ORIGINAL ARTICLE

The association of Maternal obesity with cesarean section and macrosomia outcomes among Moroccan women from the province of kenitra, Morocco

L'association de l'obésité maternelle avec la césarienne et de la macrosomie chez les femmes marocaines de la province de Kénitra, Maroc

Mohamed Derdak[1], Miloud Chakit[2,1], Malika El Ouardi[1], Mohamed Belkhaoud[1], Ali Quyou[1], Moulay Laarbi Ouahidi[1]

1. Biology and Health Laboratory, Faculty of Sciences, Ibn Tofail University, Kénitra, Morocco.
2. National School of Public Health, Rabat, Morocco.

Abstract

Introduction: Obesity is a common problem with increasing prevalence and health consequences. In pregnant patients, its impact seems equally worrying affecting large population. Some obesity complications in pregnant women have not been examined, in particular link with fetal macrosomia.
Aim: The study aimed to assess the obesity factor associated with cesarean section and birth-weight infants.
Methods: In a retrospective study, 174 women were recorder in the period from 2021 to 2022 in the Hospital El Idrissi of Kenitra, Morocco. For each patient, age, newborn weight, number of grosses, body mass index (BMI) prepregnancy and before delivering were recorded, univariate and bivariate analyses was performed for all parameters.
Results: The occurrence of maternal complications during attempted vaginal delivery of a child weighing more than 4000 g is 6%. Risk factors for maternal complications, in addition to the child's birth weight (p=0.004, attributable risk (AR)=10%), are the mother's origin (p=0.04; AR=3%), a long duration of labor (p=0.02; AR=12%), and a cesarean section during labor (p=0.004; AR=17%). Multiparous patients who had already given birth vaginally to a macrosomic child had a reduced risk of maternal complications (p=0.03). The prevalence of obesity was 2% (p<0.001). Obesity was significantly associated with an increased risk of cesarean delivery and macrosomia (p<0.0001). The prevalence of macrosomia remained higher in the overweight group than in the normal weight group (aOR=2.01, 95% CI: 1.13-3.58, p<0.05).
Conclusion: The study shows a significant relationship between obesity and macrosomia outcome in Moroccan women.

Key Words: obesity; macrosomia; cesarean section; pregnancy; Morocco.

Résumé

Introduction : L'obésité est un problème fréquent avec une prévalence et des conséquences sanitaires croissantes. Chez les patientes enceintes, son impact semble tout aussi préoccupant touchant une large population. Certaines complications de l'obésité chez les femmes enceintes n'ont pas été examinées, en particulier le lien avec la macrosomie fœtale.
Objectif : L'étude visait à évaluer le facteur obésité associé à la césarienne et au poids de naissance des nourrissons.
Méthodes : Dans une étude rétrospective, 174 femmes ont été enregistrées dans la période 2021-2022 à l'hôpital El Idrissi de Kénitra, au Maroc. Pour chaque patiente, l'âge, le poids du nouveau-né, le nombre de greffons, l'indice de masse corporelle (IMC) avant la grossesse et avant l'accouchement ont été enregistrés, des analyses univariées et bivariées ont été réalisées pour tous les paramètres.
Résultats : La survenue de complications maternelles lors d'une tentative d'accouchement par voie basse d'un enfant pesant plus de 4000 g est de 6%. La prévalence de l'obésité était de 2% (p<0,001). L'obésité était associée de manière statistiquement significative à un risque accru de césarienne et de macrosomie (p<0,0001). L'association était différente (p interaction <0,005), pour la survenue de diabète gestationnel, de complications hypertensives de la grossesse et pour la macrosomie, avec une augmentation plus importante des complications avec l'IMC de la population étudiée.
Conclusion : L'étude montre une relation significative entre l'obésité et l'évolution de la macrosomie chez les femmes marocaines.

Mots clés : obésité, macrosomie, césarienne; grossesse; Maroc.

Correspondance
Miloud Chakit
National School of Public Health, Rabat, Morocco. Biology and Health Laboratory, Faculty of Sciences, Ibn Tofail University, Kénitra, Morocco.
Email: miloud.chakit@uit.ac.ma

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Introduction

Obesity has been described as a global epidemic due to its increasing prevalence in recent decades (1). It represents a major public health issue due to the health consequences it represents, which rival tobacco use as a cause of illness and premature death. In terms of financial cost, obesity is a factor in increasing the use of health services, exposing people to cardiovascular disorders, metabolic disorders such as hypertension, diabetes and dyslipidemia, and the occurrence of certain cancers or psychosocial problems (2–5).

