

Cesarean Section Rate according to Rhobson system classification at Qena University Hospitals

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Abstract

Background: The Robson Ten-Group Classification System categorizes pregnancies based on various factors. Global CS rates are increasing annually. Egypt has a high CS rate of 51.8%, ranking third globally.

Objectives: To analyze CS rates using the 10-group classification and devise strategies to reduce high CS rates.

Patients and methods: We conducted a cross-sectional study of 2000 patients at Qena University Hospital, from March 2022 to February 2023. Inclusion criteria involved females giving birth, categorized into Robson's 10 classes. Data collected included parity, prior delivery method, previous CS, gestational age, labor onset, and Robson classification. Comprehensive patient assessments were conducted.

Results: Significant differences ($P < 0.0001$) in age, gestational age, Cesarean sections (CS), parity, and mode of delivery among the ten groups were observed, highlighting diverse group profiles. Group 4 had the highest average age (31.22 years), Group-1 the youngest (22.29 years), Group-3 the lowest gestational age (38.59 weeks), and Group-10 the highest (34.5 weeks). Also there was significant difference among groups regarding Robson classification data ($P < 0.0001$).

Conclusion: In summary, group five after that, group ten, and two among the ten groups according to the Rhobson system classification had the highest total CS rates, the highest total number of women delivered, and the largest contribution to the overall CS rate in Qena University Hospital.

Keywords: Cesarean Section (CS); Robson Ten-Group Classification System.

DOI: 10.21608/SVUIJM.2023.236195.1696

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Received: 2 September, 2023.

Revised: 2 October, 2023.

Accepted: 3 October, 2023.

Published: 27 April, 2025

Cite this article as Abd El-Naser Abd El-Gaber Ali, Hazem Hashem Ahmed, Shimaa Ahmed Ali Khalawy, Mostafa Mohamed Khodary. (2025). Cesarean Section Rate according to Rhobson system classification at Qena University Hospitals. *SVU-International Journal of Medical Sciences*. Vol.8, Issue 1, pp: 1035-1052.

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Introduction

During the last period, there has been widespread concern regarding the increase in CS rates (**Robson et al., 2001**). While this rise is a global trend, its onset and progression vary significantly from one country to another, leading to substantial regional disparities (**Thomas et al., 2001**).

Cesarean sections constituted 18.6% of all births across 150 countries. Over the 24-year study period (1990–2014), a trend analysis of data from 121 countries revealed an average increase in CS rates of 12.4%, with an annual average rate of 4.4% (**Betrán et al., 2016**). The highest annual increase rate (6.4%) was observed in Asia, while the lowest (1.6%) was in North America.

Egypt boasts an estimated CS rate of 51.8%, ranking it as the third highest globally (**Kandil et al., 2018**). This rate is likely influenced by various factors, including an elevated demand for CS among primigravidae. High CS rates in Egypt can be partly attributed to obstetricians capitalizing on women's concerns about labor and delivery pain and duration. In the absence of evidence, they may promote the superiority and safety of cesarean sections for the long-term health of mothers. An illustrative example is the universal recommendation against vaginal birth after CS (VBAC) (**Iriye et al., 2017; Murphy et al., 2020**).

The Robson Ten-Group Classification System is a tool that facilitates critical analysis based on pregnancy characteristics (ranging from 1 to 10, encompassing fetal presentation, gestational age, onset of labor, indications for CS, history of CS, and the number of infants) (**Senanayake et al., 2019**).

Despite significantly reducing perinatal morbidity and mortality, CS poses a substantial threat to maternal and neonatal health. Complications

such as bleeding, anemia, extended hospitalization, wound infections with dehiscence, urinary tract infections, and endometritis are among the issues and adverse outcomes associated with CS (**Miseljic et al., 2020**). Some maternal mortality related to CS is attributed to uncontrolled bleeding, worsening preexisting systemic disorders, heart failure, and similar conditions (**Miseljic et al., 2020**). Additionally, uterine rupture, abnormal placental attachment in subsequent pregnancies, ectopic pregnancies, preterm births, and stillbirths are potential complications. The higher cost to patients, society, or the country is another significant unintended consequence (**Chu et al., 2021**).

The research aimed to investigate CS rates at Qena University Hospital using a 10-group categorization system, identify the categories with the highest CS rates, and propose solutions for reducing the overall CS rates.

Patients and methods

From March 1, 2022, to February 28, 2023, we conducted a cross-sectional study upon 2000 patients at the Obstetrics and Gynecology Department at Qena University Hospital, South Valley University, Egypt.

Inclusion Criteria: To evaluate the overall rate and group representation, all females who gave birth during the study period were included and categorized into one of Robson's 10 classes. Obstetric data for each patient were collected through a questionnaire and recorded in Microsoft Excel. This information included parity, prior delivery method, previous Cesarean sections (CS) and their indications, gestational age at the onset of labor, and whether labor commenced spontaneously or was induced. The Robson system accounted for all in-hospital births. The

Robson Ten-Group Classification System for Pregnancy facilitated the

analysis (Barčaitė et al., 2015). (Table.1).

Table 1. The Robson Ten-Group Classification System

Group	Description	Group Criteria
Group 1	Nulliparous persons in Spontaneous Labor	- Nulliparous (no prior childbirth) - Single cephalic presentation - At least 37 weeks gestation - Undergoing spontaneous labor
Group 2	Nulliparous persons with Induction or Cesarean Section	- Nulliparous - Single cephalic presentation - At least 37 weeks gestation - Induction or cesarean section before labor onset
Group 3	Multiparous Women in Spontaneous Labor - Women who have already given birth - No prior cesarean section	- Multiparous (prior childbirth) - Single cephalic presentation - At least 37 weeks gestation - Spontaneous labor onset
Group 4	Multiparous Women with Induction/Cesarean Section - Women who have given birth many times - No prior cesarean section	- Multiparous - Single cephalic presentation - At least 37 weeks gestation - Planned induction/cesarean before labor
Group 5	Individuals with a History of Cesarean Section	- History of prior cesarean section - Single cephalic presentation - Typically after 37 weeks gestation
Group 6	Nulliparous Women with Breech Presentation	- Nulliparous - Breech presentation - Primigravid - Breech presentation discussion
Group 7	Multiparous Women with Breech Presentation	- Multiparous - Breech presentation - History of previous cesarean sections
Group 8	Multiple Pregnancies - The Phenomenon of Multiple Pregnancies	- History of previous cesarean sections
Group 9	Unconventional Positions - Unconventional job roles	- History of previous cesarean section procedures
Group 10	Single Cephalic Presentation in Preterm Births	- Single cephalic presentation - Gestational age less than 37 weeks - History of previous cesarean procedures history

Methods: Patients underwent a comprehensive assessment, including a complete medical history, physical examination, abdominal palpation during pregnancy, and fetal auscultation.

Ethical considerations: played a pivotal role in this research endeavor, underscoring our commitment to upholding ethical standards. We diligently submitted the study protocol for approval to the Institutional Review Board at Qena University Hospital, which is affiliated with South Valley University in Egypt. Approval was granted by the Ethical Committee of the Qena Faculty of Medicine. Prior to their participation, all study

participants provided written informed consent, and our research team diligently safeguarded their confidentiality and personal privacy throughout the research period.

Statistical analysis:

The data in this study underwent rigorous examination using contemporary statistical methods. It was meticulously collected, organized, and subjected to comprehensive analysis using professional statistical software packages, specifically SPSS 22.0 for Windows (SPSS Inc., Chicago, IL, USA) and MedCalc 13 for Windows (MedCalc Software BVBA, Ostend, Belgium). To assess the normality of data distribution, the

Shapiro-Wilk test was employed. To explore relationships between categorical variables, statistical significance was determined through the utilization of the Chi-square (χ^2) and Fisher's exact tests. Qualitative data were effectively presented using percentages and frequencies. Quantitative data for parametric variables were represented with mean values and their respective standard deviations, while non-parametric data were characterized by median values and their ranges. To assess disparities in quantitative variables between two groups, assuming a parametric distribution, the independent T-test was employed. For non-parametric variables, the Mann-Whitney test was appropriately utilized. The study also employed the one-way analysis of variance (ANOVA) test, coupled with the least significant difference (LSD) post hoc test, to evaluate the distribution of variables following a

normal distribution across multiple dependent groups. Variables that deviated from a normal distribution were examined using the Kruskal-Wallis test.

