Faculty of Medicine

Introduction to Community Medicine Course

(31505201)

Unit 2 Nutrition and Nutrition Assessment and Diet

Assessment of Nutritional Status. Anthropometric Assessment.

By

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MD MPH JBCM PhD

4-10-2016
<table>
<thead>
<tr>
<th>Presentation outline</th>
</tr>
</thead>
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<td><strong>What is Nutritional assessment and Why?</strong></td>
</tr>
<tr>
<td><strong>Tools and Methods of Nutritional Assessments</strong></td>
</tr>
<tr>
<td><strong>Anthropometric Assessment : Obesity</strong></td>
</tr>
</tbody>
</table>
First assessment (exam)
Sunday
23-10-2016
12:00-13:00
في نفس القاعة
لا تيجي تحدد النقاط المهمة
طالب في كلية طب
طالب في كلية طب
#BAanadrol
3 Differences between

<table>
<thead>
<tr>
<th>Marasmus</th>
<th>kwashiorkor</th>
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<td>1-</td>
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INTRODUCTION

The nutritional status of an individual is often the result of many inter-related factors.

It is influenced by food intake, quantity & quality, & physical health.

The spectrum of nutritional status spread from obesity to severe malnutrition
What is Nutritional Assessment?

“the evaluation of nutrition needs of individuals based upon appropriate biochemical, anthropometric, physical, and dietary data to determine nutrient needs and recommended appropriate nutrition intake including enteral and parenteral nutrition”

- American Dietetic Association
The purpose of nutritional assessment

- Identify individuals or population groups at risk of becoming malnourished
- To obtain *precise information* about the prevalence and geographic distribution of nutritional problems of a community
- To develop *health care programs* that meet the community needs
- To measure the *effectiveness* of the nutritional programs & intervention once initiated
Nutritional Assessment Tools
Nutritional Assessment Tools

- No single / standard way of assessing nutritional status

- Various validated assessment tools developed
  - some disease specific
  - some age specific

- 2 examples
  - Mini Nutritional Assessment (MNA)
  - Subjective Global Assessment (SGA)
Mini Nutritional Assessment (MNA)

• Screening and Assessment tool for the identification of malnutrition in the elderly
• Considers:
  – Dietary Intake – foods, patterns
  – Weight change, BMI, Muscle circumferences
  – Functional impairment, Independence, Living arrangements
  – Psychological issues, Self assessment
Subjective Global Assessment

• Valid assessment tool

• Strong correlation with other subjective and objective measures of nutrition

• Highly predictive of nutritional status in a number of different patient groups

• Quick, simple and reliable
Subjective Global Assessment...features

• Medical History
  – Weight change
  – Dietary intake
  – GI symptoms
  – Functional impairment

• Physical Examination
  – Loss of subcutaneous fat
  – Muscle wasting
  – Oedema and ascites
Subjective Global Assessment

...Classifications

A  Well nourished

B  Moderately malnourished or suspected of malnutrition

C  Severely malnourished
Full Nutrition Assessment
Step 1...Data collection

• Systematic Approach
• Assessment based on clinical/psychosocial/physical information
  – Dietary
  – Anthropometric
  – Biochemical
  – Physical
• Including
  – Subjective (eg. signs/symptoms of nutritional problem, appetite)
  – Objective (eg. Lab results)
Data Collection...
An Example... A B C D E

A  Anthropometry
B  Biochemical Data
C  Clinical signs and symptoms, medical condition
D  Dietary Intake
E  Exercise (Energy balance – expenditure)

Consider current level, history and changes
Methods of Nutritional Assessment
Methods of Nutritional Assessment

Nutrition is assessed by two types of methods; direct and indirect.

