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**REVIEW ARTICLE**

# NUTRITION: RISK FREE ANALYSIS TOOL

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**ABSTRACT**

Healthy diet helps children to grow develop and perform well in school. Healthy food also helps to prevent chronic diseases, such as heart disease, certain cancers, diabetes, stroke and osteoporosis that are leading causes of disability and death. Family, friends and personal beliefs, including cultural and environmental considerations, play a major role in people's food selection. The nutritional assessment process includes two phases: screening and assessment. The definitions of nutrional screening and assessment vary slightly from one setting to another. The major purpose, however, is to screen for nutritional risks and apply specific assessment techniques to determine an action plan (Council on Practice, Quality Management Committee, 1994). Screening identifies patients at nutritional risk or suspected to be at risk due to disease or medical treatment. The goals of screening are to identify individuals who are at nutritional risk and those who need further assessment, as well as to determine who should provide that assessment .Screening can be done in different places. The screening tool can be used in the clinic setting, for the elderly in congregate feeding situations. A short screening can be used in hospitalized patients not suspected of being at risk. Thus various nutritional analysis tools available in literature are discussed for effectively identifying the population under nutritional risk.



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## INTRODUCTION

Nutrition is essential for growth and development, health and wellbeing. People require energy and certain essential nutrients. The body cannot make these nutrients on its own and must obtain them from food. Essential nutrients include vitamins, minerals, certain amino acids and fatty acids. Food also contains fiber and other components that are important for health. Each of these food components has a specific function in the body. For example, people need calcium for strong bones, but many other nutrients also take part in building and maintaining bones (Grant *et al*., 1999). As UNICEF documented in its 2013 report, 'Improving Child Nutrition: The achievable imperative for global progress,' the scope of under nutrition goes beyond the crises we see in the headlines. Stunting affects 165 million children under five years old - one out of every four. This is basically detected by Nutrition status assessment (UNICEF Annual Report 2013). The damage to physical and cognitive development, especially during the first two years of a child's life, is largely irreversible. A child's poorer school performance results in future income reductions of up to 22 per cent on average. As adults, they are also at increased risk of obesity, diabetes and cardiovascular disease.

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Public health nutrition is concerned with promoting and maintaining the nutritional health of populations. In contemporary times, hundreds of millions of people globally struggled to gain sufficient food for health. Meanwhile, in many countries, over - consumption and dietary imbalances are contributing to epidemics of obesity and diet related chronic diseases, such as diabetes, cancers and cardiovascular disease (Mark Lawrence *et al*., 2007). The methods used were initially described following a conference held in 1932 by the Health Organization of the League of Nations. Various tools have been designed to assess the nutrition status (Mark Lawrence *et al*., 2007). Eating a healthy diet contributes to preventing future illness, improving quality of life and life expectancy. In this context, extensive research has been done to provide guidance on some of these new, improved techniques, as well as a comprehensive of many of the older, established methods in nutritional assessment.

**I.Direct methods** (World Health Organisation Technical Report Series 258,1963)

**A.Nutritional anthropometry:**

The pattern of growth and the physical state of the body, though genetically determined, are strongly influenced by nutrition, so that anthropometric measurements are useful

criteria for assessing nutritional status. Techniques of obtaining anthropometric measurements have been discussed in the literature and have been extensively reviewed. Anthropometric measurements are the most basic method of assessing body composition. Anthropometric measurements describe body mass, size, shape, and level of fatness. Because body size changes with weight gain, anthropometry gives the researcher or clinician an adequate assessment of the overall adiposity of an individual. However, the associative power among anthropometric measures and indices is altered as weight is gained or lost. Standardized anthropometric techniques are necessary for comparisons between clinical and research studies, and video and text media describing these techniques are available. Those interested in using anthropometric equipment and methods should consult these resources.

