

COPD and environmental risk factors other than smoking

7. Body mass index (BMI)

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Date : 9th November 2007

1. Papers identified

Using the procedures described in “COPD and risk factors other than smoking. 1. Identifying Relevant Papers,” 36 papers were identified as relevant.¹⁻³⁶

2. Specific studies

34 of the papers describe results from particular studies, though for some studies there are more than one publication. Table 1 summarizes relevant findings from these. Of the 34 publications, 11 relate to prospective studies, with one of these a case-control study nested within a prospective study. Of the rest, seven are case-control studies and 16 cross-sectional studies. Only eight of the publications^{1,7,9,15-17,30,31} have the relationship between BMI (or weight) as a major interest, the remainder mainly considering BMI as only one of a number of possible explanatory variables considered. Although BMI (based on measured weight and height) is the measure used in the majority of the studies included, Table 1 also includes a number of other studies with related variables, including – body weight (in one study¹ at birth and after 1 year), weight gain over a period, waist-hip ratio, desirable relative weight, and in one study “underweight” based on the opinion of a proxy respondent. The endpoints used also vary considerably.

Assessment of the relationship of BMI to COPD is complex for a number of reasons. These include:

- (i) The disease process itself may result in weight loss, an issue of most importance in case-control studies. Two of the 36 papers identified^{12,35} refer to the association between malnutrition and COPD. As one of those references¹² points out, “.. a portion of patients with advanced disease (perhaps 50%) experience weight loss as part of the syndrome. It also seems clear that low weight (or weight loss) correlates with morbidity and mortality. However, it is not certain whether this implies a causal relationship or is simply an epiphenomenon; that is, low weight is a marker for more severely impaired lung function which is the primary risk factor.”
- (ii) Smokers have lower BMI than nonsmokers. In this context, it should be noted that a substantial majority (82%) of the 34 publications took smoking into account in at least some of their analyses (or concerned never smokers).
- (iii) In a number of the studies, associations were investigated by looking at the linear relationship of BMI to disease risk or lung function. If the relationship is in fact U-shaped, this may result in a true relationship being missed.

That said, the data from those publications do suggest that BMI may have an important role. Many of the studies report that low BMI or underweight was associated with a significant, and often quite substantial, increased risk of COPD (or reduction in lung function). Less frequently, some studies report an increased risk in the obese, and a few studies increases in both the underweight and overweight, i.e. a U-shaped relationship. Interestingly, the two prospective studies using weight gain as a measure,^{7,9} both involving quite complex analyses, reported that weight gain was associated with a trend towards poorer lung function. Overall, the conclusions

are not totally clear and a more detailed analysis than this cursory look may be required for a better understanding. However, it is notable that very few of the studies included report no significant association, with some of those having limited power to detect a true relationship.

3. Reviews

Of the 36 papers identified, none are detailed reviews of the evidence relating BMI to COPD. In the “Step 1 papers” (see report 1) relatively few mentioned BMI. Higgins (1991)³⁷ included “low BMI” in a table giving risk factors for COLD, while the review of Viegi (2001)³⁸ listed “low birth weight” as a host factor for which there was good evidence. Neither paper gave any detailed evidence. Though a detailed review paper may exist, none have been unearthed by the searches.

4. Conclusions

While interpretation of the data is difficult, due to the various sources of potential bias – in particular the weight loss associated with the disease process and with smoking – the data seem reasonably consistent in indicating that low BMI is associated with poorer lung function and an increased risk of COPD. Some studies also suggest an adverse effect of obesity.

