

Prevalence of overweight, obesity and abdominal obesity in Flemish adults

by

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Abstract

Aims: *To report the prevalence of overweight, obesity and abdominal obesity (AO) in a sample of the Flemish adult population of Belgium, as measured in the "Sport, Physical Activity and Health Study (SPAHS, 2002-2004)". To compare these results with data of Flemish adults in the "Belgian Health Interview Surveys (HIS)" of 1997, 2001 and 2004, and with the obesity prevalence in Europe and in the US.*

Methods: *Between 2002-2004, 5170 subjects of an original random sample, aged 18-75 years, participated in this study. Among other measurements weight, height and waist circumference (WC) were measured by trained staff.*

Results: *The present overweight prevalence in Flanders is higher in men than in women, 41.4% and 29.8% respectively. When comparing*

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the results of the SPAH with those of the HIS, the overweight prevalence has increased in both men and women. The weighed obesity prevalence in the SPAH is 10.7% in men and 10.2% in women and thus lower than in the US and other European countries. The prevalence of AO also increases with age: from 0.9% to 26.3% and from 2.3% to 38.5% in men and women respectively.

Conclusions: *The obesity prevalence in Flemish adults is considerable, but less dramatic than in some other European countries and the US. Worldwide similar projects to assess the obesity prevalence are needed to allow comparisons between the different countries on a more reliable basis. They should include a uniform standardization of WC measurement and objective measurements of weight and height.*

Keywords: *abdominal fat, Belgium, body mass index, Europe, obesity*

Introduction

Only a few studies have been published on the prevalence of overweight and obesity in Belgium. Most of these studies have been carried out on the working population, either in the Flemish part of Belgium (1-3) or nationally (4-5). These surveys reveal higher overweight and obesity prevalence among male compared to female employees; however, they are neither representative for Flemish workers, nor for the Flemish adult population. According to Stam-Moraga et al. (4), the prevalence of obesity increased between 1977-1992 in working men aged 40-54 years. Moens et al. (1) also reported an increase in overweight and obesity prevalence in the Flemish working population between 1993 and 2003. To our knowledge, the Belgian Interuniversity Research on Nutrition and Health (BIRNH) study is the only survey to have made use of anthropometric data of a representative sample of the Belgian adult population (6). The BIRNH study indicates a rather high prevalence of obesity in Belgium. However, this survey was performed between 1979 and 1984, and consequently, these data are far from recent. The Belgian Health Interview Survey (HIS), conducted by the Scientific Institute of Public Health (Epidemiology Unit) in 1997 (7), 2001 (8) and 2004 (9), reports more recent and representative data concerning the distribution of the body mass index (BMI) in the Flemish adult population. These results, however, are based on reported height and weight, and are therefore less reliable compared to measured data (10-14).

In recent years, besides BMI, the use of waist circumference (WC) has gained importance in clinical practice. WC is reported to be a

suitable indicator for abdominal obesity (AO) in large-scale epidemiological surveys and a good predictor of several diseases (15-22). Moreover, according to a number of studies (23-24), BMI should not be used as the sole criterion to define overweight. Until now, data from waist measurements in nationally representative studies have been scarce. To improve the classification determined by the international BMI cut offs, it would also be useful to report WC in large-scale population studies (25-27).

As no recent BMI data based on measurements were available, the first aim of this study was to report the prevalence of overweight and obesity among a sample of Flemish adults, as representative as possible, and to compare our results with data of Flemish residents within the Belgian HIS 1997, 2001 and 2004, and also with the obesity prevalence in Europe and in the US. The second aim was to describe the distribution of WC and the prevalence of AO in our sample of Flemish adults, using the definitions recommended by the World Health Organization (28).