**Weight, Stature and Body Mass Index (BMI)**

Body weight is the most frequently used measure of obesity. In general, persons with high body weights typically have higher amounts of body fat. A variety of scales are available for measuring weight, and these should be calibrated regularly for accurate assessments of weight. Changes in weight correspond to changes in body water, fat, and/or lean tissue. Weight also changes with age in children as they grow and in adults as they accumulate fat. However, body weight taken without other measures of body size is misleading because a person's weight is highly related to stature (i.e., tall people are generally heavier than short people). Stature is measured easily with a variety of wall-mounted equipment. Additional methods have been developed for predicting stature when it cannot be measured directly, e.g., for the handicapped or mobility impaired. One way to overcome the lack of specificity in body weight is to use the body mass index. BMI is a descriptive index of body habitus that encompasses both the lean and the obese and is expressed as weight divided by stature squared ($kg/m^2$). A significant advantage of BMI is the availability of extensive national reference data and its established relationships with levels of body fatness, morbidity, and mortality in adults. BMI is particularly useful in monitoring the treatment of obesity, with a weight change of about 3.5 kg needed to produce a unit change in BMI. In adults, BMI levels above 25 are associated with an increased risk of morbidity and mortality, with BMI levels of 30 and greater indicating obesity. In children, BMI is not a straightforward index because of growth. However, high BMI percentile levels based on Centers for Disease Control and Prevention (CDC) BMI growth charts and changes in parameters of BMI curves in children are linked to significant levels of risk for adult obesity at corresponding high percentile levels. The use of BMI alone is also cautioned in athletes and persons with certain medical conditions (e.g., sarcopenia) where body weight may be altered significantly by changing proportions of muscle and fat masses.

**Abdominal Circumference**

Obesity is commonly associated with increased amounts of intra-abdominal fat. A centralized fat pattern is associated with the deposition of both intra-abdominal and subcutaneous abdominal adipose tissue. It should be noted that abdominal circumference is an imperfect indicator of intra-abdominal adipose tissue, as it also includes subcutaneous fat deposition, as well as visceral adipose tissue. This does not preclude its usefulness, as it is associated with specific health risks. Persons in the upper percentiles for abdominal circumference are considered obese and at increased risk for morbidity, specifically type 2 diabetes and the metabolic syndrome, and mortality. There has been a steady increase in the prevalence of high abdominal circumference in the general population from 10 to 20% in the 1960s to between 40 and 60% in the year 2000. Circumferences of other body segments such as the arm and leg are possible, but there are few reference data available for comparative purposes. Furthermore, the calculation of fat and muscle areas of the arm is not accurate or valid in the obese. The ratio of abdominal circumference (often referred to incorrectly as “waist” circumference) to hip circumference is a rudimentary index for describing adipose tissue distribution or fat patterning. Abdomen-to-hip ratios greater than 0.85 represent a centralized distribution of fat. Most men with a ratio greater than 1.0 and women with a ratio greater than 0.85 are at increased risk for cardiovascular disease, diabetes, and cancers.

**Skinfolds**

Skinfold measurements are used to characterize subcutaneous fat thickness at various regions of the body, but it should be noted that they have limited utility in the overweight or obese adult. The primary limitation is that most skinfold calipers have an upper measurement limit of 45 to 55 mm, which restricts their use to subjects who are moderately overweight or thinner. A few skinfold calipers take large measurements, but this is not a significant improvement because of the difficulty of grasping and holding a large skinfold while reading the caliper dial. The majority of national reference data available are for skinfolds at the triceps and subscapular locations. The triceps skinfold varies considerably by sex and can reflect changes in the underlying triceps muscle rather than an actual change in body fatness. Skinfolds are particularly useful in monitoring changes in fatness in children because of their small body size, and the majority of fat is subcutaneous even in obese children. However, the statistical relationships between skinfolds and percent or total body fat in children and adults are often not as strong as that of BMI. Also, the true upper distribution of subcutaneous fat measurements remains unknown because most obese children and adults have not had their skinfolds measured.

**B. Clinical assessment of nutritional status (Aphenas. Papas, 1989)**

Clinical examination is the most essential part of all nutritional surveys, since the ultimate objective is to assess levels of health of individuals or of population groups in relation to the food they consume. Numerous functional or structural manifestations are known to be associated with states of malnutrition. They are assessed in the course of clinical examination with or without instrumental aid. Physical signs and symptoms of malnutrition can be valuable aids in detecting nutritional deficiencies. These may include delayed growth and development as determined by comparing an individual or a group with normal values on growth charts; pallor of the skin, mucous membranes of the mouth and eyes, nail beds or palm surfaces; and the more serious signs of advanced protein-calorie malnutrition such as changes occurring in hair color and body appearance, as by edema. Obviously, the sooner the diagnosis of nutritional status is made in individuals and in populations the sooner clinical public health intervention

programs can be formulated. One does not have to be a physician to recognize major signs of nutritional deprivation. Auxiliary health workers can be trained in nutritional diagnosis so that they may be alerted to the major signs of clinical deficiencies. They, in turn, can alert physicians who may then conduct a more detailed examination so that the presence or absence of nutritional deficiencies can be more definitively ascertained. In 1962 the World Health Organization Expert Committee on Medical Assessment of Nutritional Status proposed a classification of physical signs to be used in nutrition surveys. Updated in 1966, this is a most valuable guide in the diagnosis and interpretation of the clinical signs of malnutrition.

