Nutrition for Bone Health and Falls Prevention

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Aim and Learning Objectives

Aims:
A. To increase awareness of the importance of nutrition in preventing falls and reducing the risk of injury from falls
B. Promoting bone health and empowering older people, communities and care providers to reduce the risk and rate of falling and the severity of injuries and to promote the best outcomes for people who have suffered falls, through nutrition.

By the end of this session you will be aware of:
1. Risk factors for falls and the MMEDS Bundle
2. The link between Malnutrition, Frailty and Falls
3. The importance of nutrition screening in falls prevention
4. Nutritional considerations in falls prevention and the key nutrients required to maintain good bone health
1
Risk factors for falls & falls injuries and the MMEDS Bundle
## Risk factors for falls

**Intrinsic Factors:**
- History of falls
- Age
- Gender
- Living alone
- Ethnicity
- Medicines
- Medical conditions
- Impaired mobility and gait
- Muscle Weakness
- Nutritional deficiencies

**Extrinsic Factors:**
- Sedentary behaviour
- Psychological status – fear of falling
- Impaired cognition
- Visual impairments
- Foot problems

*Extrinsic Factors:*
- Environmental hazards
- Footwear and clothing
- Inappropriate walking aids or assistive devices

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(1: Todd & Skelton, 2004)
What increases Osteoporosis risk?²

<table>
<thead>
<tr>
<th>Non-modifiable</th>
<th>Modifiable</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Advanced Age</td>
<td>• Nutrition:</td>
</tr>
<tr>
<td>• Female Gender</td>
<td>• Low calcium intake</td>
</tr>
<tr>
<td>• White / Asian Race</td>
<td>• Low Vitamin D intake</td>
</tr>
<tr>
<td>• Family history osteoporosis &amp; Hip fracture</td>
<td>• Low body weight</td>
</tr>
<tr>
<td>• Metabolic bone diseases</td>
<td>• Sedentary Lifestyle</td>
</tr>
<tr>
<td>• Certain malignancies (myeloma, lymphoma)</td>
<td>• Smoking</td>
</tr>
<tr>
<td></td>
<td>• Stress / depression</td>
</tr>
<tr>
<td></td>
<td>• Glucocorticoid therapy</td>
</tr>
<tr>
<td></td>
<td>• Surgical or drug induced hypogonadism</td>
</tr>
</tbody>
</table>

(²: HSE, National council on ageing & older people, DoH, 2008)
Re-cap: What is the MMEDS Bundle?

- **M**edication
- **M**obility
- **E**xercise
- **D**iet
- **S**afety (Personal & Environmental)
The link between Malnutrition, Frailty & Falls
What is malnutrition?

- ‘a state resulting from a lack of intake or uptake of nutrition that leads to altered body composition....leading to diminished physical and mental function and impaired clinical outcome from disease’.

- The term malnutrition addresses 3 broad groups of conditions:
  - Under-nutrition, which includes wasting, stunting and underweight
  - Micronutrient deficiencies or excess
  - Overweight, obesity and diet-related diseases (such as heart disease, stroke, diabetes and some cancers)

- No globally agreed diagnosis criteria as yet, however a standardised approach is strongly recommended to agree clear diagnostic characteristics to identify and document adult malnutrition in routine clinical practice internationally.
Prevalence of Malnutrition in Ireland

- 25%-34% of hospital admissions are at risk of malnutrition
- More GP visits
- More prescriptions
- More hospital admissions
- Longer stays, more complications
- More support needed after discharge
- More likely to need care
- 70% of patients weigh less on discharge from hospital

What can lead to malnutrition?

- Constipation or diarrhoea
- Nausea / Reflux / Anorexia
- Taste changes
- Poor oral health / infections
- Sore / Dry mouth
- Dislike of hospital diets
- Modified diets / Dysphagia
- Pain / Discomfort swallowing
- Embarrassment
- Confusion / Forgetfulness
- Breathlessness
- Drowsiness
- Depression
- Reduced ability to self-feed
- Co-ordination
- Tremor
- Posture
- Poor supported feeding techniques

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Consequences of malnutrition?\textsuperscript{15,16,17}

Consequences of Malnutrition (within days)

- Poor breathing and cough from loss of muscle strength
- Poor Immunity and infections
- Liver fatty change, functional decline necrosis, fibrosis
- Impaired wound healing and susceptibility to pressure ulcers
- Impaired gut integrity and immunity
- Loss of muscle and bone strength - falls and fractures
- Decreased Cardiac output
- Hypothermia – decline in all functions
- Renal function – limited ability to excrete salt and water

(\textsuperscript{15}: Russell & Elia, 2012; \textsuperscript{16}: Stratton et al, 2003; \textsuperscript{17}: Saunders & Smith, 2010)
What is frailty?\textsuperscript{18}

- A distinctive health state related to the ageing process in which multiple body systems gradually lose their in-built reserves.

