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# Risk Factors Associated with Caesarean Sections Compared with Normal Vaginal Deliveries in Palestine

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## Abstract

According to the World Health Organization (WHO) and the Ministry of Health report in Palestine, the usage and incidence of cesarean sections (CS) delivery method is a global and local issue that has increased recently. WHO has pointed out that any region has no justification for having a rate higher than the recommended rate. In order to decrease this rate, the current study aimed to assess the common non-obstetric and obstetric risk factors of CS among Palestinian women. A descriptive cross-sectional study was conducted using a standardized questionnaire to determine the independent risk factors related to CS compared with standard vaginal delivery (NVD). A total of 300 participants (150 cases who had a CS and 150 who had (NVD) were selected from three hospitals in Palestine, and they were interviewed through face-to-face interviews. The following independent risk factors were found to have a significant association ($P<0.05$) with increased risk of CS: over-weight before and during pregnancy; having edema, anemia, bleeding, or high blood pressure during pregnancy; mal-presentation of the fetus; higher level of education; living in the village; history of eclampsia; previous CS; advanced gestational age; head circumference of a newborn, use of pregnancy fixatives products, and use of Intra-Uterine Device (IUD) contraceptive methods. However, the independent factors that might help patients avoid cesarean section were practicing exercise before pregnancy, increasing the number of antenatal visits, and using safe medical herbs. This study provided new evidence of a positive relationship between using fixatives during pregnancy and an increased risk of CS; this result has not been studied in previous research papers. The study highlights the importance of increasing awareness about clinical and public health measures to prevent risk factors associated with increased risk of cesarean section. To decrease the risks, maintaining normal BMI, practicing sports, the importance of adequate antenatal visits, and preventing any complications during pregnancy.

**Keywords**: Obstetrics; Non-obstetrics; Caesarean section; Vaginal deliveries.

## INTRODUCTION

According to the World Health Organization (WHO) and the Ministry of Health report, the usage and incidence of cesarean sections (CS) delivery method is a global and local issue that increased recently (1). The number of CS deliveries continues to increase in developing and the most developed countries (2). The prevalence exceeded the world health organization recommendations rate of 10–15%. WHO has pointed out that there is no justification for any region to have a rate higher than the recommended rate (3). The percentage of cesarean sections in 2010 increased to 4.8% compared to the percentage of the same period in 2009, while in 2011, the number of cesarean deliveries in the West Bank and Gaza strip was 14,511births (4, 5). In addition, according to the recent annual report of the Palestinian Ministry of Health in 2020, the rate of cesarean section births in Palestine reached 25. 8% (6).

Moreover, the percentage of cesarean sections in the Palestinian hospitals in mid-2015 was 24.4%, according to the Palestinian Ministry of Health 2015 (7, 8). The rate of the cesarean sections increases with the maternal age, particularly over the age of 35 years and more; this is due to the increase in the proportion of mal-presentation, labor dysfunction, and labor complications (9). Moreover, CS is higher among first-time mothers and women who have 3 or more life births (10). Additionally, the extremes of the neonatal birth weight were associated with emergency cesarean sections as it increases the newborn head circumference (11). CS is

higher for a birth weight over 3000 kg (12). While cesarean delivery increased 1.5 times with overweight women, it rose even higher with obese pregnant women, 2.25 times more than normal-weight mothers (13). In addition to the above non-obstetric factors, short-stature mothers who are 155 cm or below had statistically significant higher rates of CS (14). The CS rate tended to rise with increased maternal schooling and women working outside the house (15).

This study aimed to assess the common risk factors related to the cesarean section among women attending three major hospitals north of the West Bank. The study objectives were to investigate the relationship between the non-obstetric risk factors and the cesarean delivery rate and assess the association between the obstetric risk factors, including the gestational age, gestational diabetes, number of previous CS, and fetal presentation factors associated with the cesarean delivery rate.