It must be emphasized that 1) signs of malnutrition may not be specific-that is, they may be related to non-nutritional factors such as poor hygiene or excessive exposure to the sun-and 2) they may not correlate with dietary intake data or the biochemical values in the individual or the population. This should not discourage the health worker from participating in the clinical evaluation of children and adults. The W.H.O. Committee has conveniently classified the physical signs most often associated with malnutrition into the following three groups:

**Group One:** Signs that are considered to be of value in nutritional assessment. These are often associated with nutritional deficiency status. Signs of malnutrition may often be mixed and may be due to the deficiency of two or more micronutrients.

**Group Two:** Signs that need further investigation. They may be related to malnutrition, perhaps of a chronic type, but are often found in populations of developing countries where other health and environmental problems, such as poverty and illiteracy, are co-existent.

**Group Three:** These include physical signs that have no relation to malnutrition, although they may be similar to physical signs found in persons with malnutrition and must be carefully delineated from them. This usually takes the particular expertise of a physician or other health worker expertly trained in nutritional diagnosis.

### C. Biochemical assessment (Wasantwiscit *et al*., 2011)

Variations in the quantity and composition of the diet are reflected by changes in the concentration of chemical substances in tissues and body fluids, and/or by the appearance or disappearance of specific metabolites. The nutritional spectrum varies from frank deficiency at one extreme, through optimal nutrition, to over nutrition at the other. Most available biochemical tests can be divided into those which measure changes that directly reflect the supply of nutrient and those which detect biochemical changes that reflect metabolic alterations brought about by nutrient deficiencies or imbalances. Levels of essential dietary constituents in the body fluids are indicators of nutrient supply. The concentration of essential nutrients in body fluids may be reduced as a result of dietary deficiency, poor absorption, impaired transport or abnormal utilization. Biochemical tests available for assessing nutritional status can be grouped into two general and somewhat arbitrary categories: static tests and functional tests. These are sometimes referred to as direct and indirect tests, respectively; other, more detailed classification schemes also may be encountered. Static tests are based on measurement of a nutrient or its metabolite in the blood, urine, or body tissue lot example. Serum measurements of albumin, calcium, or vitamin A. These are among the most readily available tests, but they have certain limitations. Functional tests of nutritional status are based on the idea that "the final outcome of a nutrient deficiency and its biologic importance are not only a measured level in a tissue or blood, but the failure of one or more physiologic processes that rely on that nutrient for optimal performance." Included among these functional tests are measurement of dark adaptation (assesses vitamin A status). Biochemical tests are a valuable adjunct in assessing and managing nutritional status however, their use is not without problems. Most notable among these is the influence that non-nutritional factors can have on test results. A variety of pathologic conditions, use of certain medications, and technical problems in a sample collection or assay can affect test results in ways that make them unusable. Another problem with some biochemical tests is their nonspecificity.

### D. Biophysical tests and tests of physical function

The main purpose of biophysical tests is to assess alterations in function associated with inadequate nutrition. A large number of tests have been devised to determine deviations in visual acuity, dark adaptation of the eye, capillary fragility, nerve accommodation, physical performance, muscle co-ordination, and so on, in different deficiency states. Their nutritional significance has been critically discussed and the value of most of them is uncertain. These tests are used in specific studies, where additional information regarding change in the bone or muscular performance is required. Radiological methods have been used in studying the change of bones in rickets, osteomalacia, osteoporosis and scurvy.

When clinical examination suggests radiographic examination, the following is done.

- In active rickets there is widened concave (cupped) rarified, frayed distal end of long bones usually the radius and ulna.
- In rickets, there is healed concave line of increase density at distal ends of long bones usually the radius and ulna.
- In infantile scurvy there is ground glass appearance of long bone with loss of density.
- In beri beri there is increased cardiac size as visible through rays.
- Changes in bone also occur in advanced fluorosis.

