

## Relationship between Sociodemographic Characteristics, Eating Habits and Gestational Weight Gain Among Prénant Women Living in the Communes of Abobo, Cocody and Yopougon (Abidjan, Côte d'Ivoire)

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### Abstract

### Original Research Article

Sub-optimal diet and inadequate weight gain during pregnancy increase the risk of adverse health outcomes for both mother and child. The aim of this study was to determine the maternal characteristics associated with gestational weight gain (GWG). This was a retrospective study conducted in the delivery departments of three maternity hospitals (maternity hospitals of Yopougon Attié General Hospital, Abobo-Té and Anono Riviera-2 community-based urban health centers) in the Abidjan district from October 1 to November 30, 2018. A total of 146 pregnant women were included in this study. Sociodemographic and dietary characteristics, obstetric history and delivery characteristics were recorded in the pregnancy follow-up booklet and maternity registers. Maternal anthropometry was used to calculate mothers' body mass index (BMI) and total gestational weight gain. Statistical analyses were performed using SPSS version 25 software. The majority of participants had adequate GWG (51.4%), 30.1% insufficient GWG and 18.5% excessive GWG. GWG was also significantly associated with ethnicity ( $p < 0.05$ ). Women from the Gur and Akan ethnic groups had more insufficient GWG (57.1% and 42.6, respectively), while Krou (72.4%) and Mandé (57.1%) women had more adequate GWG. In addition, 42.9% of Mandé pregnant women had more excessive GWG. Women in partnerships (64.5%) showed more adequate GWG, whereas insufficient GWG was more prevalent in 51.3% of single women. A proportion of 38.8% of active women had insufficient GWG versus 31.9% of excessive GWG in non-active pregnant women ( $p < 0.05$ ). Women with high dietary diversity had an adequate GWG than their counterparts (56.9% v 38.6%). This study revealed the presence of both inadequate and excessive weight gain despite a more common adequate GWG. In addition, it revealed an association between GWG, ethnicity, marital status, female occupation and dietary diversity.

**Keywords:** Gestational weight gain, Sociodemographic characteristics, Dietary diversity, Pregnancy, Côte d'Ivoire.

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## INTRODUCTION

Pregnancy represents a crucial period in a woman's life, during which her body changes and adapts to meet the physiological changes and metabolic needs of fetal development (IOM, 2009). The main consequence of all these changes is maternal weight gain during pregnancy (Stock and Metcalfe, 1994). Weight gain during pregnancy is a widely used anthropometric indicator, both in health services and in maternal and fetal health research, as it has a direct influence on

pregnancy outcome (IOM, 1992). It is therefore an important predictor of maternal-fetal nutrition. Adequate nutrition and weight gain during pregnancy can therefore guide the development of policies and strategies for maternal nutrition care, actions that will ultimately promote better pregnancy outcomes. Several published works have shown that non-optimal maternal diet and inadequate weight gain during pregnancy increase the risk of adverse health outcomes for both mother and child (Gresham *et al.*, 2014; Procter and Campbell, 2014;

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Nnam, 2015; Gresham *et al.*, 2016; Papatkakis *et al.*, 2016).

Inappropriate gestational weight gain predisposes women to adverse pregnancy outcomes and future risk of chronic non-communicable diseases. The Institute of Medicine (IOM) guideline has provided specific recommendations for gestational weight gain (GWG) by BMI based on the WHO classification (IOM, 2009). Thus, women who gain weight below the recommended threshold have an inadequate GWG, which is associated with intrauterine growth retardation, low birth weight, prematurity and an increased risk of neonatal morbidity and mortality (Davis *et al.*, 2013; Wang *et al.*, 2021). Women who have gained weight within the stipulated range are described as having adequate GWG, while those who exceed the recommendation have excessive GPG.

The prevalence of insufficient and excessive GWG has been documented in different countries, namely China (22.6% vs. 50%) (Li *et al.*, 2013); Brazil (22.6% vs. 50%) (Campos *et al.*, 2019); Turkey (10.8% vs. 14.0%) (Eraslan *et al.*, 2019); Cameroon (40% vs. 32%) (Fouelifack *et al.*, 2015). In contrast to these countries, there are gaps in the literature on maternal health in Côte d'Ivoire, in which the GPG was reviewed.

