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PRE- PREGNANCY WEIGHT AND FETAL GROWTH MOROCCAN DATA

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ABSTRACT

Objective: Establishing anthropometric parameters of newborn term birth study of maternal factors and socioeconomic risk associated with delayed intrauterine growth associated with prepregnancy body mass index **Methods:** A study was carried outover a period of one year from October1, 2010 to October1,2011,using data collected from a descriptive-transversal study. We recruited 1408 nondiabetic women, delivering singleton from 37 completed weeks up to 42 weeks gestation. Maternal pre pregnancy body mass index [BMI] was categorised in four classes: underweight:<18.5, normal weight: 18.5–24.9, overweight: 25–29.9, and obesity:>30 kg/m² **Results:** The mean birth-weight was 3372 ± 576 g. The incidence of low birth-weight was 5,6%. Among mother's and socioeconomic risk factors, teenage mothers, mothers with a weight lower than 50 kg or with body mass index lower than 20 kg/m² had a high risk of having a child with intrauterine growth retardation. **Conclusion**: These findings support the need to control pre-pregnancy weight against the risk of low birth weight and macrosomia among lean and obese women, respectively.

KEYWORDS: BMI, low birth weight, macrosomia anthopometrics parameters.

INTRODUCTION

It has known for many years that the size and weight of the mother are closely related to the birth weight of the child and as a result of pregnancy such as perinatal mortality, low birth weight and growth retardation are often due to chronic malnutrition during pregnancy. Expectant mothers who start pregnancy with a healthy physiology of reproduction and who have not suffered from poor health or nutritional deprivation during pregnancy are more likely to have babies bigger and healthier than those who do not benefit no such benefits. Several studies provide evidence of the relationship between reproductive efficiency and socio-economic status.

Studies in the United States by the National Institute of Health have shown that mothers who weigh more than 68 kg at the time of conception or taking over 13.6 kg during pregnancy tend to have children and larger healthier, with lower than those who weigh less or gain less weight perinatal mortality.

The development of the fetus can be considered the result of the interaction between the genetic potential and the intrauterine environment. Women who become pregnant in good reproductive physiology and who have not suffered from poor health or nutritional deprivation during childhood will deliver babies bigger and healthier than those who do not receive such benefits. The relationship between dietary intake and maternal effects and offspring is seen perfectly in experiments on animals, especially in species where the gestational period is relatively short and where you can easily highlight a correlation between dietary intake and maternal or fetal growth Screening delay intrauterine growth restriction [IUGR] is usually done during pregnancy with fetal biometry and allows proper monitoring of high-risk pregnancies. The objective of our study is to highlight the link between maternal body mass index and fetal growth parameters via anthropometric newborn.

Ethical Considerations

The administration of the Prefectural Hospital Hassan II and the Ethics Committee of the Faculty of Medicine and Pharmacy of Rabat has given their agreement for the implementation of the study for epidemiological purposes. Women who met the inclusion criteria were informed of the study objectives and the conditions of participation. Their consent was obtained before starting the filling of farm returns. Participation in the study was free, Respect for anonymity and confidentiality of information was rigorous.

METHODS

Study Population and Design.

A descriptive-transversal quantitative study at the Maternity Department of Hassan II Hospital in Benslimane, a town located in the north-west of Morocco, 60 km far away of the capital Rabat, which has a population of 22,000 inhabitants. The study was carried out over a period of one year from October 1, 2010 to October 1, 2011.

Inclusion Criteria

Only women who knew their weight before pregnancy. The weight measurement during this consultation confirmed the weight before pregnancy reported by women.

Exclusion Criteria

Were excluded abortions before 22 weeks of gestation [WG] and fetal deaths to prevent such accidents from other causes than maternal weight; twins, mothers with more hypertension, ignoring the date of their last menstrual period or missing weight, diabetic women to avoid this pathology is a confounding factor of macrosomia; it's directly related to birth weight. Information on the determinants and covariates was obtained from a questionnaire.

