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Evaluation of Labour Care Guide: Labor progression in obese women from Basra, Iraq

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ABSTRACT

The prevalence of maternal obesity has emerged as a significant global public health issue. The World Health Organization (WHO) has just introduced a revolutionary tool known as the WHO Labour Care Guide for the purpose of monitoring the well-being of mothers and infants throughout the process of labor. The study aims to evaluate the impact of obesity on the progression of labor, mode of delivery, and subsequent neonatal complications. Our research was conducted on 176 women who fulfilled the inclusion criteria at Basra Maternity and Child Hospital, the number of women with normal BMI was 100, while the class 1 obese was 76 cases. The results show the risk of emergency caesarean section is significantly increased among the class 1 obese woman, the percentages were 40.7%, and 14% respectively (p-value <0.001), regarding the neonatal outcome assessed by the APGAR scoring system, there was a relatively low APGAR score among the total deliveries of class 1 obese women regardless of the mode of delivery, (p-value was significant <0.001) compared with the average Body Mass Index women, the neonatal birth weight was significantly different between the two Body Mass Index groups, there is an increase in the birth weight among class 1 obese women (p-value <0.001). The study concludes obesity has a substantial influence on the increased incidence of caesarean section deliveries among women classified as having obesity class I, and there is a positive correlation between body mass index and the desire for oxytocin administration among obese women.

Keywords: labor progression, LCG, obesity, obese women

INTRODUCTION

Obesity is the most prevalent medical issue associated with pregnancy [1]. Obesity has been defined by the World Health Organization (WHO) as "a pandemic nutritional disorder which represents a rapidly growing threat to the health of populations of an increasing number of countries worldwide" [2]. As the prevalence of obesity rises, so does the proportion of women of reproductive age who are overweight or obese. This has a negative influence on female reproduction in general, as well as maternity care [3,4]. Maternal obesity has been linked to an increased risk of obstetric problems [5]. Obese women have a slower progression with a higher chance of dystocia in the early stage of labor, which are risk factors for chorioamnionitis, emergency caesarean section (CS), and crucial postpartum hemorrhage. It has also been associated with an increase in caesarean section rates, depression, and health problems [6]. Babies born to obese mothers have a higher risk of premature delivery, stillbirth, and fetal abnormalities [7].

Changes in labor due to obesity

Placental function

The transport of amino acids through the placenta is reduced in women who give birth to new-borns with normal birth weight, but it is enhanced in obese women who deliver large-weight babies [8]. The impact of obesity on placental steroid hormone production in pregnant women has not yet been definitively determined. However, it is important to note that obesity has been linked to decreased levels of mid and late-pregnancy steroid hormones [9].

Elevated leptin

Leptin induces the secretion of prostaglandin E2 (PGE2) from placental and adipose tissue via the activation of inflammatory signaling pathways [10].

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Obese women may have chronically elevated levels of PGE2 throughout late pregnancy, which might potentially lead to reduced responsiveness of maternal tissues to PGE2 at the initiation of labor [11]. Studies have shown that leptin can suppress the degradation of collagen by Matrix metal proteinases (MMPs) and prevent the death of cervical cells [12]. This mechanism suggests that in obese women, leptin may have a role in restricting cervical ripening. Leptin has been shown to enhance the synthesis of cervical collagen throughout the latter stages of pregnancy [13], also elevated levels of leptin during the 2nd trimester of pregnancy has been shown to potentially decrease the apoptosis of the membranes and lessen the weakening of the fetal membrane, hence potentially preventing spontaneous membrane rupture in women who are obese [14].

Cholesterol and potassium channels

Cholesterol plays an essential part in promoting the operation of plasma membrane channels located inside lipid rafts, which are characterized by a high concentration of cholesterol [15]. There is a significant elevation in the activity of hyperpolarizing potassium channels, which are known to facilitate relaxation, in obese women in comparison to women of normal weight [14].

The World Health Organization (WHO) was responsible for the development of the WHO Labour Care Guide (LCG) as well as the associated user's manual for the WHO Labour Care Guide. The World Health Organization LCG serves as a mechanism to support the implementation of high-quality, research-based, patient-focused care to promote a favorable birthing experience. This initiative operates within a comprehensive framework that emphasizes human rights [16].

