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REVIEW ARTICLE

AN AYURVEDIC PERSPECTIVE OF LOW BIRTH WEIGHT – A CONCEPTUAL STUDY

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ABSTRACT

Low Birth Weight neonates are the neonates with birth weight less than 2500grams. In India 6-8 billion LBWs are born annually.[1]Blending of concepts from Contemporary and Ayurvedic disciplines, in an attempt to find solutions to problems of management of LBW is the need of the day. In this paper, description of the conceptual basis for understanding Low Birth Weight based on literary survey and analysis was presented. There is vast literature available in contemporary science about the aetiologies, pathogenesis, physiological variations, management interventions etc. in LBWs'. Breast feeding is an important asset against neonatal morbidities and mortalities in LBW's, in developing countries.[2] Among the available, contemporary breast feeding interventions there is a lacuna in understanding measures to enhance the breast milk to suffice the greater nutritional demands of LBWs. In Ayurvedic literature many measures are mentioned to cater to the needs of LBWs like measures to enhance breast-milk, under the heading of stanya vardhak yogas.[3]However we do not find direct references of LBW in Ayurveda. This study intends to fill in the lacunae of both the disciplines by knowledge integration, hereby drawing out the likely Nidanapanchakas and Ayurvedic principles of management, for this condition.

Keywords: Low birth weight, Nidan panchaka, Stanya vardhak yogas.

Key messages

1. Measures like Garbini paricharya are preventive measures against Low Birth Weight.
2. Stanya vardhak upaya can prove to be one of the beneficial means to correct the deficits of LBWs.

INTRODUCTION:

Babies with a birth weight less than 2500 grams irrespective of their period of gestation are termed as Low Birth Weight babies, which include the preterms (a baby with a gestational age less than 37 completed weeks) and Small For Dates (babies with birth weight less than 10th percentile for their gestational age). Low birth weight babies form the most vulnerable group of neonates.[4] Globally, about 20.6 million Low Birth Weight neonates are born each year. LBW infants are at higher risks of early growth retardation, developmental delay, infectious diseases, and death during infancy and childhood.[5].In Ayurvedic classics a direct reference of Low Birth Weight Babies is not

available yet Ayurvedic treatment principles could be pertinent in the management of this condition hence an attempt was made to study this condition in Ayurvedic perspectives.

AIMS AND OBJECTIVES:

1.To review Low Birth Weight in an Ayurvedic standpoint 2.To discuss Ayurvedic Management plan for this condition.

MATERIALS AND METHODS:

Classical texts of Ayurveda related to Kaumarabhrutya, texts on Pediatrics, journals, online sources like pubmed and WHO websites were explored.

The conceptual basis: In Ayurveda any pathological condition is studied under the headings of Nidana(etiology), Purvaroopa (prodromal symptom), Samprapthi(pathogenesis), Roopa(symptomatology) , and Upashaya (beneficial therapeutic trial) which are together termed as Nidana Panchaka.

Nidana (Predisposing Factors): In Ayurvedic classics some of the Garbini janya hetus(maternal causes) of LBW are:-

Garbhini aharas (Maternal diet): Consumption of Katu ahara(pungent food), results in durbala apathya(weak progeny).[6]

Garbhini Vihara(maternal modes of life): Utkutaasana(squatting) and vishama aasanas(abnormal postures) if not avoided may lead to akaala prasava(premature delivery) or garbha shosh(IUGR)[7], due to vitiation of Vata.

Garbhini vyadhis(maternal disorders): Garbini Akshepa(pre-eclampsia) leads to placental insufficiency which may cause LBW.[8]

Jaataharinis(maternal afflictions by supernatural causes): Stambini jataharini, which manifests as, loss of quivering of the fetus, resembling symptoms of garbhakshaya(IUGR), may lead to LBW.[9]

Garbhini Chikitsas (maternal treatment modalities): Certain procedures like nasya(nasal medication) and basti(enemas) are contra-indicated in the pregnant women as they cause heen angata(reduction in body parts) and various disorders of Vata in the fetus which could be co-related to LBW.[10,11]

Among the modern etiologies of Preterm and Small For Dates, maternal causes are the most significant ones as enlisted in Table no 1.

