



NUTRITIONAL SUPPORT IN HEPATIC FAILURE

Essay

Submitted for partial fulfillment of Master Degree in
Intensive Care

By

Ahmed Maher Ali

M.B.,B.Ch.

Supervised by

PROF. DR. AMR ESAM EL DIN ABD EL HAMID

Professor of Anaesthesia and Intensive care
Faculty of Medicine - Ain Shams University

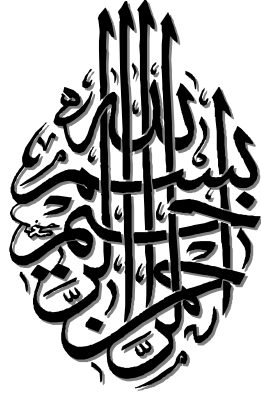
DR. MAYAR HASSAN EL SERSI

Lecturer of Anaesthesia and Intensive care
Faculty of Medicine - Ain Shams University

DR. HANY MAHER SALIB

Lecturer of Anaesthesia and Intensive care
Faculty of Medicine - Ain Shams University

**Faculty of Medicine
Ain Shams University
2013**



قَالُوا سُبْحَانَكَ لَا عِلْمَ لَنَا إِلَّا مَا
عَلَّمْتَنَا إِنَّكَ أَنْتَ الْعَلِيمُ الْحَكِيمُ

صدق الله العظيم

سورة البقرة آية (٣٢)



Acknowledgment

First, I wish to express my deep thanks, sincere gratitude to ALLAH, who always helps me, care for me and grunted me the ability to accomplish this thesis.

*I would like to express my deepest gratitude, thanks and gratefulness to **Prof. Dr. Amr Esam El Din Abd El Hamid**, Prof. of Anaesthesia and Intensive care, Faculty of Medicine, Ain Shams University, for his enthusiastic support, continuous encouragement valuable scientific advices, and great help through out of the accomplishment of this work,*

*I am very grateful to **Dr. Mayar Hassan El Sersi**, Assistant Professor of Anaesthesia and Intensive care,, Faculty of Medicine, Ain Shams University, for her kind supervision, support, indispensable suggestion, and great help through out of course of my thesis.*

*My sincere thanks to **Dr. Hany Maher Salib**, Lecturer of Anaesthesia and Intensive care,, Faculty of Medicine, Ain Shams University, for his kind and meticulous supervision, support, help, valuable supervision all through the work,*

Words can never express my sincere thanks to my family for their generous support and continuous encouragement.

I would like to express my everlasting gratitude to all my dear friends, colleagues and all who offered me any kind of help, encouragement wishing them the best of all.

LIST OF CONTENTS

Title	Page
LIST OF CONTENTS	I
LIST OF FIGURES	II
LIST OF TABLES	III
LIST OF ABBREVIATIONS	V
INTRODUCTION	IX
CHAPTER (1) : Physiology Of The Liver	1
CHAPTER (2) : Manifestations Of Liver Failure	22
CHAPTER (3) : Nutritional Support In ICU	48
CHAPTER (4) : Nutritional Support In Hepatic Failure	97
SUMMARY	121
REFERENCES	123
ARABIC SUMMARY	-

LIST OF FIGURES

NO.	Title	Page
1	Segmental anatomy of the liver	2
2	Interrelationships of protein, carbohydrate and lipid metabolism	18
3	Factors precipitating hepatic encephalopathy	37
4	Pathogenesis of ascites in the setting of cirrhosis	40
5	Pathophysiology and triggers of hepatorenal syndrome	43
6	Fibrinolysis	47
7	Etiology-based malnutrition definitions	49
8	Approaches for supplying nutrients	62
9	Protein requirements in stress	65
10	Feeding protocol to achieve enteral nutrition	77
11	General characteristics of standard formula	78

