Challenges of Addressing Overnutrition and Undernutrition During Pregnancy in Chile/Latin America

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Future perspectives and actions are needed to address issues and challenges related to both overnutrition and undernutrition in pregnant women in the Chile/Latin American and Caribbean (LAC) region, specifically development of an agreement on maternal anthropometric classification of nutritional status and weight gain guidelines in the LAC region, the need for further study of diet quality and multi-micronutrient (MMN) supplementation in the LAC region, and proposal of new newborn indicators to assess the medium- and long-term health risks associated with early experiences, especially during pregnancy.

Maternal Anthropometric Classification of Nutritional Status and Weight Gain Guidelines

International recommendations during the 1970s and 1980s established 12.5 kg as the optimal weight gain for pregnant women regardless of pregestational weight and height.[1,2] A standard developed in Uruguay served this purpose in the LAC region during the 1980s.[3] In the 1980s, studies on healthy Chilean women with term deliveries of 39–41 weeks, singleton pregnancies, and healthy newborns considered the influence of maternal nutritional status at the beginning of pregnancy and height.

The Rosso and Mardones (RM) Chart was designed to define the maternal "critical body mass" normal weight/height area, which was associated to an "optimal" birth weight (ie, the mean ±1 SD of this healthy population) (Figure).[4,5] This approach was in agreement with a recent World Health Organization (WHO) proposal to establish optimal birth weight.[6] Between 1987 and 2005, the Chilean Ministry of Health used the RM Chart to diagnose adequate or normal maternal body mass index (BMI) and consequently recommend weight gain during pregnancy. This chart also was incorporated in other LAC countries at the national level—Argentina, Brazil, Colombia, Ecuador, Paraguay, Panama, Uruguay, and Brazil. However, Brazil and Uruguay are not currently using it.

