OBESITAT I ASMA

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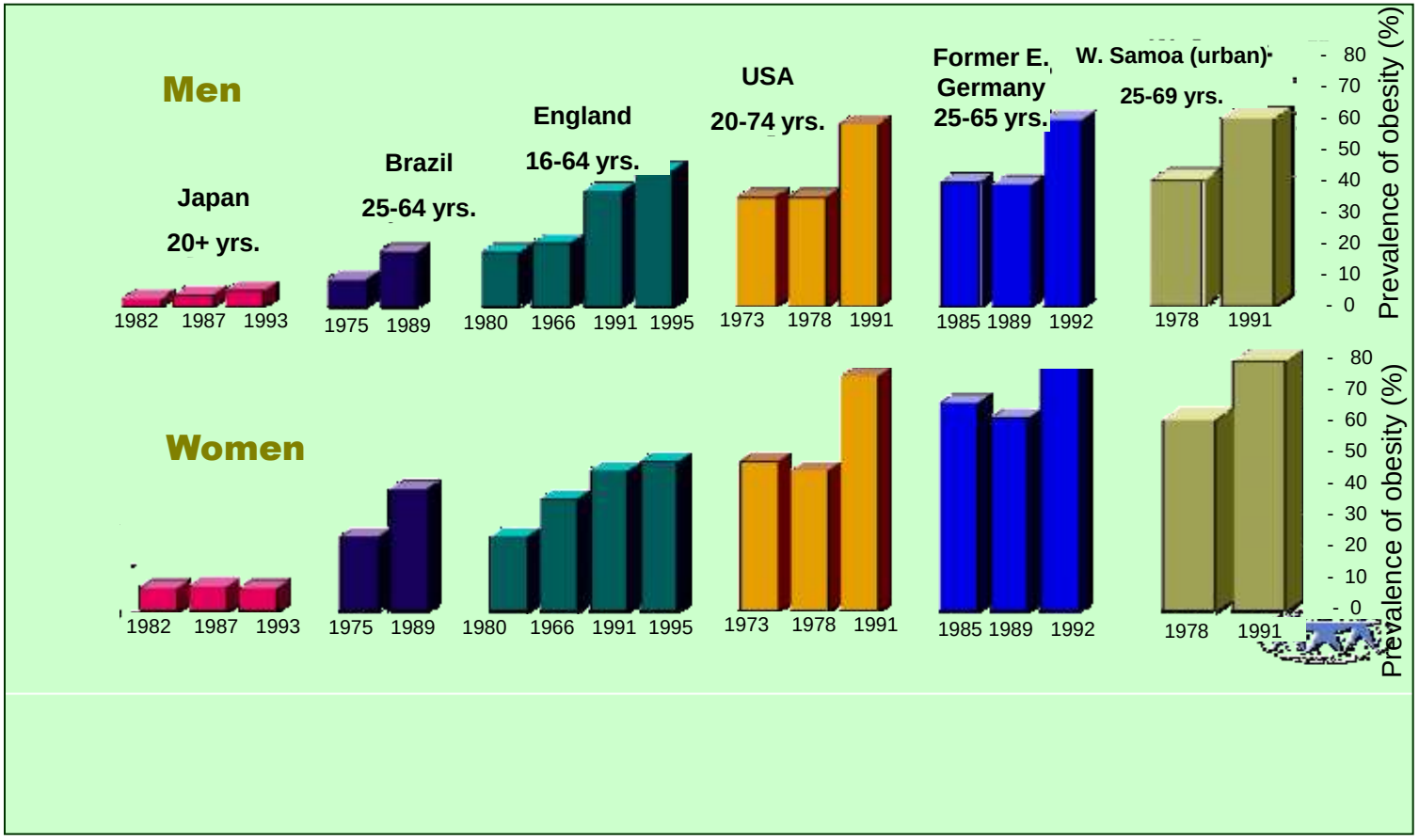
Guió

- Obesitat i Asma. Dos entitats prevalents.
- Evidencies Associació Asma i Obesitat
  - Obesitat factor de risc per asma al marge de races
  - Guany de pes augmenta la incidència d'asma
  - Pèrdua de pes milloria d'aspectes de l'asma
  - Associació entre severitat de l'asma i obesitat. Especialment en dones.
- Mecanismes que expliquen l'associació
  - Genètica
  - Inflamació sistèmica
  - Adipoquines
  - Canvis mecànics funció pulmonar
  - Comorbiditats
- Fenotip Asma-Obesitat
- Tractament

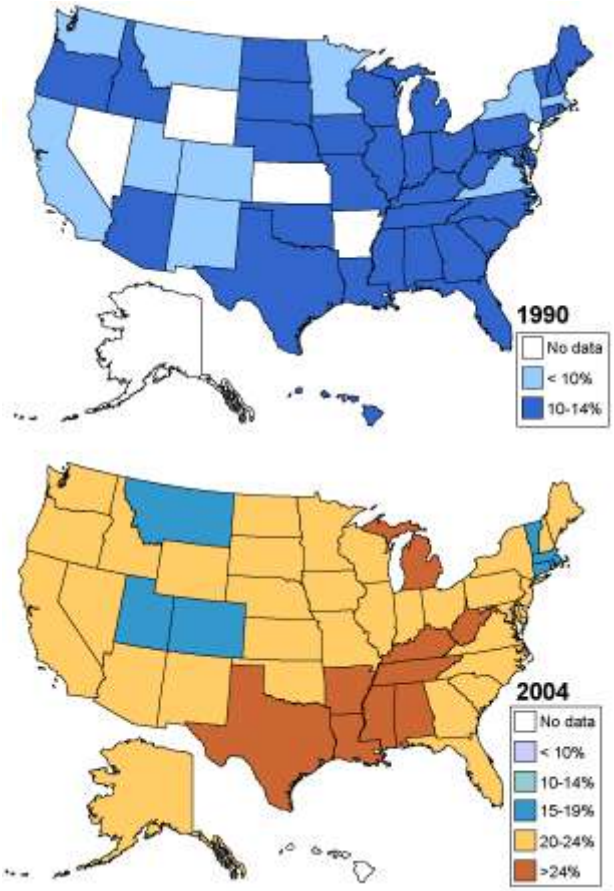
Obesitat


Men
Japan
20+ yrs.
1982 1987 1993
Brazil
25-64 yrs.
1975 1989
England
16-64 yrs.
1980 1966 1991 1995
USA
20-74 yrs.
1973 1978 1991
Former E. Germany
25-65 yrs.
1985 1989 1992
W. Samoa (urban)
25-69 yrs.
1978 1991
Women
1982 1987 1993
1975 1989
1980 1966 1991 1995
1973 1978 1991
1985 1989 1992
1978 1991
80
70
60
50
40
30
20
10
0
Prevalence of obesity (%)

Obesitat

AUGMENT DE LA PREVALENÇA EN PAÏSOS OCCIDENTALS:

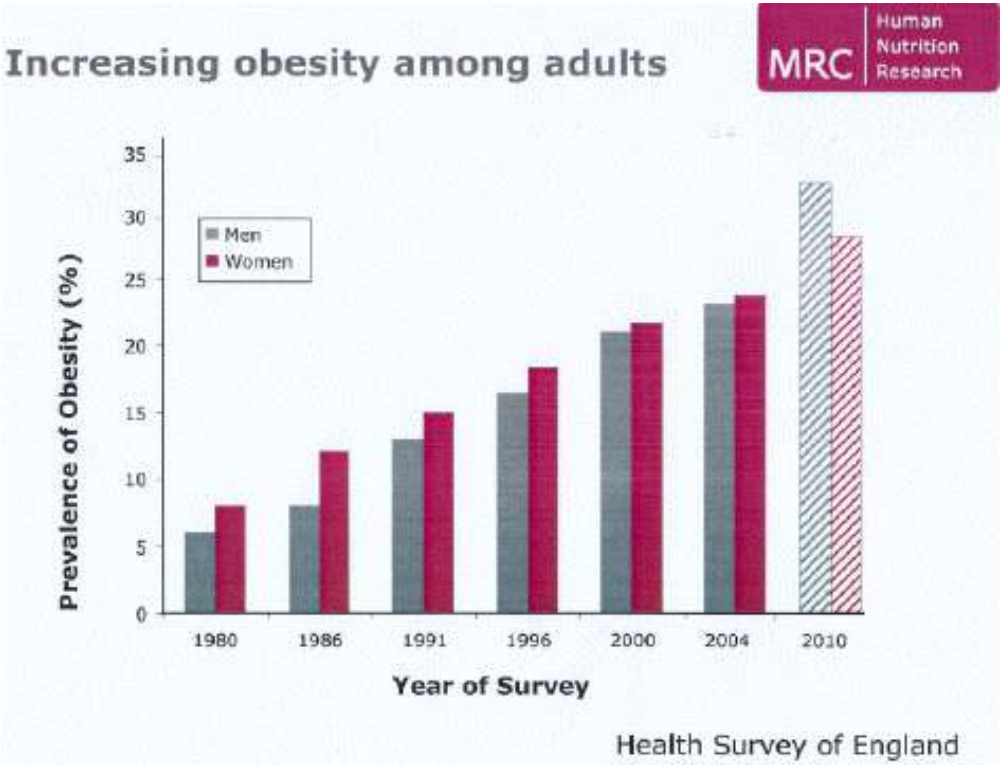
USA 1990 – 2004:



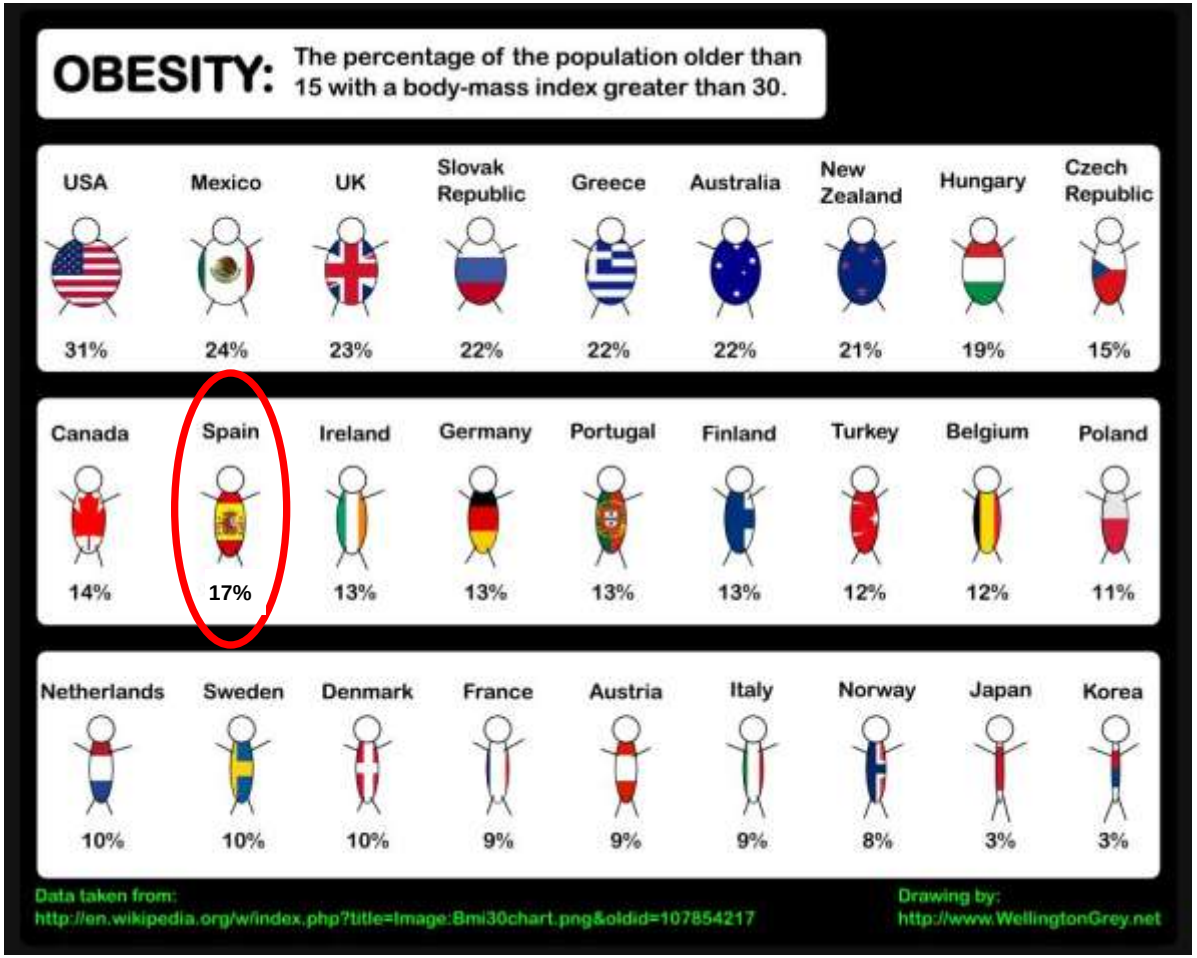
65% de la població a USA tenen sobrepés o son obesos

Obesitat

- **AUGMENT DE LA PREVALENÇA EN PAÏSOS OCCIDENTALS : UK 1987 – 2004:**



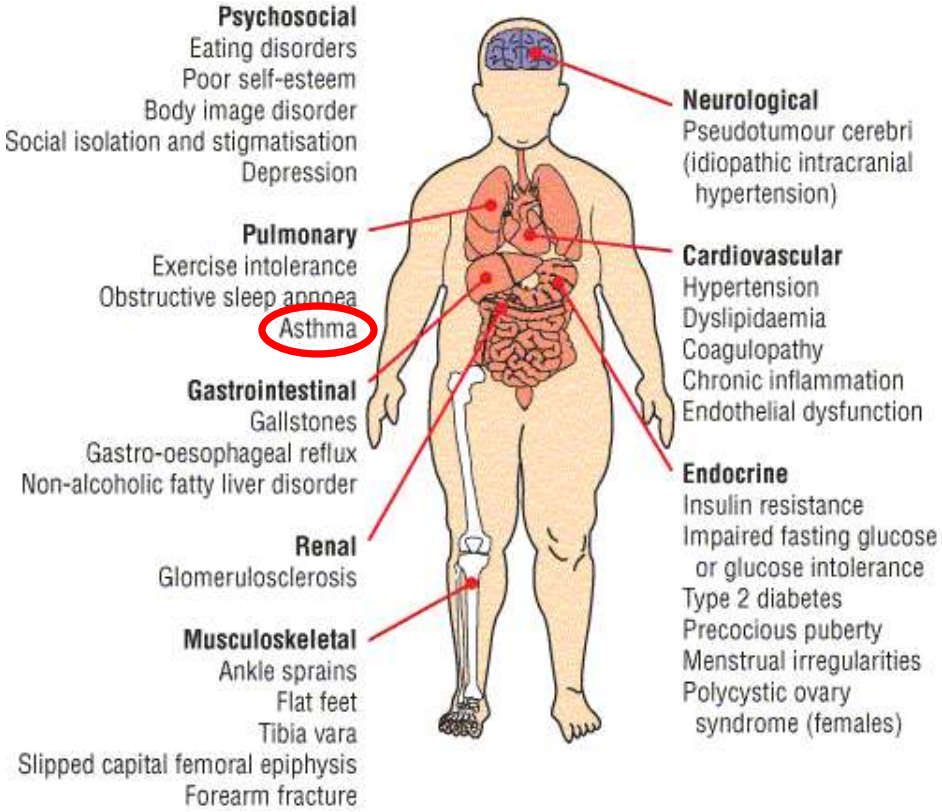
Obesitat


OBESITY: The percentage of the population older than 15 with a body-mass index greater than 30.
USA 31%
Mexico 24%
UK 23%
Slovak Republic 22%
Greece 22%
Australia 22%
New Zealand 21%
Hungary 19%
Czech Republic 15%
Canada 14%
Spain 17%
Ireland 13%
Germany 13%
Portugal 13%
Finland 13%
Turkey 12%
Belgium 12%
Poland 11%
Netherlands 10%
Sweden 10%
Denmark 10%
France 9%
Austria 9%
Italy 9%
Norway 8%
Japan 3%
Korea 3%
Data taken from:
http://en.wikipedia.org/w/index.php?title=Image:Bmi30chart.png&oldid=107854217
Drawing by:
http://www.WellingtonGrey.net