Fetal macrosomia, like obesity, is continuously increasing. Several studies have shown a progressive increase in the mean birth weight of newborns, the mean birth weight for a given gestational age and the proportion of fetuses above the 90th percentile for a given gestational age in many countries such as Canada (6) and Norway (7). This trend has been attributed on the one hand to an increase in the size of patients, their BMI, their weight gain during pregnancy and the existence of gestational diabetes and on the other hand to the concomitant reduction in smoking consumption during pregnancy (8). There is no consensus on the definition of fetal macrosomia. Authors have variably used as a definition a birth weight greater than 4000g or 5000g, or greater than 90th percentile for a given gestational age (9,10). As a result, the prevalence of fetal macrosomia varies between 0.5-15% depending on the definition taken. In France, the threshold chosen is most often a birth weight greater than 4000g, which represented 6.9% of births in 1998 (11), 6.6% of births in 2003 and 7% of births in 2010 (12). These figures have therefore remained stable in France over all these years. On the maternal level, fetal macrosomia is related with a risk of obstetric complications such as increased risk of cesarean sections, increased postpartum hemorrhage, and increased rate of infection. Similarly, the risk of perineal complications and anesthetic accidents is also increased (13). Fetal macrosomia is also associated with increased perinatal mortality (14) and neonatal morbidity (9). The latter is mainly represented by the risk of neonatal trauma such as shoulder dystocia (6.7% to 14%) (15), elongation of the brachial plexus (14% among dystocias) and humeral or clavicular fracture (18%) (16). The remainder of the morbidity is linked to neonatal hypoglycemia (10%) (17).

The association between fetal macrosomia and maternal obesity is particular. Indeed, macrosomia is more frequent in cases of high BMI (8.3% for patients with normal BMI, 13.3% for moderate and severe obesity, and 14.6% for morbid obesity). In addition, fetal macrosomia is more difficult to detect in obese patients: clinical examination and ultrasound scans are more difficult. Finally, and probably one of the most notable reasons, although macrosomia is a pathology in itself, it is also a side effect of obesity, which therefore needs to be studied specifically in obese patients because of the existing generational link: obese patients more frequently give birth to macrosomic children. This reduction in growth can result in hypotrophy, which is defined as a weight below the 10th percentile in a given population of the same gestational age.

The frequency of macrosomic infant births has been stable for several years. Macrosomia complicates between 5 and 10% of pregnancies when considering infants with a birth weight greater than 4000 grams (g) (18). In France in 2022, 6.7% of newborns had a birth weight greater than or equal to 4000g (19).

The delivery of a macrosomic infant is generally feared by healthcare teams and patients for its frequent complications. The delivery of a newborn suspected of being macrosomal therefore requires special care; each professional must be aware of and be trained in these risks of complications. In this study, we will consider identifying the obesity factor associated with cesarean section and birth-weight infants.

Methods

Study type

This is a retrospective study conducted at the maternity ward of the EL IDRISSI provincial Hospital in Kenitra, Morocco, over the period from April to October, 2021. The study involved a population of 549 pregnant women who attended the health centers of antenatal consultations and gave birth at the maternity ward of the provincial hospital, 174 women only are eligible. Cases with missing data were excluded (Figure 1).

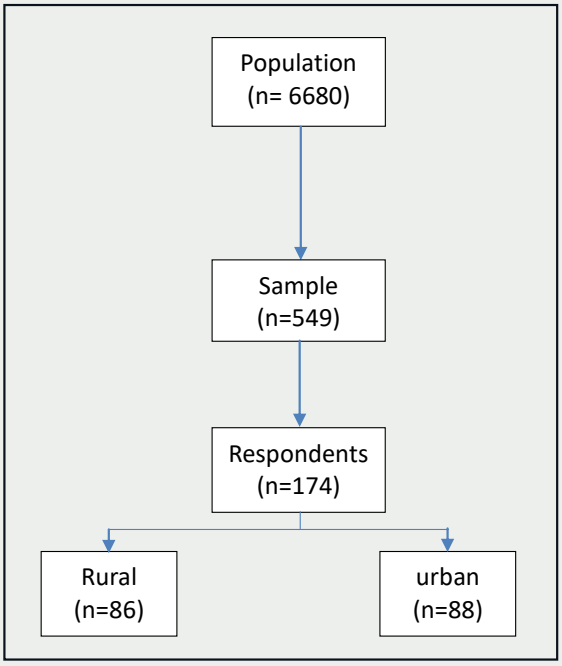

Figure 1. Flow chart.

