Nutritional assessment is the tool by which the nutritionist evaluates the patient for maintenance of normal growth and health. This includes assessment for risk factors contributing to disease and early detection and treatment of nutritional deficiencies and excesses. Comparing an individual against an established norm provides a basis for objective recommendations and evaluation of medical nutrition therapy.\textsuperscript{1,2} Although much information has been published on the use of increasingly sophisticated techniques, clinical judgment and perceptive history taking remain important overall components of nutritional assessment.\textsuperscript{3} In children this encompasses factors such as family history, developmental assessment, medical history including growth history, and physical examination including anthropometry. Nutritional assessment in children has special significance because undernutrition is the single most important cause of growth retardation.\textsuperscript{4} Acute and chronic malnutrition remain common in hospitalized pediatric patients in the United States, underscoring the need for early detection and treatment of nutritional deficiency.\textsuperscript{5} In addition, in the United States, overnutrition in the pediatric population has risen significantly,\textsuperscript{6} and the association of obesity with chronic diseases in adulthood such as heart disease and diabetes is strong; thus nutri-
A combination of anthropometric, biochemical, clinical, and dietary information forms the basis of evaluation. As no one parameter is completely satisfactory with regard to sensitivity and specificity, in each category various tests monitor different aspects of nutritional status. Criteria for evaluating a nutritional assessment parameter are outlined in Table 1–1. Standards that are relevant to a specific population, as well as appropriate techniques and equipment for measurement, are important. In these sections, guidelines are provided to help determine where to begin the assessment of an individual (Table 1–2), what type of assessment is likely to yield valuable screening information, and how and when to proceed with more extensive and costly evaluation. An example of a worksheet for data collection and assessment on general pediatrics is included (Table 1–3) . Dietary insufficiency or excess generally precedes signs of biochemical, anthropometric, or clinical deficiency, and guidelines for dietary

Table 1–1. Criteria for Evaluation of a Nutritional Assessment Parameter

1. What biochemical or physiologic phenomena does the parameter measure?
2. How well established are the standard values for a specific age?
3. How well does the parameter assess nutritional status in a given disease?
4. How well does the measurement detect early signs of deficiency or excess?
5. What is the correlation of the measurement with function (eg, immunity, growth)?
6. How available and reliable is the measurement?
7. What is the cost-benefit ratio of the test for this particular patient?
Table 1–2. Approach to Identification of Nutritional Problems

<table>
<thead>
<tr>
<th>Screening</th>
<th>Dietary</th>
<th>Clinical</th>
<th>Anthropometric</th>
<th>Biochemical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Routine:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>To be done on all patients. If problems are indicated, additional midlevel or in-depth parameters should be evaluated</td>
<td>Typical dietary pattern (food pyramid/food frequency), vitamin and mineral supplement, family eating habits, subsidy support</td>
<td>Physical and dental history and examination, sexual maturation, use of medication(s)</td>
<td>Weight, length, head circumference, weight for height, and BMI</td>
<td>Hemoglobin, hematocrit, MCV, total cholesterol (LDL dependent on total cholesterol)</td>
</tr>
<tr>
<td>Midlevel, add:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>As indicated by routine screening or in populations at risk of chronic nutrition problems and children with special health care needs</td>
<td>24-hour recall and 3- to 7-day food records, developmental evaluation of feeding skills</td>
<td>More extensive examination (eg, skin, hair, nails) circumference, prediction of mature height, bioelectric impedance</td>
<td>Height and weight Z score, triceps skinfold, arm</td>
<td>Albumin, prealbumin, total protein, total lymphocyte count</td>
</tr>
</tbody>
</table>
Table 1–2. Approach to Identification of Nutritional Problems, continued

| Screening                                      | Dietary                | Clinical                              | Anthropometric       | Biochemical                        |
|------------------------------------------------|------------------------|======================================|----------------------|------------------------------------|
| In-depth, add:                                 |                        |                                      |                      |                                    |
| As indicated in acute                          | Same, observation in   | Bone mineralization                  | Height velocity,     | Specific vitamin, mineral, and      |
| and chronic PCM and                            | hospital               | (eg, epiphyseal enlargement, cranial | DEXA                 | electrolyte levels or enzymes and   |
| to monitor chronically                         |                        | bossing), bone age                   |                      | proteins that require that nutrient;|
| ill patients                                    |                        |                                      |                      | delayed cutaneous hypersensitivity  |

BMI = body mass index; DEXA = dual-energy x-ray absorptiometry; LDL = low-density lipoproteins; MCV = mean corpuscular volume.
**TABLE 1–3. Pediatric Nutritional Assessment Data Sheet**