- The direct methods deal with the individual and measure objective criteria,
- while indirect methods use community health indices that reflects nutritional influences.
Direct Methods

These are ABCDE

- Anthropometric methods
- Biochemical, laboratory methods
- Clinical methods
- Dietary evaluation methods
- Exercise (Energy balance – expenditure)
Indirect Methods

These include three categories:

- **Economic factors** e.g. per capita income, population density & social habits
- **Vital health statistics** particularly infant & under 5 mortality & fertility index
- **Ecological variables** including crop production
Anthropometric Methods
Anthropometric Methods

Anthropometry is the measurement of body height, weight & proportions.

It is an essential component of clinical examination of infants, children & pregnant women.

It is used to evaluate both under & over nutrition.

The measured values reflects the current nutritional status & don’t differentiate between acute & chronic changes.
Anthropometry for children

Accurate measurement of height and weight is essential. The results can then be used to evaluate the physical growth of the child.

For growth monitoring the data are plotted on growth charts over a period of time that is enough to calculate growth velocity, which can then be compared to international standards.
Other anthropometric Measurements

- Mid-arm circumference
- Skin fold thickness
- Head circumference
- Head/chest ratio
- Hip/waist ratio
WHO Child Growth Standards

Length/height-for-age, weight-for-age, weight-for-length, weight-for-height and body mass index-for-age

Methods and development
Growth Monitoring Chart
Percentile chart
2 to 20 years: Boys
Cerebral palsy
GMFCS V, tube fed
Weight—for—age percentiles

Mother's Stature | Father's Stature
---|---
Date | Age | Weight | Stature | BMI

Notes:

Low weight (see text)

SOURCE: Life Expectancy Project (2011)
Based on data from California Department of Developmental Services
http://www.LifeExpectancy.org/Articles/NewGrowthCharts.shtml

2 to 20 years: Girls
Cerebral palsy
GMFCS IV
Weight—for—age percentiles

Mother's Stature | Father's Stature
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http://www.LifeExpectancy.org/Articles/NewGrowthCharts.shtml
Weight-for-length BOYS
Birth to 2 years (z-scores)
Length-for-age GIRLS

Birth to 2 years (percentiles)
Measurements for adults

Height:

The subject stands erect & bare footed on a stadiometer with a movable head piece. The head piece is leveled with skull vault & height is recorded to the nearest 0.5 cm.
Nutritional Indices in Adults

• The international standard for assessing body size in adults is the body mass index (BMI).

• BMI is computed using the following formula: BMI = Weight (kg)/ Height (m²)

• Evidence shows that high BMI (obesity level) is associated with type 2 diabetes & high risk of cardiovascular morbidity & mortality
Use a regularly calibrated electronic or balanced-beam scale. Spring scales are less reliable.

Weigh in light clothes, no shoes

Read to the nearest 100 gm (0.1kg)
BMI (WHO - Classification)

- BMI < 18.5 = Under Weight
- BMI 18.5-24.5 = Healthy weight range
- BMI 25-30 = Overweight (grade 1 obesity)
- BMI >30-40 = Obese (grade 2 obesity)
- BMI >40 = Very obese (morbid or grade 3 obesity)
Waist/Hip Ratio

• Waist circumference is measured at the level of the umbilicus to the nearest 0.5 cm.

🌟 The subject stands erect with relaxed abdominal muscles, arms at the side, and feet together.

🌟 The measurement should be taken at the end of a normal expiration.
Waist circumference

- Waist circumference predicts mortality better than any other anthropometric measurement.
- It has been proposed that waist measurement alone can be used to assess obesity, and two levels of risk have been identified.

<table>
<thead>
<tr>
<th>LEVEL</th>
<th>MALES</th>
<th>FEMALE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>&gt; 94cm</td>
<td>&gt; 80cm</td>
</tr>
<tr>
<td>2</td>
<td>&gt; 102cm</td>
<td>&gt; 88cm</td>
</tr>
</tbody>
</table>
Waist circumference/2

Level 1 is the maximum acceptable waist circumference irrespective of the adult age and there should be no further weight gain.