Participants

The study was conducted at the Kenitra Hospital center (Rabat sale kenitra region). Our retrospective study was based on the recording of data collected from the records systematically established after each delivery over a period from April to October 2021. All patients with singleton pregnancies who delivered at a gestational age of more than 24 weeks of amenorrhea and with a known

pre-pregnancy BMI value were included. All maternal and neonatal data were collected retrospectively and recorded in a database. This study focused on the fetal outcome (hypotrophic, normal, or hypertrophic) and the associated risk factors of 174 deliveries.

Inclusion criteria: All women who just gave birth to neonates during the period April-October 2021 in the hospital center were included.

Exclusion criteria: Women with an associate disease or mental illness were excluded from the study.

Variables

The corpulence of women in early pregnancy was assessed using the IOTF international references: underweight if BMI < 18.5 kg/m2; normal corpulence if BMI ranged between 18.5 and 25 kg/m2; overweight if BMI ranged between 25 and 30 kg/m2; obese if BMI exceeded 30 kg/m2 (with obesity I: BMI 30–35 kg/m2; obesity II: BMI 35–40 kg/m2; obesity III: BMI > 40 kg/m2). Gestational diabetes was assessed based on the results of the fasting blood glucose value and the oral glucose tolerance test (oral intake of 75 g of glucose) performed between weeks 24 and 28 of amenorrhea. Women were considered to have had gestational diabetes if: H0 (fasting blood glucose) ≥ 0.92 g/L or if H1 (1-hour blood glucose) ≥ 1.8 g/L or if H2 (2-hour blood glucose) ≥ 1.53 g/L, in accordance with the recommendations of the National College of French Obstetricians and Gynecologists and the French-speaking Diabetes Society.

Weight gain during pregnancy was calculated from the weight at the start of pregnancy and the weight closest to the date of delivery: Weight gain (in kg) = weight close to delivery - weight at the start of pregnancy. Excessive weight gain (EWG) during pregnancy has been defined in 2 ways: weight gain > 12 kg, a criterion often used in the literature, and weight gain based on the BMI at the beginning of pregnancy according to the recommendations of the Institute of Medicine (IOM) [11]: EWG > 18 kg if the BMI at the beginning of pregnancy is in the underweight zone: <18.5 kg/m²; EWG > 16 kg if the BMI is in the normal corpulence zone: [18.5–24.9 kg/m²]; EWG > 11.5 kg if the BMI is in the overweight zone: [25–29.9 kg/m²]; EWG > 9 kg if the BMI is in the obese zone: 30 kg/m² (20–22).

The mode of delivery was classified as "vaginal" or "cesarean". The corpulence of the newborn was studied according to the exact birth weight (BW). "Hypotrophy" was defined by a BW < 2.5 kg and "macrosomia" by a BW > 4 kg.

Statistical analysis

The statistical analyses chosen for interpretation, confirmation, and decision are the application of the chi-squared test for the analysis of contingency coefficients. With a significance threshold less than or equal to 5%. Effect of BMI on perinatal outcomes after adjustment: logistic regression model analysis. The odds ratios (OR) are presented with their 95% confidence intervals. The following explanatory variables were tested: age, origin, pregnancy follow-up, and method of conception.

Results

General characteristics of the population

A total of 174 women were included. The mean maternal age was 31.6 years [±5.2] with a mean BMI at the beginning of pregnancy of 23.9 kg/m² [±4.9]. The majority of patients (60%) had a normal BMI at the beginning of pregnancy, while 32.5% were overweight or obese (Tables 1 and 2).

