



Centre For Research On  
Nutrition Support Systems

# Nutrition In Disease Management

**UPDATE SERIES 58**  
**April 2013**

- **Dietary Guidelines for the Management of Type 2 Diabetes in Asian Indians**
- **Principles of Nutritional Management of Children with Chronic Liver Disease**

## To Our Readers

Dear Readers,

The April 2013 issue (58) of the CRNSS Update Series “ Nutrition in Disease Management” consists of a main article which addresses a very important disease entity which is both a clinical as well as public health problem in countries of South Asia, such as India. In this context, the availability of dietary guidelines for the same is both timely and appropriate. The authors of this write-up are well-known for their work on Type 2 Diabetes Mellitus and they have several publications to their credit on this subject.

The issue also provides an overview by a pediatric gastroenterologist regarding the broad principles underlying nutritional management in children with chronic liver disease.

The issue displays the Final Announcement regarding a Workshop on Clinical Nutrition only for dietitians and nutritionists jointly organized by the Centre for Research on Nutrition Support Systems and the Apollo Hospitals Dietetic Group being conducted on May 18-19, 2013 at the Indraprastha Apollo Hospital, New Delhi.

**Dr. Sarath Gopalan**

Executive Director, CRNSS  
and Editor

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# Dietary Guidelines for the Management of Type 2 Diabetes in Asian Indians

Anoop Misra<sup>1,2,3,4,5</sup> & Seema Gulati<sup>1,2,3</sup>

<sup>1</sup> Diabetes Foundation (India), SDA, New Delhi, India

<sup>2</sup> National Diabetes, Obesity and Cholesterol Diseases Foundation (N-DOC), SDA, New Delhi, India

<sup>3</sup> Center of Nutrition & Metabolic Research (C-NET), SDA, New Delhi, India

<sup>4</sup> Fortis C-DOC Center for Excellence for Diabetes, Metabolic Disease and Endocrinology, New Delhi, India

<sup>5</sup> Fortis Ft. Lt. Rajan Dhall Hospital, Center for Internal Medicine, New Delhi, India

## INTRODUCTION

Asian Indians (people of Indian origin living in India or living in other countries) have become more affluent, urbanized and mechanized during the previous decade. Hectic lifestyle and easy availability of convenience foods has led to irregular meals and frequent snacking on energy-dense fast foods ; including ready-to-use gravies and soups, packaged salty snacks, readymade cookies, and commercial fast-foods rather than traditional home-cooked food [1]. Further, consumption of animal foods, sweetened carbonated drinks, sugar and sweeteners has also increased [2]. In addition, traditional Indian energy-dense foods continue to be consumed. Overall, this nutritional transition, has resulted in high consumption of calories, saturated fats , trans fatty acids (TFAs), simple sugars, salt, along with low intake of fiber, monounsaturated fatty acids (MUFAs) and n-3 polyunsaturated fatty acids (PUFAs) [1]. This nutrition transition has the potential to cause obesity, and other diet-related non-communicable diseases (DR-NCDs) such as type 2 diabetes mellitus (T2DM), hypertension and cardiovascular disease (CVD) [2].

India is home to over 61 million diabetics - an increase from 50.8 million last year. By 2030, India's diabetes burden is expected to cross the 100 million mark as against 87 million earlier estimated. The country is also the largest contributor to regional mortality with 983, 000 deaths caused due to diabetes in 2011.[3] The rapid increasing prevalence of DR-NCDs in Asian Indian population is concerning, necessitating preventive steps.

Data regarding time trends in food and nutrient intakes are available at National Nutrition Monitoring Bureau (NNMB), which were established in 10 major States in India in 1972. Repeat NNMB surveys have shown a decrease in the

<sup>1</sup>“Fast foods” refers to energy-dense foods prepared and sold commercially by roadside vendors and food outlets; prepared either by deep frying or with preheated or precooked ingredients. These foods typically have low nutritional value and preparation time



average intake of all the macronutrients between 1975-79 and 1996-97 among the rural adults. The intake of protein was 62g/consumption unit/day in 1975-79 and declined to 54g in 1996-97 among rural adults  $\geq 18$  years age, energy also declined from 2350 Kcal in 1975-79 to 2110 Kcal in 1996-97 [4]. A similar trend was observed among tribal population in various parts of India (Protein: 55g/day in 1985-87 and 54g/day in 1998-99, energy: 2213 Kcal/day in 1985-87 and 2239 Kcal/day in 1998-99) [5]. While carbohydrates remain the major source of energy in Indian diets, the percentage of total energy intake derived from carbohydrates has declined (1975-79: 80.3%; 2001: 75.5%), with increase in the percentage of energy coming from dietary fats (1975-79: 8.9%; 2001: 13.9%).