Côte d'Ivoire carries a considerable burden of maternal mortality estimated at 614 maternal deaths per 100,000 live births, according to the Demographic and Health Survey (MSLS/INS, ICF International, 2011-2012). What role might inadequate weight gain play in this high prevalence of maternal mortality? The aim of this study was to assess GWG in maternity units in the Abidjan district and the influence of certain sociodemographic, dietary and obstetric characteristics on the weight gain of pregnant women.

## MATERIALS AND METHODS

### Study population

The study population consisted of 146 pregnant women who had delivery data available in the birth registers of the maternity units visited.

**Type of study and study period:** This was a retrospective study which took place from October 1 to November 30, 2018.

### Study Area

This study was conducted in the delivery units of the maternity wards of the Yopougon Attié General Hospital, the Abobo-Té and Anono Riviera-2 Community-Based Urban Health Centers (CSUCOM) in the communes of Yopougon, Abobo and Cocody respectively.

### Sampling and Subject Selection

All pregnant women whose delivery data were available in the birth registers of the selected maternity

hospitals and who had participated in the previous study conducted (Vanié *et al.*, 2019), were included in the present study. No sampling method was used to determine the size and selection of study subjects.

### Data Collection

#### Sociodemographic and economic characteristics

The household's economic situation assessed using the well-being index, is based on the non-monetary approach to household poverty developed by Garenne and Hohmann (2003) and the choice of variables to be included in the index calculation are taken from the study by Deza *et al.*, (2017). The welfare quintile obtained was then classified into welfare terciles (Low, Medium and High).

#### Dietary Diversity

A 24-hour dietary recall was used to assess the quality of the pregnant women's diet using the Dietary Diversity Score (DDS) according to the method described by FAO (2011).

#### Anthropometric data collection

The mother's weight and height were recorded in the pregnancy follow-up booklet or in maternity registers. These data were used to calculate the mothers' body mass index (BMI) and gestational weight gain (GWG).

Participants were classified according to their body mass index as underweight (BMI < 19.8 kg/m<sup>2</sup>), normal weight (19.8-26 kg/m<sup>2</sup>), overweight (26-29.9 kg/m<sup>2</sup>) and obese (≥ 30 kg/m<sup>2</sup>) according to the recommendations of the US Institute of Medicine (IOM, 1990).

GWG was calculated as the difference between maternal weight at the end of pregnancy (usually measured just before delivery) and pre-pregnancy weight (or, failing that, the weight recorded in the first trimester). Maternal weight gain was then classified into three categories: inadequate, adequate and excessive. The IOM cut-off points for inadequate gestational weight gain are below 12.5, 11.5, 7 and 5 kg for underweight, normal weight, overweight and obese, respectively, while those for excessive gestational weight gain are above 18, 16, 11 and 9 kg, respectively, for underweight, normal weight, overweight and obese.

#### Birth Data Collection

The total number of prenatal consultations (ANC), term and mode of delivery were retrospectively recorded from maternity hospital delivery registers.

#### Statistical Analysis

Data were entered and analyzed using Statistical Package for Social Sciences (SPSS version 25.0 Inc, Chicago, IL, USA). Descriptive statistics were calculated for all variables. Differences between groups were assessed using the Chi-square test for categorical

variables and Student's t-test for continuous variables. The prevalence of insufficient and excessive gestational weight gain was calculated by dividing the number of pregnant women with insufficient and excessive gestational weight gain respectively by the total number of pregnant women. Statistical significance was established when the p-value was less than 0.05.

## RESULTS

### Sociodemographic and dietary characteristics of pregnant women in the 3rd trimester of pregnancy

Maternal characteristics concerned the sociodemographic factors and dietary habits of women

in the third trimester of pregnancy (Table 1). Study participants ranged in age from 20 to 42 years, with an average age of  $28.44 \pm 5.88$  years. A large proportion of pregnant women belonged to the Akan ethnic group (42.1%), had a secondary education (40.7%) and were engaged in an income-generating activity (44.7%). However, some of them (36%) were housewives. More than two-thirds of the women lived in couples (72.4%), and the average household size was  $4.27 \pm 2.09$  people. Around 38% of pregnant women belonged to households with a low well-being index. Over two-thirds of pregnant women (80.4%) ate at least the 3 main meals of the day, with an average of  $3.27 \pm 0.9$  meals per day. Only 47.6% had a snack as an additional meal of the day.

