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Sociodemographic factors and risk-taking behaviour during adolescence and obesity among more than 40 000 Danes

Pernille Frederiksen[1], Kirsten E Jensen[1] and Susanne K Kjaer[1,2,*]

[1]Virus, Lifestyle and Genes, Danish Cancer Society Research Center, Strandboulevarden 49, DK-2100 Copenhagen, Denmark: [2]Department of Obstetrics and Gynecology, Rigshospitalet, University of Copenhagen, Copenhagen, Denmark

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Abstract

Objective: The prevalence of obesity has increased in the last decades in the Western world. The aim of the present study was to examine the association between risk-taking behaviour in adolescence and adult obesity in men and women. Furthermore, we wished to describe social differences in obesity in Denmark.

Design: Two population-based questionnaire studies (2004–2005 and 2006–2007) were used to collect information on weight and height, sociodemographic factors and factors regarding risk-taking behaviour during adolescence. Data were analysed using multivariate logistic regression.

Setting: Denmark.

Subjects: Individuals aged 18–45 years (men: *n* 22 827, participation rate 71·0 %; women: *n* 20 870, participation rate 81·4 %).

Results: The prevalence of overweight and obesity was respectively 37·8 % and 10·6 % in men and 20·1 % and 9·7 % in women. In both sexes, obesity was found to be associated with older age, low level of schooling and living outside the capital centre. In relation to risk-taking behaviour, young age (≤13 years) at first intercourse significantly increased the odds of being obese in adulthood (men: OR = 1·34, 95 % CI 1·04, 1·71; women: OR = 1·66, 95 % CI 1·27, 1·99). In women specifically, young age at start drinking alcohol (≤12 years) was associated with obesity.

Conclusions: Sociodemographic factors, in particular age, level of schooling and area of residence, are associated with obesity in both men and women. Risk-taking behaviour during adolescence seems to cluster in both obese men and obese women, however most convincingly in women.

Keywords
Obesity
Sociodemographic factors
Risk-taking behaviour
Adults

In Western European countries as well as in the USA, the prevalence of obesity has increased during the past four decades in both men and women[1–3]. According to the WHO the rise in national obesity prevalences can be characterized as an obesity epidemic[4]; however, some studies have indicated that the epidemic is levelling off in some specific groups from the late 1990s[5,6]. Being a major cause of morbidity and of premature mortality[7,8], obesity has substantial medical and social consequences for the individual and economic consequences for society[9]. Obesity is often defined as excess body fat tissue, but exact measurements of body fat tissue require expensive methods that are difficult to implement in epidemiological studies[10]. Consequently, obesity has been redefined as excess body weight and thus BMI, which expresses weight adjusted for height, has become a highly used tool to measure obesity[10].

A social gradient has been found in the prevalence of obesity: in most Western countries, individuals with lowest social position have the highest prevalence of obesity[11–14]. Obesity is found to be associated with different measures of sociodemographic and socio-economic status, such as low level of schooling[11,12,14,15], living in rural areas[16–18], low household income[12,14] and unemployment[14,19]. The influence of social factors on obesity has been found to differ between sexes; more social factors have been found to be associated with obesity in women than in men and the associations between obesity and social factors have been found to be stronger and more consistent throughout the literature in women than in men[2,5,11,12,20]. In addition, sex differences in the historical development of obesity epidemics have also been seen. One study found that men had a steadily increasing prevalence of obesity in the 1970s and through up to the 2000s, whereas the prevalence of obesity in women remained stable until the 1990s after which an increase occurred similar to that in men[21]. Another study focusing on the years 1999–2004 showed significant increases in obesity in men but not in women[22].

*Corresponding author: Email Susanne@cancer.dk

These findings suggest that it is highly relevant to examine men and women separately when measuring the prevalence of obesity and in identifying the influence of social factors on obesity.