Level 2 denotes obesity and requires weight management to reduce the risk of type 2 diabetes & CVS complications.
Hip Circumference

- Is measured at the point of greatest circumference around hips & buttocks to the nearest 0.5 cm.
- The subject should be standing and the measurer should squat beside him.
- Both measurement should taken with a flexible, non-stretchable tape in close contact with the skin, but without indenting the soft tissue.
Interpretation of WHR

- High risk WHR = >0.80 for females & >0.95 for males i.e. waist measurement >80% of hip measurement for women and >95% for men indicates central (upper body) obesity and is considered high risk for diabetes & CVS disorders.

- A WHR below these cut-off levels is considered low risk.
Anthropometry

- Height
- Weight
- Weight history / pattern (% weight change)
- Weight for Height
- BMI
- Growth Pattern, head circumference (paediatrics)
- MAMC
- TSF
- Waist circumference
- Hip circumference
- WHR

Be aware of fluid status, presence of oedema.
Anthropometry – Body Composition

Muscle, Fat, Bone, Water

Body Mass:
• LBM – Body mass that contains small % (~3%) essential fat
  [Essential fat + Muscle + Water + Bone]
• Fat Free Mass (FFM)

Fat Store:
• Essential Fat for physiological function, eg. fat stored in muscle, liver, heart
• Storage fat in adipose tissue – visceral fat and subcutaneous fat
ADVANTAGES OF ANTHROPOMETRY

• Objective with high specificity & sensitivity
• Measures many variables of nutritional significance (Ht, Wt, MAC, HC, skin fold thickness, waist & hip ratio & BMI).
• Readings are numerical & gradable on standard growth charts
• Readings are reproducible.
• Non-expensive & need minimal training
Limitations of Anthropometry

- Inter-observers errors in measurement
- Limited nutritional diagnosis
- Problems with reference standards, i.e. local versus international standards.
- Arbitrary statistical cut-off levels for what considered as abnormal values.
DIETARY ASSESSMENT
DIETARY ASSESSMENT

• Nutritional intake of humans is assessed by five different methods. These are:
  
  – 24 hours dietary recall
  – Food frequency questionnaire
  – Dietary history since early life
  – Food dairy technique
  – Observed food consumption
24 Hours Dietary Recall

A trained interviewer asks the subject to recall all food & drink taken in the previous 24 hours.

It is quick, easy, & depends on short-term memory, but may not be truly representative of the person’s usual intake.
Food Frequency Questionnaire

In this method the subject is given a list of around 100 food items to indicate his or her intake (frequency & quantity) per day, per week & per month.

inexpensive, more representative & easy to use.
Limitations:

- Long Questionnaire
- Errors with estimating serving size.
- Needs updating with new commercial food products to keep pace with changing dietary habits.
DIETARY HISTORY

- It is an accurate method for assessing the nutritional status.
- The information should be collected by a trained interviewer.
- Details about usual intake, types, amount, frequency & timing needs to be obtained.
- Cross-checking to verify data is important.
FOOD DAIRY

Food intake (types & amounts) should be recorded by the subject at the time of consumption.

The length of the collection period range between 1-7 days.

Reliable but difficult to maintain.
Observed Food Consumption

- The most unused method in clinical practice, but it is recommended for research purposes.
- The meal eaten by the individual is weighed and contents are exactly calculated.
- The method is characterized by having a high degree of accuracy but expensive & needs time & efforts.
Interpretation of Dietary Data

1. **Qualitative Method**

- using the food pyramid & the basic food groups method.
- Different nutrients are classified into 5 groups (fat & oils, bread & cereals, milk products, meat-fish-poultry, vegetables & fruits)
- determine the number of serving from each group & compare it with minimum requirement.
Interpretation of Dietary Data/2

2. Quantitative Method

• The amount of energy & specific nutrients in each food consumed can be calculated using food composition tables & then compare it with the recommended daily intake.