**Table 1: Socio-demographic characteristics and dietary habits of pregnant women in the 3rd trimester of pregnancy**

Variables	Category	Frequency	Percentage
Age group	20 to 29 years old	84	57.5
	30 and over	62	42.5
Ethnic group	Akan	61	42.1
	Krou	29	20
	Mandé	14	9.6
	Gur	14	9.6
	Non-Nationals	27	18.6
Marital status	Single	39	26.9
	Married / Concubine	107	73.1
Educational level	≤ Primary	43	29.5
	Secondary and above	103	70.5
Occupation	Employed/ Income-generating activities (IGA)	85	64.4
	Not working (Housewife)	47	35.6
Household size	≤ 4 persons	70	47.9
	> 4 persons	76	52.1
Well-being index	Low	55	37.7
	Medium	37	26
	High	53	36.3
Frequency of meals per day	<b>mean ± SD</b>	<b>3.27 ± 0.9</b>	
	< 3	28	19.2
	≥ 3	118	80.8
Regularity of breakfast	Yes	113	77.4
	No	33	22.6
Snack (additional meal)	Yes	86	60.6
	No	60	39.4
Dietary diversity score	<b>mean ± SD</b>	<b>4.20 ± 1.04</b>	
	Low	44	30.1
	Medium	85	58.3
	High	17	11.6

### Obstetrical history, maternal anthropometry and delivery characteristics

Among the women interviewed, 56 (38.6%) were first-time mothers (Table 2). Until delivery, 75.9% of women had undergone at least 4 ANC in accordance with the recommendations of the Ivory Coast health authorities. The mean weight at the beginning of pregnancy was  $60.9 \pm 13.2$  kg, with extremes ranging from 40 to 95 kg (Table 2). Most of the pregnant women studied (91.8%) were of large stature ( $>1.55$  m), and the mean BMI of participants at the beginning of pregnancy

was  $22.8 \pm 3.7$  kg/m<sup>2</sup>. Over half the pregnant women (56.79%) had a normal BMI (19.9 - 26 kg/m<sup>2</sup>), compared with 18.52% and 23.46% respectively who were underweight (BMI ≤ 19.8 kg/m<sup>2</sup>) and overweight including obese (≥ 26 kg/m<sup>2</sup>).

At pregnancy term, 142 of the women (97.3%) gave birth at least at 37 weeks versus 4 women (2.7%) who gave birth before pregnancy term (< 37 weeks). Over ¾ of pregnant women (87.68%) gave birth vaginally, compared with 12.32% by caesarean section.

