IARC HANDBOOKS

ABSENCE OF EXCESS BODY FATNESS

VOLUME 16

This publication represents the views and expert opinions of an IARC Working Group on the Evaluation of Cancer-Preventive Interventions, which met in Lyon, 5–12 April 2016

LYON, FRANCE - 2018

IARC HANDBOOKS OF CANCER PREVENTION

Table 2.2.8a Cohort studies of measures of body fatness and cancer of the lung

Reference Cohort Location Follow-up period	Total number of subjects Sex Incidence/mortality	Exposure categories	Exposed cases	Relative risk (95% CI)	Covariates	Comments
Olson et al. (2002) Iowa Women's Health Study USA 1986–1998	38 006 Women Incidence	BMI < 22.8 22.9–25.0 25–27.4 27.4–30.7 ≥ 30.7 [P_{trend}]	168 126 87 81 70	1.0 0.92 (0.73–1.16) 0.76 (0.58–0.98) 0.69 (0.52–0.90) 0.66 (0.50–0.89) [< 0.001]	Age, smoking status (never, former, current), physical activity score, education level, beer consumption	No association with weight at age 18 yr, or with WC; association similar for current, former, and never-smokers
Calle et al. (2003) Population-based cohort USA	404 576 Men Mortality	BMI 18.5–24.9 25–29.9 30–34.9 35–39.9 [P_{trend}]	4885 4281 681 78	1.00 0.78 (0.75–0.82) 0.79 (0.73–0.86) 0.67 (0.54–0.84) [< 0.001]	Age, education level, smoking, physical activity, alcohol consumption, marital status, aspirin, fat intake, vegetable intake	
	495 477 Women Mortality	BMI 18.5–24.9 25–29.9 30–34.9 35–39.9 ≥ 40 [P_{trend}]	3693 1278 305 54 19	1.00 0.88 (0.83–0.94) 0.82 (0.72–0.92) 0.66 (0.50–0.86) 0.81 (0.52–1.28) [< 0.001]	Age, education level, smoking, physical activity, alcohol consumption, marital status, aspirin, fat intake, vegetable intake, HRT use	
Samanic et al. (2004) United States Veterans cohort USA 1969–1996	4 500 700 Men Incidence	Obesity White men: Non-obese Obese Black men: Non-obese Obese	78 205 4398 18 884 568	1.00 0.91 (0.88–0.94) 1.00 0.60 (0.55–0.65)	Age, calendar year	Obesity defined as discharge diagnosis of obesity: ICD-8: 277; ICD-9: 278.0

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Kuriyama et al. (2005) Population-based cohort Japan 1984–1992	12 485 Men Incidence	BMI 18.5–24.9 25.0–27.4 27.5–29.9 ≥ 30 [P_{trend}]	 123 18 2 3	 1.00 0.77 (0.47–1.27) 0.30 (0.07–1.20) 0.80 (0.20–3.26) [0.08]		Too few lung cancers in women in this cohort (n = 48)
Rapp et al. (2005) Population-based cohort Austria 1985–2002	67 447 Men Incidence	BMI 18.5–24.9 25–29.9 30–34.9 ≥ 35 [P_{trend}]	 209 198 50 7	 1.00 0.80 (0.66–0.97) 0.88 (0.65–1.20) 0.88 (0.41–1.86) [0.15]	Age, smoking, occupation	
	78 484 Women Incidence	BMI 18.5–24.9 25–29.9 30–34.9 [P_{trend}]	 64 45 17	 1.00 1.00 (0.68–1.48) 0.87 (0.50–1.50) [0.67]		
Samanic et al. (2006) Swedish Construction Worker Cohort Sweden 1971–1999	362 552 Men Incidence	BMI 18.5–24.9 25–29.9 ≥ 30 [P_{trend}]	 1638 1040 153	 1.00 0.80 (0.74–0.87) 0.74 (0.63–0.88) [< 0.001]	Age, year, smoking status	
		BMI 18.5–24.9 25–29.9 ≥ 30 [P_{trend}]	 54 63 10	 1.00 1.17 (0.81–1.70) 1.11 (0.56–2.20) [0.47]	Age, year	Never-smokers