As obesity in adulthood has been found to be associated with social position both in adulthood and in childhood[23], it could be hypothesized that other characteristics early in life such as risk-taking behaviour may also be associated with obesity in adulthood. This hypothesis may be supported by previous findings showing that teens from families characterized by low social position not only have higher risk of obesity in adulthood[23], but also engage in risk-related behaviour (e.g. young age at first intercourse and sexual activity without protection) at a younger age than teens from families with high social position[24]. However, no studies focusing on early risk-taking behaviour in relation to risk of obesity in adulthood have to our knowledge been published so far. Thus, the aim of the present study was to examine the distribution of overweight and obesity in relation to sociodemographic factors (age, level of schooling, area of residence and marital status) among men and women in two large, population-based, cross-sectional studies from Denmark. Furthermore, we wanted to examine the potential association between obesity in adulthood and sociodemographic characteristics in adulthood and variables reflecting risk-taking behaviour in adolescence (young age at initiation of smoking, young age at initiation of alcohol consumption and young age at first sexual intercourse) in a multivariate analysis including both sociodemographic factors and signs of risk-taking behaviour.

Methods

Study population

The present analysis is based on data from two previously described population-based studies concerning lifestyle habits among men and women[25,26]. Both studies were approved by the Danish Data Protection Agency. In Denmark all residents are assigned a unique personal identification number (PIN) which comprises information on date of birth and sex. The PIN is registered in the computerized Danish Civil Registration System. In brief, random samples of Danish men and women aged 18–45 years were drawn from the Civil Registration System. From November 2006 to July 2007 and from November 2004 to July 2005 respectively, 33 000 men and 28 000 women living in Denmark were invited to participate in the study. Individuals who had moved, emigrated or died before contact and those who could not speak Danish were ineligible for the study (n_{men} 487, n_{women} 728). In addition, no contact was established or participation was actively denied (by telephone, email or letter) by 9434 men and 5073 women. In total, 23 079 men (response rate 71·0 %) and 22 199 women (response rate 81·4 %) were included in the study. Subsequently, we excluded twelve men and twenty-six women because of discrepancies between their PIN and self-reported year of birth; and 238 men and 1301 women were excluded due to missing answers to the core questions concerning weight, height, marital status or level of schooling. Finally, two men and two women were excluded as outliers as they had BMI lower than 15·0 kg/m^2 or higher than 69·0 kg/m^2, leaving 22 827 men and 20 870 women available for analysis. Ethical approval was not required for the secondary data analyses reported here.

Data collection

Identical data collection methods were used for the male and the female surveys. All potential participants were appointed a unique study number to guarantee confidentiality and received an invitation letter and a self-administered questionnaire along with a stamped and addressed envelope. Alternatively to returning the questionnaire by postal mail, the participants had the possibility of answering an identical web-based questionnaire. Individuals who did not respond within four weeks received a reminder. For those who still did not respond, telephone interviews were attempted comprising the same questions as the self-administered questionnaire. The questionnaire contained questions about sociodemographic factors, smoking history, alcohol consumption and sexual history.

Self-reported body weight and body height were used to calculate individual BMI values using the standard formula provided by the WHO: body weight (kg)/(body height (m))^2. To categorize the BMI values, we used standard reference values also provided by the WHO[4]: underweight was defined as BMI $<$ 18·5 kg/m^2, normal weight as BMI = 18·5–24·9 kg/m^2, overweight as BMI = 25·0–29·9 kg/m^2 and obesity was defined as BMI $\geq$ 30·0 kg/m^2. Age was categorized in five-year age groups. In Denmark, nine years of schooling is mandatory, the tenth year of schooling is voluntary and eleven or more years of schooling indicate high school/gymnasium. Thus we categorized level of schooling accordingly into three categories: low ($\leq$9 years of schooling), middle (10 years of schooling) and high ($\geq$11 years of schooling). The variable area of residence contained seven categories: capital centre, northern capital areas, southern capital areas, large provincial city areas, small provincial city areas, rural areas and peripheral rural areas[27]. This categorization made it possible to identify possible differences between urban and rural areas in Denmark and to distinguish between urban areas of the capital, i.e. the northern municipalities in the capital area are characterized by a high proportion of individuals with high social position whereas the southern municipalities have a high proportion of individuals with low social position[28]. The variable marital status consisted of two categories: married/cohabiting and not cohabiting, whereas the three variables

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reflecting different levels of risk-taking behaviour (age at initiation of smoking, age at initiation of alcohol consumption and age at first sexual intercourse) were divided into four or five categories enabling us to identify differences in age at initiation of risk-taking behaviour.