There are a total of seven sections that have been derived from the previous WHO design; the partograph [17]. The following sections delineate the recommended care protocols during the active phase of the 1st stage of labor and the 2nd stage of labor: these sections include the identification of information and labor characteristics at admission, supportive care refers to the implementation of treatments aimed at enhancing the quality of care, promoting women's comfort, improving outcomes, and enhancing the overall care experience, the well-being and overall health of the infant, the overall state of the woman, the purpose of this documentation is to monitor labor progression, including the frequency and length of contractions, cervical dilatation, and descent of the baby's head, medicine and shared decision-making is a crucial aspect of documenting the plan of care, which is informed by continuous surveillance and ongoing contact with the woman and her partner, ensuring that their agreement is obtained [18].

PATIENTS AND METHODS

Study setting

The current inquiry was conducted at the Obstetrics and Gynecology Department of Basra Maternity and Children Hospital, from 1 October, 2022, to 1 June, 2023. This study is a prospective observational case-control study that aims to assess the effectiveness of the labor care guide in pregnant women with obesity. Specifically, the study aims to evaluate the impact of obesity on the progression of labor, mode of delivery, and subsequent neonatal complications. Additionally, the study aims to compare these outcomes between obese and normal-weight women.

Patients

The research comprised a total of 176 pregnant women who met the specified inclusion and exclusion criteria.

Inclusion criteria

1. Pregnant women between the ages of 18 and 35.
2. The pre-pregnancy weight is known by the patients.
3. In this research, the participants were categorized based on their pre-pregnancy BMI. Specifically, only those with a normal BMI (18.5-24.9 Kg/m^2) and those with class I obesity (BMI 30-34.9 Kg/m^2) were taken into account in the research.
4. The research participants included primigravida individuals, as well as women who had endured two or fewer first-trimester miscarriages in their medical records.
5. A single full-term pregnancy, the gestational period is lasting between 37 completed and 40 completed weeks. The determination of gestational age was achieved by the use of both the last menstrual cycle and first trimester ultrasounds.
6. Patients presenting with active labor, characterized by a cervical dilation of 5 cm or more, a cephalic presentation, and intact membranes, together with the presence of regular uterine contractions occurring at a frequency of 3-5 contractions per 10 minutes.
7. The research participants did not have any medical conditions such as diabetes, hypertension, or heart problems.

Exclusion criteria

This research excluded women who met any of the following criteria: having a high-risk pregnancy, having a relevant medical or surgical history (such as diabetes mellitus or a scared uterus), having fetal co-

morbidities, experiencing non-spontaneous labor onset before 41 weeks, or being admitted for elective caesarean section and those who gain excessive weight during current pregnancy.

Data collection and methods

The participants involved in this research underwent the following procedures:

8. Verbal permission was acquired from the pregnant women who were included in the research.
9. Complete history taking, which includes name, age, profession, and address. The obstetric history, including the first day of the last menstrual period (LMP), early scan results, and record of gestational age, as well as the medical or operational history. Furthermore, it is important to consider any potential medication allergies, as well as obstetric or surgical complications.
10. Clinical examination.

A- General examination

Vital signs are blood pressure, pulse rate, respiration rate, and body temperature.

The height (measured in square meters) and weight (measured in kilograms), the BMI was determined upon admission by the use of the following formula:

$$BMI = \frac{(\text{weight in (Kg)})}{(\text{Height in (meters)2})}$$

Taking into account the patient's pre-pregnancy weight, which was known either by her weight previously reported in her follow-up card or through her own words.

The head and neck examination includes the assessment of jaundice, pallor, pigmentations, edema, goiter, swollen lymph nodes, and congested neck veins.

The limb should be examined for the presence of edema, varicose veins, and other abnormalities.

B- Abdominal examination

- **Inspection**: to identify abdominal size, *Striae gravidarum*, and pigmentations such as linea nigra.
- **Obstetric palpation** (Leopold maneuvers).

  Auscultation: Fetal heart sounds: by Fetal Doppler ultrasound.

  Per vaginal: A per vaginal (P.V) examination is conducted to evaluate the degree of cervical dilatation and effacement, determine the condition of the membranes (whether intact or ruptured), rule out cord presentation and prolapse, identify the presence of meconium staining in the amniotic fluid following membrane rupture, and assess the fetal position, caput, and molding.