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Reference Cohort Location Follow-up period	Total number of subjects Sex Incidence/mortality	Exposure categories	Exposed cases	Relative risk (95% CI)	Covariates	Comments
Fujino et al. (2007) Japan Collaborative Cohort Study for Evaluation of Cancer (JACC) Japan NR	Men Incidence	BMI < 18.5 18.5–24.9 25–29.9 ≥ 30	85 672 89 3	1.35 (1.07–1.70) 1.00 0.66 (0.53–0.82) 0.38 (0.12–1.18)	Age, study area	Weight at age 20 yr not associated with risk
	Women Incidence	BMI < 18.5 18.5–24.9 25–29.9 ≥ 30	25 168 53 2	1.00 (0.40–2.49) 1.00 1.07 (0.78–1.46) 0.38 (0.09–4.01)	Age, study area	Weight at age 20 yr not associated with risk
Reeves et al. (2007) Population-based cohort United Kingdom 1996–2001	1.2 million Women Incidence	BMI < 22.5 22.5–24.9 25.0–27.4 27.5–29.9 ≥ 30 per 10 kg/m^2	828 823 653 376 491	1.17 (1.09–1.25) 1.00 0.91 (0.85–0.99) 0.83 (0.75–0.91) 0.84 (0.77–0.92) 0.74 (0.67–0.82)	Age, region, SES, reproductive history, smoking, alcohol consumption, physical activity, HRT use	Null association also for never-smokers
Jee et al. (2008) Cohort from National Health Insurance Corporation Republic of Korea 1992–2006	770 556 Men Incidence	BMI < 20 20–22.9 23–24.9 25.0–29.9 ≥ 30 [P_{trend}]	1606 3655 2172 1560 73	1.35 (1.24–1.47) 1.13 (1.05–1.21) 1.00 0.92 (0.84–1.00) 1.29 (0.96–1.73) [< 0.0001]	Age, smoking status and dose	

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Reference Cohort Location Follow-up period	Total number of subjects Sex Incidence/mortality	Exposure categories	Exposed cases	Relative risk (95% CI)	Covariates	Comments
Jee et al. (2008) (cont.)	443 273 Women Incidence	BMI < 20 20–22.9 23–24.9 25.0–29.9 ≥ 30 [P_{trend}]	338 740 505 590 58	1.20 (1.00–1.44) 1.18 (1.02–1.37) 1.00 1.10 (0.94–1.29) 0.91 (0.63–1.33) [0.07]		
Kabat et al. (2008) Women's Health Initiative USA 1998–2006	161 809 Women Incidence	BMI < 23.1 23.1–25.6 25.6–28.3 28.3–32.2 ≥ 32.2 [P_{trend}]	314 311 236 265 227	1.0 1.04 (0.88–1.23) 0.77 (0.64–0.93) 0.81 (0.68–0.98) 0.79 (0.65–0.96) [0.001]	Age, smoking, education level, ethnicity, HRT use, diet, physical activity, study	No association seen for WC, or weight at ages 18, 35, or 50 yr
		BMI < 23.1 23.1–25.6 25.6–28.3 28.3–32.2 ≥ 32.2 [P_{trend}]	197 total	1.0 1.24 (0.80–1.89) 0.94 (0.60–1.50) 0.73 (0.45–1.21) 0.83 (0.50–1.38) [0.15]	Age, education level, ethnicity, HRT use, diet, physical activity, height, study	Never-smokers
Andreotti et al. (2010) Agricultural workers USA 1993–2005	39 628 Men Incidence	BMI < 18.5 18.5–24.9 25–29.9 30–34.9 ≥ 35 [P_{trend}]	2 86 127 40 6	– 1.00 0.85 (0.60–1.20) 0.85 (0.54–1.35) 0.47 (0.15–1.49) [0.15]	Age, race, smoking, vegetable intake, exercise, cancer family history	

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Reference Cohort Location Follow-up period	Total number of subjects Sex Incidence/mortality	Exposure categories	Exposed cases	Relative risk (95% CI)	Covariates	Comments
Koh et al. (2010) Population-based cohort Singapore 1993–2006	63 257 Men and women Incidence	BMI < 20 20–24 24–28 ≥ 28 [P_{trend}]	220 609 164 49	1.34 (0.98–1.83) 1.18 (0.88–1.59) 0.91 (0.66–1.25) 1.00 [0.0004]	Age, sex	Association not seen in former smokers
		BMI < 20 20–24 24–28 ≥ 28 [P_{trend}]	23 50 176 38	0.93 (0.55–1.56) 1.01 (0.65–1.56) 0.69 (0.42–1.13) 1.00 [0.31]		Subanalysis in never-smokers
Parr et al. (2010) Pooled analysis of 39 cohort studies Asia, Australia, and New Zealand 1961–NR	424 519 Men and women Mortality	BMI 12–18.4 18.5–24.9 25–29.9 ≥ 30 [P_{trend}]	1478 total	1.11 (0.86–1.44) 1.0 0.68 (0.59–0.79) 0.83 (0.64–1.08) [0.003]	Age, sex, tobacco use	
Leung et al. (2011) Elderly Health Service clients China 2000–2008	64 574 Men and women Mortality	BMI < 18.5 18.5–22.9 23–24.9 25–29.9 ≥ 30 [P_{trend}]	66 325 214 298 29	1.38 (1.05–1.79) 1.00 0.92 (0.77–1.09) 0.87 (0.75–1.02) 0.55 (0.38–0.80) [< 0.001]	Sex, smoking, education level, marital status, alcohol consumption	Similar association for never-smokers and ever-smokers