Results

(Table.2) show that group 1 (n=82) is notable for its average age of 22.29 years (Mean $\pm$ SD: 22.29 $\pm$ 5.01), while group 2 (n=162) and group 3 (n=192) exhibit mean ages of 24.1 $\pm$ 5.59 and 28.27 $\pm$ 5.89 years, respectively. group 4 (n=82) has an older average age of 31.22 $\pm$ 6.72 years, and group 5 (n=892) follows closely with an average age of 28.63 $\pm$ 5.62 years. group 6 (n=20) has a mean age of 23.65 $\pm$ 5.44 years, group 7 (n=117) averages 29.3 $\pm$ 5.9 years, group 8 (n=146) has an average age of 27.61 $\pm$ 5.2 years, group 9 (n=9) shows an average age of 28.44 $\pm$ 6.43 years, and finally, group 10 (n=484) has an average age of 28.98 $\pm$ 5.81 years.

Table 2. Groups characteristics

Variables		Group 1 (n = 82)	Group 2 (n = 162)	Group 3 (n = 192)	Group 4 (n = 82)	Group 5 (n = 892)	Group 6 (n = 20)	Group 7 (n = 117)	Group 8 (n = 146)	Group9 (n = 9)	Group 10 (n = 484)	P- value
Age (years)	Mean $\pm$ SD	22.29 $\pm$ 5.01	24.1 $\pm$ 5.59	28.27 $\pm$ 5.89	31.22 $\pm$ 6.72	28.63 $\pm$ 5.62	23.65 $\pm$ 5.44	29.3 $\pm$ 5.9	27.61 $\pm$ 5.2	28.44 $\pm$ 6.43	28.98 $\pm$ 5.81	> 0.001
Post hoc analysis for age		P1 (0.361) , P2 (< 0.0001) , P3 (< 0.0001) , P4 (< 0.0001) , P5 (0.9944) , P6 (< 0.0001) , P7 (< 0.0001) , P8 (0.0656) , P9 (< 0.0001) , P10 (< 0.0001) , P11 (< 0.0001) , P12 (< 0.0001) , P13(>0.99) , P14 (< 0.0001) , P15 (< 0.0001) , P16 (0.4403) , P17 (< 0.0001) , P18 (0.0034) , P19 (0.9987) , P20 (0.02) , P21 (0.8753) , P22 (0.9886) , P23(>0.99) , P24 (0.9072) , P25 (0.0032) , P26 (< 0.0001) , P27 (0.3636) , P28 (0.0001) , P29 (0.9307) , P30 (0.0338) , P31 (0.0043) , P32 (0.9731) , P33 (0.5953) , P34(>0.99) , P35 (0.9859) , P36 (0.0017) , P37 (0.1018) , P38 (0.5316) , P39 (0.0016) , P40 (0.332) , P41(>0.99) , P42 (0.9999) , P43(>0.99) , P44 (0.2444) , P45(>0.99) ,										
GA (weeks)	Mean $\pm$ SD	38.45 $\pm$ 1.1	38.41 $\pm$ 1.28	38.59 $\pm$ 0.989	38.34 $\pm$ 1.5	38.05 $\pm$ 0.978	35.8 $\pm$ 3.3	36.33 $\pm$ 3.13	34.85 $\pm$ 3.8	37.33 $\pm$ 3.32	34.5 $\pm$ 2.62	> 0.001
Post hoc analysis for GA		P1 (>0.99) , P2 (0.9999) , P3 (>0.99) , P4 (0.7591) , P5 (< 0.0001) , P6 (< 0.0001) , P7 (< 0.0001) , P8 (0.8379) , P9 (< 0.0001) , P10 (0.9976) , P11 (>0.99) , P12 (0.4975) , P13 (< 0.0001) , P14 (< 0.0001) , P15 (< 0.0001) , P16 (0.847) , P17 (< 0.0001) , P18 (0.9941) , P19 (0.0201) , P20 (< 0.0001) , P21 (< 0.0001) , P22 (< 0.0001) , P23 (0.6842) , P24 (< 0.0001) , P25 (0.9587) , P26 (< 0.0001) , P27 (< 0.0001) , P28 (< 0.0001) , P29 (0.9069) , P30 (< 0.0001) , P31 (< 0.0001) , P32 (< 0.0001) , P33 (< 0.0001) , P34 (0.9855) , P35 (< 0.0001) , P36 (0.9834) , P37 (0.5812) , P38 (0.6432) , P39 (0.1072) , P40 (< 0.0001) , P41 (0.9042) , P42 (< 0.0001) , P43 (0.0092) , P44 (0.6799) , P45 (0.0007).										

Number of CS	Mean ± SD	00 ±	0.02 ± 0.16	00 ±	0.16 ± 0.6	2.13 ± 1.14	00 ±	1.86 ± 1.38	1.68 ± 1.68	0.56 ± 1.01	± 1.58 1.42	> 0.001
	Range	0	0 – 1	0	0 – 4	0 – 7	0	0 – 5	0 – 6	0 – 3	0 – 6	
Post hoc analysis for CS number	P1>0.99), P2>0.99), P3 (0.9964), P4 (< 0.0001), P5>0.99), P6 (< 0.0001), P7 (< 0.0001), P8 (0.9259), P9 (< 0.0001), P10>0.99), P11 (0.9962), P12 (< 0.0001), P13>0.99), P14 (< 0.0001), P15 (< 0.0001), P16 (0.9307), P17 (< 0.0001), P18 (0.9876), P19 (< 0.0001), P20>0.99), P21 (< 0.0001), P22 (< 0.0001), P23 (0.9123), P24 (< 0.0001), P25 (< 0.0001), P26 (0.9999), P27 (< 0.0001), P28 (< 0.0001), P29 (0.9921), P30 (< 0.0001), P31 (< 0.0001), P32 (0.3147), P33 (0.0003), P34 (0.0014), P35 (< 0.0001), P36 (< 0.0001), P37 (< 0.0001), P38 (0.9678), P39 (< 0.0001), P40 (0.9585), P41 (0.0318), P42 (0.3295), P43 (0.1137), P44 (0.9954), P45 (0.186).											
Parity	Nullipara	82 (100%)	162 (100%)	0	0	0	20 (100%)	0	39 (26.7%)	3 (33.3%)	91 (18.8%)	> 0.001
	Multipara	0	0	192 (100%)	82 (100%)	892 (100%)	0	117 (100%)	107 (73.3%)	6 (66.7%)	393 (81.2%)	
	P1 (0.625), P2 (< 0.001), P3 (< 0.001), P4 (< 0.001), P5 (0.289), P6 (< 0.001), P7 (< 0.001), P8 (< 0.001), P9 (< 0.001), P10 (< 0.001), P11 (< 0.001), P12 (< 0.001), P13 (0.084), P14 (< 0.001), P15 (< 0.001), P16 (< 0.001), P17 (< 0.001), P18 (0.537), P19 (0.233), P20 (< 0.001), P21 (0), 724), P22 (< 0.001), P23 (< 0.001), P24 (< 0.001), P25 (0), 035), P26 (< 0.001), P27 (0.802), P28 (< 0.001), P29 (< 0.001), P30 (< 0.001), P31 (< 0.001), P32 (0), 091), P33 (< 0.001), P34 (< 0.001), P35 (< 0.001), P36 (< 0.001), P37 (< 0.001), P38 (< 0.001), P39 (< 0.001), P40 (< 0.001), P41 (< 0.001), P42 (< 0.001), P43 (0.664), P44 (0.038), P45 (0.272).											
Previous CS	Yes	0	0	0	0	892 (100%)	0	92 (78.6%)	93 (63.7%)	3 (33.3%)	337 (69.6%)	> 0.001
	No	82 (100%)	162 (100%)	192 (100%)	82 (100%)	0	20 (100%)	25 (21.4%)	53 (36.3%)	6 (66.7%)	147 (30.4%)	
	P1 (0.625), P2 (0), 537), P3(> 0.99), P4 (< 0.001), P5 (0.289), P6 (< 0.001), P7 (< 0.001), P8 (< 0.001), P9 (< 0.001), P10 (0.905), P11 (0.625), P12 (< 0.001), P13 (0.084), P14 (< 0.001), P15 (< 0.001), P16 (< 0.001), P17 (< 0.001), P18 (0.537), P19 (< 0.001), P20 (0.055), P21 (< 0.001), P22 (< 0.001), P23 (< 0.001), P24 (< 0.001), P25 (< 0.001), P26 (0.289), P27 (< 0.001), P28 (< 0.001), P29 (< 0.001), P30 (< 0.001), P31 (< 0.001), P32 (< 0.001), P33 (< 0.001), P34 (< 0.001), P35 (< 0.001), P36 (< 0.001), P37 (< 0.001), P38 (0.035), P39 (< 0.001), P40 (0.008), P41 (0.002), P42 (0.053), P43 (0.686), P44 (0.177), P45 (0.02).											
Labor onset	Induced	0	2 (1.2%)	0	0	0	1 (5%)	0	0	0	0	> 0.001
	Pre-labor CS	0	160 (98.8%)	0	82 (100%)	819 (91.8%)	16 (80%)	99 (84.6%)	95 (65.1%)	7 (77.8%)	405 (83.7%)	
	Spontaneous	82 (100%)	0	192 (100%)	0	73 (8.2%)	3 (15%)	18 (15.4%)	51 (34.9%)	2 (22.2%)	79 (16.3%)	
	P1 (< 0.001), P2 (0), 693), P3 (< 0.001), P4 (< 0.001), P5 (< 0.001), P6 (< 0.001), P7 (< 0.001), P8 (< 0.001), P9 (< 0.001), P10 (< 0.001), P11 (0.891), P12 (< 0.001), P13 (< 0.001), P14 (< 0.001), P15 (< 0.001), P16 (< 0.001), P17 (< 0.001), P18 (< 0.001), P19 (< 0.001), P20 (< 0.001), P21 (< 0.001), P22 (< 0.001), P23 (< 0.001), P24 (< 0.001), P25 (0.008), P26 (0.008), P27 (0.003), P28 (< 0.001), P29 (< 0.001), P30 (< 0.001), P31 (< 0.001), P32 (0.009), P33 (< 0.001), P34 (< 0.001), P35 (< 0.001), P36 (0.356), P37 (0.065), P38 (0.804), P39 (0.003), P40 (0.002), P41 (0.071), P42 (0.538), P43 (0.03), P44 (< 0.001), P45 (< 0.001).											
Maturity	Pre-term	0	0	0	0	0	7 (35%)	45 (38.5%)	93 (63.7%)	2 (22.2%)	484 (100%)	> 0.001