Methods

Survey and subjects

One of the main purposes of the Flemish Policy Research Centre Sport, Physical Activity and Health (SPA-H), set up by the Flemish Government in 2002, was to investigate the actual pattern of physical activity, sports participation, physical fitness and general health among the adult population of Flanders (the Northern half of Belgium). The Flemish population with its roughly 6 million inhabitants represents the largest language group (Dutch) in Belgium. The data collection for this epidemiological study took place between October 2002 and February 2004 in 46 Flemish municipalities, selected on the basis of clustered random sampling. Subjects with ages between 18 and 75 years were selected at random within these municipalities by the National Institute of Statistics (NIS). Although randomly selected, the participation rate and thus the degree of representativeness depends on the subjects' good will to participate. In an effort to increase the participation, all selected subjects were first informed by letter and were then contacted by phone to make an appointment. In case subjects could not be reached the first time, the telephonic contact trials were repeated up to the ultimate measurement day. The testing days were endorsed by the local municipalities and organized in cooperation with them. Some non-native Dutch speaking subjects, who had problems filling in the questionnaires, were assisted by staff members. This way, non-participation of subjects of

other than Flemish origin, residing in the chosen communities, was avoided. Thus the criterion for random selection was residence rather than nationality or language. Pregnant women were excluded. A total of 5170 subjects, aged 18-75 years, volunteered to participate in the study (2746 men and 2424 women). They correspond to 28% of the original random sample.

The Belgian HIS is a monitoring system used to estimate health related issues, including body weight and height, in the Belgian population at least once every five years. This questionnaire consists of general questions on socio-economic characteristics, medical history, smoking and drinking habits, physical activity and nutrition (7-9). For comparison with the SPAH Study, only data of adults living in Flanders were taken into consideration.

For comparison with the US, data of the National Health and Nutrition Examination Survey (NHANES) 2001-2002 were used (29). NHANES was designed to assess the health and nutritional status of adults and children in the United States. This survey combines interviews and physical examinations, including anthropometric measurements.

Study sample representativeness

The representativeness of our sample was first investigated by comparing with the total Flemish adult population for geographic distribution, gender, age and educational level. Regarding geographic distribution, it was found that the proportional distribution for the five Flemish provinces was very accurate. Concerning age, the highest underrepresentation was 2.32% in women aged 18 to 24 years and the highest overrepresentation was 1.95% in men aged 55 to 59 years. The lower educational levels (primary and/or grammar school) were slightly underrepresented and the higher educational levels (college or university degree) were slightly overrepresented. Because of the large number of subjects, some of these differences are significant, but they are small enough to be irrelevant. The largest difference for the geographic distribution, for example, was 1.9% for men in one province. In the light of the small observed differences between sample and population, our sample can be considered sufficiently representative with regard to age, gender, geographical distribution and educational level.

A weak point of the present study is the fact that the sample, although originally randomly drawn, consists of voluntary participants, which reduces its representativeness. In an effort to evaluate the differences

between the participants and the non-participants and because the non-participant rate was relatively high, a short questionnaire, aiming to describe the individual sociodemographic status and the level of physical activity, was sent to a subsample of the non-participants (N=2140). This sample consisted of 70 randomly selected 'non-participants' from each municipality. A total of 1299 questionnaires (60%) were completed correctly and returned anonymously. Body height and weight were among the variables to be filled in. After comparison no significant differences were found in weight and BMI between the participant group and the responding non-participant group. Nevertheless, this comparison should be looked at with some caution since the BMI of the non-participants was based on reported data and since obese persons are known to underreport their weight. Therefore the mean BMI of the non-participant group might be higher if this group consisted of a large proportion of obese individuals.

Measurements

Participants signed an informed consent statement before the start of the study. Several anthropometric measurements were taken using standardized procedures and equipment (30). Body weight, height and girth measurements were measured by trained staff. Body weight was measured to the nearest 0.1 kg with digital scales with the subjects in underwear. A Holtain stadiometer was used to measure body height to the nearest millimetre. Circumferences were measured by means of a Rosscraft measuring tape to the nearest millimetre. The WC was measured at the narrowest level frontally, between the lowest rib margin and the iliac crest. This measurement was always taken at the end of a normal respiration, without constricting the skin with the measuring tape. In the present study only the results concerning the distribution of BMI and WC, as anthropometric indicators of overweight and obesity, will be discussed.