However, the proportion of dietary energy from fat still remains less than 15%, which is lower than the recommended dietary allowance (RDA) of 15-30% [6]. Consumption of oils, fats and animal products have increased in almost all the States [4]. Energy intake is lower in urban areas, in spite of higher intake of fats and oils, due to lower cereal consumption as compared to rural areas [7]. Several reasons attributable for these dichotomous observations of decreased energy intake with rising prevalence of obesity could be due to; under reporting of dietary consumption data [7], higher energy intake in comparison to energy expenditure [8], and increasingly sedentary lifestyle [4].

Nutrition management is an integral part of the treatment and self management of diabetes. The goals of nutrition management are to maintain or improve quality of life nutritional and physiological health and to prevent and treat acute and long term complications of diabetes and associated co morbid conditions. In general nutrition advice for people with diabetes is the same as that for all Asian Indians. For individuals with type 2 diabetes impaired glucose tolerance or impaired fasting glucose attention to food portions and weight management combined with physical activity may help improve glycemic control. Nutrition and all forms of diabetes management should be individualized.

## ENERGY

Energy requirement for any individual is calculated by multiplying the activity factor by ideal body weight of that individual (Table 1 & Table 2) For example an Asian Indian man with medium built frame, 165 cm tall should ideally weigh 62 kg and would require 1850 Kcal to maintain healthy weight if he is sedentary. Ideal body weight should be aimed to maintain a body mass index (BMI) between 18-23 kg  $m^2$



**Table 1: Calculation Of Ideal Body Weight**

Built	Women	Men
Medium	100 lbs (45.5 kg) for first 5 ft. (152cm) height, plus 5 lb (2.3 kg) for each additional inch.	106 lbs (48 kg) for first 5 ft. (152 cm) of height, plus 6 lbs (2.7 kg) for additional inch.
Small	Subtract 10 %	Subtract 10 %
Large	Add 10 %	Add 10 %

Source: Adapted from Committees of the American Diabetes Association Inc. and American Dietetics Association, 1977  
A Guide for Professionals: The Effective Application of "Exchange Lists for Meal Planning." New York: American Diabetes Association; Chicago: American Dietetic Association, 1977.

**Table 2: Calculation Of Energy Requirement**

Activity	Obese	Normal	Underweight
Sedentary	20-25	30	35
Moderate	30	35	40
Heavy	35	40	45-50

Source: Williams, 1989  
Williams SR: Nutrition and Diet Therapy, 6th ed. St. Louis: Times Mirror/Mosby, 1989.

## CARBOHYDRATES AND FIBER

### Recommendations:

- The daily carbohydrate intake should be approximately 50-60% of the total calorie intake. For example, in an 1800 and 2000 calorie diet, the carbohydrate intake for a sedentary to moderately active individual should be 225-270 g/day and 250-300 g/day respectively.
- The primary source of complex carbohydrates in the diet should be cereals (whole wheat, brown rice etc., millets (pearl millet (bajra), finger millet (agi), great millet (kolar)) pulses (red gram (ur dal), green gram (abut), moong) etc.] and legumes (soya, horse gram (kulthi)). Complex carbohydrates should be preferred over refined carbohydrates and its products e.g. whole grain bread over white (maida) bread.
- Low GI carbohydrate foods e.g. oats (ai), unpolished rice, parboiled rice, whole pulses, beans (ali) and legumes (abut, anaz) some whole fruits (like guava, apple etc.) should be preferred. High GI foods (refined



flour root vegetables such as yam (sooran /shakarkand) potato tapioca (type of shakarkand) colocasia (arbi) etc ] should be consumed in moderation .