These give accurate information. The results can be used as a supporting data to other methods. Equipment required for these tests is expensive and technical knowledge is required in interpreting data. It is difficult to transport the equipment to interior parts of any village.

## II. Indirect methods

**A. Vital statistics** (World Health Organisation Ecological Factors and Surveys)

Malnutrition influences morbidity rates for various diseases (such as tuberculosis), maternal and perinatal mortality rates, life expectancy and other health statistics. A variety of vital

statistics may therefore be considered as indirect indicators of the nutritional status of the community.

**B. Dietary assessment methods (Ann M. Coulston., 2012)**

The appropriate tool for dietary assessment will depend on the purpose for which it is needed. The purpose may be to measure nutrients, foods or eating habits. Many different methods have been developed for the purpose of assessing dietary intake. These range from detailed individual weighed records collected over a period of 7 days or more to food frequency questionnaires, household survey methods and simple food lists.

In general the procedure for measuring energy and nutrient intake involves**:**

(i) A report of all food consumed by an individual
(ii) Identification of the foods such that an appropriate item can be chosen from standard food tables. In detailed studies a duplicate portion of the food may be chemically analysed to find out the nutrient content
(iii) Quantification of the portion size of each food item
(iv) Determination of the frequency with which each food is eaten
(v) Calculation of the nutrient intake (portion size (g) x frequency x the nutrient content per g). (Rutishauser and Black, 2002)

To measure food intake alone it is possible to miss out steps (ii) and (v). Indeed if we are only interested in the intake of certain foods it may not be necessary to have a report of all food consumed.

Dop *et al*. (1994) concluded that the 24-h recall can be used for diet surveys of group of children. Shatenstein B, Nadon S, Godin *et al*. (2005) concluded that the FFQ and examination of subscores revealed which food groups require attention to improve diet quality.

**C. Assessment of ecological factors** (World Health Organisation Ecological Factors and Surveys)

1. Conditioning infections;
2. Food consumption;
3. Cultural influences;
4. Socio-economic factors;
5. Food production;
6. Medical and educational services

Human malnutrition is always an ecological problem in that it is the end-result of multiple overlapping and interacting factors in the community's physical, biological and cultural environments. Thus, the amount of various foods and nutrients available to persons of different age-groups will depend upon such environmental conditions as climate, soil, irrigation, storage, transport and economic level of the population, as well as on such cultural influences as local cooking practices and food classifications, especially in relation to the distribution or restriction of foods for vulnerable age groups. Similarly, the importance of non-nutritional conditioning diseases in the production of malnutrition has become increasingly realized in recent years; in particular, the synergistic influence of bacterial, viral and parasitic infections and psychological trauma is now recognized, especially in relation to protein-energy malnutrition of early childhood. It is therefore necessary to make an ecological diagnosis of the various causative or co-existing factors responsible for malnutrition in a community before it is possible to elaborate a locally appropriate preventive programme that can be "aimed at the vulnerable links in the chain of multiple causation."

Raheela M.A. Mian, Mohammed Ali, Paola A. Ferroni *et al* (2002) conducted a study among school children with low SES in which they have found a high prevalence of malnutrition among the children with prevalence of underweight 29.5%, wasting 13% and stunting 35%. Alice H Lichtenstein, JoAnn S Carson, Rachel K Johnson *et al* (2014) found that the choice of foods meeting one front -of-pack labeling system positively influences food-group and nutrient intakes and is associated with a higher diet quality and lower risk of cardiometabolic syndrome.

**D. Nutritional surveys (Ann M. Coulston., 2012) Dietary assessment in different study designs**

The choice of the most appropriate dietary assessment tool depends on many factors. Questions that must be answered in evaluating which dietary assessment tool is most appropriate for a particular research need include the following: (1) Is information needed about foods, nutrients, other food components, or specific dietary behaviors? (2) Is the focus of the research question on describing intakes using estimates of average intake, and does it also require distributional information? (3) Is the focus of the research question on describing relationships between diet and health outcomes? (4) Is absolute or relative intake needed? (5) What level of accuracy and precision is needed? (6) What time period is of interest? (7) What are the research constraints in terms of money, interview time, staff, and respondent characteristics?

