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CHAPTER – I

INTRODUCTION

1.1 CONCEPT OF LOW BIRTH WEIGHT BABIES

“A HEALTHY BABY IS A SURE FUTURE”

(World Health Organization)

Children constitute the most important and vulnerable segment of our population. They are truly the foundation of our nation. Hence the focus of every citizen should be to promote their health and safeguard their interests. So every unborn child should be allowed to achieve his/her optimal growth and development potential so that he can effectively contribute towards nation’s productivity. The future of our nation depends on the way in which we nurture our children today.

Marlow (1988) stated that the birth of an infant is one of the most awe inspiring and emotional event that can occur in one’s life time. After nine months of anticipation and preparation the neonate arrives amid a flurry of excitement. The new human being affects the lives of the parents and also other members of the family. If the neonate is not the robust, healthy, lovable infant as expected, parents find it difficult to cope with these changes and feel varying degree of turmoil and anxiety.

Low birth weight is more common is developing countries than developed countries which significantly contribute to both neonatal and perinatal
mortality. According to the WHO, babies with a birth weight of 2500 gm or less should be designated as low birth weight (LBW) babies. The term, very low birth weight, refers to a birth weight between 1000 - 1500 gm, and extremely low birth weight to a birth weight less than 1000 gm. The term, micro preemie, is being applied for babies below 500 gm birth weight.

Preterm baby constitutes two-thirds of low birth weight babies. The incidence of low birth weight baby is about 20-25%. In affluent societies and in the developed countries, the incidence of the former is less than 10%.

Low birth weight continues to be a major public health problem in India. 80% of all neonatal deaths occur in low birth weight babies. The reason for this is obvious as most deliveries occur in rural areas where low birth weight babies are deprived of optimal equipment and trained personnel for these deliveries. Even proper referral and transport services are not available (CSSM 1998). Therefore unless some drastic measures are adopted it is unlikely that India will achieve the committed target of 10 percent of low birth weight babies by 2000 AD.

Park K (1997) The incidence of low birth weight varies between religions, countries and within areas of the same country. WHO (1991) estimates that 7% of all within the world are low birth weight with a contributory low birth weight rate of 19% in developing countries and 7% in developed countries. Neither the incidence of low birth weight nor the risk attached is spaced
evenly around the globe. In some countries third of all babies born are low birth weight and 50% of them do not live to see their first birth days. Therefore the best way to reduce the infant mortality rate would be to reduce as many low birth weight babies as possible. Babies who fall in category of low birth weight suffer adversely because of physiological handicaps like difficulty in maintaining temperature, respiration, inability to suck, proneness to infection due to reduced humoral and cellular immunity and consequent disorders.

**Malik (1997)** There are several factors interplaying for its causation. It is mostly due to maternal factors such as less age of mother, illiteracy, low socio economic condition, maternal weight below 40 Kg, low maternal nutrition, maternal illness, frequency of child birth and inadequate spacing. Hence the strategy needs to focus attention on improvement of maternal nutrition, education in order to facilitate birth weight gain during pregnancy, curtailing parity and regular antenatal care which would be possible to reduce the incidence of low birth weight.

**Bhargava (1980)** The mortality amongst babies of birth weight 1000 gm. or less is 85-96%, 1001 to 1500 gm is 30-50% & 1501-2000 gm is 8.1-31.3% respectively. The major causes of death are asphyxia, pulmonary diseases, infection and hypothermia. The smaller the infant the lower is the survival rate. Therefore for his/her survival the baby needs specialized care. In fact
many deliveries are conducted in rural areas where sufficient equipment and facilities are not available to give adequate care. Moreover, mothers of such babies have lack of knowledge about the care of such delicate babies which places a greater risk of neonatal death.

**DEFINITION OF LOW BIRTH WEIGHT BABIES**

According to **WHO**, babies with a birth weight of 2500 gm or less should be designated as low birth weight (LBW) babies. The term, very low birth weight, refers to a birth weight between 1000 gm, and extremely low birth weight to a birth weight less than 1000 gm and the term, micro preemie, is being applied for babies below 500 gm birth weight.

Low Birth Weight babies may either be due to prematurity or intrauterine growth retardation.

**J.E. Park (2004), Marlow (2005), Ghai O.P., Gupta Piyush, and Paul V.K, Wongs (2006), Dutta (2008)** defined low birth weight babies “as one whose birth weight is less than 2500 gm irrespective of the gestational age”. Very low birth weight infants weight 1500 gm or less and extremely low birth weight infant weigh 1000 gm or less.

**GLOBAL SCENARIO OF LOW BIRTH WEIGHT BABIES**

World-wide, some 20 million of the 129 million infants born in 1985 had low birth weight. Nineteen million of the low birth weight infants are born in developing countries. The incidence of low birth weight infants is not evenly
spread around the globe. It ranges from 4 - 5% in the most developed countries to almost 50% in some of the least developed countries. For the world as a whole the average for 1986 was estimated to be 15.6%.

**K. Park (2009) WHO** estimates that globally about 25 million low-birth weight babies are born each year, consisting 14 % of all live births, nearly 93 % of them in developing countries. The incidence of low birth weight varies widely between regions of the world, with levels of 27 % in Southern Asia, 6% in Eastern Asia, 14 % in Africa and 9% in Latin America. The table below shows incidence of low birth weight babies in some developed and developing countries.

**Reported incidence of LBW babies in some developed and developing countries in 2003 - 2008**

<table>
<thead>
<tr>
<th>Name of the Country</th>
<th>Percentage of LBW babies</th>
</tr>
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<tbody>
<tr>
<td>India</td>
<td>28</td>
</tr>
<tr>
<td>Sri Lanka</td>
<td>22</td>
</tr>
<tr>
<td>Thailand</td>
<td>9</td>
</tr>
<tr>
<td>China</td>
<td>2</td>
</tr>
<tr>
<td>Bangladesh</td>
<td>22</td>
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<tr>
<td>Pakistan</td>
<td>19</td>
</tr>
<tr>
<td>USA</td>
<td>8</td>
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<td>Singapore</td>
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<td>Sweden</td>
<td>4</td>
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<td>UK</td>
<td>8</td>
</tr>
<tr>
<td>Switzerland</td>
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</tr>
</tbody>
</table>

The gravity of the problem has now been universally recognized and at the 34th World Health Assembly, the member states of WHO adopted, as part of the global strategy for “Health for All by the year 2000”, the proportion of infants born with a low birth weight as one of the global indicators with
which to monitor progress. The target was reduction in the incidence of low
birth weight to less than 10%.

Birth weight is the most important determinant of perinatal outcome. World-
wide more than 20 million babies are born each year with low birth weight.
This represents 15.5% of all births. In India, 8 million babies are born with
low birth weight. As level of maturity, which can permit the infant to make a
successful transitions to extra uterine environment, is lacking in these
children. They usually require hospitalized care.

**Sushma Nangia** (2008) pointed out of 4 million global neonatal deaths that
occurs annually 98% happen in developing countries. These deaths take
place principally in Asia and Africa and remain unseen by health care
professionals; hence reduction in neonatal mortality depends significantly on
intervention which can be practiced at home. One such health promoting
activity is oil message and Kangaroo mother care for babies.