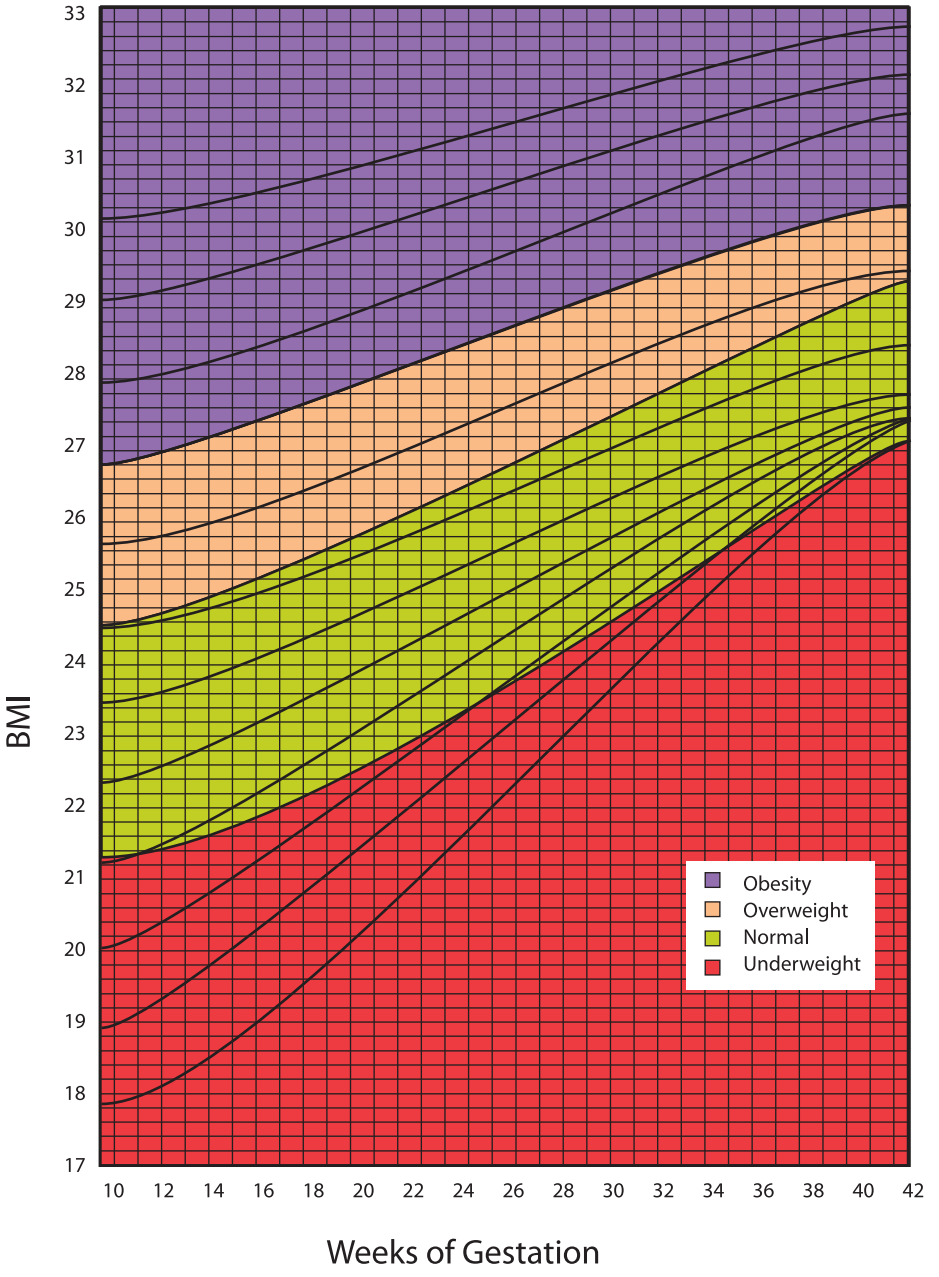

Figure. Rosso and Mardones Chart for guiding weight gain during pregnancy.[4,5] Weight for height is expressed as BMI.

Source: Mardones F, Rosso P. Design of a weight gain chart for pregnant women [article in Spanish]. *Rev Med Chil.* 1997;125:1437-1448. Translated by permission of Sociedad Medica de Santiago.

During 2005, Chile adopted the Atalah et al (AeA) proposal and changed the chart's lower and upper cutoffs, widening the normal BMI range.[7] Brazil adopted the same proposal in the last few years. Mexico recently adopted the pregnancy weight-gain guidelines issued by the Institute of Medicine (IOM), United States.[8] Central American countries have not decided which norm to use, and other countries, such as Peru, Uruguay, and Venezuela, are using the four previously mentioned norms, but not unanimously in their different provinces.

RM and AeA charts differ from the norm in the United States, mainly because the latter weight-gain guidelines were not determined proportionally for the individual height of each woman. That design inhibits its use in the LAC region, because women from our countries show an important variability in height—1 SD of mean height is about 6 cm. When using the RM and AeA charts, short and tall women are recommended to gain proportionately more and less weight than average height women respectively.

In the last 15 years, the LAC region underwent important changes in the nutritional status of pregnant women, and this nutritional transition has reached many countries. Chile reduced the prevalence of underweight pregnant women from 25.7% in 1987 to 13.3% in 2001, increased maternal overweight from 18.8% in 1987 to 21.8% in 2001, and increased obesity from 12.9% in 1987 to 32.6% in 2001.[3]

An adequate weight gain represents an important goal in prenatal care because of its influence on fetal growth and maternal health. Thus, health care providers should have at hand easy-to-use instruments for setting desirable weight gain goals for each individual mother and for monitoring weight gain during the course of pregnancy.

New research on the different outcomes associated with maternal preconceptional nutritional status and weight gain guidelines is needed. Unfortunately, implementation of experimental trials in the LAC region on this regard is currently not taking place. However, reports of observational studies are occurring. For example, a recent study in Chile used different norms in relation to these perinatal outcomes—risky birth weight (ie, <3000 g and ≥4000 g) and cesarean delivery. The study concluded that an independent and combined influence of preconception nutritional status and gestational weight gain on perinatal outcomes occurred when using standards to classify those parameters developed in the United States (IOM) and Denmark respectively.[9] The next study should look at the RM and AeA charts.

