Session 1

Introduction to Dietary Planning,
Nutritional Screening and Assessment

Nutritional Medicine Department
Overview – Session 1

• Read and review Subject Outline, Subject Rationale, Subject Assessments, Reading List.
• Foundations of a healthy diet following holistic nutrition principles
• Review of dietary guidelines and nutrient reference values (NRVs)
• Energy equations
• Food records
• Exchange lists and programs
Life-Course Approach to Nutrition

• Nutrition care is an organised group of activities allowing identification of nutritional needs and provision of care to meet these needs (Mahan, Escott-Stump & Raymond 2012, p. 253).

• Whilst each client is treated as a unique individual in the nutrition care process, there are certain factors relevant to each life stage that should be considered.

• Nutritional status at one stage of life can influence the health status in subsequent stages (Brown, 2011, p. 38).
Foundations of a Healthy Diet

General principles:

• Optimise intake of beneficial substances (e.g. nutrients and phytochemicals).

• Minimise exposure to potentially harmful substances (e.g. contaminants).

• Satisfy psychological and social needs related to food and eating.

• Choose foods that support environmental sustainability.
Optimum Nutrition

According to the NHMRC (2013):

“Optimum nutrition is essential for the normal growth and physical and cognitive development of infants and children.”

“In all Australians, nutrition contributes significantly to healthy weight, quality of life and wellbeing, resistance to infection, and protection against chronic disease and premature death.”
Foundations of a Healthy Diet

Guidance can be drawn from the following sources:

- Global Guidelines (e.g. WHO)
- Holistic nutrition principles
- Traditional diets
- Current scientific research
Foundations of a Healthy Diet

An appropriate ‘healthy diet’ for each person should consider a range of factors such as:

- Genetics
- Cultural beliefs and background
- Socioeconomic status
- Illness and disease risks
- Physical activity levels
- Health status and history
- Lifestyle
- Life stage
Foundations of a Healthy Diet

• Dietary planning involves quantitative and qualitative considerations.
• For example, ensuring that a person is consuming an adequate amount of carbohydrate-rich foods would be a quantitative consideration.
• Ensuring that those carbohydrate-rich foods are predominately wholefoods rather than refined, and low GI rather than high GI, would be a qualitative consideration.
Total Energy Intake

One of the first quantitative considerations is how much total food should a person be consuming each day?

**Australian Dietary Guidelines: Guideline 1**

“To achieve and maintain a healthy weight, be physically active and choose amounts of nutritious food and drinks to meet your energy needs.”

(www.eatforhealth.gov.au, 2013)
Total Energy Intake

Australian Dietary Guidelines: Guideline 1

Additionally:

- Children and adolescents should eat sufficient nutritious foods to grow and develop normally. They should be physically active every day and their growth should be checked regularly.

- Older people should eat nutritious foods and keep physically active to help maintain muscle strength and a healthy weight.

(www.eatforhealth.gov.au, 2013)
Energy

• Defined as “the capacity to do work”.

• The ultimate source of all energy in living organisms is the sun.

• Plants convert solar energy into chemical energy through photosynthesis.

• Animals and humans obtain nutrients and energy by consuming plants and the flesh of other animals.

(Mahan et al., 2012)
Dietary Energy

• Energy is not a nutrient but is required in the body for metabolic processes, physiological functions, muscular activity, heat production, growth and synthesis of new tissues.
• Energy is released from food components by oxidation.
• The sources of energy are carbohydrates, proteins, and lipids. Alcohol can also be a source of energy.
• The unit of energy is the kilojoule (kJ) or megajoule (1 MJ = 1,000 kJ).
• 4.18 kilojoules are equal to 1 kilocalorie.

Estimated Energy Requirement

The Estimated Energy Requirement (EER) represents the average dietary energy intake (kilojoules per day) that maintains energy balance and good health in a person of a given age, gender, weight, height and level of physical activity.

Humans need energy for:

• Basal metabolism (45-70% of daily energy expenditure).
• Physical activity (the most variable component of energy expenditure).
• Growth (at certain life stages).
• Processing food into nutrients (thermic effect of feeding).
Estimated Energy Requirement

- Estimated Energy Requirement for Maintenance (EERM, or actual energy requirement)
  - is the dietary energy intake that is predicted to maintain energy balance (plus extra needs for pregnancy, lactation and growth) in healthy individuals or groups of individuals at current levels of body size and level of physical activity.
Estimated Energy Requirement

- Desirable Estimated Energy Requirement (DEER, or energy reference value)
  - is the dietary energy intake that is predicted to maintain energy balance (plus extra needs for pregnancy, lactation and growth) in healthy individuals or groups of individuals of a defined gender, age, weight, height and level of physical activity consistent with good health and/or development.
Estimated Energy Requirement

• Basal Metabolic Rate (BMR)
  – People require energy for basal metabolism which comprises a set of functions necessary for life such as:
    • cell metabolism
    • synthesis and metabolism of enzymes and hormones
    • transport of substances around the body
    • maintenance of body temperature
    • ongoing functioning of muscles including the heart, and brain function.
Estimated Energy Requirement

• Basal Metabolic Rate (BMR)
  – The amount of energy needed for this purpose in a defined period of time is called the basal metabolic rate (BMR).
  – BMR represents about 45–70% of daily energy expenditure, depending on age, gender, body size and composition.
Estimated Energy Requirement

• Resting Metabolic Rate (RMR)
  – To measure RMR, an individual needs to fast for only 3-4 hours
  – Usually 10% higher than BMR
  – Rest comfortably before recording oxygen consumption. Less stringent measurement conditions

• Metabolic equivalents (METs)
  – One MET is defined as the energy it takes to sit quietly.
  – For the average adult, this is about 4.18 kJ (1 calorie) per every 1 kg (2.2 pounds) of body weight per hour
Estimated Energy Requirement

Over the years several different equations have been used to estimate Basal Metabolic Rate (BMR) and/or Resting Metabolic Rate (RMR):

- Schofield Equation
- Harris-Benedict Formula
- Miffin-St. Jeor Equations
- Owen Equations
- WHO/FAO/UNU Equations

Activity

Use the energy calculation tool available at the Australian Government ‘Eat for Health’ website to calculate your EER.

Nutrient Reference Values

- The Nutrient Reference Values (NRVs) are a set of recommendations for nutritional intake based on currently available scientific knowledge.

