

LETTERS

Obesity in patients with COPD, an undervalued problem?

Franssen *et al* reported potential links between obesity and chronic obstructive pulmonary disease (COPD).¹ In their review, the authors use obesity prevalence estimates for COPD patient populations from only two studies with a relatively small sample sizes.^{2,3} Therefore, in our view, whether or not obesity is actually more prevalent in patients with COPD is still a matter of debate. Moreover, the current evidence of a possible association between obesity and a worse COPD disease state is inconclusive. This information is crucial before considering any potential underlying mechanisms of this presumed association.

In order to contribute to the discussion on the role of obesity in COPD, we analysed data from a Dutch regional primary care diagnostic centre to address these questions. The procedures and database have been described elsewhere.⁴ In short, our database contains spirometry tests of patients referred by general practitioners. Also information on body mass index (BMI), smoking habits, exacerbation rate and level of dyspnoea (Medical Research Council (MRC) score) are collected during all visits.⁴ For the current analysis, we used information from the most recent spirometric tests from all current and former smokers with respiratory symptoms aged >40 years and a post-bronchodilator forced expiratory volume in 1 s (FEV₁)/forced vital capacity (FVC) of <0.70. BMI (kg/m²) was categorised as low weight (BMI ≤21), normal weight (21< BMI <25), overweight (25 ≤ BMI <30) and obesity (BMI ≥30). Obese patients were

compared with normal and overweight patients in terms of postbronchodilator FEV₁% predicted, FVC and MRC scores. The associations between obesity and these outcomes were analysed with linear regression and ordinal regression. The models were corrected for age, gender and current smoking habit.

Table 1 shows the characteristics of the study population (n = 1761) by BMI category. Overall, 15.1% of the study subjects were obese. FVC was 250 ml lower in obese patients compared with patients with normal weight and overweight (p<0.01). We found no association between obesity and post-FEV₁% predicted, but obesity was associated with higher MRC scores (odds ratio (OR) 2.05, 95% CI 1.67 to 2.52).

The prevalence of obesity in our population was lower compared with the study by Steuten *et al* (ie, 18%), but still slightly higher compared with the general Dutch population aged ≥45.⁵ Only the FVC was reduced in the obese COPD patients. This is an important observation, as this could result in under-representation of COPD in obese individuals when the main GOLD (Global Initiative for Chronic Obstructive Lung Disease) criterion (ie, FEV₁/FVC<0.70) is applied to demonstrate airflow obstruction.

Although our findings indicate that the prevalence of obesity in patients with COPD is only slightly higher compared with that of the general population, obesity is a prevalent problem in patients with COPD associated with a higher level of dyspnoea. Therefore, we ask for more attention to be paid to obesity in patients with COPD, in both research and patient care. Our efforts should focus not only on research into potential links between obesity and COPD, but also

on effective ways to prevent and treat obesity in COPD patients, which may require a different approach from that in healthy subjects.

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Authors' reply

We welcome the comments of van den Bemt *et al* regarding our review on obesity and chronic obstructive pulmonary disease (COPD). Their careful analysis of a large Dutch primary care population of COPD provides further evidence for an increased prevalence of obesity in patients with early-stage COPD. According to their data, about 17% of the patients in GOLD (Global Initiative for Chronic Obstructive Lung Disease) stage II are obese vs 11% in a healthy Dutch population.¹ The prevalence of a body mass index (BMI) ≥30 kg/m² was significantly lower in GOLD III (14%) and substantially reduced in GOLD IV patients (2%). The results of van den Bemt *et al* furthermore show that obesity is clinically important in COPD patients, since it is related to increased dyspnoea. Although the association between BMI and breathlessness is not unique for patients with COPD,² it indicates that the abundance of fat mass is a factor that should be taken into account in COPD management. Based on the existing prevalence data, the authors urge for research to be carried out into effective prevention and intervention strategies of

Table 1 Characteristics of the study population by body mass index (BMI) category