Diet Quality and MMN Supplementation in the LAC Region

Recent studies have shown that low-height, overweight pregnant women who attend the Chilean public health system have poor-quality hypercaloric intake.[10] Maternal poor-quality nutrition causes fetal growth restriction or macrosomia.[11] Balanced energy/protein supplementation of pregnant women is shown to increase birth weight, but the effects are, in most cases, only modest. Potential benefits of providing micronutrients to pregnant women, either through tablets or fortified food products, are now under investigation.

A supplement containing the recommended dietary allowances (RDA) of 15 different micronutrients was proposed,[12] supported by the findings of randomized controlled trials with a positive difference in mean birth weight of about 60 g in healthy pregnant women. During the last decade, Chile supplied two micronutrients, folic acid and iron, to the general population of pregnant women through white-flour fortification and delivery of ferrous sulphate tablets, respectively. Other countries in the LAC region are doing so, but recent information is not available. Therefore, when public programs already provide folic acid and iron, the possible impact of a combination of MMN supplementation deserves further exploration.

The previously mentioned birth-weight improvements are similar to those achieved in an earlier randomized controlled trial of an MMN-fortified milk-based supplement. A 73-g birth-weight increase in the experimental group was observed at a time when delivery of iron tablets and folic acid fortification were not public programs.[13] On the other hand, several studies have shown that either omega-3 fatty acids or fish consumption increases birth weight and prolongs gestation.[14,15]

In a recent trial, powdered milk was fortified with α-linolenic omega-3 fatty acids, plus a similar mix of vitamins and minerals.[16]

Treatment analysis showed that:

- Mean birth weight was higher in the intervention group than in the control with a difference of 118 g (95% CI, 47–190 g)
- Birth length had a difference of 0.57 cm (95% CI, 0.19–0.96 cm)
- The combination of MMN supplementation and omega-3 fatty acids still can have an important impact on fetal growth, higher than the previous 60-g difference in birth weight, when folic acid and iron are universally provided

In the intention-to-treat analysis, the birth-weight difference was significant, but with just a difference of 65.4 g (95% CI, 5–126 g). An influence in gestational age also was noted with an incidence of very preterm births (<34 weeks), lower (0.4% vs 2.1%) in the experimental group. Those findings were affected by an important amount of women who did not consume powdered milk because of a product failure, reducing the on-treatment groups from slightly more than 450 women each to about 350 women each. A new study is needed in this regard and also in light of new research supporting omega-3 supplementation during pregnancy.

Two other studies performed in Mexico did not produce favorable results in the LAC region.[17,18] It seems, on average, that the areas where the trials were performed did not lack supplemented micronutrients, although primigravidae supplemented with omega-3s had heavier infants with also larger head circumferences than controls.[17] It was concluded that prenatal docosahexaenoic acid (DHA) supplementation of primigravid women may result in increased infant birth size in a population where dietary DHA intakes are very low, and benefits of the intervention on infant health and neurodevelopment are under study.[17] Long-term possible results also should receive consideration. Maternal calcium supplementation trials done in Argentina have reported favorable long-term results in children on incidence of hypertension and caries.[19]

Newborn Indicators to Assess Health Risks Associated With Early Experiences, Especially During Pregnancy

New gold standards for fetal growth are needed, because birth weight is not always associated with medium- or long-term health outcomes.[20] Body composition at birth is associated with insulin resistance in adulthood, and new epigenetic measurements are under consideration as possible risk factors for later adiposity of children.[21,22]

