Review Article

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EFFECT OF MATERNAL DIET AND LIFESTYLE ON FETAL OUTCOME: EVIDENCES FROM *AYURVEDA:* A REVIEW

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Received on: 04/06/18 Accepted on: 05/07/18

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DOI: 10.7897/2277-4343.094129

ABSTRACT

The condition of intrauterine environment during pregnancy has influence over growth, metabolism and brain development of fetus. Maternal nutrition constitutes a major intrauterine environmental factor that alters the expression of the fetal genome. Alternations in fetal nutrition and endocrine status result in developmental alternation that permanently change the structure, physiology and metabolism of the fetus and thereby predisposes it to various abnormalities both at physical and mental levels. *Ayurveda* states that the diet, emotional state and behavior of the mother at the time of conception contribute in determining the physical, physiological and psychological constitution of the child. The proper development of fetus (both physical and mental) is due to the use of congenial or *Satmya* diet and conduct of the mother during pregnancy. The diet and conduct of mother practiced during pregnancy has its outcome over the *Aahara Rasa* which in turn nourishes the foetus. The preponderance of *Dosha* in a particular diet or practicing a particular conduct influences the development of foetus both at physical and mental level.

Keywords: Genome, Constitution, *Satmya, Aahara Rasa, Dosha*.

INTRODUCTION

A woman after conception is carrying a huge responsibility of her own self along with her baby in the womb. Each and every vital of mother and baby are going together with a rhythm and harmony all over in the pregnancy. What a mother consumes, how she is thinking, what type of activity she is doing, in which environment she is dwelling in? All of the above effect the baby in some way or other. Maternal nutritional status and lifestyle has impact both on present and long term quality of life.[1] On the other hand maternal nutrition and daily living practices are influenced by biologic, socioeconomic and demographic factors.[2] The major adverse birth outcome of poor nutritional status are low birth weight, preterm birth, intrauterine growth retardation.[3] These birth outcome contributes much in the neonatal morbidity and mortality. It predisposes the newborn to various long term health issues, disabilities and chronic diseases in adult life.

A detail description of particular regime, do's and don'ts are explained for pregnant women. Instructions are prescribed not only for post conception period but also prior to it for attainment of normal and healthy *Beeja* (gametes) for healthy progeny in later life. *Ayurveda* holds view that all the *Indriyas* (sense organs) and organs originate in the third month. Furthermore, it is explained that the time when the *Indriya* become obvious, the *Chetas* (*Manas*) starts the feeling of emotions (*spandana*).[4] *Kashyapa* also explains that all the *indriyas* become functional in the 3rd month and the fetus starts experiencing the feeling of pain and starts movement.[5] Others quote that this happens in 4th month. *Sushruta* and *Ashtanga Samgraha* hold the view that the manifestations of *Manas* arise in the 5th month.[6] Therefore from 3rd to 5th month is the crucial period for the development of *Mana*.

Researches document that the first nociceptors appear at 7 weeks of gestation, and by the 20th week these are present all over the body. Peripheral afferents make synapses to the spinal cord during approximately 10th to 30th weeks[7], which is followed by the myelination of these pathways[8]. Functional spinal reflex circuitry develops simultaneously with the growth of peripheral afferents into the spinal cord.[9] Higher parts of pain pathways include the spinothalamic tract get established at 20 weeks and get myelinated by 29 weeks of gestation[10] and thalamocortical connections begin to appear into the cortex at 24-26 weeks.[11] Finally at 29 weeks somato sensory evoked potentials (SEPs) can be registered from the cortex, indicating that a functionally meaningful pathway from the periphery to the cerebral cortex starts to operate from that time onwards.[12]

DISCUSSION

Third month of the foetal period is crucial for the development of all the *Indriyas* (sense organs) [13, 14] and the fifth month is important for the clarity & sharpness of mind[15,16]. *Ayurveda* is very specific about the aspect of development as it advocates the use of milk mixed with honey & *Ghrita* in the third month[17, 18] and milk mixed with *Ghrita* in the fifth month[19, 20]. Use of sweet, cold and liquid diet is indicated in the first month[21]. These diets keep the *Doshas* in a balanced state and at the same time, milk and *Ghrita* nourishes the brain. Inadequate diet leads to *Garbhakshaya*[22] (intrauterine growth retardation).

A detail regimen and dietetic instructions have been mentioned, which are to be followed by a woman to have a meritorious child.[23] *Ayurveda* states that the diet, emotional state and behavior of the mother at the time of conception determine the psychological constitution of the child.[24] The proper development of fetus (both physical and mental) is due to the use of *Satmya* (congenial) diet and conduct of the mother during pregnancy.[25] The diet and conduct of mother practiced during pregnancy has its effect over of *Aahara Rasa* which in turn nourishes the foetus.