**Holly Richardson** (2004) the mortality rate of neonatal infants in Bogota,
Columbia was 70%. The babies were dying of infections and respiratory
problems.

**Jeeva Shankar** (2008) pointed out- globally about 8 million infants are born
with a birth weight less than 2500 gram every year, though these low birth
weight infants contribute only 14% of total live birth, they account 60-80%
of total neonatal deaths.
Infant who weighs less than 2500 gm at birth represent about 30% of all live births in India each year. More than half of these are born at term. The goal of the national health policy is to reduce the incidence of low birth weight babies in the country to 18% by the year 1990 and 10% by the year 2000 along with the strategies developed to achieve health for all by 2000 AD.

Dutta (2008) the incidence of low birth weight baby is 30-40% in the developing countries. As such the incidence of preterm baby is about 20-25%. Suraj Gupta (2008) India’s shares are quite substantial 7-10 million. Low birth weight constitutes 30% live birth weights in India. The incidence of low birth weight generally is highest in those countries where the mean
birth weight is low and it varies about 5 - 40% of live birth weight. In India every third infant weighs less than 2500 gm.

The magnitude of low birth weight infants in developing countries is enormous. There are about total 22 million such infants in the world out of which India shares about 7 to 10 million. Low birth constitutes 30% of live births in India.

1.2 (A) PHYSIOLOGICAL PARAMETERS OF NORMAL AND 
LOW BIRTH WEIGHT BABIES

Definition: Infant grows quickly; bodily changes are rapid and profound. Physiological development refers to biological changes that children undergo as they age.

Physiological parameters include the following:

1. **Height:** The normal height of the baby at birth is between 45 to 50 cm and the infant grows 1 inch (2.5 cm) per month whereas in case of low birth weight babies the height is usually less than 44 cm. Between 0 and 6 months, the infant grows 1 inch (2.5 cm) per month to an average size of 25.5 inches (64.8 cm). Between 6 and 12 months, the infant’s birth height increases 50% to an average size at 12 months of 29 inches (73.7 cm)

2. **Weight:** The normal birth weight of baby lies between 2500g to 3500g at birth and the infant gains 1.5lb (680 g) for month whereas
the birth weight of low birth weight baby is less than 2500 g. Between 0 and 6 months, the infant gains 1.5lb (680 g) per month. Birth weight doubles by 5 months. Average 6 month weight is 16 lb (7.257 g). Between 6 and 12 months the infant gains 0.75lb (340 g) per month. Birth weight triples by 12 months. Average 12 month weight is 21.5lb (9752 g).

3. **Head circumference or occipital frontal circumference**: The head circumference lies between 33cm to 35 cm at birth and head circumference increases 0.6 inch (1.5 cm) per month. Between 0 and 6 months, head circumference increases 0.6 inch (1.5 cm) per month to an average size of 17 inches (43.2 cm). Between 6 and 12 months, head circumference increases 0.2 inch (0.5 cm) per month to an average size of 18 inches (45.7 cm). By 12 months, head circumference increases by one-third and brain weight increases 2 ½ times from birth. The head circumference disproportionately exceeds that of the chest. (Normally, the head circumference is greater than the chest circumference at birth and the difference is about 2 cm). However it is less in low birth weight babies.

4. **Chest Circumference**: Chest circumference is normally about 2 cm less than head circumference. However it is less in low birth weight babies.
NEUROBEHAVIOURAL PARAMETERS OF LOW BIRTH WEIGHT BABY

Definition: Neurobehavioural parameters means having to do with the way the brain affects emotion, behaviour and learning. (Source: NCI cancer.gov dictionary)

Neurobehavioural parameters in neonates include attention, mobility, response to visual and auditory stimuli, social and environmental adaptation. Infants with low birth weight have poor neurological competencies. Neurological behavior includes evidence of alertness, visual interest, following responses to sounds, normal tone and strength in the extremities, normal control of head and neck. (Marlow 2004)

Clusters of Neonatal Behaviors in Brazelton Neonatal Intensive Care Unit Network Neurobehavioral Assessment Scale include the following:

Habituation – Ability to respond to and then inhibit responding to discrete stimulus (light, rattle, bell, pinprick) while asleep.

Orientation – Quality of alert states and ability to attend to visual and auditory stimuli while alert.

Motor performance- Quality of movement and tone.

Range of state – Measure of general arousal level or arousability of infant.

Regulation of state – How infant responds when aroused.
**Autonomic stability** – Signs of stress (tremors, startles, skin color) related to homeostatic (self-regulating) adjustment or the nervous system.

**Reflexes** – Assessment of several neonatal reflexes.

The basic component of neonatal neurological examination:-

- Level of alertness
- Cranial nerves
- Motor examinations – tone, posture, motility, power, tendon reflexes, plantar response.
- Primary neonatal reflexes – Moro reflex, palmar grasp, asymmetric tonic neck reflex
- Sensory examination – vision, hearing, smell and taste.

Neuromotor Examination Includes

- Identification of neuromuscular abnormalities.
- Detection of infants at risk for developmental, difficulties for early intervention or follow up.
- The reliability of the assessment depends both on the ability of the tester and stage of the development of the infant. The reliability increases with experience of the observer and with the age of the infant. All neurologic examinations include an assessment of the basic posture and movements of the infant when he was undisturbed and when stimulated.
Due to immaturity of the nervous system, the preterm infants are lethargic and inactive. They have poor neonatal reflexes and uncoordinated sucking and swallowing reflexes leading to feeding difficulties. General activity is poor and neonatal reflexes such as sucking and swallowing are sluggish. There is hypotonia with poor recoil of flexed forearm when it is extended.

Low birth weight babies, have less sharp reflexes, diminished responses to visual and auditory stimuli and other neurological impairments such as attention deficit, difficulty adapting to their environment and reduced motor skills compared with normal birth weight babies.

Marilee C Allen fl et al on “Neuromaturation of multiples” suggested that low birth weight babies, have less sharp reflexes, diminished responses to visual and auditory stimuli and other neurological impairments such as attention deficit, difficulty adapting to their environment and reduced motor skills compared with normal birth weight babies.

Marlow (2004) revealed that the premature infant generally lies inactive, with the arms and legs extended. Reflex activity is not fully developed. Although the fetus sucked and swallowed in utero, the sucking reflex may be absent, minimal or ineffectual and the swallowing, gag, and cough reflexes weak at birth. Coordination of the sucking and swallowing reflexes occurs between 32 and 34 weeks of gestation, therefore, they are not well
developed at birth. Because of these factors, aspiration may easily occur. Other neurologic signs are diminished or absent.

**Neurological Assessment Includes**

(1) Muscle tone                        (2) Joint mobility
(3) Automatic reflexes             (4) Fundus examination

(1) Muscle Tone is assessed by: -
   a) Posture or attitude
   b) Passive tone (popliteal angle and scarf sign)
   c) Active tone (traction response and recoil)

(2) Joint Mobility:

   Less the gestational age, more stiff the joints are. Therefore flexion at ankle and wrist is limited in preterm. At term, joints are relatively more flexible.

(3) Automatic Reflexes develops at different gestational age.