Statistical analysis

Initially, we described the sex-specific BMI distribution as well as assessed the proportions of men and women who were normal weight, overweight or obese in relation to four sociodemographic factors: age, level of schooling, area of residence and marital status. Subsequently, we examined the association between obesity and sociodemographic factors and risk-taking behaviour using multivariate logistic regression by estimating odds ratios and corresponding 95 % confidence intervals. In the logistic regression analysis individuals with normal weight served as the comparison group for obese individuals to have a clear distinction between the two body weight groups. We show age-adjusted odds ratios and odds ratios where all variables were mutually adjusted. For statistical analysis, the SAS/STAT statistical software package version 8·2 was used.

Results

BMI distribution

The sex-specific self-reported BMI distribution is shown in Fig. 1. The distribution of BMI in the male study population peaked at 22·0–24·0 kg/m^2, with a median BMI of 24·9 kg/m^2 (25th–75th percentile: 22·9–27·4 kg/m^2; data not shown), whereas in the female study population the highest proportions of women had a BMI in the range 20·0–22·0 kg/m^2 with a median BMI of 22·8 kg/m^2 (25th–75th percentile: 20·8–25·7 kg/m^2; data not shown). Furthermore, the male study population had a higher proportion of overweight individuals than the female study population.

Prevalence of overweight and obesity in relation to sociodemographic factors

Tables 1 and 2 show the distribution of normal weight, overweight and obesity according to age, level of schooling, area of residence and marital status for men and women, respectively. The prevalence of overweight was significantly higher in men (37·8 %, 95 % CI 37·2, 38·4 %) than in women (20·1 %, 95 % CI 19·5, 20·6 %), whereas the prevalence of obesity was similar (men: 10·6 %, 95 % CI 10·3, 11·1 %; women: 9·7 %, 95 % CI 9·3, 10·1 %). In both men and women the largest proportion of obesity was found among the oldest study participants (40–45-year-olds) (men: 13.4 %; women: 11·8 %), in individuals with low level of schooling (men: 15·5 %; women: 16·4 %), in individuals living in rural areas (men: 14·7 %; women: 15·0 %) and in married/cohabiting men and women (men: 11·4 %; women: 10·4 %).

Factors associated with obesity

Table 3 displays age-adjusted and mutually adjusted odds ratios for the associations between obesity, early risk-taking behaviour and sociodemographic factors in men and women. In both men and women, obesity was more likely among those who reported a younger age at first sexual intercourse (e.g. ≤13 years, men: OR = 1·34, 95 % CI 1·04, 1·71; women: OR = 1·66, 95 % CI 1·27, 2·19) and

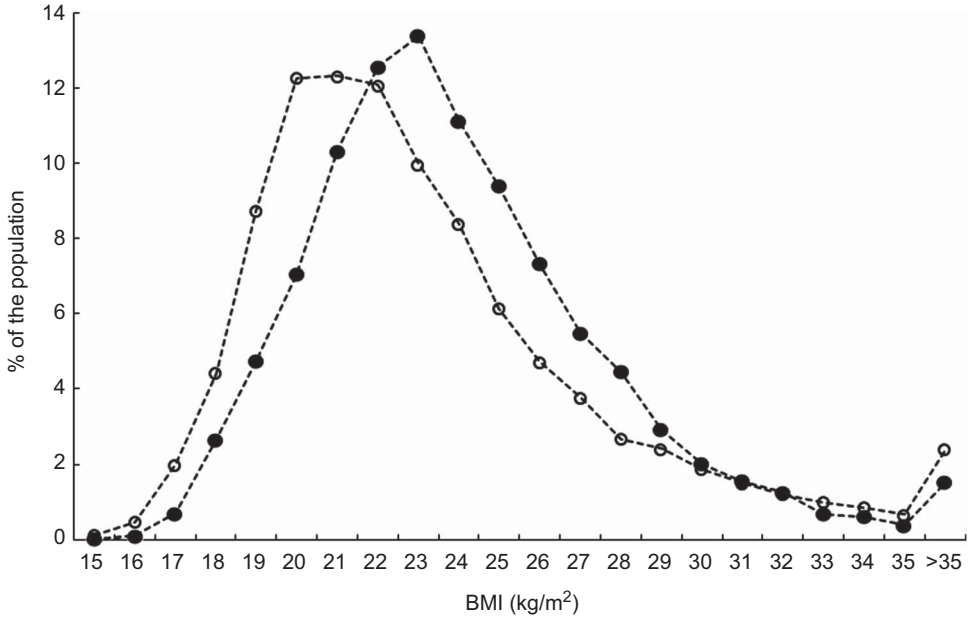

Fig. 1 Distribution of BMI in the study population: men (*n* 22 827; - - ● - -) and women (*n* 20 870; - - ○ - -) aged 18–45 years, Denmark, 2004–2005 (women) and 2006–2007 (men)