Were excluded infants from twin pregnancies, mothers having an irregular menstrual cycle or ignoring the date of their last menstrual period of mothers with autoimmune disease, endocrine disease or with a history of diabetes.

Trained female investigators administered questionnaires every day including weekend and inquiring women about the following: age, marital status, income, years of education, marital status, number of previous births, date of birth, and date of last menstrual period.

The questionnaires were completed by accessing prenatal care and medical records during the period of hospitalization for delivery. The maternal weight was measured in kilograms, before delivery, using scales. The staff was asked to weigh mothers standing still, without support, only dressed in underwear or light loincloth.

The size of the mother was measured with a measuring rod for adults graduated in centimeters, feet together, arms hanging along the body, knees well extension, back, buttocks and heels pressed against the amount of vertical fathom. Gestational age was estimated from the first day of the last menstrual period.

At birth each child recruited was weighed, measured and examined. Data on weight, height, head circumference, arm circumference, chest circumference and sex of the newborn were collected in the first two hours after delivery by the health worker. The weight of the newborn was measured at 10 g, with a brand baby weighs SECA.

Height was measured using a height gauge graduated in centimeters. The staff was asked to measure the newborn naked, flat on his back, his head firmly against the headrest board fixed by an assistant and thighs and knees extended by the investigator. Head circumference was measured in its largest diameter. Arm circumference on the left arm midway between the acromion and the olecranon.

Maternal prepregnancy body mass index [BMI] was categorised in four classes: underweight:<18.5, normal weight: 18.5–24.9, overweight: 25–29.9, and obesity:>30 kg/m² The ratio of the brachiocrania perimeters represents the brachial perimeter on the crania perimeter [or index Kanawati and Mac Laren] reflects the nutritional status up to 4 years [Kanawati and McLaren, 1970], its use has been recommended by WHO for the diagnosis of malnutrition in the child population 0-5 years.

- Severe malnutrition if the brachiocrania perimeters is <0.28,
- moderate malnutrition if the brachiocrania perimeters is between 0.28 and 0.3 and
- Normal if the brachiocrania perimeters is greater than 0.3

Indeed, all these measurements were made in centimeters using an inextensible tape measure.

Data Analysis

The parameters collected in survey forms were stored, coded and analyzed using Statistical Package for Social Sciences [SPSS] 13.0 [SPSS, Inc., Chicago, IL, USA]. According to a multiple analysis Quantitative and qualitative variables were created from the data, which were codified for the statistical analysis. The descriptive analysis of the variables was based primarily on class size and proportions, and mean and standard deviations were used as measures' of central tendency and dispersion. Regarding the conditions, qualitative variables were compared using the chi-square test or Fisher's exact test. The Kolmogorov-Smirnov test was used for the study of the distribution of the variables. Pearson correlation test was performed to understand the relationships between quantitative variables. Means comparison of quantitative variables for different classes of a qualitative variable were performed using the Student's*t*-test for independent samples, after verification of the different condition of the test. For all statistical tests, A value of p <0.05 was considered significant.

RESULTS

1: Characteristics patients by pre pregnancy BMI

We included in our survey 1,408 parturients admitted for delivery. Table1 showed the main characteristics of the sample population.

The rate of obese parturient was much smaller and younger. The average ages and sizes were, respectively, [de [27 ± 6,37ans] et. [161 cm± 5,8cm]; the statistical significance$P$ < 0.05.There was also a significant difference depending on the place of residence percentage of obese multiparous women [81.4%] and macrosomia. [Table1].