4. Laboratory investigations: CBC, RBS and Urine analysis.
5. Ultrasound: The ultrasound records were acquired from the patients for diagnosing or ruling out fetal and placental anomalies.

Diagnoses and outcome

The progress of labor, as recorded on the LCG, was closely observed and effectively controlled by obstetricians. In cases when women have sluggish progress or irregular uterine contractions during labor, the administration of an oxytocin drip has been used as a means to enhance labor, provided there are no contraindications. The practice of fetal monitoring was maintained throughout the duration of labor in instances when oxytocin was used for augmentation purposes. The decision to perform a caesarean section was made by a specialist obstetrician.

Outcome measures

Delivery outcomes include: pregnancy outcome, the reason for delivery mode and labor length (1st and 2nd stage).

Neonatal outcomes including birth weight, and APGAR score at 1 and 5 minutes after delivery as shown in the Table 1 [19].

TABLE 1. APGAR Score

Sign	0	1	2
Appearance	Blue and pale	Body pink, limbs blue	All pink
Pulse	Absent	Less than <100	More than >100
Grimace	No response	Grimace	Coughing and crying
Activity	Limp	Weak	Strong
Respiration	Absent	Irregular, slow	Good, crying

The interpretation as the fellows:

- The reassuring score is 7 to 10
- Moderately abnormal is 4 to 6
- Abnormal (ventilation is required) is 0 to 3(64).

Statistical analysis

The data set was checked for any missing data, then it was entered into the Statistical Package for the Social Sciences (SPSS) program version 26 which used code and analyzed data, the data was presented as frequencies, percentages, mean+-standard deviation, p-value was tested and a p-value (<0.05) was considered significant statistically.

Ethical approval

The research was approved by Arabic Board for Medical Specialization in Gynecology and Obstetrics. The confidentiality of the information taken from the participants that should not be disclosed to the public was maintained. The participants' information was used within the research requirements and in a way that did not harm the participants in any way. The participants' information was recorded honestly and without deviating from the true information for any purpose. Written consent was taken from the participants in the research.

RESULTS

Our research was conducted on 176 women who fulfilled the inclusion criteria at Basra Maternity and Children Hospital, from 1 October, 2022, to 1 June. 2023. From the total of 176 women, 100 were women with normal BMI , while 76 were obese (class 1). In Table 2, the results show no significant difference regarding the mean age group admitted to the labor ward (p-value >0.05), while regarding the mode of birth, the risk of emergency cesarean section is significantly increased among the class 1 obese women comparing with normal BMI, the percentages were 40.7% and 14% (p-value <0.001).

Regarding the neonatal outcome assessed by the APGAR scoring system, there was a relatively low APGAR score among the total deliveries of class 1 obese women regardless of the mode of delivery, (p-value was significant, <0.001) compared with the normal BMI women. The neonatal birth weight was significantly different between the two BMI groups. There was an increase in the birth weight among class 1 obese women (p-value <0.001).

Regarding the requirement of labor augmentation by oxytocin, the class I obese women showed increased requirements for that augmentation method. Comparing the result with the other group, the p-value revealed a significant difference. Lastly, there was a significant difference in the mean gestational age at the presentation between the obese women presented at later stages and the normal-weight women.

In Table 3, the result shows that class 1 obese women experienced a prolongation of the 1st stage of labor, compared with the duration of the same stage among normal BMI women (the median was 11.2 hours, and 9.3 hours respectively), p-value was 0.001 representing a highly significant difference between the two groups, while there was no significant difference in the duration of 2nd stage of labor.

In Table 4 the results show that the delay in 1st stage was the main cause for the emergency cesarean in the class 1 obese women, compared with the normal group (58%, and 28.57% respectively) with a significant difference represented by the p-value.

In Table 5 the result shows that there was a significant difference regarding the APGAR score between the two groups who delivered normally, lower scores were among class 1 obese women, but there was no significant difference in APGAR score between the two groups who underwent an emergency cesarean section. The birth weight was significantly different between the two groups, higher in women with class 1 obesity regardless of the mode of birth.