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Reference Cohort Location Follow-up period	Total number of subjects Sex Incidence/mortality	Exposure categories	Exposed cases	Relative risk (95% CI)	Covariates	Comments
Smith et al. (2012) NIH-AARP cohort USA 1995–2006	271 238 Men Incidence	BMI < 18.5 18.5–22.5 22.5–24.9 25–29.9 30–34.9 ≥ 35 [P_{trend}]	38 650 1327 2905 953 220	1.15 (0.83–1.59) 1.12 (1.02–1.23) 1.00 0.92 (0.86–0.98) 0.87 (0.80–0.95) 0.81 (0.70–0.94) [< 0.001]	Age, race, smoking, education level, COPD, physical activity, alcohol consumption	
		BMI < 18.5 18.5–22.5 22.5–24.9 25–29.9 30–34.9 ≥ 35 [P_{trend}]	0 16 39 77 29 5	– 1.04 (0.58–1.86) 1.00 1.01 (0.68–1.48) 1.38 (0.85–2.24) 1.04 (0.41–2.67) [0.44]		Never-smokers
	177 494 Women Incidence	BMI < 18.5 18.5–22.5 22.5–24.9 25–29.9 30–34.9 ≥ 35 [P_{trend}]	81 852 775 1082 388 166	1.23 (0.97–1.54) 1.15 (1.04–1.26) 1.00 0.99 (0.90–1.08) 0.85 (0.75–0.96) 0.73 (0.61–0.87) [< 0.001]		

Table 2.2.8a Cohort studies of measures of body fatness and cancer of the lung

Reference Cohort Location Follow-up period	Total number of subjects Sex Incidence/mortality	Exposure categories	Exposed cases	Relative risk (95% CI)	Covariates	Comments
Smith et al. (2012) (cont.)		BMI < 18.5 18.5–22.5 22.5–24.9 25–29.9 30–34.9 ≥ 35 [P_{trend}]	5 54 54 78 41 17	1.81 (0.72–4.52) 1.17 (0.80–1.70) 1.00 1.00 (0.71–1.42) 1.19 (0.79–1.80) 1.00 (0.58–1.74) [< 0.85]	Age, race, education level, COPD, physical activity, alcohol consumption	Never-smokers
Bethea et al. (2013) Black Women's Health Study USA 1995–2011	56 835 Women Incidence	BMI < 18.5 18.5–24.9 25–29.9 ≥ 30 [P_{trend}]	9 101 122 91	2.70 (1.36–5.42) 1.0 0.85 (0.65–1.11) 0.69 (0.52–0.93) [< 0.01]	Age, education level, physical activity, alcohol consumption, parity, age at first birth, family history, region	WC inversely associated with risk
Lam et al. (2013) NIH-AARP cohort USA 1995–2006	158 415 Men and women Incidence Never-smokers only	BMI < 18.5 18.5–24.9 25–29.9 ≥ 30 [P_{trend}]	23 194 192 123	1.57 (0.77–3.19) 1.00 1.00 (0.81–1.22) 1.21 (0.95–1.53) [0.21]	Age, education level, alcohol consumption, physical activity, energy intake	No association with BMI at ages 18, 35, and 50 yr, or with WC
Bhaskaran et al. (2014) Clinical Practice Research Datalink United Kingdom 1987–2012	5 243 978 Men and women Incidence	BMI, per 5 kg/m^2 All Never-smokers only	19 339 2674	0.82 (0.81–0.84) 0.99 (0.93–1.05)	Age, sex, year, diabetes, alcohol consumption, SES; for combined analysis, also adjusted for smoking	

BMI, body mass index (in kg/m^2); CI, confidence interval; COPD, chronic obstructive pulmonary disease; HRT, hormone replacement therapy; NIH-AARP, National Institutes of Health–AARP Diet and Health Study; NR, not reported; SES, socioeconomic status; WC, waist circumference; yr, year or years

Table 2.2.8b Case–control studies of measures of body fatness and cancer of the lung

Reference Study location Period	Total number of cases Total number of controls Source of controls	Exposure categories	Exposed cases	Relative risk (95% CI)	Adjustment for confounding
Goodman & Wilkens (1993) USA (Hawaii) 1979–1985	738 (men: 518, women: 230) 1626 (men: 1102, women: 524) Population	BMI 5 yr before diagnosis, quartiles:			Age, ethnicity, smoking status, pack-years of cigarette smoking
		Men: ≤ 21.9 > 21.9–23.9 > 23.9–25.8 > 25.8 [P_{trend}]	NR	1.0 0.5 0.5 0.4 [< 0.01]	
		Women: ≤ 20.2 > 20.2–22.6 > 22.6–25.5 > 25.5 [P_{trend}]	NR	1.0 0.8 1.0 0.6 [0.05]	
		BMI at age 20–29 yr, quartiles			
		Men: ≤ 20.2 > 20.2–21.8 > 21.8–23.6 > 23.6 [P_{trend}]	NR	1.0 0.8 0.8 0.9 [0.93]	
		Women: ≤ 19.1 > 19.1–20.5 > 20.5–22.3 > 22.3 [P_{trend}]	NR	1.0 1.1 1.0 0.9 [0.45]	