The different study designs are:

1. Cross-Sectional surveys
2. Case-Control (Retrospective) studies
3. Cohort (Prospective) studies
4. Intervention studies

**Corish *et al.* (2000)** conducted a prospective study which revealed that for clinical use, recent weight loss and functional status may be more appropriate variables to use in the evaluation of nutritional status on admission to hospital. **Jens Kondrup, Henrik Hojgaard Rasmussen, Ole Hamberg *et al.* (2003)** found that the screening system appears to be able to distinguish between trials with a positive effect versus no effect, and it can therefore probably also identify patients who are likely to benefit from nutritional support.

**Dietary assessment in special populations (Ann M. Coulston., 2012)**

A. Respondents Unable to Self -Report
B. Ethnic Populations
C. Children
D. Elderly

**A. Respondents Unable to Self -Report**

In many situations, respondents are unavailable or unable to report about their diets. For example, in case - control studies,

surrogate reports may be obtained for cases who have died or who are too ill to interview. Although the accuracy of surrogate reports has not been examined using the reference biomarkers of doubly labeled water or urinary nitrogen, the comparability of reports by surrogates and subjects has been studied with the goal that surrogate information might be used interchangeably with information provided by subjects.

**B. Ethnic Populations**

Special modifications may be needed in the content of dietary assessment methods when the study population is composed of individuals whose cuisine or cooking practices are not main stream. If the method requires an interview, interviewers of the same ethnic or cultural back-ground are preferable so that dietary information can be more effectively communicated. If dietary information is to be quantified into nutrient estimates, examination of the nutrient composition database is necessary to ascertain whether ethnic foods are included and whether those foods and their various preparation methods represent those consumed by the target population. It is also necessary to examine the recipes and assumptions underlying the nutrient composition of certain ethnic foods. Some very different foods may be called the same name, or identical foods may be called by different names. For these reasons, it may be necessary to obtain detailed recipe information for all ethnic mixtures reported.

**C. Children**

Assessing the diets of children is considered to be even more challenging than assessing the diets of adults. Children tend to have diets that are highly variable from day to day, and their food habits can change rapidly. Younger children are less able to recall, estimate, and cooperate in usual dietary assessment procedures; so much information by necessity has to be obtained by surrogate reporters. Although they are more able to report, adolescents may be less interested in giving accurate reports. Baranowski and Domel have posited a cognitive model of how children report dietary information. Dietary assessment in children and adolescents has been discussed and reviewed. The 24-hour recall, dietary records, dietary histories, FFQs, brief instruments, and blended instruments such as a dietary record-assisted 24- hour recall have all been used to assess children's intakes. The use of direct observation of children's diets has also been used extensively, most often as a reference method to compare with self-reported instruments. As predicted from Baranowski and Domel's model, it has been found that children's estimates of port ion size have large errors, and they are less able than adults to estimate portion sizes.

**D. Elderly**

Measuring diets among the elderly can, but does not necessarily, present special challenges. Both recall and food frequency techniques are inappropriate if memory or cognitive functioning is impaired. Similarly, self - administered tools may be inappropriate if physical disabilities such as poor vision are present. Interviewer administration is difficult when hearing problems are present. Direct observation in institutional care facilities or shelf inventories for elders who live at home can be useful. Even when cognitive integrity is not impaired, several factors can affect the assessment of diet among the elderly. Because of the frequency of chronic illness in this age group, it is more probable that special diets (e.g., low sodium, low fat, and high fiber) would have been recommended. Such recommendations could not only affect actual dietary intake but also bias reporting because individuals may report what they should eat rather than what they do eat.

**Nutritional screening tools to predict malnutrition in the elderly**

**(Kalliopi-Anna Poulia., 2012)**

Malnutrition in the elderly is a multifactorial health problem consisting of physiological, social and economic parameters, often referred as the "nine d's", namely poor dentition, dysgeusia, dysphagia, diarrhea, depression, disease, dementia, dysfunction and drugs. The variety of reasons that can trigger the development of malnutrition in the elderly has led scientists to develop methods for the early recognition of the problem and, thus, the development of a variety of nutritional screening tools. Some are based on biochemical and clinical indexes [i.e. the Nutritional Risk Index (NRI) and the Geriatric Nutritional Risk Index (GNRI)], others on anthropometry, mobility, cognitive state and self perception of health and nutrition [i.e. the Mini Nutritional Assessment (MNA) and it's shorter version, the Mini Nutritional Assessment Screening Form (MNA-SF) as well as the Malnutrition Universal Screening Tool (MUST)], while others are combining data from medical history, clinical and subjective evaluation of the patient [such as the Subjective Global Assessment (SGA) and the Nutritional Risk Screening 2002 (NRS 2002)].