## METHODOLOGY

***Population and Sample***: A retrospective descriptive study compared two groups: the CS groups and NVD, in three significant hospitals on West Bank. The study population was women who had recently given birth through CS and NVD in singleton pregnancies. The researcher excluded women with heart disease and cesarean delivery of twins or more pregnancies because the hospital's protocol is to refer these cases directly to CS. The first group consisted of women who had recently given birth through cesarean delivery in singleton pregnancies in one of the three hospitals that have been selected. The second group was a group of women who had recently given birth through standard vaginal delivery in singleton pregnancies in one of the three hospitals that have been selected for this period. A convenience sample was recruited between February 2016 to April 8, 2016; the researcher included all participants meeting inclusion criteria. Because of the limited time to complete the study, the researchers decided to include all participants that entered selected hospitals over the 3 months, and the total was 300 participants; few participants refused to participate in the study; less than 3% of the total sample because they were tired and in pain from CS.

***Measurement Tool***: The data collection form was developed from the CS risk factors found in previous studies from the national and international literature review (9, 13-38). This instrument consisted of 47 items presented under a five-part questionnaire; the first part included socio-demographic characteristics of the participations; the second part included questions about the risk factors related to present pregnancy. The third part included questions about the surgical and medical history and questions about the risk factors related to obstetric history. The last part included questions about neonatal assessment using an Apgar score instrument to evaluate the outcome of a neonate.

***Ethical Consideration****:* The study researcher had approval from An-Najah National University IRB. Moreover, permission to conduct the study in the hospitals' maternity units was obtained from the Palestinian Ministry of Health (MoH) for the government hospitals and the hospital managers of the private hospitals. An explanatory letter for all participants was attached to each questionnaire; this letter explained the aim, importance, confidentiality, and the anonymity of the information with the optional participation (voluntary). The researcher was also available at the hospital to give details and explain the study to the participants whenever needed.

***Statistical method****:* quantitative data analysis of the questionnaire results using SPSS version 24. Cronbach Alpha, equal to 0,78 (78%), was used to assess the study questionnaire's reliability and internal consistency. Data checking: the questionnaires were filled out by the researcher herself—data entry checking: to establish the validity of input to SPSS.Questionnaires were taken randomly by both researchers, and they were matched to the input numbers. P-value $<0.05$ was set as a criterion of statistical significance. The relationship between the study outcomes and the independent variables was assessed using the chi-squared test and t-test as appropriate

## RESULTS

The study includes 300 participants (150 CS and 150 NVD). These mothers have agreed to participate in the study and have

recently given birth. They matched the inclusion and exclusion criteria of the CS and NVD case. Of most women, 69% of CS cases had an age between 15-and 27 years old, while 51.3% of NVD cases were in the same age group Majority of CS cases, 75.3%, were living in villages compared to cities.

***Socio-demographic factors***

The majority of the CS cases live in villages with a frequency of 113 (75.3%) and 32(21.3%) CS living in Jenin city. The ages of the CS cases are between 15-and 27 years old, while 77(51.3%) of NVD cases are of the same age. Compared to 23(15.3% CS) and 11(7.3%), NVD cases are at the age of 35 and more. The marriage age of 142 (94.7%) NVD cases are between 15-and 27 years old, and 138 (92% CS) cases are of the same age. 83(55.3%) NVD cases studied up to secondary school, compared to 81 (54%) of CS cases with BA. 128 (85.3%) NVD cases and 119 (79.3%) CS cases do not work outside the home. 5(3.3%) of NVD and 26 (17.4%) CS mothers were overweight during BMI. 18 (12%) NVD were smokers; of these, most of them 15 (9.9%) smoke water-pipe, while 8 (5.3%) CS cases smoked cigarettes. The majority of the vaginal section cases regularly participated in exercise or sports before pregnancy, 81(54%), but the percentage becomes 15 (10%) of the cases participating in sports after pregnancy. Compared to the CS cases, only 33 (22%) practiced sports before pregnancy, and 12 (8%) practiced sports after pregnancy.