- A state of increased vulnerability, associated with a decline in physical and psychological reserves.

- An apparently small event may trigger a dramatic change in physical or mental wellbeing.

No Formal consensus on the Definition of Frailty, but there is consensus that Nutrition is one of the main factors

\textsuperscript{18} (BGS 2014)
The Link between Nutrition, Frailty & Falls

- Malnutrition is associated with loss of muscle mass (sarcopenia).
- Excessive loss of muscle mass and strength results in:
  - Physical impairment, frailty, disability and dependence on others
- Inadequate nutrition contributes to the progression of many diseases, and is considered one important contributing factor in the complex aetiology of sarcopenia and frailty
How does malnutrition and frailty increase risk of falls and injury from falls?

- Unintentional weight loss is often due to inadequate energy and protein intake.

- In relation to falls and injuries related to falls, unintentional weight loss leads to:
  - muscle wasting
  - lower muscle strength
  - poor physical performance.
  - feeling of exhaustion
  - reduced physical activity
  - cycle of not eating and weight loss
  - micronutrient deficiencies increasing the risk of anaemia and osteoporosis and fractures from falls.
3

The importance of Nutrition screening in falls prevention
What is nutrition screening?

Nutrition screening is the first step in identifying patients who are at risk of nutrition problems or who have undetected malnutrition.

- It allows for prevention of nutrition-related problems when risks are identified and early intervention when problems are confirmed.

- It should be completed on admission to a health service (within 24 hours in acute hospitals)\(^ {19,20,21,22,23}\)

Screening to Identify Malnutrition

- Gold standard method is use of a validated Malnutrition screening tool
- Examples of tools with the best validity in the older population are:
  - Hospital setting: \textsuperscript{23,24,25}
    - ‘MUST’ ‘MNA-SF-V1’
    - ‘MST’ or ‘NRS-2002’
  - Rehabilitation Setting: \textsuperscript{24,25}
    - ‘NUFFE’
  - Residential / Institution Setting: \textsuperscript{24,25}
    - ‘SNAQ-RC’
  - Community Setting: \textsuperscript{24,25}
    - ‘DETERMINE’

Examples of tools are:
- MNA-SF
- MST
- DETERMINE
- SNAQ
- ‘MUST’

It only takes 3-5 minutes to complete a nutrition screening tool

(23:DoH, 2019; 24&25: Power et al, MaNuEL Study, 2018)
Screening tool example: ’MUST’\textsuperscript{26}  
(Malnutrition Universal Screening Tool)

- Most commonly used screening tool in Irish Hospitals (65\%)\textsuperscript{20}
- Completed by nursing staff on admission
- ‘MUST’ Education sessions available on HSE LanD
- Three steps:
  - BMI (using weight and height – from ulna length)
  - Unintentional weight loss / gain over previous month
  - “Acute disease effect – there has been or is likely to be little nutritional intake for > 5 days”

\textsuperscript{18}(20: HIQA, 2016; 26: BAPEN, 2003)  

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Management of Malnutrition after screening

Follow your local nutrition screening management guidelines e.g.

- Immediate referral to Dietitian for full dietary assessment
- Implementation of High Protein High Calorie diet
- Monitor dietary intake using detailed 3 day food & fluid intake charts
- Close weight monitoring and re-screen if further weight loss
- Provide nourishing snacks / fortified milk between meals
- Fortify foods with extra calories / protein

Food First Approach!
Early Referral to Dietitian is key!

Other appropriate referrals to help prevent falls include:

- Patients requiring enteral tube feeding (PEG/NG)
- Patients with Chronic Kidney Disease and elevated electrolyte levels
- Patients with wounds and poorly healing wounds
- Patients with newly diagnosed Coeliac Disease
- Newly diagnosed Diabetes Mellitus or unstable glycaemic control
- Patients with gastrointestinal conditions e.g. IBD, Diverticular Dx, constipation, diarrhoea etc
- Patients requiring texture modified diets and thickened fluids
- Patients who have been commenced on Oral Nutritional Supplements
- Patients with micronutrient deficiencies including anaemia’s
- Patients who have a BMI >30kg/m2
- Patients with hypertension
- And many more....
4
Prevention of falls and falls injuries and maintaining good bone health: Some key nutritional considerations
Nutritional Assessment

☑ Must be completed by a Registered Dietitian.
☑ The Dietitian then makes a nutrition diagnosis, selects an appropriate intervention and monitors progress with the care plan.