**Persson MD**, **Brismar KE, Katzarski KS *et al*. (2006) found** that the data justify the use of SGA and MNA for the assessment of nutritional status in geriatric patients. **Adrienne M.Young, Sarah Kidston, Merrilyn D.Banks *et al*. (2011)** found that With the exception of the Rapid Screen, all screening tools were accurate in identifying malnutrition and therefore can be recommended for use in elderly hospitalized patients.

**Selected issues in dietary assessment methods (Ann M. Coulston., 2012)**

**A.Cognitive Testing Research Related to Dietary Assessment**

Nearly all studies using dietary information about subjects rely on the subjects own reports of their diets. Because such reports are based on complex cognitive processes, it is important to understand reliability of respondents and method of retrieving the information and reported to the investigator.

**B.Validation / Calibration Studies**

It is important and desirable that any new dietary assessment method be validated or calibrated against more established methods. The NCI maintains a register of validation/ calibration studies and publications on the web. A contingency table was made to analyze the relation between each nutritional screening tool and various nutritional variables or the MIS. These tables were used to determine the sensitivity, specificity, accuracy, positive predictive value (PPV), and negative predictive value (NPV) according to the following equations:

Sensitivity = true positives / (true positives+false negatives)
Specificity = true negatives / (true negatives+false positives)
Accuracy = true positives (true negatives+total numbers)
PPV = true test positives / all test positives and
NPV = true test negatives / all test negatives
To determine posttest probability, the positive likelihood ratio (LR+) and negative likelihood ratio (LR-) were calculated as follows:
LR += sensitivity/ (1 - specificity) and
LR - = (1 - sensitivity)/specificity

**C.Mode of Administration**

Instruments may be interviewer -administered or self - administered. Interviewer administered questionnaires may be in person or by telephone. A self administered instrument may be completed on paper or electronically. For interviewer - administered instruments, telephone administration is less expensive than in-person administration. However, concern is increasing about response rates in telephone surveys, given the public's distaste for prevalent telemarketing, technology that allows for the screening of calls, the increase in the proportion of the population who use only wireless telephones, and the general resistance of the public to engage in telephone interviews. For these reasons, response rates obtained using random digit dialing techniques have been dropping.

**D.Estimation of Portion Size of Foods**

Research has shown that untrained individuals have difficulty in estimating portion sizes of foods, both when examining displayed foods and when reporting about foods previously consumed. Furthermore, respondents appear to be relatively insensitive to changes made in portion size shown in reference categories asked on FFQs. Portion sizes of foods that are commonly bought and/or consumed in defined units (e.g., bread by the slice, pieces of fruit, and beverages in cans or bottles) may be more easily reported than amorphous foods (e.g., steak, lettuce, and pasta) or poured liquids. Other studies indicate that small portion sizes tend to be overestimated and large portion sizes underestimated.

**E.Choice of Nutrient and Food Database**

It is necessary to use a nutrient composition database when dietary data are to be converted to nutrient intake data. Typically, such a database includes the description of the food, a food code, and the nutrient composition per 100 grams of the food. The number of foods and nutrients included varies with the database. Research on nutrients, other dietary components, and foods is ongoing, and there is constant interest in updating current values and providing new values for a variety of dietary components of interest.

**F.Choice of Dietary Analysis Software**

Software should be chosen on the basis of the research needs, the level of detail necessary, the quality of the nutrient composition database, and the hardware and software requirements. If precise nutrient information is required, it is important that the system be able to expand to incorporate information about newer foods in the marketplace and to integrate detailed information about food preparation by process single recipe information (e.g., the ingredients and cooking steps for homemade stew).

**G.Estimating Usual Intakes of Nutrients and Foods**

In theory, usual intake is defined as the long-term average intake of a food or nutrient. The concept of long - term average daily intake, or "usual intake," is important because dietary recommendations are intended to be met over time and diet - health hypotheses are based on dietary intakes over the long term. Consequently, it is the usual intake that is often of most interest to policymakers (when they want to know the proportion of the population at or below a certain level of intake) or to researchers (when they want to examine relationships between diet and health).