• Evaluation by this method is expensive & time consuming, unless computing facilities are available.
Biochemical-Laboratory Assessment
Initial Laboratory Assessment

- **Hemoglobin estimation** is the most important test, & useful index of the overall state of nutrition. Beside anemia it also tells about protein & trace element nutrition.

- **Stool examination** for the presence of ova and/or intestinal parasites
  - Urine dipstick & microscopy for albumin, sugar and blood
Specific Lab Tests

- Measurement of individual nutrient in body fluids (e.g. serum retinol, serum iron, urinary iodine, vitamin D)
- Detection of abnormal amount of metabolites in the urine (e.g. urinary creatinine/hydroxyproline ratio)
- Analysis of hair, nails & skin for micro-nutrients.
Advantages of Biochemical Method

- It is useful in detecting early changes in body metabolism & nutrition before the appearance of overt clinical signs.
- It is precise, accurate and reproducible.
- Useful to validate data obtained from dietary methods e.g. comparing salt intake with 24-hour urinary excretion.
Limitations of Biochemical Method

- Time consuming
- Expensive
- They cannot be applied on large scale
- Needs trained personnel & facilities
CLINICAL ASSESSMENT
It is an essential feature of all nutritional surveys.

It is the simplest & most practical method of ascertaining the nutritional status of a group of individuals.

It utilizes a number of physical signs, (specific & non-specific), associated with malnutrition deficiency of vitamins & micronutrients.
CLINICAL ASSESSMENT

- Good nutritional history should be obtained.
- General clinical examination, with special attention to organs like hair, angles of the mouth, gums, nails, skin, eyes, tongue, muscles, bones, & thyroid gland.
- Detection of relevant signs helps in establishing the nutritional diagnosis.
CLINICAL ASSESSMENT

• **ADVANTAGES**
  – Fast & Easy to perform
  – Inexpensive
  – Non-invasive

• **LIMITATIONS**
  – Did not detect early cases
## Clinical signs of nutritional deficiency

<table>
<thead>
<tr>
<th>HAIR</th>
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</thead>
<tbody>
<tr>
<td><strong>Spare &amp; thin</strong></td>
<td><strong>Protein, zinc, biotin deficiency</strong></td>
</tr>
<tr>
<td><strong>Easy to pull out</strong></td>
<td><strong>Protein deficiency</strong></td>
</tr>
<tr>
<td><strong>Corkscrew Coiled hair</strong></td>
<td><strong>Vit C &amp; Vit A deficiency</strong></td>
</tr>
</tbody>
</table>
Clinical signs of nutritional deficiency

**MOUTH**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Deficiency Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glossitis</td>
<td>Riboflavin, niacin, folic acid, B12, pr.</td>
</tr>
<tr>
<td>Bleeding &amp; spongy gums</td>
<td>Vit. C, A, K, folic acid &amp; niacin</td>
</tr>
<tr>
<td>Angular stomatitis, cheilosis &amp; fissured tongue</td>
<td>B 2, 6, &amp; niacin</td>
</tr>
<tr>
<td>Leukoplakia</td>
<td>Vit. A, B12, B-complex, folic acid &amp; niacin</td>
</tr>
<tr>
<td>Sore mouth &amp; tongue</td>
<td>Vit B12, 6, c, niacin, folic acid &amp; iron</td>
</tr>
</tbody>
</table>
## Clinical signs of nutritional deficiency

<table>
<thead>
<tr>
<th>EYES</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Night blindness, exophthalmia</strong></td>
<td><strong>Vitamin A deficiency</strong></td>
</tr>
<tr>
<td><strong>Photophobia-blurring, conjunctival inflammation</strong></td>
<td><strong>Vit B2 &amp; vit A deficiencies</strong></td>
</tr>
</tbody>
</table>
### Clinical signs of nutritional deficiency

#### NAILS

<table>
<thead>
<tr>
<th>Spooning</th>
<th>Iron deficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transverse lines</td>
<td>Protein deficiency</td>
</tr>
</tbody>
</table>
Clinical signs of nutritional deficiency