Table 2.2.8b Case–control studies of measures of body fatness and cancer of the lung

Reference Study location Period	Total number of cases Total number of controls Source of controls	Exposure categories	Exposed cases	Relative risk (95% CI)	Adjustment for confounding
Kabat (1996) USA (8 cities) 1981–1990	3607 9681 Hospital	BMI 5 yr before diagnosis			Age, education level, smoking (kg of tar inhaled), race, hospital, time period, alcohol consumption, history of chronic lung disease
		Current smokers: Men: ≥ 28 25–27.9 22–24.9 < 22 [P_{trend}]	NR	1.0 1.2 (1.0–1.5) 1.5 (1.2–1.9) 2.0 (1.5–2.5) [0.0001]	
		Women: ≥ 28 25–27.9 22–24.9 < 22 [P_{trend}]	NR	1.0 1.2 (0.8–2.0) 1.7 (1.2–2.4) 2.0 (1.4–2.7) [0.0001]	
		Former smokers: Men: ≥ 28 25–27.9 22–24.9 < 22 [P_{trend}]	NR	1.0 1.1 (0.9–1.4) 1.2 (1.0–1.5) 1.3 (1.0–1.8) [0.02]	Additionally adjusted for years since stopping
		Women: ≥ 28 25–27.9 22–24.9 < 22 [P_{trend}]	NR	1.0 1.4 (0.9–2.2) 1.1 (0.7–1.7) 1.5 (1.0–2.2) [0.2]	

Table 2.2.8b Case–control studies of measures of body fatness and cancer of the lung

Reference Study location Period	Total number of cases Total number of controls Source of controls	Exposure categories	Exposed cases	Relative risk (95% CI)	Adjustment for confounding
Kabat (1996) (cont.)		Never-smokers: Men:	NR		
		≥ 28		1.0	
		25–27.9		0.8 (0.4–1.5)	
		22–24.9		0.5 (0.3–1.1)	
		< 22		0.9 (0.4–2.1)	
		[P_{trend}]		[0.4]	
		Women:	NR		
		≥ 28		1.0	
		25–27.9		1.9 (0.9–6.5)	
		22–24.9		2.4 (1.3–4.2)	
		< 22		2.9 (1.6–5.0)	
		[P_{trend}]		[0.0001]	
Rauscher et al. (2000) USA (New York State) 1982–1985	Pairs of never-smokers and former smokers 412 412 (188 pairs never-smokers; 224 former smokers) Population	BMI before illness (cases) or 1 yr ago (controls), octiles Overall:			Age, years of smoking, number of cigarettes smoked per day, education level
		O1: ≤ 21.26	41	1.0	
		O2–O7: > 21.26– ≤ 30.84	305	1.5 (1.0–2.3)	
		O8: > 30.84	66	2.6 (1.5–5.2)	
		Men:			
		O1: ≤ 21.26	11	1.0	
		O2–O7: > 21.26– ≤ 30.84	164	2.1 (0.9–5.0)	
		O8: > 30.84	31	3.4 (1.2–10)	
		Women:			
		O1: ≤ 21.26	30	1.0	
		O2–O7: > 21.26– ≤ 30.84	141	1.2 (0.7–2.1)	
		O8: > 30.84	35	2.9 (1.3–6.5)	

Table 2.2.8b Case–control studies of measures of body fatness and cancer of the lung

Reference Study location Period	Total number of cases Total number of controls Source of controls	Exposure categories	Exposed cases	Relative risk (95% CI)	Adjustment for confounding
Rauscher et al. (2000) (cont.)		Never-smokers:			
		O1: ≤ 21.26	23	1.0	
		O2–O7: > 21.26– ≤ 30.84	137	1.5 (0.9–2.7)	
		O8: > 30.84	28	2.4 (1.1–6.0)	
		Former smokers:			
		O1: ≤ 21.26	28	1.0	
		O2–O7: > 21.26–≤ 30.84	168	1.5 (0.8–3.0)	
		O8: > 30.84	38	3.2 (1.3–8.1)	
Kubík et al. (2004) Czech Republic 1998–2002	Women: 435 non-smokers; 1710 smokers Population (proxy controls)	Current BMI			Age, residence, education level, smoking
		< 22.9	128	1.00	
		23.0–25.9	100	0.55 (0.39–0.78)	
		26.0–28.9	106	0.54 (0.39–0.77)	
		> 28.9	101	0.34 (0.24–0.49)	
		[P_{trend}]		[< 0.001]	
Pan et al. (2004) Canada (10 provinces), NECSS study 1994–1997	3338 (men: 1736, women: 1602) 5039 Population	BMI 2 yr before interview			5-yr age group, province of residence, education level, pack-years of smoking, alcohol consumption, total energy intake, vegetable intake, dietary fibre intake, recreational physical activity For women, also menopausal status, number of live births, age at menarche, age at end of first pregnancy For all, also sex
		All:	3338		
		< 25		1.00	
		25– < 30		0.74 (0.65–0.84)	
		≥ 30		0.77 (0.66–0.91)	
		[P_{trend}]		[< 0.0001]	
		Men:	1763		
		< 25		1.00	
		25– < 30		0.75 (0.64–0.88)	
		≥ 30		0.72 (0.57–0.90)	
		[P_{trend}]		[< 0.0005]	