- The NRVs was a joint initiative of the Australian National Health and Medical Research Council (NHMRC) and the New Zealand Ministry of Health (MoH).

- These recommendations apply to healthy people and may not be appropriate for people with diseases that increase or decrease nutrient needs.

NRV Inclusions:

<table>
<thead>
<tr>
<th>Macronutrients</th>
<th>Vitamins</th>
<th>Minerals and trace elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy</td>
<td>Vitamin A</td>
<td>Calcium</td>
</tr>
<tr>
<td>Protein</td>
<td>Thiamine</td>
<td>Chromium</td>
</tr>
<tr>
<td>Fat (for infants only)</td>
<td>Riboflavin</td>
<td>Copper</td>
</tr>
<tr>
<td>Omega-3 fatty acids (α-linolenic)</td>
<td>Niacin</td>
<td>Fluoride</td>
</tr>
<tr>
<td>Omega-3 EPA/DHA</td>
<td>Pantothenic acid</td>
<td>Iodine</td>
</tr>
<tr>
<td>Omega-6 fatty acids (linoleic)</td>
<td>B6</td>
<td>Iron</td>
</tr>
<tr>
<td>Carbohydrate (for infants only)</td>
<td>B12</td>
<td>Magnesium</td>
</tr>
<tr>
<td>Dietary fibre</td>
<td>Folate</td>
<td>Manganese</td>
</tr>
<tr>
<td>Water</td>
<td>Biotin</td>
<td>Molybdenum</td>
</tr>
<tr>
<td></td>
<td>Choline</td>
<td>Phosphorus</td>
</tr>
<tr>
<td></td>
<td>Vitamin C</td>
<td>Potassium</td>
</tr>
<tr>
<td></td>
<td>Vitamin D</td>
<td>Sodium</td>
</tr>
<tr>
<td></td>
<td>Vitamin E</td>
<td>Zinc</td>
</tr>
<tr>
<td></td>
<td>Vitamin K</td>
<td></td>
</tr>
</tbody>
</table>

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Nutrient Reference Values

Revise definitions of the following terms:
- Estimated Average Requirement (EAR)
- Recommended Dietary Intake (RDI)
- Adequate Intake (AI)
- Upper Level of Intake (UL)
- Suggested Dietary Targets to reduce chronic disease risk (ST)
- Acceptable Macronutrient Distribution Ranges (AMDR)
## Nutrient Reference Values

<table>
<thead>
<tr>
<th>Nutrient Reference Value</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimated Average Requirement (EAR)</td>
<td>A daily nutrient level estimated to meet the requirements of half the healthy individuals in a particular life stage and gender group.</td>
</tr>
<tr>
<td>Recommended Dietary Intake (RDI)</td>
<td>The average daily dietary intake level that is sufficient to meet the nutrient requirements of nearly all (97–98 per cent) healthy individuals in a particular life stage and gender group.</td>
</tr>
<tr>
<td>Adequate Intake (AI)</td>
<td>The average daily nutrient intake level based on observed or experimentally-determined approximations or estimates of nutrient intake by a group (or groups) of apparently healthy people that are assumed to be adequate. (Used when an RDI cannot be determined)</td>
</tr>
<tr>
<td>Upper Level of Intake (UL)</td>
<td>The highest average daily nutrient intake level likely to pose no adverse health effects to almost all individuals in the general population. As intake increases above the UL, the potential risk of adverse effects increases.</td>
</tr>
<tr>
<td>Suggested Dietary Target (SDT)</td>
<td>A daily average intake from food and beverages for certain nutrients that that may help in prevention of chronic disease.</td>
</tr>
</tbody>
</table>

## Nutrient Reference Values

<table>
<thead>
<tr>
<th>Nutrient Reference Value</th>
<th>For individuals:</th>
<th>For groups:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimated Average Requirement (EAR)</td>
<td>Use to examine the probability that usual intake is inadequate</td>
<td>Use to estimate the prevalence of inadequate intakes within a group</td>
</tr>
<tr>
<td>Recommended Dietary Intake (RDI)</td>
<td>Usual intake at or above this level has a low probability of inadequacy</td>
<td>Do not use to assess intakes of groups</td>
</tr>
<tr>
<td>Adequate Intake (AI)</td>
<td>Usual intake at or above this level has a low probability of inadequacy. When the AI is based on median intakes of healthy populations, this assessment is made with less confidence</td>
<td>Mean usual intake at or above this level implies a low prevalence of inadequate intakes. When the AI is based on median intakes of healthy populations, this assessment is made with less confidence</td>
</tr>
<tr>
<td>Upper Level of Intake (UL)</td>
<td>Usual intake above this level may place an individual at risk of adverse effects from excessive nutrient intake</td>
<td>Use to estimate the percentage of the population at potential risk of adverse effects from excessive nutrient intake</td>
</tr>
</tbody>
</table>

Australian Dietary Guidelines

• The most recent version of the Australian Dietary Guidelines was released in April 2013.
• A new website was set up with the release of the Guidelines to help Australians make healthier food choices: www.eatforhealth.gov.au
• The Australian Dietary Guidelines are supported by a 226 page publication explaining the science and rationale behind the development of the guidelines.
Healthy Eating Pyramids/Plates

Many countries issue guidelines for dietary planning in the form of a food pyramid or food plate. The Healthy Eating Pyramid is a simple visual guide to the types and proportion of foods that should be eaten every day for good health.

Healthy Eating Pyramids/Plates

• Originally modelled in 1974 from a Swedish concept.
• First Australian pyramid launched in Australia by the Australian Nutrition Foundation in 1982.
• The Australian Guide to Healthy Eating was updated in 2013 based on 5 core food groups and represented visually as a plate.
• A new website was launched to accompany the updated Australian Dietary Guidelines and Australian Guide to Healthy Eating – [www.eatforhealth.gov.au](http://www.eatforhealth.gov.au)
Healthy Eating Pyramids/Plates
Activity

Working in small groups, find national dietary guidelines for 2 other countries and compare and contrast to the Australian Dietary Guidelines.
Health Effects of Guidelines

Does adhering to national nutritional guidelines lead to better health outcomes?

Read the following article and summarise the key findings:

Holistic Nutrition Principles

• Elson Haas (US Integrative Medicine practitioner) has developed a list of 10 key components of a healthy diet based on his view of a holistic nutrition approach (Haas, 1992, p.508-516).