**Table 2: Prenatal and delivery characteristics of pregnant women**

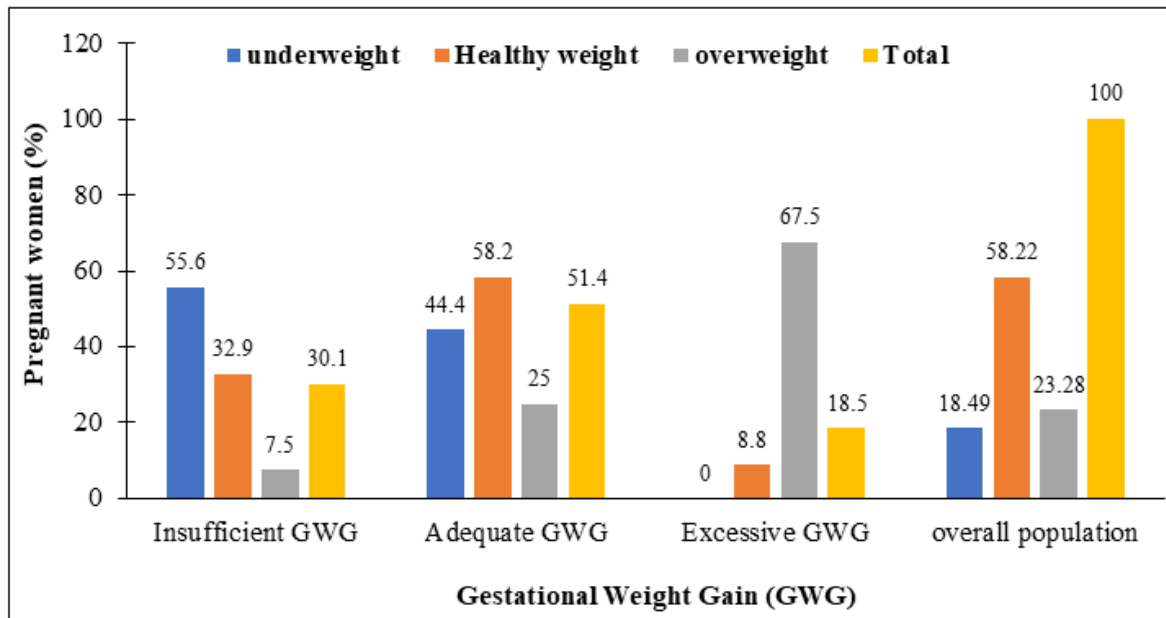
Variables	Categories	Frequency	Percentage
Parity	mean ± SD	2.24 ± 1.05	
	Primiparous	56	38.4
	Multiparous	90	61.6
Total number of ANC at the end of pregnancy	mean ± SD	4.37 ± 1.20 ANC (1 - 7)	
	< 4 ANC	35	24.1
	≥ 4 ANC	110	75.9
Average design weight	mean ± SD (min-max)	60.9 ± 13.2 kg (40 - 95)	
Mother's size	mean ± SD (min-max)	1.63 ± 0.06 (1.49 – 1.78)	
	< 1.55	12	8.2
	≥ 1.55	134	91.8
Weight status	mean ± SD (min-max)	22.8 ± 3.7 kg/m <sup>2</sup> (16.6 - 38.9)	
	Underweight (below 19.8 kg/m <sup>2</sup> )	27	18.49
	Healthy Weight (19.9 - 26 kg/m <sup>2</sup> )	85	58.22
	Overweight (26 - 29.9 kg/m <sup>2</sup> )	27	18.49
	Obesity (30 kg/m <sup>2</sup> and above)	7	4.79
Term of birth	Preterm (<37 week of pregnancy)	4	2.7
	Term (≥37 week of pregnancy)	142	97.3
Mode of delivery	Cesarean	18	12.32
	Vaginal	128	87.68

\*: Statistically significant difference ( $p < 5\%$ ); NS: Not significant at the 5% level

**Gestational weight gain according to maternal body mass index**

Figure 1 shows the prevalence of the three categories of gestational weight gain according to IOM guidelines (Insufficient, Adequate, Excessive) among pregnant women surveyed. Over half of all women

surveyed (51.4%) had adequate GWG, compared with 30.1% and 18.5% with inadequate and excessive GWG respectively. Adequate GWG was more prevalent in women of normal weight (58.2%) than in those underweight (44.4%) and overweight (25%) at conception (Figure 1).



**Figure 1: Gestational weight gain according to BMI at conception**

**Maternal prenatal factors associated with gestational weight gain**

**Gestational weight gain according to sociodemographic and prenatal characteristics**

Results showed no significant difference ( $p >$

0.05) for most socio-demographic characteristics and gestational weight gain, with the exception of ethnicity, marital status and occupation (Table 3). The results show that 57.1% and 42.6% respectively of Gur and Akan women had insufficient GWG ( $p < 0.05$ ) in contrast to

Krou (72.4%) and Mandé (57.1%) women with adequate GWG. However, 42.9% of Mandé pregnant women also had excessive GWG.

The results show that 64.5% of women in partnerships had adequate GWG, whereas insufficient GWG was more prevalent in single women (51.3%). With regard to women's occupation, the results show higher proportions of adequate GWG among both working and non-working women. However, 38.8% of women in activity had insufficient GWG, compared with

31.9% of pregnant women without activities with excessive GWG ( $p < 0.05$ ).

In general, adequate gestational weight gain (adequate GWG) was the most prevalent, regardless of prenatal characteristics (Table 3). Multiparous women showed adequate, insufficient and excessive weight gain, with proportions of 57.6%, 25.9% and 16.5% respectively, compared with 42.6%, 36.1 and 19.7% in primiparous women. However, these results showed no significant difference ( $p > 0.05$ ).

