



## Editorial

## Is nutrition deficiency a key factor of adverse outcomes for pregnant adolescents?



Adolescent pregnancy (teenage pregnancy) is a high-risk condition associated with adverse outcome, not only for the mother but also for the newborn child.<sup>1</sup> One report showed that teenage pregnancy was associated with adverse maternal outcomes, because teenage mothers had a higher risk of severe perineal tear during labor than adult mothers [odds ratio (OR) 1.6; 95% confidence interval (CI) 0.95–2.70].<sup>2</sup> Another report showed that younger pregnant women had a significantly increased risk of development of striae gravidarum than older pregnant women.<sup>3</sup> Striae gravidarum results in itching and discomfort and produces significant psychological burden in affected women.<sup>1</sup> In terms of adverse fetal outcomes, teenage mothers were more likely to have infants with low body weight (<2500 g; OR 2.8; 95% CI 1.3–6.1,  $p < 0.006$ ), pre-term babies (<37 weeks of gestational age; OR 1.9; 95% CI 1.0–3.4,  $p < 0.003$ ), and lower 5-minute Apgar scores (OR 1.7, 95% CI 0.9–3.0,  $p = 0.05$ ) compared to adult mothers.<sup>2</sup> These reports reinforce the assertion that pregnant adolescents are at an increased risk for adverse outcomes.

Palpably worse outcomes for both infant and mother have been noted in adolescent pregnancy by many studies, including: (1) an increase of fetal death, neonatal death, low birth weight, intrauterine growth retardation, prematurity; and (2) an increase of severe perineal laceration and a tendency to result in permanent body image changes, such as occurrence of striae gravidarum, and an increase of maternal mortality.<sup>2–5</sup> The results of these studies all suggest that health during and after adolescent pregnancy is an important issue that requires additional efforts to improve outcomes. Major underlying causes for worse outcome of both mothers and fetuses include: (1) unintended, unwanted, and unsupported pregnancy; (2) poor maternal nutrition; (3) not securing adequate care during the course of pregnancy; (4) labor without assistance by experienced obstetricians; and (5) not securing proper *post-partum* maternal and newborn care.<sup>4</sup> In addition, adolescent mothers were more likely to be unemployed, unmarried, and less educated than the adult mothers, and low socioeconomic status subsequently results in inadequate prenatal care, including poor nutrition support.<sup>2</sup>

In fact, malnutrition might be very common in adolescent pregnancy. A recent review article focusing on adolescent

pregnancy and the first 1000 days after childbirth found that >35% of adolescent pregnancies were considered nutritionally at-risk.<sup>4</sup> The seventh National Nutrition Survey showed that >25% of female adolescents were underweight. In addition, based on the criteria which defined nutritionally at-risk pregnant women as those with body mass index-for-age <P<sub>95</sub>, more than one-third of adolescent pregnancies were nutritionally at-risk. Adequate nutrition support for pregnant women, especially pregnancy during the period of adolescence, is very important because it positively affects fetal growth and minimizes the risk of intrauterine growth retardation.

The study by Guzel et al<sup>6</sup> in this issue of the *Journal of the Chinese Medical Association* focused on this issue to investigate the nutrition status in adolescent pregnancy. The authors evaluated the maternal serum amino acid levels in the first trimester of adolescent pregnancies, and found that nutrition may be one of the important factors contributing to worse fetal outcome in adolescent mothers.<sup>6</sup> The authors found that some amino acid levels, including isoleucine, leucine, lysine, methionine, phenylalanine, tyrosine, threonine, valine, arginine, and proline were statistically and significantly lower in adolescent pregnancies that were associated with low birth weight and prematurity.<sup>6</sup> Furthermore, pregnant adolescents who had lower serum levels of alanine and histidine were more at risk for preterm delivery and delivery of lower birth-weight fetuses than those who had normal serum levels.<sup>6</sup> Other nutritional components have contributed to worse outcomes, including the association between low serum level of tryptophan and delivery of low birth-weight fetuses, and the association between low serum level of serine and delivery of low birth-weight fetuses.<sup>6</sup> All of these studies suggested that existing levels of nutrition support for adolescent pregnancy may not be adequate, which might partially explain why adolescent pregnancy might have a higher risk of delivery of low-weight births. However, it is uncertain whether malnutrition during the early pregnancy is predictive as to whether these adolescent mothers are still at-risk nutritionally. In addition, does any evidence support whether certain amino acids are particularly important in pregnant mothers, regardless whether they are adult or adolescent?

It is well-known that some formula diets, such as a plant-based protein diet, might fail to provide adequate amounts of essential amino acids.<sup>7</sup> The proteins observed in these products are often considered to be low quality proteins. Therefore, it would be interesting to ascertain whether or not a maternal low quality protein diet might influence fetal growth and development. One study, using Wistar rats provided some interesting findings.<sup>7</sup> Plasma amino acid profiles of the offspring of adolescent mothers showed that plasma methionine, glutamine, and lysine were significantly lower and aspartic acid, ornithine, and glycine–proline were significantly higher in the low quality protein diet group (fed with 20% wheat gluten), but there was no difference of birth weights between the high quality protein diet groups (included 20% casein) and the low quality protein diet groups.<sup>7</sup> Although this study cannot be totally reflective of poor nutrition status, its results hinted that investigation of individual amino acids from either maternal serum or an offspring's serum might not always be an efficacious tool to examine aspects of the influence of maternal malnutrition on fetal growth and development.

