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**Original Article**

# Risk Factors and Outcomes Associated with Maternal Obesity and Overweight: A Cross Sectional Study among Moroccan Women in Marrakech

***Sara Samim [1], Mohamed Loukid [1], Saloua Lamtali [1,2]**

1. *Laboratory of Pharmacology, Neurobiology, Anthropobiology, and Environment, Cadi Ayyad University, Faculty of Sciences Semlalia, Marrakech, Morocco*
2. *Higher Institute of Nursing and Health Techniques, Marrakech, Morocco*

***Corresponding Author:** Email: msaratijani@gmail.com

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**Abstract**

**Background:** Obesity is becoming a real challenge for public health among pregnant women. This study aimed to identify sociodemographic and lifestyle risk factors and outcomes linked to maternal obesity and overweight.

**Methods:** A cross-sectional study was carried out from Nov 2021 to Dec 2022 in the maternity health facility of Mohammed VI Hospital, as well as in one of the main health centers with a delivery unit in Marrakech, Morocco. Parturients were divided into four categories according to their pre pregnancy BMI: underweight, normal weight, overweight and obese. We used the chi-square test ($\chi^2$) to analyze the sociodemographic and lifestyle factors associated with maternal obesity and overweight. The same tool was utilized to explore maternal and neonatal complications.

**Results:** Overall, 400 parturient women with singleton pregnancies were included in the study. The prevalence of overweight and obesity was 29.8% and 31.5% respectively. Maternal age, type of housing, practicing sports, feelings about pregnancy were correlated with an increased risk of maternal obesity and being overweight. The risks of gestational diabetes, hypertension, anemia, cesarean delivery, and fetal macrosomia were higher among overweight and obese women compared to normal weight ones. The differences were significant ($P<0.05$).

**Conclusion:** Maternal overweight and obesity are strongly linked with socio-economic, lifestyle, and psychological factors which can lead to serious complications for both mother and baby. Further research is needed to develop appropriate preventive measures and interventions for maternal obesity and overweight.

**Keywords:** Obesity; Overweight; Pregnancy; Sociodemographic; Gestational diabetes; Preeclampsia

## Introduction

Overweight and obesity have reached alarming rates worldwide and are still escalating both in the developed and developing countries such as Morocco. According to the WHO worldwide obesity has tripled since 1957, and if this current trend continues by 2030, up to 57.8% of the world's adult population (3.3 billion people) could be either overweight or obese (1).

In Morocco and according to statistics provided by the Ministry of Health (MoH), nearly 20% of Moroccan people are obese and 53% are overweight (2), a concerning trend that affects women more than men, especially that female obesity is still considered in many African countries as a symbol of wealth, beauty, and fertility.

Dietary and lifestyle changes are considered to be amongst the fundamental causes of obesity and overweight. In fact, the globe is undergoing a nutritional transition due to urbanization and economic development (3). This has led to the rapid progression of obesity among the adult population.

Demographic and socioeconomic status have also been identified as one of the factors linked to overweight and obesity. Several studies aiming to explore the relationship between socioeconomic status (SES) and obesity showed that obesity in the developing countries is strongly linked to people with a higher SES in contrast to the situation in the developed countries where overweight and obesity are predominant among poor people (4,5).

For obese women, pregnancy can result in maternal and fetal complications beginning in the conception period and continuing through the postpartum period. The maternal and fetal risks caused by obesity have been well documented. Indeed, obesity affects fertility and results in increased time to conceive. Besides obese women have lower response rates to assisted conception treatment. During pregnancy, obese women have a greater risk to suffer from serious complications such as gestational diabetes, Hypertension and Preeclampsia (6). Furthermore, a higher BMI reading can also affect the delivery mode. In fact, numerous studies reported a higher risk of cesarean delivery among overweight and obese women. Consequently, obese women are more likely to experience post cesarean infectious morbidity and endomyometritis, even if the cesarean is elective and pro- phylactic antibiotics are given (7). Regardless of delivery mode, a higher BMI can engender a postpartum hemorrhage (8). On the other hand, many neonatal and fetal complications were highlighted, such as fetal macrosomia, congenital malformations, and neonatal death.

Not enough is known about risk factors identified with maternal obesity and overweight and much less is true among Moroccan population, we aimed to recognize these factors and evaluate pregnancy outcomes related to overweight and obesity among Moroccan women.