Table 1. Patient characteristics

	Number (%)
Age at delivery (mean ± sd years)	
<30	120 (22.84±4.51)
≥30	54 (36.65±4.18)
Origin	
Urban	88(50.58)
Rural	86(49.42)
BMI	
Under weight	17 (9.77)
Normal	126 (72.41)
Overweight	28 (16.09)
Obese	3 (1.73)
Newborn sex	
Male	83(47.7)
Female	91 (52.3)

Table 2. Patient characteristics according to weight status.

Characteristics	Pre-pregnancy Body Mass Index					
	Total (n =174)	Normal (n=77)	Underweight (n=25)	Overweight (n=45)	Obese (n=27)	p-value
Age, years (mean ± SD)	27.78±6.79	27.31±7.36	26.25±6.89	28.45±6.13	29.39±5.65	p<0.01
Number of pregnancies (mean ± SD)	2.35±1.41	2.37±1.37	2.33±1.56	2.33±1.32	2.51±1.50	p>0.05
Area of residence, n (%)						
Rural	86 (48.8)	65 (51.6)	10 (58.8)	10 (35.7)	1 (33.3)	p<0.01
Urban	88 (51.2)	61 (48.4)	7 (41.2)	18 (64.3)	2 (66.7)	
Pregnancy follow-up						
No	313 (50.7)	115 (42.1)	51 (58.6)	88 (54.7)	59 (61.5)	p<0.01
Yes	304 (49.3)	158 (57.9)	36 (41.4)	73 (45.3)	37 (38.5)	
Conception method, n (%)						
Spontaneous pregnancy	553 (89.6)	258 (94.5)	80 (92.0)	137 (85.1)	78 (81.3)	p<0.001
ART	64 (10.4)	15 (5.5)	7 (8.0)	24 (14.9)	18 (18.8)	

Infant weight

The mean birth weight was 3465 g (95% CI [3388; 3544]; range: 1700-4600). 81% of the infants weighed less than 4000 g: 15.4% between 4000 g and 4500 g and 3.4% above 4500 g (6 infants). The newborns were male in 47.7 % (83 cases) of cases and female in 52.3% (91 cases). Seventy-three newborns (4.7%) were admitted to the neonatal intensive care unit, mainly for respiratory distress (43%) or hypoglycemic episodes (30%) (Figure 2).

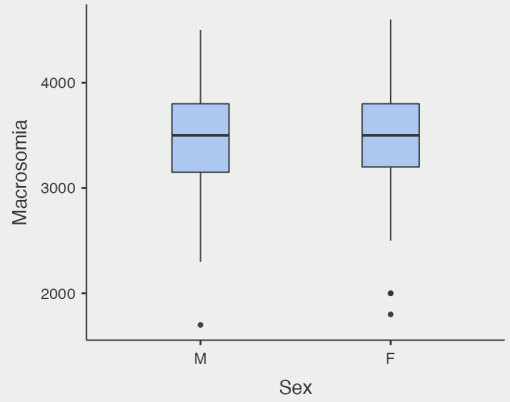

Figure 2. Macrosomia outcomes and sex.

The mean length of stay of the infant in the intensive care unit was 2 days [range 1-10]. Regarding neonatal complications, shoulder dystocia occurred in 5.1% of deliveries and 5 children had a transient brachial plexus injury that resolved completely within the first 6 months of life, without sequelae.

Among the 617 women included with an average age of 27.15 years, 50.1% (n=309) were from urban areas, 49.3% (n=304) had a pregnancy followed, and 10.4% (n=64) had benefited from assisted reproductive technology (Table 3).

Table 3. Prevalence of macrosomia and cesarean delivery according to BMI.

	Macrosomia % (95% CI)	Cesarean section % (95% CI)
Underweight (< 18,5)	6.38 (3.29-12.02)	6.89 (3.05-14.81)
Normal (18,5 ≤ IMC < 25)	28.72 (21.68-36.97)	25.86 (17.55-36.37)
overweight (25 ≤ IMC< 30)	31.91 (24.56-40.29)	34.48 (25.03-45.34)
Obese (IMC ≥ 30)	33 (25.52-41.39)	32.75 (23.50-43.57)

Obese women before pregnancy had a higher prevalence of macrosomia (33%) compared with overweight women (31.91%) and underweight women (6.38%). Similarly, obese women had a higher prevalence of macrosomia (33%) compared with women with normal BMI (28.72%). However, the prevalence of cesarean delivery among obese and overweight women was higher (32.75% and 34.48%, respectively) than cesarean delivery among women with normal BMI (25.86%) and underweight women (6.89%).