Table 1: characteristics patients by pre pregnancy BMI

Variables	BMI kg/m²				p
	<20	20-24,9	25-29,9	≥ 30	
	N=102	N=871	N=348	N=87	
Age [y ±sd]	25±5,7	26± 6,3	28 ±6,2	29± 6,2	0,01*
Residence n[%]					<0,01*
Urban	43[42,2]	323[37,1]	161[46,4]	40[46]	
Rural	59[57,8]	548[62,9]	186[53,6]	47[54]	
Monthly income n[%]					0,41
<5000 DH	98[96]	81[93,1]	328[94,3]	84[96,6]	
>5000 DH	4[3,9]	60[6,9]	20[5,9]	3[3,4]	
Multiparity	[53[52	[542[62,3	[241[69,5	[70[81,4	<0,01*
fundal height cm ±sd	30 ±3,5	31±3,5	32±3,5	34±4,6	<0,01*
size cm ±sd	164±6	161±5,3	160±5,6	159±8,9	<0,01*
Birth weight g± sd	3186±60	3325±556	3458±542	3705±692	<0,01*

*Significant [P < 0.05].Quantitative variables were expressed in average±standard deviation, and qualitative variables were expressed in numbers and percentages DH= Moroccan currency

2: Influence of maternal anthropometric parameters on fetal growth

In order to determine if the malnutrition of women affects fetal growth, we evaluated the influence of the weight, size and body mass index parturients at the time of delivery on anthropometric parameters of newborns . Our result showed that fetal anthropometric parameters were significantly correlated with those of the parent p <0.05. [Table 2].

Table 2: correlation fetal and maternal anthropometric parameters

Variables	Age	Weight	Size	BMI	Weight gain	F H	PARITY
Birth weight g	0,062*	0,182*	0,123*	0,165*	0,230*	0,536*	0,149*
Perimeter crania cm	0,062*	0,158*	0,086*	0 ,153*	0,219*	0,460*	0,136*
size cm	0 ,082*	0,184*	0,116*	0 ,173*	0,220*	0,468*	0,153*
Perimeter brachial cm	NS	0,083*	0,025*	0,07*	0,175*	0,225*	0,05*
kanawati index cm	0,05*	0,06*	NS	0 ,073*	0,169*	0,154*	0,06*

*= Pearson correlation [r]; s=Statistical significance when p < 0.05. FH = fundal height, s=significant, NS=no significant.

3: Neonatal complications according to the BMI

According to the BMI before pregnancy shows, the average newborn weight was 3,186±603 g 3,325 ±556 g, 3,458±542 g, and 3,705±692 g for underweight, normal, overweight, and obese groups, respectively. Macrosomia prevalence is higher among obese women accounting for 40.2% against 8.8%, 13.7%, and 17% of the same groups, respectively; the difference is significant. Whereas the prevalence of low birth weight is low in obese women with just 2.3% against 6.9%, 3.8 and 3.2% for underweight, normal, and overweight groups, respectively, the difference is not significant. [Table3]

Table3: neonatal complications according to the BMI

variables	**BMI kg/m2**				
	<20	20- 24,9	25-29,9	≥30	P-value
	N=102	N=871	N=348	N=87	
Birth weight g ±sd	3186±603	3325±556	3458±542	3705±692	<0,01
[Low birth weight n[%	[7[6,9	[33[3,8	[11[3,2	[2[2,3	0,312
[Macrosomia n[%	[9[8,8	[119[13,7	[59[17	[35[40,2	<0,01
[Stillbirth n [%	[5[4,9	[32[3,7	[14[4	[1[1,1	0,5

Significant [*P* < 0.05].Quantitative variables were expressed in average±standard deviation, and qualitative variables were expressed in numbers and percentages

4: Influence of maternal anthropometric parameters on gestational age

The result was significant between the birth weight anthropometric parameters and gestational week except for the size which is p> 0.05. [table 4].