## Methods

### *Study Design and Population*

We conducted a cross sectional study from Nov 2021 to Dec 2022 in the Obstetrics and Gynecology Service of the Maternal & Child University Hospital Mohammed VI, as well as in one of the main health centers with a delivery unit in Marrakech, Morocco. We recruited 400 parturients who gave birth during the study period.

The study included women aged 18 yr and over with singleton who accepted to participate in the survey and who knew their pre pregnancy weight or have it on her personal maternal health record book provided by MoH. Most women of reproductive age who use the public health system tend to have one due to the stipulation of the Moroccan MoH to keep such records during the entire pregnancy-delivery period.

This record documents all pre- and post-natal visits and includes information on previous pregnancies and notations about complications or medications, among other things.

Women with missing data about pregnancy weight or height and multiple pregnancies have been excluded.

### *Data Collection Methods*

Data collection was performed by face-to-face interview with the parturient via a pretested and structured questionnaire. The questionnaire is composed of the following items:

a. ***Demographic and Socio-economic Characteristics:*** age, age at marriage, marital status, place of residence, medical insurance, level of education and occupation status were assessed for each parent.

b. ***Maternal Anthropometric Measurements:*** the weight and height were obtained from the personal maternal health record book. BMI was calculated based on weight and height measurements taken and was categorized into 4 categories: underweight (<18 kg/m2), normal weight (18.5-24.9 kg/m2), overweight (25-29.9 kg/m2), and obesity (>30 kg/m2).
c. ***Lifestyle Factors:*** maternal smoking and alcohol consumption, physical activity, and maternal feelings about pregnancy.
d. ***Medical and Obstetric history:*** chronic pathology, gravidity, parity, number of abortions neonatal death, and numbers of c-sections.
e. ***Pregnancy Outcomes:*** gestational complications included were diabetes, hypertension, preeclampsia, anemia, infections, thromboembolic accidents, and sleep apnea.
f. ***Delivery Data:*** gestational age at birth, delivery mode and delivery induction were obtained from hospital registries.
g. ***Neonatal Outcomes:*** newborn characteristics were sex, weight, transferred to specific neonatal unit, congenital malformations, and death.

### *Ethical Considerations*

The study was approved by the regional delegation of the Moroccan Ministry of Health (Approval number 4269 delivered on 02 June 2021) as well as by King Mohammed VI University Hospital (Approval number 4996 delivered on 29 June 2021). Oral consent was obtained from participants after being informed about the study objectives with assurance of the anonymity and confidentiality of the women's responses.

### *Data Analysis*

Statistical analyses were performed using SPSS 26 ver. (IBM Corp., Armonk, NY, USA). Data were expressed as means ± standard deviation (SD) for quantitative variables while qualitative variables were expressed in numbers and corresponding percentages.

The Pearson Chi square test was used to study the association between the different factors and maternal BMI categories. Means comparisons were carried out for quantitative variables by student's test for independent samples. All statistical tests were conducted with IC of 95% and *P*-value<0.05 considered as significant.

## Results

### *Main characteristics of the study participants according to BMI*

During these 13 months, 400 women were included in our study, 29.8% of patients were overweight and 31.5 % were obese. General characteristics of the participants according to BMI are presented in Table 1.

**Table 1:** General patient characteristics

| | ***Pre-pregnancy BMI category*** | | | |
|---|---|---|---|---|
| Characteristics | Underweight | Normal | Overweight | Obese |
| Age (Y±Sd) | 26± 6 | 27± 6 | 30± 6 | 31± 7 |
| Weight (Kg) | 48.64±13.35 | 58.63±6.50 | 67.70±14.87 | 86.82±15.75 |
| IMC (kg/m2) | 19±4 | 22±2 | 26±6 | 33±5 |
| GWG (kg) | 11.42±4.78 | 8.59±5 | 10.64±15.30 | 7.33±11.46 |
| Parity N (%) | | | | |
| Primiparous | 9(64.3) | 75(53.2.) | 49(41.2) | 46(37.1) |
| Multiparous | 5(35.7) | 66(46.8) | 70(58.8) | 78(62.9) |

*Sociodemographic and Lifestyle Characteristics by BMI Status*

Obese women tended to be older and multiparous. The mean gestational weight gain increased with decreasing maternal BMI.