Obesitat

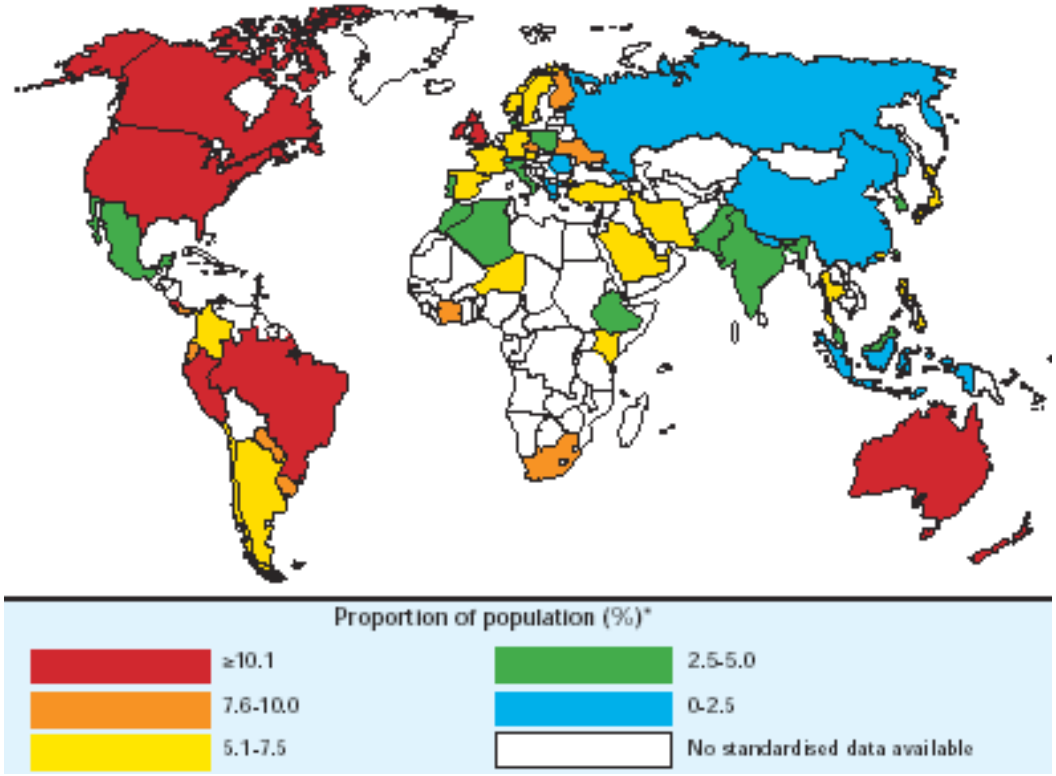
OBESITAT COM A FACTOR DE RISC:

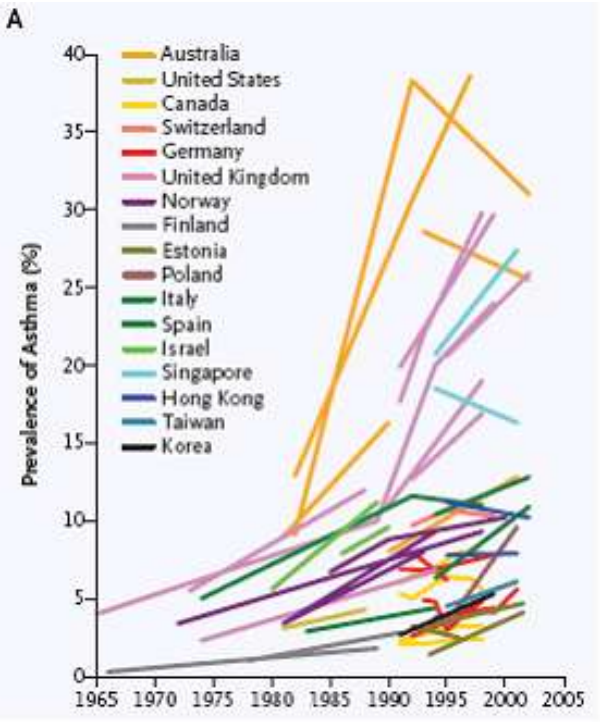
*** Obesitat augmenta el risc de desenvolupar altres problemes de salut:**



ASMA

INCREASING PREVALENCE IN WESTERN COUNTRIES:





300 milions d'asmàtics al mon

Prevalença: 1-18%

250000 defuncions per asma

Evidencies de la associació

- Estudis mostren que els obesos tenen 1,5-3 vegades més possibilitats de desenvolupar asma.
- L'augment de pes s'associa amb augment en els casos nous (incidencia) d'asma
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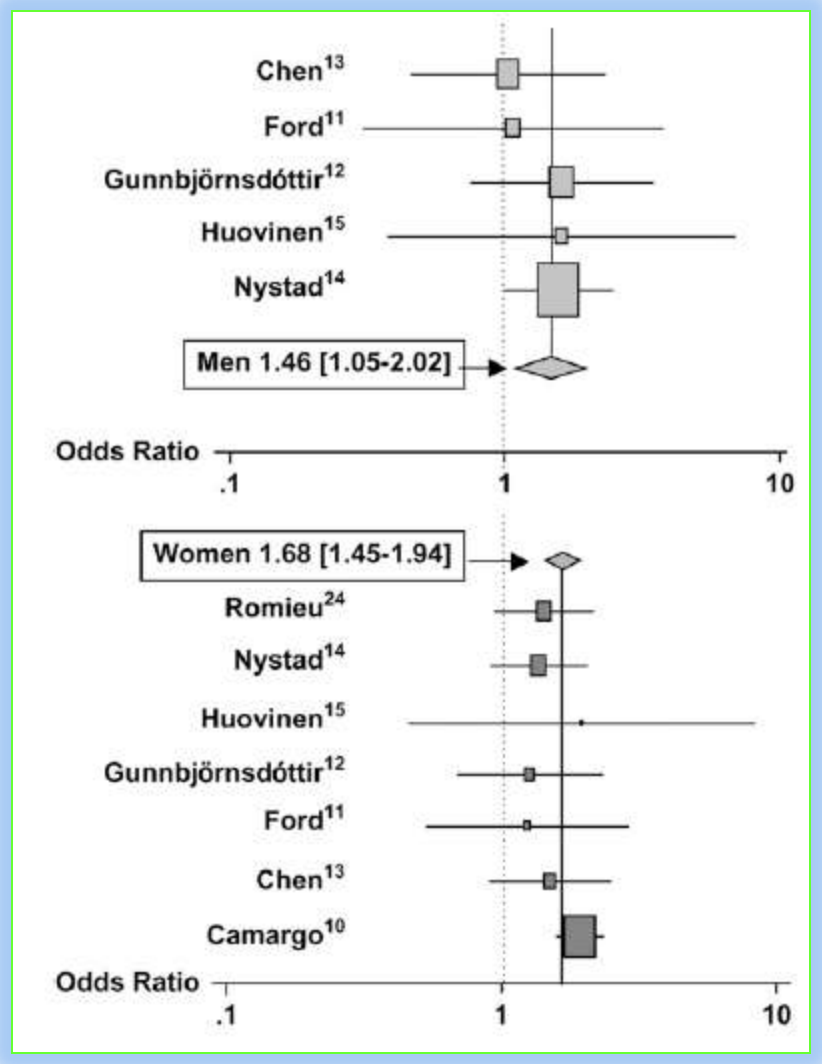
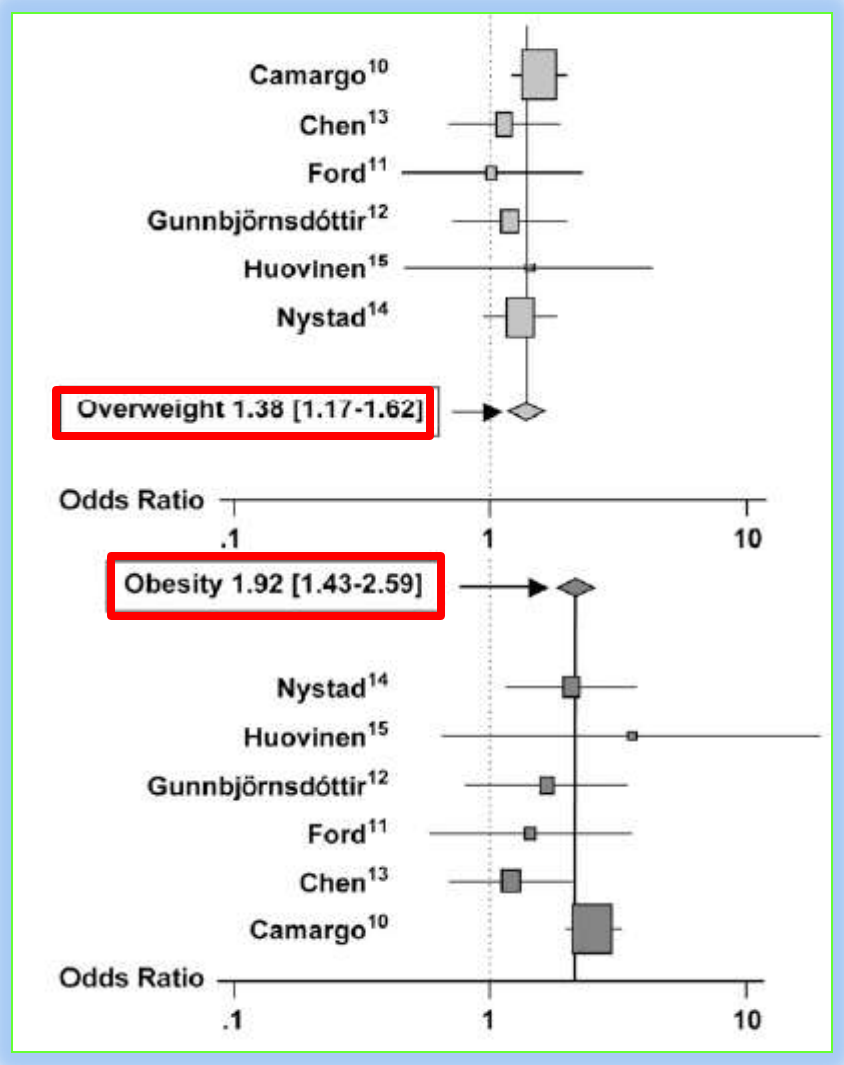
- Hi ha una associació particularment convincent entre l'obesitat i severitat de l'asma, sobretot en les dones

Obesitat com a factor de risc per Asma





Beuther DA & Sutherland ER – Overweight, obesity, and incident asthma. A meta-analysis of prospective epidemiologic studies. *Am J Respir Crit Care Med* 2007;175:661.666

Obesitat com a factor de risc per asma

	RR (95% CI) by category of BMI (kg/m^2)					RR (95% CI) for 3 units increase in BMI
	< 20	20-24.9	25-29.9	30-34.9	≥ 35	
Never-smokers						
RR*	0.9 (0.6-1.4)	Ref	1.5 (1.3-1.7)	2.2 (1.8-2.7)	3.5 (2.6-4.5)	1.27 (1.22-1.32)
N†	28 (2.0)	390 (1.9)	456 (2.6)	153 (4.0)	61 (7.0)	1088 (2.5)
Ex-smokers						
RR*	0.7 (0.4-1.3)	Ref	1.2 (1.0-1.4)	1.9 (1.6-2.4)	2.6 (1.9-3.7)	1.22 (1.16-1.28)
N†	11 (2.1)	313 (2.6)	346 (2.9)	127 (4.6)	39 (6.7)	836 (3.0)
Current smokers						
RR*	1.1 (0.9-1.3)	Ref	1.3 (1.2-1.4)	1.6 (1.4-1.9)	1.7 (1.3-2.3)	1.14 (1.10-1.18)
N†	102 (5.0)	840 (4.0)	710 (4.7)	196 (6.1)	47 (7.5)	1895 (4.5)
All						
RR‡	1.0 (0.9-1.2)	Ref	1.3 (1.2-1.4)	1.8 (1.6-2.0)	2.4 (2.0-2.9)	1.19 (1.17-1.22)
N†	141 (3.6)	1543 (2.9)	1512 (3.4)	476 (4.9)	147 (7.1)	3819 (3.4)

Hjellvik V et al – Body mass index as predictor for asthma: a cohort study of 118723 men and women – ERJ 2010

Evidencies de la associació

- Estudis mostren que els obesos tenen 1,5-3 vegades més possibilitats de desenvolupar asma.
- L'augment de pes s'associa amb augment en els casos nous (incidencia) d'asma
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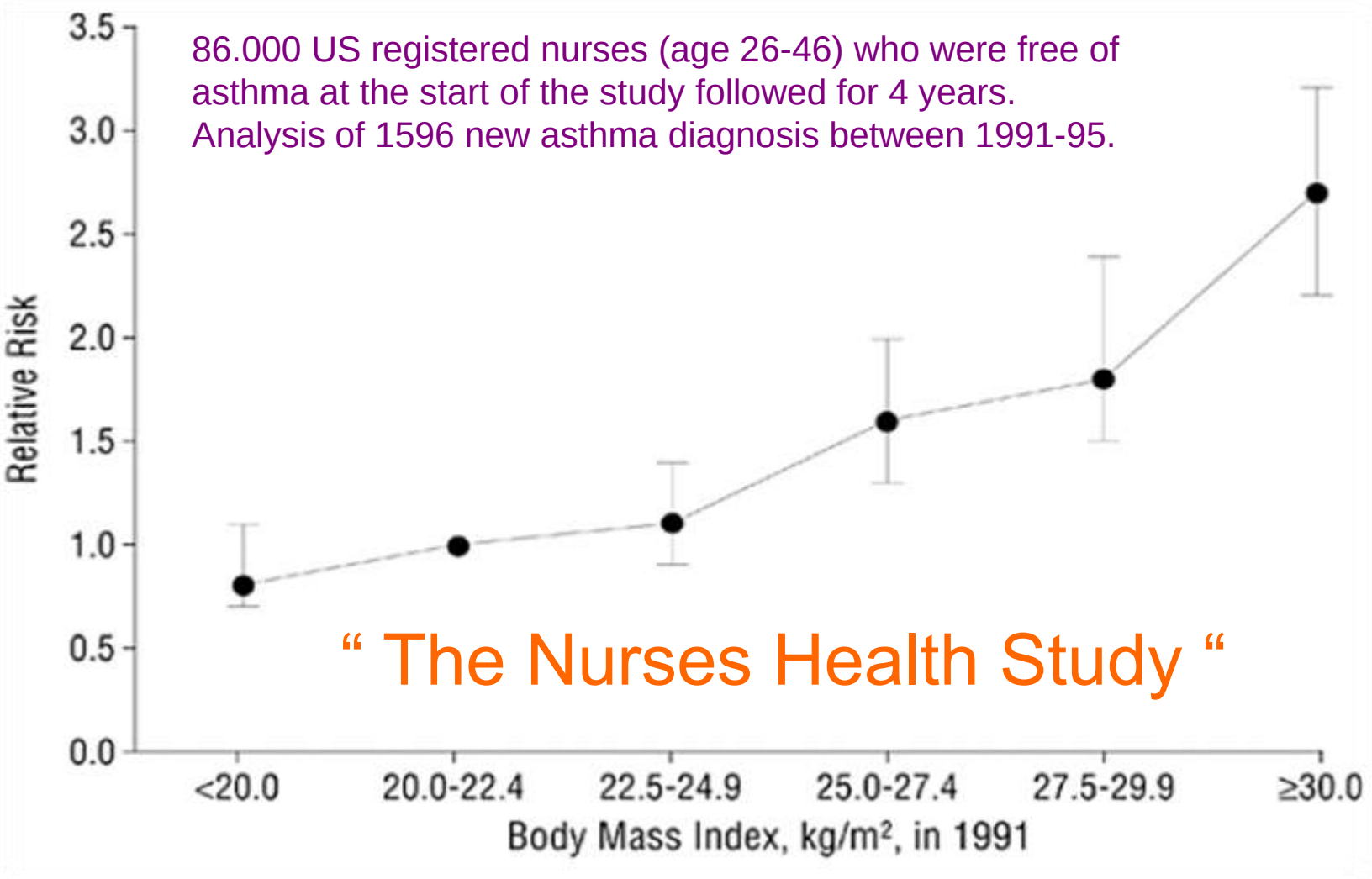
- Hi ha una associació particularment convincent entre l'obesitat i severitat de l'asma, sobretot en les dones

Incidència d'asma en funció del pes



Camargo CA et al – Prospective study of Body Mass Index, weight change and risk of adult-onset of asthma in women. *Arch Internal Med* 1999;159:2582-2588

Incidència d'asma en funció del pes

Table 3. Relative Risk (RR) of Adult-onset Asthma During 4-Year Follow-up (1991-1995) According to Change in Weight Since Age 18*

Case Definition 1	Change in Weight, kg								*P* for Trend
	<–5	–5 to –2.1	–2 to 2	2.1 to 5	5.1 to 10	10.1 to 20	20.1 to 25	>25	
No. (n = 1596)	54	64	158	220	311	390	145	254	. . .
Age-adjusted RR (95% CI)	1.0 (0.7-1.3)	0.8 (0.6-1.1)	1.0 (reference)	0.9 (0.8-1.2)	1.1 (0.9-1.3)	1.4 (1.2-1.7)	2.1 (1.7-2.6)	2.7 (2.2-3.4)	<.001
Multivariate RR (95% CI)	0.8 (0.6-1.1)	0.8 (0.6-1.1)	1.0 (reference)	0.9 (0.8-1.2)	1.1 (0.9-1.3)	1.4 (1.2-1.7)	2.0 (1.6-2.5)	2.5 (2.0-3.1)	<.001

** Case definition 1 includes participants who reported a physician diagnosis of asthma on 2 separate questionnaires and the use of an asthma medication since diagnosis. Ellipses indicate not applicable; CI, confidence interval. Multivariate RRs are adjusted for age, race, US region, smoking status, physical activity, total energy intake, hysterectomy status, birth weight, duration of breastfeeding, and body mass index at age 18.*