Women who gave birth by cesarean section were more likely to be in precarious situations, overweight and/or obese at the beginning of pregnancy, and more likely to have excessive weight gain during pregnancy and more likely to have macrosomic newborns (whatever the definition used), compared with women who gave birth naturally.

Effect of BMI on perinatal outcomes

After adjustment for age, origin, pregnancy follow-up, and method of conception (Table 4), almost similar results were found. The prevalence of macrosomia remained higher in the overweight group than in the normal weight group (aOR=2.01, 95% CI: 1.13-3.58, p<0.05).

Table 4. Association between weight status and pre-grosses, logistic regression

Pregnancy outcomes	Pre-pregnancy Body Mass Index			
	Normal (n=126)	underweight (n=17)	overweight (n=28)	Obese (n=3)
Macrosomia	Reference	0.71 (0.28-1.80)	2.01 (1.13-3.58) *	4.13 (2.24-7.59) ***
Cesarean section	Reference	0.92 (0.29-2.88)	2.51 (1.23-5.13) *	4.36 (2.05-9.26) ***

Macrosomia and cesarean delivery were not statistically different between the underweight group and the reference group. The prevalence of macrosomia (aOR=4.13, 95% CI: 2.24-7.59, p<0.001) and cesarean delivery (aOR=3.36, 95% CI: 2.05-9.26, p<0.001), were significantly higher.

Pre-pregnancy BMI groups were defined as underweight < 18.5 kg/m^2, normal weight 18.5–23.9 kg/m^2, overweight 24–27.9 kg/m^2, and obese ≥ 28 kg/m^2. *p < 0.05, **p < 0.01, and ***p < 0.001. All analyses were adjusted for age, area of residence, pregnancy follow-up, and method of conception. Abbreviations: BMI: body mass index (Figure 3).

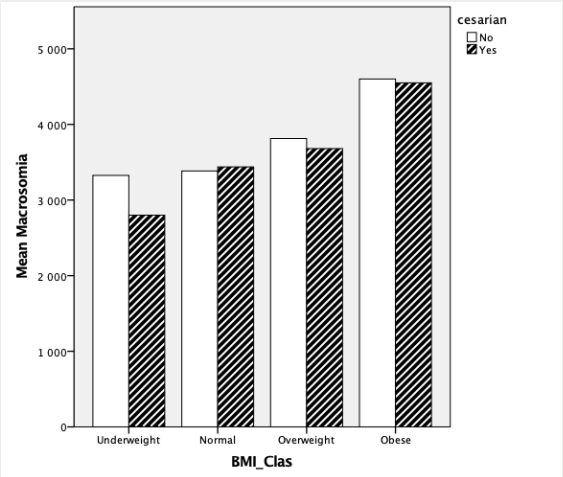

Figure 3. Age and IMC as risk factors for pregnancy outcomes

Univariate analysis

The results of the univariate analysis are presented in Table 5. The factors significantly ($p < 0.05$) associated with the composite criterion of maternal morbidity (CM) in univariate analysis were maternal age, history of vaginal delivery of a macrosomic infant (> 4000g), cesarean delivery, and birth weight of the newborn. The origin of the patients, the term of delivery, the induction of labor and the sex of the infant, although not statistically significant (p between 0.05 and 0.2), were retained in the multivariate model. The BMI of the patients, the existence of maternal diabetes (gestational or pre-existing), and the center, although having a p-value less than 0.2, were also retained in the multivariate analysis as adjustment variables.

Table 5. Correlation between macrosomia, age and BMI in participants.

