Nutrition of the High Risk Newborn

Essay

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بسم الله الرحمن الرحيم

وعلمك ما لم تكن تعلم

وكان فضل الله عليك عظيما

صدق الله العظيم

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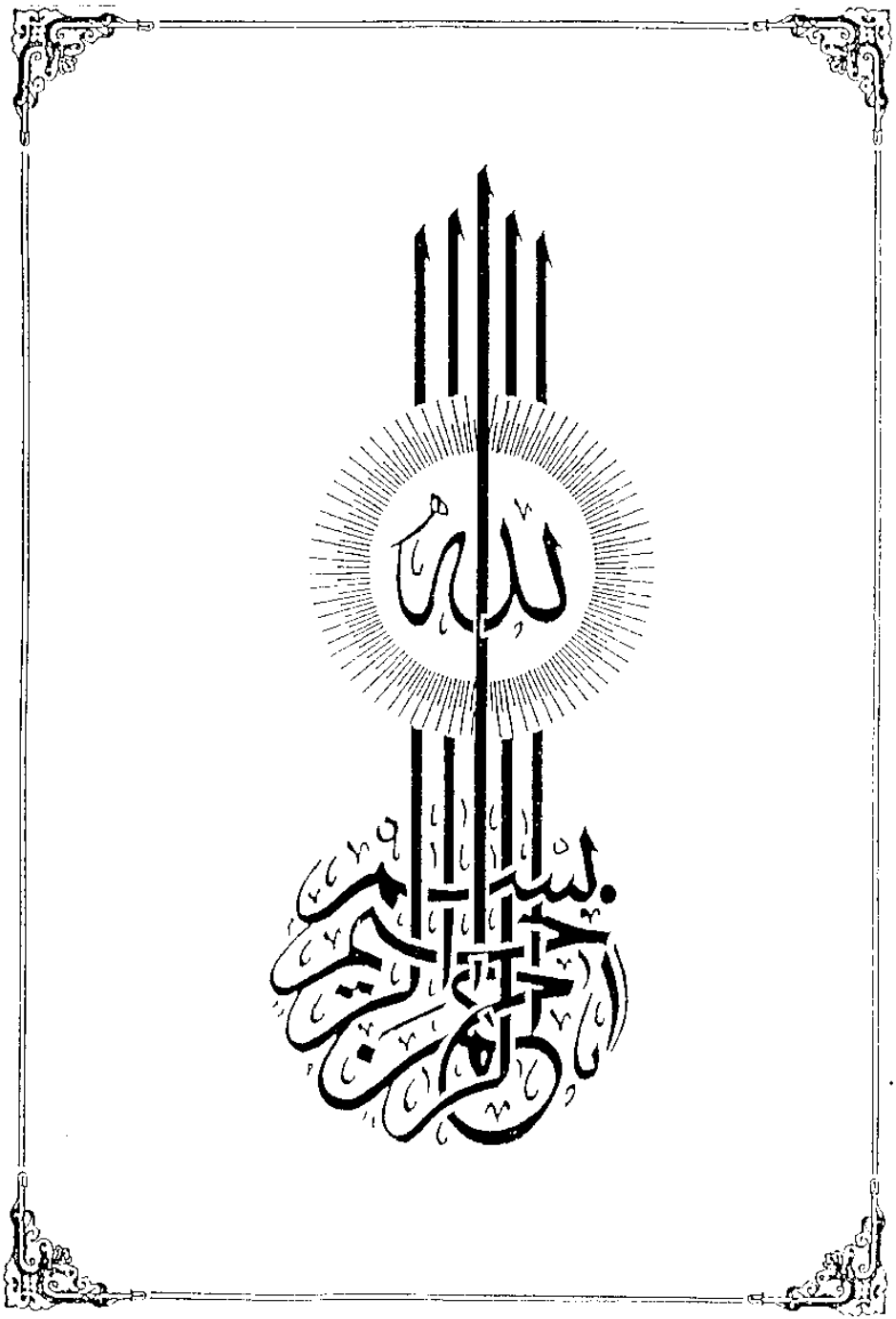

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CONTENTS

	Pages
INTRODUCTION & AIM OF THE WORK	
I. NUTRITIONAL REQUIREMENTS OF THE NEWBORN	*1*
II. IDENTIFICATION OF THE HIGH RISK NEWBORN	*25*
III. NUTRITION OF THE HIGH RISK NEWBORN	*31*
IV. ENTERAL FEEDING	*37*
I. Breast Feeding	*37*
II. Formula Feeding	*50*
III. Nutrient and Multivitamin Supplementation	*68*
V. FORCED ENTERAL FEEDING	*73*
VI. TOTAL PARENTERAL NUTRITION (TPN)	*88*
VII. ROUTES OF ADMINISTRATION OF TPN	*103*
VIII. PARENTERAL NUTRITION SOLUTIONS	*140*
IX. TOTAL PARENTERAL NUTRITION MONITORING	*191*
X. COMPLICATIONS OF TOTAL PARENTERAL NUTRITION	*197*
SUMMARY & CONCLUSION	*223*
REFERENCES	*225*
ARABIC SUMMARY	