### SKIN

<table>
<thead>
<tr>
<th>Condition</th>
<th>Deficiency Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pallor</td>
<td>Folic acid, iron, B12</td>
</tr>
<tr>
<td>Follicular hyperkeratosis</td>
<td>Vitamin B &amp; Vitamin C</td>
</tr>
<tr>
<td>Flaking dermatitis</td>
<td>PEM, Vit B2, Vitamin A, Zinc &amp; Niacin</td>
</tr>
<tr>
<td>Pigmentation, desquamation</td>
<td>Niacin &amp; PEM</td>
</tr>
<tr>
<td>Bruising, purpura</td>
<td>Vit K, Vit C &amp; folic acid</td>
</tr>
</tbody>
</table>
Clinical signs of nutritional deficiency

**Thyroid gland**

- in mountainous areas and far from sea places Goiter is a reliable sign of iodine deficiency.
Clinical signs of nutritional deficiency

**Joins & bones**

- Help detect signs of vitamin D deficiency (Rickets) & vitamin C deficiency (Scurvy)
Clinical issues to consider:

- Medical history, treatment and medications
- Significant factors affecting nutritional intake
- Fluid balance – input and output, Bowel habits
- Physical assessment of nutritional status
- Clinical signs and symptoms
Clinical Signs and Symptoms

**Signs**
- Subjective, impression
- Descriptive, observation
- Appearance
- Visual examination
- Needs clinical judgment
- Eg muscle wasting, malnutrition

**Symptoms**
- Recall, report by subjects
- Descriptive
- Eg nausea, itchiness, diarrhea, anorexia
Obesity
Potential Negative Health Effects of Overweight and Obesity

**MENTAL HEALTH**
Increased rates of depression and anxiety disorders

**CARDIOVASCULAR SYSTEM**
- High blood pressure
- Higher triglyceride levels and decreased HDL levels, both factors in the development of cardiovascular disease

**ENDOCRINE SYSTEM**
A weight gain of 11–18 pounds doubles a person’s risk of type 2 diabetes

**REPRODUCTIVE SYSTEM**
- Higher rates of sexual dysfunction
- Increased risks for endometrial, prostate, and uterine cancer
- Increased risk of breast cancer in women
- In pregnant women, increased risk of fetal and maternal death, labor and delivery complications, and birth defects

**IMMUNE SYSTEM**
- Tendency toward more infectious diseases
- Reduced wound healing

**HEART**
- Dramatically increased risk for all forms of heart disease

**RESPIRATORY SYSTEM**
- Increased risk of sleep apnea and asthma

**DIGESTIVE SYSTEM**
- Increased risks for colon, gallbladder, and kidney cancer
- Increased risks of gallbladder disease

**BONES AND JOINTS**
- For every 2 pound increase in weight, the risk of arthritis increases 9%–13%
- Increased risk of osteoarthritis, especially in weight-bearing joints like knees and hips
Assessment of obesity

- Relative Weight (RW)
- Body Mass Index (BMI)
- Waist Circumference (WC)
- Mid Upper Arm Circumference (MAC)
- Triceps Skin Fold Thickness (TSF)
- Growth Monitoring Chart – infants and young children.
Assessing Body Weight and Body Composition

• **Body Mass Index (BMI)**
  - Index of the relationship between height and weight
  - BMI = weight (kg)/height squared (m$^2$)
  - BMI of 18.5 to 25 kg/m$^2$ indicates healthy weight

• **Youth and BMI**
  - Labeled differently, as “at risk of overweight” and “overweight”
Weight Classifications

A Review

- **Body mass index** (BMI) is a mathematical ratio which is calculated as weight (kg)/ height squared (m²). It is used to describe an individual's relative weight for height, and is significantly correlated with total body fat content. BMI is intended for those 20 years of age and older.