- 4 . The total dietary fiber in daily diet should be 25 to 40 g /day (eg .100g of apple (1 small apple )gives 10 g of fiber ;100g of whole wheat flour gives 19g of fiber ]Whole grains cereals pulses vegetables and fruits contain high dietary fiber .
- 5 . A minimum of four to five servings per day of fruits and vegetables are recommended i.e .approximately 400 500 g /day including 3 vegetable and 2 fruit portions . (eg .100g (one katori )raw vegetables e.g .cauliflower , brinjal etc .=20 30 Kcal ,100g fruit e.g .one apple =59 Kcal ]Fruits should be eaten whole preferably with the skin whenever feasible instead of fruit juices .
- 6 . Simple sugars like crystalline sugar , sugarcane juice , sweetened carbonated beverages fruit juices and sugar syrups should be avoided .

#### FATS

For optimal health across the life course the following recommendations along with food based guidelines are suggested [10] :

- 1 . Fats should provide not more than 30% of total energy /day and SFAs should provide no more than 10 % of total energy /day .For individuals having LDL cholesterol of  $\leq 100$ mg /dl ,SFAs should be  $< 7\%$  of total energy /day .
- 2 . Essential PUFAs (LA )should provide 5 8%of total energy /day .
- 3 . ALA should be 1 2 %of total energy /day .
- 4 . Optimal ratio of LA /ALA should be 5 10 .
- 5 . Long chain n-3 PUFAs should be obtained from fish / walnuts / flaxseeds /canola oil etc .
- 6 . Cis MUFAs should provide 10 15%of total energy /day .
- 7 . TFAs should be  $< 1\%$ of total energy /day .
- 8 . Cholesterol intake should be limited to 200 300 mg /day .



#### FOOD BASED GUIDELINES TO ENSURE OPTIMAL FAT QUALITY IN ASIAN INDIAN DIETS

- 1 . Since complete dependence on just one vegetable oil does not ensure optimal intake of various fatty acids ,use of 2 or more vegetable oils is recommended (Table 3) .
- 2 . The recommendation for oils are as follows [1] :
  - a ) Preferred vegetable oil ( ) along with ALA containing oil ( ) or vegetable oil containing high LA along with moderate or low LA containing oil ( ) are listed in the table below .However ,the latter combination would ensure moderation in LA intake only and is recommended when other dietary components provide high ALA or fish is consumed .Improvement of n-3 PUFA nutritional status in Indian adults has been shown with two of these oil combinations (groundnut oil /sunflower oil and canola ) [1] .
  - b ) Consumption of butter and ghee (clarified butter )should be kept to minimum .
  - c ) Use of PHVO (Anaspati ) as cooking medium should be strictly avoided .
  - d ) Coconut oil ,palm kernel oil ,palm oil and palmolein or their solid fractions should be substituted for PHVO in foods that require solid fats (bakery fats ,shortening etc ) These oils are high in SFAs but are TFA free .
- 3 . To ensure correct balance of fatty acids from dietary components other than visible fat ,the following dietary guidelines are recommended [1 - 13] :
  - a ) Regular consumption of foods with high ALA content (wheat , pearl ,millet ,pulses ,green leafy vegetables ,fenugreek ,flaxseed , mustard seeds ) .
  - b ) Partial substitution of visible fat and invisible fats from animal foods with whole nuts such as pistachios and almonds .
  - c ) Moderation in the use of animal foods containing high fat ,SFAs and cholesterol .



- i . For non vegetarians , consumption of 100 200 g fish ( 6 pieces ) week .
- ii . Minimizing consumption of premixed ready to eat fastfoods , bakery foods and processed foods prepared in PHV (hydrogenated fat )like savory (hamkeen ) .
- iii . Choose low fat dairy foods such as double toned milk (fat < 15 % )or curd prepared from such milk .The preference of low fat dairy foods would also reduce ruminant TFAs .

Table3 : Recommended Oil Combinations In Indian Diets (Oils In 1:1 Proportion)	
Oil Containing LA+ Oil Containing both LA and ALA	Oil Containing High LA+ Oil Containing Moderate or Low LA
Groundnut/Sesame/Rice bran/cottonseed + Mustard	Sunflower/Safflower+Palmolein/Olive
Groundnut/Sesame/Rice Bran/cottonseed +Canola	Safflower/Sunflower+Groundnut/ Sesame/Rice bran
Groundnut/Sesame/Rice bran/cottonseed +Soybean	
Palmolein+Soyabean	
Safflower/Sunflower+Palmolein + Mustard	

**LA: Linoleic Acid; ALA: AlphaLinolenic Acid**

## PROTEIN

- 1 . Protein intake should be based on body weight .This should be 1g kg /day , considering the quality of protein in a usual Indian vegetarian diet .
- 2 . In conjunction with energy intake ,the protein intake should provide 10 15% of the total calories /day in sedentary to moderately active individuals .



