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Weight Gain During Pregnancy in Antananarivo, Madagascar: Determinants and Outcome

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Abstract: Weight gain during pregnancy has effects on growth and development during intrauterine life. Data for this subject is not available for Madagascar. This study aims to measure the weight gain during pregnancy, to identify its determinants and to assess its effect on the baby's weight at birth. A retrospective cohort study was carried out on pregnant women who gave birth in three maternity wards in the city of Antananarivo. The study included women who followed the first early prenatal consultation and who had their weight noted in the pregnancy notebook, during this prenatal consultation. Weight gain during pregnancy was assessed by using the difference in weight during the early prenatal visit and the weight before delivery. Recommendations from the Institute of Medicine were used to classify weight gain during pregnancy. Of the 380 pregnant women included in the study, 76.3% did not obtain the needed weight gain during pregnancy, 20% obtained normal weight gain and 3.7% obtained excess weight gain. In a multivariate analysis, the good nutritional status of women (body mass index <18.5 kg / m²) at the beginning of pregnancy (ORa (95% CI): 3.11 (1.06 - 9.10)) and their level of secondary education (ORa (95% CI): 5.96 (2.07 - 17.18)) and university education (ORa (95% CI): 6.45 (2.63 - 23.43)), were retained as predictors of sufficient weight gain during pregnancy. In a linear regression, the baby's weight increased significantly with the increase in weight gain during pregnancy, coefficient ß (ES) = 91 (7), p<0.001. Most women did not obtain the weight gain recommended during pregnancy and had a risk of giving birth to a low-weight baby. It is necessary to identify the other determinants of this weight gain.

Keywords: Birth Weight, Determinant, Madagascar, Weight Gain, Pregnancy

1. Introduction

The nutritional status of women during pregnancy and breastfeeding is an important condition for fetal development, pregnancy outcome and child growth [1, 2]. Weight gain during pregnancy is one indicator of the nutritional status of women during this period. A recommendation on the weight gain required during pregnancy has been established [3].

Women with low weight gain during pregnancy have a high risk of having a premature delivery and having a newborn with intrauterine growth retardation: low birthweight, Small for Gestational Age (SGA), etc. [4, 5].

In high-income countries, the proportion of pregnant women with a weight gain below the recommendation remains low compared to those in low and middle-income countries. In USA and Europe, this proportion is 21% and 18%

respectively, while it is 31% in Asia [6]. Data showing the situation in Africa remains poor. But it is known that in low- and middle-income countries, many women are undernourished and that undernutrition before and during pregnancy is a risk factor for underweight gain [7]. It is also known that in low- and middle-income countries, 43% of children are born SGA and/or premature and that insufficient weight gain during pregnancy is an important determinant [8].

Madagascar does not have enough information to reflect and understand the situation. A previous study in a rural Madagascar community found that no pregnant women obtained the recommended weight gain during pregnancy [9]. This present study was conducted to provide data concerning pregnancy weight gain in Madagascar. It aims to measure the weight gain of pregnant women during pregnancy, identify its determinants and assess its effects on the baby's birth weight.

2. Methods

2.1. Study Site

A retrospective, longitudinal study was carried out in the maternity ward of three hospitals located in the city of Antananarivo, the capital of the country: 1) the University Hospital Center (UHC) of Gynecology Obstetrics of Befelatanana, which is a public center and a national reference center, 2) the Pavillon Sainte Fleur, which is a semi-private hospital and 3) the Marie Stopes International, which is a private center.

2.2. Study Population

The study population consisted of women who gave birth in these maternity wards. Women who followed early antenatal consultation (ANC) (during the first trimester of pregnancy) and had their weight recorded in the notebook or in the pregnancy monitoring file, during this ANC, were included. Women with twin pregnancies and women with diabetes were excluded from the study.

2.3. Data Collection

Data collection was for one month at the UHC facility and five months at Pavillon Sainte Fleur and Marie Stopes International. Interviewers collected data on the participants' social characteristics. The weight during early ANC, recorded in the pregnancy monitoring document, has been transcribed. Before delivery, women were weighed with 100g accuracy with a SECA electronic scale and height was measured with 1 cm accuracy with a SECA wall mounted height rod.

Weight gain during pregnancy was assessed by the difference between the weight during early ANC and the weight before delivery. The Body Mass Index at the beginning of pregnancy was calculated by dividing weight in kilograms by height in square meters. WHO defined standards were used to assess the nutritional status of women at the beginning of their pregnancy (undernourished, normal,

overweight and obese) and recommendations from the Institute of Medicine in 2009 were used to classify the weight gain during the pregnancy (Table 1) [3, 10].

Table 1. Classification of nutritional status according to BMI and weight gain during pregnancy.

IMC (kg/m²)	Nutritional status	Total weight gain during pregnancy (kg)
<18,5	Undernourished	12,5 – 18
18,5 – 24,9	Normal	11,5 – 16
25,0 – 29,9	Overweight	7 – 11,5
≥30,0	Obese	5 – 9

Source: OMS, 1986 and Institute of Medicine, 2009.