• Read his 10 points on the next 4 slides and then discuss which points, if any, you agree with; which points, if any, you disagree with; and whether you have any suggestions for additional points.
Holistic Nutrition Principles - Haas

Elson Haas MD lists ten key components of a healthy diet:

1. **Natural Foods:** non-GM, non-processed, non-sprayed, non-irradiated, non-long term refrigerated fresh and natural fruits, vegetables, nuts, seeds, whole grains, legumes, dairy, and lean fish and meats.

2. **Seasonal Foods:** eating foods that are available and grown locally in each season (e.g. tomatoes in summer, broccoli in winter) keeps us attuned to the Earth and the cycles of nature.

3. **Fresh Foods:** eating as close as possible from the garden, orchard or field. “Just picked” is best.
4. **Nutritious Foods:** foods included in the diet must contain all the vitamins, minerals, amino acids, fatty acids, enzymes, and carbohydrates that our body needs to function optimally.

5. **Clean Foods:** a clean diet means eating non-polluted, chemical and additive free foods. It also means eating a diet free from refined and processed foods with added sugar, sodium etc. Clean water. Hygienically stored and prepared foods.

6. **Tasty and Appealing Foods:** each meal should be appealing to our eyes, mouths and senses. Nourish ourselves on every level.
7. **Variety and Rotation:** eat a variety of foods that provide us with a variety of nutrients, thus avoiding any marked deficiency. Rotate the diet from day to day and explore new foods.

8. **Food combining:** fruits eaten by themselves or with other fruits. Proteins and starches are not eaten together. Combine protein and vegetable or starch and vegetable.

9. **Moderation:** good nutrition begins with not under or over eating. Both these cause tremendous stress on a body.
10. **Balance:** this is perhaps the most important consideration for long term health. The five aspects of balance:

- **Macronutrients** – proteins, fats and CHOs.
- **Micronutrients** – vitamins, minerals, amino acids, fatty acids.
- **Food groups** – fruits, vegetables, grains, legumes, nuts, seeds, dairy, eggs, poultry, meats.
- **Flavours and Colours** – sour, bitter, sweet, spicy, salty. Red, orange, yellow, green, blue, purple.
- **Acid/Alkaline** – acid forming and alkaline-forming foods.

(Haas, 1992, pp. 508-516)
Activity

Discuss the 10 components of a healthy diet suggested by Haas in small groups.

The next slide includes 6 dietary-planning principles put forward by Whitney et al., 2011. Read these and compare to the principles put forward by Haas.
Diet-Planning Principles

- Adequacy
- Balance
- Energy (kilojoule) control
- Nutrient density
- Moderation
- Variety

(Whitney et al., 2011)
Diet Records

Diet records:

- Provide a record of a person’s food and beverage intake to assist in identifying possible nutrient imbalances and/or eating habits that are not conducive to achieving health goals.

- A nutritionist analyses diet record information in conjunction with information from other sources in order to develop a nutrition care plan in collaboration with the client.
Diet Recording Methods

The main methods used in practice are:

- 24-hour recall
- Usual intake
- Food record
- Food frequency questionnaire
Diet Recording Methods

• 24-hour recall
  – provides data for one day only.
  – the assessor asks the client to recount everything eaten or drunk in the past 24 hours or for the previous day.
  – an advantage is that it is easy to obtain.
  – a disadvantage is that it does not provide enough information to allow accurate generalisations about a person’s usual food intake.
Diet Recording Methods

• **Usual intake**
  – the assessor asks the person about their typical food intake – e.g. “what do you usually eat for breakfast”, etc.
Diet Recording Methods

• **Food record** (sometimes referred to as a diet diary)
  – the person records everything he or she eats and drinks.
  – the person could be asked to weigh food to ensure recording is accurate.
  – a food record could be kept for 3 days, 1 week, 2 weeks, a month or longer depending on the practitioner and the client.
  – this method requires considerable effort on the part of the client.
  – another disadvantage is that client’s might change their eating habits (consciously or unconsciously) as a consequence of having to record everything.
Diet Recording Methods

• Food frequency questionnaire
  – can be used to obtain information about a client’s usual food intake over a month or longer.
  – clients may be asked how many serves of each of certain food types (listed in the FFQ) they eat in a typical day (or week or month).
# Diet Records

**DIET DIARY** Please record every food that you consume and each drink that you have over a day. Record any troubling body symptoms and information about bowel function that have occurred throughout the day. This provides a clear idea of whether diet is contributing to health problems and will be used by your holistic health practitioner to review in conjunction with you.

<table>
<thead>
<tr>
<th>Day</th>
<th>Foods &amp; Drinks consumed</th>
<th>Body symptoms</th>
<th>Stool frequency/ day</th>
<th>Stool consistency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Morning</td>
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<tr>
<td>Afternoon</td>
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</tr>
<tr>
<td>After 6pm</td>
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<td></td>
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</tr>
<tr>
<td>Tuesday</td>
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<tr>
<td>Morning</td>
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<td>Afternoon</td>
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<td>After 6pm</td>
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<td>Wednesday</td>
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<td>Morning</td>
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<td>Afternoon</td>
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<tr>
<td>After 6pm</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
Diet Records

- Estimates of nutrient intakes from diet records must be combined with other sources of information when carrying out a nutrition assessment.

- Each person digests, absorbs, metabolises and excretes nutrients in a unique way (biochemical individuality).