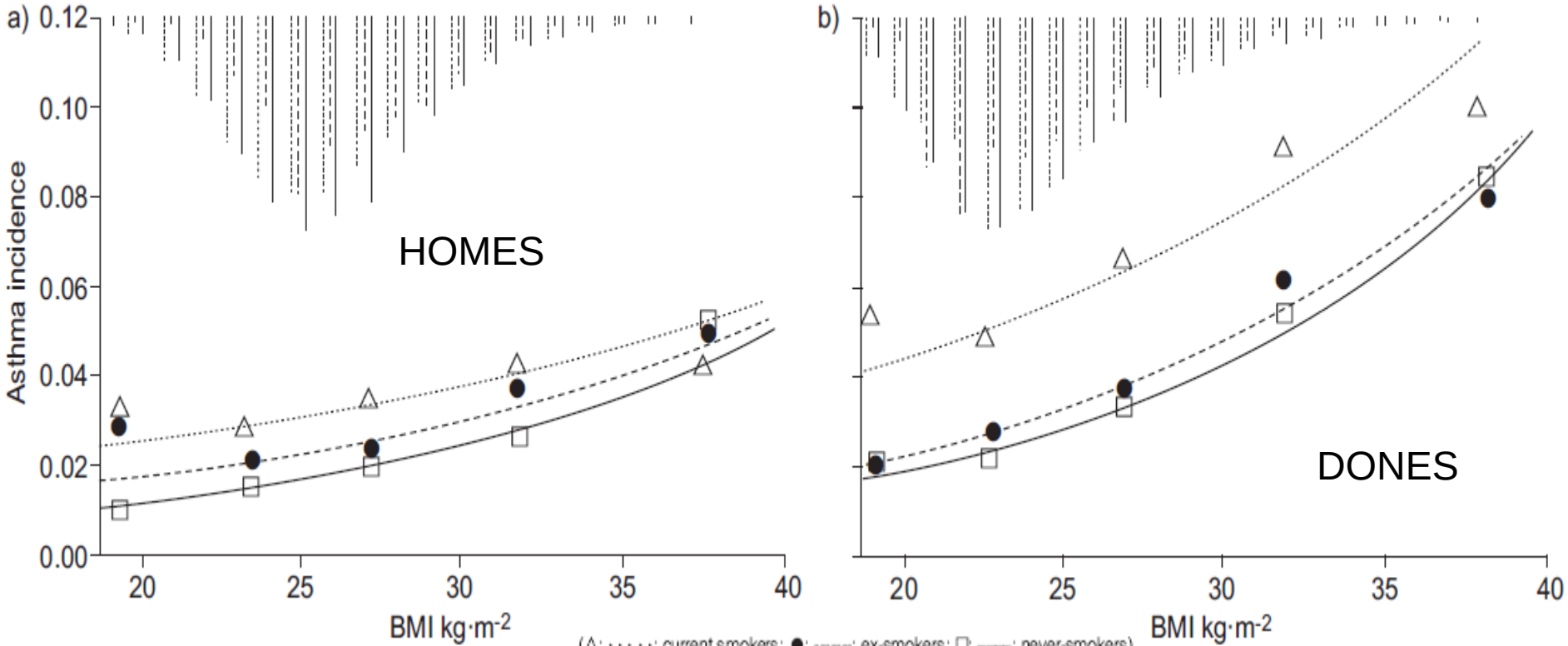
" The Nurses Health Study "

Camargo CA et al – Prospective study of Body Mass Index, weight change and risk of adult-onset of asthma in women. *Arch Internal Med* 1999;159:2582-2588

Incidència d'asma en funció del pes

RR (95% CI) by category of change in BMI (kg/m^2)

RR (95% CI) for 3



status.

(△; · · · · · : current smokers; ●; ——: ex-smokers; □; ——: never-smokers).

‡ In addition adjusted for BMI.

§ Number (percentage) of incident asthma cases.

Hjellvik V et al – Body mass index as predictor for asthma: a cohort study of 118723 men and women – ERJ 2010

Evidencies de la associació

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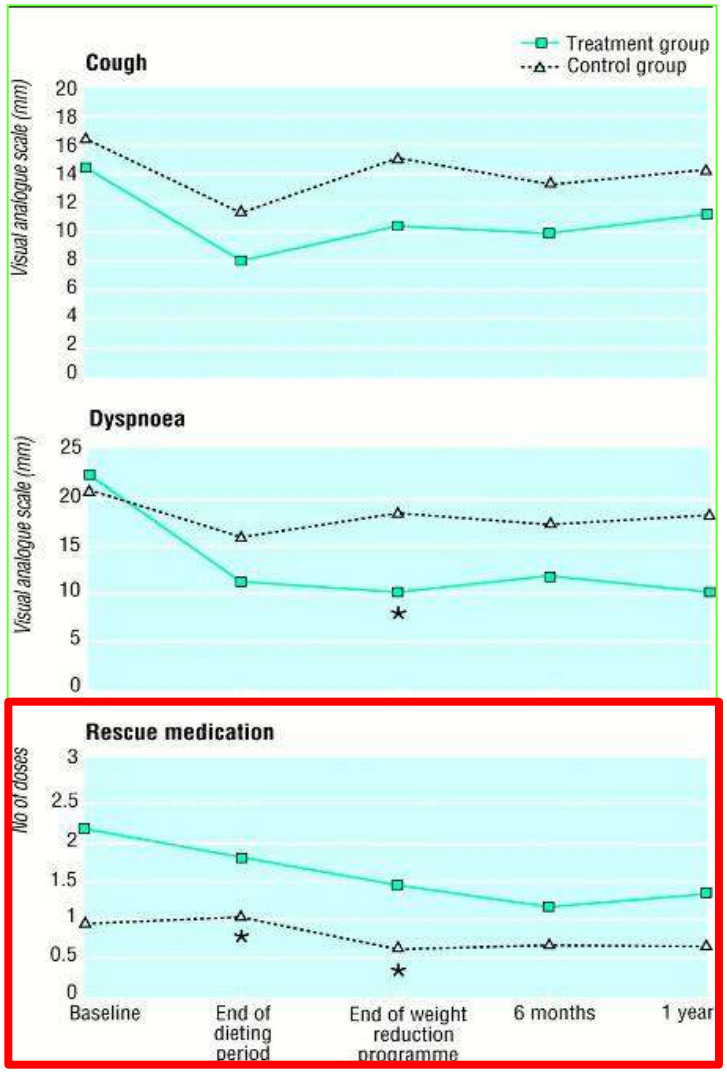
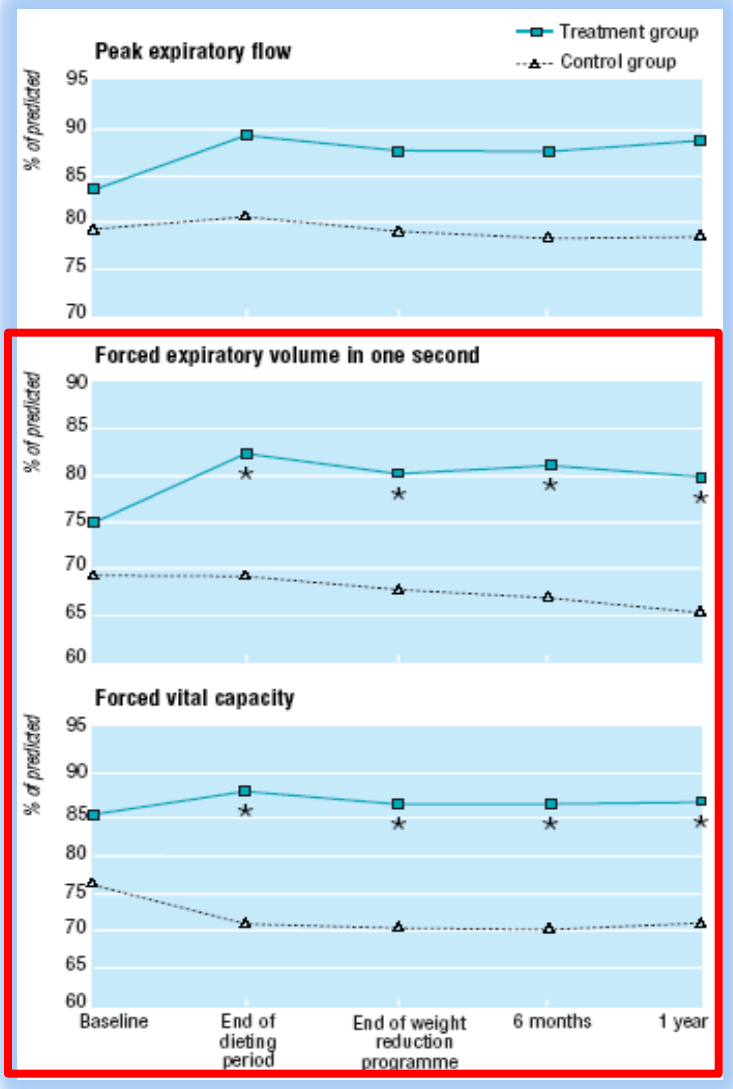
Pèrdua de pes. Dieta





Stenius-Aarniala B et al. – Immediate and long term effects of weight reduction in obese people with asthma: randomised controlled study. *BMJ* 2000

Pèrdua de pes. Cirurgia Bariàtrica

Reduction of obesity-related illnesses following LAP-BAND surgery in 163 patients with ≥18 months of follow-up

Comorbidity	No. of patients	Resolved	Improved	Not improved	*P*
		n (%)	n (%)	n (%)	
GERD*	48	35 (72.9)	7 (14.6)	6 (12.5)	<0.05
Hypertension	40	17 (42.5)	2 (5)	21 (52.5)	<0.05
Dyslipidemia	16	10 (63.5)	0	6 (37.5)	<0.05
Diabetes	12	4 (33)	4 (33)	4 (33)	<0.05
Asthma	11	9 (81.8)	0	2 (18.2)	<0.05
Sleep apnea	9	3 (33)	0	6 (67)	NS

* Improvement in GERD was seen immediately after surgery.
NS = not significant.

Spivak H.. – Weight loss and improvement of obesity-related illness in 500 US patients following laparoscopic adjustable gastric banding procedure. *The American Joounal of Surgery 2005*

Evidencies de la associació

- Estudis mostren que els obesos tenen 1,5-3 vegades més possibilitats de desenvolupar asma.
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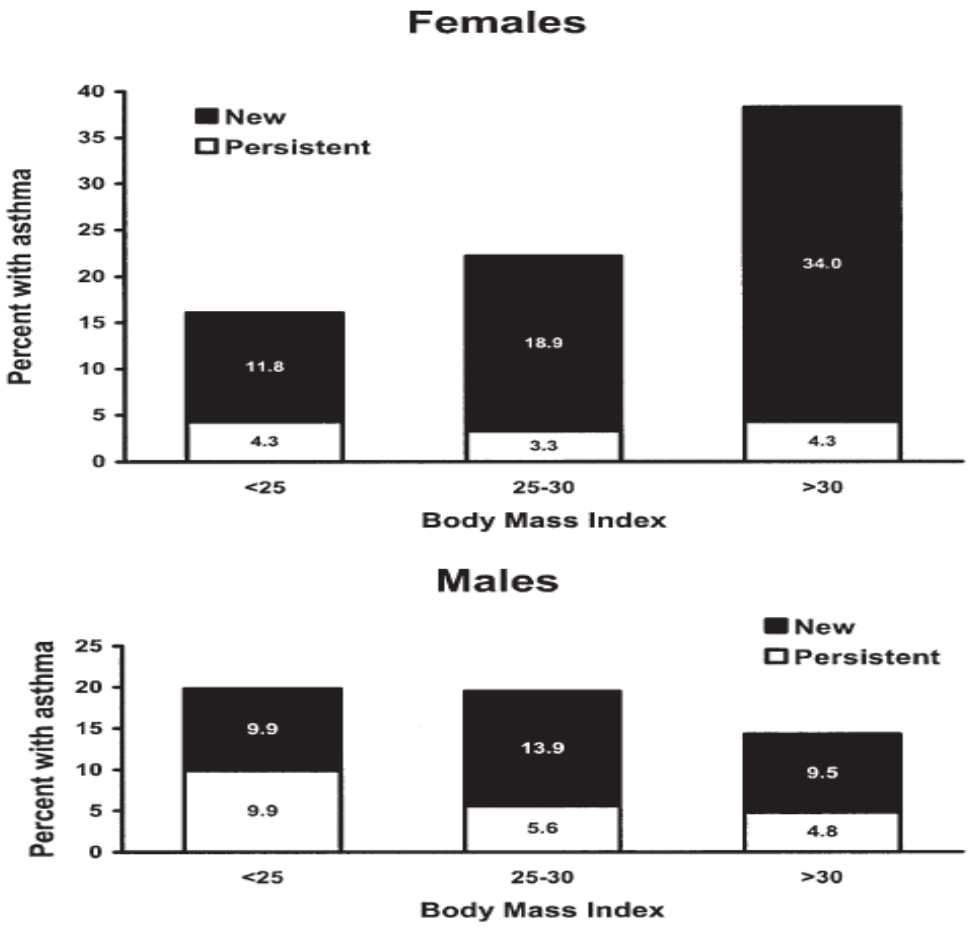
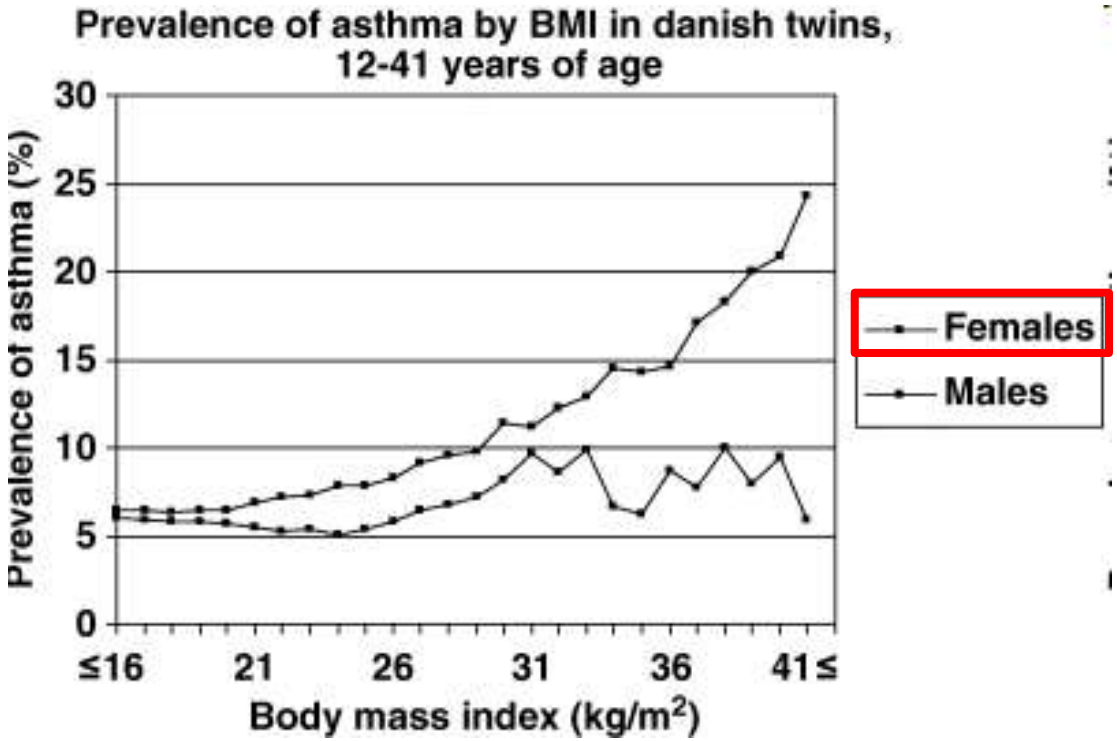
Major associació obesitat/asma en dones



Hancox RJ et al – Sex differences in the relation between body mass index and asthma and atopy in a birth cohort. Am J Respir Crit Care Med 2005

Major associació obesitat/asma en dones



Thomsen SF et al. – Association between obesity and asthma in a twin cohort. *Allergy* 2007;62:1199-1204