LIST OF TABLES

NO.	Title	Page
1	Major effects of metabolic hormones controlling the overall flow of fuels	8
2	Serum proteins produced by the liver	12
3	Classification of Liver Disease	24
4	Child's Criteria of Hepatic Functional Reserve	24
5	Cardinal Clinical Manifestations of Liver Disease	26
6	Putative toxins causing hepatic encephalopathy	38
7	The International Ascites Club proposed different diagnostic criteria of HRS	44
8	Classification of nutritional status by body mass index in adults	50
9	Bedside tests for simple assessment of malnutrition	51
10	Features of subjective global assessment	52
11	The 3 visceral proteins in relation to the degree of malnutrition	54
12	Nutrition support in a hypermetabolic patient	67
13	Electrolyte requirements and assessment of deficiency	68
14	Trace element requirements and assessment of deficiency	69
15	Vitamin requirements and assessment of deficiency	70
16	Specific indications for EN in selected diseases/clinical situations	73
17	Causes of diarrhea in ICU patient	83
18	Nutritional classification of amino acids	91

NO.	Title	Page
19	Metabolic alterations leading to malnutrition in end-stage liver failure	97
20	Suggested guidelines for improving oral intake	116
21	BCAA-Enriched enteral formulations	118
22	BCAA-Enriched parenteral formulations	120

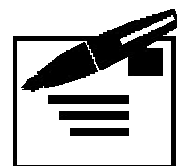
LIST OF ABBREVIATIONS

AAA	: Aromatic amino acids
Acetyl-CoA	: Acetylcoenzyme A
ALT	: Serum alanine aminotransferase
ASPEN	: American society for parenteral and enteral nutrition
BBB	: Blood brain barrier
BCAA	: Branched chain amino acid
BEE	: Basal energy expenditure
BIA	: Bioelectrical impedance analysis
BMI	: Body mass index
BMR	: Basal metabolic rate
BW	: Body weight
BZDs	: Benzodiazepines
CLD	: Chronic liver disease
CNS	: Central nervous system
COPD	: Chronic obstructive pulmonary disease
CSF	: Cerebrospinal fluid
CVA	: Central venous alimentation
DEXA	: Dual-energy x-ray absorptiometry
DHA	: Docosahexaenoic acid
DIC	: Disseminated intravascular coagulation
EN	: Enteral nutrition

EPA	: Eicosapentanoic acid
ESLD	: End stage liver disease
ESPEN	: European society for clinical nutrition and metabolism
FFA	: Free fatty acid
FFM	: Fat free mass
GABA	: Gamma-Aminobutyric Acid
GI	: Gastrointestinal
GK	: Glucokinase
GLUT1	: Glucose transporter-1
GLUT2	: Glucose transporter-2
HCC	: Hepatocellular carcinoma
HCV	: Hepatitis C virus
HDL	: High density lipoproteins
HE	: Hepatic encephalopathy
HMG-CoA	: 3-Hydroxyl-3-methylglutaryl Co-A
HRS	: Hepatorenal syndrome
IC	: Indirect calorimetry
ICU	: Intensive Care Unit
IDL	: Intermediate density lipoproteins
IGF-1	: Insulin-like growth factor
IgG	: Immunoglobulin G
IL-1	: Interleukin-1

LC	: Liver cirrhosis
LCAT	: Lecithin-cholesterol acyltransferase
LCTs	: Long chain triglycerides
LDL	: Low density lipoproteins
LFTs	: liver function tests
LP-X	: Lipoprotein X
MAC	: Mid-arm circumference
MAMC	: Mid-arm muscle circumference
MCTs	: Medium chain triglycerides
NA	: Nutritional assessment
NAC	: N-acetylcysteine
NH₃	: Ammonia
NH₄⁺	: Ammonium
PNI	: Prognostic nutritional index
PPN	: Peripheral parenteral nutrition
PT	: Prothrombin time
PUFA	: Polyunsaturated fatty acids
PVA	: Peripheral venous alimentation
RBCs	: Red blood cells
REE	: Resting energy expenditure
RQ	: Respiratory quotient
SAAG	: Serum ascites albumin gradient
SGA	: Subjective global assessment

SGOT	: Serum glutamic-oxaloacetic transaminase
TEE	: Total energy expenditure
TF	: Tube feeding
TGs	: Triglycerides
TLC	: Total lymphocyte count
TNF	: Tumor necrosis factor
TPN	: Total parenteral nutrition
TST	: Triceps skin fold thickness
UUN	: Urinary urea nitrogen
VCO2	: Carbon dioxide production
VLDL	: Very low density lipoproteins
VO2	: Oxygen consumption



INTRODUCTION
&
AIM OF THE WORK
