All sorrows are less with bread (Spanish proverb)

FATIGUE MANAGEMENT AND NUTRITION
With a good chunk of the world’s population not eating enough and an equally large portion eating too much, there is no denying that we need to put a nutrition revolution on the menu where people work” (International Labour Organisation 2006)
The clinical perspective defines well-being as the absence of negative conditions and the psychological perspective defines well-being as the prevalence of positive attributes.
Optimal Nutritional status viewed as a balance between nutrient intake and nutrient requirement.
Biological models used to describe fatigue
BIOLOGICAL MODELS

- Energy supply/ depletion model
  - Worker simply runs out of energy – maybe because of inadequate carbohydrate supply

- In the “GUIDELINE FOR THE COMPILATION OF A MANDATORY COP FOR AN OCCUPATIONAL HEALTH PROGRAMME” (Occupational Hygiene and Medical Surveillance) On Thermal Stress the following on carbohydrate intake is recommended:
  - a generous carbohydrate-rich meal at the end of a shift in order to replenish body stores,
  - a light carbohydrate meal immediately prior to the shift which, although in itself inadequate in the absence of the previous night’s meal, is much more tolerable when embarking on any form of physical exertion, and
  - a mid-shift feed comprising an acceptable tasty fluid meal containing mainly carbohydrate.
Peripheral fatigue
Muscle fatigue - ionic disturbances, (loss of potassium, magnesium), accumulation of metabolites (hydrogen ion, inorganic phosphate) and substrate depletion (glycogen, phosphocreatin)

Fatigue and central nervous system
Central fatigue hypotheses – impaired function of the central nervous system – significant in prolonged exercise (voluntary effort declines)
BIOLOGICAL MODELS

• Fatigue and central nervous system
  - central tryptophan availability ↑ serotonin activity → lethargy
  - Food high tryptophan together with carbohydrate produce drowsiness (soya, maize, milk,) – produce sleepiness

• Dopamine neurotransmission is associated with physiological functions such as stimulation, motivation, reinforcement, reward and motor behaviour control.
  + Food high in tyrosine (cheese, beef, lamb, fish, poultry) and low in carbohydrates stimulate excitatory neurotransmitters and enhance wake-fullness
A measure to ensure a properly fed and healthy workforce is an indispensable element of social protection of workers, and yet frequently absent from programmes to improve working conditions and occupational health and safety. (Wanjek 2005)
IMPACT OF NUTRITION ON HEALTH


- 3 (b) Sufficient proper food/ nutrition and water are components of an adequate standard of living which has been linked to the productivity of mineworkers and must be provided for at an affordable, equitable and sustainable manner by the employer or necessary facilities for employees to prepare their own foods”
CYCLE OF POOR NUTRITION AND IMPACT ON PRODUCTIVITY

Poor nutrition → Poor Health → Poor qualified job pool → Lower productivity → Loss of competitiveness → Higher business costs, lower investment, lower economic growth → Lower wages, greater wealth disparity → Poor nutrition

Lack of energy, loss of strength, loss of coordination, lower learning potential

Esme Bredenhann (RD) (SA) July 2015
## IMPACT OF POOR NUTRITION ON WORK PERFORMANCE

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td>Inadequate intake Poor health</td>
<td>Decrease the nutritional status of the individual</td>
</tr>
<tr>
<td>Step 2</td>
<td>Decrease of nutritional status of the individual</td>
<td>Imposes ceiling upon physical work</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lowers physical fitness</td>
</tr>
<tr>
<td>Step 3</td>
<td>Work effort ceiling Lower physical fitness</td>
<td>Lower work performance of the individual</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Decreased working time of the individual</td>
</tr>
<tr>
<td>Step 4</td>
<td>Lower marginal product of labour</td>
<td>Income of worker declines</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total nett output for entire population declines</td>
</tr>
</tbody>
</table>
**NUTRITIONAL STATUS**

- **Definition**: State of the body in relation to the consumption and utilization of nutrients / the extent to which nutrients are available to meet metabolic needs/ the levels of nutrients in the body and the ability of those levels to maintain normal metabolic integrity.