Analysis of the sociodemographic parameters revealed that obesity was prevalent among women aged between 25 and 35 compared to the other age

groups. Regarding the educational status, illiteracy is predominant among obese women (20.6%). Furthermore, the women with increased BMI were less likely to have a higher education (4%), but no statistical differences were noticed.

Most study participants were housewives, and no significant correlation was observed between the BMI categories and the occupation of husbands.

In addition, obese women were significantly less likely to live in an apartment compared with normal weight women (*P*=0.020) and more likely to have medical insurance, although without statistical significance (*P*=0.168).

Increasing family size is linked with reduced prevalence of obesity, which is an indirect indicator of SES, but not statistically significant in our sample (*P*=0.621).

In addition to the previous socio-economic factors, behavioral factors such as active and passive tobacco smoking do not seem to be significantly correlated with obesity (Table 2) (*P*=0.277).

**Table 2:** Sociodemographic and lifestyle characteristics by BMI status

| *Characteristics* | *Underweight N=14* | *Normal N=141* | *Overweight N=119* | *Obese N=126* | *P-value* |
|---|---|---|---|---|---|
| Age(yr) | | | | | |
| <25 | 5(35.7) | 65(46.1) | 35(29.4) | 25(19.8) | 0.000* |
| 25-35 | 8(57.1) | 65(46.1) | 59(49.6) | 59(46.8) | |
| >35 | 1(7.1) | 11(7.8) | 25(21.0) | 42(33.3) | |
| Level of education n (%) | | | | | |
| Illiterate | 0(0.0) | 16(11.3) | 15 (12.6) | 26(20.6) | |
| Primary school | 8(57.1) | 66(46.8) | 48(40.3) | 48(38.1) | 0.172 |
| Secondary | 6(42.9) | 49(34.8) | 51(42.9) | 47(37.3) | |
| University | 0(0.0) | 10(7.1) | 5(4.2) | 5(4.0) | |
| Occupation of women n (%) | | | | | |
| Housewife | 14(100) | 135(95.7) | 117(98.3) | 120(95.2) | 0.243 |
| Employed | 0(100) | 6(4.3) | 2(1.7) | 6(4.8) | |
| Occupation of husband n (%) | | | | | |
| Active | 14(100.0) | 135(95.7) | 117(98.3) | 120(95.2) | 0.332 |
| Unemployed | 0(0.0) | 6(4.3) | 2(1.7) | 6(4.8) | |
| Medical insurance n (%) | | | | | |
| Yes | 7(50.0) | 62(44.0) | 64(53.8) | 72(57.2) | 0.168 |
| No | 7(50.0) | 79(56.0) | 55(46.2) | 54(42.9) | |
| Type of house n (%) | | | | | |
| House | 13(92.9) | 129(91.5) | 115(96.6) | 125(99.2) | 0.020* |
| Apartment | 1(7.1) | 12(8.5) | 4(3.4) | 1(0.8) | |
| Family size n (%) | | | | | |
| Small | 6(42.9) | 66(46.8) | 49(41.2) | 51(40.5) | |
| Medium | 7(50.0) | 55(39.0) | 56(47.1) | 64(50.8) | 0.621 |
| Large | 1(7.1) | 20(14.2) | 14(118) | 11(8.7) | |
| Smoking cigarette n (%) | | | | | |
| Yes | 0(0.0) | 1(0.7) | 1(0.8) | 0(0.0) | 0.650 |
| No | 14(100.0) | 140(99.3) | 118(99.2) | 126(100.0) | |
| Practicing sports n (%) | | | | | |
| Yes | 1(7.1) | 34(24.1) | 12(10.1) | 10(7.9) | 0.001* |
| No | 13(92.9) | 107(75.9) | 107(89.9) | 116(92.1) | |
| Passive smoking at home n (%) | | | | | |
| Yes | 0(0.0) | 27(19.1) | 26(21.8) | 24(19.2) | |
| No | 14(100.0) | 114(80.9) | 93(78.2) | 102(81.0) | 0.277 |
| Feeling about current pregnancy n (%) | | | | | |
| Anxious | | | | | |
| Nervous | | | | | |
| Calm | 2(14.3) | 8(5.7) | 14(11.9) | 22(17.5) | |
| | 0(0.0) | 5(3.5) | 15(12.7) | 28(22.2) | 0.000* |
| | 12(85.7) | 128(90.8) | 89(75.4) | 76(60.3) | |

Physical activity was low in all BMI categories. Besides there were statistically significant differences in the prevalence of obesity depending on practicing sports (*P*=0001).