5. References

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TABLE 1 Brief summary of results from 34 published papers relating to BMI and COPD

<u>Source</u>	<u>Study design^a</u>	<u>Measure^b</u>	<u>Endpoint^c</u>	<u>Significant relationships^d</u>	<u>Smoking adjusted</u>
Barker et al ¹	P	Weight at birth, 1 year	COAD death, FEV ₁	-	FEV ₁ only
Becklake et al (1987) ²	CC	Weight	EMP	-	No
Bednarek et al (2005) ³	C	BMI	COPD, FEV ₁ /FVC	-(FEV ₁ /FVC)	COPD only
Burchfiel et al (1996) ⁴	P	BMI	FEV ₁ decline	-	Yes
Celli et al (2005) ⁵	C	BMI	AO	-	Never Sm.
Chan-Yeung et al (2007) ⁶	CC	BMI	COPD	-	Yes
Chen et al (1993) ⁷	P	Weight gain	Lung function	+	Yes
Chen et al (2000) ⁸	C	BMI	COPD	+(women)	Yes
Chinn et al (1996) ⁹	P	Weight gain	FEV ₁	+	Yes
Dean et al (1977) ¹⁰	CC	BMI	CB death	-	Yes
Dean et al (1978) ¹¹	C	BMI	Bronchitis syndrome	-(men), U (women)	Yes
Ehrlich et al (2004) ¹³	C	BMI	CB	No	Yes
Enright et al (1994) ¹⁴	C	Weight	CB, EMP	+(CB), -(EMP)	Yes
Guerra et al 2002 ¹⁵	CC	BMI	CB, EMP	+(CB), -(EMP)	Yes
Harik-Khan et al (2001) ¹⁶	CC	BMI, WHR	FEV ₁	-(WHR, men)	Yes
Harik-Khan et al (2002) ¹⁷	P	BMI	COPD	-	Yes
Higgins et al (1982) ¹⁸	C	BMI	OAD	-	Yes
Hnizdo et al (1990) ¹⁹	C	BMI	Lung function	-	No
Hnizdo et al (1990) ²⁰	NCC	Weight	COPD	-	No
Hospers et al (1999) ²¹	P	BMI	COPD death	-	Yes
Hospers et al (2000) ²²	P	BMI	COPD death	No	Yes
Hyman and Reid 2004 ²³	C	BMI	COPD	-	No
Johannessen et al (2005) ²⁴	C	BMI	COPD	-	Yes
Lange et al (1990) ²⁵	P	BMI	OLD death	-	Yes
Langhammer et al (2000) ²⁶	C	BMI	CB	+(women)	Yes

TABLE 1 Brief summary of results from 34 published papers relating to BMI and COPD (contd.)

<u>Source</u>	<u>Study design</u> ^a	<u>Measure</u> ^b	<u>Endpoint</u> ^c	<u>Significant relationships</u> ^d	<u>Smoking adjusted</u>
Menezes et al (2005) ²⁷	C	BMI	COPD	-	Yes
Metzner et al (1983) ²⁸	C	DRW	CB, FEV ₁	No	No
Meyer et al (2002) ²⁹	CC	Underweight	COPD	-	Yes
Negri et al (1988) ³⁰	C	BMI	CB , EMP	U-shaped	Yes
Nemery et al (1983) ³¹	C	BMI	FEV ₁ /VC	- (in smokers)	Yes
Prescott et al (1996) ³²	P	BMI	COPD death	-	Yes
Shin et al (2003) ³³	C	BMI	AO	No	Yes
Thorn et al 2007 ³⁴	P	BMI	OS	+	Yes
Xiao et al (2004) ³⁶	CC	BMI	COPD	-	No

^a Abbreviations used for study design:

C = cross-sectional
CC = case-control

NCC = nested case-control
P = prospective

^b Abbreviations used for measure:

BMI = body mass index
DRW = desirable relative weight

WHR = waist hip ratio

^c Abbreviations used for endpoint:

AO = airways obstruction
CB = chronic bronchitis
COAD = chronic obstructive airways disease
COPD = chronic obstructive pulmonary disease
EMP = emphysema

FEV₁ = forced expiratory volume in 1 sec
FVC = forced vital capacity
OAD = obstructive airways disease
OLD = obstructive lung disease

^d + Implies significant decrease in lung function or increased risk of disease associated with increased BMI or other body weight measure

- Implies significant increase in lung function or decreased risk of disease associated with increased BMI or other body weight measure

U shaped implies low lung function or high risk of disease associated with both ends of the BMI scale