Table 4: correlation anthropometric parameters and gestational week

	<37 GW	37-40 GW	>40GW	P-value
Birth weight g	2014±1124	3443±518	3379±527	<0,05
Perimeter crania cm	35,4±2,9	34,7±1,65	35,03±1,16	<0,05
Size cm	49,12±3,8	50,17±1,6	49,9±2,52	NS
Perimeter brachial cm	16,14±8,8	13,35±1,64	13,43±2,5	<0 ,05
kanawati index cm	0,4±0,2	0,3±0,03	0,38±0,06	<0,05
Note:Variables mean ± standard deviation Kanawati index = ratio Perimeter brachial on Perimeter crania Abreviations NS=no significant,GW: gestational week				

5: The impact of low age, weight and pre-pregnancy BMI on low birth weight

The results recorded in Table 5 shows that age less 18 years [Odds ratio[OR] = 2.6, 95% confidence interval [CI] = 0.7–8.7], weight less than 50 kg [OR = 1.8, 95% CI = 0.8–4], and BMI less than 20 kg/m²[OR = 2.02, 95% CI = 0.8–4.59], were associated with low birth, But not significantly

Table 5: the impact of low age, weight and pre-pregnancy BMI on low birth weight

*=no significant, BMI=body mass index

	Odds Ratio	95% Confidence-interval	P-value
Age <18 years	2,6	0 ,7-8,7	0,133*
weight <50Kg	1,8	0,8-4	0,136*
BMI <20 kg/m²	2,02	0,8-4,59	0,1*

DISCUSSION

Our study shows that the size and weight significantly influence maternal anthropometric parameters of newborn maternal effect size is an important parameter influencing significantly the size and weight of the newborn at birth.[1] Conversely, women who in late pregnancy less than 50 kg and / or a body mass index less than 20 kg/m2 have weight newborns with weight, height and head circumference have relatively increased risk of having a newborn with a delay of intrauterine growth. The weight to gain during pregnancy in industrialized countries is an important factor associated with fetal growth.[2, 3] Our study supports the hypothesis that, in this particular population, the nutritional status of the mother, as reflected by the body mass index and weight in late pregnancy, also plays a key role in fetal growth, role seeming more important than the genetic determinism of the mother reflected by maternal height. The description of parental income in our population shows a dominance of low-income professions. Our study showed no significant effect on anthropometric parameters of the child. However, we can not underestimate the fact that the socioeconomic level of the patients in our study is low. Indeed, the profession of fathers determinant of family income significantly influence fetal growth of newborns. Father's occupation affects the nutritional status of the mother. These findings support the importance of socioeconomic status on both the nutritional status of the mother and fetal growth. Low socioeconomic status and poor maternal nutritional status can result can thus explain the lower birth weight of newborns in many prosperous regions.[3] and fetal growth is necessarily conditioned by the environment intrauterin by a and fetal genetic sucseptibilité secondly indeed the medium composition intrauterine depends on the genome and the maternal environment, and in the absence of maternal diabetes moitiée factors influence the variance in birth weight of lean mass and fat mass.[4] Moreover, it has been shown that maternal education level is a significant factor influencing fetal growth.[5,6] the average age of women in our population is 27 years.; we had more women than most minor women which explains the reliable rate of low birth weight nnes tranche minor mothers. . Epidemiological studies on the comparison of birth weight in different social groups and similar observations during famines or wars have shown the effects of an acute shortage of food on fetal development. It has known for many years that the size of the mother is closely linked with birth weight and consequences of pregnancy, such as perinatal mortality. There are more mothers in small groups whose socio-economic status is low, which means that inadequate nutrition and frequent diseases can prevent many girls social group considered to achieve optimal physical development. The physiological state of the mother, especially reproductive physiology when pregnancy begins, has a considerable influence on the development of the fetus. Several studies show the relationship between the size in adulthood, reproductive efficiency and socioeconomic status. In general, the baby weighs less than a small woman, has less vitality and survivable lower than that of a great woman. Developmental delay in the mother can not be corrected by a proper diet during pregnancy and it is the same for reproductive efficiency.

