designed the study, collected the data, performed the statistical analysis, and drafted the manuscript. TL supervised the research process, provided academic guidance, and critically revised the manuscript for important intellectual content. Both authors read and approved the final manuscript.

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Conflicts of interest

The authors declare no conflict of interest.

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