NCPM Assessment:
1. Medical Tests, Procedures, and Social history
2. Biochemistry
3. Medications
4. Nutrition focussed physical findings
5. Anthropometry & nutritional requirements
6. Food and nutrition related history
7. Nutrition Diagnosis
8. Nutrition care Plan devised

(27: Diagram Source BDA 2017)
Diet related issues that can lead to falls:

- Anaemia
- Diabetes and poor glycaemic control
- Constipation
- Sarcopenia
- Weight loss and Frailty
- Hyper or Hypotension
- Dehydration

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Is Hydration important in falls Prevention?

- Even mild dehydration affects mental performance and tiredness

- Common complications:
  - Low blood pressure
  - Constipation
  - Urinary tract infections
  - Weakness
  - Dizziness

- Overall increased risk of falls
Tips to help promote optimal hydration

✓ Regular / Hourly prompting
✓ Accessibility of fluids
✓ Regular prompting / assistance to use the toilet
✓ Preferred fluids: minerals, fruit juices, favourite drinks, fresh water and at preferred temperature
✓ Squash or juice added to water rather than plain water if thickened
✓ Assess if assisted beaker / adapted cups or assistance to take the fluids is required
✓ Encourage foods with good fluid content such as pureed fruit, yoghurt, jelly, custard, soup
✓ Determine an individualised daily goal and to use self monitoring tools
Nutrition, Falls and the food pyramid:
Main Key Nutrients for Falls Prevention & Bone Health?

1. Calcium & Vitamin D
2. Protein
3. Phosphorus
4. Magnesium
5. Iron & Vitamin C
1. Calcium and Vitamin D

Adequate amounts can help prevent fractures

- **Calcium** is the most abundant mineral in the body:
  - 99% in bones & teeth and 1% tissue and fluid
  - Its needed to build bone & teeth, and supports muscle function

- **Vitamin D** helps the body to absorb calcium and phosphorus, helps improve muscle function, and the maintenance of normal bones

- It also helps reduce the risk of falls associated with poor balance and muscle weakness.\(^{29,30}\)

How much Calcium is needed?

<table>
<thead>
<tr>
<th>How Much?</th>
<th>RDA (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adults</td>
<td>950 – 1000mg / day</td>
</tr>
</tbody>
</table>

Aim for 3 portions of dairy foods/day for older adults:
- = 200ml glass of milk / milk on cereal
- = 125 g carton of yoghurt / 200ml yogurt drink
- = 25g hard cheese (matchbox size piece)
- = 50g soft cheese
- = 1 portion of milk pudding

Other non dairy sources include:
- Dark green vegetables
- Tinned fish e.g. sardines / salmon with bones
- Pulses, nuts & dried fruit e.g. figs / apricots
- fortified cereals
- Tofu

(12: HSE Food, Nutrition and Hydration Policy, 2018)
<table>
<thead>
<tr>
<th>Food</th>
<th>Weight</th>
<th>Calcium Content (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whole milk</td>
<td>190ml</td>
<td>224</td>
</tr>
<tr>
<td>Skimmed Milk</td>
<td>190ml</td>
<td>235</td>
</tr>
<tr>
<td>Soy Milk (non fortified)</td>
<td>190ml</td>
<td>25</td>
</tr>
<tr>
<td>Goats Milk</td>
<td>190ml</td>
<td>190</td>
</tr>
<tr>
<td>Yoghurt</td>
<td>150g</td>
<td>225</td>
</tr>
<tr>
<td>Cheddar Cheese</td>
<td>28g</td>
<td>202</td>
</tr>
<tr>
<td>Boiled spinach</td>
<td>112g</td>
<td>179</td>
</tr>
<tr>
<td>Boiled broccoli</td>
<td>112g</td>
<td>45</td>
</tr>
<tr>
<td>Baked Beans</td>
<td>112g</td>
<td>59</td>
</tr>
<tr>
<td>Large orange</td>
<td>1</td>
<td>58</td>
</tr>
<tr>
<td>Dried apricots</td>
<td>100g</td>
<td>92</td>
</tr>
<tr>
<td>Brazil nuts</td>
<td>100g</td>
<td>170</td>
</tr>
<tr>
<td>Salmon (tinned)</td>
<td>56g</td>
<td>52</td>
</tr>
<tr>
<td>Tofu</td>
<td>100g</td>
<td>480</td>
</tr>
</tbody>
</table>

(31: Irish Osteoporosis Society, 2018)

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What reduces the absorption of Calcium?

**Alcohol**
- Excess- often leads to poor / unbalanced diet
- Poor intake of most nutrients
- Reduces bone formation & calcium absorption
- Increased likelihood of falls

**Caffeine**
- A lot of Caffeine (i.e. 1g/day or more) will lead to more loss of Calcium (in urine). Its found in:
  - Brewed coffee: 100mg/cup,
  - Instant coffee: 65mg/cup,
  - Decaf coffee: 5mg/cup,
  - Tea: 47mg/cup,
  - Cola: 35mg/can,
  - Red bull: 80mg/can,
  - Dark chocolate: 20mg/oz,
  - Milk chocolate: 6mg/oz

Source and how much Vitamin D?