	Low weight BMI ≤21 (n = 222)	Normal weight BMI 21.01–24.99 (n = 583)	Overweight BMI 25–29.99 (n = 690)	Obesity BMI ≥30 (n = 266)
Age*	60.3 (11.2)	62.2 (10.7)	63.9 (10.3)	63.6 (10.0)
Gender (male)	104 (46.8)	363 (62.3)	497 (72.0)	168 (63.2)
Current smoker	154 (69.4)	331 (56.8)	289 (41.9)	111 (41.7)
GOLD stages				
I	32 (14.4)	89 (15.3)	91 (13.2)	22 (13.3)
II	100 (45.0)	362 (62.1)	440 (63.8)	187 (70.3)
III or IV	90 (40.6)	132 (22.6)	159 (23.1)	57 (21.5)
MRC score				
0	55 (24.8)	211 (36.2)	215 (31.2)	46 (17.3)
1	92 (41.4)	238 (40.8)	277 (40.1)	114 (42.9)
2–4	75 (33.8)	134 (23.0)	198 (28.8)	106 (39.8)
Postbronchodilator lung function				
FEV ₁ % predicted†	56.5 (18.2)	63.0 (16.8)	62.7 (16.2)	61.1 (13.4)
FVC (litres)†	3.2 (0.96)	3.4 (1.00)	3.4 (1.00)	3.1 (0.92)
FEV ₁ /FVC†	0.54 (0.11)	0.57 (0.10)	0.59 (0.09)	0.62 (0.07)

Figures are number and percentage unless stated otherwise.

*All differences between groups were significant (p<0.01). †Mean (SD).

FEV₁, forced expiratory volume in 1 s; FVC, forced vital capacity; GOLD, Global Initiative for Chronic Obstructive Lung Disease; MRC, Medical Research Council.

obesity in COPD. Unfortunately van den Bemt *et al* were not able to distinguish in their study between the prevalence of fat abundance in absolute or relative terms (ie, obesity vs sarcopenic obesity). In our review, we specifically focused on the impact of excessive fat mass (in both absolute and relative terms) on the pathogenesis of systemic features of COPD such as systemic inflammation and cardiovascular disease rather than that of a high BMI per se, since pulmonary disease severity appears to be associated not only with a decline in BMI but also with a shift in body composition. Insight into the pathogenesis of a disturbed energy balance in COPD patients with fat abundance is needed to determine if a generic- or a disease- (and maybe even disease state-) specific intervention approach is needed. Fat mass is merely determined by an imbalance between dietary intake and energy expenditure. No data are yet available regarding dietary intake in obese and non-obese patients with COPD adjusting for GOLD stage. Several studies, however, have consistently demonstrated a very low physical activity level (the most variable component of energy expenditure) in patients with COPD.³ The studies so far therefore clearly point towards promoting exercise in early-stage COPD patients with obesity in order to improve energy balance, decrease dyspnoea and possibly also prevent adverse effects of fat abundance on cardiometabolic risk as outlined in our review.⁴

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Validation of two activity monitors in patients with COPD

Physical activity in daily life is increasingly used as an outcome measure in chronic respiratory disease.¹ Valid and user-friendly instruments are needed to quantify daily activity.^{1,2} The DynaPort activity monitor (McRoberts, The Hague, The Netherlands) has been validated and used in patients with chronic obstructive pulmonary disease

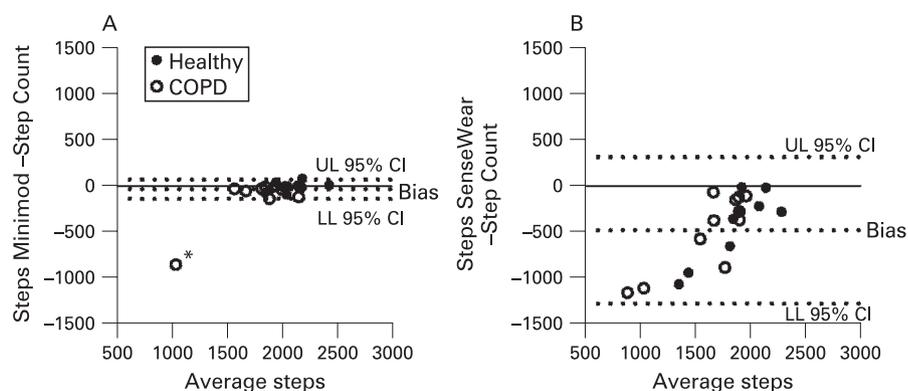


Figure 1 Mean sum of steps plotted against differences between sum of steps of (A) the Minimod monitor and manually counted steps (Step Count): mean bias -43 steps (95% CI -146 to 60) and (B) the SenseWear monitor and Step Count: mean bias -486 steps (95% CI -1278 to 306). *Subject walking slower than 2.5 km/h.