Factors influencing fetal growth at several levels: the nutritional status of the mother, characterized by its lipid and protein reserves play on the build [weight, height] of the child.[7] Some authors.[8] have found that it is actually much more than the weight of the mother before pregnancy mattered, which calls into question the importance of supplementation during pregnancy. Larsen et al.[9] showed that the frequency of macrosomia increases with a high BMI. Besides, obese woman seems more likely to experience a macrosomic baby than a woman of normal weight. Pregnancy in obese Women is associated with a high rate off et al macrosomia, which tends to be not dependent on gestational diabetes. The risk of macrosomia depends not only on the weight before pregnancy.[10] but also on weight gain during pregnancy.[11] our finding is in line with Edwards et al.'s study.[12] in which they compared two groups of parturients with high BMI and showed that macrosomia was significantly more frequent when weight gain exceeds 8 kg during pregnancy. Ducarne et al. [13] found out that the average weight of newborns was influenced by the BMI of their mothers, and there were also agreater number of children in these obese patients who were macrosomic. In this study, it was observed that high body mass index combined with high weight gain was a factor risk for hypertension, macrosomia, and low risk of low birth weight. Cnattingius et al.[14] confirmed the idea and stated that overweight protects against low birth weight. Besides, Kabali and Werler.[15] proved that the risk of fetal macrosomia was significantly higher for women who were overweight before pregnancy and for those who gained excessive gestational weight. However, the risk was not increased for women of normal weight before pregnancy who gained excessive gestational weight or for those who were overweight before pregnancy but gained a normal or low gestational weight. Therefore, pregestational BMI and gestational weight gain are major factors in determining birth weight.

Our results are largely confirmed by numerous studies Larsen et al.[9] the frequency of macrosomia increases with l`indice body mass in obese women and seems more willing to make macrosomic that women of normal weight baby. Pregnancy in obese women is associated with a high rate of fetal macrosomia, regardless of the concept of gestational diabetes. Macrosomia risk depends, on one hand, the previous weight.[10] and, on the other hand, the weight gain during pregnancy.[11] There is a linear relationship between BMI before pregnancy and the incidence of macrosomia.[11] Weight gain of more than 14 kg in obese patients multiplied by 2 to 3 times the risk of having a child macrosome.

Edwards et al.[1] demonstrated in a study comparing two groups of teenagers whose high BMI divided according to weight gain pergestationnel that macrosomia was significantly more frequent when weight gain exceeded 8 kg during pregnancy; our results confirm this study and is widely approved by Boyd et al.[16] how showed that the risk of macrosomia increases markedly with excessive weight gain in addition an earlier study on a Chinese population.[17] that has largely proved the risk of the occurrence of macrosomia was two fold for women who gain more weight during pregnancy then Kabali et al.[15] affirmed that fetal macrosomia was significantly higher among women who gained excessive gestational weight. There is also a linear relationship between maternal and fetal blood glucose blood glucose.[18] so it is possible that excess weight gain during pregnancy increase fetal weight `s rise in blood sugar. Two factors, however, contradict this hypothesis. On the one hand, excessive maternal weight gain does not appear linked to the occurrence of gestational diabetes.[18] and it is rather influenced by pre-existing obesity or rapid weight gain before or early pregnancy . In addition, Madsen and Ditzel showed in patients with insulin-dependent type 1 diabetes, the rate of fetal macrosomia increase despite glucose control.[19] in our study, we havn't included diabetic parturients.

Ducarme.[13] found that not only the average weight of newborns is influenced by the BMI of their mothers, but there are also a greater number of children in these macrosomic obese patients. In our study we noticed that body mass index beside weight gain was a predictor factor for arterial hypertension and macrosomia and conversely it was protective against low birth it similar to Cnattingus et al.[14] who affirmed that hight weight in pregnant women also protects against low birth . In sum, our results are in agreement with most studies that empower body mass index and weight gain gestational in the determination of birth weight.

