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Women and Pregnancies as an Immediate Target against the Obesity Epidemic

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Abstract- The author wishes to enlarge an important current debate among obstetricians trying to sensitize specialists of obesity/endocrinology/nutrition, and make them aware of a possible very important debate: having a “normal shaped” baby (neither too small, nor too big, 10% of SGA, small for gestational age and 10% of LGA, large for gestational age), is possible by an optimal gestational weight gain (optGWG) during pregnancy. This is a simple mathematical linear equation, $y = ax + b$ (y being optimal gestational weight gain, optGWG, x being pre-pregnancy body mass index, ppBMI). Beginning with severe obesity (36 kg/m^2), women should not gain weight during their pregnancy, while they should lose weight in higher BMIs (e.g. losing 6 kg for a 40 kg/m^2 morbid obese). This is predictable since the first trimester of pregnancy.

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Women and Pregnancies as an Immediate Target against the Obesity Epidemic

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We have previously shown by a mathematical simulation on 59,000 singleton term pregnancies that we could lower by 35/40% major complications like caesarean sections, late onset preeclampsia, and the harmful incidence of macrosomic babies (over 4 kg). After delivery, these women would further lose additional 5-10 kg (baby, placenta, amniotic fluid), and have a significant weight loss as compared with their ppBMI. This very encouraging achievement (along with a 9-month dialogue with health workers) should also trigger behavioural changes later in these women.

Conclusion: The pregnancy-strategy to convince obese women with the paramount motivation of the good of their babies has to be attempted. Besides actively counterbalancing morbid effects of high BMIs in pregnancies (and, importantly for the future of mankind, by avoiding a lot of macrosomic and LGA newborns), should imply new habits in women's future lives afterwards.

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INTRODUCTION

People with obesity worldwide has become a major challenge in this 21st century with an apparent irresistible rise of this epidemic since the 1970's [1,2]. Nowadays, it is evaluated that obese people (≥ 30 kg/m²) represent some one billion inhabitants (out of seven) on this planet [1,2]. Women (probably comprising more than 50% cases of total obesity cases) are particularly affected and this problem has become a major challenge for obstetric care [3]. But we may consider that pregnancy in obese women can be one of the best possibility of management and counselling: all pregnant women are prone to a monthly follow-up during 9 months. This kind of intense follow up and dialogue rarely exists in humans' lives and, there, we may have a major public health leverage of action.

We have recently shown that “There is a peculiar phenomenon: two separate individuals (mother and foetus) have a mutually interactive dependency concerning their respective weight” [4]. Based on the simple axiom: “what is the optimal gestational weight gain at term (optGWG) to achieve the natural rate of 10% of SGA (small for gestational age) as well as 10% of LGA (Large for gestational age) in newborns in my population”.

Considering crude results on a reproductive population, only women with a normal BMI (20-24.9 kg/m²) seem to achieve a “natural” equilibrium in the newborns' SGA/LGA risk (both 10%). Very thin mothers have a higher risk of small for gestational age (SGA, until 25% of births) infants, and rarely give birth to a large for gestational age (LGA) infant. While morbidly obese women often give birth to LGA (until also 20-25% of births), and rarely to SGA. This equilibrium in the SGA/LGA risk (both 10%) is materialized geometrically by a crossing point: we proposed to call this crossing point the Maternal Fetal Corpulence symbiosis (MFCS) [4]. We have shown also that this MFCS point could exist in all women with an adequate gestational weight gain adapted to the maternal pre-pregnancy BMI. The optimal gestational weight gain (optGWG) to achieve this goal is a mathematical linear equation, $y = ax + b$:

$$\text{optGWG (kg)} = -1.2 \text{ ppBMI (Kg/m}^2\text{)} + 42 \pm 2\text{kg [4].}$$

optGWG being optimal gestational weight gain. ppBMI being pre-pregnancy BMI.

We concluded then: "IOM-2009 recommendations are adequate for normal and overweighted women but not for thin and obese women: a thin woman (17 kg/m²) should gain 21.6 ± 2 kg (instead of 12.5-18). An obese 32 kg/m² should gain 3.6 kg (instead of 5-9). Very obese 40 kg/m² should lose 6 kg." [4] See Table 1.

We have put an online calculator consultable on smart phone at REPERE.RE (REseau PERinatal REunion), in three languages (French, Spanish and English) [5], adapted to the Reunionese women. We encourage any reader to validate these findings adapted to their own populations (it is easy to do if you know the specific SGA/LGA curves of your term -37-42 weeks gestation- newborns).

I. THE CONTROVERSIES ON GESTATIONAL WEIGHT GAIN. [4]

Knowing the optimal gestational weight gain (GWG, from conception to birth) among the annual 135 million of human pregnancies is considered to be one of the "Holy Grails" to achieve for maternity health care providers and for women themselves. Extensive literature exists on the subject with, in background, the current international cornerstone which is the 2009-IOM recommendations [6] based on the WHO-BMI classification standardized in 2000 [7]: Since then a lot of controversies aroused on these recommendations, for example Asian people claim that their women are leaner than Caucasians, and that the International recommendations are too low. On the other hand, for obese women, the major controversies concerns the debate if severe and morbid obese women should lose weight during their pregnancy [8-14] (our results suggest that it should be the case, see Table 1). We already extensively discussed these controversies in another paper [4].