**Table 3: Sociodemographic and prenatal characteristics associated with different levels of gestational weight gain among pregnant women in Abidjan**

Gestational Weight Gain (GWG)					
Variables	Category	Insufficient	Adequate	Excessive	p
		N (%)	N (%)	N (%)	
Age group	20 to 29 years old	31 (36.9)	43 (51.2)	11 (13.1)	NS
	30 and over	14 (22.6)	33 (53.2)	14 (22.6)	NS
Ethnic group	Akan	23 (42.6)	21 (34.4)	14 (23)	<b>0,010*</b>
	Krou	0 (0)	21 (72.4)	9 (27.6)	
	Mandé	0 (0)	8 (57.1)	6 (42.9)	
	Gur	8 (57.1)	2 (14.3)	4 (28.6)	
	Non-Nationals	8 (29.6)	19 (70.4)	0 (0)	
Marital status	Single	20 (51.3)	7 (17.9)	9 (30.8)	<b>0.002*</b>
	Married / Concubine	23 (21.5)	69 (64.5)	15 (14)	
Education level	≤ Primary	12 (27.9)	23 (53.5)	8 (18.6)	NS
	Secondary and above	32 (31.1)	52 (50.5)	19 (18.4)	
Occupation	Employed/Income-generating activities (IGA)	33 (38.8)	45 (53.6)	7 (8.2)	<b>0.014*</b>
	Not working (Housewife)	8 (17)	24 (51.1)	15 (31.9)	
Household size	≤ 4 persons	26 (37.1)	27 (38.6)	17 (24.3)	NS
	> 4 persons	20 (26.3)	45 (59.2)	11 (14.5)	
Well-being index	Low	21 (38.2)	23 (41.8)	11 (20)	NS
	Medium	7 (18.9)	27 (70.3)	3 (8.1)	
	High	13 (24.5)	27 (50.9)	13 (24.5)	
Parity	Primiparous	20 (35.7)	24 (42.6)	11 (19.6)	NS
	Multiparous	23 (25.6)	52 (57.8)	15 (16.7)	
Number of ANC at the end of pregnancy	< 4 ANC	9 (25.7)	14 (40)	12 (34.3)	NS
	≥ 4 ANC	38 (34.5)	55 (50)	17 (15.5)	

\*: Statistically significant difference ( $p < 5%$ ); NS: Not significant at the 5%

**Gestational weight gain according to dietary characteristics of pregnant women**

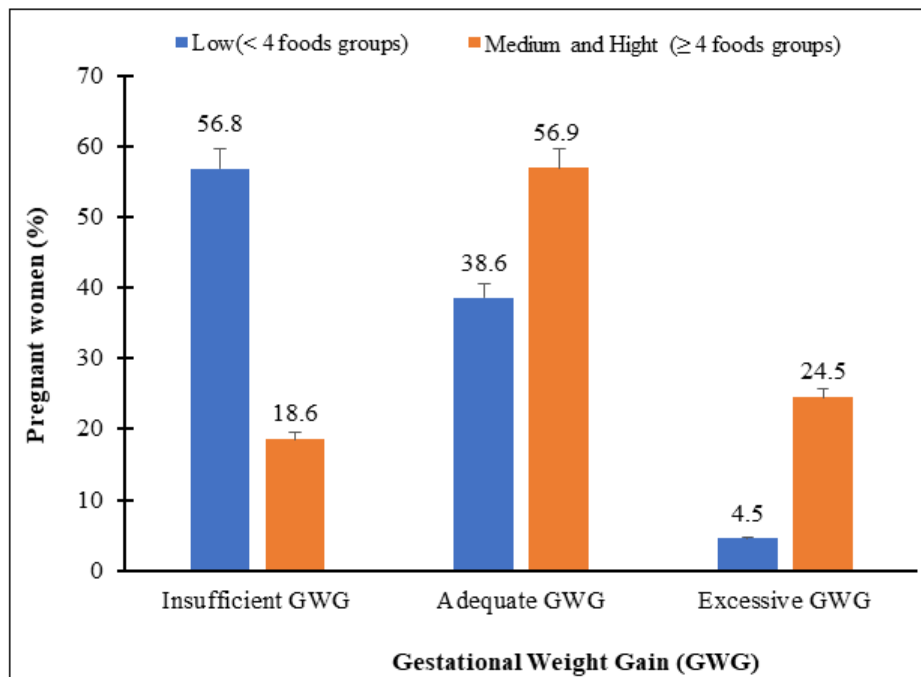
In terms of dietary habits, adequate gestational weight gain (Adequate GWG) remained the most common, regardless of dietary characteristics (Table 4). Meal frequency, breakfast regularity and snack intake