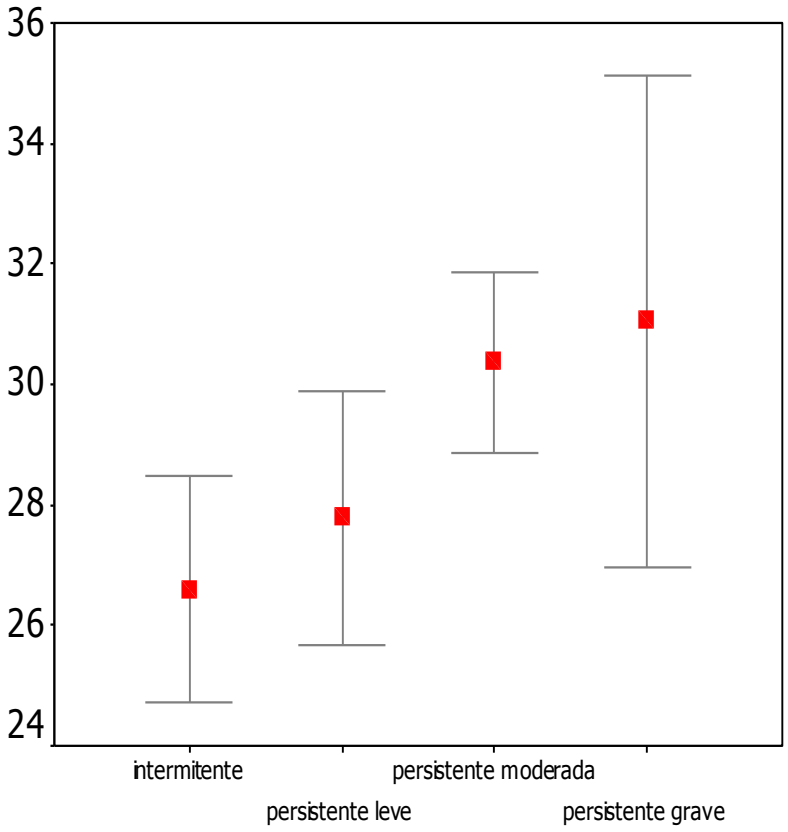
Associació asma-obesitat amb severitat

TABLE 3. RELATIONS BETWEEN ASTHMA CLINICAL SEVERITY SCORE AND BODY MASS INDEX ACCORDING TO SEX

	β ± SD*	p Value	p Interaction†
Men			
Unadjusted (n = 156)	0.053 ± 0.042	0.3	
Adjusted on age, smoking habits, and FEV_1 % predicted (n = 153)	0.018 ± 0.045	0.7	
Adjusted on age, smoking habits, FEV_1 % predicted, and BHR (n = 72)	0.043 ± 0.068	0.5	
Adjusted on age, smoking habits, FEV_1 % predicted, and residual of grade of dyspnea‡ (n = 148)	0.017 ± 0.044	0.7	
Women			
Unadjusted (n = 149)	0.156 ± 0.039	0.0001	0.09
Adjusted on age, smoking habits, and FEV_1 % predicted (n = 148)	0.162 ± 0.040	0.0001	0.03
Adjusted on age, smoking habits, FEV_1 % predicted, and BHR (n = 74)	0.149 ± 0.056	0.01	0.16
Adjusted on age, smoking habits, FEV_1 % predicted, and residual of grade of dyspnea‡ (n = 145)	0.183 ± 0.038	0.0001	0.02

Varraso R et al – Asthma Severity is associated with body mass index and early menarche in women. *Am J Respir Crit Care Med* 2005

Associació asma-obesitat amb severitat



	TOTAL (N = 159)	OBESOS (n = 56)	NO OBESOS (n = 103)	P
Edad (años)	48 ± 17	53,5 13	44 18	*0,001*
Sexo (home/don)	60/99	15/41	45/58	*0,041*
Agudiz (0 – 15)	1,65 ± 2,8	2,30 3,7	1,29 2,1	*0,029*
Disnea MRC	0.9 ± 0.84	1,26 0,9	0,75 0,77	*0,000*
ACT	20 ± 5	19,15 6	21 4	*0,031*
FVC (% val. Ref)	90 ± 19	87 17	92 20	*NS*
FEV_1 (% val. Ref)	82 ± 21	79 19	84 21	*NS*
FEV_1 postBD (ml)	256 ± 222	165 151	298 237	*0,004*
ERV (n = 69) (% val. Ref)	104 ± 72	103 80	104 68	*NS*
IC (n = 71) (% val. Ref)	92 ± 33	83 44	98 21	*0,048*
Metacolina +	38	15	23	*NS*

Tarrega J et al – Relación entre el IMC con la Hiperrespuesta Bronquial, la funcion pulmonar y la gravedad del asma . *En procés de revisió.*

Associació amb mal control de l'asma

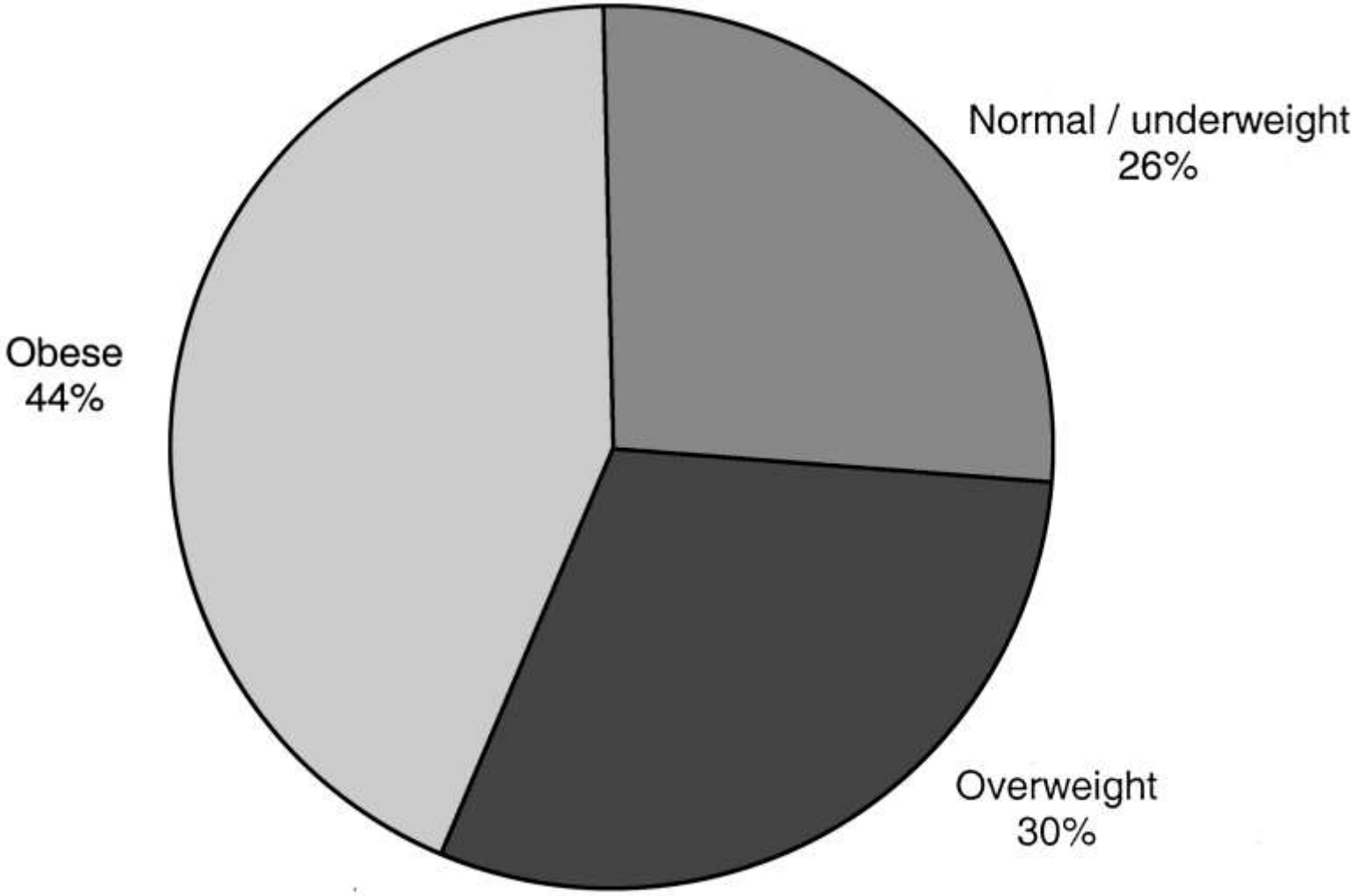
Table 1. Studies of asthma severity and control in obese asthmatics.

Study (year)	Country	Population	n	Measure of control	Main findings associated with increased BMI	Ref.
Saint Pierre *et al.* (2006)	France, outpatients	Adults	406	Clinic assessment	More likely to have poor control	[14]
Varraso *et al.* (2005)	France, study population	Adults	366	Asthma severity	Increased severity in women only	[15]
Dixon *et al.* (2006)	USA, study population	Adults	488	Questionnaire	Worse control, more rescue medication use	[13]
Lavoie *et al.* (2006)	Canada, outpatients	Adults	382	Asthma control and QoL	Worse control and QoL	[16]
Schatz et al. (2007)	USA, managed care organization	Adults	570	Questionnaire	Worse control	[17]
Lessard *et al.* (2008)	Canada, study population	Adults	44	Questionnaire	Worse control	[18]
Mosen *et al.* (2008)	USA, managed care organization	Adults	1113	Questionnaires and hospitalizations	Worse control and increased hospitalizations	[19]
Taylor *et al.* (2008)	USA, population survey	Adults	3095	Symptoms, medication use	More symptoms and increased medication use	[20]
Vortmann *et al.* (2008)	USA, cohort	Adults	843	Symptoms, QoL	More symptoms and worse QoL	[21]
Clerisme-Beaty *et al.* (2009)	USA, urban cohort	Adults	292	Questionnaire	No difference in obese and lean groups	[22]
Sutherland *et al.* (2009)	USA, study population	Adults	1265	Questionnaire, medication use	Increased rescue medication use, worse QoL	[23]
Sastre *et al.* (2010)	Spain, study population	Adults	607	% patients with poor control	Worse control	[24]
Grammer *et al.* (2010)	USA, urban cohort	Adults	191	Asthma QoL and ED/urgent care visits	Increased rescue medication use, worse QoL and more frequent urgent care visits	[25]
Kattan *et al.* (2010)	USA, urban cohort	Adolescents	368	Symptom days and exacerbations	Increased severity in women only	[26]
Barros *et al.* (2011)	Brazil, clinic population	Adults	508	% patients with poor control	More in obese and underweight patients	[27]
Quinto *et al.* (2011)	USA, managed care organization	Children	32,321	Medications dispensed	Increased rescue medication use	[28]
Youkou *et al.* (2011)	Japan, outpatient population	Adults	2124	Questionnaire, medication use	No difference in control, but more medication use	[29]

ED: Emergency department; QoL: Quality of life.

Exacerbacions

Distribution of BMI among adults presenting to the ED with acute asthma.



Thomson CC et al. Chest 2003;124:795-802

Exacerbacions

TABLE E1. Multiple logistic regression results: Independent effect of BMI status with asthma outcome measures (female subjects)

	OR (95% CI), with BMI <25 kg/m^2 as reference		
Models* and BMI level	**Low AQLQ score (<3.9)**	**High ATAQ score (>1)**	**Asthma-related hospitalization in past year**
Model 1	N = 570	n = 563	n = 562
Overweight	1.1 (0.6-1.9)	1.3 (0.8-2.3)	1.8 (0.5-6.1)
Obese	2.2 (1.4-3.6)	3.0 (1.9-4.8)	2.8 (0.9-8.5)
Model 2	N = 478	n = 471	n = 473
Overweight	1.4 (0.7-2.6)	1.6 (0.9-2.9)	3.2 (0.6-16.2)
Obese	2.7 (1.5-4.7)	3.2 (1.8-5.4)	5.7 (1.2-26.8)
Model 3	N = 400	n = 400	n = 396
Overweight	1.2 (0.6-2.6)	1.5 (0.7-2.9)	2.2 (0.4-12.3)
Obese	2.6 (1.3-5.1)	2.8 (1.5-5.2)	4.5 (0.9-23.1)

*Model 1, unadjusted; model 2, adjusted for demographic factors (age, nonwhite race, education less than college, income <$35,000, and smoking status [current vs former/never]); model 3, adjusted for the above plus oral corticosteroids, history of gastroesophageal reflux, and regular ICS use in the past month and region location.

TABLE E2. Multiple logistic regression results: Independent effect of BMI status with asthma outcome measures (male subjects)

	OR (95% CI), with BMI <25 kg/m^2 as reference		
Models* and BMI level	**Low AQLQ score (<3.9)**	**High ATAQ score (>1)**	**Asthma-related hospitalization in past year**
Model 1	n = 539	n = 533	n = 534
Overweight	1.9 (1.0-3.9)	1.5 (0.8-2.6)	0.7 (0.2-1.9)
Obese	3.0 (1.5-6.0)	2.6 (1.4-4.6)	2.5 (1.0-6.4)
Model 2	[n = 479]	[n = 474]	[n = 475]
Overweight	2.3 (1.0-5.0)	(0.7-2.4)	(0.3-5.0)
Obese	3.3 (1.5-7.4)	2.1 (1.2-4.0)	3.6 (1.0-13.4)
Model 3	n = 391	n = 391	n = 389
Overweight	2.7 (1.0-7.3)	1.4 (0.6-2.6)	2.1 (0.3-14.9)
Obese	3.7 (1.4-10.3)	2.3 (1.1-4.6)	4.7 (0.7-31.7)

*Model 1, unadjusted; model 2, adjusted for demographic factors (age, nonwhite race, education less than college, income <$35,000, and smoking status [current vs former/never]); model 3, adjusted for the above plus oral corticosteroids, history of gastroesophageal reflux, and regular ICS use in the past month and region location.

Mosen et al– The relationship between obesity and asthma severity and control in adults. J Allergy Clin Immunol 2008

Exacerbacions

Table 1—*Characteristics of All Patients Stratified by BMI

Characteristics	BMI < 25 kg/m² (n = 265)	BMI ≥ 25 kg/m² (n = 161)	Difference (95% CI)	p Value
At ED presentation				
Age, yr	30.2 ± 11.4	38.6 ± 9.5	8.4 (6.2–10.5)	0.0001
Female gender	150 (56.6)	118 (73.3)		0.001
BMI, kg/m²	21.7 ± 2.4	29.1 ± 3.2	7.4 (6.8–7.9)	0.0001
Smoking status				
Current smoker	97 (36.8)	56 (34.9)	1.8 (−7.6–11.0)	0.75
Never smoker	91 (34,5)	59 (36.7)	−2.3 (−11.7–6.9)	0.67
Former smoker	75 (28.7)	46 (28.4)	−0.3 (−9.3–8.3)	0.65
Duration of symptoms prior to ED presentation, h	24.9 ± 21.5	31.3 ± 27.7	6.4 (1.6–11.1)	0.008
Heart rate, beats/min	105.0 ± 17.1	104.4 ± 16.9	−0.6 (−3.9–2.7)	0.7
Respiratory rate, breaths/min	21.2 ± 5.2	21.7 ± 5.8	0.5 (−0.5–1.5)	0.36
Accessory muscle use	1.41 ± 0.66	1.34 ± 0.61	−0.07 (−0.1–0.05)	0.27
Dyspnea	1.53 ± 0.56	1.80 ± 0.66	0.2 (0.1–0.3)	0.0001
Wheezing	1.58 ± 0.53	1.54 ± 0.57	−0.04 (−0.14–0.06)	0.46
PEF, % predicted	30.5 ± 10.8	33.5 ± 10.8	−3.0 (−0.8-− 5.1)	0.006
PEF, L/min	161.2 ± 60.7	170.0 ± 61.9	8.8 (−3.2–20.8)	0.15
FEV_1, % predicted	27.0 ± 11.6	30.1 ± 12.2	3.1 (0.7–5.4)	0.008
FEV_1, L	0.90 ± 0.38	0.88 ± 0.35	−0.02 (−0.09–0.05)	0.58
SaO_2, %	95.4 ± 1.8	95.2 ± 2.0	−0.2 (−0.5–0.1)	0.28
β_2-agonists used within previous 7 d	155 (58.5)	103 (64.0)	5.5 (−4.1–14.7)	0.21
ICS used within previous 7 d	57 (21.5)	67 (41.6)	20.1 (11.0 to 29.1)	0.0001
Theophylline used within previous 7 d	121 (45.7)	109 (67.7)	22.0 (12.4–31.0)	0.0001
At ED discharge				
Change in PEF, % predicted	100.4 ± 123.5	79.5 ± 62.1	− 20.9 (−41.4-−0.3)	0.04
Change in FEV_1, % predicted	108.8 ± 94.4	95.0 ± 80.1	−13.0 (−30.4–4.4)	0.12
Final SaO_2, %	96.7 ± 2.3	96.5 ± 2.0	−0.2 (−0.6–0.2)	0.36
Albuterol dose received in the ED treatment, mg	5.8 ± 4.7	7.3 ± 6.7	1.5 (0.4–2.5)	0.007
ED length of stay, h	1.9 ± 1.6	2.3 ± 1.8	0.4 (0.2–0.7)	0.01
Hospital admissions	18 (6.8)	22 (13.7)	6.9 (1.1–13.5)	0.02

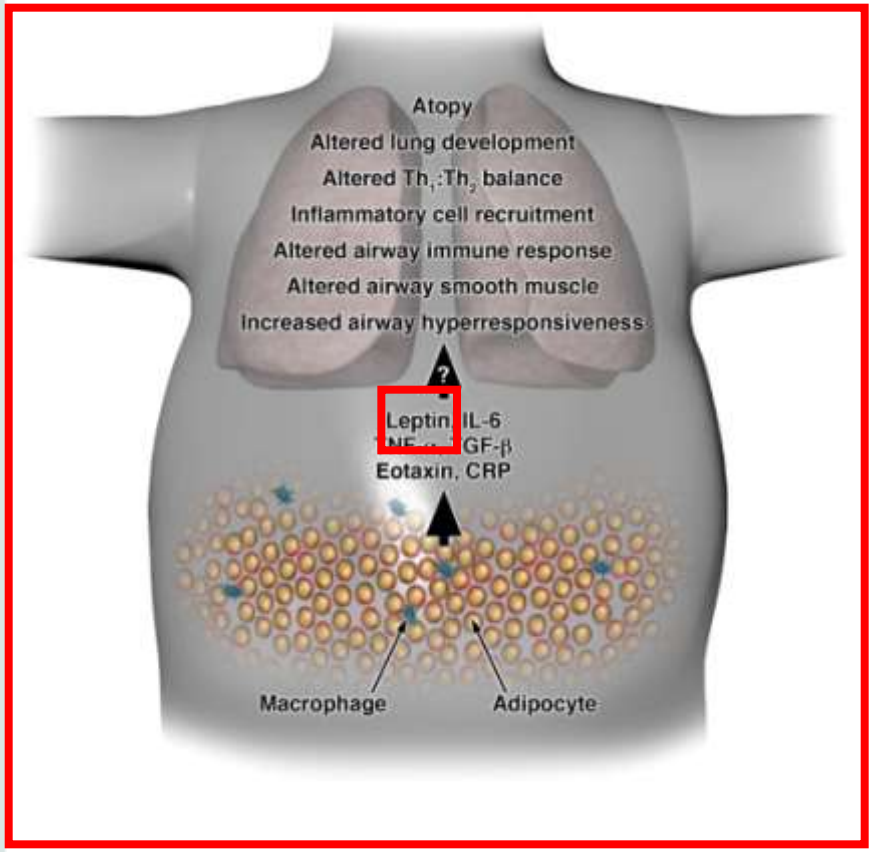
*Data are presented as mean ± 1 SD or No. (%) unless otherwise indicated.

