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Changes in body composition in lactating adolescent mothers

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SUMMARY. We assessed changes in body composition in lactating adolescent mothers living under unfavorable socioeconomic and sanitary conditions. A total of 17 healthy primiparous adolescents under 17 years of age attending the Maternity Hospital of the city of La Plata, Argentina, were followed at 4 time points (15 days and 3, 6 and 12 months postpartum) to assess, a) dietary intake, b) practice of physical activity, c) nutritional condition (weight, height, body mass index [BMI] according to age, and body composition by the sum of skinfold measurements), d) characteristics of lactation, and e) growth parameters of the child. The mean age of adolescents was 15.06 ± 0.66 years (mean menarchal age, 11.59 ± 0.80 years). All adolescents breastfed up to 12 months postpartum, and maternal milk covered above 80% the baby intake (mean 7.06 ± 2.54 breast feeds/day). While the daily intake of nutrients by adolescent mothers was constant up to 6 months postpartum, there was a modest decrease in that of proteins, carbohydrates and lipids 15 days and 12 months postpartum. The decrease in energetic intake during the same period was significant ($p< 0.05$). The practice of physical activity was classified as moderate during the follow-up period. Whereas mean basal percent of fat body mass (FBM) was 29.85 ± 2.87, and decreased significantly at 6 (27.2% ± 3.9%; p= 0.02) and 12 (26.1% ± 3.9%; p=0.002) months postpartum, changes in lean body mass (LBM) were not significant. In conclusion, lactating adolescents maintained LBM, whereas weight, FBM and BMI decreased markedly from 3 months postpartum.

Key words: Body composition, anthropometry, lactation, adolescent mothers, Argentina.

RESUMEN. Cambios en la composición corporal de puérperas adolescentes durante la lactancia. Se evaluaron los cambios en la composición corporal durante la lactancia en adolescentes con condiciones socioeconómicas y sanitarias desfavorables. Se estudiaron 17 adolescentes menores de 17 años, primíparas, sanas, asistidas en la Maternidad de La Plata, Argentina. Las adolescentes se evaluaron en cuatro oportunidades: a los 15 días y a los 3, 6 y 12 meses post-parto, determinando a) consumo dietético, b) actividad física, c) estado nutricional (peso, talla, Índice de Masa Corporal según edad, y composición corporal por suma de pliegues cutáneos), d) características de la lactancia, y e) parámetros de crecimiento del niño. La media de edad de las adolescentes fue 15.06 ± 0.66 años (promedio de edad de la menarca, 11.59 ± 0.80 años). Todas amamantaron hasta los 12 meses, y la leche materna cubrió más del 80 % de la ingesta, con un promedio de 7.06 ± 2.54 tetadas/día. Aunque la ingesta diaria de nutrimentos se mantuvo constante hasta los 6 meses y se observó una disminución no significativa de la ingesta de proteínas, hidratos de carbono y lípidos en los controles del día 15 y los 12 meses, la disminución de la ingesta energética durante el mismo período fue significativa ($p< 0.05$). La práctica de actividad física en todos los casos fue evaluada como leve durante el período de seguimiento. El porcentaje de masa grasa basal fue 29.85 ± 2.87%, disminuyendo significativamente a los 6 meses (27.2 ± 3.9%; p= 0.02) y al año (26.1 ± 3.9%; p=0.002) de seguimiento. En cambio, no se registraron cambios significativos en la masa magra. En conclusión, las madres adolescentes durante la lactancia mantienen la masa magra, mientras que el peso, la masa grasa y el IMC disminuyen significativamente a partir de los 3 meses post-parto.

Palabras clave: Composición corporal, antropometría, madres adolescentes, lactancia, Argentina.

INTRODUCTION

During pregnancy and lactation, a series of metabolic changes assure the growth of the fetus, maternal health and postpartum breast-milk production.

Pregnancy is accompanied by increased body weight as a result of fetal growth and increased maternal fluids and soft tissues. Fat body mass (FBM) is also increased and maintained as fat reserves to meet the cost of subsequent lactation (1).

In the second-half of pregnancy, increased levels of plasmatic corionic somatotrofin, cortisol, prolactin and glucagon keep a sustained lipolytic and anti-insulinic activity for better fatty acid utilization from peripheral tissues (1). These metabolic changes assure the constant flux of glucose and aminoacids to the fetus.