- 3 . Recommended protein sources :
  - a . Non vegetarian Egg white fish and lean chicken .
  - b . Vegetarian : Soya , pulses , whole grams (channa , rajma , green gram etc . )milk and low fat dairy products .
- 4 . Protein is restricted in diabetics only when kidney is affected .Protein is then reduced depending on glomerular filtration rate (GFR ) GFR can be calculated as :  $140 \text{ age} \times \text{present body weight} / 72 \times \text{serum creatinine levels}$  .
- 5 . Protein recommendation for diabetics with nephropathy is decided on the basis of following : Stages If GFR is :
  - 0-15ml/min-CKD stage V (ESRD\*)-(protein-0.6gm x IBW\*\*)
  - 15-30ml/min-CKD stage IV (protein- 0.6-0.7gm x IBW)
  - 30-60ml/min-CKD stage III (protein -0.8-0.9gm x IBW)
  - 60-90ml/min-CKD stage II (protein -0.9-1gm x IBW)
  - 90ml/min-CKD stage I (protein – 1gm x IBW)

\*ESRD: end stage renal disease

\*\* IBW: Ideal body weight

## SALT

1. Salt intake should be less than 5 g of sodium chloride (or about 2 g sodium)/day [10].
2. Addition of extra salt at the dining table should be avoided.
3. Dietary intake of sodium from all sources (pickles, chutneys, namkeens, papads bakery items, potato chips, popcorn, salty biscuits, preserved meat products, other pre-prepared and preserved foods, soups, cheese, fast foods) should be limited. Avoid processed foods that have high salt content.
4. Reading of food labels to determine sodium content of the commercial foods should be encouraged. Sodium, in such foods may be added in such foods in the form of sodium benzoate, monosodium glutamate,



baking powder, and baking soda.

## SUGAR AND ARTIFICIAL SWEETENERS

1. Free sugars should be less than 10% of total calories/day, which includes all added sugars and sugars present in honey, syrups and fruit juices [10]
2. Alternatives to sweetened beverages can be water, skimmed buttermilk, tender coconut water, low fat milk.
3. Indian sweets, halwa (a gelatinous sweet dish made from grain flour, ghee, sugar and nuts), kheer (a sweet dish made from boiling rice with milk, sugar, cardamoms, saffron and nuts), puddings, ice creams, sweetened biscuits, cakes, pastries and baked goods are high in added sugars and should be restricted.
4. Encourage reading of food labels to determine sugar content. Some of the names in the ingredients list for the presence of added sugars include: brown sugar, corn syrup, dextrose, honey, malt syrup, sugar, molasses and sucrose.
5. Artificial sweeteners could be used in moderation. However, these do not contain any beneficial nutrients and long-term health benefit, if any, is not clear in non-diabetic individuals. The Food and Drug Administration (FDA) has approved 5 artificial sweeteners; saccharin (Sweet 'N' Low, Sweet Twin, Necta Sweet), aspartame (Equal, Sweetex, Sugar free, Sugar free gold), acesulfame-K, neotame (both are used in beverages, dairy products, pharmaceutical products, chewing gum etc.), and sucralose (Splenda, Zero, Sugar free natura) as safe [14, 15]. Although doubts have been raised regarding safety of saccharin, however, FDA has approved it to be used in limited quantity due to low price, good shelf life and heat stability. Stevia (Steviocal, Gwiser) and some sugar alcohols (Sorbitol, xylitol, mannitol, maltitol etc.) have been approved by FDA under GRAS (Generally Recognized as Safe) status.