TABLE 2. Comparison between the two groups regarding age, mode of delivery, neonatal outcomes, augmentation by oxytocin and gestational age

Variables	Normal BMI *n= 100	Class I obesity n=76	p-value**
Mean age group (years)	24 (18-35)	25 (18-35)	0.131
Mode of birth			
• Vaginal birth	n= 86 (86%)	n= 45 (59.2%)	0.001
• Cesarean section	n= 14 (14%)	n= 31 (40.7%)	0.001
APGAR Score			
• 1 min	8 ± 0.8	7.8 ± 0.7	0.002
• 5 min	9.1 ± 0.8	8.5 ± 0.7	0.002
Neonatal Birth weight (kg) Mean ± SD	3.1 ± 0.3	3.6 ± 0.2	0.001
Augmentation by oxytocin	n= 79 (79%)	n= 70 (92%)	0.001
The mean age of gestation at the presentation	37 weeks ± 3 days	39 weeks ± 4 days	0.003

** n: number **p-value <0.05 is significant*

TABLE 3. Comparison between the two groups regarding duration of labor in those with normal delivery

Variables	Normal BMI n= 86	Class I obesity n=45	p-value*
Duration of 1st stage of labor (hours) Mean ± SD	9.3 ± 0.4	11.2 ± 0.12	0.001
Duration of 2nd stage of labor (hours) Mean ± SD	1.2 ± 0.2	1.3 ± 0.3	0.21

TABLE 4. Comparison between the two groups regarding the causes of the emergency caesarian section

Variables	Normal BMI	Class I obesity	p-value*
Neonatal compromise	4 (28.57%)	7 (22.5%)	0.002
Delay in 1st stage	4 (28.57%)	18 (58%)	0.001
Delay in 2nd stage	6 (42.85%)	6 (19.3%)	0.001
Total	14	31	

TABLE 5. APGAR Score comparison between two different BMI and their mode of delivery

		Normal BMI	Class I obesity	p-value*
Normal Vaginal Delivery				
APGAR Mean ± SD	1 minute	8 ± 0.7	7.5 ± 0.3	<0.001
	5 minutes	9.3 ± 0.7	8.6 ± 0.3	<0.001
Birth Weight (kg) Mean ± SD		3.1 ± 0.2	3.5 ± 0.3	<0.001
Cesarean Section				
APGAR Mean ± SD	1 minute	7.3 ± 0.2	7.4 ± 0.3	0.3
	5 minutes	8.6 ± 0.4	8.5 ± 0.2	0.3
Birth Weight (kg) Mean ± SD		3.3 ± 0.2	3.7 ± 0.4	<0.001

DISCUSSION

Given the global significance of obesity as a prevalent issue, it is vital to examine its effects on labor. The research provided convincing evidence of the impact of obesity on both labor outcomes and the mode of delivery. The class I obesity group had a much higher risk of undergoing CS compared to the normal BMI categories, with percentages of 40.7% and 14% respectively. The present findings are consistent with prior research conducted by Maged et al. (2018) [20], Abdo et al. (2018) [21], and Khalifa et al. (2021) [22], which demonstrated elevated rates of caesarean section (CS) among pregnant women with obesity. Additionally, our results align with a randomized controlled study conducted by Doherty [23], who examined the impact of pre-pregnancy BMI on pregnancy outcomes. The findings of this research indicate that there is a higher likelihood of obese women having caesarean section deliveries in comparison to women with normal weight [21]. Furthermore, our findings are consistent with a large prospective observational cohort research conducted by Bergholt [24] at High Wycombe General Hospital in London, which included 4341 women. This study revealed a significant correlation between an elevated BMI and an increased occurrence of caesarean section deliveries [24].

The rise in caesarean sections (CS) has been attributed to several factors. These included a potential association between elevated cholesterol deposits in the myometrium of obese women, which can impact contractions [25]; additionally, an increase in maternal soft tissue within the pelvic region can narrow the birth canal, leading to more challenging deliveries, particularly in cases involving macrosomic infants [26]. The use of oxytocin has been shown to be a consequence of impaired uterine muscle activity, resulting in reduced strength and frequency of contractions in myometrial cells, as indicated by findings from in vitro experiments [27,28].