<table>
<thead>
<tr>
<th>Name</th>
<th>_______________________________________________</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date</td>
<td>_______________________________________________</td>
</tr>
<tr>
<td>Date of Birth</td>
<td>_______________________________________________</td>
</tr>
</tbody>
</table>

**History**

Presenting Problems:
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Growth History:
________________________________________________________________________
________________________________________________________________________

**Anthropometric Data**

Weight _______kg ______percentile ______% standard
Height _______cm ______percentile ______% standard
Weight/height ______percentile
BMI ______percentile
Head circumference ______cm ______percentile
Skinfold thickness ______mm ______percentile
Arm circumference ______cm ______percentile

**Biochemical Data**

Hemoglobin _______________ WBC _____________________
Hematocrit ________________ TLC ______________________
MCV _____________________ Cholesterol ________________
Albumin___________________ LDL ______________________
Total protein_________________

**Clinical Data**

Signs or symptoms of nutrient deficiencies or excess________
________________________________________________________________________

Classification of malnutrition/risk of overweight/overweight ______
________________________________________________________________________
TABLE 1–3. Pediatric Nutritional Assessment Data, continued

<table>
<thead>
<tr>
<th>Dietary Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimated calorie intake from ________________</td>
</tr>
<tr>
<td>___________kcal/day _______________kcal/kg</td>
</tr>
<tr>
<td>___________g protein _______________protein/kg _____% kcals</td>
</tr>
<tr>
<td>_____________g fat _____________% calories</td>
</tr>
<tr>
<td>______g carbohydrate _____________% calories</td>
</tr>
</tbody>
</table>

Vitamin/mineral supplement type and amount:

Feeding skills and behavior appropriate for age:

yes _____________delayed ________________

Use of:

Food stamps ___________WIC ___________ Other ___________

<table>
<thead>
<tr>
<th>Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ideal weight for height ________________________________kg</td>
</tr>
<tr>
<td>Recommended _________________kcal/day</td>
</tr>
<tr>
<td>Recommended _________________protein/day</td>
</tr>
</tbody>
</table>

assessments are included in this chapter. The various indices of anthropometry and body composition, reference standards, techniques, interpretation, and classification of malnutrition are detailed in Chapter 2. Clinical evaluation is covered in Chapter 3, and biochemical parameters useful in nutritional assessment are included in Chapter 4. Basic guidelines related to nutritional assessment, recommendations for specific disease states, and nutrition therapies are discussed throughout the manual. The following are excellent general reference sources for
pediatric nutritional assessment: The Centers for Disease Control (Nutrition Division, Atlanta, Georgia) Anthropometric Software Package, which can be used to calculate height and weight percentile, Z score, and malnutrition category relative to the National Center for Health Statistics (NCHS) reference growth standards; the American Academy of Pediatrics Pediatric Nutrition Handbook; and Quality Assurance Criteria for Pediatric Nutrition Conditions: a Model prepared by dietitians in the Pediatric Nutrition Practice Group.

Dietary inadequacy or excess is frequently the cause of under- or overnutrition and often precedes biochemical, anthropometric, or clinical signs; thus, evaluation of an individual’s diet plays an important role in nutritional diagnosis and treatment. Quality and quantity of food intake and the macro- and micronutrients provided can be measured using a variety of techniques. In addition, dieting history, development of feeding skills, abnormal eating habits, difficulty in feeding, and activity level should be assessed.

Several methods are available for the collection of information about food consumption. Some are more appropriate for the assessment of population data on food intake. In the clinical setting, where individual information is important, more detailed and precise methods are generally used. The most common dietary assessment tools in clinical practice are the 24-hour recall, 3- to 7-day food records, and “usual patterns” described by the patient or their caretaker. A complete dietary history combines a number of these methods with the gathering of medical and clinical information relative to dietary assessment.

Each method has certain weaknesses and limitations, and difficulty in quantifying and qualifying actual intake is well documented. Normal-weight patients give the most accurate record, whereas underweight patients over-
estimate and overweight patients underestimate actual food consumed. Similarly, dietary intake assessed over long periods tends to be overestimated and over short periods underestimated. Considerable differences in nutrient intakes may be obtained because of different techniques, variability of intake from day to day, difficulty in obtaining information on children by different care providers, and imprecision in estimating quantity in smaller children. It can be helpful in some cases to use a combination of methods (24-hour recall with 3-day food records) to provide a more complete and accurate dietary evaluation. Emphasis should be placed on careful questioning and detailed recording of intake.

Additional limitations to the establishment of accurate assessment of intake include a wide variety of food composition tables and computerized databases for analysis and difficulty in establishing actual nutrient needs.

References
Chapter 1  Nutritional Assessment: Dietary Evaluation