## REFERENCES:

1. Misra, A., et al., South Asian diets and insulin resistance. *Br J Nutr*, 2009. 101(4): p. 465-73.
2. Misra, A. and L. Khurana, Obesity and the metabolic syndrome in developing countries. *J Clin Endocrinol Metab*, 2008. 93(11 Suppl 1): p. S9-30.
3. <http://www.idf.org/diabetesatlas/5e/south-east-asia>.
4. National Nutrition Monitoring Bureau (NNMB), Report of second repeat surveys in rural areas in NNMB States-NNMB Technical Report No.18, National Institute of Nutrition, ICMR, Hyderabad.1999.
5. National Nutrition Monitoring Bureau (NNMB), Report of first repeat surveys in tribal areas in NNMB States-NNMB Technical Report No.19, National Institute of Nutrition, ICMR, Hyderabad.2000.
6. National Institute of Nutrition (NIN). Dietary Guidelines for Indians: A Manual. NIN, Hyderabad. 1998.
7. Livingstone, M.B. and A.E. Black, Markers of the validity of reported energy intake. *J Nutr*, 2003. 133 Suppl 3: p. 895S-920S.
8. Stubbs, C.O. and A.J. Lee, The obesity epidemic: both energy intake and physical activity contribute. *Med J Aust*, 2004. 181(9): p. 489-91.
9. Diekman, C., et al., Summary statement of the International Expert Meeting: health significance of fat quality of the diet. Barcelona, Spain, February 1-2, 2009. *Ann Nutr Metab*, 2009. 54 Suppl 1: p. 39-40.
10. World Health Organization, "Diet, Nutrition and Prevention of Chronic Diseases", WHO Technical Series 916; 2003.
11. Ghafoorunissa, Fats in Indian diets and their nutritional and health implications. *Lipids*, 1996. 31 Suppl: p. S287-91.
12. Ghafoorunissa, Requirements of dietary fats to meet nutritional needs & prevent the risk of atherosclerosis--an Indian perspective. *Indian J Med Res*, 1998. 108: p. 191-202.
13. Ghafoorunissa. Dietary fat and diet related chronic diseases: An Indian perspective. *Touch* 2005; 7: 1-6.
14. Borzelleca JF, Verhagan H. Sucralose Safety Assessment. *Food Chem Toxicol* 2000;38:S129.
15. World Health Organization Expert Committee on Food Additive: Toxicological Evaluation of Certain Food Additives and Food Contaminants, Geneva, World Health organization. 1981; 16:11-27; 1983;18: 12-4.



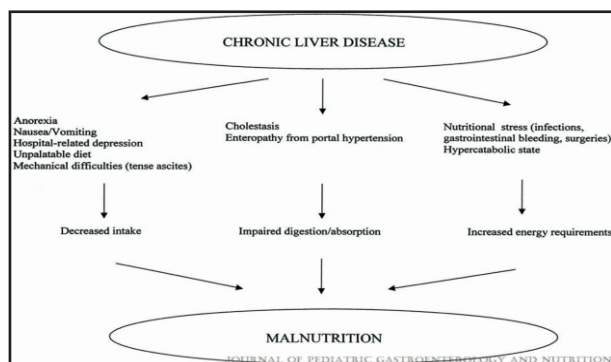
# Principles of Nutritional Management of Children with Chronic Liver Disease

Dr Akshay Kapoor  
Consultant Pediatric Gastroenterologist  
Indraprastha Apollo Hospital Sarita Vihar, New Delhi, INDIA

Chronic liver disease (CLD) is a complex multi-system disorder with a propensity to affect, sometimes severely the nutritional status and wellbeing of children. Malnutrition is a multifactorial process in children with CLD and carries an independent risk of morbidity and mortality. A thorough nutritional assessment is needed to determine the degree of malnutrition present and to tailor the nutritional intervention. With the advent and success of pediatric liver transplantation (LT), it has become paramount that the nutritional status of children be optimized prior to LT. Studies have conclusively proved that pre-transplant nutritional status affects post transplant outcomes.

## CAUSES OF MALNUTRITION AND MULTIVITAMIN DEFICIENCY IN CLD

The etiology of malnutrition in CLD is complex. The following figure is a lucid line diagram which shows the process in children with CLD



Adapted from: Ramaccioni, Valeria; Soriano, Humberto E.; Arumugam, Ramalingam; Klish, William J. *Journal of Pediatric Gastroenterology and Nutrition*. 30(4):361-367, April 2000.

The severity of malnutrition may not correlate with the degree of vitamin or trace mineral deficiency or the degree of hepatic dysfunction.