Reflexes are: -
   a) Corneal Reflex: Neonate blinks at sudden appearance of bright light.
   b) Pupillary reflex: Pupils constrict when a bright light shines towards it.
   c) Doll’s eye: As the head is moved slowly to the right or left, eyes lag behind and do not immediately adjust to the new position of the head.
Nose:-

a) Sneeze: There is spontaneous response of nasal passage to any irritation.

b) Glabellar: Tapping on the glabellas causes the eyes to close tightly.

Mouth and Throat:-

a) Sucking: Neonate begins strong sucking movement.

b) Rooting: Touching or stroking the chick along the side of the mouth causes infant to turn the head towards that side and begins to suck.

c) Gagging: Stimulation of posterior pharynx by food, suction or passing tube causes infant to gag.

d) Extrusion: When tongue is touched or depressed the infant responds by forcing it outward.

e) Yawning: It is spontaneous response to decreased oxygen by increasing inspired air.

f) Coughing: Irritation of mucous membrane of larynx and tracheobronchial tree causes coughing.

Extremities:-

a) Grasping: Touching palm or soles of feet near the base of digits causes flexion of hands and toes.
PREDICTORS OF PHYSIOLOGICAL & NEUROBEHAVIOURAL PARAMETERS OF LOW BIRTH WEIGHT BABIES

1. **Genetic & Chromosomal Disorders**

   Certain genetic disorders (short-limbed dwarfism) and chromosomal disorders (Turner syndrome, trisomies) exert their adverse influence early during gestation, reducing both cell number and cell size. The result is hypoplastic Intra Uterine Growth Retardation (IUGR) with reduced growth and developmental potentials.

2. **Maternal age**

   Maternal age has been reported to be a condition that intensifies the possibility of physical hazards during the prenatal period. The reason for this is that as women approaches the menopause, they frequently have endocrine disorders which slows down the development of the embryo and fetus, causing such developmental irregularities as cretinism, Down syndrome, heart malformation, all of which involve physical and internal defects. Premature births are relatively common among very young and unmarried mothers. Past history of preterm births is associated with three to four times increased risk of prematurity in subsequent pregnancies.

   **In Washington**, infants born to mothers less than 20 years of age and older than 34 have a significantly increased risk of LBW compared to
women between 25-29 years. Infants born to mothers younger than 18 years had the highest rate of low birth weight (8.2%).

**Trivedi (1986)** studied on “Epidemiology of low birth weight” found that the mother’s age was significantly associated with low birth weight. Younger mothers (15-25) years have 26.59% of low birth weight babies.

**Samiran et al (2006)** in her study regarding “The Effect of Maternal Age and Parity on birth weight among Bengalese of Kolkata, India” showed that the young mothers had 2.9 times more risk than those mothers aged between 19-28 years of delivering LBW babies. Similarly, young (<19 years) mothers had three times more risk of delivering Low Birth Weight babies compared with older (29 years) mothers.

**Dalton Conley (2006)** in her study “Birth Weight and Income: Interactions across Generations” showed that the socio-economic and demographic factors affecting birth weight are maternal age (such that women under 20 and over 35 are at a higher risk of delivering a low birth weight infant).

**Mondal B (1998)** in his study “Low Birth weight in relation to sex of baby, maternal age and parity: a hospital based study” on Tangsa tribe
from Arunachal Pradesh quoted that Young mothers (less than 20 years) had also higher incidence of low birth weight babies.

3. **Parity**

It has been found that the first born baby to be significantly lighter than the second born. Some previous studies have reported an increase in birth weight with every successive birth order. Others found birth weight to increase from birth order 1 to birth order 3 but to decrease after that.

**O.P Ghai (1980)** in his Literature “Maternal Factors in the epidemiology of low birth weight” reported the incidence of low birth infants increased in grand multipara particularly beyond 4th parity.

4. **Maternal Education**

Infants born to women who had not completed high school had a significantly higher low birth weight rate (6.7%) than infants born to mothers with some college education (4.9%).

**Deshmukh (1998)** conducted cohort study on “low birth weight and associated maternal factors in an urban area” with a sample of 210 pregnant mothers revealed that maternal education is a significant factor for low birth weight babies.
5. **Maternal Nutrition**

Maternal malnutrition can play havoc with normal development, especially the development of the fetal brain. Excessive smoking and drinking are detrimental to normal development especially during the period of embryo and fetus. Maternal nutrition, drug intake/abuse, infection, smoking, exposure to radiation, chronic illnesses – all have a bearing on fetal growth. Mother’s psychological well being is also a very important factor for the well being of the fetus.

Nutritional deficiency of proteins, calories, minerals and vitamins both qualitative and quantitative among mothers considerably retards physical growth and development of fetus and also cause deficiency diseases. Malnourished mothers produce low birth weight babies. A religious and social taboo about certain food stuffs affects markedly the growth and development of the newborn.

6. **Socio economic status**

Well to do families are usually better nourished. Rates of low birth weight increase with decreasing socioeconomic status. This persists across various measures of economic status, including parental occupations, income and education. In addition, women in poverty have higher infant morbidity and morality despite advances in perinatal technology.
Dalton Conley revealed in her study “Birth Weight and Income: Interactions across Generations” showed that poverty increases the incidence of low birth weight babies.


7. Behavioral and Personal Risk Factors

Alcohol, tobacco, and illegal substances are major risk factors for low birth weight, very low birth weight, preterm birth, and other poor infant outcomes. Smoking accounts for 20 to 30% of all low birth weight babies in the United States. Women who smoke have a 3.5 fold increase in IUGR (Intra Uterine Growth Retardation), and newborns of smokers are smaller at every gestational age. In addition, exposure to environmental tobacco smoke increases the risk of low birth weight and preterm delivery among older non smoking women. Illicit drug use increases the incidence of IUGR, preterm birth, and adverse pregnancy outcome, but other risky behaviors associated with drug use, such as smoking and alcohol contribute to overall risk. The Health of Washington State, (2002.)
Samiran et al (2000) in her study regarding “The Effect of Maternal Age and Parity on birth weight among Bengalese of Kolkatta, India” stated the causes of low birth weight are multifactorial among which tobacco consumption has association with low birth weight babies.

Deshmukh (1998) conducted cohort study on “low birth weight and associated maternal factors in an urban area” with a sample of 210 pregnant mothers revealed that anemia, low socio-economic status, short stature, short birth interval, tobacco exposure, low maternal age, low body mass index and primiparity are significant risk factors for low birth weight.

Dalton Conley in her study “Birth Weight and Income: Interactions across Generations” showed that Behavioral factor such as alcohol, drug use by the mother have known to increase the risk of low birth weight babies.

Maternal smoking too has been well documented as a factor increasing the incidence of low birth weight. (Overspent & Moss 1991).

A study on “Maternal bio-social factors affecting low birth weight” conducted by Malik et al (1997) to assess the influence of some of the maternal bio-social on the variance of birth weight and found strong correlation existed between birth weight and maternal height, weight, age, antenatal care visit and risk status at pregnancy. A short
malnourished, young, unregistered or primipara mother was associated with a higher rate of low birth weight.

8. **Sex of the baby**

   Sex is determined by conception after birth; a male is both longer and heavier than the female infant. Girls mature earlier, reach the period of rapid growth than boys and are taller on the average.