Table 2.2.8b Case–control studies of measures of body fatness and cancer of the lung

Reference Study location Period	Total number of cases Total number of controls Source of controls	Exposure categories	Exposed cases	Relative risk (95% CI)	Adjustment for confounding
Pan et al. (2004) (cont.)		Women:	1602		
		< 25		1.00	
		25– < 30		0.71 (0.58–0.85)	
		≥ 30		0.85 (0.66–1.10)	
		[P_{trend}]		[0.011]	
Kanashiki et al. (2005) Japan 1993–2003	363 1089 Population	BMI 2 yr before diagnosis			Smoking status, age
		Men:			
		< 20.8	57	2.0 (1.2–3.4)	
		20.8–22.8	56	2.0 (1.2–3.4)	
		22.9–24.9	28	1.0	
		≥ 25.0	43	1.6 (0.9–2.7)	
		Women:			
		< 20.8	25	1.3 (0.7–2.6)	
		20.8–22.8	24	1.0 (0.6–2.1)	
		22.9–24.9	22	1.0	
		≥ 25.0	30	1.2 (0.6–2.3)	
		Women, never-smokers:			
		< 20.8	22	1.2 (0.6–2.4)	
		20.8–22.8	19	0.9 (0.5–1.9)	
		22.9–24.9	21	1.0	
		≥ 25.0	29	1.3 (0.7–2.5)	
		BMI 4 yr before diagnosis			
		Men:			
		< 20.8	53	1.3 (0.8–2.1)	
		20.8–22.8	52	1.3 (0.8–2.0)	
		22.9–24.9	40	1.0	
		≥ 25.0	35	0.9 (0.5–1.5)	

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Reference Study location Period	Total number of cases Total number of controls Source of controls	Exposure categories	Exposed cases	Relative risk (95% CI)	Adjustment for confounding
Kanashiki et al. (2005) (cont.)		Women:			
		< 20.8	21	1.3 (0.7–2.7)	
		20.8–22.8	21	1.1 (0.6–2.2)	
		22.9–24.9	20	1.0	
		≥ 25.0	38	1.9 (1.0–3.6)	
		Women, never-smokers:			
		< 20.8	17	1.3 (0.6–2.7)	
		20.8–22.8	20	1.3 (0.6–2.6)	
		22.9–24.9	17	1.0	
		≥ 25.0	36	2.6 (1.2–4.3)	
		BMI at time of diagnosis			
		Men, current smokers:			
		< 20.8	20	0.9 (0.3–2.4)	
		20.8–22.8	13	0.6 (0.2–1.6)	
		22.9–24.9	13	1.0	
		≥ 25.0	6	0.3 (0.1–1.0)	
		Men, former smokers:			
		< 20.8	13	3.1 (0.1–1.0)	
		20.8–22.8	5	1.7 (0.5–6.1)	
		22.9–24.9	9	1.0	
		≥ 25.0	12	2.3 (0.8–6.3)	
		Men, never-smokers:			
		< 20.8	1	1.5 (0.1–28)	
		20.8–22.8	3	2.0 (0.2–25)	
		22.9–24.9	2	1.0	
		≥ 25.0	2	1.5 (0.1–19)	

