



It is Possible to Establish Quickly a Smart-phone Calculator for Optimal Gestational Weight Gain Specific for Indian Pregnant Women

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Abstract

International IOM 2009 recommendations for gestational weight gain during pregnancy are highly contested in Asia by Indians and East-Asian scholars (China, Korea, Japan etc..). They even use "Asian adapted" overweight and obese classifications (e.g. obesity $\geq 27.5 \text{ kg/m}^2$ instead of 30 kg/m^2).

We have demonstrated 4 years ago that if we chose as prerequisite rationale that the maternal optimal gestational weight in term pregnancies (optGWG) is to have Appropriate for Gestational Age (AGA) term newborns (by definition 80% of a neonatal population, with 10% of SGA -small for gestational age- as well as 10% of LGA -Large for gestational age-), there is an association with maternal PRE-pregnancy Body Mass Index (ppBMI), and that this association is a linear curve ($y = ax + b$).

We propose then an alternative solution for Indian scientists/epidemiologists to confirm in the Indian population our preceding findings and establish in India their specific linear equation knowing the specific SGA-LGA definitions of term newborns in India.

It will be easy to make this linear equation accessible everywhere on smartphones for health workers and women themselves. The Indian calculator will give therefore indispensable councils since the beginning of pregnancy to each pregnant woman, and should be useful also for the great "Indian diaspora" around the planet (e.g. Mauritius, Trinidad and Tobago, Fiji, French overseas territories etc...), where obesity is a huge rising problem in this community.

Keywords: Pregnancy; Epidemiology; Pre-pregnancy Body Mass Index; Gestational Weight Gain; Caesarean Section; Obesity; Maternal Fetal Corpulence Symbiosis

Comments

We observed in our population that women who achieved to have a natural rate of 10% of SGA (small for gestational age) as well as 10% of LGA (Large for gestational age) in term newborns were those with a normal pre-pregnancy BMI (20 to 24.9 kg/m^2). This 10% rate of SGA and LGA is indeed a crossing point that we coined "maternal fetal corpulence symbiosis, MFCS" [1]. But considering lean women or on the other side of the BMI spectrum (overweight and obese women), we noticed that we could also

achieve also this MFCS point by modulating the gestational weight gain in pregnancies. We have demonstrated 4 years ago that if we take as principle that the optimal optimal gestational weight in term pregnancies (optGWG) is to have "harmonious babies" (Appropriate for Gestational age, AGA) for all women whatever their pre-pregnancy Body Mass Index (ppBMI), this is linear curve ($y = ax + b$) [1]. Our mathematical linear equation in Reunion island (French overseas Department in the Indian Ocean, nearby Mauritius island) is:

optGWG (kg) = $-1.2 \text{ ppBMI (Kg/m}^2) + 42 \pm 2\text{kg}$ [1,2].

The fact that this 10% crossing point (MFCS, neonatal data) corresponding to a given maternal ppBMI category evolves linearly with the maternal gestational weight gain suggests that there is a biological/nutritional maternal-foetal connection.

Are the international IOM 2009 guidelines for gestational weight gain (GWG) [3], made mainly on Caucasian population, adequate for other population such as Asian women for example? For Indian [4-8], Chinese, Japanese, and Korean scholars, the answer is clearly NO [9-12]. Especially, as there are relatively few overweight or obese women in these populations, they even argue that the IOM recommendations in contrary are too low for underweight women [9-12]. With the Reunion formula the optimal GWG for a 20.0 kg/m² woman is of 18 kg [2] (and not 11.5 to 16 kg as stated by the IOM 2009 recommendations).

Our formula, designed in our Reunionese population (Creole people mainly from African and some Indian descent) is probably not adaptable everywhere [1,2]. As a matter of fact, MFCS is based on the NEONATAL population. SGA/LGA limits are specific for different ethnicities (Indians, Chinese, Eastern Asians, Africans, Polynesian Maoris etc...) [13,14]. For example, in India, the SGA limit at term is 2200g [7,8], and not approximately 2500g as it is in Reunion. A recent WHO publication proposed even that the universal definition of low birthweight (below 2500g) is ill adapted for all continents: it should be 2200g in Africa, 2200g in Latin America and 2100g in Asia [15].

Countries like India, China or Japan have a high rate of lean women [4-13]. In our formula [1,2], lean women of 18.5 kg/m² should have an optGWG of 20 kg (instead of 12.5-18 kg, IOM 2009 recommendations). Are those 20 kg adapted for Indian women? We cannot answer as we do not know Indian newborns' SGA-LGA definitions. It is the same problem when considering large for gestational age LGA newborns (whatever the gestational age). Considering the specific problem of macrosomic newborns at term (BW \geq 4000g), in Reunion they represent 3.9% of term babies, but it is 0.5% in India, 6.9% in China, 2.0% in Niger, 2.2% in Thailand, 9.3% in Paraguay 1.3% in Philippines, Nepal, Sri-Lanka etc...[16].