**Elia *et al.* (2012)** reviewed nutrition screening tools and found that the incorporation of age and age -specific body mass index criteria into adult screening tools can influence the prevalence and age distribution of malnutrition, but no justification is usually provided for their use.

**Recent updates**

**A.Nutritional Screening tools for Hospitalized Children (Wonoputri N., 2014)**

The European Society for Clinical Nutrition and Metabolism (ESPEN), American Society for Parenteral and Enteral Nutr ition (ASPEN), and European Society for Paediatric Gastroenterology, Hepatology and Nutrition (ESPGHAN) recommend nutritional screening, which is rapid and simple, to be used to determine patients who are nutritionally at risk. An assessment tool that has been adapted for children, Subjective Global Nutritional Assessment in Children (SGNA), has shown its ability to identify malnourished children, identifying those at higher risk of nutrition associated complications, and prolonged hospitalizations. However, assessment tools are more complex and time consuming. Therefore, a nutritional screening tool is needed to evaluate every child admitted to the hospital.

Numerous screening tools have been developed in previous years, but no universally accepted screening tools are available. Paediatric Yorkhill Malnutrition Score (PYMS) was developed and validated in United Kingdom for hospitalized children aged 1–16 years old. Screening Tool for the Assessment of Malnutrition in Paediatrics (STAMP) was also developed and validated in the United Kingdom for hospitalized children. Screening Tool for Risk on Nutritional Status and Growth (STRONG-kids) was developed and validated in Dutch hospitals screening children between 1 month and 16 years.

**B.Digital Photographs, as a tool in 24h Recall (Claudia E Lazarte., 2012)**

Nutritional assessment in many low-income countries emphasizes new simple, non-invasive approaches that can be used to measure the risk of both nutrient shortages and excesses, as well as to monitor and evaluate the effects of a nutrition intervention. As a new approach the inclusion of digital photographs has been used to estimate portion size by taking photos of food and meals before and after consumption and by making food estimations either with the digital photographs alone or by comparing them with standard photographs. This method was validated mostly by comparing it with weighed records (as a reference method). Studies have

been conducted in a variety of settings such as schools, colleges, university cafeterias, laboratories, hospitals or community centers and in free-living conditions. The results indicate that digital photographs are useful for assessing dietary intake in individuals, and for reducing the respondent burden associated with completing food records. To our knowledge, the use of digital photographs has not yet been validated or used in rural populations in low income countries.

**Photo atlas**

A photo atlas with color photographs of 78 common foods consumed in the area, in various portion sizes, was included to assist the interviewer and participants in estimating the sizes of the portions. A total of 334 photos, divided into 8 food groups, that is meat, cereals, legumes, tubers, vegetables, fruits, composite meals and drinks, are depicted in the atlas. To prepare the photo atlas, population-based data as suggested by Nelson and Haraldsdóttir (1998).

**Photo kit**

A photo kit to be used by the subjects for taking photographs of all their foods consumed during the test day was prepared, containing: a digital camera (Samsung Digimax S760, LCD screen 2.4 in) a camera case and a table mat. The table mat to put the plate on is marked with 1.5 cm grids providing a standard background, equal to that used in the photo atlas.

**Reference method: WFR (Weighed Food Record)**

The WFR, was run in parallel with the FP 24-hR. An assistant, who had previously been trained by a nutritionist, visited each subject during the preparation and consumption of her meals during the test day. Before consumption of the meals, the amount of each food item and beverage was transferred to a clean dish, weighed (Ohaus Traveler TA 1501, capacity 1500 ± 0.1 g), and recorded separately, the same procedure was followed after consumption if there were leftovers, and the actual amount of each type of food eaten was subsequently calculated subtracting leftovers. In the case of mixed meals such as soups or stews, raw ingredients used in their preparation, were weighed (±0.1 g) and recorded individually, the final total weight of the mixed dish was weighed in the cooking pot, using a second scale with greater capacity (Ohaus Valor™ 1000 V11P30, capacity 30 kg ± 5 g), also the individual served dish was weighed (±0.1 g) and recorded. The weight of each ingredient was calculated for individual consumption. Wang *et al*. (2002) conducted a study to evaluate the validity and reliability of an alternative dietary measurement method that assists epidemiologic studies. They validated a handheld personal digital assistant with camera and mobile phone card, called Wellnavi in which a 1-d weighed diet record was employed as reference method among 20 college students. It was concluded that this dietary assessment instrument can usefully measure individual dietary intakes for a variety of nutrients in an epidemiologic study. Beasley (2005) conducted a study to assess the accuracy of a food record delivered on a personal digital assistant (PDA) and also to examine sources of error from the PDA based food record. 39 adults were trained to record food intake using Diet Mate Pro, a dietary assessment program delivered on a PDA. After 3d of use, subjects were assessed for 24 hour recall. Recalled and actual food intakes were compared with estimates recorded by the subjects when using the PDA. It was concluded that DietMatePro, a PDA based dietary assessment program, provides a method of assessing energy and macronutrient intakes comparable to the 24-h recall in samples lacking dietary restrictions.