Concerning the psychological factors, anxiety was significantly higher among obese women compared with normal weight women who appeared to be calm and had positive feelings about their pregnancy (*P*=0.000).

### *Maternal and Neonatal Outcomes Classified by Pre-pregnancy BMI*

Concerning the gestational morbidity, as shown in Table 3, the risk of gestational diabetes increased consistently and significantly with pre pregnancy BMI. (*P*=0.006) Similarly, the risk of gestational hypertension was 5 times higher among obese women compared with normal weight women (21.4%), and (4.3%) respectively with significant statistical difference (*P*=0.000). Whereas overweight and obese women were less likely to suffer from anemia, the difference was statistically significant (*P*=0.023). On the other hand, no statistically significant difference was observed with regard to preeclampsia (*P*=0.377).

The resort to cesarean appears to be more frequent for obese women and statistically significant (*P*=0.000).

For neonatal outcomes, babies of overweight and obese women are at increased risk of macrosomia. Compared to normal weight women, the difference was significant. In contrast, obese women are less likely to deliver low birth babies (*P*=0.000).

Moreover, babies born to obese women required admission to neonatal intensive care units, but without statistical significance (*P*=0.104).

**Table 3:** Maternal and neonatal outcomes according to pre-pregnancy BMI

| ***Variable*** | ***PRE-PREGNANCY BMI category*** | | | | |
|---|---|---|---|---|---|
| | Underweight n=14 | Normal n=141 | Overweight n=119 | Obese n=126 | P-value |
| Maternal Outcomes | | | | | |
| Gestational diabetes N (%) | | | | | |
| Yes | | | | | |
| No | 1(7.1) | 13(9.2) | 23(19.3) | 31(24.6) | 0.006* |
| Gestational Hypertension N (%) | 13(92.9) | 128(90.8) | 96(80.7) | 95(75.4) | |
| Yes | | | | | 0.000* |
| No | 0(0.0) | 6(4.3) | 6(5.0) | 27(21.4) | |
| Preeclampsia N (%) | 14(100.0) | 135(95.7) | 113(95.0) | 99(78.6) | |
| Yes | | | | | 0.377 |
| No | 0(0.0) | 9(6.4) | 3(2.5) | 5(4.0) | |
| `Anemia N (%) | 14(100.0) | 132(93.6) | 116(97.5) | 121(96.0) | |
| Yes | | | | | 0.023* |
| No | 4(28.6) | 19(13.5) | 12(10.1) | 7(5.6) | |
| Mode delivery N (%) | 10(71.4) | 122(86.5) | 107(89.9) | 119(94.4) | 0.000* |
| Vaginal delivery | 12(85.7) | 103(73.0) | 81(68.1) | 60(47.6) | |
| Cesarean section | 2(14.3) | 38(27.0) | 38(31.9) | 66(52.4) | |
| Neonatal Outcomes | | | | | |
| N (%) | | | | | |
| Macrosomia | 1(7.1) | 7(5.0) | 12(10.1) | 25(19.8) | |
| Low Birth weight | 2(14.3) | 2(1.4) | 4(3.4) | 10(7.9) | 0.000* |
| Normal weight | 11(78.6) | 132(93.6) | 103(86.6) | 91(72.2) | |
| Admission to NICU N (%) | | | | | |
| Yes | 1(7.1) | 4(2.8) | 8(6.7) | 13(10.3) | 0.104 |
| No | 13(92.9) | 137(97.2) | 111(93.3) | 113(89.7) | |

## Discussion

In the present study, we explored the risk factors and outcomes related to obesity and overweight within a sampling of pregnant Moroccan women who delivered during the study period.

Our results have shown that the prevalence of obesity and overweight were 31.5% and 29.8% respectively. These prevalence rates were higher than those estimated nationally (2) but similar to other studies conducted in Morocco (9,10) and in other African countries (11).