Statistical analysis

Men and women were analysed separately and, for comparison with HIS and NHANES 2001-2002, divided into six age interval groups: 18-24, 25-34, 35-44, 45-54, 55-64 and 65-74 years. The international BMI cutoff (28) scores were used for the classification in underweight ($\text{BMI} < 18.5 \text{ kg/m}^2$), normal weight ($18.5 \text{ kg/m}^2 \leq \text{BMI} < 25 \text{ kg/m}^2$), overweight ($25 \text{ kg/m}^2 \leq \text{BMI} < 30 \text{ kg/m}^2$) and obese adults ($\text{BMI} \geq 30 \text{ kg/m}^2$). The data were analysed using the SPSS 12.0 statistical software package for Windows. Because of the relatively large number of subjects and to avoid type I error, all significance levels were set at 0.01. One-Way

ANOVAs, if necessary followed by a Scheffe post hoc test, were used to test the within-age group differences in BMI between HIS 1997, 2001, 2004 and the present SPAH Study. Odds ratios (OR) with 99% confidence intervals (CI) were calculated to test the change in overweight and obesity between HIS 1997 and 2001 on the one hand and the SPAH Study on the other hand. Chi-square tests were used to test whether within-age group differences in overweight and obesity prevalence exist between HIS 2004 and SPAH. For WC, the classification proposed by Lean et al. (31) and adopted by the World Health Organization (28), was applied. WC values < 94 cm in men and < 80 cm in women are considered as normal with low health risk. Male subjects with WC between 94-102 cm and female subjects with WC between 80-88 cm are regarded to have moderate risk AO. Men and women with, respectively, WC values ≥ 102 cm and ≥ 88 cm, were considered to have high risk AO.

Results

Table 1 shows the distribution of the mean BMI by age category in Flemish men and women as reported in HIS 1997, 2001 and 2004, and compared to the SPAH Study, held between 2002 and 2004. In general, the results of these four surveys are similar. The results of the SPAH Study reveal that the mean BMI in men increases with age from 22.5 kg/m² in the youngest age group to 27.1 kg/m² in the 65-74y age group. The mean BMI in women also increases with age. In the SPAH Study, the mean BMI in the 18-24y-old women is 21.8 kg/m², it increases gradually up to 26.8 kg/m² in the 65-74y-old women. Using a 0.01 significance level, no significant differences between the four surveys were found at the different age levels in both genders.

The prevalence of overweight and obesity, and the OR for test of change in overweight and obesity between the HIS 1997 and HIS 2001 on the one hand and the SPAH Study on the other hand, are reported in Table 2 for men and in Table 3 for women. The prevalences of overweight and obesity increase with age in both sexes, up to the age of 75y for overweight and 65y for obesity. Except for the youngest age group the prevalence of overweight is significantly higher in men than in women. From the age of 35y on, approximately half of the Flemish men are overweight or obese. This is also the case in Flemish women from the age of 45y on. In the 55-64 age group nearly one out of five is obese in both genders.

When comparing the four surveys, the overweight prevalence seems to have increased in 2004. The OR confidence intervals indicate that

Table 1.
Distribution of mean BMI (kg/m²) by age category in Flemish men and women according to the HIS 1997¹, HIS 2001¹, HIS 2004¹ and the SPAH Study 2002-2004²