<table>
<thead>
<tr>
<th>With a BMI of:</th>
<th>You are considered:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below 18.5</td>
<td>Underweight</td>
</tr>
<tr>
<td>18.5 - 24.9</td>
<td>Healthy Weight</td>
</tr>
<tr>
<td>25.0 - 29.9</td>
<td>Overweight</td>
</tr>
<tr>
<td>30 or higher</td>
<td>Obese</td>
</tr>
</tbody>
</table>
## Body Mass Index (BMI)

<table>
<thead>
<tr>
<th>Height</th>
<th>Weight in pounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>4’10”</td>
<td></td>
</tr>
<tr>
<td>91</td>
<td>96</td>
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<tr>
<td>4’11”</td>
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<td>94</td>
<td>99</td>
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<td>5’</td>
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<td>97</td>
<td>102</td>
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<td>5’1”</td>
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<td>155</td>
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<td>6’3”</td>
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<td>152</td>
<td>160</td>
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<tr>
<td>6’4”</td>
<td></td>
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<tr>
<td>156</td>
<td>164</td>
</tr>
</tbody>
</table>

- **Healthy weight** BMI 18.5–24.9
- **Overweight** BMI 25–29.9
- **Obese** BMI 30–39.9
- **Morbidly obese** BMI ≥40
Assessment of obesity

1-relative weight (RW)

The weight and height measures are used to calculate the "relative weight" which is the deviation from standard weight for height (displayed in special tables for the desirable for a given height).

Relative weight = \frac{\text{Body weight in Kg}}{\text{Standard weight (Kg)}} \times 100

2-Body Mass Index (BMI)

The weight and height measures can be used to calculate the person’s body mass index.

\text{BMI} = \frac{\text{weight (Kg)}}{\text{Height in (meters)}^2}

This ratio is used in evaluating obesity status. Health risk associated with obesity begins at a level of 25 to 30 kg/m².
<table>
<thead>
<tr>
<th>Interpretation</th>
<th>Relative weight to standard weight for height %</th>
<th>BMI (Kg/m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight</td>
<td>&lt; 100%</td>
<td>&lt; 18.5</td>
</tr>
<tr>
<td>Normal</td>
<td>100%</td>
<td>18.5-24.9</td>
</tr>
<tr>
<td>Overweight</td>
<td>110%-119%</td>
<td>25.0-29.9</td>
</tr>
<tr>
<td>Obesity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Mild</td>
<td>120%-139%</td>
<td>30.0-34.9</td>
</tr>
<tr>
<td>- Moderate</td>
<td>140%-200%</td>
<td>35.0-39.9</td>
</tr>
<tr>
<td>- Severe</td>
<td>Over 200%</td>
<td>≥ 40</td>
</tr>
</tbody>
</table>
3-Waist Circumference (WC)

The waist circumference is used to assess adiposity, which is related to visceral deposition of fat. The individual is considered at risk for type 2 diabetes, when the waist circumference is more than 102 cm in males and more than 88 cm in females.

4-Mid Upper Arm Circumference (MAC)

The MAC is measured using a non-stretchable centimeter tape. Readings (in centimeters) are to be compared to with previous readings and with standard reference tables.

5-Triceps Skin Fold Thickness (TSF)

TSF measurement provides a good estimate of the subcutaneous fat reserves.

- The skin fold thickness at the midpoint of the upper arm is measured by using a "standard millimeter skin fold caliper", and excessive pressure should be avoided.

- The findings are to be compared with standard reference tables.

- Practically the skin fold test application is usually for infants and young children. Both lower (marasmus) and higher (overweight or obesity) levels of skin thickness are significant.

- Normal thickness is 20 mm in men, and 30 mm in women.

6- Growth monitoring of infants and young children
For whom with Insomnia

هل تعلم أن الموز يعزز القدرة على النوم، لاحتوائه على المغنيسيوم والبوتاسيوم اللذين يساعدان على استرخاء العضلات والكربوهيدرات التي تحسّن النوم.
THANK YOU!