   **Mondal B (1998)** in his study “Low Birth weight in relation to sex of baby, maternal age and parity”: a hospital based study on Tangsa tribe from Arunachal Pradesh found that the female babies had a significantly higher incidence of low birth weight than the male babies.

   A epidemiological co-relation study by **Kamaldas and Sampath Kumar (1992)** on “Epidemiological co-relates of low birth weight” on a sample of 328 consecutive births at Christian Medical College, Vellore revealed that female around 25.7% had a higher rate of Low Birth Weight than male – 23.4%. prime parity (36.8%) was responsible for low birth weight and higher percentage (32.5%) among young mothers (19 years). The rate of low birth weight was high in unbooked mothers.

   **Dalton Conley** in her study “Birth Weight and Income: Interactions across Generations” reveals female have a greater risk of Low Birth Weight than the male babies.
9. **Pre pregnancy related Maternal Risk Factor**

Risk factors include the pregnancy conditions such as multiple gestation, twin or more pregnancy, inadequate pregnancy weight gain, perinatal infections such as HIV, Hepatitis B, and sexually transmitted diseases.

*Rajesh kumar et al (1970)* studied on the effect of physical hard work during pregnancy on birth weight reported that physical hard work during pregnancy can lower birth weight by higher energy expenditure in women with marginal nutritional deficiency.

Current research shows a link between periodontal disease in pregnancy and preterm and low birth weight infants. Risk factors for IUGR include maternal medical conditions such as hypertension, renal disease and diabetes. Behaviour such as smoking and substance use and poor nutrition fetal/ placental factors such as placental disease, multiple gestation, infection and genetic disorder.

**HAZARDS OF LOW BIRTH WEIGHT BABIES**

The functional immaturity of various systems result in different clinical problems and their knowledge is essential for the satisfactory management of these babies.

**Central nervous system** - The immaturity of nervous system is expressed as inactivity and lethargy, poor cough reflex and incoordinated sucking and
swallowing in babies weighing less than 1800 gm or born before 35 weeks of gestation. Resuscitation difficulties at birth and recurrent apneic attacks are common. Retrolental fibroplasia due to oxygen toxicity is limited to babies with a gestation of less than 35 weeks. On the other hand, they are more resistant to toxic effects of hypoxia as compared to the term babies. The blood brain barrier, which is possibly a function of available serum proteins, is inefficient in preterm babies, thus brain damage may occur at lower serum bilirubin levels.

**Respiratory system** – The cuboidal alveolar lining in babies with a gestational age of less than 28 weeks results in poor alveolar diffusion of gases and therefore the infant may not be viable. They pose resuscitation difficulties at birth, often followed by hyaline membrane disease, if associated with deficiency of pulmonary surfactant. The breathing is mostly diaphragmatic, periodic and associated with intercostals recessions due to soft ribs, pulmonary aspiration and atelectsits are common.

**Cardiovascular system** – The closure of ductus arteriosus is delayed among preterm infants. About one-third infants with gestational age of 34 weeks or less manifest clinical evidences of patent ductus arteriosus with or without congestive heart failure. Its incidence is much higher among preterm infants with hyaline membrane disease or protracted hypoxia due to any cause.
**Gastrointestinal system** – Due to poor or incoordinated sucking and swallowing there are difficulties in self-feeding, although their digestive ability is generally good. Animal fat is not tolerated as well as the vegetable fat. Regurgitation and aspiration are common because of incoordinated sucking, small capacity of stomach, incompetence of cardio-esophageal junction and poor cough reflex. Abdominal distension and functional intestinal obstruction are due to hypotonia. Enterocolitis occurs when other predisposing factors are present. Immaturity of glucuronyl transferase system in the liver leads to hyperbilirubinemia, which may be aggravated by dehydration, delayed feeding and hypoglycemia. The relatively low serum albumin, acidosis and hypoxia in these babies predispose to the development of kernicterus at lower serum bilirubin levels. The relative deficiency of Vitamin K dependent coagulation factors and increased capillary fragility, especially following hypoxia results in intraventricular or intracerebral hemorrhage. The poor hepatic glycogen stores, delayed feeding, birth asphyxia and respiratory distress syndrome contribute to the development of hypoglycemia.

**Thermo-regulation** – The hypothermia is invariable and life threatening unless environmental temperature is monitored. Excessive heat loss is due to relatively large surface area and poor generation of heat due to paucity of brown fat in a baby who is equipped with an inefficient thermostat.
Infections – Infections are an important cause of neonatal mortality in low birth weight babies. The low levels of IgG antibodies and inefficient cellular immunity predispose them to infections. Excessive handling, humid and warm atmosphere, contaminated incubators and resuscitators expose them to infecting organisms, thus contributing to high incidence of infections.

Renal immaturity – The blood urea nitrogen is high due to low glomerular filtration rate. The renal tubular ammonia mechanism is poorly developed thus acidosis occurs early. They are vulnerable to develop late metabolic acidosis especially when fed with a high protein milk formula. The maximum tubular diluting ability in the newborn is satisfactory but ability to concentrate urine is very poor. Preterm baby has to pass 4 to 5 ml of urine to excrete one milli osmole of solute as compared to 0.7 ml by an adult for the same purpose. Therefore, the baby cannot conserve water and gets dehydrated readily. The solute retention and low serum proteins explains the occurrence of edema in some preterm infants.

Toxicity of drugs – Poor hepatic detoxification and reduced renal clearance make a preterm baby vulnerable to toxic effects of drugs unless caution is exercised during their administration.

Nutritional handicaps – Low birth weight babies are prone to develop anemia around 6 to 8 weeks of age. This is due to diminished total stores of
iron due to short gestation. They may also manifest deficiencies of folic acid and vitamin E. Vitamin E deficiency occurs among infants weighing less than 1500 gm, particularly those fed on iron fortified milk formula. These infants are prone to develop hemolytic anemia, thrombocytopenia, and edema at 6 to 10 weeks of age. Vitamin E being an anti-oxidant, its deficiency state may be associated with oxygen toxicity to the vulnerable tissues in the form of retrolental fibroplasias and broncho pulmonary dysplasia. Rapid growth following adequate feeding may result in rickets unless vitamin D is administered.

**Biochemical disturbances** – These babies are prone to develop hypoglycemia, hypocalcaemia, hypoprotienemia, acidosis and hypoxia.

**COMPLICATIONS OF LOW BIRTH WEIGHT BABIES**

- **Asphyxia** – The babies are likely to be asphyxiated because of anatomical and functional immaturity. Even minor degree of anoxia may produce subserosal haemorrhages especially in the heart, lungs and liver. In addition, it may produce intense congestion of the choroids plexus leading to intraventricular haemorrhage (IVH).

- **Hypothermia** – A low birth weight baby has reduced subcutaneous as well as brown fat. Very often the newborn fails to maintain the thermoneutral range of temperature.

- **Pulmonary syndrome** – This includes: (a) Pulmonary oedema (b) Intra
alveolar haemorrhage (c) Idiopathic respiratory distress syndrome (R.D.S.). The first two are the effects of hypoxia; R.D.S. is one of the major causes of death in preterm babies born before 34 weeks. The deficient lung surfactant is the principal factor responsible for pulmonary atelectasis leading to hypoxia and acidosis.