		Without macrosomia	Macrosomia	p-value
Age	<30	104 (86.67)	16 (13.33)	0.007
	≥30	37 (68.52)	17 (31.48)	
BMI	Underweight	15 (88.23)	2 (11.77)	
	Normal	111 (88.09)	15 (11.91)	0.000
	Overweight	15 (53.57)	13 (46.43)	
	Obese	1 (33.33)	2 (66.67)	

Discussion

The results of this work showed a significant association between body mass index (BMI) before pregnancy and adverse pregnancy outcomes. After adjusting for confounding factors, BMI between 25 and 30 kg/m2 and ≥30 kg/m2 before pregnancy is associated with a 2.04- and 3.65-times higher risk of macrosomia than normal BMI, respectively. The risk of preeclampsia is 4.73 times higher in obese women than in women of normal weight before pregnancy. Whereas gestational diabetes was 2.75 times higher among women in the pre-pregnancy obese group compared to participants in the normal group. However, the mode of delivery by cesarean section was 2.45 and 5.02 times more common among participants in the pre-pregnancy overweight and obese groups, respectively, compared to women in the normal group.

A prevalence of 12.8% of anemia was noted among women in our sample aged between 15 and 47 years in this study, which remains very low compared to that (34.7%) published by the national nutrition survey carried out between 2019 and 2020 on the population of the same age group (PNN, 2019). This difference could be due to the fact that cases were not taken into account due to missing information and the hospital capacity does not allow all women of childbearing age to be accommodated. In addition, pre-gestational BMI ≥ 30 kg/m2 had a protective effect against anemia, where the risk of anemia decreased by 73% when compared to the normal weight group. In a study in Bangladesh with multiple statistical approaches, overweight/obese women were found to have a lower probability of being anemic, while underweight women were more likely to be anemic (23). Another cross-sectional study of Chinese women showed a significantly lower risk of anemia in overweight and obese women than in normal-weight women (24). This could be explained by the fact that a high BMI in early pregnancy may reflect sufficient nutritional intake, including the intake of various micronutrients essential for hematopoiesis (25,26). In addition, a high BMI could be the result of good management of chronic diseases, such as tuberculosis or parasitic infections, known as risk factors for anemia (27). Which suggests that the high Hb levels may be a consequence of their better nutritional status.

The results of this study also revealed a prevalence of 15.2% of macrosomic births, which is almost similar to that reported by El Bakkali et al. (28) on the same source population (14.37%). Overall, macrosomia affects 3-15% of all pregnancies (29). This diversity is explained by the complex and multifactorial etiology of macrosomia, the cultural and nutritional transition that Morocco is currently experiencing. Compared with the risk of intrauterine growth, macrosomia was higher in obese women. In this context, Leddy et al. (30) assessed the impact of maternal obesity on maternal and fetal health and according to their findings, high BMI affects fetal growth and gestational age, such that low weight of birth, unlike fetal macrosomia, is less likely to occur. Furthermore, several studies have shown that gestational diabetes is an independent risk factor for fetal macrosomia, while many others have concluded that it is a potentiating factor that only amplifies the effect of fetal macrosomia. maternal obesity (29). Both relationships are supported by specific pathophysiological explanations, with altered adiponectin levels and microRNA expression supporting the role of gestational diabetes (31), while changes in leptin levels support the effect of obesity (32). What is certain is that the combination of these two factors has a multiplier effect, very probably from a mechanical point of view. Better designed studies that account for other potential confounding factors are needed to better understand these complex relationships.

A prevalence of 8.6% of women had gestational diabetes, which is consistent with the published result in a prospective cohort study on 3,172 Chinese pregnant women at Peking Union Medical College (33). However, our study did not find an increase in the prevalence of gestational diabetes in the overweight group. This could be explained by the level of difference between the American, Chinese, and Moroccan target populations, which can lead to discrepancies. The disparity can also be attributed to classification bias if we compare the proportion of our group overweight (26.1%) with that of 15.9% reported in a Chinese prospective cohort study (34) and that of 28.5% in another American study, (35), which showed a significantly high association between women who were overweight before pregnancy and gestational diabetes, which assumes insufficient power behind the inconsistency of results. Therefore, the results relating to maternal underweight and obesity status from this study can be generalized to the Moroccan female population of childbearing age, while the results of the overweight group require careful interpretation.