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Reference Study location Period	Total number of cases Total number of controls Source of controls	Exposure categories	Exposed cases	Relative risk (95% CI)	Adjustment for confounding
Kanashiki et al. (2005) (cont.)		Women, never-smokers: < 20.8 20.8–22.8 22.9–24.9 ≥ 25.0	23 14 31 30	0.8 (0.4–1.6) 0.4 (0.2–0.7) 1.0 0.9 (0.5–1.6)	
Brennan et al. (2009) Eastern Europe and Russian Federation (15 centres in 6 countries) 1998–2003	2250 3052 Hospital	BMI 2 yr before interview ≤ 25 26–30 31–35 36–40 ≥ 41 [P_trend]	1180 719 231 50 11	1.00 0.60 (0.52–0.69) 0.47 (0.39–0.58) 0.54 (0.36–0.81) 0.30 (0.14–0.66) [5×10^{-18}]	Age, sex, cumulative tobacco consumption, years of alcohol consumption, country
Heck et al. (2009) USA (10 counties) 2005–2007	223 (men: 100, women: 123) 238 (men: 97, women: 141) Population	BMI 6 mo before interview 17.2–24.9 25–29.9 ≥ 30	89 72 62	1.00 0.80 (0.51–1.24) 0.65 (0.41–1.01)	Crude odds
Tarleton et al. (2012) USA (Los Angeles County) 1999–2004	611 (men: 303, women: 308) 1029 (men: 623, women: 417) Population (neighbourhood controls)	All: BMI at age 21 yr < 20.34 20.34– < 22.15 22.15– < 24.34 ≥ 24.34 [P_trend]	187 148 129 134	1.00 0.97 (0.69–1.35) 0.89 (0.63–1.27) 0.93 (0.64–1.34) [0.611]	Age, sex, ethnicity, tobacco smoking status, education level, energy intake

Table 2.2.8b Case–control studies of measures of body fatness and cancer of the lung

Reference Study location Period	Total number of cases Total number of controls Source of controls	Exposure categories	Exposed cases	Relative risk (95% CI)	Adjustment for confounding
Tarleton et al. (2012) (cont.)		BMI 1 yr before interview			
		< 18.5	18	1.31 (0.55–3.14)	
		18.5– < 25	263	1.00	
		25– < 30	214	0.87 (0.66–1.16)	
		≥ 30	114	0.58 (0.41–0.81)	
		[P_{trend}]		[0.001]	
		BMI change			
		< −5% (loss)	51	1.09 (0.60–1.98)	
		−5%– < +5%	113	1.00	
		5%– < 15%	132	0.76 (0.51–1.13)	
		15%– < 25%	113	0.72 (0.47–1.09)	
		25%– < 35%	67	0.53 (0.33–0.84)	
		> 35%	122	0.53 (0.35–0.80)	
		[P_{trend}]		[0.001]	
		BMI change, by tobacco smoking status			
		Never smokers:			
		< −5% (loss)	4	1.59 (0.36–7.02)	
		−5%– < +5%	10	1.00	
		5%– < 25%	54	1.45 (0.66–3.19)	
		≥ 25%	37	1.11 (0.49–2.54)	
		[P_{trend}]		[0.787]	
		Former smokers:			
		< −5% (loss)	30	1.60 (0.72–3.54)	
		−5%– < +5%	63	1.00	
		5%– < 25%	142	0.67 (0.41–1.08)	
		≥ 25%	120	0.54 (0.33–0.90)	
		[P_{trend}]		[0.017]	

Table 2.2.8b Case–control studies of measures of body fatness and cancer of the lung

Reference Study location Period	Total number of cases Total number of controls Source of controls	Exposure categories	Exposed cases	Relative risk (95% CI)	Adjustment for confounding
Tarleton et al. (2012) (cont.)		Current smokers			
		< −5% (loss)	17	0.81 (0.31–2.10)	
		−5%– < +5%	40	1.00	
		5%– < 25%	49	0.40 (0.21–0.78)	
		≥ 25%	32	0.28 (0.13–0.57)	
		[P_{trend}]		[0.001]	
Tarnaud et al. (2012) France, ICARE study 2001–2006	2625 (men: 2029, women: 596) 3381 (men: 2641, women: 740) Population	BMI 2 yr before interview			Age, area of residence, tobacco smoking consumption, education level, occupational exposure, previous chronic bronchitis, parental history of lung cancer
		All:			
		Men:			
		< 18.5	28	2.7 (1.2–6.2)	
		≥ 18.5– < 25	712	1.0	
		≥ 25– < 30	660	0.9 (0.7–1.1)	
		≥ 30– < 32.5	152	0.8 (0.6–1.1)	
		≥ 32.5	124	0.8 (0.6–1.0)	
		[P_{trend}]		[0.02]	
		Women:			
		< 18.5	36	1.5 (0.7–2.9)	
		≥ 18.5– < 25	288	1.0	
		≥ 25– < 30	108	0.9 (0.6–1.2)	
		≥ 30	63	0.8 (0.6–1.3)	
		[P_{trend}]		[0.20]	
		Current smokers:			
		Men:			
		< 18.5	24	4.1 (1.1–15.1)	
		≥ 18.5– < 25	502	1.0	
		≥ 25– < 30	317	0.6 (0.5–0.8)	
		≥ 30– < 32.5	66	0.7 (0.4–1.2)	
		≥ 32.5	47	0.5 (0.3–0.8)	
		[P_{trend}]		[< 0.001]	

Table 2.2.8b Case–control studies of measures of body fatness and cancer of the lung