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Table 1 Prevalence of normal weight, overweight and obesity according to sociodemographic factors among men (*n* 22 827) aged 18–45 years, Denmark, 2006–2007

		Normal weight (BMI = 18·5–24·9 kg/m^2)			Overweight (BMI = 25·0–29·9 kg/m^2)			Obesity (BMI ≥ 30·0 kg/m^2)		
	Total*	*n*	%	95 % CI	*n*	%	95 % CI	*n*	%	95 % CI
Total	22 827	11 575	50·7	50·1, 51·4	8631	37·8	37·2, 38·4	2430	10·6	10·3, 11·1
Age										
18–24 years	4298	3041	70·8	69·4, 72·1	901	21·0	19·8, 22·2	240	5·6	4·9, 6·3
25–29 years	3296	1857	56·3	54·7, 58·0	1138	34·5	32·9, 36·2	276	8·4	7·4, 9·3
30–34 years	4335	2157	49·8	48·3, 51·3	1633	37·7	36·2, 39·1	527	12·2	11·2, 13·1
35–39 years	4862	2161	44·4	43·1, 45·8	2110	43·4	42·0, 44·8	579	11·9	11·0, 12·8
40–45 years	6036	2359	39·1	37·9, 40·3	2849	47·2	45·9, 48·5	808	13·4	12·5, 14·3
Level of schooling										
High (≥11 years)	12 939	7195	55·6	54·8, 56·5	4574	35·4	34·5, 36·2	1077	8·3	7·9, 8·8
Middle (10 years)	6365	2951	46·4	45·1, 47·6	2548	40·0	38·8, 41·2	806	12·7	11·9, 13·5
Low (≤9 years)	3523	1429	40·6	38·9, 42·2	1509	42·8	41·2, 44·5	547	15·5	14·3, 16·7
Area of residence										
Capital centre	2998	1919	64·0	62·3, 65·7	891	29·7	28·2, 31·4	166	5·5	4·7, 6·4
Northern capital areas	1158	652	56·3	53·5, 59·2	409	35·3	32·6, 38·1	85	7·2	5·8, 8·8
Southern capital areas	1035	488	47·1	44·1, 50·2	416	40·2	37·2, 43·2	119	11·5	9·6, 13·4
Large provincial city areas	3517	1953	55·5	53·9, 57.2	1205	34·3	32·7, 35·8	326	9·3	8·3, 10·2
Small provincial city areas	10 501	5011	47·7	46·8, 48·7	4198	40·0	39·0, 40·9	1204	11·5	10·9, 12·1
Rural areas	2689	1148	42·7	40·8, 44·6	1128	42·0	40·1, 43·8	394	14·7	13·3, 16·0
Peripheral rural areas	929	404	43·5	40·3, 46·7	384	41·3	38·2, 44·5	136	14·6	12·4, 16·9
Marital status										
Not cohabiting	7621	4645	61·0	59·9, 62·1	2151	28·2	27·2, 29·2	692	9·1	8·4, 9·7
Married/cohabiting	15 206	6930	45·6	44·8, 46·4	6480	42·6	41·8, 43·4	1738	11·4	10·9, 11·9

*Of the total male study population 191 men were underweight.