***Obstetric non-obstetric risk factors***

Chi-square test showed (as presented in Table 1) that living in a village ($p<0.0001$), level of education ($p<0.0001$), mother weight before pregnancy and mother weight before giving birth ($p<0.0001$), and practicing sports before pregnancy ($p<0.0001$) were the socio-demographic factors that associated with CS. The factors that were related to present pregnancy and were a significant included number of visits to the doctor or antenatal care units ($p<0.0001$), duration of pregnancy/ Weeks ($p<0.0001$), mothers who had hypertension ($p<0.0001$), mothers who had a face, hands, and ankle edema ($p<0.0001$), mothers who had bleeding during pregnancy ($p<0.005$) and mothers who had anemia ($p<0.001$). In addition to fetal malpresentation (non-cephalic) during the first 36 weeks of pregnancy ($p<0.006$), mothers who had pregnancy fixative ($p<0.00$), also the amount of pregnancy fixative that mothers used ($p<0.0001$), mothers who were not drinking medical safe traditional herbs ($p<0.003$).

The factors that were related to the mother's obstetric history that were significant included a history of having Eclampsia ($p<0.0001$) and a history of using Intra-Uterine Device (IUD) contraceptive methods ($p<0.0001$), previous CS ($p<0.001$). Moreover, among the factors that were related to the newborn, head large circumference measurement for 36 cm and more of the newborn ($p<0.001$) and the period that the child stayed in the intensive care unit ($p<0.031$).

**Table (1):** Socio-demographic variables and Chi-square test of the independent variables.

| Characters | Values | Number/ Percentage for NVD group | Percentage for CS group | Chi-square p-value |
|---|---|---|---|---|
| Place of residency | City | N=51 (34.)0% | N=32, 21.3% | 21.874 <0.000 |
| | Village | N=77, (51.3 %) | N=113,75.3% | |
| | Camp | N=22, 14.7 % | N=5, 3.3% | |
| The educational level | Primary and Elementary | N=23, 15.3% | N= 21, 14.0% | 22.607b <0.000 |
| | Secondary | N=83, 55.3% | N= 48, 32.0% | |
| | Bachelor degree | N=43, 28.7% | N=82, 54.0% | |
| | Higher education | N=1, 0.7% | N=0,00 | |
| Mother's weight before pregnancy | 50-55 / Kg | N=76, 50.7% | N=32, 21.3% | 43.945c <0.000 |
| | 56-60 / Kg | N=40, 26.7% | N=35, 23.3% | |
| | 61-65 / | N=23, 15.3% | N=35, 23.3% | |

| Characters | Values | Number/ Percentage for NVD group | Percentage for CS group | Chi-square p-value |
|---|---|---|---|---|
| | Kg | | | |
| | 66 / Kg and more | N=11, 7.3% | N=48, 32.0% | |
| Mother BMI | Under Weight (less than 18.5) | N=3, 2% | N=2, 1.3% | 15.941d <0.0013 |
| | Normal(18.5-24.9) | N=142, 94.7% | N=122, 81.3% | |
| | Overweight(25-29.9) | N=5, 3.3% | N=26, 17.4% | |
| | Obesity(above 30) | | | |
| Mother's weight before giving birth | 50-55 / Kg | N=19, 12.7% | N=8, 5.3% | 48.180a <0.000 |
| | 56-60 / Kg | N=38, 25.3% | N=16, 10.7% | |
| | 61-65 / Kg | N=44, 29.3% | N=17, 11.3% | |
| | 66 / Kg and more | N=49, 32.7% | N=109, 72.7% | |
| Do you practice sports before pregnancy? | Yes | N=81, 54.0% | N=33, 22.0% | 32.598e <0.000 |
| | No | N=69, 46.0& | N=117, 78.0% | |
| How many times did you visit your doctor/ antenatal visits? | 4 Times or less | N=1, 0.7% | N=3, 2.0% | 34.250g <0.000 |
| | 5-7 / Times | N=20, 13.3% | N=12, 8.0% | |
| | 8-12 / Times | N=114, 76.0% | N=78, 52.0% | |
| | 13 / Times or more | N=15, 10.0% | N=57, 38.0% | |
| Duration of pregnancy/ Weeks | 31-34 / Weeks | N=3, 2.0% | N=2, 1.3% | 17.002d <0.000 |
| | 35-37 / Weeks | N=5, 3.3% | N=27, 18.0% | |
| | 38 / Weeks and more | N=142, 94.7% | N=121, 80.7% | |
| | No | N=41, 27.3% | N=65, 43.3% | |