Reference Study location Period	Total number of cases Total number of controls Source of controls	Exposure categories	Exposed cases	Relative risk (95% CI)	Adjustment for confounding
Tarnaud et al. (2012) (cont.)	2625 (men: 2029, women: 596) 3381 (men: 2641, women: 740) Population	Women: < 18.5 ≥ 18.5– < 25 ≥ 25– < 30 ≥ 30 [P_{trend}]	29 170 41 20	2.0 (0.6–6.5) 1.0 0.9 (0.4–2.1) 0.3 (0.1–0.7) [0.007]	
		Former smokers: Men: < 18.5 ≥ 18.5– < 25 ≥ 25– < 30 ≥ 30– < 32.5 ≥ 32.5 [P_{trend}]	4 192 319 83 74	2.9 (0.6–14.5) 1.0 1.1 (0.8–1.4) 0.9 (0.6–1.3) 1.0 (0.7–1.5) [0.68]	
		Women: < 18.5 ≥ 18.5– < 25 ≥ 25– < 30 ≥ 30 [P_{trend}]	3 50 25 9	0.5 (0.1–3.0) 1.0 0.7 (0.3–1.5) 0.6 (0.2–1.7) [0.42]	
		Never-smokers: Men: < 18.5 ≥ 18.5– < 25 ≥ 25– < 30 ≥ 30– < 32.5 ≥ 32.5 [P_{trend}]	– 18 24 3 3	– 1.0 1.4 (0.7–2.7) 0.7 (0.2–2.7) 1.3 (0.4–4.9) [0.71]	

Table 2.2.8b Case–control studies of measures of body fatness and cancer of the lung

Reference Study location Period	Total number of cases Total number of controls Source of controls	Exposure categories	Exposed cases	Relative risk (95% CI)	Adjustment for confounding
Tarnaud et al. (2012) (cont.)	2625 (men: 2029, women: 596) 3381 (men: 2641, women: 740) Population	Women: < 18.5 ≥ 18.5– < 25 ≥ 25– < 30 ≥ 30 [P_{trend}]	4 68 42 34	1.5 (0.4–5.3) 1.0 1.0 (0.6–1.5) 1.2 (0.7–2.0) [0.75]	
		BMI at age 30 yr			
		All: Men: < 18.5 ≥ 18.5– < 25 ≥ 25– < 30 ≥ 30– < 32.5 ≥ 32.5 [P_{trend}]	26 1090 401 32 9	1.5 (0.8–3.0) 1.0 1.1 (0.9–1.4) 0.6 (0.3–1.1) 0.3 (0.1–0.7) [0.07]	
		Women: < 18.5 ≥ 18.5– < 25 ≥ 25– < 30 ≥ 30 [P_{trend}]	66 344 35 10	1.0 (0.7–1.6) 1.0 0.9 (0.6–1.5) 0.7 (0.3–1.7) [0.44]	
		Current smokers: Men: < 18.5 ≥ 18.5– < 25 ≥ 25– < 30 ≥ 30– < 32.5 ≥ 32.5 [P_{trend}]	17 638 210 15 3	2.1 (0.6–7.1) 1.0 0.9 (0.7–1.3) 0.6 (0.2–1.7) 0.2 (0.5–0.9) [0.04]	

Table 2.2.8b Case–control studies of measures of body fatness and cancer of the lung

Reference Study location Period	Total number of cases Total number of controls Source of controls	Exposure categories	Exposed cases	Relative risk (95% CI)	Adjustment for confounding
Tarnaud et al. (2012) (cont.)	2625 (men: 2029, women: 596) 3381 (men: 2641, women: 740) Population	Women: < 18.5 ≥ 18.5– < 25 ≥ 25– < 30 ≥ 30 [P_{trend}]	50 176 10 2	1.4 (0.6–3.0) 1.0 0.6 (0.2–1.9) 0.1 (0.0–0.8) [0.014]	
		Former smokers: Men: < 18.5 ≥ 18.5– < 25 ≥ 25– < 30 ≥ 30– < 32.5 ≥ 32.5 [P_{trend}]	9 425 177 16 6	1.5 (0.6–14.5) 1.0 1.2 (0.8–1.4) 0.5 (0.6–1.3) [sic] 0.4 (0.7–1.5) [sic] [0.17]	
		Women: < 18.5 ≥ 18.5– < 25 ≥ 25– < 30 ≥ 30 [P_{trend}]	9 65 7 2	1.3 (0.4–4.4) 1.0 0.7 (0.2–2.3) 1.2 (0.1–11.1) [0.68]	
		Never-smokers: Men: < 18.5 ≥ 18.5– < 25 ≥ 25– < 30 ≥ 30– < 32.5 ≥ 32.5 [P_{trend}]	– 27 14 1 –	– 1.0 1.7 (0.7–2.7) 1.3 (0.2–2.7) – (0.4–4.9) [sic] [0.35]	