II. LOWERING IMPORTANT MATERNAL/FETAL MORBIDITIES BY ACHIEVING AN OPTIMAL GESTATIONAL WEIGHT GAIN (OPTGWG)

We have recently retrospectively tested the effect of achieving optGWG (± 2kg) in our reunionese population by a mathematical simulation on a 18 -year (2001-2018) [15] and 19-year historical cohort. (2001-2019) [16] on 57,000, and then 59,000 term pregnancies. Achieving an optGWG in overweight-obese women should on the mother side almost halve the incidence of preeclampsia (major complication of human pregnancies, hypertension plus proteinuria) [15,16,17], diminish by some 30% the rate of caesarean sections and probably lower the rate of gestational diabetes mellitus (GDM) [16]. For newborns, while reaching a 10% rate of large for gestational age (the very definition of the linear equation), it would lower by 30 to 40% the rate of the harmful

macrosomic babies (≥ 4 kg), prone to neonatal complications, and following morbidities in later life (cardiovascular diseases, obesity, type 2 diabetes, metabolic syndrome etc...) as well as transfers of these babies in neonatal department [16]. Besides having significant health (and cost) benefits by lowering all these maternal/foetal complications, such interventions should convince and induce major changes of behaviour in these women during their pregnancies.

III. PHYSICIANS AND HEALTH WORKERS' FUTURE DIALOGUE WITH OVERWEIGHT/OBESE WOMEN

Obese pregnant women being somewhere "captive" of a 9-month follow-up management of the problem may be caught at the root. First of all, and very important: our calculator [5] does not classify women in "guilty categories" (underweight/normal weight/overweight/obese class I/obese class II or III). It simply counsels to each single woman (considered simply as a single plot on a curve) a personal goal of gestational weight gain to possibly achieve to have a "newborn in good shape" (neither too small, nor too big) since the first prenatal visit in the first trimester of pregnancy.

Women as they attempt to navigate pregnancy in a food environment that favors over-consumption of unhealthy foods and a world where the demands of life limit the amount of time available for physical activity. Therefore, it is well-known how it is difficult to make obese people losing weight (diet counselling, physical exercises etc...[2, 18-19]). We propose that the perspective to have a "newborn in good shape" may be that time highly motivating to women with obesity. If we take the example of a severe obese 36 kg/m² (see Table 1), she should not take any pound or kilogram during her pregnancy. After delivering the baby (and the placenta), she would lose some 10-15 kg as compared to her basic state before pregnancy. We have shown recently that very severe obese should even lose weight during their pregnancy [21]. These two very encouraging achievements ("good-shaped baby" and personal loss of weight) would probably motivate these women to extend the new behaviours acquired during pregnancy.

IV. CONCLUSION

Being overweight/obese may not have to result in a higher risk of developing important maternal/fetal morbidities by establishing targeted and strictly monitored interventions on adequate GWG. We have certainly an achievable pathway to actively counterbalance the morbid effects of high BMIs; an approach urgently requiring adequately powered prospective trials. Lowering by 30-40% such major complications like caesarean sections, late onset preeclampsia, and, concerning newborns the harmful

incidence of macrosomic newborns (over 4 kg) is of paramount importance. For the good of their babies, it is quite sure that, this time, obese women would be compliant to new behaviours (and perhaps follow them later on after delivery).

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Table 1: Comparisons between the current international recommendations for gestational weight gain (IOM 2009), and the linear equation. Being a linear equation, each woman may be considered as a single plot, and the calculations are then individualized.

IOM 2009 recommendations seem to be inadequate for underweight women, and on the other side for obese, beginning at 32 kg/m². Especially, from 36 kg/m² and upward, women should LOSE weight for this pregnancy.

We have validated this linear curve until 40-41 kg/m², as we did not had in our cohort enough morbid obese women (over 40 kg/m²). Moreover, and especially, we had not enough women who had actually lost weight during their pregnancy to test it (if we extrapolate this curve, a woman with a pre-pregnancy BMI of 45 kg/m² should lose 12 kg).

In bold italic, GWG in disagreement with IOM 2009 recommendations

MATERNAL CORPULENCE (PRE-PREGNANCY BMI)	GESTATIONAL WEIGHT GAIN (GWG) IOM 2009 RECOMMENDATIONS []	PROPOSED LINEAR MODEL To have "normally shaped newborns"[3]
Underweight women < 18.5kg/m ²	12.5-18 kg	<i>22.8 kg (16 kg/m²)</i> <i>21.6 kg (17 kg/m²)</i> <i>20.4 kg (18 kg/m²)</i>
Normal weight women 18.5-24.9 kg/m ²	11.5-16 kg	<i>19.2 kg (19kg/m²)</i> <i>18 kg (20 kg/m²)</i> <i>16.8 kg (21 kg/m²)</i> <i>15.6 kg (22kg/m²)</i> <i>13.2 kg (24 kg/m²)</i> <i>12.1 kg (24.9 kg/m²)</i>
Overweight women 25-29.9 kg/m ²	7-11.5 kg	<i>12.0 kg (25 kg/m²)</i> <i>10.8 kg (26 kg/m²)</i> <i>8.4 kg (28 kg/m²)</i> <i>7.2 kg (29 kg/m²)</i>
Obesity class I 30-34.9 kg/m ²	5-9 kg	<i>6.0 kg (30 kg/m²)</i> <i>4.8 kg (31 kg/m²)</i> <i>3.2 kg (32 kg/m²)</i> <i>2.4 kg (33 kg/m²)</i> <i>1.2 kg (34 kg/m²)</i>
Obesity class II 35-39.9 kg/m ²	5-9 kg	<i>0 kg (35 kg/m²)</i> <i>Minus 1.2 kg (36 kg/m²)</i> <i>Minus 2.4kg (37 kg/m²)</i> <i>Minus 3.6 kg (38 kg/m²)</i> <i>Minus 4.8 kg (39 kg/m²)</i>
Obesity class III Over 40 kg/m ²	5-9 kg	<i>Minus 6 kg (40kg/m²)</i> <i>Minus7.2 kg (41 kg/m²)</i>