Men Age category	HIS 1997		HIS 2001		HIS 2004		SPAH		ANOVA P
	N	Mean (SD)	N	Mean (SD)	N	Mean (SD)	N	Mean (SD)	
18-24	153	22.4 (2.9)	157	22.3 (3.1)	143	22.6 (3.1)	218	22.5 (3.0)	0.87
25-34	279	24.1 (3.3)	277	24.6 (3.4)	253	23.9 (3.1)	348	24.5 (3.5)	0.02
35-44	275	25.5 (3.6)	333	25.4 (3.5)	303	25.8 (3.7)	659	25.5 (3.3)	0.62
45-54	238	26.0 (3.7)	303	26.1 (3.8)	294	26.0 (3.5)	565	26.3 (3.3)	0.55
55-64	202	26.6 (4.1)	255	26.6 (4.0)	269	26.7 (3.6)	548	27.0 (3.3)	0.37
65-74	168	26.1 (3.4)	203	26.5 (4.0)	278	26.4 (3.3)	353	27.1 (3.2)	0.02
Women Age category	HIS 1997		HIS 2001		HIS 2004		SPAH		ANOVA P
	N	Mean (SD)	N	Mean (SD)	N	Mean (SD)	N	Mean (SD)	
18-24	151	21.4 (3.1)	152	22.0 (3.2)	156	21.8 (3.3)	173	21.8 (2.7)	0.41
25-34	304	22.4 (3.6)	286	23.0 (4.0)	273	23.4 (7.1)	337	23.3 (3.5)	0.04
35-44	254	23.8 (4.0)	315	23.4 (4.1)	301	23.9 (4.4)	621	23.9 (3.8)	0.38
45-54	221	25.0 (4.1)	276	25.3 (4.8)	289	24.5 (4.4)	576	25.3 (4.2)	0.05
55-64	197	26.2 (4.3)	255	25.7 (4.7)	253	26.3 (6.4)	440	26.4 (4.2)	0.35
65-74	187	25.7 (4.2)	201	26.6 (4.5)	288	26.2 (4.9)	228	26.8 (3.8)	0.06

¹ Epidemiological surveys performed by the Scientific Institute of Public Health

² Epidemiological study performed by the Flemish Policy Research Centre Sport, Physical Activity and Health

the overweight prevalence in the two oldest male groups increased significantly between HIS 2001 and SPAH. In the oldest female group the overweight prevalence increased significantly between HIS 1997 and SPAH. Concerning the obesity prevalence, no consistent pattern of change can be observed. The ORs indicate no significant change in obesity between the different periods, ranging between 0.64 and 1.49 in men and between 0.43 and 1.75 in women. In 25-34y old men, the overweight and obesity prevalences are significantly higher ($P<0.01$) in SPAH compared to HIS 2004. In women from the age of 45y on, the prevalence of overweight is also higher ($P<0.01$) in SPAH compared to HIS 2004.

Table 4 shows a comparison between the overweight and obesity prevalence in the Flemish part of Belgium and in the US (NHANES 2001-2002). The obesity rate among US men is 11% to 20% higher than among Flemish men of the same age groups. In each age category, the obesity percentage for US women is more than 20% higher than for Flemish women. Furthermore, in the youngest age groups, the prevalence of overweight is higher in US adults compared to Flemish adults. On the other hand, from the age of 45y on, the overweight prevalence is higher in Flemish adults compared to US adults.

Figure 1 gives an overview, based on data of the International Obesity Task Force (IOTF 2005), of the obesity prevalence among adults in Europe, including the countries which have recently become members of the European Union. For Flanders the present results of the SPAH Study are used. Flanders is ranked in the fourth to last position. Only Italy, The Netherlands and Sweden have lower obesity prevalences in the European Union.

The distribution of mean WC and the prevalence of moderate and high risk AO among Flemish adults are presented in Table 5. The mean WC increases with age in both sexes: from 78.3 cm up to 96.8 cm in men and from 70.2 cm to 85.7 cm in women. The prevalence of moderate risk AO ranges from 3.7% in the youngest male group to 36.7% in the oldest male group, and from 2.9% in the youngest female group to 35.5% in the oldest female group. The prevalence of high risk AO also increases with age from 0.9% to 26.3% and from 2.3% to 38.5% in men and women respectively.