Rodrigo GJ., Plaza V. Body Mass Index and Response to Emergency Department Treatment in Adutls with severe asthma Exacerbations. Chest 2007

Mecanismes que relacionen Obesitat amb Asma

Possible mechanism	Brief explanation
Comorbidities	There may be an indirect link between obesity and asthma due to the role of obesity in other disease processes (e.g. increased risk of gastro-oesophageal reflux disease, sleep-disordered breathing, type 2 diabetes, and hypertension)
Foetal programming	Asthma may be the result of events occurring during development (e.g. obesity-related abnormalities in lung development)
Genetics	There may be an overlap in the genes responsible for asthma and obesity (e.g. TNF-α)
Effects on lung volume	Obesity produces negative effects on the residual capacity of the lung and the flexibility of airway smooth muscle, making the muscle stiffer and reducing airway volume
Chronic systemic inflammation	The expression of inflammatory genes (e.g. TNF-α, which causes airway hyperresponsiveness) is upregulated in the adipose tissue of obese individuals, leading to chronic, low-level systemic inflammation
Action of adipokines	There are changes in the serum concentrations of adipokines (e.g. leptin, adiponectin, and PAI-1) that could modify airway function and lead to asthma

PAI = plasminogen activator inhibitor; TNF-α = tumour necrosis factor alpha.



Adipoquines

Table 2 Adipokines

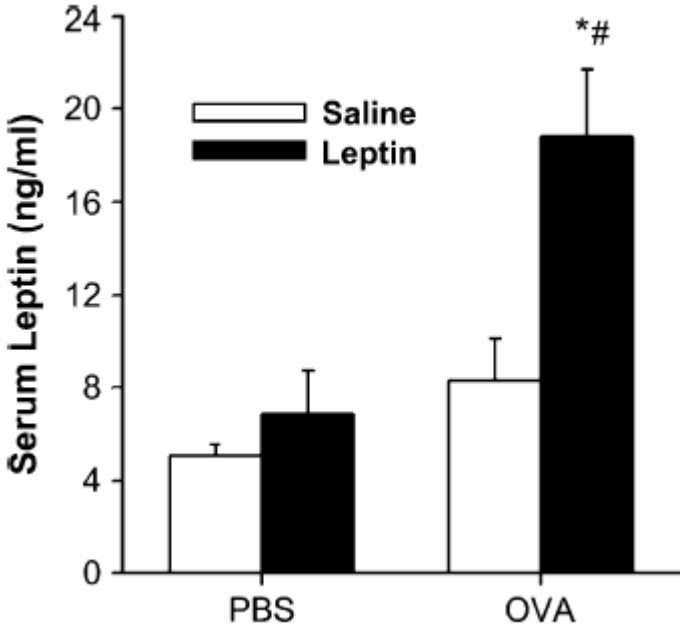
Cytokines	Chemokines	Energy regulating hormones	Acute phase reactants	Other factors
TNFα	IL-8	Leptin	Serum amyloid A	Acylation-stimulating protein
IL-1	MCP-1	Adiponectin	C-reactive protein	Angiotensinogen
IL-6	MIP-1α	Resistin	α1-acid glycoprotein	Complement B, C3, and D
Visfatin	Eotaxin		PAI-1	VEGF
IL-10				IL-1RA
TGFβ				Retinal binding protein-4

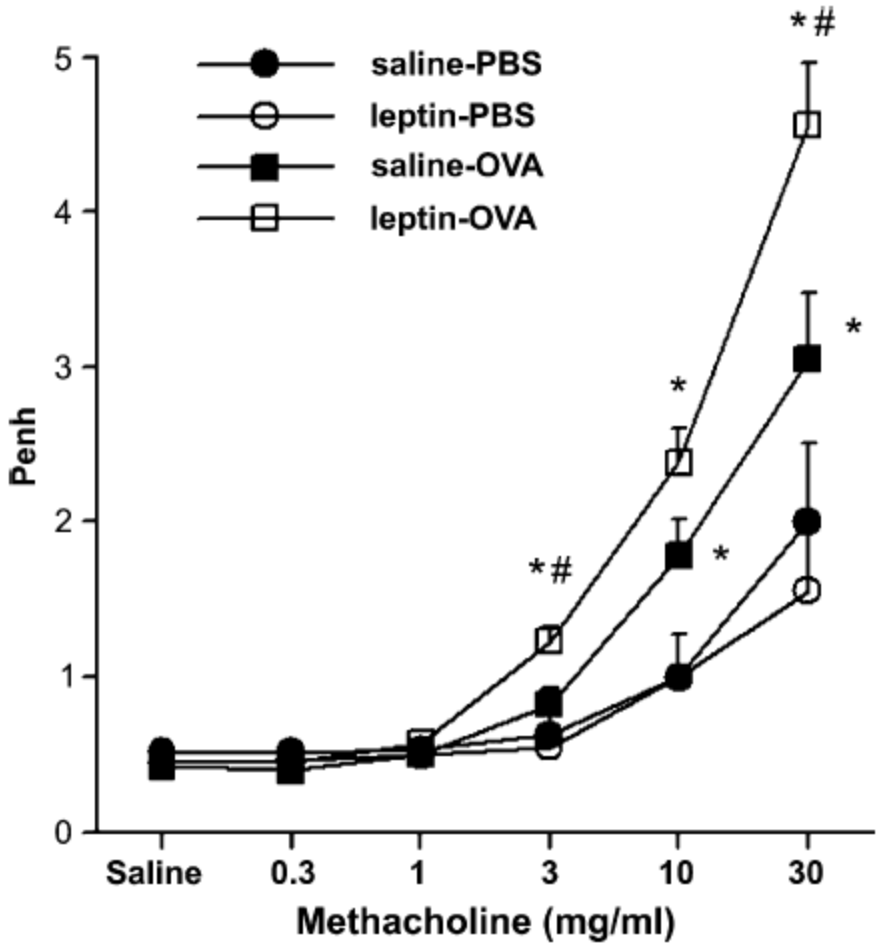
Shore SA. Obesity and asthma: implications for treatment 2007

Leptina

- Hormona reguladora de l'energia
- Receptors de leptina existents en vía aérea
- Augmenta amb l'obesitat
- Efectes sistèmics proinflamatoris
  - Estimula la producció de TNF-α, IL-6
  - Promou la proliferació de cel TH1 i les seves citoquines
- En model murí relacionat amb hiperresposta bronquial
- Mes controvertit en el paper en humans

Leptina. Model muri





Shore et al– Effect of leptin on allergic airway responses in mice. J Allergy Clin Immunol 2005

Leptina. Models humans

Table 1. *A summary of studies evaluating the leptin-asthma association*

Authors (Years and Country) (Ref. No.)	Subject Characteristics	Study Design Characteristics	Obesity-Asthma Association	Leptin-Asthma Association, Adjusted For Obesity	Comment
			Studies involving children		
Guler et al. (2004, Turkey) (27)	6 ± 3 yr, 135 subjects, 102 with asthma	Cross sectional	No BMI-asthma association	All (OR: 2.0; 95% CI: 1.1–3.6) with current asthma; stronger for boys than girls	Association stronger for atopic asthma than for nonatopic asthma
Nagel et al. (2009, Germany) (53)	10 ± 2.2 yr, 462 subjects, 30 with asthma	Cross sectional	No BMI-asthma association	All (OR: 4.1; 95% CI: 1.3–12.5) for ever asthma; stronger for girls than boys	Association stronger for nonatopic asthma than for atopic asthma
Kim et al. (2008, Korea) (35)	10 ± 2 yr, 240 subjects, 186 with asthma	Cross sectional	No association	No association with current asthma (methacholine confirmed)	
			Studies involving adults		
Sood et al. (2006, US) (79)	44 ± 1 yr, 5,876 subjects, 290 with asthma	Cross sectional, population based	BMI-asthma association present	Women with highest leptin quartile (OR: 3.2; 95% CI: 1.3–7.7) for current asthma; stronger in premenopausal women (OR: 3.6)	Results were adjusted for atopy; adjusting for different obesity measures affected association differently
			Studies involving both children and adults		
Jartti et al. (2009, Finland) (31)	*1*) 3–18 yr, 3,583 subjects, 64 with asthma; *2*) 9–24 yr, 2,764 subjects, 101 with asthma; *3*) 24–39 yr, 2,620 subjects, 121 with asthma	Sequential case control, population based	BMI-asthma association only at 24–39 yr age	No association with ever asthma	

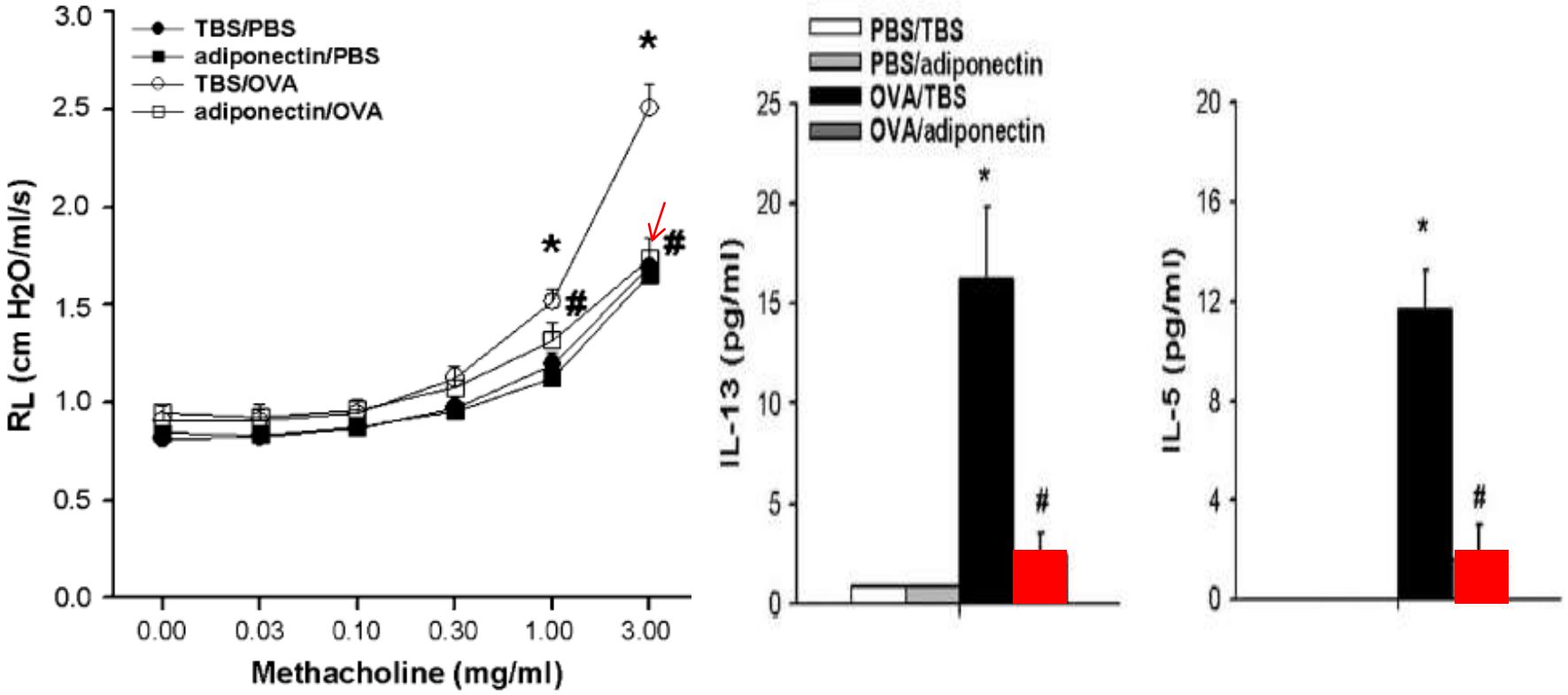
BMI, body mass index; OR, odds ratio; CI, confidence interval.

Sood et al– Obesity, adipokines, and lung disease. J Appl Physiol 2010

Adiponectina

- Adipoquina antiinflamatòria
- Inhibeix citoquines proinflamatories
  - TNF-alfa, IL-6, Factor κβ
- Indueix citoquines antiinflamatòries
  - IL-10, antagonista receptor IL-1
- Reduïda en pacients obesos
  - TNF-α e IL-6 inhibeixen la producció d'adiponectina

Adiponectina. Models murins



Shore et al– Adiponectin attenuates allergen-induced airway inflammation and hyperresponsiveness in mice. J Allergy Clin Immunol 2006

Adiponectina. Models humans

Table 2. *A summary of studies evaluating the adiponectin-asthma association*

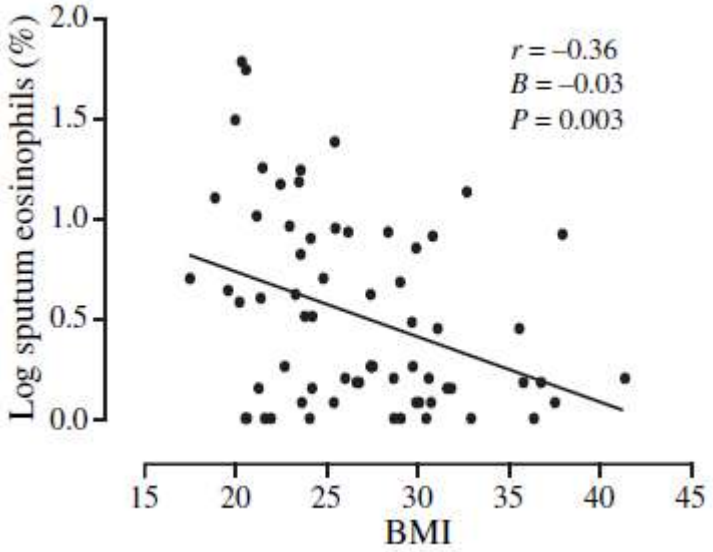
Authors (Years and Country) (Ref. No.)	Subject Characteristics	Study Design Characteristics	Obesity-Asthma Association	Adiponectin-Asthma Association, Adjusted for Obesity	Comments
			Studies involving children		
Nagel et al. (2009, Germany) (53)	10 ± 2.2 yr, 462 subjects, 30 with asthma	Cross sectional	No association	β-coefficient of 0.6 between low levels of log adiponectin and ever asthma ($P = 0.20$)	Association significant only for nonatopic asthma (β coefficient of 1.4; $P < 0.01$)
Kim et al. (2008, Korea) (35)	10 ± 2 yr, 240 subjects, 186 with asthma	Cross sectional	No association	No association with current asthma (methacholine confirmed)	
			Studies involving adults		
Sood et al. (2008, US) (80)	44 ± 1 yr, 5,876 subjects, 290 with asthma	Cross sectional, population based	BMI-asthma association present	Premenopausal women (OR: 0.5; 95% CI: 0.3–0.8 in the highest tertile with current asthma)	
			Studies involving children and adults		
Jartti et al. (2009, Finland) (31)	*1*) 3–18 yr, 3,583 subjects, 64 with asthma; *2*) 9–24 yr, 2,764 subjects, 101 with asthma; *3*) 24–39 yr, 2,620 subjects, 121 with asthma	Sequential case control, population based	BMI-asthma association only at 24–39 yr age	No association with ever asthma	

Sood et al. Obesity, adipokines, and lung disease. J Appl Physiol 2010

Adipoquines i alteració immune

- Limfòcits TH CD4 son les cèl·lules fonamentals en la resposta inflamatòria en l'asma
  - TH2: IL-4,5,13
  - TH17: citoquines que promouen neutrofília
  - TH1: TNF-α, IFN-γ
- Obesitat: altera producció de limfòcits CD4
- Obesitat i Asma
  - Reducció FENO
  - Relació inversa amb eosinofília
  - Augment en la neutrofília a via aèria