Table 2 Prevalence of normal weight, overweight and obesity according to sociodemographic factors among women (*n* 20 870) aged 18–45 years, Denmark, 2004–2005

		Normal weight (BMI = 18·5–24·9 kg/m^2)			Overweight (BMI = 25·0–29·9 kg/m^2)			Obesity (BMI ≥ 30·0 kg/m^2)		
	Total*	*n*	%	95 % CI	*n*	%	95 % CI	*n*	%	95 % CI
Total	20 870	13 789	66·1	65·4, 66·7	4187	20·1	19·5, 20·6	2028	9·7	9·3, 10·1
Age										
18–24 years	5492	3951	71·9	70·8, 73·1	805	14·7	13·7, 15·6	328	6·0	5·4, 6·6
25–29 years	3254	2201	67·6	66·0, 69·3	595	18·3	17·0, 19·6	322	9·9	8·9, 10·9
30–34 years	3683	2389	64·9	63·3, 66·4	768	20·9	19·5, 22·2	406	11·0	10·0, 12·0
35–39 years	3896	2470	63·4	61·9, 64·9	896	23·0	21·7, 24·3	434	11·1	10·2, 12·1
40–45 years	4545	2778	61·1	59·7, 62·5	1123	24·7	23·5, 26·0	538	11·8	10·9, 12·8
Level of schooling										
High (≥11 years)	13 586	9584	70·5	69·8, 71·3	2429	17·9	17·2, 18·5	978	7·2	6·7, 7·6
Middle (10 years)	5598	3274	58·5	57·2, 59·8	1343	24·0	22·9, 25·1	774	13·8	12·9, 14·7
Low (≤9 years)	1686	931	55·2	52·9, 57·6	415	24·6	22·6, 26·7	276	16·4	14·6, 18·1
Area of residence										
Capital centre	3142	2366	75·3	73·8, 76·8	457	14·5	13·3, 15·8	155	4·9	4·2, 5·7
Northern capital areas	1126	842	74·8	72·2, 77·3	182	16·2	14·0, 18·3	60	5·3	4·0, 6·6
Southern capital areas	1043	661	63·4	60·5, 66·3	218	20·9	18·4, 23·4	111	10·6	8·8, 12·5
Large provincial city areas	3398	2408	70·9	69·9, 72·9	578	17·0	15·3, 17·8	254	7·5	6·4, 8·1
Small provincial city areas	9295	5871	63·2	62·2, 64·1	2025	21·8	21·0, 22·6	1026	11·0	10·4, 11·7
Rural areas	2069	1191	57·6	55·4, 59·7	511	24·7	22·8, 26·6	310	15·0	13·5, 16·5
Peripheral rural areas	797	450	56·5	53·0, 59·9	216	27·1	24·0, 30·2	112	14·1	11·6, 16·5
Marital status										
Not cohabiting	6349	4405	69·4	68·3, 70·5	1028	16·2	15·3, 17·1	511	8·0	7·4, 8·7
Married/cohabiting	14 521	9384	64·6	63·9, 65·4	3159	21·8	21·1, 22·4	1517	10·4	10·0, 11·0

*Of the total female study population 866 women were underweight.

in women who initiated alcohol consumption at a young age (≤12 years; OR = 1·52, 95 % CI 1·05, 2·20). In addition, young age at initiation of smoking (≤13 years) tended to be associated with obesity, although the associations did not reach statistical significance in the mutually adjusted analysis. Furthermore, men and women who had never smoked, and men and women who did not consume alcohol, were more likely to be obese. With regard to the sociodemographic factors, there was an overall tendency that the risk of obesity increased with increasing age,

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Table 3 Associations between obesity and risk-taking behaviour and sociodemographic factors among men (*n* 12 960)* and women (*n* 14 250)* aged 18–45 years, Denmark, 2004–2005 (women) and 2006–2007 (men)