During lactation, there is a hypoinsulinemic state accompanied by a decreased insulin response in muscular and adipose tissue which favors higher carbohydrate utilization by the mammary gland for breast-milk production. This situation maintains up to 6 months postpartum (2). Breast-milk production involves the presence of other nutrients such as calcium, proteins, zinc and iron.

Energy cost during pregnancy and lactation is generally increased and concomitant with increased body and fetal weight. However, there is a high intra-variability in the metabolic response among women, partly attributed to differences in body fat and nutritional condition before pregnancy and life conditions during pregnancy (3, 4).

Reports in the literature are mostly concerned with changes during pregnancy and lactation in adult women; however, very few data refer to the energy cost of lactation in adolescent mothers, a stage in life particularly important in the process of infant and maternal growth. During pregnancy, 50% of adolescent mothers continue to grow. Using leptin as a biomarker of adolescent maternal growth, for the highest quartile, low birth weight increased > 5-fold, fetal growth restriction increased > 6-fold, and infant birth weight decreased by 200 g (5). In lactating adolescent mothers, changes in body composition are expected, since women have not yet completed their maturity cycle (1).

luego del embarazo, (¿?) serie de pequeños cambios continuos que afectan el metabolismo de todos los nutrientes In Argentina, 14.6 % of pregnancies are from women under 20 years of age (6). This figure varies according to the region, and is generally higher in populations with structural poverty (6). A nutritional survey performed in our country reported that the mean energetic intake in adolescents was 2697 ± 1099 Kcal/day for a recommended dietary intake of 2500 Kcal/day, thus showing that a large number of women in the study sample was below the recommended requirements (7). On the other hand, the amount of milk produced by adolescents at 6, 12, 18, and 24 weeks postpartum ranged from 37-54% less ($P < .05$) than that of the adults, and resulted in a 45% weaning rate at 18 weeks postpartum in the younger group (8).

In view of the aforementioned data, we assessed changes in body composition, i.e. gain or loss of fat body mass (FBM) and/or lean body mass (LBM) during lactation in adolescent mothers under 17 years of age with unfavourable socioeconomic and sanitary conditions.

METHODS

Study design

Data were taken from a descriptive observational study performed in 17 adolescent mothers less than 17 years of age recruited at the Maternity of the Hospital Interzonal General de Agudos "General San Martín", La Plata, Argentina, during routine prenatal and delivery care in the period 2003-2004. Enrollments included all primiparous teenagers with term-pregnancy, birth weight above 2500 g, breast-feeding for no less than 6 months, and with no smoking habits. Informed consent was obtained from adolescent mothers and their tutors and the study was approved by the Ethical Committee of the Instituto de Investigaciones Pediátricas (IDIP), La Plata Children´s Hospital "Sor María Ludovica" que amamantaron a sus hijos por un periodo no menor a 6 meses. Teenagers presenting chronic or infectious diseases and prolonged treatment with drugs at the start of the study were excluded. Adolescents were assessed at four time points during the study period: 15 days after delivery, and 3, 6 and 12 months postpartum. Assessments were performed at IDIP, evaluating: a) dietary intake, b) practice of physical activity, c) nutritional condition (weight, height, body mass index [BMI] according to age, and body composition as determined by the sum of skinfolds measurements), d) characteristics of lactation: type of breast-feeding (exclusive or partial), and number of breastfeeds per day through a survey), and e) growth parameters of the child (weight and height)

Dietary intake was surveyed by a nutritionist by means of a questionnaire recording weekly frequency of food intake of all foodstuff consumed (9). The nutritional content of food was analysed with a software with national charts of food composition (10). We estimated daily energy as well as protein, fat and carbohydrate consumption in Kcal and g. The percentage of recommended dietary allowances (RDA) was assessed according to international standards for protein (11) and calorie (12) intake.

Physical activity was evaluated through a survey and ranked according to the National Research Council Classification (13).

Weight and height assessments were performed by the same observer according with already standardized procedures (14) with an electronic digital balance (TANITA Model 1582, 100 g scale and maximal capacity of 136 kg) and a stadiometer in mm (SECA Model 222). Teenagers wore no shoes and light clothing.

Body mass index (BMI) was calculated as Weight (Kg)/ Height^2 (m) (15).

Body composition was obtained by the sum of four skinfold measurements (subscapular, suprailiac, bicipital and tricipital) using a Lange caliper and the Durnin formula for FBM and LBM assessments (16).