The preponderance of *Dosha* in a particular diet or practicing a particular conduct influences the development of foetus both at physical and mental level. The *Rasavaha Nadi* of mother is connected with the *Garbha Nabhi Nadi*(Umbilical cord) and the essence of the food that the mother takes reaches the foetus for its nutrition.[26,27] The *Sattva* in the fetus depends upon the type of dietetics(*Sattvika*, *Rajasika* or *Tamasika*) the pregnant women is indulged in.[28]

In *Geeta* it is mentioned that *Sattvika Aahara* leads to *Sattvika mana*, *Tamsika Aahara* results in *Tamsika mana* and *Rajasika Aahara* in to *Rajasika mana*.[29] *Chandyogopanishad* explains that the mind is what we eat and a food that is pure results in a clean state of mind. A clean mind has memory which transcends many births.[30]

Regular intake of *Vata* dominant diet by a pregnant woman leads to vitiation of *Vata* in her body and reaches the *Garbhashaya* (uterus) and further makes the child *Jada* (Idiot), *Muka* (Dumb), *Minmina* (Dyslaxia), stuttering speech, limp, stunted and with loss of one or more organs and other *Vata* disorders.[31]

Mana (Psyche) of a child is in accordance with the *Mana* of parents. This point supports the view that genes are responsible for the temperament.[32] Whatever the things a pregnant woman listens during pregnancy, the *Manas* of the fetus become like that.[33] It implies that the nature or the environment or the conduct of the mother during pregnancy also has influence on the development of *Mana* and further the *Manasika Prakriti* in the fetus. It is very similar to the concept of epigenetics and genome.

The nutritional environment during the fetal development has also been demonstrated to influence growth, metabolism and brain development with an increasing evidence that dietary levels of methyl- donors epigenetically alter gene expression in offspring.[34] Nutrition constitutes a major intrauterine environmental factor that alters the expression of the fetal genome and may change lifelong consequences. Change in fetal nutrition and endocrine status may result in developmental alternations that permanently change the structure, physiology and metabolism of the offspring, thereby predisposing it to abnormalities both at physical and mental levels. Evidences support that maternal nutritional status can alter the epigenetic state of the fetal genome. Stable alteration of gene expression through DNA methylation and histone modifications is a good example of it. This provide a basis for molecular mechanism of maternal nutrition on both fetal programming and genomic imprinting. Brain and cognitive development of the child are strongly determined by nutritional status of both the child and his/her mother during the prenatal period. Micronutrients, proteins and essential fatty acids (EFA'S) are essential for the proper growth, development of structure of the brain and for the activity required in metabolic and signaling pathways. During gestation, breastfeeding and first two years of life, certain nutrient deficiencies have dramatic effects on brain development.[35] Nutrition significantly determines the future learning, working and thinking performance of children.

Regular intake of *Vata* and *Kapha* predominant diet leads to malnutrition in fetus. Malnutrition effects adversely the brain of the fetus and young infant that later impairs the intelligence. Prenatal and early postnatal malnutrition poses the most serious adverse effect on intelligence because about 70% of the brain growth takes place in utero, and the remaining 30% including dendritic growth and synaptic branching is completed by the age of 18-24 months after birth.[36] Malnutrition impairs the growth of the brain and reduces the number of brain cells and brain size and is associated with a correlation of 0.40.[37] Deficiency of iron reduces the number of dopamine receptors and this impairs dopamine neurotransmission, which in turn impairs learning and brain function in adult life. Fatty acids are essential for growth and efficient brain functioning; about half of these acids are acquired in utero and the other half postnatal in the first 12 months of life from breast milk; these fatty acids are not present in cow milk or most infant formulas. This is one of the reasons for better IQ in breastfed infants.[38]

Alcohol intake by a pregnant woman during pregnancy leads to a child with unstable mind and poor memory.[39] The more alcohol a woman consumes during pregnancy, the poorer the child's motor coordination, speed of information processing, attention, reasoning, intelligence and achievement test scores during the preschool and school years.[40] In adolescence and early adulthood, fetal alcohol spectrum disorder (FASD) is associated with persisting attention and motor deficits, poor school performance, trouble with the law, inappropriate sexual behavior, alcohol and drug abuse and long lasting mental health problems.[41] Alcohol consumption during pregnancy interferes with the cell duplication and their migration in the primitive neural tube. EEG and MRI report reveals reduced brain size, damage to many brain structures, and abnormalities in brain functioning, including the chemical & electrical activity involved in transferring messages from one part of the brain to the other.[42] Also the body uses large quantities of oxygen to metabolize alcohol. In a pregnant woman who is heavily drunk large quantity of oxygen are drawn away and insufficient amount reaches the cell of the developing fetus.