	Term	82 (100%)	162 (100%)	192 (100%)	82 (100%)	892 (100%)	13 (65%)	72 (61.5%)	53 (36.3%)	7 (77.8%)	0	
	P1(> 0.99), P2(> 0.99), P3(> 0.99), P4(> 0.99), P5 (< 0.001), P6 (< 0.001), P7 (< 0.001), P8 (0.009), P9 (< 0.001), P10(> 0.99), P11(> 0.99), P12(> 0.99), P13 (< 0.001), P14 (< 0.001), P15 (< 0.001), P16 (0.003), P17 (< 0.001), P18(> 0.99), P19(> 0.99), P20 (< 0.001), P21 (< 0.001), P22 (< 0.001), P23 (0.002), P24 (< 0.001), P25(> 0.99), P26 (< 0.001), P27 (< 0.001), P28 (< 0.001), P29 (0.009), P30 (< 0.001), P31 (< 0.001), P32 (< 0.001), P33 (< 0.001), P34 (0.0001), P35 (< 0.001), P36 (0.809), P37 (0.026), P38 (0.675), P39 (< 0.001), P40 (0.0001), P41 (0.482), P42 (< 0.001), P43 (0.028), P44 (< 0.001), P45 (< 0.001).											
Mode of delivery	CS	4 (4.9%)	162 (100%)	14 (7.3%)	81 (98.8%)	836 (93.7%)	18 (90%)	103 (88%)	104 (71.2%)	8 (88.9%)	412 (85.1%)	> 0.001
	VD	78 (95.1%)	0	178 (92.7%)	1 (1.2%)	56 (6.3%)	2 (10%)	14 (12%)	42 (28.8%)	1 (11.1%)	72 (14.9%)	
	P1 (< 0.001), P2 (0.599), P3 (< 0.001), P4 (< 0.001), P5 (< 0.001), P6 (< 0.001), P7 (< 0.001), P8 (< 0.001), P9 (< 0.001), P10 (< 0.001), P11 (0.336), P12 (< 0.001), P13 (0.0115), P14 (< 0.001), P15 (< 0.001), P16 (0.053), P17 (< 0.001), P18 (< 0.001), P19 (< 0.001), P20 (< 0.001), P21 (< 0.001), P22 (< 0.001), P23 (< 0.001), P24 (< 0.001), P25 (0.08), P26 (0.097), P27 (0.005), P28 (< 0.001), P29 (0.189), P30 (< 0.001), P31 (0.367), P32 (0.032), P33 (< 0.001), P34 (0.446), P35 (< 0.001), P36(> 0.99), P37 (0.104 P38(> 0.99), P39 (0.752), P40 (0.001), P41(> 0.99), P42 (0.465), P43 (0.446), P44 (0.0003), P45(> 0.99).											

P1: Group1 vs Group2 , P2: Group1 vs Group3 , P3: Group1 vs Group4 , P4: Group1 vs Group5 , P5: Group1 vs Group6 , P6: Group1 vs Group7 , P7: Group1 vs Group8 , P8: Group1 vs Group9 , P9: Group1 vs Group10 , P10: Group2 vs Group3 , P11: Group2 vs Group4 , P12: Group2 vs Group5 , P13: Group2 vs Group6 , P14: Group2 vs Group7 , P15: Group2 vs Group8 , P16: Group2 vs Group9 , P17: Group2 vs Group10 , P18: Group3 vs Group4 , P19: Group3 vs Group5 , P20: Group3 vs Group6 , P21: Group3 vs Group7 , P22: Group3 vs Group8 , P23: Group3 vs Group9 , P24: Group3 vs Group10 , P25: Group4 vs Group5 , P26: Group4 vs Group6 , P27: Group4 vs Group7 , P28: Group4 vs Group8 , P29: Group4 vs Group9 , P30: Group4 vs Group10 , P31: Group5 vs Group6 , P32: Group5 vs Group7 , P33: Group5 vs Group8 , P34: Group5 vs Group9 , P35: Group5 vs Group10 , P36: Group6 vs Group7 , P37: Group6 vs Group8 , P38: Group6 vs Group9 , P39: Group6 vs Group10 , P40: Group7 vs Group8 , P41: Group7 vs Group9 , P42: Group7 vs Group10 , P43: Group8 vs Group9 , P44: Group8 vs Group10 , P45: Group9 vs Group10

The research findings revealed significant disparities in age, quantified in years, across eleven separate cohorts. Group 1 exhibited an age rise that was not found to be statistically significant when compared to Group 2 ($p=0.3610$). Nevertheless, the results demonstrated significant age increments in comparison to Groups 3 through 10 ($p<0.001$). Group 2 exhibited a comparable trend, with no statistically significant disparity in comparison to Group 3 ($p=1.0000$), but demonstrating noteworthy dissimilarities when compared to Groups 4 through 10 ($p<0.001$). Group 3 had a statistically significant augmentation in comparison to Group 4 ($p=0.0034$). Group 4 exhibited a statistically significant decrease when

compared to both Group 5 ($p=0.0032$) and Group 6 ($p<0.001$). Group 5 exhibited significant differences in age when compared to Group 6 ($p=0.0043$) and Group 10 ($p=0.0011$). Group 6 exhibited a statistically significant rise in age compared to Group 7 ($p=0.0017$), as well as noteworthy decreases when compared to Groups 4 and 10 ($p<0.001$). There was no statistically significant difference in age between Groups 7 and 8 ($p=0.3320$). Group 8 shown a lack of significant age escalation in comparison to Group 9 ($p=1.0000$), although revealed a statistically significant rise in age when contrasted with Group 10 ($p=0.0004$). Group 9 had a statistically insignificant increase

in age when compared to Group 10 (p=0.9985), (Fig. 1).