- Analysis of a diet record is only one piece of a puzzle that must be put together with other indicators when developing a treatment plan.
Exchange Lists and Programs

• A concept designed by the American Diabetes Association and the American Dietetic Association.
• Separates foods into 6 categories based on their carbohydrate, protein, fat and calorie content.
• Food serving sizes are listed so that easy comparisons or swaps can be made when diets are being designed.
• Allows for easy meal planning as it fosters variety, whist keeping a meal plan nutritionally complete.
## Exchange Lists and Programs
### Clinical Applications

<table>
<thead>
<tr>
<th>CEREALS/GRAINS/PASTA</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>*Bran cereals, concentrated (such as Bran Buds, All Bran)</td>
<td>1/3 cup</td>
</tr>
<tr>
<td>*Bran cereals, flaked</td>
<td>1/2 cup</td>
</tr>
<tr>
<td>Bulgur (cooked)</td>
<td>1/2 cup</td>
</tr>
<tr>
<td>Cooked cereals</td>
<td>1/2 cup</td>
</tr>
<tr>
<td>Cornmeal (dry)</td>
<td>2 1/2 tbsp</td>
</tr>
<tr>
<td>Grape Nuts</td>
<td>3 tbsp</td>
</tr>
<tr>
<td>Grits (cooked)</td>
<td>1/2 cup</td>
</tr>
<tr>
<td>Other ready-to-eat, unsweetened (plain) cereals</td>
<td>3/4 cup</td>
</tr>
<tr>
<td>Pasta (cooked)</td>
<td>1/2 cup</td>
</tr>
<tr>
<td>Puffed cereal</td>
<td>1 1/2 cups</td>
</tr>
<tr>
<td>Rice, white or brown (cooked)</td>
<td>1 1/3 cup</td>
</tr>
<tr>
<td>Shredded wheat</td>
<td>1/2 cup</td>
</tr>
<tr>
<td>*Wheat germ</td>
<td>3 tbsp</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DRIED BEANS/PEAS/LENTILS</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>*Beans and peas (cooked) (such as kidney, white, split, blackeye)</td>
<td>1/3 cup</td>
</tr>
<tr>
<td>*Lentils (cooked)</td>
<td>1/3 cup</td>
</tr>
<tr>
<td>*Baked beans</td>
<td>1/4 cup</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>STARCHY VEGETABLES</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>*Corn</td>
<td>1/2 cup</td>
</tr>
<tr>
<td>*Corn on the cob, 6 in.</td>
<td>1 long</td>
</tr>
<tr>
<td>*Lima beans</td>
<td>1/2 cup</td>
</tr>
<tr>
<td>*Peas, green (canned or frozen)</td>
<td>1/2 cup</td>
</tr>
<tr>
<td>*Plaintain</td>
<td>1/2 cup</td>
</tr>
<tr>
<td>Potato, baked 1 small</td>
<td>(3 oz)</td>
</tr>
<tr>
<td>Potato, mashed</td>
<td>1/2 cup</td>
</tr>
<tr>
<td>Squash, winter (acorn, butternut)</td>
<td>3/4 cup</td>
</tr>
<tr>
<td>Yam, sweet potato</td>
<td>1/3 cup</td>
</tr>
</tbody>
</table>
Exchange Lists and Programs

Categories

1. Starch
2. Fruit
3. Milk
4. Sweets, desserts and other carbohydrates
5. Fat
6. Meat and meat substitutes
Exchange Lists and Programs
Clinical Applications

Work out the nutritional requirements of the patient based on their individual needs.

What split is needed, taking into account the patient’s needs? i.e. physical activity levels, weight loss, weight gain etc. How many ‘exchanges’ should they have?

Based on the number and types of exchanges, what sorts of meals could be created?

(Mahan et al., 2012)
Assessing Nutritional Status
Nutritional Status

**Under nutrition**
- When nutritional reserves are depleted or intake is inadequate to meet daily metabolic needs a state of under nutrition develops.
- May stem from: inadequate ingestion, impaired digestion or absorption, dysfunctional metabolic processing, or increased excretion of essential nutrients.

**Over nutrition**
- Excess energy and/or nutrients
- Presents problems manifesting as obesity, diabetes, atherosclerotic heart disease, hypertension and the metabolic syndrome.
- Obesity is associated with low-grade inflammation.

(Mahan et al., 2012, p. 131)
Signs and Symptoms

• **Signs**
  – physical indicators of disease that can be seen by others – *e.g. pale skin or skin rashes.*

• **Symptoms**
  – subjective manifestations of disease, such as stomach pain or loss of appetite, that cannot be seen by others.

  (McGuire & Beerman, 2013)
Physical Examination

• When conducting a physical examination it is important to consider both nutritional causes and non-nutritional causes
  – e.g. dry, cracked lips
    • might be indicative of B vitamin deficiencies or
    • may have been caused by exposure to hot, windy weather conditions.
• Don’t jump to conclusions based on one sign or symptom. Consider the totality of the evidence.
## Hair

<table>
<thead>
<tr>
<th>Sign or symptom</th>
<th>Nutrient considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extremely painful when hair is gently pulled</td>
<td>• deficiency of vitamin D</td>
</tr>
<tr>
<td>Flaky dandruff</td>
<td>• deficiency of selenium, EFAs, vitamin B-complex with emphasis on vitamin B6</td>
</tr>
<tr>
<td>Dull, lifeless hair</td>
<td>• deficiency of EFAs</td>
</tr>
<tr>
<td>Thinning hair in a postmenopausal woman</td>
<td>• deficiency of DHEA</td>
</tr>
<tr>
<td>Thinning hair in a woman taking birth control pills, pregnant or postpartum</td>
<td>• deficiency of vitamin B-complex with emphasis of vitamin B6 and folate</td>
</tr>
<tr>
<td>Thinning hair in a woman not taking birth control/oestrogen or pregnant</td>
<td>• deficiency of hydrochloric acid and pepsin</td>
</tr>
<tr>
<td>Alopecia</td>
<td>• deficiency of vitamin B-complex, EFAs</td>
</tr>
<tr>
<td>Premature greying</td>
<td>• copper deficiency</td>
</tr>
</tbody>
</table>

(Crouse & Reiley, 2008)
# Eyes

<table>
<thead>
<tr>
<th>Sign or symptom</th>
<th>Nutrient considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cataract in the older patient</strong></td>
<td>• glucose imbalance</td>
</tr>
<tr>
<td></td>
<td>• deficiency of vitamin B2, vitamin A, vitamin C, zinc, selenium, magnesium</td>
</tr>
<tr>
<td><strong>Floaters</strong></td>
<td>• deficiency of choline, inositol, methionine</td>
</tr>
<tr>
<td><strong>Retinitis pigmentosa</strong></td>
<td>• deficiency of calcium, vitamin D</td>
</tr>
<tr>
<td><strong>Dark circles under both eyes</strong></td>
<td>• allergies, fatigue, emotional upset, pregnancy, hormone treatment</td>
</tr>
<tr>
<td><strong>Dilated pupils to 1/4 inch or more in a child</strong></td>
<td>• allergies, especially to milk</td>
</tr>
</tbody>
</table>