The duration of the 1st stage of labor differed significantly between the two groups (p-value <0.001). Our findings align with the results reported by Maged et al. (2017) [29], who investigated the impact of elevated BMI on labor progression. Their study revealed an apparent prolongation of the 1st stage of labor and a significant rise in the rate of emergency caesarean sections among obese women [29].

Moreover, our findings have been supported in prior analytical study, including a substantial sample size of 118,978 women through the process of childbirth. A strong opposite correlation was seen between BMI and the duration of labor, with women with a normal BMI delivering their babies around 2 to 4 hours quicker compared to those who were classified as obese and morbidly obese, respectively. It has been recommended that the labor management protocol should take into account individual variations in maternal BMI [20,22]. Furthermore, our findings are consistent with the research conducted by Khalifa et al. (2021) [22] in the Egyptian community. Our investigation revealed that there was no significant difference in the mean duration of the 2nd stage of labor among pregnant women, regardless of their higher BMI, in vaginal deliveries. This conclusion is also consistent with a previous study conducted by Abdo et al. [21].

Regarding the association between BMI and macrosomia, our study reveals a significant positive correlation, indicating a tendency for fetal weight to increase as BMI increases (p-value <0.001). This finding aligns with previous research conducted by Vahratian et al., who similarly observed that infants born to obese women are more susceptible to macrosomia and other associated complications [30]. Also, our study comes in agreement with Khalifa et al. [22], and Catalano and Shankar [31].

About the APGAR score at 1 and 5 minutes, there was a statistically significant rise in the occurrence of decreased APGAR scores as BMI categories increased (p-value <0.001) among women who had normal deliveries. This finding is supported by the study conducted by Abdo et al. [21], our findings indicating that there is no significant difference in the APGAR score between the two groups of women who underwent caesarean section. This aligns with the findings of Shenouda et al. (2019) [32], who suggested that obese women tend to have slower labor progression compared to women with normal BMI. This can be attributed to the fact that obese women have not yet reached their average BMI-adjusted labor curves. Our results support this explanation, as we observed prolongation of the 1st stage of labor rather than fetal compromise as the main indication for CS [32].

Limitations

Limitation of study relatively small size of the study population. The weight was obtained from the women themselves, or recorded at early pregnancy appointments which was not available for the majority of the attendants. Measurements of cervical dilation were subjective and were based on examinations performed by numerous midwives. The results of this study are only applicable to women who reach the active stage of labor as it does not take into consideration the duration of the preliminary latent phase. The uniformity of labor management cannot be ensured due to the number of different care providers. However, all personnel are required to follow established guidelines, which should eliminate any substantial differences in the management of care.

CONCLUSION

This study has concluded that obesity has a substantial influence on the increased incidence of caesarean section (CS) deliveries among women classified as having obesity class I compared with normal BMI. Also, the impacts of obesity on birth outcomes, such as a lower APGAR score and a heavier baby, are clear. In addition, obesity has been seen to have a major impact on the duration of labor during the 1st stage, but its influence during the 2nd stage seems less significant.

Authors' contributions:
Conceptualization, Sabreen MM Alkhulaifi and Sajidah Al-Rubaai; methodology Sabreen MM Alkhulaifi; software, Sajidah Al-Rubaai; validation, Sabreen MM Alkhulaifi, formal analysis, Sabreen MM Alkhulaifi; investigation, Marwah Sadeq Mustafa Almansor; resources, Sajidah Al-Rubaai; data curation, Marwah Sadeq Mustafa Almansor; writing—original draft preparation, Marwah Sadeq Mustafa Almansor; writing—review and editing, Sajidah Al-Rubaai; visualization Sabreen MM Alkhulaifi; supervision, Marwah Sadeq Mustafa Almansor; project administration, Sabreen MM Alkhulaifi; funding acquisition, Sajidah Al-Rubaai. All authors have read and agreed to the published version of the manuscript.