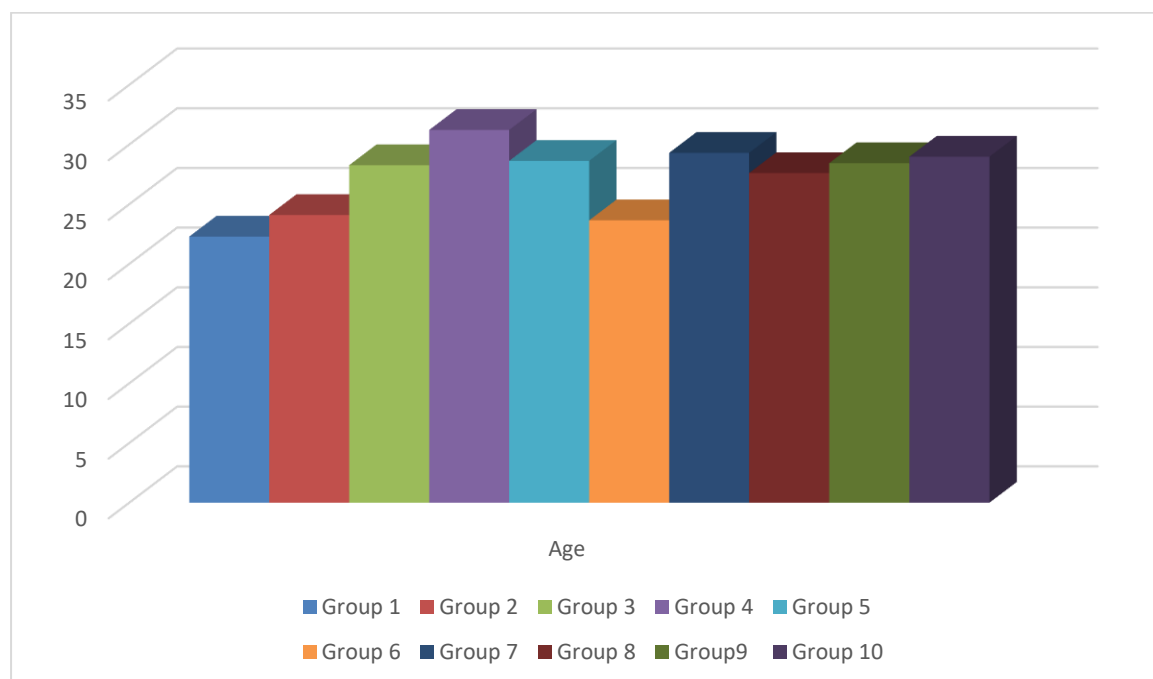


Fig. 1. Age means in different groups

Furthermore, the table provides comprehensive data regarding gestational age (GA) in weeks across the ten distinct groups. Group 1 displayed a mean GA of 38.45 ± 1.1 weeks, while Group 2 showed a mean GA of 38.41 ± 1.28 weeks. Group 3 exhibited a mean GA of 38.59 ± 0.989 weeks, and Group 4 had a mean GA of 38.34 ± 1.5 weeks. Group 5 presented a mean GA of 38.05 ± 0.978 weeks. Group 6 had a mean GA of 35.8 ± 3.3 weeks, Group 7 showed a mean GA of 36.33 ± 3.13 weeks, and Group 8 demonstrated a mean GA of 34.85 ± 3.8 weeks. Group 9 displayed a mean GA of 37.33 ± 3.32 weeks, while Group 10 had a mean GA of 34.5 ± 2.62 weeks. Significant disparities in gestational age (GA) were identified among these groups. Group 1 exhibited a statistically insignificant reduction in GA when compared to Group 2 ($p=1.0000$), as well as Groups 3 and 4 ($p>0.9941$). However, it's noteworthy that Group 1 displayed a substantial reduction in GA when compared to

Groups 5 through 10 ($p<0.0001$). Similarly, Group 2 demonstrated a statistically non-significant reduction compared to Group 3 ($p=0.9976$) and Groups 4 and 9 ($p>0.8470$). Nevertheless, noteworthy differences were observed between Groups 5 through 8 and Group 10, with a statistically significant difference ($p<0.0001$). Group 3 showed no statistically significant differences in gestational age (GA) when compared to Groups 4 and 9 ($p>0.6842$). However, substantial variations were evident between Group 3 and Groups 5 through 8 and 10 ($p<0.0001$). There were no significant differences in gestational age (GA) between Groups 4 and 9 ($p=0.9069$). However, significant differences in GA were observed between Groups 5 through 8 and 10 ($p<0.0001$). Groups 5 and 6 exhibited a statistically non-significant increase in GA ($p=0.8035$) and a statistically non-significant decrease ($p=0.1072$), respectively. Nevertheless, remarkable changes in gestational age

(GA) were noted across Groups 7, 8, and 10, with a statistically significant p-value of less than 0.0001. Significant variations in gestational age (GA) were observed between Groups 7 and 8 ($p<0.0001$), as well as between Groups

9 and 10 ($p=0.0007$). Additionally, Group 9 displayed a non-significant increase in GA compared to Group 10 ($p=0.0007$), (Fig. 2).

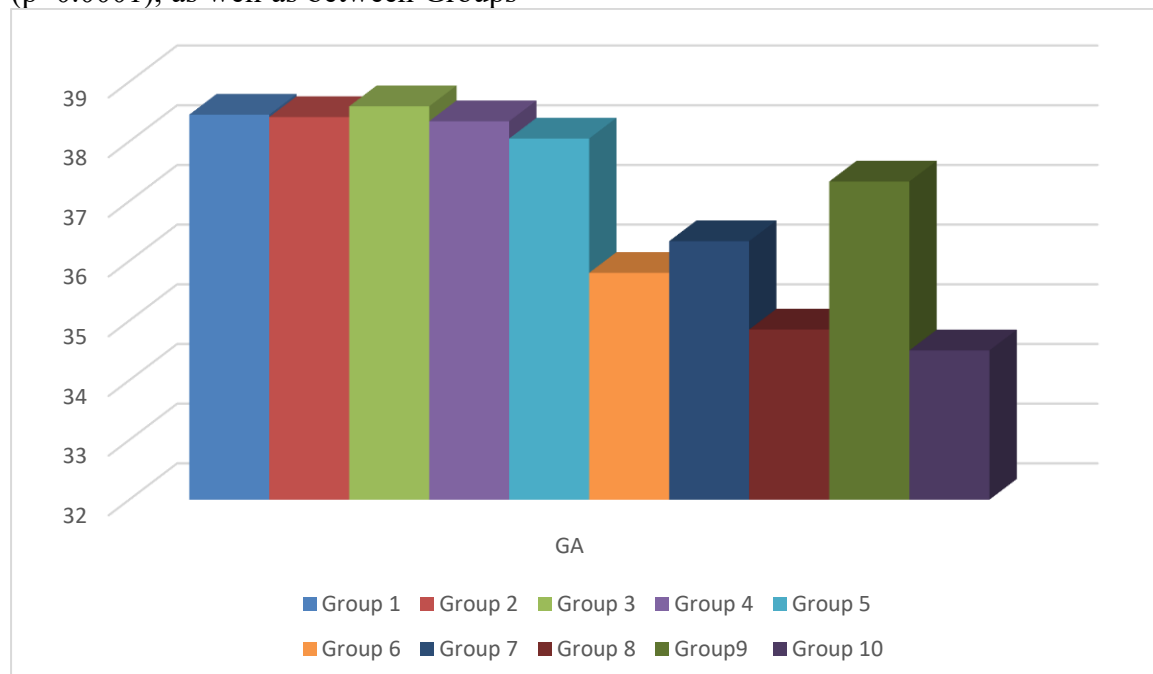


Fig. 2. Gestational age means in different groups

Additionally, the table presents extensive data pertaining to the frequency of cesarean sections (CS) across the 10 distinct groups, spanning from 0 to 7 CS. Significant disparities in the incidence of cesarean sections (CS) were observed across these groups. Group 1 exhibited a statistically non-significant elevation in CS in comparison to Group 2 ($p=1.0000$), Group 3 ($p=1.0000$), and Group 4 ($p=0.9964$). Nevertheless, it is important to highlight that Group 1 had a statistically significant elevation in CS in comparison to Groups 5, 6, 7, 8, and 10 ($p<0.0001$). In contrast, Group 2 did not demonstrate any statistically significant variations in cesarean sections (CS) in comparison to Groups 3 ($p=1.0000$) and 4 ($p=0.9962$). However, significant differences were seen when comparing Group 2 with Groups 5 through 8 and 10 ($p<0.0001$).

