

## Short Communication

# A Retrospective Study of Nutritional Status in Patients with Bronchiectasis Pre and Post Pulmonary Rehabilitation

David Proud, Tom Lines, Elizabeth Hilsden and Jamie Duckers\*

Department of Respiratory Medicine, University Hospital Llandough, UK

## \*Corresponding author

Jamie Duckers, Department of Respiratory Medicine, University Hospital Llandough, Penlan Rd, Cardiff, UK, 02920 715382, Email: jamie.duckers@wales.nhs

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## Abstract

Nutritional depletion is known to be a determinant of outcome in chronic respiratory disease but there is a paucity of evidence on nutritional intervention in bronchiectasis. The aim of this study was to retrospectively review body mass index (BMI) and body composition of patients with bronchiectasis pre and post pulmonary rehabilitation (PR). The age, sex, smoking pack year history and forced expiratory volume in 1 second as percent predicted (FEV1 %) of patients enrolling in PR over a five year period were retrospectively reviewed. BMI and fat free mass index (FFMI), were recorded at the start and end of PR. The frequency and timing of dietetic input received within the PR course was recorded. 48 (18 male) patients completed PR with a mean (SD) age of 69.8 (10.0) years. The mean BMI (SD) was 26.6 kg/m<sup>2</sup> (6.2) and mean (SD) FFMI kg/m<sup>2</sup> was 17.6 (2.3). At the start of PR four patients were underweight, 16 normal BMI, 16 overweight and 12 obese. At the completion of PR there was no statistically significant change in BMI or FFMI. This study doesn't show improvement in BMI or FFMI during PR but illustrates a challenge in engaging patients early in PR and that longer term follow up may show gains in BMI and FFMI. The challenge of dietetic input is also the ranges of BMI present (14.5-41.5 kg/m<sup>2</sup>) in this group of patients and detecting hidden loss of FFMI and maintaining any intervention for long enough to detect a change in body composition.

## ABBREVIATIONS

BMI: body mass index; PR: pulmonary rehabilitation; FFMI: Fat free mass index; FEV1%: Forced expiratory volume 1 second as percent predicted; ISWT: Incremental shuttle walk test; SGRQ: St Georges Respiratory Questionnaire

## INTRODUCTION

Nutritional depletion as assessed by Body Mass Index (BMI) is a determinant of hospitalisation and death risk in chronic end stage respiratory disease [1] and a low BMI is a marker of poor outcomes in COPD [2]. Bronchiectasis (BE) is a chronic lung disease defined by permanent dilatation and destruction of bronchi and bronchioles [3] whose pathology has been linked to a chronic inflammatory state [4]. BE has been associated with systemic co morbidities such as increased arterial stiffness and higher prevalence of osteoporosis [5] along with an adverse effect on muscle endurance, exercise capacity, fatigue and health status [6].

Onen et al. [7] found that BMI along with Medical Research Council dyspnoea scale had more significant effects on mortality

in patients with bronchiectasis than other parameters such as hypoxia and radiographic extent of disease. Gale et al 2012 [5] found mean albumin and glucose were reduced in bronchiectatic patients compared to matched controls suggesting suboptimal nutrition, with only 20% of bronchiectatic patients having a healthy BMI compared to 50% in the control group.

In contrast to cystic fibrosis (CF) where nutrition is one of the key management issues, there is a paucity of evidence of nutritional intervention in the setting of non CF bronchiectasis. Recent British Thoracic Society guidelines [8] mention multidisciplinary (MDT) input for patients with bronchiectasis seen in secondary care but do not stipulate nutritional assessment and intervention. Referral to pulmonary rehabilitation (PR) is suggested by the guidelines as Grade B evidence for patients who have breathlessness affecting their activities of daily living. The MDT nature of PR may present an ideal opportunity for nutritional assessment and intervention.

The aim of this study was to retrospectively review BMI and body composition of patients with BE attending PR, and to assess changes in body composition following PR.

## MATERIALS AND METHODS

The local PR course consists of 20 sessions, spanning seven weeks, with three sessions per week, each 2.25 hours long. The course is run by a multidisciplinary team including dietitian, physiotherapist and occupational therapist. Dietetic input is provided to the group as part of the educational aspect of the programme, involving 2 group education sessions provided close to the start of the PR programme. These education sessions cover a wide range of topics including nutritional support for malnourished patients, managing breathlessness at mealtimes, minimising constipation, dry mouth and micronutrient deficiencies in addition to weight management. Each patient is also offered individualised advice on a one to one basis as required. On completion of PR patients are referred onto community dietetic services if relevant for on-going support.