ABBREVIATIONS

a.a.	:	Amino acids
AAPCON	:	American Academy of Pediatrics, Committee on Nutrition
BCAA	:	Branched-chain-amino acids
BPD	:	Broncho-pulmonary dysplasia
BUN	:	Blood urea nitrogen
CNS	:	Central nervous system
DIC	:	Dissemenated intravascular coagulopathy
EFA	:	Essential fatty acid
GIT	:	Gastrointestinal tract
HIV	:	Human immunodificiency virus
HMF	:	Human milk fortifiers
ICH	:	Intracranial haemorrhage
Ig	:	Immunoglobulin
IM	:	Intramuscular
IUGR	:	Intrauterine growth retardation
IV	:	Intravenous
IVC	:	Inferior vena cava
LBW	:	Low birth wieght
LPL	:	Lipoprotein lipase
MCTs	:	Medium-chain triglycerides
MSUD	:	Maple syrup urine disease
MVI	:	Multivitamin infusion
NCHS	:	National Center for Health Statistics
NICU	:	Neonatal Intensive Care Unit
PCSC	:	Percutaneous insertion of a silastic central venous catheter
PDS	:	Post ductal stenosis
PN	:	Parenteral nutrition
PT	:	Prothrombin time
PTT	:	Partial thromboplastin time
PUFA	:	Poly unsaturated fatty acids
RDAs	:	Recommended dietary allowances
RDS	:	Respiratory distress syndrom
RF	:	Renal failure
SGA	:	Small for gestational age
STORCHEB-	:	S: Syphilis
AIDS	:	T: Toxoplasmosis

: O: Others
: R: Rubella
: C: CytoMegalo inclusion virus
: H: herpes simplex
: EB: Epstein barr
: AIDS: Acquired Immune Deficiency Syndrome

SVC : Superior vena cava
TPN : Total parenteral nutrition
TTN : Transient tachypnea of the newborn
VLBW : Very low birh weight

LIST OF FIGURES

	Pages
Figure (1) : Neonatal mortality risk	26
Figure (2) : Grid for recording weights of premature infants	34
Figure (3) : Sites for central venous access in infants.	109
Figure (4) : Slit-valve non-refluxing silicone catheter	113
Figure (5) : Dressing technique for fixation of central venous catheter	117
Figure (6) : The operative field	119
Figure (7) : Venotomy with microvascular scissors.	120
Figure (8) : Venotomy with the No. 11 scalpel	121
Figure (9) : A catheter is inserted into the inferior vena cava	124
Figure (10) : Insertion of percutaneous central silastic catheter (PCSC)	127
Figure (11) : The dressing	129
Figure (12) : Technique of applying occlusive central venous catheter dressing	131
Figure (13) : Comparative figure between MB233G and Vamin 9 glucose	154
Figure (14) : Example of pediatric parenteral nutrition order	190

Introduction
&
Aim of the Essay

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&
AIM OF THE ESSAY

Because of the major advances in respiratory and other life support, nutrition and the absorptive function of the gut have largely replaced the lung as the major limiting factors in intact survival of the sick, premature, or low birth weight newborn. Mortality rates of 85% for infants weighing less than 1500 gm at birth were common 25 years ago, but are now at the order of 10% to 15%. Hence, these premature and sick infants are surviving to offer an unprecedented nutritional challenge in securing survival and normal growth.

The general objective of a nutritional regimen for the high risk newborn is to support life and a rate of growth sufficient to fulfill the individual's genetic potential.

This review aims to provide the background and practical experience of this subject, however, as there are still major uncertainties about the nutritional goals to optimize body composition and long-term growth and development. The indication of enteral and parenteral feeding, routes of administration solution used and complication of different types of nutrition of high risk newborn will be discussed.

I. Nutritional Requirements of the Newborn

I. NUTRITIONAL REQUIREMENTS OF THE NEWBORN

A knowledge of fetal growth and body composition during the third trimester is useful in understanding the nutritional needs of the newborn. Fetal growth in the third trimester is characterized by rapid weight gain (10 to 15 g/kg/day) with a quadrupling of fetal mass. This growth is fueled by a constant flux of transplacental glucose, amino acids, mineral, and vitamins.

Inadequate delivery of nutrients and oxygen results in intra-uterine growth retardation, and in some cases, fetal demise. In ~~constant~~, excessive glucose delivery in diabetic pregnancies predispose the fetus to hyperinsulinemia and macrosomia.