**C.Body Mass Index with Per Cent Body Fat (PBF) (Betty Rani Issac., 2014)**

Considering the increasing prevalence of coronary artery diseases, hypertension and diabetes in urban India, it is important to maintain desirable body weight for height. Even though Indians generally have a lower Body Mass Index (BMI), they have a higher percentage of body fat than many other ethnic groups. WHO expert consultation has indicated that, Indians have a higher risk even at lower BMI and contain more body fat and are more prone to health risks than the European populations. Due to this reason the risks for diabetes and Cardio Vascular Diseases (CVD) are associated with even a lower BMI among Indian populations. Many Asian populations, especially Indians, have a higher total and central adiposity for a given body weight when compared with matched White populations. A higher prevalence of metabolic syndrome in Indians is mostly attributed to the higher prevalence of central adiposity.

Many researchers are of the opinion that it might be advantageous to use anthropometry especially BMI to estimate body fat. The following predictive equations were compared;

- Body fat per cent from body density (Siri's equation, 1961)
- Body fat per cent from predictive equation for Asian Indians (Goel *et al*., 2014)
- Body fat per cent from body density (Siri's equation, 1961)

This calculation of body fat per cent involves measuring four skinfold sites, triceps, biceps, subscapular and suprailiac and substitute the log of their sum into the following linear regression equation,

$$\textbf{Body density} = \textbf{C-M x (log } \Sigma \textbf{S)}$$

Where C and M stand for standard age and sex specific coefficients and ZS = Sum of all four skin fold measurements (mm)

Once the body density is determined, per cent body fat (%BF) can be calculated using the **Siri's Equation (1961)** as given below:

$$\textbf{Per cent Body Fat} = \textit{(495/body densi ty)} - \textbf{450}$$

***Body fat per*** *cent from predictive equation* for ***Asian Indians (Goel et al.)***

Goel *et al.* (2014) derived predictive equations of body fat for Indians as functions of simple anthropometric measures such as triceps skinfold, waist circumference, weight and height. It is calculated by the following formula;

Per cent Body Fat = 42.42 + 0.003 x age (years) +7.04 x gender (male =1, female = 2)+0.42 x triceps skin fold (mm) + 0.29 x waist circumference (cm) + 0.22 x weight (Kg) - 0.42 x height (cm)

**Betty Rani Isaac *et al.* (2014)** conducted a study to find out the correlation of BMI with per cent body fat and applicability

of BMI in predicting malnutrition in field studies and to compare the per cent body fat obtained from the convetional siri's predictive equation for general population and with Goel's equation for asian Indians on a group of 420 adults aged 18-60 years from Kochi. The subjects were classified on the basis of WHO's BMI cut off points, which defines low less than 18.5 (underweight), normal 18.5 – 24.9 (normal weight) and high 25 and above (over weight). Goel's equation was found to be highly correlated to BMI than Siri's predictive equation. It was concluded that BMI can thus be the pivotal point in determining the percentage undernutrition and overnutrition.

**Conclusion**

For most animal species, including humans, teeth are essential for bitting and chewing food and therefore contribute to physical growth and health. A good diet is not only necessary for development of the masticatory system; it also helps keep this system functioning properly. Since dentistry, or oral medicine, and eating are so closely linked, it is important for dentists to pay attention to their patient's nutritional status. While a skillful technician may reconstruct the teeth very successfully in terms of esthetics, only an oral doctor can truly improve a patient's dental health. The esthetic care provided by the technician may have no impact on the patient's health, but dental care must. Nutritional assessment recognized by the profession as a non-invasive, risk-free and worth must be integral to the practice of a dentist, the oral physician of the 21st century.

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