## ASSESSMENT OF NUTRITIONAL STATUS IN A CHILD WITH CLD

A number of obstacles complicate the ability to accurately assess the nutritional status of a child with liver disease. Body weight may be deceptive because



organomegaly from an enlarged liver or spleen, edema or ascites can mask weight loss and actually increase or falsely inflate the weight. Height may be a better indicator of malnutrition in these children and can be a reliable tool to determine chronic malnutrition. A decrease in height for age percentile may be indicative of the duration of malnutrition. Triceps skinfold and arm circumference measurements provide a sensitive indicator of nutritional status in children with chronic liver disease. As lower extremities are more prone to peripheral edema and fluid retention than upper extremities, upper extremity measurements may be a better indicator of body fat stores and muscle mass.

Reduced fat fold thickness and mid upper arm circumference have been observed in children prior to weight or height reductions. In children, early reduction in fat and muscle stores reflects the preferential utilization of fat stores to conserve protein stores for energy in the malnourished state. To optimize the accuracy of anthropometric measurements, it is prudent that the same observer take serial measurements using a standard technique. Measurement of plasma proteins including albumin, transferrin, prealbumin, and retinol-binding protein actually reflect the severity of liver disease, rather than the nutritional status of the child. Similarly, immune status and nitrogen balance studies cannot be used as proxy markers of the nutritional status. Dual energy x-ray absorptiometry (DEXA scan) is a non-invasive method with minimal radiation that provides accurate measurement of body composition and bone density. This has emerged as a reliable tool in centres where it is available.

## NUTRITIONAL MEASURES TO BE TAKEN IN A CHILD WITH CLD

For reasons mentioned previously in the text, the daily energy intake of the child is often lower than the daily recommended intake. However, due to increased resting energy expenditure (due to the CLD) the energy intake should be increased. The aim is therefore to reach an energy intake of 130 % of recommended daily energy intake for age. If this goal is not achieved by oral feeding, nasogastric feeding should be started, supplying sufficient amount to reach 150 Kcal/kg/day. These measures should be initiated as soon as abnormal weight gain is observed, or even anticipated. Once malnutrition becomes established, it becomes increasingly difficult to restore body mass. It is important to emphasize, that children with CLD require 2.5-3g/kg of protein daily. Protein intake need not be entirely restricted in patients with hepatic encephalopathy.

## FAT

Steatorrhea is frequently observed in patients with cirrhosis and/or chronic cholestasis. There is a poor correlation between the degree of biliary obstruction and the amount of fat excreted in the stools. Intraluminal bile salt concentrations are below the critical micellar concentration such that intraluminal products of lipolysis cannot form micellar solutions. A prolonged



prothrombin time is seen often which corrects with parenteral vitamin K administration pointing to poor fat-soluble vitamin absorption.

Treatment with a low fat diet supplemented with medium chain triglyceride (MCT) (C8-C12 fatty acids) containing formulas or MCT oil helps to decrease the degree of steatorrhea and may help to improve the nutritional status of the child. MCT-enhanced diets can also improve energy intake in older children with cholestasis. MCT does not require intraluminal bile salts for micellar formation in order to be absorbed in the intestinal lumen. They are relatively water soluble and directly absorbed into the portal circulation. Essential fatty acids (linolenic, linoleic and arachidonic acid) also need to be supplemented especially in neonatal cholestasis. Corn oil or safflower oil containing linoleic acid can be added to food or to MCT containing preparations.

## CARBOHYDRATE

Carbohydrate intake should equal 60% of the daily energy intake of the child. If there is any evidence of lactose intolerance, the diet should be tailored accordingly.

## FAT SOLUBLE VITAMINS AND MINERALS

Bile acids in the intestinal lumen are not only important for fat absorption from the lumen but also for fat-soluble vitamin absorption. Vitamins A, D, E and K are all dependent upon intraluminal bile acid concentration. When the intraluminal bile acid concentration falls below a critical micellar concentration (1.5-2.0 mM), malabsorption of fat-soluble vitamins ensues. Bile acid binding resins (Cholestyramine), may deplete enteral bile acids and interfere with fat-soluble vitamin absorption from the intestines. Vitamins A and E in addition, require hydrolysis by an intestinal esterase that is bile acid dependent prior to intestinal absorption.