(Crouse & Reiley, 2008)
Nose

• Loss of smell - consider zinc and/or Vitamin A deficiency.
• Polyps - consider allergy, especially to salicylates or artificial colours and preservatives.
## Ears

<table>
<thead>
<tr>
<th>Sign or symptom</th>
<th>Nutrient considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardened or excessive ear wax</td>
<td>• deficiency of EFAs</td>
</tr>
<tr>
<td>Cracking behind ears</td>
<td>• deficiency of zinc</td>
</tr>
<tr>
<td>Diagonal crease across lobes</td>
<td>• cardiovascular disease, Vitamin E</td>
</tr>
<tr>
<td>Fluid behind tympanic membrane or recurrent otitis media</td>
<td>• allergies, especially to milk</td>
</tr>
<tr>
<td>Tinnitus</td>
<td>• allergies, aspirin toxicity or cardiovascular disease</td>
</tr>
</tbody>
</table>

(Crouse & Reiley, 2008)
Oral Cavity

• Due to the rapid turnover of cells in the oral mucosa, vitamin and mineral deficiencies may manifest early in the lips, tongue, gums or mucosa.

• As the cellular turnover of the oral cavity is 3-5 days, repeating the physical examination frequently is useful for monitoring the effectiveness of the nutrition therapy.

• Early detection and treatment of nutrient deficiencies is essential.

(Radler & Lister, 2013)
Lips and Oral Cavity

<table>
<thead>
<tr>
<th>Sign or symptom</th>
<th>Nutrient considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cheilosis</td>
<td>• Deficiency of vitamin B2, vitamin B3, vitamin B6, folate, B12, iron (Radler &amp; Lister, 2013)</td>
</tr>
<tr>
<td>Xerostomia (dry mouth)</td>
<td>• Deficiency of zinc (Radler &amp; Lister 2013)</td>
</tr>
<tr>
<td>Loss of taste</td>
<td>• Deficiency of zinc, iron (Sakaguchi et al., 2013).</td>
</tr>
<tr>
<td></td>
<td>• High dose biotin might be helpful (Greenway et al. 2011)</td>
</tr>
<tr>
<td>Enlarged tonsils in children</td>
<td>• Food allergies (Modrzyriski et al., 2004)</td>
</tr>
</tbody>
</table>
Lips and Oral Cavity (cont)

<table>
<thead>
<tr>
<th>Sign or symptom</th>
<th>Nutrient considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aphthous stomatitis (mouth ulcers)</td>
<td>• Deficiency of vitamin B12, folate (Radler &amp; Lister, 2013)</td>
</tr>
<tr>
<td>Candidiasis (thrush)</td>
<td>• Deficiency of vitamin C, iron (Radler &amp; Lister, 2013)</td>
</tr>
<tr>
<td>Pale mucous membranes</td>
<td>• Deficiency of iron (Whitney, 2011)</td>
</tr>
<tr>
<td>Bleeding gums, tooth loss, dental caries</td>
<td>• Vitamin C deficiency; vitamin B12 deficiency (Radler &amp; Lister, 2013)</td>
</tr>
</tbody>
</table>
## Teeth and Tongue

<table>
<thead>
<tr>
<th>Teeth Sign /symptom</th>
<th>Nutrient considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Periodontal problems</strong></td>
<td>• deficiency of co-enzyme Q10, folate, antioxidants, calcium, vitamin C</td>
</tr>
<tr>
<td><strong>Bruxism</strong></td>
<td>• allergies or stress</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tongue Sign / Symptom</th>
<th>Nutrient considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pale tongue with pale buccal membranes</strong></td>
<td>• anaemia</td>
</tr>
<tr>
<td><strong>Geographic tongue</strong></td>
<td>• deficiency of folate, vitamin B12, zinc</td>
</tr>
<tr>
<td><strong>Swollen and scalloped</strong></td>
<td>• Food allergies</td>
</tr>
</tbody>
</table>

*(Crouse & Reiley, 2008)*
## Face

<table>
<thead>
<tr>
<th>Sign or symptom</th>
<th>Nutrient considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acne in a teenager</td>
<td>• deficiency of zinc, EFAs, selenium in boys</td>
</tr>
<tr>
<td>Dilated capillaries on cheeks and edges of nose in men</td>
<td>• Alcoholism, deficiency of hydrochloric acid and low pepsin production</td>
</tr>
<tr>
<td>Reddened facial skin, usually on forehead and cheeks with scattered acne-like lumps</td>
<td>• deficiency of hydrochloric acid and low pepsin production</td>
</tr>
<tr>
<td>Slightly yellow tone to facial skin in an older person</td>
<td>• deficiency of vitamin B12, folate, vitamin B-complex</td>
</tr>
<tr>
<td>Seborrhoeic dermatitis on eyebrows, centre of forehead, angles of nose, or chest</td>
<td>• deficiency of vitamin B6, vitamin B-complex, EFAs</td>
</tr>
</tbody>
</table>

(Crouse & Reiley, 2008)
<table>
<thead>
<tr>
<th>Sign or symptom</th>
<th>Nutrient considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slightly yellow</td>
<td>• overconsumption of carrots or hypothyroidism (thyroid provides the hormone necessary to transform beta carotene to vitamin A)</td>
</tr>
<tr>
<td>Dry/rough skin</td>
<td>• deficiency of EFAs, vitamin A</td>
</tr>
<tr>
<td>Multiple pigmented skin tags</td>
<td>• Type 2 diabetes, especially if female</td>
</tr>
<tr>
<td>Yellow spots, pimples under eyes</td>
<td>• Type 2 diabetes or hypoglycaemia</td>
</tr>
<tr>
<td>Red nodules on elbow</td>
<td>• deficiency of EFAs</td>
</tr>
<tr>
<td>Dermatographism</td>
<td>• allergies</td>
</tr>
<tr>
<td>Sign or symptom</td>
<td>Nutrient considerations</td>
</tr>
<tr>
<td>------------------------------------------------------</td>
<td>----------------------------------------------</td>
</tr>
<tr>
<td>Follicular hyperkeratosis</td>
<td>• deficiency of vitamin A, EFAs, zinc</td>
</tr>
<tr>
<td>Slow wound healing</td>
<td>• deficiency of vitamin A, EFAs, vitamin B6, vitamin C, zinc</td>
</tr>
<tr>
<td>Dry, greyish skin</td>
<td>• deficiency of biotin</td>
</tr>
<tr>
<td>Scaly dark dermatitis with pigmented lesions</td>
<td>• deficiency of vitamin B3</td>
</tr>
<tr>
<td>Easy bruising</td>
<td>• Consider Vitamins C and K</td>
</tr>
</tbody>
</table>
Hands