The importance of birth length in this regard also is recognized in many countries throughout the world. For example, the University of Pelotas group in Brazil showed that birth length strongly predicts adolescent height and that birth weight's effect disappears when adjusting for birth length.[23] Adult height also is highly associated to general mortality in Chile and elsewhere, indicating the public health importance of birth length.[24] Different studies conducted in developed countries demonstrated that cognitive capacity was affected. Recent studies in school-age children in the LAC region, specifically in Guatemala and Chile, show similar results, including a higher effect of birth length when compared to birth weight[25,26]; in Chile birth length at <50 cm had the worst results.[26]

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Obesity rates in school-age children are inversely associated with adjusted birth length in Chile[27]; the highest rate was reported in children with birth length <50 cm. Uauy et al have commented that children societies undergoing nutritional transition are presenting excessive weight gains but low growth in height.[28] Both combined phenomena increase BMI rates, so it becomes indispensable to enhance birth length to address obesity.

Another Chilean study of school-age children showed significant inverse associations between three perinatal factors—birth weight, birth length, and gestational age—and metabolic syndrome factors. For example, hypertension had an odds ratio for birth length <50 cm of 1.46 (95% CI, 1.13–1.88).[29]

The idea of considering birth length <50 cm as a possible new indicator of fetal growth would need further studies to show its possible association with health outcomes in the middle or long term. The proportion at the local or national level of this indicator in Argentina, Chile, and Uruguay has reached 48%, 44.5%, and 62.7%, respectively[26]; the latter figure is possibly associated with a higher prevalence of maternal smoking. Other countries in the LAC region and different populations of Australia have reached the following proportions (Table).[26]

Table. Proportion of Birth Length <50 cm

Area	Year(s)	Percentage
Argentina (Sardá Maternity Hospital, Buenos Aires)	1988–1999	48%
Brazil (city of Pelotas)	2004	76.5%
Chile (national figures)	2000–2002	44.5%
Colombia (department of Caldas)	2003–2009	54.5%
Colombia (city of Medellín)	2009	67.6%
Eastern Australia (indigenous mothers, aboriginal or Torres Strait Islander)	2002–2008	50.8%
Eastern Australia (nonindigenous mothers—Caucasian, Asian, Indian, African, Maori, and other ethnicities)	2002–2008	37.6%
Eastern Australia (Caucasian mothers)	2002–2008	36.6%
Uruguay (national figures)	2009	62.7%

Sources:

Argentina, Chile, and Uruguay: Mardones F, Grandi C, Moratorio X. Fetal life and healthy growth. In: Uauy R, Carmuega S, eds. *Healthy Growth in the South Cone of Latin America.* Buenos Aires, Argentina: Danone. In press.

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Guatemalan early nutritional interventions have demonstrated that higher birth length and consequently improved adult height result in substantial gains in human capital and economic productivity.[25] International experiences also have shown that in order to enhance birth weight and height, it is necessary to overcome maternal restriction because of short maternal stature.[30]

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Q & A

Q: What do we know about the long-term effects on the child of maternal stunting? You have talked about the weight the mother brings to the pregnancy, but you have opened up a whole different way of looking at the problem, and I assume also the one from India.

I heard one talk where somebody was talking about the granddaughters, their pregnancies expressing what happened in the grandmother. It interested me because in the 1950s weight gain was restricted in pregnancy. The obesity epidemic is kind of happening in the granddaughters of those people. Do you think

that maternal stunting gets passed along as well, and that it is not just a question of what happens in that fetal environment in pregnancy, but also what happened in that mother's mother's pregnancy?

Dr Mardones: What I observed in Chile is that in the last 20 years, maternal height has not improved or moved, probably just 1 or 2 cm, but quite slowly. This is a sign of inequality in some way that we need to improve the maternal diet or the quality of the diet in the general population and that is probably not well considered. We saw information from the Southampton survey that problems also exist in developed countries.

The maternal nutritional status is not improving around the world in the speed that it should. That is my impression. In this audience, most probably, we have more height than our parents, but this is not the case in many low-income populations in Latin America.