**Table (2):** Frequency of clinical complications in the sample, Chi-square, and p-value.

| Characters | Values | Number/ Percentage for NVD group | Percentage for CS group | Chi-square p-value |
|---|---|---|---|---|
| Did you have hypertension during your current pregnancy? | Yes | N=0, 0% | N=22, 14.7% | 23.741h <0.000 |
| | No | N=150, 100.0% | N=128, 85.3% | |
| Did you have swelling in your face, hands, or severe pain in your ankles? | Yes | N=33, 22.0% | N=64, 42.7% | 14.641i <0.000 |
| | No | N=117, 78.0% | N=86, 57.3% | |
| Did you have hemorrhage during current pregnancy? | Yes | N=1, 0.7% | N=10, 6.7% | 7.644j <0.006 |
| | No | N= 149, 99.3% | N= 140, 93.3% | |
| Did you have anemia during your current pregnancy? | Yes | N=7, 4.7% | N=24, 16.0% | 10.397k <0.001 |
| | No | N= 143, 95.3% | N=126, 84.0% | |
| What was the presentation of the newborn during the first 36 weeks of pregnancy? | Cephalic presentation | N=150, 100% | N=120, 80.0% | 33.333l <0.006 |
| | Breech presentation | N=0, 0% | N=22, 14.7% | |

| Characters | Values | Number/ Percentage for NVD group | Percentage for CS group | Chi-square p-value |
|---|---|---|---|---|
| | Shoulders' width | 0 | N=1, 0.7% | |
| | Transverse lie | 0 | N=7, 4.7% | |
| Did you take any pregnancy fixative? | Yes | N=21, 14.0% | N=80, 53.3% | 51.958m |
| | No | N=129, 86% | N=70, 46.7% | <0.000 |
| If you used pregnancy fixative tablets, how much did you use? (progesterone hormone) | Full box and more | N=9, 6.0% | N=76, 50.7% | .073n |
| | Slice | N=10, 6.7% | N=74, 49.3% | <0.000 |
| Did you drink medical herbs during your Current pregnancy | Yes | N=109, 72.7% | N=84, 56% | 8.669o |
| | | | | <0.003 |
| Did you have Eclampsia in current pregnancy? | Yes | N=1, 0.7% | N=16, 10.7% | 14.030P |
| | No | N=149, 99.3% | N=134, 89.3% | <0.000 |

**Table (2):** Frequency of clinical characteristics in the sample, Chi-square, and p-values.

| Characters | Values | Number/ Percentage for NVD group | Percentage for CS group | |
|---|---|---|---|---|
| What kind of contraceptives did you take? | Pills | N=16, 10.7% | N=7, 4.7% | 41.497q |
| | Cervical cup | N=3, 2.0% | N=2, 1.3% | <0.000 |
| | Male condom | N=20, 13.3% | N=7, 4.7% | |
| | Intra Uterine Device | N=5, 3.3% | N=36, 24.0% | |
| | Lactation amenorrhea methods | N=3, 2.0% | N=1, 0.7% | |
| | Fertility awareness | N=7, 4.7% | N=1, 0.7% | |
| | Another ways | N=1, 0.7% | N=5, 3.4% | |
| Did you have a female or male baby in the last Previous CS? | | Previous cs | Previous cs | .745r |
| | Male | N= 7, 6.5% | N=51, 45.9% | <0.001 |
| | Female | N=8, 7.4% | N=36, 32.4% | |
| | Total births | N=15, 13.8% | N=87, 87.4% | |
| What is the head circumference measurement of your newborn? | 30-31 / Cm | N=31, 20.7% | N=2, 1.3% | 175.781s |
| | 31.5-33 / Cm | N=101, 67.3% | N=18, 12.0% | <0.000 |
| | 33.5-35 / Cm | N=18, 12.0% | N=61, 40.7% | |
| | 36 / cm and more | 00 | N=69, 46.0% | |
| The period that the newborn stayed in the intensive care unit | Many hours | N=3, 2.0% | N=13, 8.7% | 106.373t< |
| | Many days | N=5, 4% | N=2, 1.3% | 0.031 |
| Times of breast feeding after birth | 1-2 Hours | N=84, 56.0% | N=25, 16.7% | <0.000 |
| | 2.5-3 Hours | N=37, 24.7% | N=21, 14.0% | |
| | 3.5-4 | N=18, 12.0% | N=20, 13.3% | |