There were no statistically significant variations in cognitive skills (CS) between Group 3 and Group 4 ($p=0.9876$). Nevertheless, there were notable disparities seen between Group 3 and Groups 5 through 8 and 10, with statistical significance ($p<0.0001$). There were no statistically significant variations seen in the rates of cesarean sections (CS) between Groups 4 and 9 ($p=0.9921$). However, there were notable disparities in CS when comparing Groups 5 through 8 with Group 10 ($p<0.0001$). Groups 5 and 6 had a statistically significant reduction ($p<0.0014$) and a statistically significant elevation ($p<0.0003$) in CS, respectively, as compared to Group 8. Statistically significant differences were found between Groups 7 and 9 in relation to CS ($p=0.0318$), as well as between Groups 8 and 9 ($p=0.1137$). Finally, there were no statistically

significant differences seen in computer science performance between Groups 9 and 10 ($p=0.1860$), (Fig. 3)

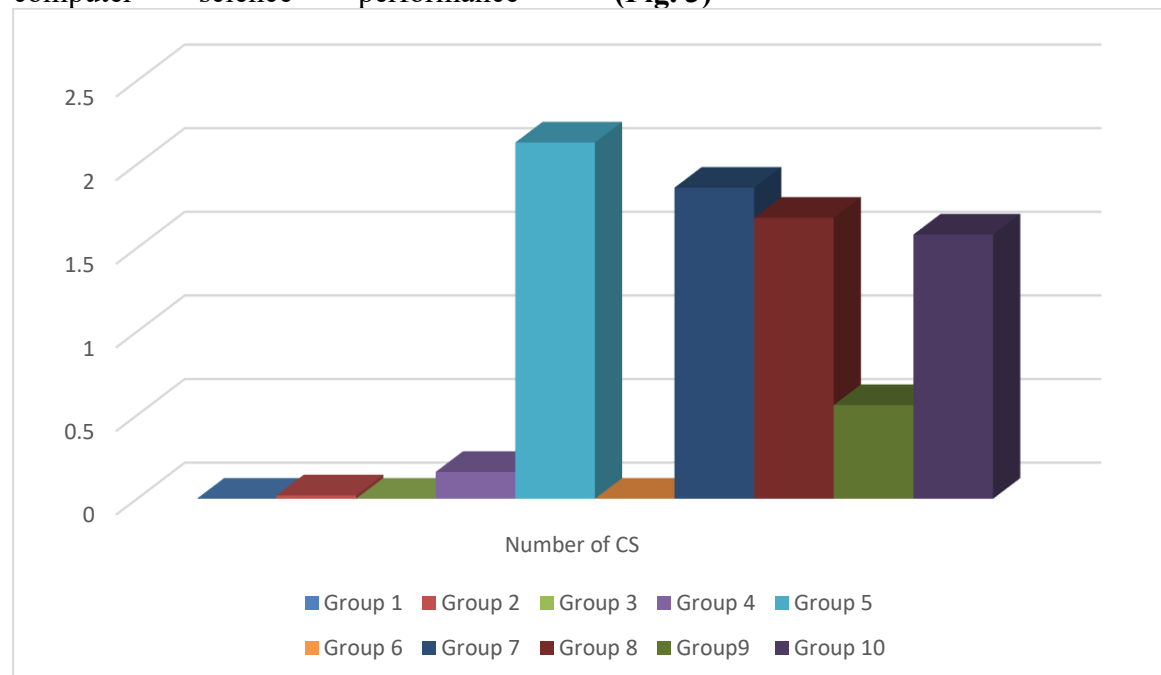


Fig. 3. Number of CS means in different groups

Parity was classified into two main categories: nullipara, referring to women who have never given birth, and multipara, referring to women who had given birth to two or more children. The term "nullipara" refers to persons belonging to both Group 1 and Group 2, who have not experienced childbirth in the past. On the other hand, it can be seen that people belonging to Group 3 through Group 10 have a prominent multiparous condition, signifying their exposure to several instances of delivery. A statistically significant disparity in parity was detected among the aforementioned groups ($p < 0.001$). Group 1 had a notable disparity in comparison to Group 3, Group 4, Group 5, Group 7, Group 8, Group 9, and Group 10, as seen by a significant rise in parity. All of the comparisons resulted in p -values < 0.001 , indicating a statistically significant difference. On the contrary, Group 2 did not demonstrate any statistically significant alteration in parity as

compared to Group 1. Moreover, Group 6 exhibited a notable improvement in parity when compared to Groups 3, 4, 5, and 10. Group 5 had a statistically significant rise in parity in comparison to Group 4, as shown by a p -value of 0.035. Nevertheless, there were no statistically significant disparities in parity identified when comparing Group 3 to Group 4, Group 3 to Group 5, Group 3 to Group 7, and Group 8 to Group 9. In conclusion, Group 8 exhibited a noteworthy improvement in parity as compared to Group 10, as shown by a statistically significant p -value of 0.038.

In relation to previous computer science proficiency, it is noteworthy that Group 5 had a 100% rate, whilst the other groups showed different numbers of participants lacking prior knowledge in computer science. A substantial statistical difference was seen across the groups in relation to their degree of previous computer science expertise ($p < 0.001$). Group 1 shown noteworthy decreases

in comparison to Groups 4, 5, 6, 7, 8, 9, and 10, with all p-values being less than 0.001. Group 2 had statistically significant decreases in contrast to Groups 5, 6, 7, 8, 9, and 10, with p-values < 0.001 for all comparisons. Similarly, Group 3 exhibited noteworthy decreases when compared to Groups 5, 6, 7, 8, 9, and 10, with p-values less than 0.001 for all comparisons. Additionally, it was noted that Group 6 had a statistically significant reduction in comparison to Group 9 ($p = 0.686$). Furthermore, Group 7 exhibited a noteworthy distinction, although with a reduced degree of statistical significance, in comparison to Groups 8 and 10 ($p = 0.02$ and $p > 0.05$, respectively). A considerable discrepancy was discovered between Group 9 and Group 10, with a statistically significant differentiation at a low level of significance ($p = 0.008$). No significant variations were detected among these groups. Labor initiation may be classified into several categories, such as induced labor, pre-labor cesarean section, and spontaneous labor. These categories include the many trends that have been noticed among these groupings. A substantial statistical difference was seen across the groups with regards to the initiation of work ($p < 0.001$). Statistically significant elevations in the rates of induced labor were seen in Group 2, Group 4, Group 5, Group 6, Group 7, Group 8, Group 9, and Group 10, with p-values less than 0.001. On the other hand, while examining the data, it was found that there were no statistically significant differences ($p > 0.05$) in the comparisons made between Group 1 and Group 3, as well as between Group 2 and Group 3.