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REFERENCES

1. Dutton H, Borengasser SJ, Gaudet LM, Barbour LA, Keely EJ. Obesity in Pregnancy. *Medical Clinics of North America.* 2018 Jan;102(1):87–106. doi: 10.1016/j.mcna.2017.08.008.
2. Upadhyay J, Farr O, Perakakis N, Ghaly W, Mantzoros C. Obesity as a Disease. *Med Clin North Am* [Internet]. 2018 Jan;102(1):13–33. doi: 10.1016/j.mcna.2017.08.004.
3. Meldrum DR. Introduction. *Fertility and Sterility* [Internet]. 2017 Apr;107(4):831–2. doi: 10.1016/j.fertnstert.2017.02.110.
4. Mitanchez D, Chavatte-Palmer P. Review shows that maternal obesity induces serious adverse neonatal effects and is associated with childhood obesity in their offspring. *Acta Paediatrica.* 2018 Mar 8;107(7):1156–65. doi: 10.1111/apa.14269.
5. Patro Golab B, Santos S, Voerman E, Lawlor DA, Jaddoe VWV, Gaillard R, et al. Influence of maternal obesity on the association between common pregnancy complications and risk of childhood obesity: an individual participant data meta-analysis. *Lancet Child & Adolescent Health* [Internet]. 2018 Nov;2(11):812–21. doi: 10.1016/s2352-4642(18)30273-6.
6. Ramö Isgren A, Kjölhede P, Carlhäll S, Blomberg M. Maternal body mass index and oxytocin in augmentation of labour in nulliparous women: a prospective observational study. *BMJ Open.* 2021 Mar; 11(3):e044754. doi: 10.1136/bmjopen-2020-044754.
7. Berger H, Melamed N, Davis BM, Hasan H, Mawjee K, Barrett J, et al. Impact of diabetes, obesity and hypertension on preterm birth: Population-based study. *PLOS One.* 2020 Mar 25;15(3):e0228743. doi: 10.1371/journal.pone.0228743.
8. Kelly Amy C, Powell Theresa L, Jansson T. Placental function in maternal obesity. *Clin Sci.* 2020 Apr;134(8):961–84. doi: 10.1042/cs20190266.
9. Alcántara-Alonso V, Panetta P, de Gortari P, Grammatopoulos DK. Corticotropin-Releasing Hormone As the Homeostatic Rheostat of Feto-Maternal Symbiosis and Developmental Programming In Utero and Neonatal Life. *Front Endocrinol.* 2017 Jul 11;8. doi: 10.3389/fendo.2017.00161.
10. Pérez-Pérez A, Vilariño-García T, Guadix P, Dueñas JL, Sánchez-Margalet V. Leptin and Nutrition in Gestational Diabetes. *Nutrients* [Internet]. 2020 Jul 2;12(7):1970. doi: 10.3390/nu12071970.
11. Osayande OE, Bafor EE, Ugwu AC. Ex-vivo effect of leptin and gaba on spontaneous uterine contractility in pregnant and non-pregnant rats. *Ann Biomed Sci* [Internet]. 2020 Mar 13;19(1):27–37.
12. Gonzalez-Avila G, Sommer B, A Armando García-Hernández, Ramos C. Matrix Metalloproteinases' Role in Tumor Microenvironment. *Adv Exp Med Bio.* 2020 Jan 1;97–131. doi: 10.1007/978-3-030-40146-7_5.
13. Brown AP, Chiswick C, Denison FC. Induction of labor in obese women. Elsevier eBooks. 2020 Jan 1;201–6. doi: 10.1016/b978-0-12-817921-5.00021-7.
14. Carvajal JA, Oporto JI. The Myometrium in Pregnant Women with Obesity. *Curr Vasc Pharmacol.* 2020 Dec 30;19(2):193–200. doi: 10.2174/1570161118666200525133530.
15. Meza U, Delgado-Ramírez M, Romero-Méndez C, Sánchez-Armass S, Rodríguez-Menchaca AA. Functional marriage in plasma membrane: Critical cholesterol level–optimal protein activity. *Br J Pharmacol.* 2020 Mar 24;177(11):2456–65. doi: 10.1111/bph.15027.
16. World Health Organisation. WHO Labour Care Guide User's ManUal [Internet]. 2020.
17. Shafti V, Haghollahi F. The World Health Organization Labor Care Guide. Fertility, Gynecology and Andrology [Internet]. 2023;3(1). doi: 10.5812/fga-136218.
18. Organization WH. Key points for considering adoption of the WHO labour care guide: policy brief [Internet]. www.who.int. 2022. https://www.who.int/publications/i/item/9789240055766.