Participation in the study was voluntary, so the consent of each participant was requested after explaining the objectives and the course of the survey and its anonymity.

2.4. Data Analyze

Stata / IC 13.1 software (Stata Corp LP, College Station, USA) was used to analyze the data. The chi-square or chi-square for trend tests were used to compare the proportions. Logistic regression was used to identify predictors of sufficient weight gain during pregnancy and linear regression to identify those of babies' birth weights. A degressive procedure was used to select the variables of the final model. The adequacy of the final model was checked by using a Hosmer-Lemeshow test for logistic regression and using residual analysis for linear regression. The significance level (p-value) was set at 0.05.

3. Results

3.1. Sample Description

A total of 380 pregnant women were included in the study: 180 (47.4%) came from the public hospital and 200 (52.6%) came from private hospitals. The age of women ranged from 16 to 45 years with an average age (±SD) estimated at 27 years (±6). One percent of mothers were illiterate, 18.4% had a primary education and 26.6% had a higher education. Almost half of the mothers were housewives, 22.4% worked in the secondary sector and 22.9% in the primary sector. Gravidity ranged from 1 to 8 with a median value of 2 and 91% of the mothers were married.

3.2. Nutritional Status at the Beginning of Pregnancy

The mean of BMI (±SD) of the mothers was estimated at 21.5 (±2.5). At the beginning of their pregnancy, 11.8% were undernourished (BMI <18.5), 81.8% were in good nutritional status (18.5≤BMI<25) and 6.3% were overweight or obese (one obese woman). The height of mothers ranged from 141 cm to 185 cm with an average height (±SD) estimated at 155 cm (±6) and only 2% of them have a height <145 cm.

3.3. Weight Gain During Pregnancy

Weight gain during pregnancy ranged from 4 kg to 24

kg. The average weight gain (±SD) was 9.6 kg (±2.7). Almost three quarters of pregnant women (76.3%) did not obtained the weight gain recommended during pregnancy, 20% had normal gain and 3.7% had excess gain. The proportion of women who gained sufficient weight during pregnancy is 23.7% overall, 8.3% for the public hospital (CHU) and 37.5% for the private hospitals.

With a bivariate analysis (Table 2), the chance of having sufficient weight gain during pregnancy is significantly important in women who are well nourished at the beginning of pregnancy (p = 0.019). This chance increases significantly with the increase of education level (p<0.001) and with the increase of the age of the woman (p = 0.011).

Table 2. Association between women's social characteristics and weight gain during pregnancy.

Characteristic	n	Sufficient gain n (%)	OR (95%CI)	p
Undernutrition				0.019
Yes	45	4 (8.9)	1	
No	335	86 (25.7)	3.54 (1.23–0.17)	
Education level				
Illiterate, Primary	74	4 (5.4)	1	<0.001*
Secondary	205	53 (25.9)	6.10 (2.12–7.52)	
University	101	33 (32.7)	8.49 (2.86–5.26)	
Age				0.011*
<20	40	3 (7.5)	1	
20-29	205	49 (23.9)	3.87 (1.14–3.12)	
30 et +	135	38 (28.2)	4.83 (1.4–16.61)	
Marital status				0.152
Couple	334	78 (22.7)	1	
Single	36	12 (33.3)	1.83 (0.88–3.79)	
Gravidity				0.479
1	125	25 (20.0)	1	
2-3	204	52 (25.5)	1.37 (0.80–2.35)	
4 et +	51	13 (25.5)	1.37 (0.63–3.95)	

*chi² for trend.

In multivariate analysis (Table 3), the good nutritional status at the beginning of pregnancy and the increase in the level of education of women are retained as a predictor of sufficient weight gain during pregnancy. Adjusted for the level of education, the chance of obtaining sufficient weight is three times higher in undernourished women at the beginning of pregnancy.

Table 3. Association between women's social characteristics and weight gain during pregnancy.

Characteristic	n	Sufficient gain n (%)	Adjusted OR (95%CI)	p
Undernutrition				0.038
Yes	45	4 (8.9)	1	
No	335	86 (26.9)	3.11 (1.06–9.10)	
Education level				
Illiterate, Primary	74	5 (6.8)	1	0.001
Secondary	205	53 (26.8)	5.96 (2.07–17.18)	
University	101	33 (33.6)	6.45 (2.63–23.43)	

3.4. Birth weight

Babies' birth weight ranged from 1140 g to 4550 g. Average birth weight (±SD) was 2.905 g (±470) and the incidence of low birth weight (weight <2,500 g) (95%CI) was 9.6% (9.3% - 10.0%).