| Characters | Values | Number/ Percentage for NVD group | Percentage for CS group | |
|---|---|---|---|---|
| | Hours | | | |
| | More than 4 hours | N=9, 6.0% | N=84, 56.0% | |
| | Not breastfeed | N=2, 1.3% | | |

## DISCUSSION

The findings of the previously reviewed studies (9, 13-38) found that prim-parity, mother age (35 years and above), diabetes before pregnancy, short-statured mothers, previous miscarriage, and stillbirth, young mother, maternal hypertension, maternal race, paternal old age, and large hospital size were mother risk factors for CS. While LBW, young fetus gestational age, neonatal overweight, dead newborn, and fetal distress were neonatal risk factors for CS. However, this study showed that living in a village increased the risk of CS more than living in a city ($p<0.001$), which contrasts with the findings of the Brazilian study conducted in 2014. It aimed to assess the changes in CS risk factors over a specific period between1991 to 2006 (28).

The educational level of the mothers is another independent risk factor according to the study results ($p<0.001$). The educated mother who had a Bachelor's degree level composed half (54%) of the exposed group or CS group. Similarly, in the previous study conducted in Iran, the author found that the CS rate increased 7 times with higher educated mothers (24).

Overweight mothers and mothers ' weight are significant independent variables before giving birth ($p<0.001$). This result is in parallel with the results of another study conducted in Oman, one of this study's findings was overweight BMI, which was genuinely associated with the risk of having CS with (OR=1.93;p=0.05) (18), because being overweight is associated with preeclampsia, gestational hypertension, gestational diabetes, and fetal macrosomia (18). The current study found that not practicing sports before pregnancy is a significant risk factor ($p<0.001$). This result is similar to a previous study that aimed to find the effect of practicing a physical activity related to CS. One of the relevant Turkish study findings was that increasing the number of practiced physical activities will decrease the risk of CS by 4 times (27).

Mothers who had taken pregnancy fixative products were more likely to have CS ($p<0.001$). This result has not been studied in any previous research papers. According to the chi-square test, mothers using medical herbs showed a significant difference ($p<0.003$). One of the significant factors related to current pregnancy was the number of the mothers' visits to doctors for Obstetrics and Gynecology and /or antenatal care clinics during the current pregnancy ($p<0.000$). Women with CS had more visits; most of the visits were after 36 weeks of gestation. This result is similar to the previous study that was conducted in China. The author found that CS increased by 1.24 for mothers who used the health insurance to visit gynecology in urban areas, and it increased by 1.45 for the same reason in rural areas (37).

The weeks of gestation is one of the significant independent factors with ($p<0.001$); this is in contrast to the finding of a UK study that attempted to find the common CS risk factors and found that the probability of experiencing CS increased with increasing gestational age (25). Hypertension was a significant difference factor ($p<0.001$), which is similar to the findings of the USA California study in 2010. The author found that hypertension is an independent risk factor for CS (27). If a mother has edema in her face, hands, or ankles, she is more likely to experience CS; additionally, CS is associated with being overweight, having high blood pressure, eclampsia and diabetes. This result is similar to a previous study conducted in Oman in 2012. The researchers found that pre-pregnancy diabetes and obesity were risk factors for CS (18).