- **Cerebral Haemorrhage** – The causes are: (a) Soft skull bones allow dangerous degree of moulding leading to subdural or subarachnoid haemorrhage (b) Fragile subependymal capillaries cannot withstand minor degree of hypoxia leading to intracentricular haemorrhage. (c) Associated hypoprothombinaemia.

- **Fetal shock** – Apart from the shock sustained during delivery, it may appear following improper resuscitative manipulation during the first day or two of birth.

- **Heart failure** – It may be precipitated by asphyxia with rapid development of pulmonary oedema which in turn impairs pulmonary aeration and aggravates pulmonary oedema.

- **Oliguria, anuria** – as the immature kidneys are unable to handle water, solute and acid loads.

- **Infection** – Protective passive immunity is usually obtained from the mother during the later month of pregnancy. As the transfer of protective immunoglobulins from the mother to a preterm baby is less, the incidence of infection is increased by 3-10 fold. Both the humoral
and cellular immune response is poor. The common types of infection are bronchopneumonia, meningitis and gastro-enteritis. Inadequate or poor cough reflex not only fails to expectorate out the infected mucus but also favours aspiration of the food. Introduction of sepsis in the gastrointestinal tract is more common in artificially fed neonates.

- **Jaundice** – Because of hepatic insufficiency, the bilirubin produced by the excessive haemolysis cannot be conjugated adequately for excretion as bile, leading to rise in unconjugated bilirubin which is responsible for exaggerated physiological jaundice.

- **Dehydration** and acidaemia due to immature renal function may occur abruptly.

- **Anemia** – Lack of stored iron, hypofunction of the bone marrow and excessive haemolysis all contribute to anemia.

- **Retinopathy of prematurity** is a multi-factorial disorder of the retina caused by abnormal neovascularisation. It is an important cause of blindness of the child under 6 years. The cause is mostly related to the liberal administration of high concentration of oxygen above 40% of a prolonged period (1-2 days) following birth.

**THEORIES & TRENDS IN GROWTH & DEVELOPMENT**

**Synactive Theory of Development Neurobehavioral Subsystems**

Growth refers to a physiologic increase in size through cell multiplication and development refers to physiological and psychosocial and cognitive
changes occurring over one’s life span due to growth maturation and learning. Although each theory may describe only one aspect of development, holistic pediatric care assumes that all are important and need consideration while providing nursing interventions. Traditional nursing place emphasis on interpreting physiologic data as the basis of care giving. Developmentally supportive care uses both physiologic and behavioural information to better understand the needs of infants in the Neonatal Intensive Care Unit (NICU) setting. Behavioural states are highly individualized and formed by experience, maturation, circadian rhythms, and genetic inheritance (Mayes, 2000). The emerging availability and regulation of arousal states mark a balancing of CNS (Central Nervous System) inhibitory and excitatory processes that impact attention states and also mark executive functions (prefrontal cortex) that influence information processing and learning as well as socialization. State organization has been described as a gaiting mechanism that protects the cortex from over stimulation and promotes coordination between attentional, executive, and sensory cortical systems.

Infant responsiveness to environmental stimuli depends on the quality, amount, and availability of particular state of arousal. States can be organized into five levels of arousal. Transitional states such as drowsiness are not considered true state but are in-between levels of arousal in which the infant either moves toward wakefulness or back into sleep.
Distinct sleep and awake states are observable by 28 weeks gestation (Holditch-Davis (1988), Glass(1994)). Young preterm infants spend 70% or more of their time in active sleep. Developmental maturation for the young preterm infant is seen by a decrease in the amount of active sleep with an increase in quiet sleep, awake periods and crying. Around 30 to 32 weeks, quiet alert states with some focused attention can be observed. Before 28 weeks, attempts to attend to stimuli may have physiologic consequences for the immature infant.

Synactive theory of development neurobehavioral subsystems

<table>
<thead>
<tr>
<th>Subsystem</th>
<th>Signs of Stress</th>
<th>Signs of Stability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Autonomic</td>
<td>Physiologic instability</td>
<td>Physiologic stability</td>
</tr>
<tr>
<td>Respiratory</td>
<td>Tachypnea, pauses, grasping, sighing</td>
<td>Smooth, stable respirations, regular rate and pattern</td>
</tr>
<tr>
<td>Color Visceral</td>
<td>Mottled, flushed, dusky, pale or gray hiccups, gagging, choking, spitting up, grunting and straining as if having a bowel movement; coughing, sneezing, yawning.</td>
<td>Pink, stable color Absence of hiccups, gagging, spitting up etc.</td>
</tr>
<tr>
<td>Autonomic</td>
<td>Tremors, startles, twitches</td>
<td>Absence of tremors, startles, twitches</td>
</tr>
<tr>
<td>Motor</td>
<td>Fluctuating tone, lack of control over movement, activity and posture.</td>
<td>Consistent tone, controlled or improved movement, activity and posture</td>
</tr>
<tr>
<td>Flaccidity</td>
<td>Low tone in trunk, limp, floppy upper and lower extremities; limp, drooping jaw (gape face)</td>
<td>Tone consistent and appropriate for postconception age. Well maintained posture.</td>
</tr>
<tr>
<td>Hypertonicity</td>
<td>Arm or leg extensions, arm(s) outstretched with fingers splayed in salute gesture, fingers stiffly outstretched, trunk arching, neck hyperextended.</td>
<td>Smooth, controlled movements.</td>
</tr>
<tr>
<td>Hyperflexion</td>
<td>Trunk, extremities, fisting</td>
<td>Successful motor strategies for self regulation (see self-regulation below)</td>
</tr>
<tr>
<td>Activity</td>
<td>Squirming, frantic diffuse activity or little or no activity or responsiveness.</td>
<td></td>
</tr>
<tr>
<td>State</td>
<td>Disorganised quality to state behaviours, including range of available states, main-tenance of state control, and transition from one state to another.</td>
<td>Easy to read state behaviours that are maintained; calm, focused alertness, well modulated sleep</td>
</tr>
<tr>
<td>Sleep</td>
<td>Whimpering sounds, facial twitching, irregular respirations, fussing, grimacing, restless appearance</td>
<td>Clear, well defined sleep states, periods of quiet, restful sleep.</td>
</tr>
</tbody>
</table>
| Awake | Glazed, unfocused look, staring, worried or pained expression, hyperalert or panicked appearance, eye roving, crying, cry-face, actively averting gaze or closing eyes, irritability, prolonged awake periods, inconsolability, frenzy | Alert with bright, shiny eyes, focused attention on object or person, animated expression (e.g. cheek softening, frowning, “ooh face,” cooing, smiling)  
Robust crying  
Good calming, consolability  
Smooth changes between states, full range of sleep/wake states |
<p>| Other State-Related Behaviors and Attention Interaction | Efforts to attend to and interact with environmental stimulation elicits signs of stress and disorganized subsystem functioning | Responsive to auditory, visual and social stimuli |</p>
<table>
<thead>
<tr>
<th>Autonomic</th>
<th>Physiologic instability of varying degrees with autonomic, respiratory, color, and visceral responses</th>
<th>Responsiveness to stimuli well maintained and prolonged</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor</td>
<td>Fluctuating tone, increased motor activity, progressively frantic diffuse activity if stimulation continues</td>
<td>Actively seeking auditory stimulus, minimal motor activity</td>
</tr>
<tr>
<td>State</td>
<td>Roving eyes, gaze averting, glazed unfocused look or worried, panicked expression, weak cry, cry-face, irritability Closed eyes and sleep like withdrawal Abrupt state changes Signs of stress when presented with more than one type of stimulus at a time</td>
<td>Bright, shiny-eyed, alert and attentive expression Sustained awake and alert state Shifting attention smoothly to more than one type of stimulation</td>
</tr>
</tbody>
</table>

**Self Regulation:** Infant’s efforts to achieve, maintain or regain a balanced, stable and relaxed state of subsystem functioning and integration; success of these efforts will vary among infants depending on maturity, available self-regulatory skills, and overall subsystem organization.