Figure 1 shows the relation between the mothers' weight gain and the baby's birth weight. In simple linear regression, the weight gain during pregnancy, the age and the education level of the mothers are associated with the baby' (p<0.001 for the three variables). In multiple linear regression, only the weight gain during pregnancy was selected as a predictor of the baby's weight at birth, coefficient ß (ES) = 91 (7), p<0.001 and r^2 = 0.284. Indeed, the baby's weight increases significantly by 91 g for an increase of 1 kg of weight gain during pregnancy.
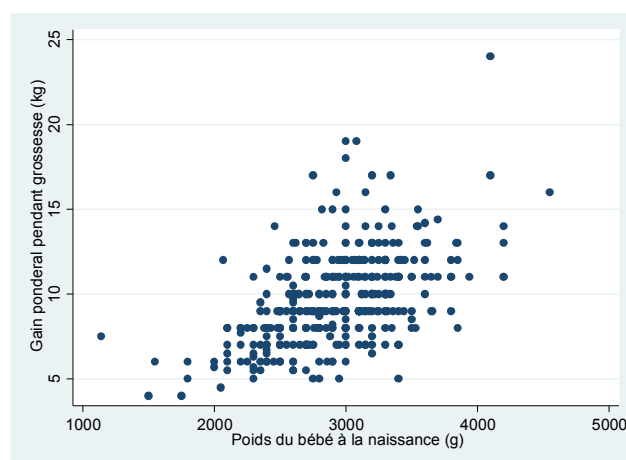
Figure 1. Mother's weight gain during pregnancy and baby's weight at birth.

4. Discussion

The study was conducted in hospitals in the city of Antananarivo, the capital of Madagascar. It included pregnant women who followed the early ANC and who had their weight recorded in the notebook or pregnancy follow-up book. The results relate to women who give birth in health establishments and who meet certain criteria. Weight during early ANC was used to calculate weight gain during pregnancy as it was not possible to know the weight of women before pregnancy [3]. It should be noted that according to a survey carried out in 2012, 47% of pregnant women in the capital followed early ANC and 64% gave birth in a health facility [11].

Results show that during pregnancy, 76.3% of pregnant women obtained weight less than the IOM recommendation and only 20% gained normal weight. The proportion of pregnant women with insufficient weight gain is high, especially for women who gave birth in the public center (8.3%). Generally, women using public maternity hospitals have a lower socio-economic level, but the situation in rural areas is even worse. According to the results of a study carried out in a rural town in Madagascar, all the pregnant women studied (100%) had an insufficient weight gain [9]. Compared to the situation of other low-income countries, the data for Madagascar show a worrying situation. In fact, in a hospital in the city of Cameroon, the proportion of pregnant women with insufficient weight gain was 28% and it was 51% according to the results of a study in an Indonesian region [12, 13].

The nutritional status of women at the beginning of their pregnancy was a predictor of weight gain during pregnancy. An undernourished woman at the beginning of pregnancy (BMI <18.5 kg / m²) is three times more likely than a well-nourished woman to have sufficient weight gain (AOR (95% CI): 3.11 (1,06-9,10). Many studies have highlighted the relationship between nutritional status before conception and weight gain during pregnancy. The nutritional status of a woman before conception results not only from her nutritional situation during this period, but during development and growth in intrauterine life, childhood and adolescence. Having good nutritional status at all stages of life are needed to cut the intergenerational cycle of malnutrition.

Alimentation is the main determinant of an individual's nutritional status. Information about participants' diets were not available for this study. However, it is very likely that the high frequency of weight gain is linked to an inadequate diet before and during pregnancy. A study carried out in one region of Madagascar has shown that mothers' nutrition during their reproductive journey is inadequate [14]. To further explain this phenomenon, it would also be necessary to consider the eating habits of women. For example, studies in another region of the country have shown that pregnant women avoid certain foods during pregnancy so as not to have an overweight baby [15]. The association between the educational level of women and sufficient weight gain during pregnancy could be explained by good nutrition and good eating behavior of women with higher educational attainment.

The factors examined in this study are limited because women's availability to answer the questions (women in labor). So other factors that could influence weight gain should be identified: diet, health, activities, etc.

Baby's birth weight increases significantly as the mother's weight gain increases during pregnancy (ß (ES) = 91 (7), p<0.001). This finding corroborates the results of studies carried out around the world and is consistent with current knowledge on this subject. This is one of the basic arguments to focus on fight against malnutrition in the first 1,000 days of life. In 2012, in the city of Antananarivo, the prevalence of low birthweight rose to 13% compared to 11% for the whole country [11]. Sufficient weight gain during pregnancy would significantly reduce this frequency of low birth weight and its consequences. A low birthweight baby has a higher risk of neonatal death (death before 1 month) and chronic malnutrition later in life. For Madagascar, the prevalence of chronic malnutrition in children under the age of 5 is among the highest in the world (47%) and neonatal mortality was 26‰ [11]. Interventions to increase the proportion of mothers gaining sufficient weight during pregnancy would help to reduce the magnitude of these problems.

5. Conclusion

The proportion of women who did not gain sufficient weight during pregnancy is significant. Insufficient weight gain has been associated with a risk of giving birth to a low-weight baby. To have sufficient weight gain, ensuring good nutritional status of mothers before conception is important. But it seems necessary to identify the other determinants such as diet, health and activities of women during pregnancy.

Acknowledgements

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