Eosinofilia i associació asma/obesitat



Van Veen et al– Airway inflammation in obese and non obese patients with difficult-to-treat asthma. Allergy 2008

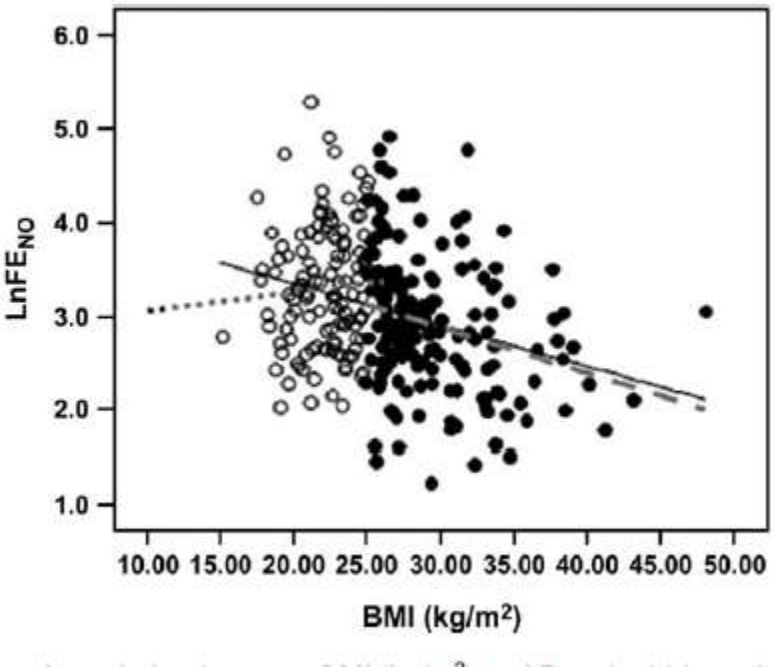
Table 3—*Differential Cell Count in Induced Sputum

Variables	Nonobese Subjects (BMI < 25 kg/m²)		Obese Subjects (BMI ≥ 30 kg/m²)	
	Using SABAs Alone (n = 11)	Using SABAs and ICS (n = 12)	Using SABAs Alone (n = 13)	Using SABAs and ICS (n = 15)
Eosinophils	2.6 (3.7)	15.2 (19.6)†	4.6 (12.9)	5.1 (8.8)
Macrophages	54.5 (30.1)	40.6 (19.4)	42.1 (19.8)	48.7 (23.9)
Lymphocytes	1.3 (0.9)	1.5 (1.3)	1.3 (1.2)	1.5 (1.0)
Neutrophils	31.6 (21.8)	40.9 (17.1)	48.6 (21.3)	41.5 (26.7)
Metachromatic cells	10.5 (17.1)	1.9 (2.1)	3.6 (3.0)	3.2 (4.1)

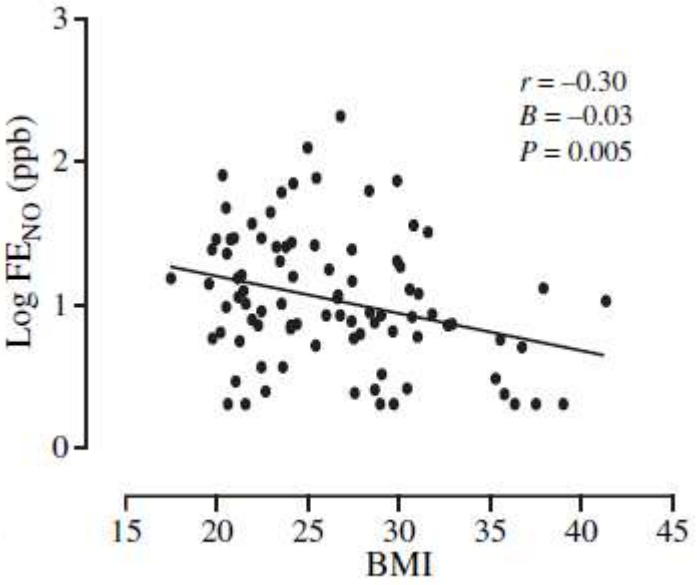
*Data are presented as mean percentage of cells (± SD). No significant differences were found between groups for the various cell counts.
†Median value 7.8 kg/m².

Lessard et al– Obesity and Asthma A Specific Phenotype? Chest 2008

FeNO i associació asma-obesitat



Barros et al. Obesity and airway inflammation in asthma. J Allergy Clin Immunol 2007



Van Veen et al– Airway inflammation in obese and non obese patients with difficult-to-treat asthma. Allergy 2008

Neutrofilia en l'associació asma-obesitat

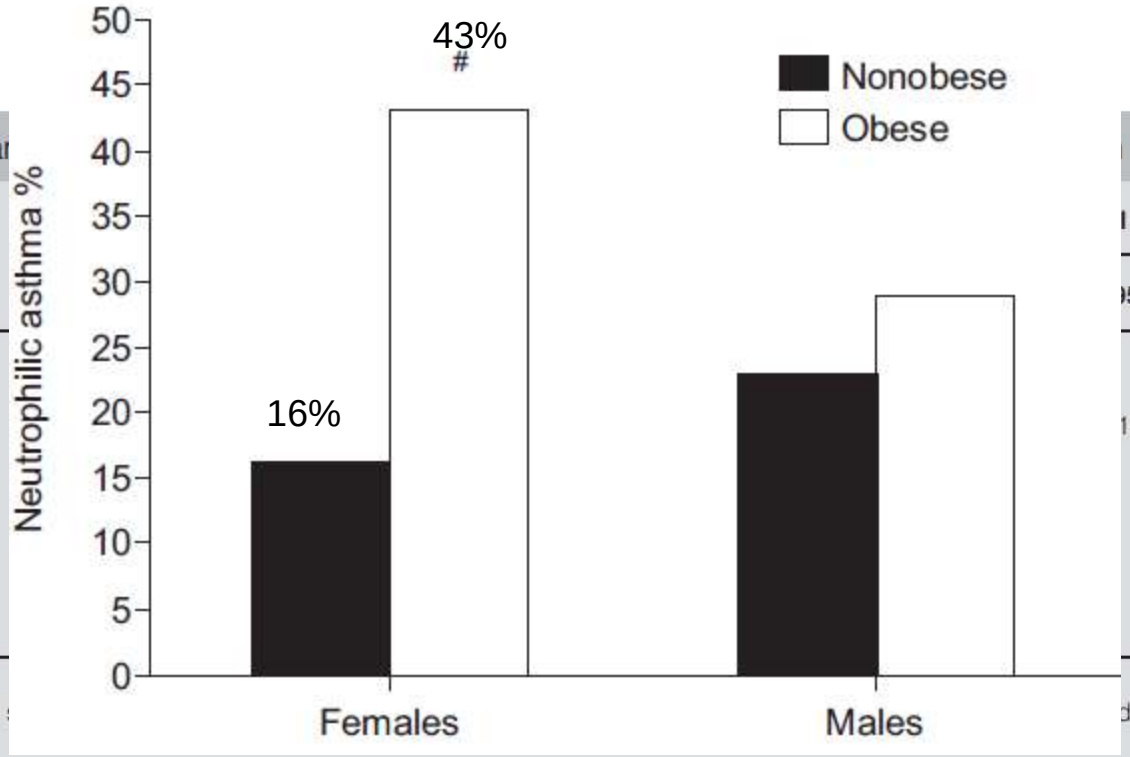


TABLE 4 Multiple linear

females with asthma

(R^2=0.102, p=0.009)

	95% CI)	p-value
Age yrs		
BMI kg·m^{-2}		
Total SFA mg·L^{-1}	1.772)	0.009
Total MUFA mg·L^{-1}		
Total PUFA mg·L^{-1}		
ICS dose# µg·day^{-1}		
Use of ICS treatment yes/no		

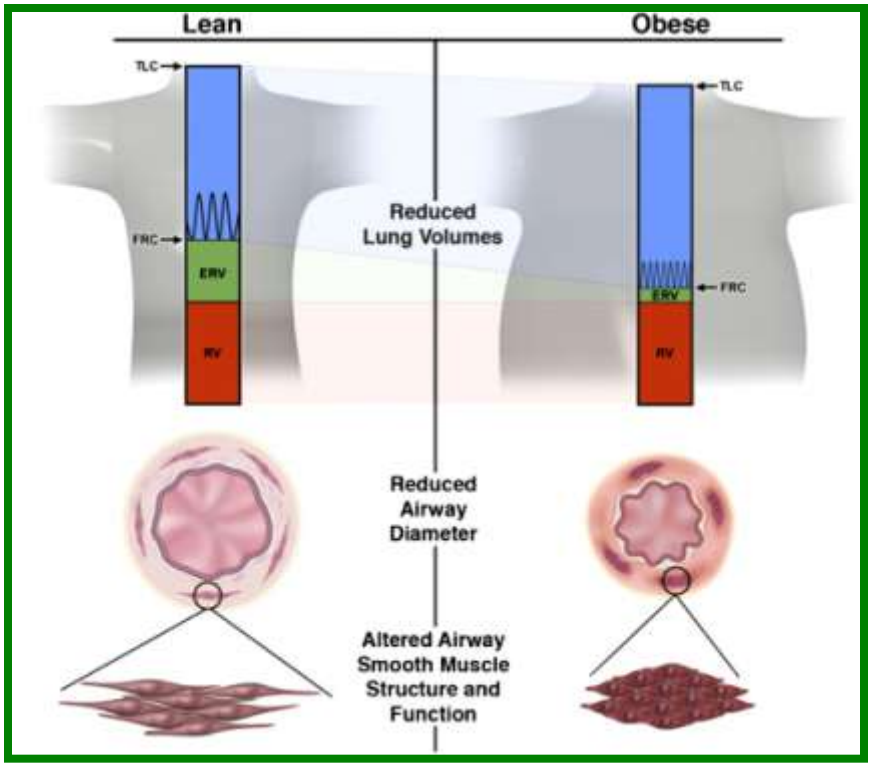
BMI: body mass index; SFA: ds; ICS: inhaled corticosteroid.
#: beclomethasone equivalents.

Scott et al. Airway inflammation is augmented by obesity and fatty acids in asthma Eur Respir J 2011

Mecanismes que relacionen Obesitat amb Asma

Possible mechanism	Brief explanation
Comorbidities	There may be an indirect link between obesity and asthma due to the role of obesity in other disease processes (e.g. increased risk of gastro-oesophageal reflux disease, sleep-disordered breathing, type 2 diabetes, and hypertension)
Foetal programming	Asthma may be the result of events occurring during development (e.g. obesity-related abnormalities in lung development)
Genetics	There may be an overlap in the genes responsible for asthma and obesity (e.g. TNF-α)
Effects on lung volume	Obesity produces negative effects on the residual capacity of the lung and the flexibility of airway smooth muscle, making the muscle stiffer and reducing airway volume
Chronic systemic inflammation	The expression of inflammatory genes (e.g. TNF-α, which causes airway hyperresponsiveness) is upregulated in the adipose tissue of obese individuals, leading to chronic, low-level systemic inflammation
Action of adipokines	There are changes in the serum concentrations of adipokines (e.g. leptin, adiponectin, and PAI-1) that could modify airway function and lead to asthma

PAI = plasminogen activator inhibitor; TNF-α = tumour necrosis factor alpha.



Mecànica respiratòria

Table 2 Airway calibre and respiratory system behaviour measured by the forced oscillation technique

	Baseline		P-*value*	*After methacholine*		P-*value*
	Obese	*Non-obese*		*Obese*	*Non-obese*	
Rrs ($cmH_2O l^{-1} s^{-1}$)	4.18±1.58	2.73±1.11	0.001	5.95±1.69	4.38±1.81	0.003
Rrs at TLC ($cmH_2O l^{-1} s^{-1}$)	1.13±0.70	0.95±0.54	0.30	2.00±1.00	1.56±0.92	0.13
sGrs (s per cmH_2O)	0.12±0.04	0.13±0.14	0.33	0.07±0.03	0.07±0.02	0.55
Xrs ($cmH_2O l^{-1} s^{-1}$)	−1.58±0.89	−0.80±0.69	0.001	−4.40±2.35	−2.30±2.0	0.002
Inspiratory capacity (l)	3.14±0.79	2.66±0.62	0.02	2.45±0.74	2.31±0.68	0.51
Tidal volume (l)	0.94±0.41	0.84±0.33	0.32	0.84±0.44	0.74±0.30	0.35
Respiratory rate (b.p.m.)	15.9±5.7	14.6±4.0	0.33	17.6±6.4	14.3±4.0	0.03

Abbreviations: Rrs, respiratory system resistance; Rrs at TLC, respiratory system resistance measured after a deep inspiration to total lung capacity (TLC); sGrs, respiratory system conductance, adjusted for resting lung volume; Xrs, respiratory system reactance. Values are mean±s.d.

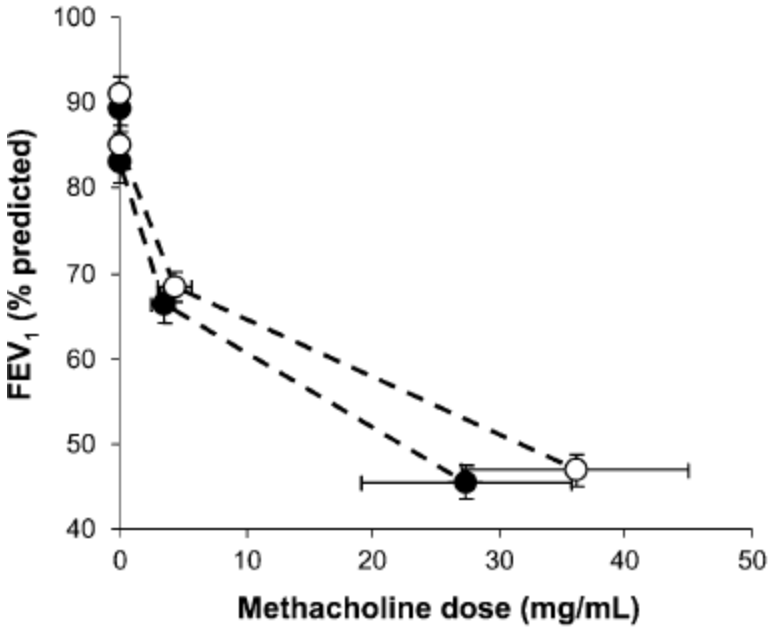
Figure 2 Mean (95% confidence interval) dose–response curves to methacholine in 23 obese (♦) and 26 non-obese (○) subjects.

major disminució en la CI que es dona en obesos (22 vs 13% amb p significativa).

disminució més important en la reactancia mesurada amb tecnica de oscilació (2,8 vs 1,5 amb p significativa)

Salome et al. Effects of Obesity on breathlessness and airway responsiveness to methacholine in non-asthmatic subjects. Int J Obes 2008

Mecànica respiratòria



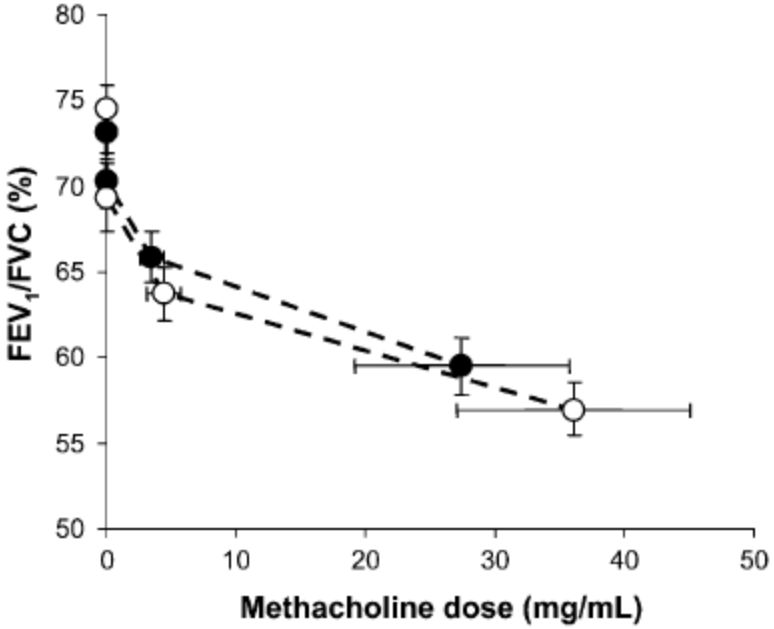


TABLE 2. RESPONSE TO METHACHOLINE

	OBA (n = 45)	NWA (n = 51)	P Value
PC_{20}	34 ± 43	25 ± 27	0.31
Maximum response	66 ± 46	72 ± 49	0.57
Δ TLC, % predicted			
PC_{20}	−1 ± 9	−1 ± 7	0.99
Maximum response	1 ± 10	2 ± 9	0.50
Δ Dyspnea, Borg unit			
PC_{20}	1.4 ± 1.5	1.4 ± 1.1	0.88
Maximum response	3.7 ± 2.2	3.8 ± 1.9	0.79

Deesomchok et al. Effects of Obesity on perceptual and mechanical responses to bronchoconstriction in Asthma. Am J Respir Crit Care Med 2010

Mecanismes que relacionen Obesitat amb Asma

Possible mechanism	Brief explanation
Comorbidities	There may be an indirect link between obesity and asthma due to the role of obesity in other disease processes (e.g. increased risk of gastro-oesophageal reflux disease, sleep-disordered breathing, type 2 diabetes, and hypertension)
Foetal programming	Asthma may be the result of events occurring during development (e.g. obesity-related abnormalities in lung development)
Genetics	There may be an overlap in the genes responsible for asthma and obesity (e.g. TNF-α)
Effects on lung volume	Obesity produces negative effects on the residual capacity of the lung and the flexibility of airway smooth muscle, making the muscle stiffer and reducing airway volume
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PAI = plasminogen activator inhibitor; TNF-α = tumour necrosis factor alpha.