These alarming rates reported from several countries are related to several factors such as lifestyle patterns and SES. Our study found a significant association between age and pre-pregnancy BMI. These results are in concordance with previous evidence from Swedish and Nigerian studies (12,13). Obesity and overweight are more common among women aged between 25 and 35. Similar results were found in another Moroccan study showing that obesity is affecting young women (14), and that can be explained by the perception of obesity among Moroccan women as a symbol of beauty and fertility.

Level of education is one of the most important factors that contribute to women's obesity (15,16,17). In our sampling a low educational level contributed to obesity, and this could be attributed to ignorance and low awareness with regards to obesity related risks among Moroccan women.

There was no significant correlation between obesity and the occupation of the women and their husbands, On the contrary a Polish study found a higher risk of obesity among occupationally active individuals (18).

Obesity and overweight were more common in women living in a house and the difference was statistically significant. Comparably obesity and overweight were more prevalent among the women living in luxurious or modern housing and in new or old medina and that can be explained by lifestyle factors such as physical activity level (19).

The household size is another SES indicator that also influences chances of being obese. Evidence from numerous studies have shown that overweight and abdominal adiposity among the women were associated with larger household sizes (15,20).

Regarding the lifestyle factors, active and passive smoking were not linked with overweight and obesity, conversely a Lebanese study has found that smokers have increased risk to be overweight whereas passive smoking at home was closely linked with lower BMI compared to nonsmokers (21).

The majority of women in our sample do not practice any sport that may be due to their low socioeconomic level and therefore the limited access to sports, these results did not show any significant relation with overweight and obesity. While another study in south of Morocco among Sahraoui women showed that lack of physical activity appears to play a critical role in the development of body fat because of the higher prevalence of sedentary habits (22).

Regarding the psychological factors, in the present study anxiety and stress were higher among obese women. Similar findings were reported from other studies (23). Indeed, they revealed that emotional problems such as depression, anxiety, and stress are positively correlated with the raising of BMI during pregnancy (24).

It is well known that being overweight or obese during pregnancy can cause several complications. In the population studied, and in concordance with several studies (6,25,26) obesity was a significant risk factor for gestational diabetes mellitus and hypertension. A meta-analysis revealed that the risk of developing GDM is two times higher among overweight and obese women compared to normal weight women (27). The present study did not show a significant relationship between preeclampsia and obesity. However, other studies indicated that the risk of preeclampsia typically doubled for each 5 to 7 kg/m2 increase in BMI (28). In addition, obese women in our sample were less vulnerable to anemia, this is consistent with previous studies that have reported a lower likelihood of anemia and iron deficiency among overweight and obese women (29,30).

Delivery patterns are also affected. Indeed, in the present study a significant correlation was observed between obesity and cesarean delivery. Similar findings considered obesity as a risk factor for cesarean delivery even after the exclusion of hypertensive disorders and diabetes Mellitus (31). In our survey, a significant correlation has been shown between pre-pregnancy BMI and neonatal weight. In fact, an increased BMI was found as a risk factor for fetal macrosomia. However, obese women have a lower risk of low birth weight confirmed by other authors (32). On the other hand, obesity appears to increase rates of admission to neonatal intensive care units, and this may be a result of lower Apgar scores among newborns of overweight and obese women (33).

This study has some limitations that should be taken into consideration. First, the sampling population is small. Second, the pre-pregnancy weight was self-reported, and the BMI may therefore be biased because women tend to underestimate their weight. Third, the cross-sectional design of the study does not allow for the identification of the causality relationship between variables. Despite these limitations, our results provide strong epidemiological evidence on prevalence, risk factors and outcomes associated with maternal obesity for further investigations through other study designs.

## Conclusion

The main contributory factors for overweight and obesity were young age, type of housing, practicing sports and emotional wellbeing during pregnancy. Identifying these factors may provide insights to reduce the alarming prevalence of obesity and overweight among Moroccan women of reproductive age. In addition, obesity is recognized in this study as a major risk factor for several pregnancy outcomes such as gestational diabetes mellitus, hypertension, higher rates of cesarean section, and fetal macrosomia. Hence, policy makers develop preventive strategies focused on weight management awareness, especially before conception, while taking into consideration the socioeconomic and environmental factors.

## Journalism Ethics considerations

Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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## Conflict of interest

The authors declare that there is no conflict of interest.

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