Examples of self regulatory strategies include:

**Motor** – Foot bracing against a boundary or blanket nest, hand holding, grasping hands together, hand to mouth or face, grasping blanket, tubing, tucking trunk, sucking, position changes.

**State** – Lowering state from high arousal to quiet alert or sleep state; releasing energy by rhythmic, robust crying; focused attention and orientation.
Facilitation by caregivers through environmental modifications or developmental care techniques can aid the infant’s own self regulatory abilities when environmental challenges exceed the infant’s capabilities.

**Arousal states**

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deep Sleep</td>
<td>Regular breathing, eyes closed with no movement of eyes under lid, relaxed face, little or no movement or activity except for possible startle response</td>
</tr>
<tr>
<td>Active sleep</td>
<td>Sometimes called light sleep. May see rapid eye movements (REM) under closed lids, low activity level, breathing regular or irregular, occasional sighing or smiling</td>
</tr>
<tr>
<td>Drowsy</td>
<td>Eyes open or closed, unfocused expression, activity level varied.</td>
</tr>
<tr>
<td>Quiet awake</td>
<td>Different qualities of alerting: Bright, shiny appearance to eyes, focused attention, minimal motor activity.</td>
</tr>
<tr>
<td>Robust</td>
<td></td>
</tr>
<tr>
<td>Low Level</td>
<td>Dull or unfocused eyes, little energy, appears to look through an object or caregiver.</td>
</tr>
<tr>
<td>Hyper alert</td>
<td>Wide eyes, panicked expression, may fixate on an object or caregiver very intensely and have trouble breaking away.</td>
</tr>
<tr>
<td>Active awake</td>
<td>Active, eyes open or closed, fussy but not crying robustly</td>
</tr>
<tr>
<td>Crying</td>
<td>Highest level of arousal, agitated, rhythmic and robust crying.</td>
</tr>
</tbody>
</table>

**Blackburn (1998)** Responsiveness to sound and touch is greater during active or light rapid eye movement [REM] sleep, resulting in longer periods of vulnerability to sleep disturbance.

**Holditch-Davis (1998)** Maturation continues throughout the first year of life. By 6 months, the amount of quiet sleep is greater than that of active sleep. By 1 year, infants usually sleep 10 to 12 hours at night and take one to two naps during the day. Preterm infants generally demonstrate shorter
night sleep and awaken more frequently than term infants. Other maturational changes include organization of the standard sleep cycle and electroencephalogram (EEG) sleep patterns comparable to adults. Neurological insults, severity of illness, hyperbilirubinemia, and prenatal exposure to drugs can alter behavioral state patterns.

**TRENDS OF GROWTH AND DEVELOPMENT IN NORMAL & LOWBIRTH WEIGHT BABIES** - trends of growth and development in normal & lowbirth weight babies includes the following:

a) **Directional Trends**: Growth and development proceed in regular, related directions or gradients and reflect the physical development and maturation of neuromuscular functions.

The first pattern is the *cephalocaudal*, or head to tail direction. The head end of the organism develops first and is very large and complex, whereas the lower end is small and simple and takes shape at a later period. The physical evidence of this trend is most apparent during the period before birth, but it also applies to postnatal behavior development. Infants achieve structural control of the head before they have control of the trunk and extremities, hold their back erect before they stand, use their eyes before their hands, and gain control of their hands before they have control of their feet.
Second, the proximodistal, or near-to-far trend applies to the midline-to-peripheral concept. A conspicuous illustration is the early embryonic development of limb buds, which is followed by rudimentary fingers and toes. In the infant shoulder control precedes mastery of the hands, the whole hand is used as a unit before the fingers can be manipulated, and the central nervous system develops more rapidly than the peripheral nervous system.

These trends or patterns are bilateral and appear symmetric each side develops in the same direction and at the same rate as the other. For some of the neurologic functions, this symmetry is only external because of unilateral differentiation of function at an early stage of postnatal development.

The third trend is differentiation, describes development from simple operations to more complex activities and functions. From very broad, global patterns of behavior, more specific, refined patterns emerge. All areas of development (physical, mental, social and emotional) proceed in this direction. Generalized development precedes specific or specialized development; gross, random muscle movements take place before the fine muscle control.
b) **Sequential Trends** – In all dimensions of growth and development there is a definite, predictable sequence, with each child normally passing through every stage. Children crawl before they creep, creep before they stand, and stand before they walk. Later facets of the personality are built on the early foundation of trust. The child babbles, then forms words and finally, sentences; writing emerges from scribbling.

1.3 **PHYSIOLOGICAL & NEUROBEHAVIORAL PARAMETERS AND ITS EMPIRICAL STATUS**

Review of relevant literature formulates a base for any scientific research. It provides the investigator an insight for deeper exploration on the subject and open new ways for study. The review makes the researcher aware about the methods and contents of the problems already investigated and present a diagnostic approach and prepares a solid foundation for the new to be undertaken.

Thus, it is evident that review of relevant literature not only prepares a valid base for future researches but it also pin points the existing gap in the literature which could be filled in by the future researches and thereby advances the frontiers of existing body of knowledge.

The premature transition to extra uterine environment imposes a challenge to pre term that need to maintain stability in a sensory rich environment
therefore creating a stable atmosphere is a crucial stage in creating normal
development of these newborns

**Halpern et al (2000)** stated that preterm infant and children with birth
weight under 2000 gm have a higher incidence of developmental delay. Not
only do developmental outcomes for these children depend on the clinical
signs they present, but also on the kind of medical assistance they receive.
The infants and premature newborns who undergo Kangaroo Mother Care
programme receive sensorial and vestibular stimulation which in turn would
help their neuropsychomotor development.

**Mc Master P etal (2000)** stated in his study that strict adherence to
kangaroo mother care and breast feeding had beneficial effect in reducing
the length of stay and increasing weight gain in very low birth weight
infants.

**Meier PP etal (2003)** supporting lactation in mother with very low birth
weight infants suggested that mothers and father are encouraged to hold
even the smallest ventilated infants in Kangaroo mother care to minimize
apnoea, bradycardia, and hypoxemia that can accompany bolus gavage
feedings.