did not reveal any difference in the population according to the category of gestational weight gain. However, dietary diversity led to a significantly higher proportion of adequate weight gain among women who consumed more than four food groups (56.9%) (Figure 2).

**Table 4. dietary habits associated with gestational weight gain among pregnant women in Abidjan**

Gestational Weight Gain (GWG)					
Variables	Category	Insufficient	Adequate	Excessive	p
		N (%)	N (%)	N (%)	
Frequency of meals per day	< 3 meal	5 (17.9)	18 (64.3)	5 (17.9)	NS
	≥ 3 meal	43 (36.4)	53 (44.9)	22 (18.6)	
Regularity of breakfast	Yes	35 (31)	60 (53.1)	18 (15.9)	NS
	No	10 (30.3)	14 (42.3)	8 (24.2)	
Snack (additional meal)	Yes	33 (38.4)	35 (40.7)	18 (20.9)	NS
	No	12 (20)	39 (65)	8 (13.3)	

\*: Statistically significant difference ( $p < 5\%$ ); NS: Not significant at the 5%



**Figure 2: Gestational weight gain according to dietary diversity score**

## DISCUSSION

This study examined the relationship between some prenatal maternal characteristics and total gestational weight gain in women who gave birth in the maternity wards of three communes in the district of Abidjan.

Concerning the prevalence of the gestational weight gain category, our results show the frequent occurrence of gestational weight gain (GWG) in the range recommended by the IOM compared with the other categories. This higher frequency of adequate GWG in most of the women in the present study could probably be related to anthropometric characteristics, notably the BMI and height of the mothers. This observation is in line with the findings of other studies that have shown that weight gain in the third trimester of pregnancy increased with maternal height (Abrahms *et al.*, 1995; Voigt *et al.*, 2007; Straube *et al.*, 2008; Hassan *et al.*, 2018). These results are in agreement with some studies that found adequate weight gain to be more frequent than underweight and overweight gain (Fouelifack *et al.*, 2015; Kheirouri and Alizadeh, 2017). However, other research points instead to more excessive GWG (Fraga and Filha, 2014; Silva *et al.*, 2019) and insufficient GWG (Farhangi, 2016; Tebbani *et al.*, 2018; Wanyama *et al.*, 2018) of women during pregnancy.

Regarding factors associated with gestational weight gain, the results of this study revealed that sociodemographic and obstetric characteristics, dietary habits as well as maternal anthropometry at conception and delivery were significantly associated with weight

gain in pregnant women during pregnancy. The results showed an association between gestational weight gain (GWG), ethnicity and marital status. On this point, the results indicate a higher rate of insufficient GWG among the Akan and Gurs compared to the Krous, Mandés and non-nationals, most of whom presented an adequate GWG. On the other hand, excessive GWG was found in all women regardless of ethnicity, with the exception of non-Ivorian women. This result could be attributed to a number of cultural norms, dietary practices linked to prejudices within each ethnic group that affect nutritional status. This result is in agreement with those of several authors who found that the prevalence of underweight and overweight gain varied according to women's ethnic origin and/or nationality (Chasan-Taber, 2008; Sangi-Haghighpeykar, 2014; Hassan *et al.*, 2018).

Living with a partner favored adequate weight gain compared to single women. This could be due to the absence of the father as a support and source of financial instability, which constitutes a risk factor for the nutritional status of women, and consequently leading to a reduction in the birth weight of the newborn (Melo *et al.*, 2007). Indeed, according to Kleinman *et al.*, (1990) and Olsen and Strawderman (2003), married women are more likely to gain weight within the IOM recommended weight gain range than single or separated/divorced women, as in the present study. Similar results have been reported in Brazil (Silva *et al.*, 2019).