Dry with fissures on knuckles
Consider deficiency of EFAs

Callouses and contractures
Consider Vitamin E
# Nails

<table>
<thead>
<tr>
<th>Sign or symptom</th>
<th>Nutrient consideration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flattened and spooned</td>
<td>• iron deficiency anaemia, deficiency of hydrochloric acid or malabsorption</td>
</tr>
<tr>
<td>Thin, weak, bend easily in women</td>
<td>• hypothyroidism, deficiency of hydrochloric acid and pepsin, EFAs, calcium, zinc</td>
</tr>
<tr>
<td>White spots on nails</td>
<td>• deficiency of zinc, malabsorption due to gluten/gliadin intolerance, or low pancreatic enzymes</td>
</tr>
<tr>
<td>Cracks and splits at fingertips</td>
<td>• deficiency of zinc, EFAs</td>
</tr>
<tr>
<td>Paronychia</td>
<td>• deficiency of EFAs, zinc</td>
</tr>
<tr>
<td>Brittle nails</td>
<td>• deficiency of calcium, iron, zinc</td>
</tr>
<tr>
<td>Horizontal and vertical ridges</td>
<td>• deficiency of vitamin B-complex</td>
</tr>
<tr>
<td>Dryness with rounded or curved nail ends</td>
<td>• deficiency of vitamin B12</td>
</tr>
<tr>
<td>Discolouration</td>
<td>• Type 2 diabetes or allergies (Crouse &amp; Reiley, 2008)</td>
</tr>
</tbody>
</table>
# Musculoskeletal

<table>
<thead>
<tr>
<th>Sign or symptom</th>
<th>Nutrient consideration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bursitis</td>
<td>• deficiency of vitamin B12</td>
</tr>
<tr>
<td>Costochondritis</td>
<td>• deficiency of vitamin B6</td>
</tr>
<tr>
<td>Degenerative arthritis, especially with crepitus behind the patella</td>
<td>• deficiency of niacinamide, glucosamine</td>
</tr>
<tr>
<td>Enlarged, painful nodule below the patella on the anterior side</td>
<td>• deficiency of vitamin E, selenium</td>
</tr>
<tr>
<td>Pain in lower leg if pressure is applied to tibia</td>
<td>• deficiency of calcium, niacinamide</td>
</tr>
<tr>
<td></td>
<td>(Crouse &amp; Reiley, 2008)</td>
</tr>
</tbody>
</table>
Biochemical Analyses
Biochemical Analyses

• Biochemical analyses (i.e. laboratory tests) help to determine what is happening to the body internally.

• Common tests are based on analysis of blood and urine samples, which contain nutrients, enzymes and metabolites that reflect nutritional status.

• Interpretation of biochemical data requires skill. (Whitney et al., 2011)
Nitrogen Balance

- Gold standard
- Assessment of protein metabolism – deficiency or excess
- N balance = N intake (diet) – N loss (urine + faeces + skin + hair)
- N intake determined from careful dietary assessment
- A method for assessing adequacy of recent changes in body composition. These may be due to adequacy/inadequacy of nutritional intake, the metabolic effects of severe illness or disease state, and the ability to utilise the nutritional regimen.
Nitrogen Balance (cont.)

<table>
<thead>
<tr>
<th>Decreased Urine N</th>
<th>Increased Urine N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Starvation</td>
<td>Excess dietary protein</td>
</tr>
<tr>
<td>Chronic inadequate intake</td>
<td>Increase net protein catabolism e.g. trauma, sepsis</td>
</tr>
</tbody>
</table>
Transthyretin/Prealbumin

Protein that carries retinol and thyroxine and has a high binding capacity for these compounds, but low levels in the blood in comparison to albumin

<table>
<thead>
<tr>
<th>Increase</th>
<th>Decrease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uraemia</td>
<td>Malnutrition/ malabsorption</td>
</tr>
<tr>
<td>Dehydration</td>
<td>Inflammatory response of any cause</td>
</tr>
<tr>
<td>Alcoholics</td>
<td>Fasting</td>
</tr>
<tr>
<td></td>
<td>Hyperthyroidism</td>
</tr>
<tr>
<td></td>
<td>Severe liver injury</td>
</tr>
<tr>
<td></td>
<td>Overhydration</td>
</tr>
<tr>
<td></td>
<td>Pregnancy</td>
</tr>
</tbody>
</table>
Albumin

• Major plasma protein in the bloodstream. Regulates osmotic pressure and blood volume.
• Homeostasis may maintain serum albumin levels of those on a low protein diet by reducing catabolism and extravascular levels.
• Serum albumin-optimal 42-50 g/L.
• Low albumin indicates impaired protein synthesis.
• Albumin <35 g/L signifies severe protein deprivation.
<table>
<thead>
<tr>
<th>Increase</th>
<th>Decrease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dehydration</td>
<td>Inflammatory reaction of any cause</td>
</tr>
<tr>
<td></td>
<td>Nephrotic syndrome</td>
</tr>
<tr>
<td></td>
<td>Other losses, e.g. from IBD, burns etc</td>
</tr>
<tr>
<td></td>
<td>Severe liver disease</td>
</tr>
<tr>
<td></td>
<td>Malignancy</td>
</tr>
<tr>
<td></td>
<td>Overhydration</td>
</tr>
<tr>
<td></td>
<td>Pregnancy</td>
</tr>
</tbody>
</table>
Urine Creatinine

The end product of metabolism of creatine and creatine phosphate in skeletal muscle. Each gram of urinary creatinine is derived from ~17kg skeletal muscle. Urinary creatinine levels can also be an indicator of renal function.

Of most use in patients with normal renal function with 24 hour urine creatinine excretion for indexing muscle mass.