(COPD).^{3,4} The device is, however, technically difficult to handle and, due to its size ($12.5 \times 9.5 \times 3$ cm, 375 g), it is always noticeable. We therefore validated two smaller activity monitors in a sample of 10 patients with COPD (mean (SD) forced expiratory volume in 1 s 49 (16)% predicted; mean (SD) age 65 (8) years) and 10 healthy elderly volunteers (mean (SD) age 65 (9) years). Detailed characteristics of the study subjects are summarised in table 1 in the online supplement.

All patients simultaneously wore the DynaPort, the SenseWear Pro (SenseWear, Body Media, Pittsburgh, USA) activity monitor ($8.5 \times 5.0 \times 1.5$ cm, 85 g), the DynaPort Minimod (Minimod, McRoberts, The Hague, The Netherlands) activity monitor ($8.5 \times 5.0 \times 1.0$ cm, 70 g) and a portable metabolic system (VmaxST 1.0, Viasys, MEDA, Belgium) during a 53 min protocol including different postures and activities (see table 2 in online supplement for a detailed description of the protocol). In a first analysis the accuracy of the Minimod and DynaPort to detect time spent in walking and time spent in different postures was validated against video analysis; the step count of the three activity monitors was then validated against manual step counting and, finally, estimates of energy expenditure from both the Minimod and the SenseWear were validated against indirect calorimetry. Additional information on material and methods is available in the online supplement.

The Minimod was as accurate as the previously validated DynaPort in detecting time spent in different postures and in walking (see table 3 in online supplement). During the protocol, a mean (SD) of 1976 (220) steps were manually counted. Excellent agreement with the manual step count was observed for the Minimod (mean (SD) step count 1891 (363) steps; fig 1A), with the exception of a large underestimation in one patient who walked slowly (2.5 km/h compared with other slow walking speeds of 2.8 – 4.5 km/h). This outlier

was excluded from the statistical analyses (see details in online supplement). Agreement between the manual step count and the SenseWear monitor (mean (SD) step count 1512 (517) steps) was worse. The SenseWear step count differed significantly from the manual step count (difference between means -465 steps (95% CI -717 to 213), $p < 0.001$; fig 1B).

No significant differences were found between energy expenditure estimates from indirect calorimetry (mean (SD) 144 (5) metabolic equivalents (MET)-min), the Minimod (mean (SD) 153 (6) MET-min; $+6\%$) and the SenseWear (mean (SD) 139 (6) MET-min; -4%). Correlations and agreement between energy expenditure estimates from activity monitors and indirect calorimetry are shown in figs 1 and 2 in the online supplement.

Of particular interest for physical activity intervention studies is the ability of devices to detect minutes of moderate intense physical activity (≥ 3 METs). Important health benefits have been described mainly for activities that are performed at moderate intensity (≥ 3 METs).^{5,6} No significant differences between the SenseWear and the Minimod were found for the ability to detect minutes spent sedentary (< 3 METs) (84 (11)% agreement vs 84 (7)% agreement with minutes classified as sedentary by indirect calorimetry). The SenseWear, however, detected significantly more minutes of moderate intense physical activity than the Minimod (80 (11)% vs 70 (13)% agreement with minutes classified as moderately intense activity by indirect calorimetry; $p = 0.03$).

We conclude that the SenseWear and the Minimod provide complementary information on habitual physical activity and could be useful both as outcome measures and for self-monitoring of daily activities in physical activity intervention studies in COPD. The Minimod is a very accurate instrument for detecting postures, walking and steps. The SenseWear does not provide information on time spent in postures and walking, and step counts are not accurate. It was, however, the