In infants, cholestasis leads to rapid depletion of body stores of fat-soluble vitamins with both biochemical and clinical features of deficiency evident unless adequate supplementation is utilized. Evaluation for fat-soluble vitamin deficiency, supplementation and monitoring are all necessary for infants and children with cholestasis. In order to alleviate the malabsorption of fat-soluble vitamins in chronic liver disease, a doubling of the daily dose of an aqueous preparation of vitamins A, D, E and K may be utilized as a starting dose.

Vitamin E, in the form of D- $\alpha$ -tocopherol polyethylene glycol-1000 succinate (TPGS), is the only fat-soluble vitamin that comes in an oral water-soluble formulation. Serum levels of vitamin E should be monitored (600 to 1400  $\mu\text{g}/\text{dl}$ ), and the ratio Vitamin E ( $\mu\text{g}/\text{dl}$ ) / Total lipids (mg/dl) should be kept above 0.6. Hypocalcemia, due to dietary calcium deficiency or malabsorption, can lead to



resultant rickets. Large doses of vitamin D supplements (5-20,000 IU/day) may be required to correct this condition. Zinc deficiency is common in cholestasis. Zinc is a common cofactor of various enzymatic systems, and deficiency may affect liver metabolism such as for example ammonium metabolism and urea cycle. Iron deficiency may be observed and is most often associated to occult or overt GI bleeding. Thus, both zinc and iron need to be supplemented in children with cholestasis. The exact details are given in Table 1.

**Table 1: Vitamin and mineral requirements in CLD**

Nutrient	Oral formulation	Oral dose	Parenteral formulation	Parenteral dose	Monitoring
Vitamin A	Available	5000-25000 IU/day	Intramuscular injection	50000 IU/month	Serum level between 400 500 $\mu\text{g}/\text{L}$
Vitamin D	25 OH fat soluble	24 $\mu\text{g}/\text{kg}/\text{d}$	Intramuscular injection	100000IU/6 weekly	Serum level between 25 30ng/ml
Vitamin E	Water soluble TPGS	25IU/kg/d	Intramuscular injection	10mg/kg every 2 weekly	Serum level between 5 15mg/L
Vitamin K	Fat soluble vitamin K	2.415mg/d	Intramuscular or intravenous injection	10mg every 2 weekly	Prothrombin time
Zinc	oral	1mg/kg/d			Zinc level, ALP
Water soluble Multivitamins	Oral formulation	2 X RDA			-

Malnutrition and multivitamin deficiencies in children can thus be circumvented in children with adequate nutritional support. This endeavour, will not only blunt the disease progression, but will make the child a suitable candidate for liver transplantation, if and when the need arises.

## RECOMMENDED READING:

1. Sibal A, Gupta S, Bhatia V, Kapoor A, Wadhawan M. Liver transplant for children: Indian scenario. Indian Journal of Transplantation. 2011;5(2):53-5.
2. Sokal EM, Goldstein D, Ciocca M, Lewindon P, Ni YH, Silveira T, et al. End-stage liver disease and liver transplant: current situation and key issues. J Pediatr Gastroenterol Nutr. 2008;47(2):239-46. Epub 2008/07/31.
3. Kelly DA, Sibal A. Liver transplantation in children. Indian Pediatr. 2006;43(5):389-91. Epub 2006/06/01.
4. Ramaccioni, Valeria; Soriano, Humberto E.; Arumugam, Ramalingam; Klish, William J. Nutritional Aspects of Chronic Liver Disease and Liver Transplantation In Children. Journal of Pediatric Gastroenterology and Nutrition. 30(4):361-367, April 2000.





## FINAL ANNOUNCEMENT

WORKSHOP ON CLINICAL NUTRITION  
JOINTLY ORGANISED BY  
APOLLO HOSPITALS DIETETIC GROUP  
&  
CENTRE FOR RESEARCH ON NUTRITION SUPPORT  
SYSTEMS (CRNSS), NEW DELHI

VENUE:  
AUDITORIUM, INDRAPRASTHA APOLLO HOSPITAL, NEW DELHI

DATE: MAY 18-19, 2013

### TOPICS:-

- INBORN ERRORS OF METABOLISM
- DISEASE-SPECIFIC NUTRITIONAL INTERVENTION
- NUTRITION AND WELLNESS

For details, contact:-

**Ms. DEEPIKA AGGARWAL**  
Deptt. of Dietetics,  
Indraprastha Apollo Hospital, New Delhi  
Mobile: 09717221177  
Email: deepika\_a@apollohospitalsdelhi.com