Mothers who had hemorrhaging during the last pregnancy are more likely to need CS ($p<0.001$). This result is like to the findings

of Kozhimannil, whose US-based study aimed to examine the relation between the maternal clinical diagnosis and the risk of having CS (19). Hemorrhage during the last pregnancy was one of this study's findings. This is because maternal hemorrhage is a warning sign for placenta previa, preterm birth, a blood disorder, fetal macrosomia, and a history of miscarriage and stillbirth. According to the chi-square test, having anemia was a significant difference ($p<0.001$). Fetal mal-presentation (non-cephalic pregnancy) was another independent risk factor for CS ($p<0.001$). This result is similar to the findings of a UK study aimed to find the prenatal risk factors for CS; the study found that non-cephalic presentation was associated with CS (25).

Mothers who used IUD contraceptive methods before pregnancy were more likely to have CS. This was in agreement with a previous case-control study conducted in Oman in 2012 (18). The researchers found that (8.4%) of CS mothers who have given birth were using the IUD contraceptive method, while only (3%) of the vaginal mothers who have given birth were using the same contraceptive method (18). This association might be related to uterus perforation with IUDs and uterine inflammation caused by them, thus increasing the uterus wall thickness. Women who experienced diabetes before pregnancy were more likely to experience CS($p<0.001$). This result is consistent to the findings of other studies. One of those studies was the Omani study, the researcher found that eclampsia was associated with risk of CS with ($OR=9.3;p<0.04$) (18). Women with previous CS are more likely to have another CS ($P<0.0014$). This result is similar to the findings of the Omani study, which found that the previous CS is significantly associated with the risk of the following CS ($OR=22.71;p<0.001$) (18). This has been justified by the fear of expected uterine rapture, the strong association between previous CS and fetal mal-presentation, preterm birth, risk of stillbirth, and hemorrhage due to placenta previa through pregnancy.

The neonatal large head circumference of 36 cm and more was a significant independent risk factor ($p<0.001$) for CS. This is similar to the findings of the UK study conducted in 2004, which aimed to determine the prenatal risk factors associated with CS; the author found that the significant newborn head circumference was associated with CS (25). CS newborns are more likely to be admitted to the neonatal intensive care unit ($p<0.031$). This is similar to the 2014 study conducted in Haifa, which aimed to assess CS neonatal morbidity; the researchers found that the CS newborns were more likely to need ICU, and respiratory distress plays the main reason for admitting the neonatal to ICU (16). Mothers with CS were more likely to breastfeed their infants ($p<0.000$) since most CS newborns started breastfeeding more than 4 hours later. This result has not been studied in any previous research papers. This finding is justified when CS newborn was admitted to ICU due to the mother's health after the surgical operation.

### *Study strengths and limitations*

The researcher filled in the questionnaires to avoid missing data and misunderstanding. The validity of the study instrument was established by the recommendations of a panel of four experts and three field test gynecologists. The reliability of the study instrument was determined by piloting the questionnaire on 30 mothers who were not included in the study. The major limitation of this study was the recall bias which might be challenging to avoid in questionnaire-based studies.

## *Conclusions* and recommendations

The study highlights the importance of increasing awareness about clinical and public health measures to prevent risk factors associated with increased risk of cesarean section. To decrease the risks, maintaining normal BMI, practicing sports, the importance of adequate antenatal visits, and preventing any complications during pregnancy. Antenatal care clinics should be attentive to the indication of CS, which they can discover by following up the pregnant women, checking their length or weight, and advising them on how they can try to avoid CS. Delaying CS timing for the immediate delivery and the early timing for the following CS, which is following the previous CS, both affect neonatal outcomes. Therefore, the mother has to cooperate with the antenatal care

clinic to follow up on the fetal movement to choose the suitable time for delivery.

## FUNDING

None

## AUTHOR'S CONTRIBUTION

**Eman Alshawish:** conceptualization, writing-original draft, data curation, formal analysis, investigation, methodology, project administration, resources, software, supervision, validation, visualization, and writing review & editing. **Lina Zaidan:** writing-original draft, data curation, formal analysis, investigation, validation, visualization, and writing review & editing. This research is based on Lina Zaidan's graduation thesis.

### *Conflicts of Interest*

The author and coauthor declare that there are no conflicts of interest regarding the publication of this article.

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