**Messmer PR etal (2003)** study on effect of kangaroo care on sleep time
suggested that low birth weight baby with the kangaroo care had longer and
deeper sleep periods less agitation few episodes of aponea and bradycardia
and stable oxygen saturation in kangaroo care as compared to babies in incubator.

**Mizuno K et al (2004)** stated in a study that Kangaroo Mother Care results in enhanced infant recognition of own mothers milk and longer breast feeding.

**Moore E et al (2007)** conducted randomized control trial on early mother infant skin to skin contact and breast feeding status. Kangaroo care group stated hunger cues significantly earlier than the control group and as a profound effect on early breast feeding.

**Moore J et al (2000)** stressed the maintenance of body temperature in every newborn’s health recommendations for care for all newborns Washington says that keeping the new born in close contact with mother’s skin to skin is the best as in the kangaroo mother care positions shows skin to skin contact between mother and newborn keeps newborns warmer than using a radiant warmer. The mother is a best incubator because it keeps the baby at the right temperature.

The major problem faced by low birth weight babies is hypothermia due to lack of subcutaneous fat. Hypothermia in a new born baby is defined as a skin temperature of <35.5 Deg C or core temperature of <36 Deg C. It is classified into mild hypothermia (<36.5 to 36.0 Deg C), moderate hypothermia (<36.0 to 32 Deg C) and severe hypothermia (<32 Deg C).
Morton JA (2003) stated that low birth babies under Kangaroo Mother Care provides innumerable benefit to mother and child and has consistently being associated with improved milk production, improved infant growth and competence in breast feeding and extended lactation.

Perlman JM (2007) suggested prolonged hospitalization stress, impairs neurobehavioral outcomes parent infant interaction enhance neurobehavioral development. Kangaroo Mother Care is recommended as a positive interaction to enhance neurobehavioral development. Kangaroo Mother Care reduces likelihood of developmental delay in low birth weight infants.

Mary W Walters (2007) study to determine whether breastfeeding behaviors, skin temperature, and blood glucose values could be influenced through the use of Kangaroo care at the time of birth in healthy full term infants. Descriptive study with nine full term neonates given kangaroo care beginning within 1 minute of birth and continuing until completion of the first breastfeeding by mothers who intended to breastfeed. Infant skin temperature was taken at 1 and 5 minutes after birth and every 15 minutes thereafter. Blood glucose level was taken 60 minutes after birth, the time at which the infant latched onto the breast was recorded, and breastfeeding behaviors were observed during the first breastfeeding. The findings suggested that skin temperature rose during birth kangaroo care in eight of the nine infants, and temperature remained within neutral thermal zone for all infants. Blood glucose levels varied between 43 and 85 mg/dl. For
infants who had not already fed and between 43 and 118 mg/dL for those who had fed. All but one infant spontaneously crawled to and latched onto a breast by 74 minutes after birth. Physicians noted that mothers were distracted from episiotomy or laceration repair discomfort during birth kangaroo care.

**Amy Nagorski Johnson (2007)** study to describe factors identified by nurses that promote kangaroo holding in the Special Care Nursery (SCN) environment. In a descriptive survey, sixty-seven experienced registered nurses completed a survey to identify factors that support the implementation of kangaroo holding, including assessment strategies of the infant and family, staffing requirements, and necessary environmental considerations at a 70 bed tertiary care, Level III SCN and found that the primary factor for implementing kangaroo holding was the assessed physiologic stability of the infant (stated by 98.5% of nurses), other factors identified as integral components included adequate staffing patterns, maternal readiness, and encouragement from management. Nurses with 5 or more years of SCN practice were more likely to implement kangaroo care (KC) as an intervention to support attachment for any gestational age neonate.

**Susan M. Ludington-Hoe (2004)** Studied to determine the safety and effects on healthy preterm infants of three continuous hours of kangaroo care (KC) compared to standard NICU care by measuring cardiorespiratory and
thermal responses in a randomized with a sample of controlled trial – pretest test posttest control group design with a sample of twenty four healthy preterm infants (33-35 weeks gestation at birth) nearing discharge. Eleven of the infants received KC, 13 received standard NICU care and suggested that heart rate, respiratory rate, oxygen saturation, and abdominal skin temperature were manually recorded every minute. Apnea, bradycardia, periodic breathing, and regular breathing were captured continuously on a pneumocardiogram printout. Three consecutive interfeeding intervals (three hours each) on one day constituted the pretest, test, and posttest periods. Mean cardiorespiratory and temperature outcomes remained within clinically acceptable ranges during KC. Apnea, bradycardia, and periodic breathing were absent during KC. Regular breathing increased for infants receiving KC compared to infants receiving standard NICU care.

Carol Torres (1997) study determined the effect of modifying a single aspect of the intermediate care environment on the incidence of apnea and rate of weight gain in convalescent preterm infants. Twenty two preterm infants were assigned to experimental and control groups using a randomized, matched-pair design. Over a three week period, infants in the experimental group were provided a 1 ½ hour nap period four times a day during which their beds were covered and they were left undisturbed. Control infants received standard nursing care. The infants in the experimental group had more apnea at the start of the study than the control
infants. Thus, a simple modification of nursing care that involved minimal increase in nursing time had a beneficial effect on preterm infants.

**Oil Massage**

* Agrawal KN et al (2008) to assess the effect of massage and use of oil on growth, blood flow and sleep pattern in infants revealed that massage improved weight, length, mid arm circumference and mid leg circumference as compared to infants without massage. It was also observed that seasame oil has shown better results than the use of other oils such as coconut oil, mustard oil or mineral oil.

* Heeden A et al (1993) In their study suggested that the massage infants 28% had greater weight gain per day that is 33 vs 26 gm. The experimental group showed significantly less postnatal complications and stress behavior than control infants and demonstrated more mature motor behaviors.

The transition from fetal to neonatal life represents one of the most dynamic and potentially hazardous events in human life cycle. Generally neonatal death contributes to a greater extent infant mortality rate. Out of four million global neonatal deaths that occur annually, 98% happen in developing countries. This death takes place particularly in Asia and Africa and remains unseen by health professionals. Hence reduction in neonatal mortality depends significantly on interventions which can be practiced at home. One of such health promotion activity is oil massage for infant.
For hundred years some populations in India and Mediterranean region have routinely applied natural oils to the skin of newborn baby by considering some benefits namely improvements of the skin barrier function, thermoregulation and positive effect on growth. However, oil massage is not routinely implemented in hospital settings. The reason may be the fears that touch may be aversive and painful stimuli to the new born.

Kara kara (2008) studied pre-term to assess the effect of massage showed that average weight gain was significantly high among the massage infants. Massage have not only positive effect on the child, it also gives a feeling of satisfaction to the care giver. As massage induces consistent sleep and feeding pattern in children, they become less cranky and fussy which indirectly ensures adequate rest for the mother.