Table no.1: Showing maternal causes of LBW[12]

Maternal causes for LBW	Related Ayurvedic concepts	Probable Causal Relationship
Very young or advanced maternal age	Athi baala, athi vruddha[13]	Poor status of dathus,(In athibaala inability to mobilize fats [14]while in athi vruddha dathus with poor vitality due to Vata[15]) is the cause of LBW.
Short stature	Athi Hrsva (one of Ashtau ninditiya)[16]	Altered physiology of Astau Nindit leads to poor maternal as well as fetal growth.[17]
Poor weight gain during the latter third of pregnancy	Lack of Maansanumasik Garbiniparicharya(regimen for pregnant women)	6 month onwards Ac Sushrutha prescribes medicated ghee and on the 8th month prescribes enema with the aim of vata shaman along with the usual kapha vardhan which was brought about by the regime for the initial 5 months to ensure optimal growth of the fetus.[18]
Lack of ANC		
Nulliparity	Vandyata (one who has not concieved)[19]	Sheeta guna of Vata brings about stambana in the yoni in Vandhyas which prevents raja pravrutti. In case pregnancy occurs, this pre-existing stamba guna could be responsible

		for the improper flow of nutrients to the fetus.[20]
Illness during pregnancy	Sanchari rogas[21]	Placental perfusion is reduced by the nitric oxide released in the advent of infections which inturn leads to utero placental insufficiency.[22]
Lower socio-economic status	Low caste.[23]	The nutritional demands of the pregnant woman not satisfied owing to the economic crisis in the family.
Racial	Jati prasakta bala	In some of the races wherein the staple diet supplies less nutrients and the bala is inherently low, LBW is prevalent.
Multiple gestation	Yamala garbhas (twins) produced by pravruda Vata[24]	This increased Vata, could be responsible for giving rise to stretch mechanisms which induce preterm labour leading to LBW of prematurity.[25]
Uterine and placental abnormalities	Garbhotpatti samagri, of which kshetra (uterus).[26]	The vitiation of site eg. by fibroids lead to insufficient endometrial surface area for placental invasion and growth, leading to inadequate placental perfusion.[27]
Placental anomalies	Apara[28]	Poor placental growth limit the placental supply of growth promoting hormones like human placental lactogen and also affect feto-maternal nutrient exchange.[29]
Drug abuse	Garbhaupghatakara bhavas(feto-toxic agents)	Athi guru, ushna,tikshna drugs[30]which are opposite to the properties of oja(essence of all tissues), of fetus which when reduces results poor development.

Purvaroopa (prodromal features): The antenatal changes, occurring in the fetal stage could be framed under purvaroopa of low birth weight. These changes could be governed by the mahabhutas(basic elements) which are derived from the parents (matruja-pitruja bhava), maternal diet (rasaja bhava), those surrounding the soul (atmaj bhava).These are responsible for organogenesis as well as production of various components which convert a unicellular zygote into a multi-cellular, multi-organ fetus.[31]

Vayu Mahabhuta Vikruti (Abnormal fetal growth): Vayu mahabhuta(air element) in normalcy is responsible for Dathuvyuhan(tissue-genesis) which is brought about by increase in cell number which occurs by vibhajan(cell division). Thus any abnormality in this component results in abnormality in the cell division. The period of fetal growth is from the end of embryogenesis until term. In early trimester growth occurs primarily by increased cell number (hyperplasia). Thus the insults occurring during the embryonic period lead to a global reduction in fetal growth.[32]

Jala Mahabhuta Vikruti (Fetal water component reduction): Jala mahabhuta(water element) is responsible for generating kleda(moisture).[33]Thus a reduction in this manifests as reduced water content in the LBW fetus as ascertained by modern researches[34].

Parthiva Mahabhuta Vikruti(Fetal mineral component reduction): The pruthvi mahabhuta(earth element) is responsible for the formation of Asthi(bones).[35]Its abnormality manifests as reduction in the linear growth due to poor development of the asthi dathu leading to Low Birth Weight. It is found in recent researches that fetal calcium content and bone

density area and circumference increase exponentially in relation to linear growth.[36]

Agni Mahabhuta Vikruti(Fetal enzyme deficiency): Agni mahabhuta(fire element) in normalcy is responsible for pakti(digestion) [37], which when reduced leads to improper digestion thus limiting supply of energy. Enzymes like insulin are required to digest the glucose and convert it into stores of energy ie glycogen. Low energy sources lead to poor growth. According to modern science, the lower fetal plasma concentrations of glucose and insulin, which are principle regulators of glycogen synthesis, lead to marked fetal glycogen deficiency, which continues to infancy.[38]

Mans Dathukshaya (Muscle mass reduction): Non fat dry weight and nitrogen contents which are predictors of protein content, have linear relation with fetal weight. Among the SFDs, protein contents are reduced for body weight primarily as a result of deficient production of muscle mass.[39,40]A reduction in muscle mass can be correlated to mans kshaya(reduction in muscle tissue) which might occur due to uttarottar dathukshaya(sequential tissue reduction).