Children were followed-up monthly at the Service of Healthy Children of La Plata Children´s Hospital, measuring body weight on an electronic scale (10 g accuracy), and height with a stadiometer (1 mm accuracy) according to national reference tables to estimate growth adequacy (14).

A social survey was also performed to determine Unsatisfied Basic Needs of the study sample.

Statistical analysis

Data from surveys and assessments were entered into a specially designed data base. The descriptive analysis of data was performed with the Data Base and Statistical Program EpiInfo 6 (CDC/OMS). Differences between means and percentages were analysed with ANOVA and Chi^2, respectively.

RESULTS

Mean age of adolescents was 15.06 ± 0.66 years, with a mean menarchal age of 11.59 ± 0.80 years. All adolescents belonged to homes with unsatisfied basic needs, were breastfeeding up to 12 months postpartum, and maternal milk covered above 80% the baby intake (mean 7.06 ± 2.54 breastfeeds/day). Briefly, fifteen days after delivery all mothers practiced exclusive breastfeeding (9.5 ± 2 breastfeeds/day). There was a slight decrease at 3 months (94.1%), and at 6 months postpartum all had abandoned that practice, when complementary feeding was incorporated to lactation. However, 94.1% continued with partial breastfeeding (6.7 ± 3.1 breastfeeds/day), and one year after implementing the program 82.3% of mothers were breastfeeding (4 ± 2.8 breastfeeds/day).

Breastfeeding manifested in the changes undergone by children during the follow-up period: whereas birth weight was 3.12 ± 0.29 kg, it rose to 8.03 ± 2.17 kg and 9.97 ± 1.36 kg at 6 and 12 months, respectively, showing an adequate growth for age in all children.

Table 1 shows weight, height and BMI during the follow-up period. Of all mothers evaluated at 15 days postpartum, only 2 (11.7%) were overweight as assessed by BMI> 25 kg/m^2, 1 (6%) had FBM above 34% (cut-off point) (17), and the rest were normal. At the end of the evaluation period, only one adolescent (6%) was underweight.

TABLE 1
Mean weight, height and BMI at day 15 and at months 3, 6, and 12 of follow-up

	15 days	3 months	6 months	12 months
Weight (kg)	54 ± 5.1	49 ± 5.2[a]	47 ± 5.1[b]	49 ± 5.1[c]
Height (m)	1.55 ± 0.069	1.55 ± 0.064	1.55 ± 0.068	1.56 ± 0.062
BMI	22.5 ± 1.8	21 ± 1.4[d]	19 ± 1.6[e]	21 ± 2.1[f]

[a]p= 0.005; [b]p=0.0004; [c] p=0.005; [d]p=0.0006; [e]p=0.0000; [f]p=0.01

The mean height increase was 0.9 cm per year; however, differences in height in check-ups at day 15 and at 12 months were not statistically significant, with progressive decreases in weight and BMI.

Table 2 shows the daily intake of nutrients and the percentage of RDA. At 15 days postpartum, the percent adequacy of protein intake for the RDA was ≥ 100% in 47% of mothers, falling to 53% at 12 months. Only 1 mother (6) met 100% of RDA for calorie intake 15 days postpartum. At 12 months only 4 mothers (23%) met such RDA. There were no significant differences when analysing weight loss of mothers who met the RDA vs those who did not. Whereas the decrease in protein, carbohydrate and lipid intake was not significant 15 days and at 12 months postpartum, the decrease in energetic intake during the same period was significant ($p< 0.05$).

TABLE 2
Daily intake of nutrients and percentage of adequacy of RDA at day 15 and at months 3, 6, and 12 of follow-up

	15 days	3 months	6 months	12 months
Energy kcal/day	2275 ± 641	2183.2 ± 605	2383 ± 678	1919 ± 603*
% adequacy RDA	72 ± 20	66 ± 19	76 ± 23	70 ± 25
Energy (Kcal/kg)	41.8 ± 10.7	40.05 ± 10.9	44.65± 15.2	41.36 ± 14.5
Proteins (g)	72 ± 23	77 ± 23	75 ± 23	65 ± 21
% adequacy RDA	103 ± 32	104 ± 30	103 ± 33	104 ± 47
Carbohydrates (g)	321 ± 110	312 ± 111	346 ± 97	293 ± 102
Lipids (g)	81 ± 23	78± 36	78 ± 37	70 ± 29

*p <0.05 with respect to basal (15 days).