Genètica

TABLE V. Unique and shared additive genetic and environmental effects for asthma and obesity

Effect	Proportion of variance (95% CI)		
	Additive genetic (A)	Common environment (C)	Unique environment (E)
Trait specific			
Asthma	0.33 (0.01-0.62)	0.18 (0.00-0.26)	0.49 (0.38-0.58)
Obesity	0.76 (0.38-0.83)	0.01 (0.00-0.03)	0.23 (0.17-0.32)
Shared	0.08	–	0.05

Anàlisi de 1001 bessons monozigòtics i 383 dizigòtics que mostren que un 8% del component genètic de l'obesitat es compartit amb l'asma

Hallstrand TS et al. Genetic pleiotropy between asthma and obesity in a community-based sample of twins. J.Allergy Clin Immunol 2005

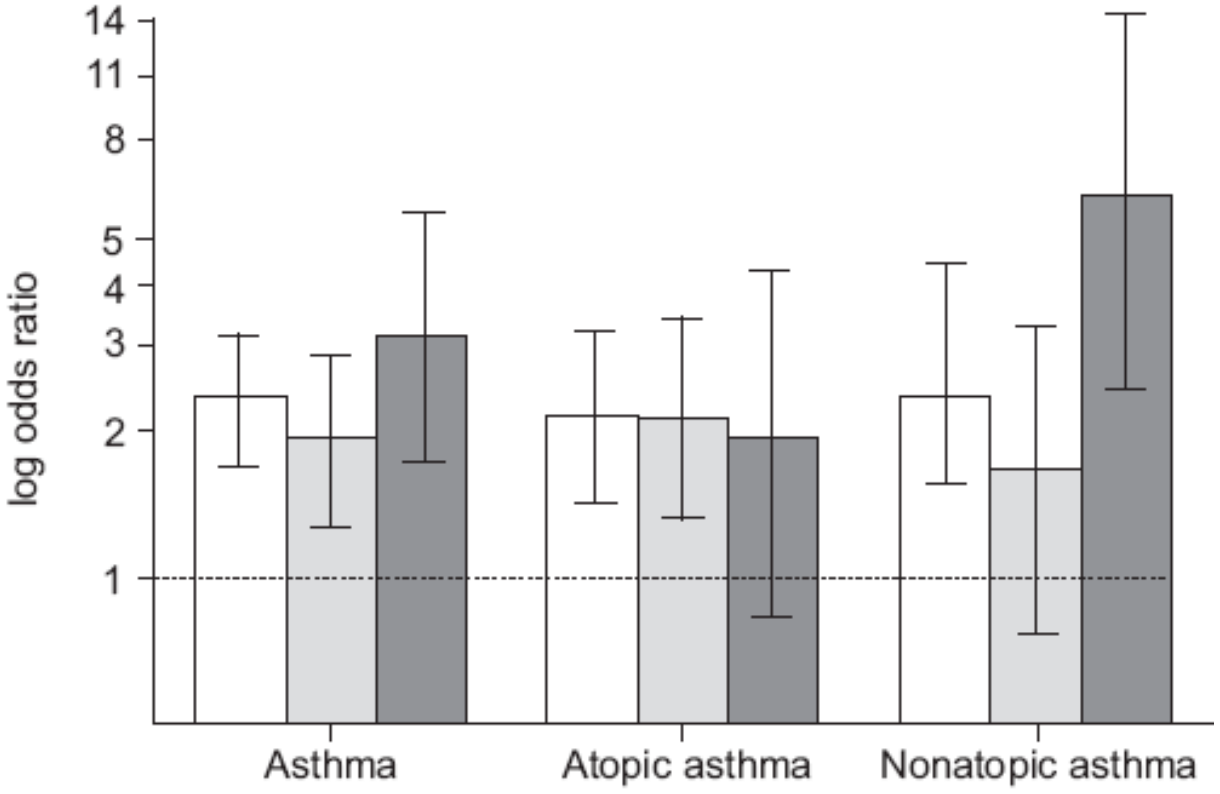
TABLE 1. CANDIDATE GENES OF POTENTIAL RELEVANCE TO BOTH OBESITY AND ASTHMA

Locus	Candidate Genes	Relevance to Asthma	Relevance to Obesity
5q	ADRB2	Controls airway tone	Controls metabolic rate
	NR3C1	Modulates inflammation	Modulates inflammation
6p	TNF, HLA gene cluster	Modulates immune and inflammatory responses	Modulates immune and inflammatory responses
11q13	UCP2, UCP3	Unknown	Controls metabolic rate
	IgE (FCεRB)	Th2 inflammatory response	Unknown
12q	STAT6, IGF1, IL1A, LTA4H	Modulates inflammatory responses	Modulates inflammatory responses

Definition of abbreviations: ADRB2 = β_2-adrenergic receptor; IGF = insulin-like growth factor; IL1A = interleukin 1α; LTA4H = leukotriene A4 hydroxylase; NR3C1 = glucocorticoid receptor; STAT6 = signal transducer and activator of transcription gene; TNF = tumor necrosis factor; UCP = uncoupling protein.

Beuther et al. Obesity and Asthma. Am J Respir Crit Care Med 2006

Genètica. Polimorfismes TNFA



Castro-Giner et al. Joint effect of obesity and TNFA variability on asthma: two international cohort studies. Eur Respir J 2009

Mecanismes que relacionen Obesitat amb Asma

Possible mechanism	Brief explanation
Comorbidities	There may be an indirect link between obesity and asthma due to the role of obesity in other disease processes (e.g. increased risk of gastro-oesophageal reflux disease, sleep-disordered breathing, type 2 diabetes, and hypertension)
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PAI = plasminogen activator inhibitor; TNF-α = tumour necrosis factor alpha.

SAHS factor de risc per asma

Table 3. – Odds ratios (OR) for asthma and respiratory symptom onset

	Onset of asthma	Onset of wheeze	Onset of night-time symptoms
Females	1.28 (1.06–1.55)	1.10 (1.00–1.21)	1.19 (1.06–1.34)
BMI groups			
<20	1.01 (0.69–1.45)	0.96 (0.79–1.15)	1.03 (0.82–1.28)
⩾20–<25	1	1	1
⩾25–<30	1.14 (0.93–1.41)	1.24 (1.11–1.40)	1.08 (0.95–1.23)
⩾30	1.67 (1.24–2.25)	2.23 (1.91–2.60)	1.56 (1.30–1.88)
Nocturnal GOR >1·week^{-1}	1.82 (1.38–2.40)	2.04 (1.75–2.38)	3.05 (2.60–3.58)
Snoring >3·week^{-1}	1.12 (0.89–1.42)	1.53 (1.36–1.72)	1.60 (1.37–1.82)

Gunnbjornsdottir et al. Obesity and nocturna GOR are related to onset of asthma and respiratory symptoms. Eur Respir J 2004

TABLE 2. RISK FACTORS FOR WHEEZE: RESULTS OF MULTIPLE LOGISTIC REGRESSION ANALYSES, INCLUDING TRADITIONAL RISK FACTORS WITH AND WITHOUT SLEEP-DISORDERED BREATHING

	Without SDB			With SDB		
Risk Factor	OR	95% CI	p Value	OR	95% CI	p Value
Age	1.16	0.93, 1.43	0.1863	1.17	0.94, 1.45	0.1572
Male sex	1.62	1.15, 2.29	0.0062	1.65	1.16, 2.33	0.0050
African American race	1.90	1.35, 2.70	0.0003	1.72	1.21, 2.46	0.0028
Preterm	2.66	1.87, 3.77	< 0.0001	2.46	1.73, 3.51	< 0.0001
Maternal asthma history	1.93	1.16, 3.22	0.0118	1.95	1.17, 3.27	0.0111
Obesity (95th percentile)	1.57	1.01, 2.44	0.0430	1.45	0.93, 2.26	0.1048
SDB	—	—	—	1.89	1.26, 2.85	0.0023

Sulit et al. Associations of Obesity, Sleep-disordered Breathing, and Wheezing in Children. Am J Respir Crit Care Med 2005

SAHS i mal control de l'Asma

Table 4—*Multivariate Logistic Regression Models of Not-Well-Controlled Asthma (Defined Based on ACQ Full Version) on High OSA Risk, With Adjustment for Factors Known To Worsen Asthma Control*

	Adjusted for Demographics[a]		Adjusted for Demographics and Obesity		Adjusted for Demographics, Obesity, and GERD		Adjusted for Demographics, Obesity, GERD, and Nasal Diseases		Adjusted for Demographics, Obesity, GERD, Nasal Diseases, and Psychiatric Disease	
Characteristic	OR (95% CI)	*P* Value	OR (95% CI)	*P* Value	OR (95% CI)	*P* Value	OR (95% CI)	*P* Value	OR (95% CI)	*P* Value
High OSA risk	3.92 (2.27-6.76)	< .0001	3.29 (1.82-5.95)	< .0001	3.11 (1.71-5.68)	.0002	3.01 (1.62-5.60)	.0005	2.87 (1.54-5.32)	.0009
Obesity	…	…	1.52 (0.87-2.65)	.15	1.38 (0.78-2.43)	.27	1.38 (0.77-2.46)	.27	1.43 (0.80-2.54)	.23
GERD	…	…	…	…	2.87 (1.67-4.94)	.0001	3.20 (1.82-5.65)	< .0001	3.00 (1.70-5.31)	.0002
Nasal diseases										
Rhinitis	…	…	…	…	…	…	0.33 (0.12-0.86)	.02	0.38 (0.14-1.02)	.05
Sinusitis	…	…	…	…	…	…	0.56 (0.29-1.07)	.08	0.55 (0.29-1.06)	.08
Nasal polyps	…	…	…	…	…	…	2.28 (1.04-5.01)	.04	2.37 (1.08-5.24)	.03
Psychiatric disease	…	…	…	…	…	…	…	…	1.79 (0.97-3.27)	.06

Not-well-controlled asthma is defined by an ACQ score of ≥ 1.5. High OSA risk is defined as an SA-SDQ score of ≥ 36 for men and ≥ 32 for women. See Table 1, 2, and 3 legends for expansion of abbreviations.

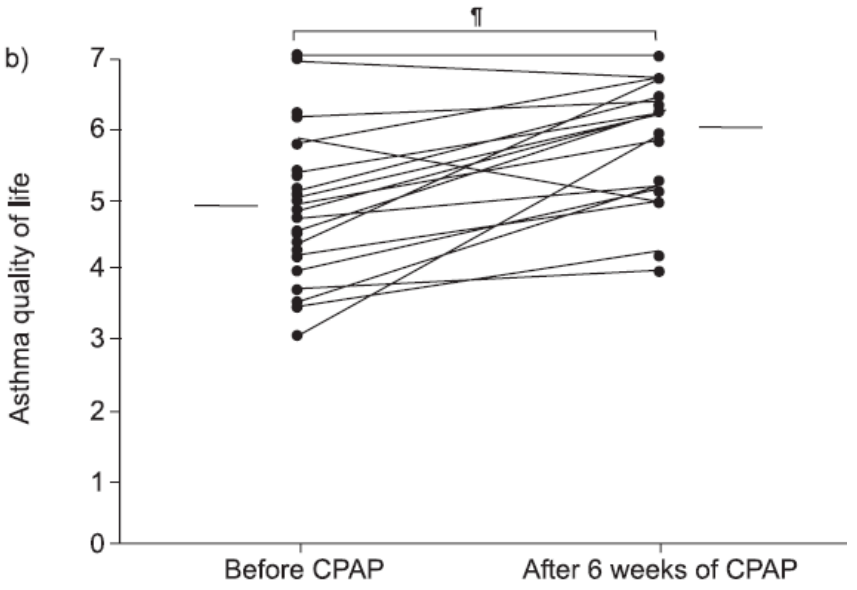
[a]Demographics include age, sex, and race (black vs all others).

Teodorescu et al. Association of OSA risk with asthma control in adults Chest 2010

SAHS i millora de l'asma amb CPAP

TABLE 2 Functional and clinical characteristics of the subjects at baseline (pre-) and after 6 weeks of treatment (post-) with continuous positive airway pressure (CPAP)

	Pre-CPAP	Post-CPAP
FEV_1 % pred	82.2±13.6	80.4±13.6
FEV_1/FVC %	77.3±8.3	76.3±10.1
PC_{20} mg·mL^{-1}	2.2 (1.3–3.5)	2.5 (1.4–4.5)
AHI	48.1±23.6	2.6±2.5***
QOLAs	5.0±1.2	5.8±0.9***
QOLAp	4.1±1.4	6.0±1.0***



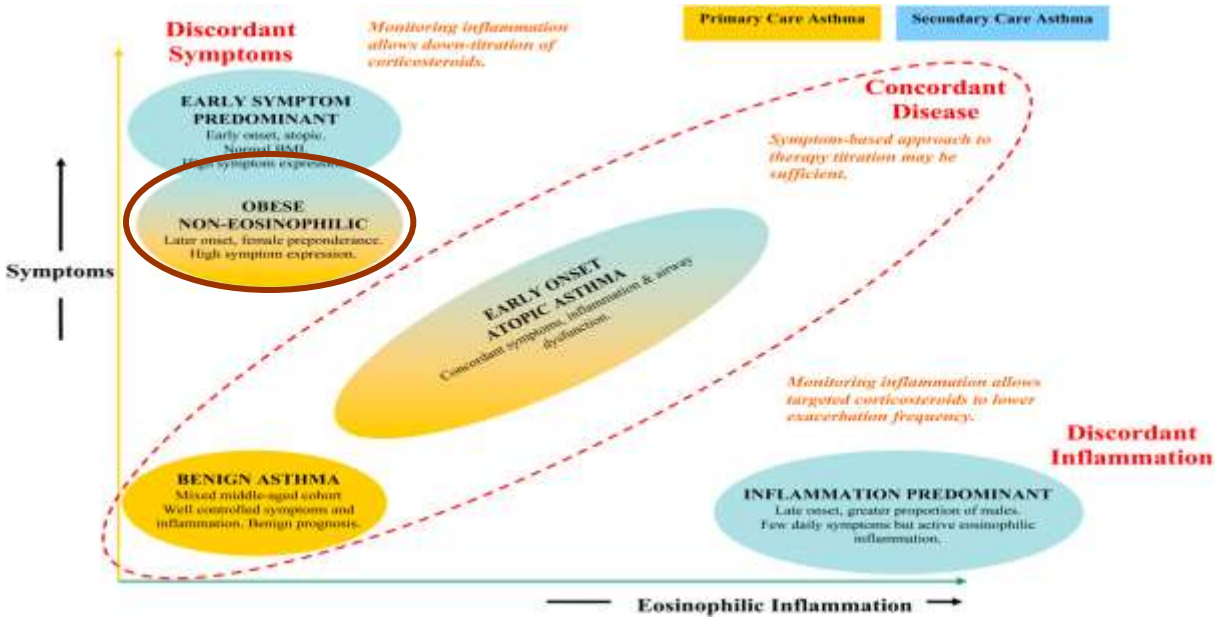
Lafond C et al. Impact of CPAP on asthmatic patients with obstructive sleep apnea. Eur Respir J 2007

Fenotip Asma-Obesitat

TABLE 1. DEMOGRAPHICS AND CLINICAL CHARACTERISTICS OF SUBJECTS

	Total Cohort	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	*P* Value*
Number of subjects	726	110	321	59	120	116	
Age at enrollment, years	37 (14)†	27 (8)	33 (12)	50 (8)	38 (13)	49 (11)	<0.0001
Sex, % female	66	80	67	71	53	63	0.0006
Race, % White/AA/other	64/28/8	62/29/9	63/30/7	73/22/5	62/33/5	68/20/12	0.17
Body mass index (BMI)	29 (8)	27 (5)	28 (8)	33 (9)	31 (9)	31 (7)	<0.0001
% with BMI >30	37	24	31	58	44	51	<0.0001
Age of asthma onset, years	15 (14)	11 (10)	11 (11)	42 (10)	8 (10)	21 (15)	<0.0001
% with onset > 12 years of age	46	39	36	100	28	69	
Asthma duration, years	22 (14)	15 (9)	22 (12)	9 (7)	30 (14)	29 (15)	<0.0001
Baseline lung function‡							
FEV_1 % predicted	74 (22)	102 (11)	82 (11)	75 (11)	57 (12)	43 (14)	<0.0001
FVC % predicted	86 (19)	112 (10)	93 (9)	80 (8)	72 (12)	60 (13)	<0.0001
FEV_1/FVC	0.70 (0.1)	0.78 (0.1)	0.74 (0.1)	0.74 (0.1)	0.64 (0.1)	0.57 (0.1)	<0.0001
Maximal lung function§							
FEV_1 % predicted	87 (20)	113 (8)	94 (9)	84 (9)	76 (12)	58 (14)	<0.0001
FVC % predicted	96 (17)	117 (10)	100 (10)	87 (8)	89 (12)	75 (15)	<0.0001
Change in % predicted FEV_1	13 (11)	11 (9)	12 (9)	10 (7)	19 (15)	14 (11)	<0.0001
Atopy status							
Number of positive SPT	3.4 (3.0)	3.9 (3.0)	3.6 (3.0)	2.2 (2.5)	4.0 (3.1)	2.6 (2.7)	<0.0001
Subjects with > one positive SPT, %	77	85	78	64	83	66	0.0008