	Men			Women		
	OR†	OR‡	95 % CI	OR†	OR‡	95 % CI
Behavioural factors						
Age at first sexual intercourse						
≤13 years	1·49§	1·34	1·04, 1·71	1·97§	1·66	1·27, 2·19
14–15 years	1·27§	1·22	1·08, 139	1·07	1·08	0·95, 1·23
16–17 years	1·00	1·00	–	1·00	1·00	–
≥18 years/never	1·05	1·05	0·93, 1·18	1·11	1·07	0·94, 1·22
Age at initiation of alcohol consumption						
≤12 years	1·27	1·11	0·82, 1·49	1·60§	1·52	1·05, 2·20
13–14 years	1·10	1·08	0·96, 1·21	1·00	0·99	0·87, 1·13
15–16 years	1·00	1·00	–	1·00	1·00	–
≥17 years	1·08	1·07	0·93, 1·23	1·37§	1·31	1·14, 1·50
No consumption of alcohol	1·86§	1·69	1·01, 2·84	1·91§	1·55	1·18, 2·05
Age at initiation of smoking						
≤13 years	1·52§	1·21	0·96, 1·52	1·56§	1·27	0·99, 1·62
14–15 years	1·13	0·99	0·83, 1·20	1·18	1·14	0·94, 1·37
16–17 years	1·00	1·00	–	1·00	1·00	–
≥18 years	0·90	0·98	0·81, 1·19	0·98	1·10	0·89, 1·34
Never smoked	1·07	1·21	1·03, 1·41	1·20§	1·32	1·12, 1·56
Sociodemographic factors						
Age						
18–24 years	1·00	1·00	–	1·00	1·00	–
25–29 years	2·07§	2·28	1·85, 2·81	1·85§	1·91	1·59, 2·92
30–34 years	3·39§	3·44	2·84, 4·17	2·05§	1·91	1·60, 2·28
35–39 years	3·75§	3·42	2·82, 4·14	2·21§	1·76	1·47, 2·10
40–45 years	4·71§	3·97	3·30, 4·79	2·40§	1·74	1·46, 2·07
Level of schooling						
High (≥11 years)	1·00	1·00	–	1·00	1·00	–
Middle (10 years)	2·34§	2·09	1·86, 2·34	2·18§	2·00	1·78, 2·25
Low (≤9 years)	3·06§	2·72	2·35, 3·14	2·77§	2·39	2·02, 2·82
Area of residence						
Capital centre	1·00	1·00	–	1·00	1·00	–
Northern capital areas	1·37§	1·44	1·07, 1·94	0·94	0·95	0·68, 1·33
Southern capital areas	2·77§	2·40	1·82, 3·16	2·29§	1·96	1·48, 2·60
Large provincial city areas	2·08§	1·97	1·59, 2·44	1·60§	1·60	1·28, 2·00
Small provincial city areas	2·63§	2·17	1·80, 2·62	2·46§	2·21	1·83, 2·68
Rural areas	3·67§	2·82	2·27, 3·50	3·70§	3·24	2·59, 4·06
Peripheral rural areas	3·64§	2·72	2·06, 3·59	3·67§	3·07	2·32, 4·07
Marital status						
Not cohabiting	1·00	1·00	–	1·00	1·00	–
Married/cohabiting	1·32§	1·15	1·03, 1·30	1·27§	1·04	0·91, 1·18

*Study participants with missing values on marital status, age at initiation of smoking, age at initiation of alcohol consumption or age at first sexual intercourse were excluded from the analyses (1045 men/1567 women).
†Adjusted for age.
‡Mutually adjusted.
§Confidence interval does not include 1·00.

decreasing level of schooling and living in areas outside the capital centre even after mutual adjustment and adjustment for the behavioural factors. In terms of marital status we found in the mutually adjusted analysis that men who were married/cohabiting had a statistically significantly increased risk of obesity compared with men who were not cohabiting (OR = 1·15, 95 % CI 1·03, 1·30), whereas for women marital status was not associated with obesity in the mutually adjusted analysis.

Discussion

In the current population-based study of more than 43 000 Danish men and women aged 18–45 years we found that nearly 40 % of the men and 20 % of the women were overweight, while ~10 % of both men and women were obese. This is in line with findings from other studies in Nordic countries[2,19,29]. A higher prevalence of overweight in men than in women has been a common finding in most European populations[30], and the overall sex-specific distributions of BMI in our study showed that the BMI distribution in the male study population was skewed to the right compared with the female study population. This pattern resembles the British male and female BMI distribution curves most recently presented by the National Obesity Observatory in England[31].

The sex-specific differences in the prevalence of overweight found in many studies can theoretically be caused by a misclassification of muscularly built men as

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being overweight instead of being normal weight. The misclassification takes place because of the difference in weight of muscle tissue and body fat tissue and because BMI measures excessive body weight and is not an optimal measure of body fat tissue[32]. However, a study conducted in five European populations found that BMI is a valid overall predictor of the body fat mass percentage when used at a group level[32]. In combination with BMI waist circumference measurement could be a useful measure of abdominal fat[33]; however, this measurement was not available in our study.