Therefore and logically, an Indian linear equation should then be slightly different than ours ($y = -1.2x + 42$). It is time and urgent to verify there. Specific neonatal curves exist in India and probably

also large databases on Indian women's GWGs, using the simple methodology proposed in 2018 in the Heliyon paper [1] (Heliyon is the Open Source of the Lancet and Cell). That accomplishment in India, a country of more than a billion inhabitants, would be an international scientific leap forward.

Very important, since it is a mathematical linear equation it allows that EACH WOMAN may be considered as a SINGLE PLOT and that we may calculate for each woman at the beginning of pregnancy her individualized optGWG for that pregnancy. This is of paramount importance because we do not classify women in underweight/normal weight/overweight/obese class I/obese class II... Additionally, it allows to bypass and ignore a conundrum: even the WHO categories are contested in East Asia. For overweight East Asian consider 22.5 kg/m² to define overweight (and not the international 25 kg/m²) and 27.5 kg/m² for obesity (and not 30 kg/m²) [13].

Conclusion

We could lower probably the rate of low-birthweights babies in lean women (by higher GWG than the international IOM 2009 recommendations). For obese women, on the other spectrum, we have also shown by retrospective simulations on our population that we may also lower c-section rates, late onset preeclampsia, macrosomic babies and LGA babies in term pregnancies [17]. Obesity is not yet a huge problem in mainland India, but has become a serious problem in the Indian diaspora (e.g. Mauritius, Trinidad and Tobago, Fiji, French overseas territories, Canada, UK etc...). It is also easy to make this accessible everywhere on smartphones for health workers and women themselves [2]. Knowing the specific SGA-LGA definitions of newborns in a setting or a country, allows to easily find the MFCS curve everywhere. The Indian calculator accessible on smart-phone will be useful for India itself but also for all Indian people disseminated all around the world.

Conflicts of Interest

None.

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Bibliography

1. Robillard PY, et al. "Relationship between pre-pregnancy maternal BMI and optimal weight gain in singleton pregnancies". *Heliyon* 4.5 (2018): e00615.
2. Gestational weight gain calculator (English version) on smart phone. REPERE.RE (Reseau Perinatal REunion).
3. IOM. Weight gain during pregnancy: reexamining the Guidelines. Institute of Medicine (US), National Research Council (US), Committee to Reexamine IOM Pregnancy Weight Guidelines (2009).
4. Anand P, et al. "Which growths charts to use to classify neonates as small for gestational age at birth?" *Indian Journal of Child Health* (2019).
5. Singhai PK, et al. "Changing trends in intrauterine growth of North Indian babies". *Indian Pediatrics* 28 (1991): 281-283.
6. Alexander AM, et al. "Birthweight centile charts from rural community-based data from Southern India". *Indian Pediatrics* 50 (2013): 1020-1024.
7. Kinare AS, et al. "Patterns of fetal growth in a rural Indian cohort and comparison with a Western European population: data from the Pune maternal nutrition study". *Journal of Ultrasound in Medicine* 29.2 (2010): 215-222.
8. Sebastian T, et al. "Small for gestational age births among South Indian women: temporal trend and risk factors from 1996 to 2010". *BMC Pregnancy Childbirth* 15 (2015): 7.
9. Guan P, et al. "Effect of maternal weight gain according to the Institute of Medicine recommendations on pregnancy outcomes in a Chinese population". *Journal of International Medical Research* 47.9 (2019): 4397-4412.
10. Li C, et al. "Joint and Independent Associations of Gestational Weight Gain and Pre-Pregnancy Body Mass Index with Outcomes of Pregnancy in Chinese Women: A Retrospective Cohort Study". *PLoS One* 10.8 (2015): e0136850.
11. Morisaki N, et al. "Pre-pregnancy BMI-specific optimal gestational weight gain for women in Japan". *Journal of Epidemiology* 27.10 (2017): 492-498.
12. Choi SK, et al. "Determining optimal gestational weight gain in the Korean population: a retrospective cohort study". *Reproductive Biology and Endocrinology* 15.1 (2017): 67.
13. Goldstein RF, et al. "Gestational weight gain across continents and ethnicity: systematic review and meta-analysis of maternal and infant outcomes in more than one million women". *BMC Medicine* 16 (2018): 153.
14. Goldstein RF, et al. "Association of Gestational Weight Gain With Maternal and Infant Outcomes: A Systematic Review and Meta-analysis". *JAMA* 317.21 (2017): 2207-2225.
15. Laopaiboon M, et al. "An outcome-based definition of low birthweight for births in low- and middle-income countries: a secondary analysis of the WHO global survey on maternal and perinatal health". *BMC Pediatrics* 19 (2019): 166.
16. Koyanagi A, et al. "Macrosomia in 23 developing countries: an analysis of a multicountry, facility-based, cross-sectional survey". *Lancet* 381.9865 (2013): 476-483.
17. Robillard PY, et al. "The urgent need to optimize gestational weight gain in overweight/obese women to lower maternal-fetal morbidities: a retrospective analysis on 59,000 singleton term pregnancies". *Archives Women Health Care*, in press.