<table>
<thead>
<tr>
<th>Increased</th>
<th>Decreased</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;24 hour urine collection</td>
<td>Incomplete urine collection</td>
</tr>
<tr>
<td>Pyrexia</td>
<td>Acute renal failure</td>
</tr>
<tr>
<td></td>
<td>Protein depletion</td>
</tr>
<tr>
<td></td>
<td>(Reduction in skeletal muscle mass)</td>
</tr>
</tbody>
</table>
BUN/Creatinine Ratio

• BUN = Blood Urea Nitrogen (also known as Urea Nitrogen or Urea)

• BUN and creatinine are the primary tests used to check how well the kidneys are able to filter waste products from the blood.

• Increased ratio may be due to a condition that causes a decrease in the flow of blood to the kidneys, such as congestive heart failure or dehydration. Could also be due to increased protein in the diet.

• Decreased ratio seen in liver disease and malnutrition.
Retinol Binding Protein

12 hour half-life reflects recent dietary intake rather than body composition. Affected by energy rather than protein malnutrition, and decreases rapidly in response to starvation. Responds to Vitamin A supplementation even if the patient has PEM (protein energy malnutrition).

<table>
<thead>
<tr>
<th>Increase</th>
<th>Decrease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduced GFR</td>
<td>Hyperthyroidism</td>
</tr>
<tr>
<td>Alcoholism</td>
<td>Malnutrition/malabsorption</td>
</tr>
<tr>
<td></td>
<td>Chronic liver disorders</td>
</tr>
<tr>
<td></td>
<td>Vitamin A deficiency</td>
</tr>
<tr>
<td></td>
<td>Zinc deficiency</td>
</tr>
</tbody>
</table>
## Iron Studies

<table>
<thead>
<tr>
<th>Biochemical test</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serum ferritin</td>
<td>Iron stores diminish in the first stage of iron deficiency. Measures of serum ferritin provide an estimate of iron stores.</td>
</tr>
<tr>
<td>Serum iron</td>
<td>Elevated levels indicate iron overload; reduced values indicate iron deficiency</td>
</tr>
<tr>
<td>Transferrin saturation</td>
<td>Derived from the serum iron and total iron binding capacity measures</td>
</tr>
<tr>
<td>Total iron binding capacity (TIBC)</td>
<td>TIBC is a measure of the total amount of iron that transferrin can carry.</td>
</tr>
</tbody>
</table>
Transferrin

• Iron transport protein with half-life of 8-10 days.
• Indicates iron status – with TIBC (total iron binding capacity).
• Total starvation does not cause a significant change in transferrin concentration after 3-5 days.

<table>
<thead>
<tr>
<th>Increase</th>
<th>Decrease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron deficiency</td>
<td>Malnutrition/malabsorption</td>
</tr>
<tr>
<td>Oestrogens/contraceptive pill</td>
<td>Inflammatory reaction of any cause</td>
</tr>
<tr>
<td>Pregnancy</td>
<td>Nephrotic syndrome</td>
</tr>
<tr>
<td>17-α-alkylated anabolic steroids</td>
<td>Other losses – IBD, burns</td>
</tr>
<tr>
<td>Acute hepatitis</td>
<td>Marked liver disease</td>
</tr>
</tbody>
</table>
Electrolytes

• Electrolyte measurements are used to screen for an electrolyte or pH imbalance and to monitor the effect of treatment on a known imbalance that is affecting bodily organ function.
• Electrolyte levels are affected by how much is taken in through the diet, the amount of water in the body, and the quantity of electrolytes excreted by the kidneys.
• Electrolytes are also affected by hormones, especially aldosterone, a hormone that retains sodium in the body but increases the loss of potassium.
• Those who experience severe fluid loss may show an increase in K+, Na+, and Cl- (Cl- tends to mirror the Na+).
• Some forms of heart disease, muscle and nerve problems, and diabetes may also have one or more abnormal electrolytes.
## Electrolytes

<table>
<thead>
<tr>
<th>Test</th>
<th>Outcome</th>
</tr>
</thead>
</table>
| Calcium| • High total calcium – hypercalcaemia  
• Hyperparathyroidism  
• Hyperthyroidism  
• Sarcoidosis  
• Prolonged immobilisation  
• Kidney transplant |
|        | • Low total calcium – hypocalcaemia  
• Hypoparathyroidism  
• Extreme deficiency in dietary calcium  
• Decreased levels of vitamin D  
• Magnesium deficiency  
• Increased levels of phosphate  
• Pancreatitis  
• Renal failure  
• Malnutrition  
• Alcoholism |
### Electrolytes

<table>
<thead>
<tr>
<th>Test</th>
<th>Outcome</th>
</tr>
</thead>
</table>
| Sodium | • **Hyponatraemia**  
  • Hyponatraemia is usually due to either too much sodium loss, too much water intake or retention, or fluid accumulation in the body (oedema).  
  • Hyponatraemia is rarely due to decreased sodium intake.  
  • Most commonly, hyponatraemia is due to sodium loss (diarrhoea, vomiting, excessive sweating, diuretic administration, kidney disease or Addison’s disease).  
  • In some cases, it is due to excess fluids in the body (drinking too much water, heart failure, cirrhosis, kidney diseases that cause protein loss [nephrotic syndrome]) and malnutrition.  
  • **Hypernatraemia**  
  • Hypernatraemia is almost always due to excessive loss of water (dehydration) without enough water intake.  
  • Symptoms include dry mucous membranes (mouth, eyes etc.), thirst, agitation, restlessness, and acting irrationally. |
# LFT – Liver Function Tests

<table>
<thead>
<tr>
<th>Test Code</th>
<th>Enzyme</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALP</td>
<td>Alkaline Phosphatase</td>
<td>• ALP is an enzyme found in high levels in bone and liver with smaller amounts found in the intestines.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Small amounts of ALP are also found in the placenta of pregnant women.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Raised in bile duct obstruction, intrahepatic cholestasis.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• ALP can also be raised in bone diseases such as Paget’s disease, vitamin D deficiency, healing fractures or in certain cancers that spread to bone.</td>
</tr>
<tr>
<td>ALT</td>
<td>Alanine Transaminase</td>
<td>• ALT is an enzyme found mostly in the liver; smaller amounts are also found in the kidneys, heart and muscles.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Raised in acute liver damage.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• ALT levels are usually not as high in chronic hepatitis, often less than 4 times the highest normal level.</td>
</tr>
</tbody>
</table>
# LFT – Liver Function Tests