Even though massage is beneficial, many time the question of its safety for premature and low birth weight babies arises. In relation to this a study was conducted by Rosemary White Irant And Mary Bath. In this study, Rice Infant Sensorimotor Stimulation technique (RIST) which includes 10 minutes of massage and 5 minutes of rocking incorporating eye to eye contact and talking was used. The infants initially responded by showing slight decrease in body temperature and significant increase in heart rate and respiratory rate. But at the end of procedure all these parameters were established.
**Cafidi et al (2001)** studied factors that predict which pre term infant benefit most from massage therapy. Ninety three pre term infants were randomly assigned to a massage therapy group or a control group once they were considered medically stable. The treatment group received daily three time fifteen minutes each massage for 10 days. The result shows that the massage therapy infants gain more weight that is 32 vs. 29 grams than the control infants. And 70 % of massage therapy infants were classified as high weight gainers where as only 40% on control infants were classified as high weight gainers.

**Kangaroo Mother Care**

Kangaroo mother care is the best method for caring low birth weight babies. All mothers can provide kangaroo mother care irrespective of age, education, culture and religion. Kangaroo mother care should be initiated in hospital under supervision and facilitate early discharge from the hospital and this practice should be conducted at home. These babies should be followed up regularly to ensure normal outcome. Studies have shown that kangaroo mother care results in increased breast feeding rate and duration. Also studies carried out in low income countries showed that prolonged skin to skin contact between the mother and her preterm low birth weight infant provides effective thermal control and are associated with reduced risk of hypothermia.
Kangaroo mother care satisfies all five senses of the baby. The baby feels warmth of mother through skin to skin contact (touch), she listens to mother’s voice and heart beat (hearing), sucks on breast (taste) has eye contact with mother (vision) and smell mother’s odour (olfaction).

Infants being given kangaroo mother care have a slightly better daily weight gain during hospital stay as evident from several studies conducted in different parts of the world.

And other effects like kangaroo mother care help both infants and parents. Mothers are reported to be significantly less stressed during kangaroo care than when the baby is receiving incubator care. Mothers prefer skin to skin contact to conventional care and report increased confidence, self esteem and feeling of fulfillment. They report a sense of empowerment, confidence and satisfaction that they can do something positive for their preterm infants. Fathers felt more relaxed, comfortable and better bonded while providing kangaroo care. Kangaroo mother care does not require additional staff unlike in incubator care. The main finding of this study was that very low birth weight preterm infants behaved different in early infancy as compared with term infants, in terms of both neurobehavioral and developmental function. Moreover, the neurobehavioral functioning of the very low birth weight infants improved only slightly over time and these infants continued to remain vulnerable and poorly organized at 6 months of (corrected) age.
Marlow (2000) revealed that the premature infant generally lies inactive, with the arms and legs extended. Reflex activity is not fully developed. Although the fetus sucked and swallowed in utero, the sucking reflex may be absent, minimal or ineffectual and the swallowing, gag, and cough reflexes weak at birth. Coordination of the sucking and swallowing reflexes occurs between 32 - 34 weeks of gestation, therefore, they are not well developed at birth. Because of these factors, aspiration may easily occur. Other neurologic signs are diminished or absent.

1.4 THE PRESENT STUDY: ITS RATIONALE

Low Birth weight is one of the most serious challenges in maternal and child health in both developed and developing countries. Its public health significance may be ascribed to numerous factors – its high incidence; its association with mental retardation and a high risk of perinatal and infant mortality and morbidity (half of all perinatal and one-third of all infant deaths are due to low birth weight), human wastage and suffering; the very high cost of special care in intensive care units and its association with socio-economic underdevelopment.

Low birth weight is single most important factor determining the survival chances of the child. Many of them die during their first year. The infant mortality rate is about 20 times greater for all low birth weight babies than for other babies. The lower the birth weight, the lower is the survival chance.
Many of them become victims of protein energy malnutrition and infection. Low birth weight is thus an important guide to the level of care needed by the individual babies. Low birth weight also reflects the inadequate nutrition and ill health of the mother. There is a strong and significant positive correlation between maternal nutritional status and the length of pregnancy and birth weight. A high percentage of low birth weight therefore points to deficient health status of pregnant women, inadequate prenatal care and the need for improved care of the newborn.

Technological developments have improved neonatal care and reduced morbidity and mortality rates among premature newborns. Most of the studies are done on premature babies and in western countries. Inadequate published data is available related to effect of massage on low birth weight babies in India. As percentage of low birth weight babies is high in India, there is a great need for developing safe and cost effective methods of ensuring weight gain and growth among these babies. It was necessary to develop evidence to promote this practice in a more scientific manner. Therefore the investigator felt the need of studying the effect of changes in physiological and neurobehavioural parameters by oil massage and kangaroo mother care on low birth weight babies. Kangaroo mother care is used in very low birth weight babies in developed nations. This review intends to determine if there is evidence to support the use of kangaroo mother care for very low birth weight babies, providing an alternative to conventional
methods of care. In 1979, Hector Martinez and Edgar Rey Sanabria, from the institute for maternal and child health at hospital San Juan de Dios, in Bogota, Colombia proposed a significant change that redefined the concept of care for prematurely born and underweight infants employing a more humanistic approach, they developed the kangaroo mother care programme.

From the review of existing literature it is evident that a number of investigation, were conducted in the western situations Hence, the present piece of research will be done under Indian context. It will definitely enhance the existing fund of knowledge in the area of child rearing practices. Relevant research in this area in India is minimal and the data available is mostly inconsistent and often based on statistically inadequate sample size, making it difficult to assess the effect of oil massage and kangaroo mother care on changes in physiological and neurobehavioural parameters in low birth weight babies. Therefore, it was proposed to carry out a study to asses and compare the effect of oil massage and kangaroo mother care on changes in physiological and neurobehavioural parameters in low birth weight babies in selected hospitals of Bhilai. Bhilai city of Chhattisgarh is one of the economically, industrially and culturally fast growing states. During the scanning of relevant literature not a single study was found to assess the impact of oil massage and Kangaroo Mother care on changes in physiological and neurobehavioral parameters in low birth weight babies.
Therefore an attempt has been made in the present endeavour to see how far Kangaroo Mother care and Oil Massage do play their role in influencing the physiological and neurobehavioral parameters in low birth weight babies under the caption “A comparative study to assess the effect of oil massage vs kangaroo mother care on changes in the physiological and neurobehavioural parameters among low birth weight babies”.

OBJECTIVES:-

The present study was carried out in Jawaharlal Nehru Hospital & Research Centre, Bhilai, and District Hospital, Durg with the following objectives:-

1. General objective:

A comparative study to assess the effect of oil massage and kangaroo mother care on changes in physiological and neurobehavioral parameters in low birth weight babies in selected hospitals of Bhilai city.
2. **Specific objectives:**

a. To assess and compare the physiological and neurobehavioural parameters of low birth weight babies before and after oil massage among Experimental Group – I and Control Group IV.

b. To assess and compare the physiological and neurobehavioural parameters of low birth weight babies before and after kangaroo mother care among Experimental Group-II and Control Group IV.

c. To assess and compare the physiological and neurobehavioural parameters of low birth weight babies before and after joint intervention (kangaroo mother care and oil massage) among Experimental Group-III and Control Group-IV.

d. To compare the changes in physiological and neurobehavioral parameters of low birth weight babies between Experimental Group –III with Experimental Group – I, Experimental Group –II and Control Group IV.
“If we could first know where we are and whither we are tending, we could then better judge what to do, and how to do it.”

......(Abraham Lincoln)

CHAPTER - II

PROBLEMS AND HYPOTHESES