Furthermore, it is also interesting to find that protein (amino acid) is seldom discussed as a public health problem among pregnant women. By contrast, vitamin A deficiency, iodine deficiency, and anemia were often considered as public health problems, reported by the seventh National Nutrition Survey consensus.<sup>4</sup> This is because good nutrition is essential to maintaining peak health and performance for humans. Besides amino acids, the following elements might be of considerably greater concern for pregnant women: (1) iron, which is essential for physical and cognitive performance; (2) calcium and vitamin D, which are essential for bone health; and (3) folate, which is essential for the prevention of neural tube defects during pregnancy and gestation. Therefore, do pregnant women need these nutrients to be supplemented? It should not be any surprise that the results are highly variable. A recent Cochrane Review indicated that there are no clear additional benefits to calcium supplementation in preventing preterm birth or low-birth-weight fetuses.<sup>8</sup> By contrast, in terms of childhood kidney outcome, a study from The Netherlands showed maternal blood 25(OH)D levels during pregnancy may influence childhood kidney outcome, because the authors found that higher maternal 25(OH)D levels were associated with lower childhood estimated glomerular filtration rate [a difference of  $-0.94 \text{ mL/min/1.73 m}^2$  (95% CI  $-1.73$  to  $-0.15$ ) per 1 standard deviation increase in 25(OH)D].<sup>9</sup> However, renal function might also be related to hormone profiles.<sup>10–12</sup> Since 25(OH)D is also a class of steroid-like hormones, it is hard to say that nutrition is the only factor contributing to renal function. However, it may partly explain why the observations are not always consistent. Although the data are not consistent, there is no doubt that adequate nutritional support is good for health, especially during the growth and development period.

In conclusion, two recent publications<sup>3,6</sup> of the *Journal of the Chinese Medical Association* recall the concerns of adolescent general health, especially issues addressing the physiological changes and neonatal outcomes of teenage

pregnancy. Every effort should be made to care for and protect adolescents to avoid unwanted and unintended pregnancy.

### Conflicts of interest

The authors declare that they have no conflicts of interest related to the subject matter or materials discussed in this article.

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### References

1. Lee WL, Yeh CC, Wang PH. Younger pregnant women have a higher risk of striae gravidarum, the study said. *J Chin Med Assoc* 2016;**79**:235–6.
2. Egbe TO, Omeichu A, Halle-Ekane GE, Tchente CN, Egbe EN, Oury JF. Prevalence and outcome of teenage hospital births at the buea health district, South West Region, Cameroon. *Reprod Health* 2015;**12**:118.
3. Ersoy E, Ersoy AO, Yasar Celik E, Tokmak A, Ozler S, Tasci Y. Is it possible to prevent striae gravidarum. *Chin J Med Assoc* 2016;**79**:272–5.
4. Capanzana MV, Aguila DV, Javier CA, Mendoza TS, Santos-Abalos VM. Adolescent pregnancy and the first 1000 days (the Philippine Situation). *Asia Pac J Clin Nutr* 2015;**24**:759–66.
5. Wang PH, Chen CY, Lee CN. Late preterm births: an important issue but often neglected. *Taiwan J Obstet Gynecol* 2014;**53**:285–6.
6. Guzel AI, Cinar M, Erkilinc S, Aksoy RT, Yumusak OH, Celik F, et al. Association between adverse perinatal outcomes and amino acid levels measured with nutrient questionnaire in adolescent pregnancies. *J Chin Med Assoc* 2016;**79**:335–9.
7. Kabasakal Cetin A, Dasgin H, Gülec A, Onbasilar İ, Akyol A. Maternal low quality protein diet alters plasma amino acid concentrations of weaning rats. *Nutrients* 2015;**7**:9847–59.
8. Buppasiri P, Lumbiganon P, Thinkhamrop J, Ngamjarus C, Laopaiboon M, Medley N. Calcium supplementation (other than for preventing or treating hypertension) for improving pregnancy and infant outcomes. *Cochrane Database Syst Rev* 2015;**2**:CD007079.
9. Miliku K, Voortman T, Franco OH, McGrath JJ, Eyles DW, Burne TH, et al. Vitamin D status during fetal life and childhood kidney outcomes. *Eur J Clin Nutr* 2015. <http://dx.doi.org/10.1038/ejcn.2015.216>.
10. Lee WL, Cheng MH, Tarng DC, Yang WC, Lee FK, Wang PH. The benefits of estrogen or selective estrogen receptor modulator on kidney and its related disease-chronic kidney disease-mineral and bone disorder: osteoporosis. *J Chin Med Assoc* 2013;**76**:365–71.
11. Huang BS, Lee WL, Wang PH. The slowing down of renal deterioration but acceleration of cardiac hypertrophy: is the estrogen receptor- $\alpha$  a hero or villain? *Am J Physiol Renal Physiol* 2014;**307**:F1352–04.
12. Lee WL, Huang BS, Chen YJ, Wang PH. Overcoming the barriers of osteoporosis treatment—a better route and a longer use. *J Chin Med Assoc* 2015;**78**:567–8.

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