- Disturbed by: decreased intake; increased requirements; altered utilisation
ASSESSMENT OF NUTRITIONAL STATUS

- **Anthropometry**
  - Weight, height, circumference, skin-fold

- **Review (dietary assessment)**
  - Individual/ groups 24 hour recall, food frequency

- **Clinical (physical appearance)**

- **Biochemical (blood tests)**
BMI VS BODY FAT

DEXA scans of two individuals with the same BMI.
BODY COMPOSITION

ectomorph  mesomorph  endomorph

endo-meso  meso  ecto-meso
endo  endo-ecto  ecto
### NUTRITIONAL STATUS SCREEN

<table>
<thead>
<tr>
<th>Yes</th>
<th>Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>I have an illness or condition that made me change the kind and amount of food I eat</td>
</tr>
<tr>
<td>2</td>
<td>I eat fewer than 2 meals per day</td>
</tr>
<tr>
<td>2</td>
<td>I eat few fruits or vegetables or milk products</td>
</tr>
<tr>
<td>2</td>
<td>I have more than three drinks of beer, liquor or wine every day</td>
</tr>
<tr>
<td>2</td>
<td>I have tooth or mouth problems that make it hard for me to eat</td>
</tr>
<tr>
<td>2</td>
<td>I do not always have enough money to buy food I need</td>
</tr>
<tr>
<td>2</td>
<td>I eat alone most of the time</td>
</tr>
<tr>
<td>2</td>
<td>I take 3 or more different prescribed or over the counter drugs per day</td>
</tr>
<tr>
<td>2</td>
<td>Without wanting to I have lost or gained 5 kilograms in the last 6 months</td>
</tr>
<tr>
<td>2</td>
<td>I am not always physically able to shop cook and/feed myself</td>
</tr>
<tr>
<td>19</td>
<td><strong>TOTAL</strong></td>
</tr>
</tbody>
</table>
0-2  Good! Recheck your nutritional score in six months
3-5  You are at moderate nutritional risk – see what can be done to improve your eating habits and lifestyle
6 or more  You are at high nutritional risk. See a professional
CURRENT SITUATION

Risk assessment done in 2000 on major risk factors and causes of death

- Alcohol intake (4\textsuperscript{th}) (7.1\% of total deaths)
- High body mass index (excess body weight (5\textsuperscript{th}) (7\% of total deaths)
- High cholesterol (7\textsuperscript{th}) (4.6\% of total deaths)
- Low fruit and vegetable intake (10\textsuperscript{th}) (3.2\% of total deaths)
- Unsafe water, sanitation and hygiene (11\textsuperscript{th}) (2.6\% of total deaths)
- Vitamin A deficiency (14\textsuperscript{th}) (0.6\% of total deaths)
- Iron deficiency anemia (16\textsuperscript{th}) (0.4\% of total deaths)
When exercise or physical work increases to more than 1 hour per day, the importance of adequate energy and nutrient intake becomes more significant.
The 2000 Position Statement on Nutrition and athletic performance, published by the American Dietetic Association, Dietitians of Canada and the American College of Sports Medicine states that any active individual “who wants to optimize health and exercise performance needs to follow good nutrition and hydration practices, use supplements and ergogenic aids carefully, minimize severe weight loss practices and eat a variety of foods in adequate amounts.”
NUTRIENT-BASED DIETARY STANDARDS

- **DRI: Dietary Reference Intakes**
  - The Dietary Reference Intakes (DRI’s) as compiled by the Institute of Medicine, Food and Nutrition Board, USA, has been used as a guideline. The aim is to move away from avoiding deficiency states as determined by clinical manifestations to maximising health and improving quality of life.
  - The emphasis is on measures to reduce the risk of chronic diseases and by guidelines for groups and individuals.

- **EER: Estimated Energy Requirement**
  - Estimated Energy Requirement is defined as the average dietary energy intake predicted to maintain energy balance in healthy, normal weight individuals of a defined age, gender, weight, height and level of physical activity consistent with good health. Relative body weight (i.e. loss, stable, gain) is the preferred indicator of energy adequacy.
- **RDA**: recommended Dietary Allowance – meets the nutrient needs of almost all (97-98%) healthy individuals in a gender group at the given life stage. The RDA is the goal for usual intake by an individual.