TABLE 2.
Overweight (OV) and obesity (OB) prevalence (%) in Flemish men according to the HIS 1997¹,
HIS 2001¹, HIS 2004¹ and the SPAH Study 2002-2004²

Age category year	HIS 1997		HIS 2001		HIS 2004		SPAH		Test of change in overweight		Test of change in obesity	
	OV	OB	OV	OB	OV	OB	OV	OB	Odds Ratio (99% C.I.)		Odds Ratio (99% C.I.)	
	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	SPAH-HIS'97	SPAH-HIS'01	SPAH-HIS'97	SPAH-HIS'01
18-24	11.1	3.3	12.1	2.5	14.7	2.1	12.4	2.8	1.13 (0.48-2.64)	1.03 (0.42-1.50)	0.84 (0.17-4.07)	1.08 (0.20-5.79)
25-34	31.2	4.3	36.8	5.8	24.9	3.2	34.8	5.7	1.21 (0.77-1.89)	0.91 (0.59-1.42)	1.36 (0.52-3.55)	1.00 (0.43-2.29)
35-44	37.8	13.5	39.9	9.0	43.2	11.2	44.0	9.1	1.21 (0.81-1.80)	1.20 (0.83-1.73)	0.64 (0.36-1.14)	1.01 (0.51-2.01)
45-54	41.2	13.0	46.2	12.2	49.3	10.2	49.2	12.9	1.45 (0.94-2.22)	1.17 (0.79-1.73)	0.99 (0.59-1.67)	1.07 (0.61-1.86)
55-64	52.0	14.4	44.3	17.6	50.2	16.0	55.3	17.9	1.34 (0.83-2.15)	1.77 (1.14-2.74)	1.30 (0.72-2.34)	1.02 (0.62-1.66)
65-74	52.4	11.9	46.3	16.7	53.2	13.3	57.8	16.7	1.55 (0.90-2.65)	1.81 (1.08-3.02)	1.49 (0.73-3.03)	1.00 (0.48-2.09)

¹ Epidemiological surveys performed by the Scientific Institute of Public Health

² Epidemiological study performed by the Flemish Policy Research Centre Sport, Physical Activity and Health

TABLE 3.
Overweight (OV) and obesity (OB) prevalence (%) in Flemish women according to the HIS 1997¹,
HIS 2001¹, HIS 2004¹ and the SPAH Study 2002-2004²

Age category year	HIS 1997		HIS 2001		HIS 2004		SPAH		Test of change in overweight		Test of change in obesity	
	OV	OB	OV	OB	OV	OB	OV	OB	Odds Ratio (99% C.I.)		Odds Ratio (99% C.I.)	
	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	SPAH-HIS'97	SPAH-HIS'01	SPAH-HIS'97	SPAH-HIS'01
18-24	11.3	0.7	8.6	2.6	10.9	3.8	11.6	1.2	1.04 (0.42-2.58)	1.38 (0.52-3.60)	1.75 (0.08-40.08)	0.43 (0.05-3.86)
25-34	15.8	3.0	21.7	5.6	16.5	8.1	20.5	5.1	1.42 (0.83-2.42)	0.93 (0.56-1.54)	1.75 (0.60-5.09)	0.90 (0.36-2.27)
35-44	22.0	7.5	21.0	7.3	21.6	7.6	22.4	7.6	1.02 (0.64-1.62)	1.09 (0.70-1.70)	1.01 (0.41-2.46)	1.04 (0.53-2.05)
45-54	31.7	11.8	26.1	16.7	24.6	10.7	33.5	13.0	1.12 (0.71-1.76)	1.38 (0.89-2.12)	1.12 (0.60-2.10)	0.75 (0.44-1.26)
55-64	39.1	15.7	32.2	18.0	33.6	19.0	40.0	18.9	1.12 (0.69-1.83)	1.51 (0.96-2.37)	1.25 (0.69-2.25)	1.06 (0.63-1.78)
65-74	36.9	17.6	43.8	18.9	35.1	20.8	50.7	16.3	1.89 (1.07-3.33)	1.31 (0.75-2.29)	0.91 (0.46-1.80)	0.84 (0.43-1.61)