Some of the symptoms mentioned in Ayurvedic Classics which could be inferred as purvaroopas(prodromal symptoms) of LBW are as follows-

Vata abhipanna Garbha: The fetus not filling the uterus and with reduced quivering due to affliction by Vata is termed as Vataabhipanna Garbha.[41] which could give rise to LBW.

Garba shosha: Garbha shosha is a condition occuring due to the drying action of vata[42], may result in LBW.

Upavishtak: Fetus not achieving adequate growth due to maternal per vaginal discharges in small quantities and continues quivering and the size of abdomen remains unaltered is termed Upavishtaka.[43,44] This condition if not treated can lead to LBW.

Nagodara and Upshushkak: The fetus showing reduction in quivering and size due to vata vriddhi due to Vataj ahara and vihara(food and modes vitiating Vata) taken by the pregnant woman is termed as Nagodara. The same is termed as Upsushkak which is caused by severe maternal per vaginal discharge leading to reduction in quivering and abdominal size.[45,46]

Garbha kshaya: Garbhakshaya manifests as loss of quivering and decrease in the fundal height.[47]This condition denotes IUGR and could end up in LBW.

The Nidana of almost all the conditions mentioned in the purvaroopas ie Vata abhipanna Garbha, Upavishtak, Nagodara, Upshushkak, Garbha kshaya are Vata Vruddhikar aharas or viharas.

Samprapti (Pathogenesis): The pathogenesis of LBW is considered as multifactorial in modern science.Keeping the Ayurvedic principles in mind the samprapthi can be simplified as shown in illustration no. 1. Matruja-pitruja(parental), atmaja(soul) and rasaja(dietary) bhavas(characters) are the sources of mahabhutas(basic elements) for the fetus any abnormality in the source manifests as altered anatomy and physiology. Maternal ahara rasa(nutrient portion) is divided into 3 components in a pregnant woman the 1st component nourishes her body, the second nourishes her fetus and the third part carries nourishment to the breasts.[48] Thus when the maternal nutrient supply itself is affected then both placental nutrition as well as nutrition via breast milk are affected. In the preterms Vata vruddhi due to ahara(diet) and vihara(modes) or daiva(supernatural) etiologies, brings about early expulsion of the fetus.

Illustration no. 1: Sampraphti Flow Chart

Matruj Pitruj Atmaj hetu ⇩ Reduction in the panchbhautik tatvas. ⇩ Affects formation of body components ⇩ Fetal anatomy and physiology altered ⇩ Body components are reduced ⇩ **IUGR LBW**	Rasaj hetu ⇩ Vata vriddhi & Kapha kshaya ⇩ Poor nutrition delivery by the placenta ⇩ Poor ahara to the fetus ⇩ Emaciation of the fetus ⇩ **IUGR LBW**	Ahara vihara daiva hetus ⇩ Vata vruddhi ⇩ Early initiation of Aavi labour pains ⇩ Expulsion of immature fetus ⇩ **PRETERM LBW**

Roopa (Symptoms): The postnatal manifestations in the LBW neonates could be enumerated under Roopa. Some of the features found in Ayurvedic classics which could be co-related to the features of LBW babies is as follows-

Mrutyu (Neonatal Mortality): There is a higher incidence of neonatal mortality among the LBW neonates which is also seen in the clinical features of Jataharinis like:- Pisachi, Yakshi, Asuri, Kaali, Varuni, Shashti, Bhiruka, Yamya, Matangi, Bhadrakali, Raudri, Vardhika, Chandikaa, Kapaalmaalini, Pilipicchika etc.[49]

Krushangata (Emaciation): This is present in Baala Karshya secondary to viras Vatasansrushta dugdha.[50]

