Nutritional Management of Chronic Obstructive Pulmonary Disease

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on behalf of

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COPD

- Cigarette smoking and air pollution are most important factors in the development of COPD + genetic components (Pauwels, 2003)
- 4th leading cause of death globally (Murray & Lopez, 1996)
- 1.4 million GP consultations per year in UK (Healthcare Commission, 2006)
- Second largest cause of emergency admissions in UK, accounting for 130,000 admissions per year (British Lung Foundation, 2007)
Impact of COPD in UK

- 1,000,000 known cases
- 600,000 diagnosed every year
- 30,000 die
Symptoms

- Progressive airflow limitation accompanied by chronic inflammation
- Dyspnoea
- Excess mucus secretion
- Chronic cough
- Muscle weakness and wasting
- Weight loss
- Acute (infective) exacerbations
Diagnosis and management

• Medical history and symptoms at presentation

• Performance of post-bronchodilator spirometry to establish lung function i.e. forced expiratory volume in one second (FEV$_1$) and forced vital capacity (FVC)

• Lung function results compared with age and gender-specific standards to determine disease severity using the GOLD criteria

• Bronchitis - history of chronic cough productive of sputum on most days of the month for at least 3 months in 2 consecutive years
Malnutrition in COPD

- Weight loss and low body weight associated with poor prognosis and increased mortality (Wilson et al., 1989; Gray-Donald et al., 1996; Landbo et al., 1999; Incalzi et al., 2001)

- Increased risk of:
  - Acute exacerbations (Connors et al., 1996)
  - Hospital readmission (Pouw et al., 2000)
  - Mechanical ventilation (Vitacca et al., 1996)

- Decreased exercise tolerance (Schols et al., 1991)

- Poor quality of life (Shoup et al., 1997; Mostert et al., 2000; Zuwallack, 2003)
Nutrition screening tools

- NSTs identify those who might benefit from nutritional support
- Patients with COPD readily move across care-settings
- NSTs independently predict outcome in terms of mortality and hospital stay (Weekes et al., 2006; Collins et al., 2010)
<table>
<thead>
<tr>
<th>NST risk category</th>
<th>Number (%) patients</th>
<th>Number (%) admitted to hospital</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 (low)</td>
<td>255 (71 %)</td>
<td>71 (28 %)</td>
</tr>
<tr>
<td>1 (medium)</td>
<td>51 (14 %)</td>
<td>23 (45 %)</td>
</tr>
<tr>
<td>2 (high)</td>
<td>55 (15 %)</td>
<td>28 (51 %)</td>
</tr>
</tbody>
</table>

*Weekes et al., 2006*  

\( \chi^2 \) test p < 0.001
### Length of hospital stay

<table>
<thead>
<tr>
<th>NST risk category</th>
<th>Median (days)</th>
<th>Range (days)</th>
<th>Mean (SD) (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 (low)</td>
<td>0</td>
<td>0 – 49</td>
<td>4.1 (9.5)</td>
</tr>
<tr>
<td>1 (medium)</td>
<td>0</td>
<td>0 – 51</td>
<td>8.0 (12.5)</td>
</tr>
<tr>
<td>2 (high)</td>
<td>1.0</td>
<td>0 – 72</td>
<td>9.6 (15.4)</td>
</tr>
</tbody>
</table>

*Weekes et al., 2006*  
Rank ANCOVA (controlling for age) $p = 0.004$
Anthropometry

- History of weight change
- Chronic inflammation + inactivity $\rightarrow$ loss of fat free mass (FFM)
- $\downarrow$ FFM can be masked by $\uparrow$ FM and fluid shifts

∴ Assess body composition together with BMI
  - Skinfold thickness measurements
  - Bio-electrical impedance analysis (BIA)
  - Dual X-Ray absorptiometry (DXA)

- Fat Free Mass Index $< 16$ kg/m$^2$ ♂
  $< 15$ kg/m$^2$ ♀
Clinical condition

- 30% clinical depression
- 30% hypertension
- 27% cardio-vascular disease
- 19% gastro-oesophageal reflux
- 10% hyperlipidaemia
- 8% osteoporosis
- 6% diabetes

- Poly-pharmacy
- Inhalers
- Nebulisers
- Oral steroids
- Antibiotics
- O₂ Therapy
Dietary intake

• Stable patients with COPD consume close to recommended daily amounts for both energy and protein (Vermeeren et al., 1997; Weekes et al., 2009)

• Intake is compromised during acute exacerbations of COPD (Vermeeren et al., 1997; Slinde et al., 2003)

• Most frequently reported symptoms likely to affect nutritional intake in COPD are anorexia, early satiety and dyspnoea (Vermeeren et al., 1997; Ceutzberg et al., 2000; Cochrane & Afolabi, 2004)
Environmental, social and psychological factors

- Strong links between social deprivation, the development of COPD and clinical outcome (Prescott et al., 1999)

- Deprivation associated with increased frequency and duration of emergency hospital admissions (Collins et al., 2010)