19. Cnattingius S, Johansson S, Razaz N. Apgar Score and Risk of Neonatal Death among Preterm Infants. *N Engl J Med.* 2020 Jul 2;383(1):49–57. doi: 10.1056/nejmoa1915075.
20. Maged AM, El-Semary AM, Marie HM, Belal DS, Hany A, Taymour MA, et al. Effect of maternal obesity on labor induction in postdate pregnancy. *Arch Gynecol Obstet.* 2018 Apr 2;298(1):45–50. doi: 10.1007/s00404-018-4767-8.
21. Abdo MM, Kamel HAH, Ibrahim ASM. Maternal Obesity and Its Effect in Late Pregnancy and Labour. *Egypt J Hospit Med* [Internet]. 2018 Apr 1;71(4):2982–8.
22. Khalifa E, El-Sateh A, Zeeneldin M, Abdelghany AM, Hosni M, Abdallah A, et al. Effect of maternal BMI on labor outcomes in primigravida pregnant women. *BMC Pregnancy and Childbirth*. 2021 Nov 8;21(1). doi: 10.1186/s12884-021-04236-z.
23. Doherty DA, Magann EF, Francis J, Morrison JC, Newnham JP. Pre-pregnancy body mass index and pregnancy outcomes. *Int J Gynecol Obstet.* 2006 Sep 27;95(3):242–7. doi: 10.1016/j.ijgo.2006.06.021.
24. Bergholt T, Lim LK, Jørgensen JS, Robson MS. Maternal body mass index in the first trimester and risk of cesarean delivery in nulliparous women in spontaneous labor. *Am J Obstet Gynecol.* 2007 Feb;196(2): 163.e1–5. doi: 10.1016/j.ajog.2006.09.026.
25. Poobalan AS, Aucott LS, Gurung T, Smith WCS, Bhattacharya S. Obesity as an independent risk factor for elective and emergency caesarean delivery in nulliparous women - systematic review and meta-analysis of cohort studies. *Obesity Rev.* 2009 Jan;10(1):28–35. doi: 10.1111/j.1467-789x.2008.00537.x.
26. Chu SY, Kim SY, Schmid CH, Dietz PM, Callaghan WM, Lau J, et al. Maternal obesity and risk of cesarean delivery: a meta-analysis. *Obesity Rev.* 2007 Sep;8(5):385–94. doi: 10.1111/j.1467-789x.2007.00397.x.
27. Jwc J. Excessive maternal weight and pregnancy outcome. *Am J Obstet Gynecol* [Internet]. 1992;167:353–72.
28. Zhang J, Bricker L, Wray S, Quenby S. Poor uterine contractility in obese women. *BJOG.* 2007 Jan 25;114(3):343–8. doi: 10.1111/j.1471-0528.2006.01233.x.
29. Maged AM, Belal DS, Marie HM, Rashwan H, Abdelaziz S, Gabr AA, et al. Prospective study of the effect of maternal body mass index on labor progress in nulliparous women in Egypt. *Int J Gynecol Obstet.* 2017 Oct 3;139(3):329–35. doi: 10.1002/ijgo.12322.
30. Vahratian A, Zhang J, Troendle JF, Savitz DA, Siega-Riz AM. Maternal Prepregnancy Overweight and Obesity and the Pattern of Labor Progression in Term Nulliparous Women. *Obstet Gynecol* [Internet]. 2004 Nov 1;104(5 Part 1):943–51. doi: 10.1097/01.AOG.0000142713.53197.91.
31. Catalano PM, Shankar K. Obesity and pregnancy: mechanisms of short term and long term adverse consequences for mother and child. *BMJ.* 2017 Feb 8;356(1):j1. doi: 10.1136/bmj.j1.
32. Shenouda C, Wijesooriya A, Toufeili A, Miller MR, Penava D, de Vrijer B. Labour Progression in Obese Women: Are Women With Increased Body Mass Index Having Unnecessary Cesarean Sections? *J Obstet Gynaecol* (Canada). 2020 Mar;42(3):293–300. doi: 10.1016/j.jogc.2019.04.014.