In agreement with findings from other large surveys, the prevalence of obesity in our study increased with increasing age in both men and women[15,19]. Our finding of an association between low level of schooling and higher risk of obesity is similar to findings in several other studies in economically developed countries[11–13,15,20]. This may reflect differences in lifestyle such as less physical activity during leisure time and poorer dietary habits in individuals with a lower education[34], and furthermore, differences in perceptions of healthy body weight or importance of focusing on health may play a role[35]. By contrast, in less-developed countries, primarily in Central and Eastern Europe, low level of schooling is found to be associated with low risk of obesity[11,13], which may reflect limited access to food and necessity for hard physical labour in individuals of low social position[10].

Our findings of a higher likelihood of obesity in men and women living in rural areas or areas outside the capital centre are also consistent with findings from other studies[16–18,28]. A study from Finland examining causes of BMI differences in relation to urbanization found that a clustering of individuals with a similar social status and an equal BMI status could be explained by both social selection (individuals of similar social position and with similar body composition choose to live in the same areas) and social causation (individuals who live in the same areas are affected by the local culture, e.g. in eating patterns, habits of physical activity, preferred body image)[17]. Furthermore, we found that the risk of obesity in the southern capital areas was similar to the risk observed in the more rural areas. This might be explained by a higher density of individuals with low social position in southern capital areas[28] and indicates that area of residence is correlated with other factors important for obesity.

In relation to marital status in the mutually adjusted analysis we found that married/cohabiting men were slightly more likely to be obese than men who are not cohabiting, whereas we did not find any association in women. Studies have reported varying results with regard to marital status[14,19,20,36–38]; one study reported results consistent with ours[37] and a study from Sweden found that entering marriage or moving in with a partner often results in weight gains[20].

In our study we used young age at first intercourse, young age at start smoking and young age at start drinking to measure signs of risk-taking behaviour in adolescence. This is not an exhaustive measure of risk-taking behaviour, but it gives an indication of a certain behavioural pattern in adolescence. In both sexes we found an association between obesity and young age at initiation of smoking and young age at first intercourse. In relation to alcohol consumption, about a 50% higher likelihood of obesity was found in women who were young when initiating alcohol consumption but not in men. It has been a consistent finding in other studies that socially related factors are more consistent and stronger contributors in women's risk of obesity than in men's[2,11,12,14,20,36]. Our overall findings of positive associations between early risk-taking behaviour and obesity after adjusting for socio-demographic factors indicate that behavioural characteristics in adolescents may influence obesity in adulthood. In both men and women we found that never smoking and never drinking alcohol also were associated with obesity. In relation to smoking, these findings are largely in line with those from other studies, which found that non-smokers have higher risk of obesity compared with individuals who are current smokers[15,36]. In relation to alcohol, a similar pattern was found in a Belgian study in which it was reported that individuals with a moderate alcohol intake have a reduced risk of obesity compared with those who never drink alcohol[15]. In contrast, other studies did not find an association between alcohol consumption and obesity[36] and a study from Finland only found an association between obesity and alcohol consumption in men but not in women[38]. We cannot explain these findings between no alcohol consumption and obesity.

The strengths of our study include the random sampling of study participants and the high response rates, both increasing the generalizability of the study results to the general population of men and women being 18–45 years old and living in Denmark. Furthermore, the large study populations imply a greater statistical strength. The study also has some potential limitations. In spite of high response rates we cannot rule out the possibility that selection bias has occurred due to lack of participation. The fact that we use self-reported data to estimate BMI may also be a limitation; some studies have found a tendency of underestimation of BMI in both men and women[39,40]. However, other studies have found that BMI is a useful measurement of obesity in large populations due to its accuracy and high cost-effectiveness when used on a population scale[32,41]. Finally, some studies have found that under-reporting of BMI is associated with obesity, young age and low educational level[42,43], explaining why our results regarding the social differences in prevalence of obesity potentially could be underestimated.

Conclusions

We found strong associations between obesity and increasing age, decreasing level of schooling and area of

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residence in both men and women. Furthermore, initiation of sexual activity (intercourse), tobacco smoking and alcohol drinking at an early age were associated with obesity, the associations being strongest in women. On the basis of our findings of some differences between men and women in the risk of obesity, further research into the sex-specific characteristics in social background, lifestyle and health behaviour will be relevant.

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