Hypoglycaemia: Early hypoglycaemia upto the first 3 days of life in LBWs is a result of diminished hepatic and skeletal glycogen stores, while the hypoglycaemia which can occur repeatedly upto weeks is caused by fasting ie poor nutrition to the neonate this induces protein breakdown which further leads to poor muscle mass.[51] The vata dries up the nutritive kapha in the ahar ras reaching the fetus hence it is found devoid of madhuryata and certain components eg. Glucose. This vitiated ahara rasa(nutritive component) when given to the fetus after birth in the form of non–nutritive stanya(breast milk) is responsible for the continued deficiency of nutritive kapha and components like glucose manifesting in hypoglycaemia in the neonates. Hypoglycaemia precipitates seizures which can be equated to gatra sfuran which is found in vata vruddhi.[52]

Hypothermia: Rapid heat loss occurs as a result of large head to body ratio, thin layer of subcutaneous fat, CNS depression which if persists for longer duration causes hypoglycaemia.[53]Hypothermia could be due to vata vruddhi by virtue of its sheetaguna(cold property).[54]

Polycythemia: SGAs manifest an increased incidence of polycythemia. Increased viscosity interferes with normal tissue perfusion and thus contributes to hypoxia and hypoglycaemia.[55] Rakta dushti(vitiation of blood) occurring due to vitiated kapha brings about ghanata(viscosity).[56] Rakta having the function of jeevana(life giving) which could be

co-related to the supply of oxygen and other vital nutrients.

Depressed immune-function: The immunologic functions of SGA may be depressed at birth and persists into childhood due to the post natal onset of malnutrition. This has been demonstrated by lower immunoglobulin levels and an attenuated antibody response to oral polio vaccine.[57] Depressed immune function in the LBWs could be due to poor uttarottar dathu poshan(sequential tissue nourishment) and ultimately poor production of oja(essence of tissues).[58]

Hypocalcemia: Stressful birth further depletes the already low stores of calcium and precipitates hypocalcemia.[59] To combat klesha(stress) there is a role of asthi dathu(bones tissue). During the formation or later in utero the pre-existing asthi kshaya(reduction in bone tissue) that is present in the fetus due to poor parthiva(earth) component is exaberated in the LBW neonate owing to stress in the form of birth, etc which might be the cause for hypocalcaemia.

Discussion: Having discussed the Nidana(etiology), Purvaroopa(prodromal symptoms), Roopa(symptoms) and Samprapthi(pathogenesis) of LBW, the management is hereby discussed**.**

Upashaya(beneficial therapeutic trials): The measures which could be taken as preventive aspects should be done in the purvaroopa stage itself ie. antenataly as follows-

Upashaya for Garbh shosh and Vata abhipanna garbha: Administration of bruhaniya(anabolic) drugs, mansras(meat soup) dugdha(milk)etc. prevents low birth weight.[60]

Upashaya for Upvishtaka and Nagodar (or Upshushkak): Administeration of ghee prepared with Madhura(sweet), bruhaniya(anabolic) and vatahara drugs is prescribed in these conditions.[61] These conditions are mainly caused by Vata which gets aggravated due to the per vaginal bleeding.[62] and therefore for the treatment of vatadhikya in these conditions use of dravyas from Vidaryadi gana etc. is advocated.[63]

Upashaya for Garbhakshaya: Ksira basti(enema with medicated milk) is advised to be administered in the eighth month.[64]

Those measures which are carried out post-natally are as follows-

Upashaya for Hypoglycaemia: Blood glucose concentrations should be maintained greater than 50 mg/dl, by early enteral feeds or intravenous glucose.[65]This deficiency of glucose is caused by the kaphakshaya. Madhura rasa(sweet substance) brings about kaphavruddi thereby correcting the deficit which has occurred in-utero or by the stanya. Madhura ras pradhan (carbohydrate rich) stanya vardhakas like, Vidari(*Puereria tuberosa*) could help to rectify the glucose deficiency.[66]

Upashaya for Hypothermia: LBW neonates should be nursed thermo-neutral environment for which they are placed under radiant warmers etc.[67]Ayurvedic measures like shiropichu and abhyanga mentioned for all newborns in Navjata Shishu Paricharya(neonatal care) are known to protect against hypothermia by preventing evaporation, and this could be applicable even to the LBWs who are at greater risks of hypothermia.