¹ Epidemiological surveys performed by the Scientific Institute of Public Health

² Epidemiological study performed by the Flemish Policy Research Centre Sport, Physical Activity and Health

TABLE 4.
Comparison between the prevalences of overweight and obesity in Flanders¹ and in the United States² in both genders

Age category (year)	Men				Women			
	Flanders		U.S.		Flanders		U.S.	
	Overweight (%)	Obesity (%)	Overweight (%)	Obesity (%)	Overweight (%)	Obesity (%)	Overweight (%)	Obesity (%)
18-24	12.4	2.8	24.8	14.4	11.6	1.2	24.6	25.0
25-34	34.8	5.7	41.9	19.0	20.5	5.1	30.9	33.1
35-44	44.0	9.1	43.8	28.8	22.3	7.6	32.2	34.4
45-54	49.0	12.9	45.3	31.4	33.3	13.0	31.3	39.8
55-64	55.3	17.9	41.4	37.1	39.8	18.9	32.3	42.0
65-74	58.1	16.4	44.5	27.6	49.6	15.8	32.3	38.7

¹ SPAH Study, 2002-2004 carried out by the Flemish Policy Research Centre Sport, Physical Activity and Health

² NHANES 2001-2002

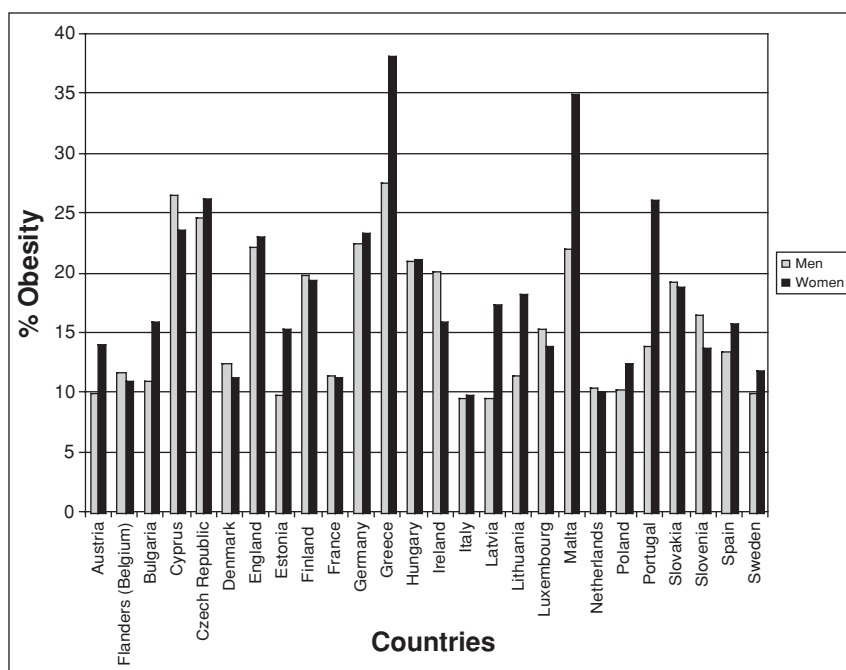
TABLE 5.
Distribution of mean waist circumference (WC) and prevalence of moderate¹
and high-risk² abdominal obesity (AO) by age category in Flemish men and women according to the SPAH Study 2002-2004

Age category (year)	Mean WC (SD)				Moderate risk AO				High risk AO	
	Men		Women		Men		Women		Men	Women
	n	(cm)	n	(cm)	(%)	(%)	(%)	(%)	(%)	(%)
18-24	218	78.3 (7.4)	175	70.2 (7.2)	3.7	2.9	0.9	2.3	0.9	2.3
25-34	349	85.4 (9.2)	334	74.9 (8.1)	9.5	15.9	4.9	7.8	4.9	7.8
35-44	661	89.7 (9.7)	624	76.6 (9.1)	20.6	19.2	10.0	10.4	10.0	10.4
45-54	564	92.1 (9.4)	576	80.1 (10.4)	25.7	24.8	14.7	20.0	14.7	20.0
55-64	547	95.0 (9.3)	442	83.6 (10.8)	34.6	28.5	21.6	32.4	21.6	32.4
65-74	357	96.8 (8.9)	231	85.7 (9.3)	36.7	35.5	26.3	38.5	26.3	38.5