<table>
<thead>
<tr>
<th>Test Code</th>
<th>Enzyme</th>
<th>Outcome</th>
</tr>
</thead>
</table>
| AST       | Aspartate Transaminase | • AST is an enzyme found mostly in the liver, red blood cells, heart and other muscles.  
• Very high levels of AST (more than 10 times the highest normal level) are usually due to a rapidly developing liver disease (acute hepatitis), which is often due to a virus infection.  
• Raised in acute liver damage.  
• In chronic hepatitis, AST often varies between normal and slightly increased (often less than 4 times the highest normal level).  
• When liver damage is due to alcohol, AST often increases much more than ALT  
• AST can be increased from haemolysis, and is increased after heart attacks and with muscle injury. |
## LFT – Liver Function Tests

<table>
<thead>
<tr>
<th>Test Code</th>
<th>Enzyme</th>
<th>Outcome</th>
</tr>
</thead>
</table>
| LDH       | Lactate Dehydrogenase | • LDH is an enzyme that is found in cells throughout the body.  
• LDH is used as a general marker of injury to cells.  
• Raised in liver disease, including hepatitis.  
• After a heart attack, blood levels of total LDH rise within 24 to 48 hours, peak in two to three days and return to normal in 10 to 14 days.  
• Elevated levels of LD may be seen with:  
  • Anaemias including haemolytic anaemia, pernicious anaemia, megaloblastic anaemia.  
  • Infections including infectious mononucleosis (glandular fever), tuberculosis and serious fungal infections.  
  • Intestinal and lung infarction (tissue death).  
  • Muscle damage.  
  • Pancreatitis.  
  • Some cancers including melanoma.  
  • Cerebrovascular accident (stroke).  
  • Drugs including anaesthetics, narcotics, methotrexate. |
## LFT – Liver Function Tests

<table>
<thead>
<tr>
<th>Test Code</th>
<th>Enzyme</th>
<th>Outcome</th>
</tr>
</thead>
</table>
| GGT       | Gamma Glutamyl Transpeptidase       | • GGT is an enzyme found mainly in the liver and is normally present in low levels in the blood.  
• Elevated levels may be due to liver disease.  
• Raised levels may also be due to congestive heart failure, drinking alcohol, and use of many medications including:  
  • nonsteroidal anti-inflammatory drugs (NSAIDs)  
  • lipid-lowering drugs  
  • antibiotics  
  • antihistamines  
  • antifungal agents  
  • anticonvulsants (seizure control medications)  
  • antidepressants  
  • hormones such as testosterone.  
• Oral contraceptives and clofibrate (lipid-lowering agent) can decrease GGT levels. |
## LFT – Liver Function Tests

<table>
<thead>
<tr>
<th>Test Code</th>
<th>Enzyme</th>
<th>Outcome</th>
</tr>
</thead>
</table>
| **BIL**   | **Total Bilirubin** | • Bilirubin levels can be used to monitor the progression of jaundice and to determine if it is the result of red blood cell breakdown or liver disease.  
• Symptoms include: jaundice, pale stools, hepatomegaly – possibly due to underactive liver function, immature hepatocytes, alcoholism, acute and chronic hepatitis. |
|           | **Direct (or conjugated) bilirubin** | • If the direct bilirubin is elevated there may be some kind of blockage of the liver or bile duct, perhaps due to gallstones, hepatitis, trauma, a drug reaction, or long-term alcohol abuse. |
|           | **Indirect (or unconjugated) bilirubin** | • If the indirect bilirubin is increased, haemolysis may be the cause. |
Insulin-Like Growth Factor 1

- Hormone that is important for growth (used as a biological maturation marker – e.g. orthodontic work)
- IGF-1 declines in PEM.
- IGF-1 has a relatively short half-life and responds specifically to protein rather than energy; therefore can be sensitive indicator of protein status and response to therapy.
- Conditions that decrease IGF-1 include: anorexia nervosa, IBD, coeliac disease, HIV infection and fasting.
Hair Analysis

- Hair analysis is a useful tool for assessing heavy metal status.
- Although it is a useful tool for measuring all of the minerals, particularly mineral balance, other tests are available for assessing levels of minerals such as sodium, potassium, calcium, magnesium, iron or iodine, for example blood tests (electrolytes, iron studies).
- However, hair analysis may be useful for interpreting trace element amounts such as zinc, copper, chromium, and manganese.
- Use of hair dyes and other chemicals can affect results.
Urinalysis

Useful screening or diagnostic tool to detect kidney or metabolic disorders, for example:

- high glucose may indicate diabetes
- high protein = proteinuria in kidney disease.

Urine sticks are cheap, handy clinical screening tools
Raman Spectroscopy for Antioxidant Status

• Non-invasive measurement. Uses a laser light pointed toward fat of the palm of the hand.
• Measures levels of carotenoids at a cellular level to give a reflection of antioxidant status.
• Serum carotenoids strongly associated with skin carotenoid levels.
Malabsorption

- Malabsorption Syndrome is a condition in which several nutrients are not absorbed.
- In almost all cases fat is not absorbed normally.
- Causes are diverse:
  - pancreatic insufficiency
  - cystic fibrosis
  - bowel disorders such as Crohn’s disease
  - coeliac disease
  - gastric surgery
  - reduced bile salt secretion
  - food allergies
  - cardiovascular disease
  - certain drugs
Tests for Malabsorption

- Faecal stain test: over 95% of patients with diarrhoea have a positive test.
- Blood carotene levels.
- D-Xylose urinary test reflects gut permeability.
- Lactulose-mannitol test – intestinal permeability.
- Fat soluble vitamins A,D, E, K may be low.
- Serum vitamin D (plasma 25-hydroxyvitamin D). Could be reduced sunlight exposure or possible renal failure.
- Hydrogen breath tests for carbohydrate malabsorption.
Tutorial Activities
Tutorial

The CSIRO have developed a Food Frequency Questionnaire for the public to assess their food intake with the Australian Dietary Guidelines. Access and complete this questionnaire and discuss in small groups:

Critique the CSIRO Healthy Diet Score

In your critique list the strengths and weaknesses of this questionnaire.

- *How easy is this questionnaire for members of the general public to complete?*
- *Are there any limitations?*
- *What questions or features or changes would add you add to optimise this questionnaire?*
- *What information does the Healthy Diet Score provide individuals and those involved in planning health services?*
References


References


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