Table 2.2.8b Case–control studies of measures of body fatness and cancer of the lung

Reference Study location Period	Total number of cases Total number of controls Source of controls	Exposure categories	Exposed cases	Relative risk (95% CI)	Adjustment for confounding
Tarnaud et al. (2012) (cont.)		Women: < 18.5 ≥ 18.5– < 25 ≥ 25– < 30 ≥ 30 [P_{trend}]	8 103 18 6	0.6 (0.2–1.3) 1.0 1.0 (0.5–1.9) 1.1 (0.4–3.1) [0.39]	
El-Zein et al. (2013) Canada (greater Montreal area) 1996–2002	1076 (men: 628, women: 443) 1439 (men: 849, women: 582) Population	BMI 2 yr before diagnosis (cases) or interview (controls) All: < 18.5 18.5–24.9 25–29.9 ≥ 30 Never-smokers and light smokers: < 18.5 18.5–24.9 25–29.9 ≥ 30 Heavy smokers: < 18.5 18.5–24.9 25–29.9 ≥ 30 BMI at age 20 yr All: < 18.5 18.5–24.9 25–29.9 ≥ 30	 63 521 346 141 7 60 47 20 56 461 299 121 114 799 145 13	 2.30 (1.30–4.10) 1.00 0.83 (0.67–1.04) 0.96 (0.71–1.31) 2.28 (0.85–6.09) 1.00 0.70 (0.45–1.08) 1.01 (0.56–1.83) 2.33 (1.11–4.90) 1.00 0.89 (0.69–1.16) 0.93 (0.64–1.34) 0.69 (0.50–0.95) 1.00 1.18 (0.87–1.60) 0.58 (0.24–1.42)	Age, sex, education level, respondent status, ancestry, consumption of fruits and vegetables, occupational exposure, recreational physical activity, alcohol consumption, Comprehensive Smoking Index (CSI)

Table 2.2.8b Case–control studies of measures of body fatness and cancer of the lung

Reference Study location Period	Total number of cases Total number of controls Source of controls	Exposure categories	Exposed cases	Relative risk (95% CI)	Adjustment for confounding
El-Zein et al. (2013) (cont.)		Never-smokers and light smokers:			
		< 18.5	12	0.59 (0.30–1.14)	
		18.5–24.9	104	1.00	
		25–29.9	15	0.70 (0.37–1.32)	
		≥ 30	3	1.63 (0.40–6.56)	
		Heavy smokers:			
		< 18.5	102	0.69 (0.47–1.01)	
		18.5–24.9	695	1.00	
		25–29.9	130	1.38 (0.96–1.98)	
		≥ 30	10	0.37 (0.13–1.03)	

BMI, body mass index (in kg/m^2); CI, confidence interval; mo, month or months; NECSS, National Enhanced Cancer Surveillance System; NR, not reported; SD, standard deviation; yr, year or years

Table 2.2.8c Mendelian randomization studies of measures of body fatness and cancer of the lung

Reference Study	Characteristics of study population	Sample size	Exposure (unit)	Outcome	Odds ratio (95% CI); *P* value (with each unit increase in exposure) of the association between the exposure and outcome(s)
Brennan et al. (2009)	Men and women from 15 centres in 6 countries in central and eastern Europe (Czech Republic, Hungary, Poland, Romania, Russian Federation, and Slovakia)	7067 (4015 cases and 3052 controls)	Increase of 1 kg/m^2 in BMI	All tumours Adenocarcinoma Squamous cell carcinoma Never-smokers Former smokers Current smokers	0.85 (0.72–0.99); *P* = 0.04 0.51 (0.33–0.82); *P* = 0.004 0.72 (0.57–0.90); *P* = 0.01 0.57 (0.35–0.94); *P* = 0.03 0.76 (0.49–1.17); *P* = 0.22 0.89 (0.67–1.17); *P* = 0.40
	Men and women from 6 studies of individuals of European ancestry	28 998 (12 160 cases and 16 838 controls)	Increase of 1 unit in genetically predicted adult BMI	Adult BMI: All tumours Adenocarcinoma Squamous cell carcinoma	 1.05 (1.02–1.09); *P* = 2.9 × 10^{-3} 0.98 (0.93–1.10); *P* = 0.59 1.10 (1.04–1.16); *P* = 6.6 × 10^{-4}
			Increase of 1 SD (~0.073 kg/m^2) in genetically predicted childhood BMI	Childhood BMI: All tumours Adenocarcinoma Squamous cell carcinoma	 1.01 (0.85–1.20); *P* = 0.90 0.90 (0.69–1.19); *P* = 0.47 1.08 (0.82–1.43); *P* = 0.57

BMI, body mass index (in kg/m^2); CI, confidence interval; SD, standard deviation

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