Maternal cocaine abuse can cause neurodevelopmental defects and predisposes the fetus to behavioral alterations and neuropsychiatric disorder later in life[43]. Long term cocaine exposure has been proved to cause uterine and umbilical blood flow disorders, fetal growth restriction and hypoxia. It reduces the capability of cerebral blood vessels to vasodilate and heart rate to increase during acute hypoxia.[44] It has also been shown that cocaine exposure can change the neurotransmitter function. Dopamine rich anterior cingulate cortex is a target of cocaine during intrauterine life. Therefore the ability to exhibit normal attention to the informational content of competing stimuli is reduced.[45]

Researches consistently indicate that when the woman experience severe emotional stress during pregnancy, the fetus is at risk for a wide variety of difficulties. Stress hormones cross the placenta causing dramatic rise in fetal heart rate and activity level.[46] They may permanently alter fetal neurological functioning, thereby heightening stress reactivity in later life.[47] It has also been observed that there is decreased DNA methylation of the corticotrophin – releasing – factor (CRF) gene promoter and increased methylation of glucocorticoid receptor (GR) exon I7 promotor region in hypothalamic tissue of adult male mice born to gestationally stressed female mice. These epigenetic modifications are the result of exposure to stress during the early stages of prenatal development and may involve dysregulation of placental gene expression.[48]

During the 4th month of pregnancy when all the *Indiryas* (senses) develop in the fetus, the fetus yearns for various objects of *Indiryas* like hearing good music, pleasant touch, tasty food. Fragrance etc., which are expressed through the longings of the mother. This condition is known as "*Dauhrida"*. Fulfillment of the *Dauhrida* (desires of the mother) leads to development of a fetus having best qualities. On the other hand, non fulfilment of *Dauhrida* is called *Dauhrida Vimanana*[49] and suppression of the *Dauhrida* (fetal desire) leads to various abnormalities in the fetus.[50] Effects of the various dietetics and mode of life style of mother upon the fetus is explained in ancient ayurvedic texts. A regular intake of wine results in excessive thirst, short memory &

fickle mindedness in child; meat of iguana daily can cause bladder stones, gravel or dysuria in child. Use of hog's meat (pork) often leads to red eyes, rough body hair, obstructed breathing & snoring in child; daily use of fish causes fixed eye or delayed dropping of eyelids; excessive use of sweet can cause *prameha* (urinary disorders), obesity and dumbness in child; excessive sour results in *raktavata* (bleeding diathesis), skin and eye disorders; excessive daily use of salty food can cause early wrinkling, graying of hair and baldness in child; excess of *Katu* (pungent) articles can lead to infertile progeny with weak & scanty *Shukra* (semen); excessive use of *Tikta* (bitter) can cause emaciation (*Shosha*) or edema (*Shopha*), weak, shraggy and poor digestive power in child; excessive use of *Kashaya* (astringent) results in dark complexion, *Anaha* (flatulance) and *Udavarta* (eructations),whereas use of diseases causing articles can lead to various types of diseases in progeny depending upon their etiology.[51, 52] Suppression of the mother or fetal cravings lead to vitiation of *Vata Dosha* which can adversely affect the growing fetus and lead to various physical and mental deficits. Suppression of the mother's longings may lead to emotional stress, which again can adversely influence the fetal development. Maternal cravings of various eatables might be indicative of various nutritional deficiencies and non-availability of that may lead to malnutrition in mother and various short term and long term suffering in child.

CONCLUSION

The guideline described for preconceptional care mentioned in *Ayurvedic* texts emphasizes that nutrition and lifestyle factors play an important role in pregnancy outcome. In addition to adequate nutritional intake, it is mentioned to have appropriate levels of physical activity and proper lifestyle throughout pregnancy to minimise detrimental health risks. Diet of pregnant mother and her lifestyle plays a key role as a modifying factor in the birth outcome, but the precise content of the intervention is yet to be elucidated.

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Cite this article as:

Gupta Shilpy *et al*. Effect of maternal diet and lifestyle on fetal outcome: Evidences from Ayurveda: a review. Int. J. Res. Ayurveda Pharm. 2018;9(4):136-139 http://dx.doi.org/10.7897/2277-4343.094129

Source of support: Nil, Conflict of interest: None Declared