Moore et al. 2010



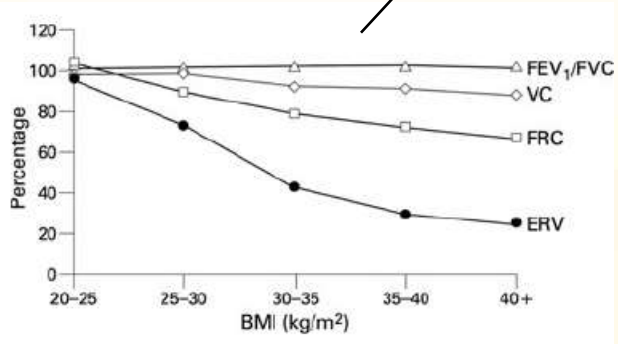
Haldar et al. 2008

Depressió

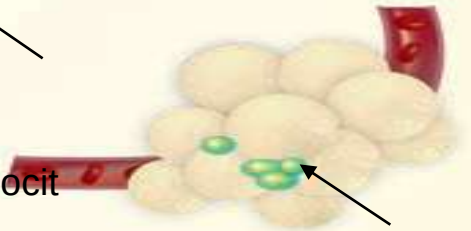
SAHS
RGE

Asma alérgica de inicio precoz

Asma IgE bajo de inicio tardío



Factors mecànics
Respirar a baixos volums podria afavorir hiperresposta bronquial



Inflamació metabòlica
Adipòcits i macrofags produeixen citoquines i adipokines, que podente tenir efectes directes sobre la via aèria e indirectes sobre funció cel.lular immune

Tractament farmacològic

Table 1 Recent publications reporting on differential response to therapy in obese asthmatics

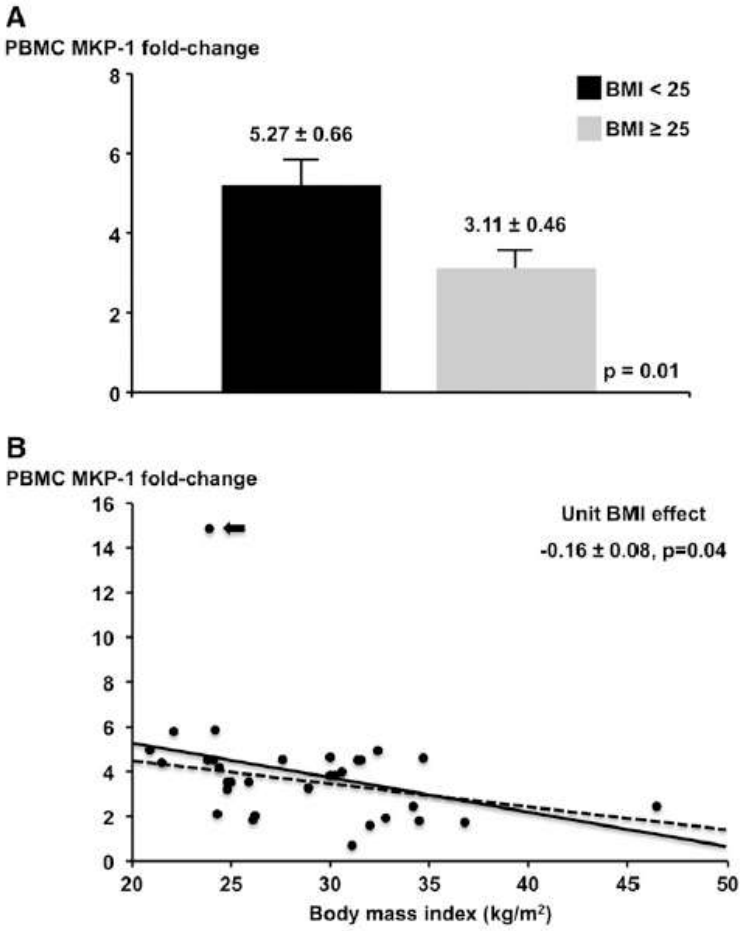
Author	Year	*n*	Population	Age	Main finding
Peters Golden [31]	2006	3,073	Pooled clinical trial (Merck)	≥18 years	Obese had fewer asthma control days on ICS, response to montelukast did not decrease with BMI
Boulet [27]	2007	1,242	Pooled clinical trial (GSK)	18–82	Obese less likely to achieve control on ICS and ICS/LABA
Sutherland [33]	2009	1,265	Pooled clinical trial (NHLBI Asthma Clinical Research Network)	adult	Obese had decreased response of eNO to ICS, decreased response of FEV1, FEV1/FVC and PC20 to ICS/LABA
Camargo and Boulet [28]	2010	1,510	Pooled clinical trial (GSK)	≥15 years	Obese have decreased response to ICS, with some improvement over time, ICS superior to montelukast
Camargo, Sutherland [29]	2010	475	Post hoc analysis of clinical trial, African Americans only (GSK)	12–65	Patients with BMI≥40 had reduced response in pm Peak flow, and increased exacerbation rates
Sutherland and Camargo [32]	2010	1,052	Pooled clinical trial data (GSK)	≥15 years	Obese had reduced response to ICS, though ICS superior to montelukast
Forno [30]	2011	1,207	Childhood Asthma Management Program	≥15 years	Overweight and obese children less responsive to ICS in terms of lung function
Yeh(35)	2011	180	ED population	Adults	Obese and non-obese had similar response to albuterol and rates of admission
Anderson [26]	2012	72	Post hoc analysis of single center clinical trial	18–65 years	Overweight and Obese had decreased response in terms of eNO and symptoms
Telenga [34]	2012	276	Pooled data from single center studies	18–60 years	Obese had decreased FEV1 response to steroids (ICS and systemic pooled)

Tractament farmacològic

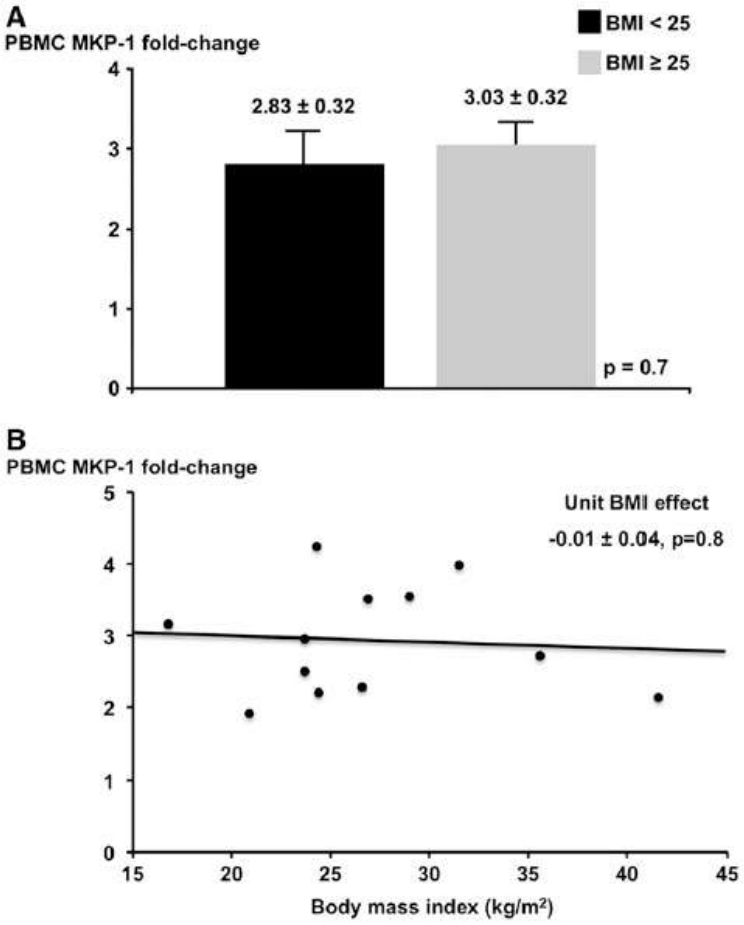
- Per que mala resposta a tractament convencional?:
  - Funció limfocítica alterada, en general es veu disminució en limfòcits CD4 TH2
  - Disminució eosinòfils, augment neutròfils.
    - Perfil associat a resistència cel.lular a esteroides
  - Efectes mecànics de l'obesitat sobre sistema respiratori.

Resistència a corticoides

Asma



No asma

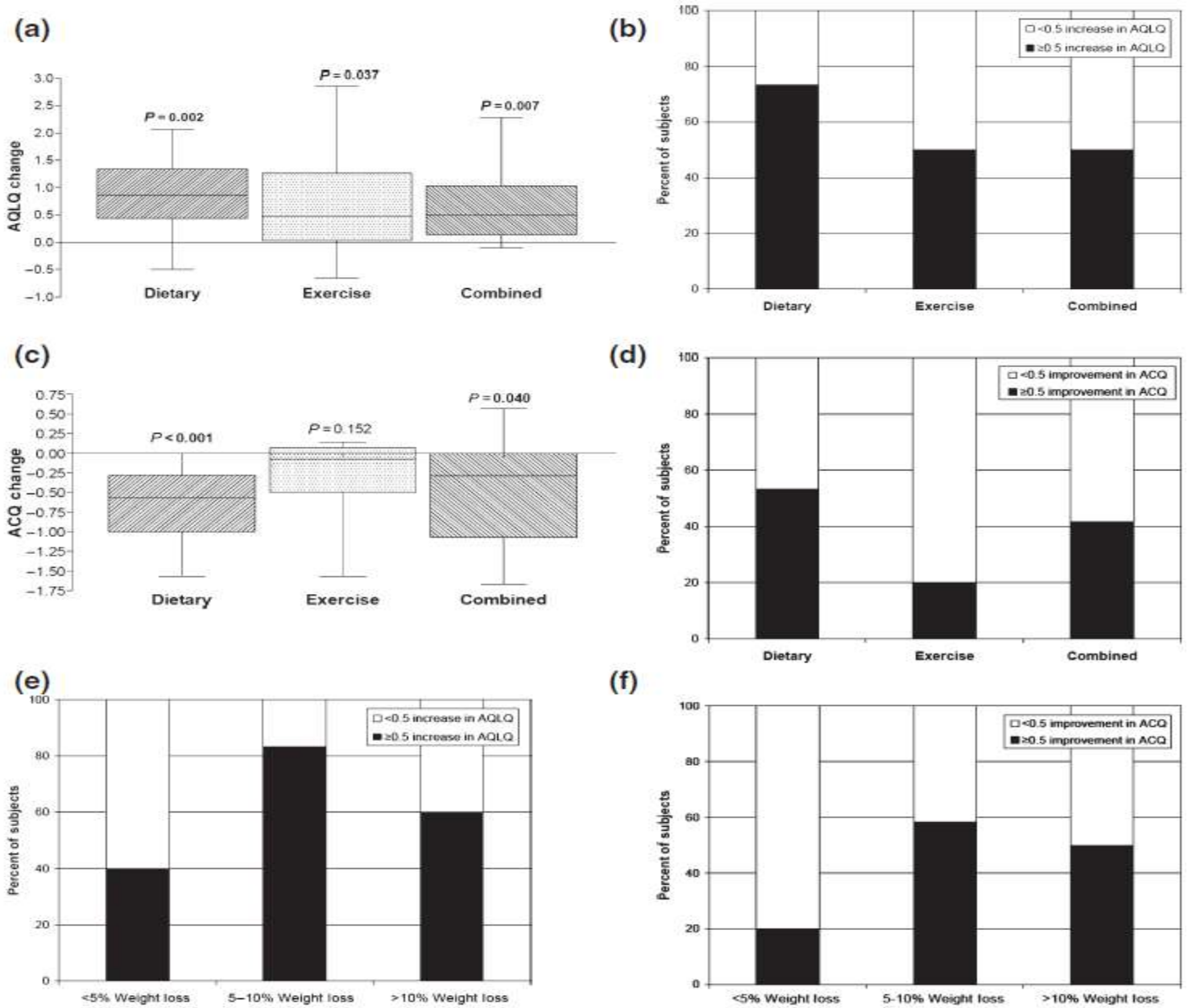


Sutherland et al. Body Mass and Glucocorticoid Response in Asthma. Am J Respir Crit Care Med 2008

Pèrdua de pes.Dieta

Medical interventions					
Sugerman[30] 2003 USA	Total = 33 Asthma n = 1 (3.3%) Mean age 16 (12–18) Mean BMI 52 kg/m^2	History of asthma	Gastric bypass	Up to 14 y	Asthma resolved (100%)
Aaron[31] 2004 Canada	Total = 58; 100% female Age 44 (13) Mean wt 115 (26) kg Asthma n = 24 (41%)	Physician diagnosis	Wt loss programme	6 mo	Mean wt ↓ 20 kg (19%); for 10% wt loss, FVC ↑ 92 ml; for 10% wt loss, FEV ↑ 73 ml; improvement in symptoms ($p<0.05$); no hospitalisations or ER visits
Hakala[19] 2000 Finland	Total = 14; 80% female Age 25–62 Mean BMI 37 (33–43) Asthma n = 14 (100%)	Physician diagnosis	Low cal diet	8 wk	BMI 32.1 kg/m^2 (↓ 5.1 kg/m^2); dyspnoea score 8.1 (↓ 6.5); use of rescue meds 0.4 does/day (↓ 0.2)
Johnson[28] 2007 USA	Total = 10, 80% female Age adult Mean wt 104.9 kg Asthma n = 10 (100%)	Physician diagnosis	Low cal diet	8 wk	Weight 96.4 kg (↓ 8%); improved asthma control on ACQ
Stenius-Aarniala[27] 2000 Finland	Total = 38 Age 18–60 BMI 30–42 kg/m^2 Asthma 38 (100%)	Physician diagnosis	Low cal diet for 8 weeks	1 y	Mean wt: treatment grp ↓ 11 kg (11%), control grp 0.3%; median No of exacerbations: treatment group 1 (0–4), control grp 1 (0–7); median No of oral steroids courses: treatment group 1 (0–3), control grp 2 (0–3)

Eneli et al – Weight loss and asthma: a systematic review. Thorax 2008



Scott et al – Dietary restriction and exercise improve airway inflammation and outcomes in overweight and obese asthma: a randomized trial Clinical and Experimental Allergy 2013

Pèrdua pes. Cirurgia Bariàtrica

Table 3. Effect of bariatric surgery on asthma.

Study (year)	Study design	Country	Population	n	Type of surgery	Main findings	Ref.
Boulet *et al.* (2012)	Prospective	Canada	Adults	12	Biliopancreatic diversion with duodenal switch procedure	Improved airway hyperreactivity and symptoms	[77]
Dixon *et al.* (2011)	Prospective	USA	Adults	23	Open or laproscopic Roux-en-Y gastric bypass or gastric banding	Improved airway hyperreactivity (particularly in late-onset asthmatics with low IgE) and symptoms	[40]
Maniscalco *et al.* (2008)	Prospective	Italy	Adults	12	Gastric banding	Improved symptoms	[75]
Simard *et al.* (2004)	Retrospective study	Canada	Adults	121	Biliopancreatic diversion with duodenal switch procedure	79% of asthmatics reported improved symptoms	[78]
Spivak *et al.* (2005)	Retrospective study	USA	Adults	11	Gastric banding	Nine out of 11 asthmatics reported improvement in symptoms	[79]
Narbro *et al.* (2002)	Retrospective study	Sweden	Adults	67	Gastric banding, bypass of vertical-banded gastroplasty	Trend towards reduced medication costs	[80]
Reddy *et al.* (2011)	Retrospective study	USA	Adults	257	Roux-en-Y gastric bypass or gastric banding	Decreased medication in patients undergoing the Roux-en-Y procedure	[74]

Anne Dixon – The treatment of asthma in obesity. Expert Rev Respir Med 2012

CONCLUSIONS

- Asma i Obesitat malalties prevalents en augment
- Obesitat com a factor de risc per asma (OR: 1,5-3)
- Associació més freqüent en dones
- Mecanismes implicats
  - Genètics
  - Inflamació sistèmica. Adipoquines
  - Efectes sobre funció pulmonar
  - Comorbiditats. SAHS i Asma associació independent?.
- Fenotip diferenciat
- Mala resposta tt convencional

CONCLUSIONS

- Característiques del fenotip asma/obesitat
  - Disminució volums pulmonars, augment en treball respiratori i associació dèbil amb mesures d'hiperresposta
  - No associació o dèbil amb atòpia
  - Augment inflamacio sistèmica, i neutrofília en via aèria
  - Asma més severa, pitjor control
  - Més comú en dones
  - Mala resposta a tractament convencional
  - Milloria en general amb pèrdua de pes. (falten estudis amplis randomitzats)

GRÀCIES