However, when calorie intake was analysed with reference to weight in kg, there were no significant differences in any of the study points. In all cases, physical activity was mild during the follow-up period.

Table 3 shows the changes in body composition, FBM and LBM, as estimated by anthropometric measurements. It can be noted that there is a marked decrease in FBM, while no changes can be observed in LBM. FBM decreased significantly at 6 and 12 months of follow-up as compared to basal values (from 27.2% ± 3.9% to 26.1% ± 3.9%; basal, 29.7% ± 2.86%; p= 0.02 and =0.002, respectively). Although the percentage of LBM increased at the end of the period as compared to basal values (70.9% ± 3.1% *vs* 73.9% ± 3.8%; p=0.009), such increase was at the expense of a percent relation, since absolute values remained unchanged.

TABLE 3
Fat and lean body mass at day 15 and at months 3, 6, and 12 of follow-up

	15 days	3 months	6 months	12 months
FBM (%)	29.7 ± 2.86	28.5 ± 2.86	27.2 ± 3.9[a]	26.1 ± 3.9[b]
FBM (kg)	16.0 ± 2.31	14.6 ± 2.32[c]	13.7 ± 2.76[d]	13.0 ± 2.6[e]
LBM (%)	70.9 ± 3.15	71.4 ± 2.86	72.7 ± 3.98	73.8 ± 3.8[f]
LBM (kg)	37.9 ± 3.59	36.7 ± 3.25	36.4 ± 3.52	36.7 ± 2.9

[a]p= 0.02; [b]p=0.002; [c]p=0.04; [d]p= 0.006; [e]p=0.0006; [f]p=0.009

DISCUSSION

Lactation is only one phase of a woman's reproductive cycle, together with pre-pregnancy, pregnancy, and post-weaning. Although they all require a special nutritional care, in lactating adolescents changes in body composition are

expected since women have not yet completed their maturity cycle (1).

Despite limitations in the dietary survey (overestimation of food intake), a high percentage of mothers did not meet 100% of RDA for calorie intake, and around 50% did not meet the total protein requirements throughout the study period. The absence of statistical significance could be due to the number of cases included in the sample.

Energy intake in the study sample of adolescent mothers was constant up to 6 months, with a significant decrease at 12 months postpartum. However, weight loss, FBM loss and decreased BMI were statistically significant from 3 months onwards. Despite differences among the various models to estimate FBM and LBM during pregnancy and lactation, assessments with our model were adequate (18). Weight loss was not accompanied by LBM loss, which remained constant during the study period. The practice of physical activity remained unchanged. FBM loss could be explained by the increase in resting energetic expenditure in well-nourished lactating women (2, 19), or by the decrease in energy intake of our adolescent mothers.

Our results regarding weight loss and FBM are similar to those reported by other authors in adult women (20, 21). Butte *et al.* reported a decrease in FBM from 28% to 26.4% between 1 and 4 months postpartum (20). Hopkinson *et al.s* found a linear decrease of FBM in a 12-month period both in lactating and non-lactating women, with higher losses at 3 and 6 months in lactating women (22). Sadurskis *et al.s* recorded a significant decrease in fat and lean mass during the first 6 months postpartum, as assessed by total body potassium counting (23).

Weight loss in lactating adolescent mothers has been described in a sample of Mexican women, although the authors did not study body composition (24). The maintenance of LBM has been described in adult women. In healthy, well-nourished women with a mean age of 21 and 38 years who breastfed for at least 6 months, it has been shown that maintenance of LBM during lactation is possible with an adequate protein intake, since protein stores during pregnancy and their subsequent mobilization would partially meet the increased needs for maternal milk-production (3). The daily intake of proteins reported by these authors was higher than that recorded in our study (r: 93-100 *vs.* 65-77 g/day, respectively). However, figures are the same if they are assessed in g/kg/day (1.3 g/kg/day).

Our results show that increments in height among participants in the study were not significant, except in one teenager. Among adolescent mothers, an important fact in the metabolic adaptative process of pregnancy was whether they were still growing, with the consequent influence on the size of their infants (25-27). However, we found no reports dealing with results in still-growing lactating adolescents.

In conclusion, whereas LBM undergoes no changes in lactating adolescents, weight, BMI and FBM decrease significantly from 3 months postpartum.

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