- Many patients with COPD become unemployed as their disease progresses or have to decrease their working hours (Eisner et al., 2002)

- Significant proportion of patients with COPD are housebound (Bestall et al., 1999)
Energy Requirements

• MEE studies have reported considerable variation in total energy expenditure (TEE) (*Slinde et al.*, 2006)

• In weight stable outpatients requirements likely to be similar to or lower than for healthy individuals of their age and gender (*Slinde et al.*, 2011)

• In acute exacerbations, REE may be up to 15–20% above predicted BMR (*Schols et al.*, 1991; *Vermeeren et al.*, 1997; *Creutzberg et al.*, 1998; *Nguyen et al.*, 1999) but since acute illness is usually accompanied by a decrease in physical activity, TEE may be similar to or lower than normal (*Scientific Advisory Committee on Nutrition*, 2011)
Measured Energy Expenditure

- BMR
- DIT
- Activity

Health:
- BMR
- DIT

Disease:
- BMR
- DIT
- Activity

REE

TEE
## Goals of treatment

<table>
<thead>
<tr>
<th>Stable COPD (outpatients)</th>
<th>Maintain nutritional status OR Improve nutritional status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute exacerbation (inpatients)</td>
<td>Minimise effects on nutritional status</td>
</tr>
<tr>
<td>Mechanical ventilation (ICU/HDU)</td>
<td>Minimise effects on nutritional status while avoiding complications of overfeeding</td>
</tr>
</tbody>
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## Requirements

**NICE guidelines (2006)**
- 25 - 35 kcal/kg/day
- 0.8 - 1.5 g protein/kg/day
- 30 - 35 ml fluid/kg/day

Alternatively use **PENG guidelines (2011)**
- No specific recommendations
- Avoid overfeeding (see PENG guidelines for maximal energy and macronutrient profiles for ventilated patients)
Nutritional intervention in COPD

• Three systematic reviews (Ferreira et al., 2008; Stratton, Green & Elia, 2003; Collins et al., 2011)

• Minimal effects on weight gain and respiratory muscle function (Ferreira et al., 2008) unless patients gained > 2 kg body weight (Stratton, Green & Elia, 2003)

• Most recent systematic review and meta-analysis showed that nutritional support is effective in stable COPD (Collins et al., 2012)
  – Significant increase in body weight (1.95 kg)
  – Significant improvements in functional status (handgrip strength, respiratory muscle strength and walking distance)
  – Significant improvements in quality of life
Oral nutritional supplements

- ONS are recommended in all individuals identified as at risk of malnutrition (BMI <20 kg/m²) \( \text{(NICE, 2010)} \)
- Majority of studies conducted in the community \( \text{(Collins et al., 2012)} \)
- Relative lack of studies evaluating the effects of ONS in hospitalised acutely unwell COPD patients
- Studies used a variety of ONS, prescriptions varied from 400 to more than 1,000 kcal per day, usually short-term (< 3 months) and no attempt made to measure effects of cessation
Dietary advice (+ food fortification)

- A recent review of nutritional support in COPD identified no randomised trials (RCTs) investigating the effectiveness of dietary advice alone (Collins et al., 2012)

- In stable COPD outpatients, dietary advice plus a 6-month supply of whole milk powder had beneficial effects (Weekes et al., 2009)
  - Significant improvements in intake, body weight, functional status and quality of life
  - Effects persisted for 6 months beyond the intervention period
  - Provision of dietary advice literature alone failed to result in any improvements
Meals on wheels and socialised eating
Enteral tube feeding

- Limited evidence that ETF is effective in COPD

- Only one trial involving nocturnal ETF in stable COPD patients (Whittaker et al., 1990)

- No studies comparing ETF and ONS during acute exacerbations

- Some evidence that patients with acute respiratory distress syndrome and acute lung injury may benefit from omega-3 enriched enteral feeds (Gadek et al., 1999; Singer et al., 2006)

- Not yet been explored during acute exacerbations of COPD
BMI and outcome in COPD

- Patients with emphysema most likely to have low BMI

- Low BMI is associated with reduced survival in hospitalised and free-living patients with COPD (Gray-Donald et al., 1996; Landbo et al., 1999)

- Improved survival in COPD patients classified as overweight or obese (Landbo et al., 1999; Vestbo et al., 2006)

- Overweight COPD patients have fewer early readmissions (Steer et al., 2010)

- Overweight and obese COPD patients have fewer emergency hospital admissions and shorter lengths of stay (Collins et al., 2011)
COPD summary

• Outpatient settings likely to be most effective for nutritional intervention in COPD
  – metabolically stable
  – less acutely unwell
  – more mobile

• Pulmonary rehabilitation including nutritional support results in significant improvements in malnourished and adequately nourished patients with COPD, suggesting a role for nutrition beyond simply treating malnutrition (Schols et al., 1995; Steiner et al., 2003)

• Recently published guidelines developed by the University of Southampton and Respiratory Dietitians Network, endorsed by DoH (www.copdeducation.org.uk)
Acknowledgements

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