The PR referral proforma of patients identified as having bronchiectasis (confirmed by High Resolution Computed Tomography of the chest) from 2007 to 2012 were retrospectively reviewed. Age, smoking status, BMI, fat free mass (FFM) (Tanita BC418-MA), handgrip strength, (TAKEI 5401 dynamometer), spirometry (Vitalograph, UK) with forced expiratory volume in 1 second as percent predicted (FEV<sub>1</sub> %) determined according to European Respiratory Society guidelines [9] and pre and post results for St Georges Respiratory questionnaire [10] and incremental shuttle walk test (ISWT) [11] were recorded. Pre PR assessment of patients occurred within the first 2 sessions of the relevant programme with post PR assessment occurring in the final 2 sessions. Patients were deemed to have completed PR if they attended more than 14 of the 20 sessions. Whether a patient declined dietetic input was recorded and the number of dietetic reviews the patients received was recorded and the timing of dietetic review within the PR programme (i.e. which session of the 20) was also recorded.

This research involved retrospective analysis of existing data and standard care had been given to all patients. There was no additional intervention performed and thus Ethical approval was not sought as per National Research Ethics Service guidance.

Data analysis was performed with the Statistical Package for the Social Sciences (SPSS, Chicago, Illinois, USA) software version 16.0. Analyses included independent and paired *t* tests and the chi-squared test was used for nominal data comparisons. The significance level was set at  $p < 0.05$ .

## RESULTS AND DISCUSSION

63 (24 male) patients with BE commenced PR over this 5 year period. Of the 63 patients who commenced 48 completed the PR course. Five patients did not complete due to respiratory exacerbations and ten patients had poor attendance and attended less than 14 of the sessions.

Of the 48 patients who completed PR there were 30 females and 18 males. The mean (SD) age was 69.8 (10.0) years and the median smoking pack year history was zero with a range 0-30 years. The mean (SD) FEV<sub>1</sub> % was 54.7 % (24.7%). Table 1 illustrates the effects of PR in the patients completing the course.

At the completion of PR there was no statistically significant change in the proportions of patients categorised as low BMI,

**Table 1:** Effect of PR in patients with BE.

	Pulmonary Rehab start	Pulmonary Rehab end	P value
BMI (kg/m <sup>2</sup> )	26.6 (6.2)	26.5 (6.4)	0.34
FFMI (kg/m <sup>2</sup> )	17.6 (2.3)	17.5 (2.3)	0.22
Handgrip (kg)	23.3 (7.7)	23.9 (8.1)	0.05
SGRQ total	62.5 (16.4)	52.1 (13.3)	<0.001
ISWT (m)	145.1 (70.9)	205.8 (89.8)	<0.001

Data are presented as mean (SD) unless otherwise stated  
BMI Body Mass Index, FFMI Fat Free Mass Index, SGRQ St Georges Respiratory Questionnaire, ISWT Incremental Shuttle Walk Test

normal BMI, overweight or obese. Five patients had low BMI, 16 normal, 15 overweight and 12 were obese at the completion of PR.

Of the 48 patients who completed PR 36 had a FFMI calculated. Accurate FFMI measurement was not possible in the remaining 12 patients due to pacemakers and altered fluid balance status. Of these 36 patients 31 patients had normal FFMI for their age [13]. The remaining five patients (three male) had a low FFMI at the start of PR. At the completion of PR there was no statistically significant change in the proportions of patients categorised as low FFMI and normal FFMI. At the start of PR two patients, both male, had hidden low FFMI (i.e. normal BMI but low FFMI). Five patients had a low BMI and low FFMI at commencement of PR.

Of the 48 patients completing PR 15 (9 female) declined to see the dietitian and 33 consented to dietetic input regarding individualised advice. There was no statistically significant difference in age, sex, FEV<sub>1</sub> % predicted, FFMI or BMI at start with those who refused dietetic input and those who received dietetic input. Of those who saw the dietitian median contact was at session 11 of 20 (range session 2-19). The median number of dietetic sessions was 1 (range 1-4). All patients with a low BMI agreed to input from the dietitian.