Multiple comparisons revealed noteworthy increases in the use of induced labor, but with a very low degree of statistical significance. The

comparisons conducted in this study included Group 2 vs Group 6, Group 2 versus Group 8, and Group 3 versus Group 6, with corresponding p-values ranging from 0.003 to 0.071. Furthermore, the statistical analysis revealed significant increases in the comparisons between Group 4 and Group 5, as well as Group 4 and Group 6, with p-values of 0.008. In a similar vein, the statistical analysis comparing Group 6 and Group 9 revealed a p-value of 0.03, indicating a noteworthy rise in the frequency of induced labor. In relation to the classification of maturity, it was noted that Group 6 mostly included of births that were preterm, while Group 10 encompassed deliveries that happened at full term. Group 5 had a notably elevated prevalence of term births. A substantial statistical difference was seen between the groups in relation to the classification of maturity ($p < 0.001$). Group 10 had a statistically significant elevation in the number of term births when compared to all other groups ($p < 0.001$), hence demonstrating a notable discrepancy in the occurrence of term births. On the other hand, it was shown that Group 1 exhibited a statistically significant rise in preterm births when compared to Group 6 ($p < 0.001$). In addition, it was noted that Group 5 exhibited a statistically significant rise in term births in comparison to Group 1 ($p < 0.001$) and Group 4 ($p = 0.0001$). In a similar vein, it was observed that Group 7 exhibited a significant rise in term births in comparison to Group 1 ($p < 0.001$), Group 4 ($p < 0.001$), and Group 5 ($p = 0.0001$).

The technique of delivery exhibited variation across the groups, whereas Group 2 entirely included cesarean sections (CS), while the other groups had varying numbers of vaginal deliveries. The incorporation of precise quantitative characteristics offers a

thorough perspective on the varied profiles within each relevant category. A statistically significant difference was seen between the groups in relation to the method of delivery ($p < 0.001$). Significant differences were seen when contrasting the groups in relation to the mode of delivery. Group 2 had a notably elevated prevalence of Cesarean sections (CS) in comparison to the other groups ($p < 0.001$), hence signifying a substantial augmentation

in the quantity of CS deliveries. In contrast, Group 5 demonstrated a statistically significant rise in the occurrence of vaginal deliveries (VD) compared to Group 1 ($p < 0.001$), Group 3 ($p < 0.001$), Group 4 ($p < 0.001$), Group 6 ($p < 0.001$), Group 7 ($p < 0.001$), Group 8 ($p < 0.001$), Group 9 ($p < 0.001$), and Group 10 ($p < 0.001$), highlighting a noteworthy increase in VD for Group 5. (Fig.4)

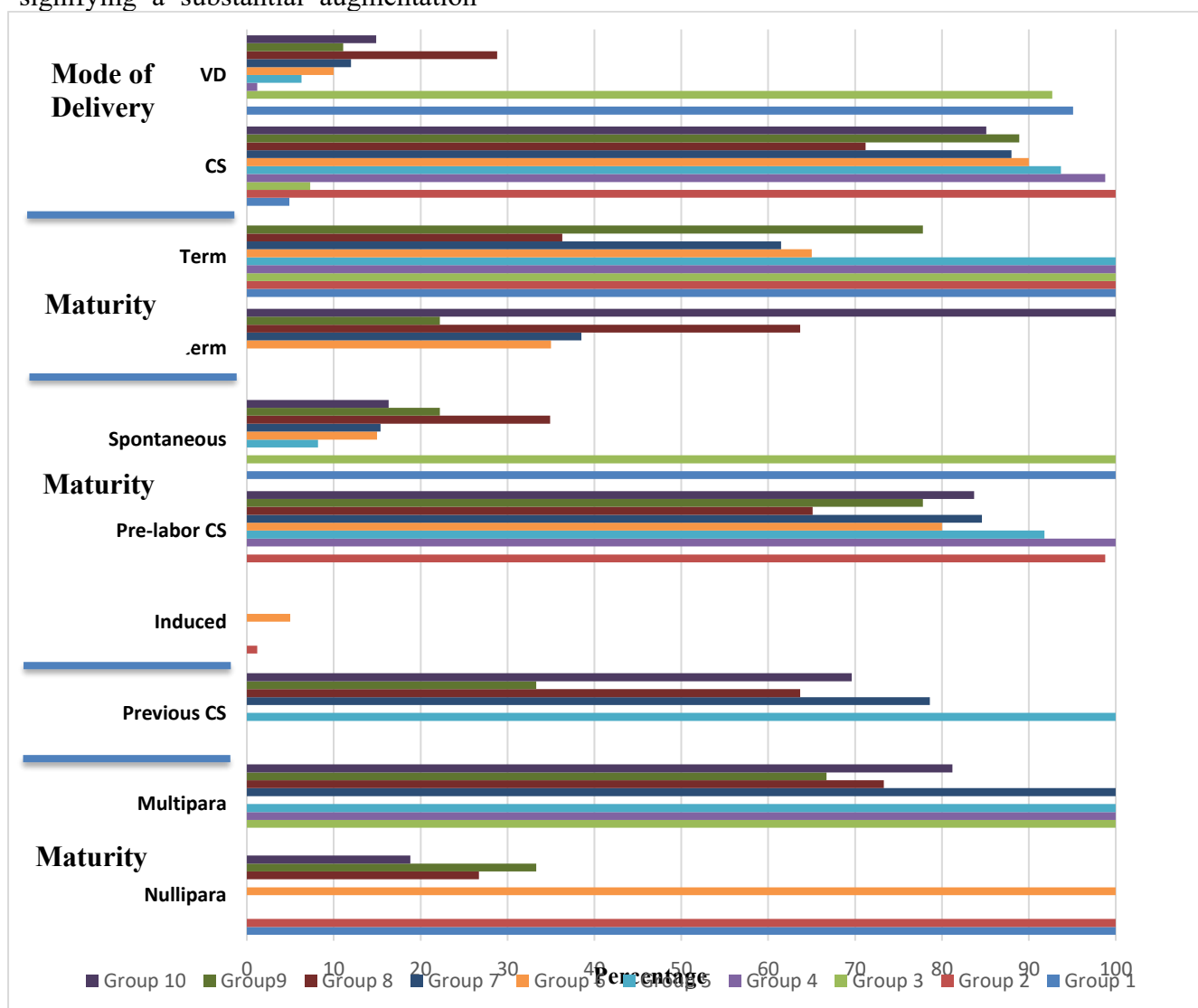


Fig. 4. Different obstetric data of included subjects

The Robson categorization report, depicted in (Table.3), presents essential quantitative data related to Cesarean section (CS) deliveries. The information in this table is organized into ten distinct categories, each

classified according to specific criteria. It includes the total count of Cesarean section (CS) procedures, the total number of women who underwent deliveries, the group sizes, the group Cesarean section rate (CSR), the

absolute contribution of each group to the overall Cesarean section rate, and the relative contribution of each group to the overall Cesarean section rate.