The index Kanawati and McLaren.[20] had the advantage of revealing in our study states light and medium malnutrition in the first class of fetus whose age is <37SA. These revealed through this sensitive and reliable index nutritional status are hidden in our population most often by edema observed in the clinical examination of children. The value of this index in the evaluation and nutritional monitoring of children was also found in studies by other authors.[21,22] The early detection of light and medium forms of malnutrition prevents passage to more severe and more difficult severe forms but also longer and more expensive to treat that may affect fetal growth. Our study supports the hypothesis that in this particular population, the nutritional status of the mother, reflected by body mass index and weight in late pregnancy, also plays a key role in fetal growth, role seeming more important than the genetic determinism of the mother reflected by maternal height.

In our study the mean's birth weight was 3372 ± 576 g; neonatal and maternel parametrics interfered positively. Many studies have shown that children from the same parents have similar birth weights and a correlation between the maternal weight and childbirth was proved.[23,24] The size of the mother is one of the factors involved in the control of fetal growth as it is correlated with the ability of the uterus to support fetal growth.[25] This allows to limit fetal growth in order to avoid problems during childbirth. We have clearly established the effect of parity on the different parameters of fetal growth. Many studies have shown that the weight of first birth is lower than that of the following.[26] Indeed, the mechanisms of the effect of parity on fetal weight are not fully understood. However, an influence of the uteroplacental vascularization has been suggested.[27] This phenomenon is not clearly understood and could be explained in terms of evolution. It could reduce the maternal metabolic and energy investment during her first pregnancy, in order to ensure its own survival and to feed her first child and therefore have subsequently other children.

Our study confirms that age significantly influence anthropometric parameters as Kirchengast and Hartmann, 2003.[28] how demonstrated that adolescents individuals give birth to children smaller mass, it was suggested that this influence is mainly due to the concept maternal stress. However, it is possible that this phenomenon is due to competition between the energy demand required for the growth of the mother and her child. Indeed, the phase of energy storage, or anabolic phase, tends to extend these young mothers. Experiments in sheep have shown that this competition continues even if the mother is supercharged.[29] A more recent study has shown that during pregnancy in young sheep would significantly reduce the size of the placenta, limiting the transfer of nutrients to the fetus.[30] This could be explained in terms of evolution by a maternal protective mechanism that would promote short-term growth and survival of the young mother at the expense of the survival of the child.

CONCLUSION

In total our study estimated by anthropometric parameters fetal growth is largely influenced by those of the mother; indeed BMI before pregnancy, maternal height and weight determine the proper course of fetal growth and are associated with increased frequency of delayed intrauterine growth IUGR; Recognition of these factors to identify single risk can lead us to make specific recommendations for this population. Sensitization during prenatal consultations but also from childhood, through adolescence and into adulthood on the importance of a balanced diet for pregnant women would be promoted. An information in health centers on the importance of the risk of teenage pregnancy would also be set up. These actions can only be done with improving the health organization and the health care system.

RECOMMANDATIONS

In order to continue progress in this area, the following recommendations are made:

- Continue to disseminate the National Academy of Sciences recommended prenatal weight gain ranges based on pre-pregnancy BMI to health care providers.

- Assess women of child bearing age for BMI, particularly those in family planning clinics, and refer those with low or high BMI to available preconception care programs for assistance in achieving ideal weight before pregnancy.
- ·Implement preconception care interventions for underweight and overweight women to assist them in achieving ideal weight before pregnancy.
- ·Take steps to ensure that health care providers recommend that women who smoke, particularly those with low pre-pregnancy BMI, are encouraged to gain at least the recommended amount of weight during pregnancy.
- ·Develop methods to ensure that health care providers refer the following to a dietitian/nutritionist:
- any pregnant woman with low or high prepregnancy weight,
- any woman, regardless of pre-pregnancy weight, who fails to gain the recommended amount of weight during pregnancy.

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Competing Interests

The authors declare that they have no competing interests.

Author's contributions

All the authors contributed to the conduct of this work. All authors also declare that they have read and approved the final version of the manuscript

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