Among the participants included in this work, a

prevalence of 7.6% had preeclampsia, which is almost consistent with the result (7%) published by Benjelloun et al. (2020) at the Ibn Rochd university hospital center in Casablanca, Morocco. This disease accounts for 2 to 8% of pregnancy-related complications (36). Compared to normal-weight and underweight women, pre-pregnancy obese women were significantly linked to an increased risk of preeclampsia. Previous studies across different countries and populations have also indicated that pre-pregnancy overweight and obesity are linked to a higher risk of preeclampsia (37–39); which is consistent with our results if we except the maternal overweight status. This discrepancy between results may be due to the effect of potential bias and different statistical methodologies. Being underweight before pregnancy was not significantly associated with the risk of preeclampsia in previously published studies, which is similar to our results in the multivariable adjusted model (37). In any case, future treatment modalities for preeclampsia targeting known pathogenic mechanisms constitute an area ripe for future studies.

A prevalence of 9.4% of delivery by cesarean section was noted in this study, which is low compared to that published by the Moroccan Ministry of Health (21.2%) in its health report in figures (2019). Many countries have exceeded the cesarean birth rate recommended by the World Health Organization (WHO) by 10–15%, with some regions recording rates above 40% (40).

Possible reasons for variations in cesarean section rates between and within countries could be attributed to a lack of trained health personnel and health infrastructure and the cost of the operation for the category of women without social coverage. Additionally, cultural and societal perceptions around prestige may push mothers to request a cesarean section (41). Compared with women of normal weight before pregnancy, the group of overweight and obese participants was significantly related to the risk of cesarean delivery, which is consistent with the results of a cohort meta-analysis by Poobalan et al between 1996 to 2007 (42) and those of Haile et al. (43). The biological mechanisms by which obesity affects the period of the active phase of labor and the rate of cervical dilation are some of the mechanisms that result in cesarean section in obese women (44–46).

Taking into account the results reported in this work separately on each of the adverse pregnancy outcomes related to pre-pregnancy body mass index and other previous studies, preeclampsia, macrosomia and cesarean delivery were respectively well reported as outcomes linked to the risk of gestational diabetes (47,48). However, according to Song et al, pre-pregnancy body mass index is a potential risk factor for gestational diabetes (34). On the other hand, gestational diabetes was also found to result from high hemoglobin levels (≥12.5 g/dL) in the first trimester and women with high Hb levels had a higher BMI before pregnancy (49). From this synthesis, serial mediation studies including pre-pregnancy BMI, adverse pregnancy outcomes and key potential confounders much better elucidate our understanding of other causal pathways and thus properly intervene before the onset of pregnancy. pregnancy to collectively prevent the occurrence of these unfavorable outcomes.

Limitations

This representative study focuses on the impact of maternal weight indicators before pregnancy on the risk of adverse pregnancy and perinatal outcomes. We used rigorous methods for data collection and management. We previously specified and adjusted for potential confounders and present evidence for the need to maintain normal weight and follow a balanced diet for Moroccan women before pregnancy. However, our study also has some limitations. Firstly, this is a retrospective study, and the pre-pregnancy body mass index was based on measurements taken at primary health centers far from the regional hospital, place of delivery, or self-declared, which may lack precision or lead to memory errors, leading to an underestimation or overestimation of weight before pregnancy. Secondly, a category of wealthy women of childbearing age often frequents private health establishments, which can lead to selection bias. Third, abnormal BMI before pregnancy could be affected by other maternal-fetal factors. Given the limitations noted in this study's sample, future study planning could account for classification and selection bias and include other pregnancy-related variables. Based on this observation, several open pragmatic randomized trials evaluating complex management combining dietary measures with physical activity are currently being carried out and could thus enable a reduction in obstetric complications such as gestational diabetes, caesarean section or instrumental extraction, but also fetal complications such as macrosomia (50–52).

Conclusion

In conclusion, overweight and obesity before pregnancy increase the risk of cesarean delivery and macrosomia. Obesity in this study constitutes a risk factor for gestational diabetes and preeclampsia while it plays a protective role against the risk of anemia. Macrosomia and cesarean section could be frequent perinatal outcomes that can be prevented by better management of recognized associated factors. These results may provide compelling evidence and the need for maintaining normal body weight and a balanced diet for Moroccan women to avoid adverse pregnancy outcomes. The future now depends on the primary prevention of obesity through government measures implemented (National Nutrition and Health Program, Obesity Plan) aimed at reducing the incidence of obesity among adolescents and young adults of childbearing age; then on the secondary prevention of obesity, the aim of which is to reduce the occurrence of obstetric and neonatal complications in obese pregnant patients through screening and early treatment of these complications.

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