## Scientific Programme for the Workshop on Clinical Nutrition

May 18 – 19, 2013

at Auditorium, Indraprastha Apollo Hospitals, New Delhi

Day 1 – May 18, 2013

Timings	Program	Speakers	Chairpersons
12:30 pm – 1:30 pm	Lunch		
1:30 pm – 1:40 pm	Welcome address	Prof Anupam Sibal	
1:40 pm – 1:45 pm	Objectives of the workshop and details of scientific program	Dr. Sarath Gopalan	
Session 1 – Nutritional management in Inborn errors of metabolism			
<i>Disorders of carbohydrate metabolism</i>			
1:45 pm – 2:15 pm	Clinician's perspective	Dr Vidyut Bhatia	Dr. Kumud Khanna
2:15 pm – 2:45 pm	Nutritionist's perspective	Ms. Anuja Aggarwal	Dr. Ratna Puri
<i>Phenylketonuria</i>			
2:45 pm – 3:15 pm	Clinician's perspective	Dr Dhanasekhar Kesavelu	Dr. Seema Kapoor
3:15 pm – 3:45 pm	Nutritionist's perspective	Ms. Deepika Aggarwal	Dr. Sunita Bijarnia
<i>Disorders of Amino acid metabolism</i>			
3:45 pm – 4:15 pm	Clinician's perspective	Dr S Srinivas	Dr. Deeksha Kapoor
4:15 pm – 4:45 pm	Nutritionist's perspective	Dr Bhuvaneshwari	Dr. Neerja Gupta
4:45 pm – 5:00 pm	Question and answers		
5:00 pm	Tea		

Session 2 – Nutritional intervention in specific settings	
<i>Nutritional management in chronic liver disease</i>	
9:00 am – 9:30 am	Clinician's perspective Dr. Sarath Gopalan
9:30 am – 10:00 am	Nutritionist's perspective Ms. Daphnee D.K.
<i>Nutritional management in the morbidly obese patient undergoing bariatric surgery</i>	
10:00 am – 10:30 am	Clinician's perspective Dr. Arun Prasad
10:30 am – 11:00 am	Nutritionist's perspective Ms Neha
11:00 am – 11:30 am	Tea break
<i>Recent advances in nutritional management in chronic kidney diseases</i>	
11:30 am – 12 noon	Clinician's perspective Dr. Sanjiv Jasuja
12 noon – 12:30 pm	Nutritionist's perspective Ms Divya
12:30 pm – 1:30 pm	Lunch
Session 3 – Nutrition and Wellness	
<i>Non-alcoholic fatty liver disease – epidemiology</i>	
1:30 pm – 2:00 pm	Clinician's perspective Dr. Anupa Sidhu
2:00 pm – 2:30 pm	Nutritionist's perspective Ms. Neelanjana Singh
<i>Diet and cardiovascular disease</i>	
2:30 pm – 3:00 pm	Clinician's perspective Dr. N N Khanna
3:00 pm – 3:30 pm	Nutritionist's perspective Ms. Ritika Samadhar
<i>Type 2 diabetes mellitus</i>	
3:30 pm – 4:00 pm	Clinician's perspective Dr. S K Wangnool
4:00 pm – 4:30 pm	Nutritionist's perspective Ms. Viveka Kaul
4:30 pm – 4:45 pm	Questions and answers
4:45 pm – 4:55 pm	Closing remarks
4:55 pm – 5:00 pm	Vote of thanks Dr Bhuvaneshwari Shankar Ms. Deepika Aggarwal
5:00 pm	Tea

## Governing Body of CRNSS

<b>Dr. S. Padmavati</b> Director, National Heart Institute, New Delhi	President
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<b>Dr. S. Ramji</b> Professor, Department of Pediatrics, Maulana Azad Medical College, New Delhi	Member
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<b>Dr. Sarath Gopalan</b> Consultant, Clinical Nutrition and Pediatric Gastroenterologist Pushpawati Singhanian Research Institute, New Delhi	Executive Director

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