During the third trimester :
The fetal protein increases by 2 g/kg/day.
The fetal fat composition increases from 1 per cent fat at 28 weeks gestation to 15 per cent at term. Only a limited amount of carbohydrate is stored as hepatic glycogen.
The fetal calcium content at term is 28 g with 98 per cent in bone.
The fetal phosphorus at term is 16 g with 80 per cent in bone.
The fetal magnesium at term 0.8 g with 60 per cent in bone.
The fetal iron averages 75 mg/kg. It increases proportionately with weight during the third trimester. Most of it is incorporated into hemoglobin.

Fetal hepatic copper stores increases to a level higher than any other time in life.

The fetal zinc accumulates to a level of 250 mcg/kg/day.

Water soluble vitamins are generally not stored in tissues and must be provided postnatally.

However, fetal hepatic folate content does increase toward term.

Fat soluble vitamins stores are limited. Hepatic retinol increases during the third trimester. However, both term and preterm infants frequently have a hepatic retinol concentration considered to be deficient in comparison with adult concentration (>20 mcg/gram), and vitamin E stores in the fetus increase in parallel with fetal fat content. Hence, prematurely delivered infants are at greater risk for vitamin E deficiency ***(D'Harlingue and Byrne 1991).***

When the rapid growth of the third trimester is interrupted by premature delivery, the infant is particularly at risk for the development of both macro-nutrient and micro-nutrient deficiencies. Estimation for energy and nutrient requirements for preterm infant must take into consideration decreased absorption,

lower nutrient reserves, and the requirement imposed by a greater growth velocity.

Estimated nutrient needs of the normal newborn are summarized in the Recommended Dietary Allowances (RDAs), published by the Food and Nutrition Board of the Nutritional Academy of Sciences ***(Table 1), 1989.***

Postnatal growth and nutrition :

Water :

There are large shifts in water balance during the postnatal period, such that the fluid needs of sick term and premature infants must be closely monitored. The full-term infant normally loses about 10 per cent of body weight postnatally partially due to a contraction of the extra cellular fluid space. Preterm infants younger than 32 weeks gestation may experience a postnatal weight loss of up to 20 per cent of birth weight with the nadir occurring at bout 2 weeks of age ***(Shaffer et al., 1987).***

Term infants fed adlibitum typically ingest milk at a rate of at least 150 ml/kg/day. During the first week; very low birth weight (VLBW) newborn may require fluid intakes of more than 200

Table (1) : Recommended daily dietary allowances for infants.

Infant age (years)	Weight (kg)	Kcals	Protein (gm)	Fat-soluble Vitamins: Vitamin A (μgRE)[a]	Vitamin D (μg)[b]	Vitamin E (mg α-TE)[c]	Vitamin K (μg)	Water-soluble Vitamins: Vitamin C (mg)	Thiamine (mg)	Riboflavin (mg)	Niacin (mg NE)[d]	Vitamin B_6 (mg)	Folacin (μg)	Vitamin B_{12} (μg)	Minerals and Trace Elements: Calcium (mg)	Phosphorus (mg)	Magnesium (mg)	Iron (mg)	Zinc (mg)	Iodine (μg)	Selenium (μg)
0.0–0.5	6	kgx108	kgx2.2	375	7.5	3	5	30	0.3	0.4	5	0.3	25	0.3	400	300	40	6	5	40	10
0.5–1.0	9	kgx98	kgx1.6	375	10	4	10	35	0.4	0.5	6	0.6	35	0.5	600	500	60	10	5	50	15

Estimated Safe and Adequate Daily Intakes of Selected Vitamins and Minerals[e]

Infant age (years)	Vitamins: Biotin (μg)	Vitamins: Pantothenic acid (mg)	Trace Elements[f]: Copper (mg)	Manganese (mg)	Fluoride (mg)	Chromium (μg)	Molybdenum (μg)
0.0–0.5	10	2	0.4-0.6	0.3-0.6	0.1-0.5	10-40	15-30
0.5–1.0	15	3	0.6-0.7	0.6-1.0	0.2-1.0	20-60	20-40

[a]Retinol equivalents: 1 retinol equivalent = 1 μg retinol or 6 μg retinol or 6 μg β-carotene.

[b]As cholecalciferol: 10 μg cholecalciferol = 400 IU of vitamin D

[c]α-Tocopherol equivalents: 1 mg of D-α-tocopherol = 1 α-TE

Niacin equivalent: 1 NE is equal to 1 mg of niacin or 60 mg of dietary tryptophan.

[e]Because there is less information on which to base allowances, these figures are not given in the main table of RDA and are provided here in the form of ranges of recommended intakes.

[f]Since the toxic levels for many trace elements may be only several times usual intakes, the upper levels for the trace elements given in this table should not be habitually exceeded.

Source: Food and Nutrition Board, National Academy of Sciences - National Research Council, 1989.