<table>
<thead>
<tr>
<th>How Much?</th>
<th>Vitamin D µg/day¹²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adults</td>
<td>15µg/day</td>
</tr>
</tbody>
</table>

- **Sunshine (UVB)³⁵,³⁶**
  - Sunshine vitamin, produced by action of UVB light on skin
  - Due to Ireland’s latitude, between late September and March the body cannot synthesise vitamin D
  - 10 – 15 minutes of sunshine exposure during the summer is enough to make sufficient vit D for each day.
  - Ability to synthesise vitamin D decreases with age and the frail and bed bound are most at risk
  - 2013 study, **40.1%** of the population had vitamin D levels considered inadequate for bone health

- **Dietary sources:**
  - Fortified milks, spreads, cereals
  - Egg yolks
  - Fish oils and oily fish (salmon, mackerel)
  - Liver


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2. Protein

- Building block for tissue and contributes to the maintenance of healthy bones and growth of muscle
- Calcium, Vitamin D and Protein all have positive effect on bone health and maintenance when used together
- But if you have low calcium intake and increased protein intake then you can lose bone mass
- Protein improves recovery from hip fracture
- It is recommended to spread protein intake across each meal
- Food examples of foods rich in protein:
  - Milk, yogurt, cheese, eggs, fish, poultry, lean meats, pulses – beans and lentils, nuts and seeds

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3. Phosphorus$^{37,38}$

- Phosphorus is an essential bone forming element as it is required for the appropriate mineralisation of the skeleton.
- It supports bone development and healthy teeth.
- Intake of phosphorus is generally adequate to meet likely skeletal needs in most patients with osteoporosis, however some people with poor intake of dairy or meat may struggle to meet requirements.

Sources of phosphorus:
- Dairy
- Eggs
- Fish
- Meat
- Pulses
- Nuts
- Wholegrains
- Soybeans

(37: Heaney, 2004; 38: Palacios, 2006)
4. Magnesium\textsuperscript{38,39}

- Magnesium is essential:
  - It is essential for the absorption and metabolism of calcium
  - It is necessary to convert Vitamin D into its active form
  - It assures the strength, firmness and health of bones and teeth
  - It is also essential to the proper functioning of the nerves and muscles and all living cells
  - 60% body reserves of magnesium are held in the bone
  - Low levels can inhibit vitamin D and calcium homeostasis in the body and be a risk factor for osteoporosis

- New research suggests that magnesium may prevent bone fractures in middle aged and older adults:
  - Men with higher levels of magnesium were 44% less likely to have bone fractures, and those with a very high level of magnesium had no fractures over 20 year follow up period

- Magnesium is found in green vegetables, nuts, seeds, squash, whole grains, legumes and avocado

(38: Palacios, 2006; 39: Sandoiu, 2017)
5. Iron & Vitamin C

- Intake of Iron rich foods can decrease at times as a person ages or iron stores can reduce due to health complications leading to anaemia.
- Symptoms of Anaemia leads to dizziness, weakness & increased risk of falls.
  - Good sources of iron include meat, poultry, fish, eggs, pulses, dried fruit, dark green vegetables, fortified foods, nuts.
- Vitamin C helps support the absorption of Iron.
- The Dietitian can help advise around iron rich foods to help avoid anaemia, and strategies to maximise absorption of iron in the diet.
- Vitamin C also contributes to normal collagen formation and normal function of the bones and cartilage.
  - Good sources include fresh fruit and vegetables, and potatoes.
RECAP: So why is diet (nutrition) important to include in the MMEDS Bundle?

Adequate nutrition and awareness of the role of diet in falls prevention can:

1. help prevent muscle wasting and weakness which is a major risk factor for falls

2. Prevent low body weight which can increase the risk of osteoporosis and fractures from falls

3. Prevent calcium and vitamin d deficits in the diet which can increase the risk of osteoporosis and fractures from falls

4. Help prevent nutritional anaemia's which can lead to dizziness, weakness and tiredness which can increase the risk in falls

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Recommendations & Take Home Messages

- Screen for malnutrition on admission / within 24 hours
- Follow all local malnutrition management guidelines
- **Refer to Dietitian** as early as possible
- Monitor for signs of dehydration & encourage fluids
- Some of the key nutrients are: calcium & vit D, Protein, Phosphorus, Magnesium, iron & vit C
- Calcium is better absorbed from dairy products than from other food sources & food sources of vitamin D are limited
- Be careful of caffeine & alcohol affecting the absorption of calcium
- If inadequate intake via diet, supplementation may be needed
- Being a healthy weight can help protect falls injuries
- A **healthy balanced diet** provides adequate nutrients for most people without the need for supplementation

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Thank you!

Any Questions?

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