Upashaya for Polycythemia: Polycythemia is managed by correction of hypoxia and hypothermia. Additionally partial volume exchange transfusion to lower the hematocrit and minimise risks may be required.[68] The plasma volume of SGAs is 52ml/kg as opposed to 43ml/kg in the terms which becomes equivalent by 12 hours of life.[71]therefore in Astanga Hrudaya there is a

reference to give Ananta mixed with ghee and honey on the first day (ie. in the 1st 12 hrs of life) for three times. Ananta is a synonym for numerous substances but in the context of Small for dates, conidering Ananta as Sariva(*Hemidesmus indicus*) which by virtue of rakta prasadan karma corrects this rakta dushti would be ideal.[69]

Upashaya for Depressed Immune functions: The concept of immune-boosters is unique in Ayurveda. Immunity is improved by oja vardhana which is brought about by the Grutas(ghee) which are prescribed in Navjata shishu Paricharya(neonatal care) as well as those prescribed in other contexts for the neonates. Honey is a universal antigen when given on the first day stimulates the early production of antibodies.[70]

Principles of Management: In Ayurveda the management is based on Samprapthi Bhanga (resolve pathogenesis)

1) **Preventive**: **Antenatal measures**- These include Garbini paricharyas(pregnancy care) designed by our Acharyas to ensure optimal nutrition to the mother thereby improving her ahara rasa(nutritive component) and the nutrition being supplied by placenta to the fetus.
2) **Therapeutic**: Postnatal measures

Vata Shamana: Among the Samprapthi ghatakas(constituents of pathogenesis), Vata dosha is the most important one, which having undergone an increase brings about karshyata (emaciation) and nisarata ie reduction in saumya component of the fetus and the neonates which has to be corrected by vatashamana.[71]

Kaphavardhana: The secondary dosha involved is Kapha which due to diminution, generates symptoms of kaphakshaya like daurbalyata(weakness) etc. which is exhibited in LBWs. The important functions of providing gaurav(heaviness) and bala(strength) to the body is the primary function of Kapha which is not attained due to its vitiation.[72]Thus kapha vardhaka upayas(measures to increase kapha) are also to be taken into consideration.

Dathuvardhana: Rasa dathu- Rasa dathu is responsible for both sthaulyata(obesity) and karshyata(leanness). The karshyata which is seen in the LBWs could be attributed to ras kshaya.[73]The main function of rasa dathu is to bring about preenana(nourishment) of the other dathus, which is not achieved due to its kshaya.

Mamsadi dathu-Poor ras dathu as well as poor agni ends in uttarottar dathukshaya(sequential reduction in the tissues) in these neonates, which needs to be corrected by measures which will ensure an improvement in all dathus. Thus the Rasayana Aushadas(rejuvenating medications) which bring about Rasadi dathu ayana(increase in Ras and subsequent dathus) should be adopted.[74]

Oja Vardhana/Bala vardhana-Measures to improve Oja(essence of tissues) should be adopted simultaneously as LBWs require tushti (satiety), pushti(nutrition) and balavardan (immune booster) which are functions of Oja.[75]

Stanya Vardhana-Breast milk is the best for all new born babies, irrespective of their birthweight and gestation.[76]Stanya(breast milk) an updathu (product) of Rasa dathu, is derived from ahar ras of mother.[77]Stanya has properties like jivana (tonic), brmhana (stoutening), satmyata (wholesomeness), snehana (unctousness) etc. which bring about balavardhana (increase in strength and immunity) in the infant.[78] Shudha kshira (pure milk) has the qualities which confers avyahat(undisturbed) bala(strength), anga(body parts), aayu(long life), arogya(health) and vardhan(growth) to the

infant.[79] The same when enhanced with Stanyavardhaka aushadas are likely to improve the immediate and long term health and wellbeing of the Low Birth Weight babies. All the therapeutic measures like Vatashamana, Kaphavardhana, Dathuvardhana, and Rasayana could be brought about by selecting appropriate Stanya vardhaka dravyas.

CONCLUSION:

The Ayurvedic antenatal precautionary measures such as garbini paricharya, as well as postnatal measures such as navajata paricharya (neonatal care) and most importantly Stanya vardhaka yogas (galectogoggues) to improve the nutrition and related problems of LBWs can be used to create powerful new approaches to sustainability in the management of LBWs.

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