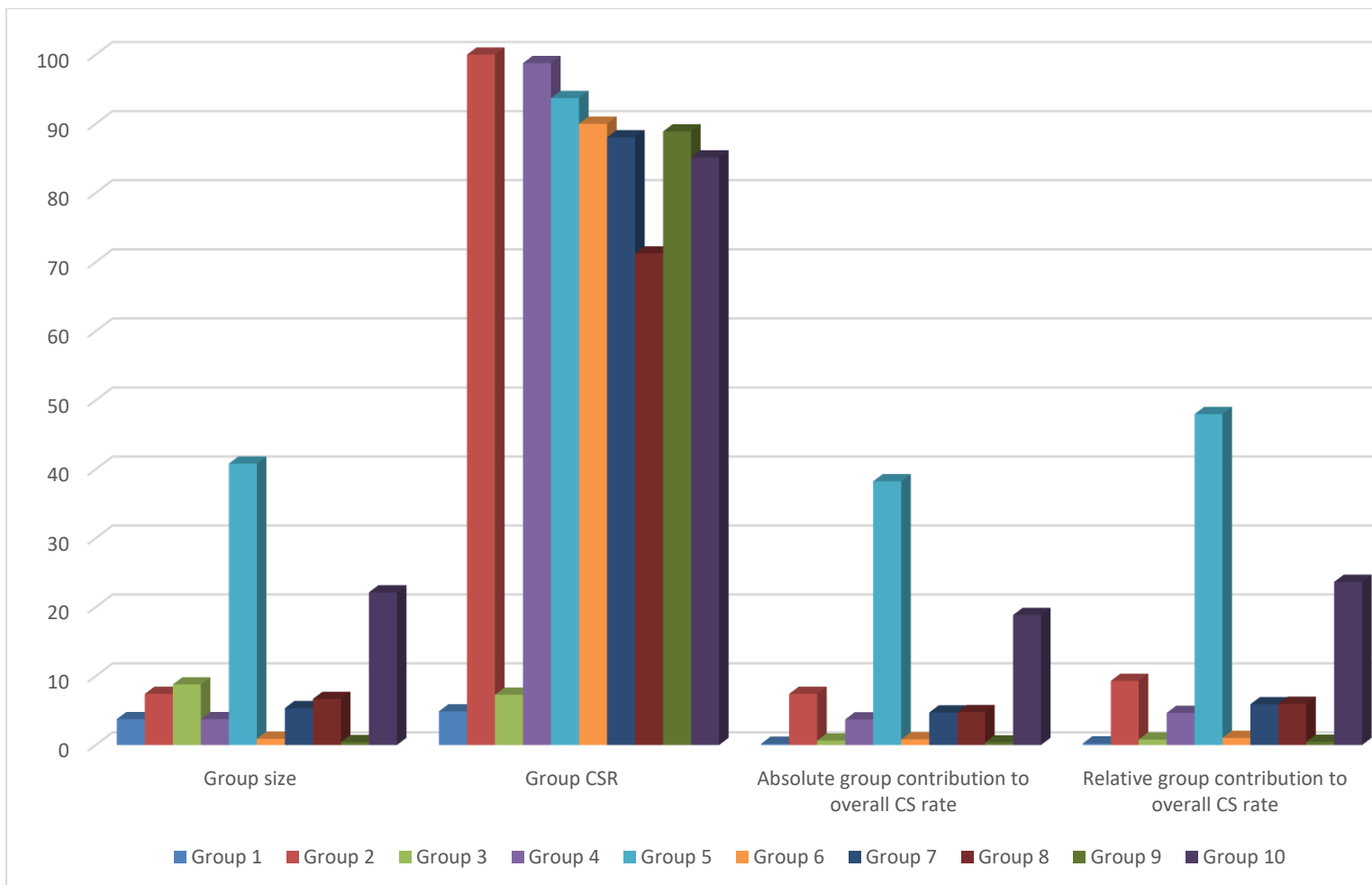
Group 1 comprises nulliparous individuals in spontaneous labor, with a total of 4 cesarean sections (CS) out of 82 women delivered, resulting in a group cesarean section rate (Group CSR) of 3.75%. This group's absolute group contribution to the overall CS rate is 4.88%, and their relative group contribution to the overall CS rate is 0.18%. In Group 2, which consists of nulliparous persons with induction or cesarean section before labor onset, there were 162 CS out of 162 women delivered, resulting in a 100% Group CSR. This group contributes 7.41% to the overall CS rate absolutely and 9.30% relatively. Group 3 includes multiparous women in spontaneous labor, with 14 CS out of 192 women delivered, leading to an 8.78% Group CSR. Their absolute and relative contributions to the overall CS rate are 7.29% and 0.64%, respectively. Group 4, which involves multiparous women with planned induction or cesarean before labor, experienced 81 CS out of 82 women delivered, resulting in a 98.78% Group CSR. This group contributes 3.75% absolutely and 4.65% relatively to the overall CS rate. In Group 5, individuals with a history of cesarean section had 836 CS out of 892 women delivered, resulting in a 40.81% Group CSR. Their absolute contribution to the overall CS rate is 93.72%, and the relative contribution is 38.24%. Group 6, comprising nulliparous women with breech presentation, experienced 18 CS out of

20 women delivered, leading to a 90.00% Group CSR. Their absolute contribution to the overall CS rate is 0.82%, and the relative contribution is 1.03%. Group 7, which consists of multiparous women with breech presentation and a history of previous cesarean sections, had 103 CS out of 117 women delivered, resulting in an 88.03% Group CSR. This group's absolute and relative contributions to the overall CS rate are 4.71% and 5.91%, respectively. In Group 8, related to multiple pregnancies with a history of previous cesarean sections, there were 104 CS out of 146 women delivered, resulting in a 71.23% Group CSR. This group contributes 6.68% absolutely and 5.97% relatively to the overall CS rate. Group 9, focusing on unconventional positions in unconventional job roles with a history of previous cesarean section procedures, experienced 8 CS out of 9 women delivered, leading to an 88.89% Group CSR. Their absolute and relative contributions to the overall CS rate are 0.37% and 0.46%, respectively. Finally, Group 10, which represents single cephalic presentation in preterm births with a history of previous cesarean procedures, had 412 CS out of 484 women delivered, resulting in a 85.12% Group CSR. This group's absolute contribution to the overall CS rate is 18.85%, and the relative contribution is 23.65%.

A notable disparity was observed in the comparison between the overall count of CS procedures and the total count of women who underwent deliveries across all groups ($p < 0.0001$). (Fig. 5).

Table 3. Robson classification report

Variables	Total number of CS	Total number of women delivered	Group size	Group CSR	Absolute group contribution to overall CS rate	Relative group contribution to overall CS rate
Group 1	4	82	3.75%	4.88%	0.18%	0.23%
Group 2	162	162	7.41%	100.00 %	7.41%	9.30%
Group 3	14	192	8.78%	7.29%	0.64%	0.80%
Group 4	81	82	3.75%	98.78%	3.71%	4.65%
Group 5	836	892	40.81%	93.72%	38.24%	47.99%
Group 6	18	20	0.91%	90.00%	0.82%	1.03%
Group 7	103	117	5.35%	88.03%	4.71%	5.91%
Group 8	104	146	6.68%	71.23%	4.76%	5.97%
Group 9	8	9	0.41%	88.89%	0.37%	0.46%
Group 10	412	484	22.14%	85.12%	18.85%	23.65%
P-value	<0.0001					

**Fig. 5. Robson classification report**

Discussion

The study revealed that the average age of individuals in group 1 was 22.29 years with a standard deviation of 5.01. Additionally, the gestational age of the same group was discovered to be 38.45 weeks with a standard deviation of 1.1. A total of 82 instances of nullipara, 82 instances of spontaneous labor commencement, term maturity, and 78 instances of vaginal birth were seen, with a mere 4 instances of cesarean section.

According to the findings of **Murugesan and Rengaraj (2021)**, the cesarean section (CS) rate was observed to be 21.4 percent among a total of 16,863 women who participated in the research. In general, the primary factors contributing to cesarean section (CS) were nonprogressive labor and cephalopelvic disproportion, which were shown to be the most often seen causes. The biggest group, including nulliparous, singleton, term cephalic pregnancies with spontaneous labor, was followed by group 2, which consisted of nulliparous, singleton, term cephalic pregnancies with induced labor, with proportions of 25 percent and 16.9 percent, respectively. Group 5, consisting of multiparous women with singleton pregnancies at term with a cephalic presentation and a preexisting uterine scar, had the largest contribution to cesarean section (CS) rates at 34.9%. Following closely behind, group 2 demonstrated a contribution of 18.9%. In terms of their impact on the field of computer science inside our hospital, it can be said that Robson groups 5, 2, and 1 have emerged as the most noteworthy contributors. According to the study conducted by **Murugesan et al. (2021)**,

Our findings showed that the mean age of group 2 (years) was 24.1 ± 5.59 and gestational age was

(weeks) 38.41 ± 1.28 . There were 162 cases of nullipara, 160 cases of pre-labor CS, only 2 cases of induced labor, 162 cases of term maturity, and 162 cases of CS.