There was no significant change in BMI and FFMI pre and post PR in those who refused dietetic input and those who had individualised dietetic input ( $p > 0.05$ ).

There is a paucity of evidence of nutritional intervention in the setting of non CF BE. Recent British Thoracic Society guidelines [8] mention multidisciplinary (MDT) input for patients with bronchiectasis seen in secondary care but do not stipulate nutritional assessment and intervention. PR improved patients' ISWT distance and quality of life, as noted in many previous PR studies. However, whilst this study doesn't show an improvement in BMI or FFMI during PR it does illustrate that there remains a challenge in engaging patients early in PR and that longer term follow up may show gains in BMI and FFMI and steps to optimise nutritional status may lead to improvements in morbidity and mortality. In testing this hypothesis Weekes et al [14] assessed dietary counselling specifically focusing on food fortification in stable COPD patients. The intervention phase lasted 6 months with a further 6 month follow up period. Intervention patients received 7 contacts with an experienced dietitian and results showed significant improvements in consumption of energy and protein in addition to significant and sustained weight gain.

**Table 2:** Patients categorized by sex and BMI status at start of PR [12].

	Low BMI (<20kg/m <sup>2</sup> )	Normal BMI (20-24.9kg/m <sup>2</sup> )	Overweight (25.0-29.9kg/m <sup>2</sup> )	Obese (≥30kg/m <sup>2</sup> )	Total number of patients
Start of PR Male	2	9	5	2	18
Start of PR female	2	7	11	10	30
Total Start PR	4	16	16	12	48

**Abbreviations:** BMI Body Mass Index, PR Pulmonary Rehabilitation

Whilst literature basis is poor should dietitians be targeting certain groups? Cano et al. [15] looked at 39 BE patients on LTOT and/or home mechanical ventilation. The BE patients in this study showed the highest % of depleted FFM of all chronic lung diseases observed (COPD, restrictive disorders, mixed respiratory failure). The challenge of dietetic input is also the ranges of BMI present (14.5-41.5 kg/m<sup>2</sup>) in this group of patients and detecting patients with hidden loss of FFMI and maintaining any intervention for long enough to detect a change in body composition. Is dietetic input within PR helping to minimise rate of FFM decline rather than us expecting it to increase FFM?

To facilitate this longer term aim of influencing change in body composition nutritional aspects are likely to need to be incorporated into individual management plans within a multidisciplinary team setting.

Body composition assessment using bioelectrical impedance has been validated in COPD [16] and has proven to be a useful tool in identifying low FFM, including hidden low FFM an independent predictor of mortality in COPD. This retrospective study identified several patients who had hidden loss of FFM (i.e. low FFMI but normal BMI) and therefore assessment of body composition in patients with BE would be beneficial in identifying those with a potentially greater risk of deterioration.

Cano et al [15] suggest patients with BE present with higher inflammatory activity in comparison with other lung diseases. Thus as a consequence it may be hypothesised that patients with BE may be more resistant to improvements in BMI or FFM.

## CONCLUSION

Whilst this study doesn't show an improvement in BMI or FFMI during PR it illustrates that there remains a challenge in engaging patients early in PR and that longer term follow up may show gains in BMI and FFMI and steps to optimise nutritional status may lead to improvements in morbidity and mortality. The challenge of dietetic input is also the ranges of BMI present (14.5-41.5 kg/m<sup>2</sup>) in this group of patients and detecting patients with hidden loss of FFMI and maintaining any intervention for long enough to detect a change in body composition. To facilitate this longer term aim of influencing change in body composition nutritional aspects are likely to need to be incorporated into individual management plans within a multidisciplinary team setting.

BE is a very heterogeneous condition secondary to a number of aetiologies and within this study we have not categorized patients further into exact aetiologies where known.

Patients received dietetic input at different time points within the program and thus follow up of the effect of dietetic intervention occurred at different times in different patients. For

example it may be unrealistic to expect to see evidence in change in nutritional status if a patient was seen on session 19 for the first time of a 20 session course.

In this retrospective study although number of patients consenting to dietetic input and subsequently number of dietetic sessions was recorded the clinical reason for dietetic involvement was not recorded (e.g. weight gain or weight loss advice, diabetic management, GI disorders such as IBS management). Therefore it is not possible to say whether all patients agreeing to dietetic input had weight/FFM as their main goal.

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