- **EAR**: Estimated Average Requirement meets estimated needs of a nutrient of 50% of healthy individuals in a specific life style and gender group. The EAR is used to calculate the RDA and it is used to assess the adequacy of nutritional intake and plan the intake of groups.

- **AI**: Adequate Intake is used where the scientific evidence is inadequate to set an EAR. The AI is the recommended average daily nutrient intake level based on observed mean nutrient intakes by a group (or groups) of apparently healthy people with normal circulating nutrient blood concentrations, growth or other functional indicators of health. The AI is expected to meet or exceed the needs of most individuals in a specific life-stage and gender group. When an RDA is not available for a nutrient the AI can be used as the goal for usual intake by an individual, it is however not equivalent to RDA.

- **UL**: Tolerable Upper Intake Level is the maximum nutrient intake by an individual, which is unlikely to pose risks of adverse health effects in almost all (97-98%) individuals in a specified group. As the intake increases above the UL the risk of adverse effect increases.
The risk of inadequacy (ROI) is as negative as the risk of adverse effects (ROAE).
Planning for Nutrient Intakes

Planning for an individual or a group

Individual

- Are there special considerations?
  - No
    - Plan so that the RDA or AI for age/sex is met
    - Remain below the UL
  - Yes
    - e.g. smoker
    - athlete
    - ill person etc

Group

- Does the group have generally similar nutritional and energy needs?
  - Yes
    - Is the requirement distribution skewed?
      - No
        - Use EAR cut-point method to plan for X% below requirement (and no more than Y% above the UL)
      - Yes
        - Use the probability approach to plan for X% below requirement
        - for others in the group
  - No
    - Can the vulnerable subgroup be identified?
      - Yes
        - Is the vulnerable subgroup an appropriate intervention target?
          - Yes
            - Target vulnerable subgroup e.g. fortified food, supplements, and/or education
          - No
            - Use nutrient density approach
      - No
        - Target vulnerable subgroup e.g. fortified food, supplements, and/or education

Other nutrients

Plan for appropriate intake of specific nutrients of concern based on special considerations
DIETARY REQUIREMENT

- Adequate energy to complete daily task

![Diagram showing energy components and affecting factors]

- REE: 60-70%
- TEF: 10%
- EEPA: 15-30%

Affecting factors:
- Body size
- Level of fitness
- Duration and magnitude
- Muscle mass
- Age
- Fat: only 4% waste
- Carbohydrate: 25% waste
- Spicy foods: MR ↑/-33%
- Body size
- Body composition
- Age
- Gender
- Hormonal status
The macro nutrient requirement is described as Acceptable Macronutrient distribution rate (AMDR)

- **Carbohydrate** - to supply 45-65% of the total daily energy intake.
  - Not more than 25% of this is derived from sugar
- **Protein** - to supply 10-30% of the total daily energy intake.
- **Fat** - to supply 20-35% of the total daily energy intake
  - The supply form linoleic acid (n-6 fatty acid) is set as not more than 5-10% of the energy requirement (mainly fat from nuts, seeds and vegetable oil such as soybean, safflower and corn oil)
  - The supply from α-linolenic acid (n-3 fatty acids) is set as 0.6-1.2% of the daily energy requirement (mainly fat from canola, flaxseed, fish oil and fatty fish)
Vitamins
The term vitamin describes a group of essential micronutrients that generally function in the body as metabolic regulators, influencing a number of physiological processes important to exercise or physical performance.

Minerals
The minerals are a large class of micro-nutrients, most of which are considered essential.

Minerals represent about 4-5% of body weight (50% of this is calcium)
CONCLUSION

Fatigue is an unsafe condition in the workplace, however it is a multi-factorial phenomenon comprised of complex interactions between physiological and psychological factors. Risk management should focus on each situation, rather than a generic solution. Factors to consider are: mental and physical demands of work; work scheduling and planning; working time; environmental factors; individual factors such as lifestyle, home environment, access to food and general health condition.
Thank you and please travel safe