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For Debate

Feeding the Fetus in the Tropics: Rest is Best

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Birth weight seems to be related in some way to environmental temperature as it is markedly lower in hotter areas of the world.¹ Because food supply in the tropics is often unreliable, the lower birth weights observed there are generally attributed to maternal malnutrition.² The importance of this factor however seems to have been overestimated. Even in the poorest countries most breast-fed infants grow well at least in the first three months of life³ although they are more demanding of nutrients than they were *in utero*.⁴ Some evidence suggests that physiological adjustments to heat, especially in working women may impair uteroplacental blood flow. This would suggest that the classical approach to the problem of fetal malnutrition in the tropics emphasizing the importance of maternal food intake might be often inappropriate.

Ambient temperature and sympathetic activity

Cutaneous venous tone depends on thermoregulatory centres but is not affected by baroreceptor reflexes.⁵ One result is that physiological consequences of upright posture are exaggerated when external temperature is above the zone of thermal comfort which is between 28°C and 31°C in a resting subject, lower during physical activity. To prevent an increase

in body temperature the organism reacts by a cutaneous vasodilatation including the venous network of the legs. This increases the pooling of blood in the lower part of the body and the level of visceral vasoconstriction required to maintain blood pressure.⁶ This makes it likely that women who remain on their feet during pregnancy have a level of sympathetic activity related to ambient temperature as soon as it is above a critical value which depends on their physical activity.

Maternal sympathetic activity and placental blood flow

In pregnant ewes electrical stimulation of the hypogastric branch of the sympathetic results in vasoconstriction of uterine vessels.⁷ Sympathomimetic drugs have the same effect.⁸ This has been shown also in cats,⁹ guinea pigs,¹⁰ monkeys,¹¹ and seems therefore to be a general feature of mammalian physiology. In evolutionary terms, the purpose of the sympathetic vaso-constrictor response was presumably to maintain blood pressure in rare emergency situations such as acute blood loss during which conservation of an optimal placental blood flow was probably not a priority.

Although man relies much more often than animals on the sympathetic system to stabilize his blood pressure since it is activated by upright posture there is no reason to believe that the depressing effect of this reaction on utero-placental blood flow has ever been removed. Evolutionary changes are slow in the case of functions of no immediate survival value¹² and this could be only another example of imperfection of the

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species which represents the price of upright posture.¹³ At all events, the human uterus has vessels which are richly innervated by adrenergic fibres.¹⁴ Furthermore, clinical situations associated with a high level of sympathetic activity such as work in a standing position,¹⁵ hypertension¹⁶ and smoking,¹⁷ are known to result in low birth weights^{18,19} which could be accounted for by a reduced placental perfusion.

Public health implications

Since utero-placental blood flow seems to be a major determinant of fetal nutrition,²⁰ this effect of temperature on sympathetic activity suggests that maternal work in a standing position in hot climates may result in fetal deprivation even though maternal diet may be sufficient to sustain fetal growth. This interpretation is compatible with the rapid growth of breast-fed infants during the first months of life and, in areas of the developing world where lactation is successful, it is more plausible than the classical interpretation which incriminates a poor maternal diet. This would imply that giving pregnant women the opportunity to rest in late pregnancy could be more important for fetal nutrition in the tropics than giving food supplements to the mother.

This conclusion is further supported by data on perinatal mortality. In temperate climates, it has been reported that women in factories had a significantly higher stillbirth rate when they worked in a standing position in late pregnancy compared to their sitting colleagues before the introduction of the present legislation.²¹ Since the effect of heat is to exaggerate the physiological repercussions of upright posture, it seems likely that it will result in an increase of perinatal mortality in women who are obliged to continue demanding domestic chores in this position up to delivery. Increased opportunities of rest is the appropriate approach to this situation.

Inadequacy of present approach to reduce perinatal mortality in the tropics

It is the nutritional aspect of antenatal care which is emphasized at the moment by international organizations. That improvement of maternal diet during pregnancy will result in a decreased perinatal mortality however still remains largely speculative. That concept is at odds with the data of the Dutch famine²² during which there was a decrease of stillbirth rate and of neonatal deaths. Since this trend was not statistically significant and may have been produced by a shift in the social distribution of the pregnant population, this does not reject totally a possible relation between poor maternal diet and increased perinatal mortality. It suggests however that diet during pregnancy is not a factor of major clinical importance.

In the last joint FAO/WHO report on energy and protein requirements published in 1973 it was men-

tioned that in many parts of the world women must continue working throughout their pregnancy.²³ Physiological adjustments required to do so in hot climates were not discussed, let alone their possible repercussions on fetal growth and there was no suggestion that these women should rest in late pregnancy. The expert committee which edited this report advised an increase in their energy intake. This conclusion is questionable if feeding the fetus is the priority, not the maternal work productivity.

In many traditional societies it is considered beneficial for women to remain active throughout pregnancy.²⁴ To challenge this unsubstantiated belief a first step could be to convince experts in nutrition that giving extra food to a pregnant woman has not the same value as allowing her to rest.

Summary

Physiological adjustments to heat, upright posture and exercise interact in man. One result is that sympathetic activity increases with temperature in nonresting subjects. Comparative evidence suggests that utero-placental blood flow is affected by this reaction. This could be a major cause of fetal malnutrition in the tropics which presumably will not be overcome by improving maternal diet. Allowing a pregnant woman rest at the end of pregnancy might be a prerequisite to reduce fetal malnutrition and perinatal mortality in these areas.

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