The findings of our study align with previous research that has used the Robson classification system to evaluate cesarean section (CS) rates. Specifically, our results are comparable with studies conducted by **Kazmi et al. (2021)** and **Kelly et al. (2013)**, which have identified groups 5, 2, and 1 as the primary factors contributing to the global CS rate. The results of a research done in Quebec indicate that women who have previously had cesarean sections (CS) and women who have never given birth (nulliparous) are the primary factors contributing to the high prevalence of CS. These two groups together account for more than sixty percent of all cesarean deliveries (**Rossignol et al., 2013, Kazmi et al., 2012, Brennan et al., 2009**)

Our results observed that the mean age of group 3 (years) was 28.27 ± 5.89 and gestational age was (weeks) 38.59 ± 0.989 , no previous CS, 192 cases were multipara, 192 cases were spontaneous, 192 cases were term maturity, 14 cases were CS, and 178 cases were vaginal delivery.

research by **Soares et al.**, who reported that Group 3 was multiparous, had no previous C-section, had a single fetus, had a cephalic presentation, was > 37 weeks gestation, and spontaneous labor. A cesarean section was observed in 12% of groups (**Soares et al., 2021**).

We found that the mean age of group 4 (years) was 31.22 ± 6.72 and gestational age was (weeks) 38.34 ± 1.5 , the number of previous CS. Ranged from 0 to 4, there were 82 cases of multipara, 82 cases of pre-labor CS onset, 82 cases of term maturity, and 81 cases of CS, with only one case of vaginal delivery.

Litorp et al. demonstrated that Correction for maternal age or private healthcare insurance impacted the odds ratio of cesarean delivery for all Robson groups, with the exception of group 4, which consisted of multipara mothers who had an induction or elective CS. Furthermore, in seven of the ten Robson groups, correction for maternal age or private healthcare insurance independently modified the odds ratio of CS. (**Litorp et al., 2013**).

Our results showed that the mean age of group 5 (years) was 28.63 ± 5.62 and gestational age was (weeks) 38.05 ± 0.978 , the number of previous CS. Ranging from 0 to 7, previous CS was observed in 892 cases; there were 892 cases of multipara, spontaneous labor onset, 819 cases of prelabor CS onset, 892 cases of term maturity, and 836 cases of vaginal delivery. These results showed that the majority of cases underwent CS. Because the possibilities were few, there was little experience, and the hospitals were not efficient for these cases.

Dhodapkar et al. (2015) observed that group 5, also known as CS, accounted for the largest proportion, namely 40.1%, of the total contribution to CS. This finding aligns with the observations reported in the majority of research conducted across India. A research conducted by **Wanjari SA (2014)** in Maharashtra revealed that recurrent cesarean sections constituted 32.8% of all cesarean sections. A comparable finding was documented in a research conducted by Abdel-Aleem H10 in Egypt, which revealed that 30% of cesarean sections (CS) were repeat CS (**Abdel-Aleem et al., 2013**).

We found that the mean age of group 6 (years) was 23.65 ± 5.44 and gestational age was (weeks) 35.8 ± 3.3 ; there was no previous CS. In total, there were 20 cases of nullipara, 3 cases of spontaneous labor onset, only

one case of induced labor, 16 cases of prelabor CS onset, 13 cases of term maturity, 7 preterm cases, and 18 cases of CS, and 2 cases of vaginal delivery.

According to the findings of **Jadoon et al. (2020)**, the study identified group 6, consisting of nulliparous women with a single breech pregnancy, and group 10, comprising of cephalic preterm pregnancies, as the second and third highest contributors to the overall cesarean section (CS) rate. These groups accounted for 4.6 percent and 2.8 percent of the total CS rate, respectively.

Our results observed that the mean age of group 7 (years) was 29.3 ± 5.9 and gestational age was (weeks) 36.33 ± 3.13 , the number of previous CS was observed in 92 cases, there were 105 cases of multipara, 18 cases of spontaneous labor onset, 99 cases of pre-labor CS onset, 72 cases of term maturity, preterm 95 cases, and 103 cases of CS, and 14 cases of vaginal delivery.

According to the findings of **Soares et al. (2021)**, a high rate of cesarean section (97.4%) was seen among multiparous women with a single fetus with pelvic presentation and a history of prior cesarean surgery.

We observed that the mean age of group 8 (years) was 27.61 ± 5.2 and gestational age was (weeks) 34.85 ± 3.8 . The number of previous CS was observed in 93 cases; there were 39 cases of nullipara, 107 cases of multipara, 51 cases of spontaneous labor onset, 95 cases of pre-labor CS onset, 53 cases of term maturity, 93 preterm cases, and 104 cases of vaginal delivery.

Soares et al. (2021) who demonstrated that in group 8 there were any woman with twin pregnancy; likelihood of previous cesarean section. Cesarian section per group was observed by 94.1%.

Our findings showed that the mean age of group 9 (years) was 28.4 ± 6.4 and gestational age was (weeks) 37.33 ± 3.32 . The number of previous CS was observed in 3 cases only; there were 3 cases of nullipara, 6 cases of multipara, 2 cases of spontaneous labor onset, 7 cases of pre-labor CS onset, 7 cases of term maturity, and 8 cases of CS, with only one case of vaginal delivery.

According to the findings of **Begum et al. (2019)**, there was an observed association between bigger hospital size and higher rates of cesarean sections in high-risk obstetric categories. For instance, it was shown that a significant proportion of moms with transverse or oblique fetal presentations sought care at prominent tertiary healthcare institutions. Likewise, across smaller healthcare facilities, the cesarean section (CS) rate for aberrant fetal presentations under the "Robson Nine" classification had a null value. The percentage of cesarean section performed before term was much higher in major institutions, reaching 44%, compared to 24-29% in small and medium-sized hospitals. Considering the fact that medical college hospitals possess superior capabilities for delivering comprehensive care to preterm and low-birth-weight babies, it may be inferred that these institutions tend to have a higher prevalence of cesarean sections. The correlation between hospital bed size and the cesarean section (CS) rate aligns with existing research that conceptualizes this phenomenon as the "supply-driven model." According to this model, there is a positive relationship between the ability of a healthcare system to provide surgical obstetric care and the proportion of women opting for surgical delivery.

It was determined that the average age of individuals in group 10

was 28.93 ± 5.8 years, while the gestational age was 34.5 ± 2.62 weeks. Additionally, the number of prior cesarean sections was also recorded. The observed range of prior cesarean sections (CS) in the sample population was 0 to 6. Out of the total 373 instances, 91 were nulliparous, 393 were multiparous, 79 had spontaneous labor commencement, 405 had pre-labor CS start, 484 had pre-term maturity, and 412 underwent CS, while only 72 cases resulted in vaginal birth.

According to the findings of **Soares et al. (2021)**, it was observed that women with a singleton fetus with cephalic presentation and gestational age less than 37 weeks had an increased probability of having had a previous cesarean section. The rate of cesarean section among the observed groups was found to be 51.23%.

The findings of our study indicate that group 5 had the highest proportion (38.65%) and shown the strongest correlation with both the total number of cesarean sections (82 patients) and the total number of women who delivered (97 patients), as reported in the Robson classification report.

In relation to the total CS rate, Group 5 made an absolute contribution of 32.67 percent, while its relative contribution to the overall CS rate was 40.8 percent. The majority of individuals in Group 7 were primarily engaged in corporate social responsibility (CSR) activities.

According to a research conducted by **Barber et al. (2011)**. From 2003 to 2009, there was a notable increase of 50 percent in primary cesarean births, resulting in a corresponding overall jump in the cesarean birth rate from 26 percent to 36.5 percent. The documented indications that have experienced an increase over time include non-reassuring fetal status, fetal arrest, multiple gestation, preeclampsia,

suspected macrosomia, and maternal request. On the other hand, indications such as arrest of descent, malpresentation, maternal-fetal indications, and other obstetric indications like cord prolapse and placenta previa have not shown a similar increase.

Conclusion

In summary, based on the Rhobson system categorization, it can be determined that group 5 exhibited the highest cumulative cesarean section rates, conducted the greatest number of cesarean sections, and made the most significant contribution to the overall cesarean section rate at Qena University Hospital. Subsequently, group 10 was succeeded by group 2. Group 2 had the most minimal aggregate rates of cesarean section.

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