In this study, the results also showed a significant association between a woman's occupation and gestational weight gain. In fact, most of the women with insufficient GWG were active women, compared

with housewives who showed excessive gestational weight gain. This could be explained by the fact that non-active women would have more time for optimal monitoring and healthy eating during pregnancy. This finding is contrary to that of Silva *et al.*, (2019), who instead revealed a higher risk of excessive weight gain among women in activity compared to women without employment.

Our results showed that weight gain varies according to dietary diversification. Women with a high dietary diversity score (> 4 food groups) presented a GWG in line with IOM recommendations in contrast to their counterparts with a low dietary diversity score ( $\leq 4$  food groups). This could be explained by the nutritional advice received during routine prenatal consultations in the maternity hospitals. This consequently favored a better nutritional status expressed by this high proportion of women with an adequate GWG. This result is in line with that of Asefa and Nemomsa (2016), who found a correlation between adequate weight gain and a diversified diet.

The results obtained in this study show significant deviations within each category of BMI from recommendations for weight gain during pregnancy, except for the normal BMI category. Depending on the mother's BMI at the start of pregnancy, in this study one in two underweight women and less than a third of normal-weight women did not gain enough weight than recommended. This is partly explained by the fact that the recommended gestational weight gain for underweight women at conception is higher than that recommended for normal or overweight women (IOM, 2009). These results are in agreement with some studies that have found that underweight women are more likely to experience underweight gain during pregnancy (Kheirouri and Alizadeh, 2017; Hassan *et al.*, 2018). However, suboptimal weight gain was more common in normal-weight women in the study by Olafsdottir *et al.*, (2006).

In overweight women, a relatively lower weight gain enables them to achieve a GWG in line with recommendations, because they are able to use some of the accumulated energy to support fetal growth (Butte *et al.*, 2003). Unfortunately, this was not the finding in the present study, as indeed in Brazil, Germany, Iran, Algeria and Australia, where overweight or obese women were more likely to gain excessive weight (Fraga and Filha, 2014; Kheirouri and Alizadeh, 2017; Tebbani *et al.*, 2018). However, in both extreme cases, excessive or insufficient GWG can lead to adverse pregnancy outcomes.

It is therefore important for health professionals responsible for antenatal care to promote weight gain among pregnant women at the intervals recommended by the IOM. In addition, other intervention strategies such as behavioral intervention, nutrition education and

lifestyle programs could be useful in managing and monitoring weight gain during pregnancy to reduce the risk to later health.

## CONCLUSION

Adequate gestational weight gain was the most common form of GWG in the pregnant population studied, with a prevalence of 51.4%, but insufficient and excessive GWG were also observed in 30.1% and 18.5% of pregnant women, respectively. This study revealed an association between certain socio-demographic characteristics, namely ethnicity, marital status and occupation of the woman, and dietary diversity. The study revealed adequate GWG in pregnant women from the Krou, Mandé and non-national ethnic groups with a diversified diet (> 4 food groups) and living in couples. Inadequate GWG was predominant among women from the Akan and Gurs ethnic groups, and single women with a poorly diversified diet and in activities.

These results suggest that healthcare professionals should pay particular attention to gestational weight gain during prenatal follow-up, and implement interventions to promote appropriate gestational weight gain in pregnant women in maternity wards in Côte d'Ivoire.

### Compliance with Ethical Standards

**Peer-review:** Externally peer-reviewed.

**Conflict of interest:** The authors declare no competing interests.

**Author contribution:** The contribution of the authors to the present study is equal. All the authors read and approved the final manuscript.

### Ethics Committee Approval

The protocol used in this study was approved by the Comité National d'Ethique et de la Recherche (N/Ref: 12618/MSHP/CNESVS-km) and access to maternity units was granted by the Direction des Etablissements et Professions de Santé (DEPS).

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**Data availability:** The data associated with this study are all presented in this manuscript.

**Consent to participate:** Consent for participate to the manuscript should be specified in this section.

**Consent for publication:** All listed authors have read the final manuscript and provided consent for publication.

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