¹ Moderate risk abdominal obesity: 94 cm ≤ in men < 102 cm and 80 cm ≤ in women < 88 cm

² High-risk abdominal obesity: in men ≥ 102 cm and in women ≥ 88 cm

Figure 1. The prevalence of obesity in Flanders (SPAH Study) compared to countries in the European Union. Based on data of the International Obesity Task Force (2005)



Discussion

The data collected by the Flemish Policy Research Centre Sport, Physical Activity and Health enabled an update of the overweight and obesity prevalence in the Flemish part of Belgium. This study is unique because the data can be considered as sufficiently representative for the Flemish adult population with respect to age, gender, geographic distribution and educational level and because they are based on objective height, weight and waist measurements.

Comparison between the SPAH Study and the HIS of 1997, 2001 and 2004 revealed no large differences regarding mean BMI among Flemish adults aged 18-75y. The overweight prevalence is higher in 2004 in almost all age groups and both genders. The obesity prevalence on the other hand shows no consistent trend. But these comparisons should be looked at with some caution because the SPAH Study is based on measured weight and height, unlike the HIS in which self-reported weight and height are used. There is some evidence that the prevalence of obesity based on self-reported weight and height is

underestimated because most individuals tend to underreport their true weight and overreport their height (10-14). Consequently, the real difference in obesity prevalences between the HIS and SPAH Study may be larger in some, and smaller in other age groups.

Stam-Moraga et al. (6), using data from the BIRNH Study (1979-1984), reported that the mean BMI of Flemish men and women, aged 25 to 74y, was 25.98 ± 3.48 and 26.30 ± 4.56 respectively (6). Striking in the BIRNH Study is that the mean BMI and the obesity prevalence were somewhat lower in men than women. This finding is in contrast with the results of the more recent HIS and SPAH Study. Furthermore, Stam-Moraga et al. (6) also reported national data of BMI by sex and similar age groups as in the SPAH Study. Compared to these results, the present BMI seems to be higher only in the two oldest groups of men. By contrast, the mean BMI among women was higher in the BIRNH Study compared with the SPAH Study in all age groups, except in the youngest women. These findings too must be approached with some caution because the BIRNH Study was carried out at national level, while the SPAH Study only took place in the Flemish part of Belgium. Between Flanders and Wallonia, the French-speaking region, differences in nutrition (32-33), coronary risk factors (34), and socio-economic status have been reported. In general, there is a more favourable situation in Flanders.

The WHO (28) reported that obesity affected an estimated 300 million people worldwide, and that more than one billion adults were overweight. The problem does not only affect industrialized countries. There is now a significant increase in overweight and obesity throughout the developing world, especially Asia and Latin America (35). The last 2 decades, the prevalence of obesity has reached epidemic proportions in the US (36). In the present study we compared the overweight and obesity prevalences in our sample of Flemish adults with the overweight and obesity rates in NHANES 2001-2002. The obesity prevalence among Flemish men is, dependent on the age group, 10 to 20% lower than among US men. Between Flemish and US women, the differences in obesity prevalence were even greater: the obesity prevalence in Flemish women was at least 20% lower in each age category.

Surveys in different European countries reported an increase in the prevalence of overweight and obesity during the last decades (37-41). The European Health Report (42) claimed that in many European countries more than half of the adult population is above the overweight threshold, with 10% to 30% of adults categorized as clinically obese. The available surveys showed a wide variation in the degree of obesity

throughout Europe. The International Obesity Task Force (43) provides an updated review of some of the best available estimates of overweight and obesity among adults in the European Union. Obesity rates range from 10% to 27% in men and up to 38% in women. In some countries, the obesity prevalence is higher in women, while in others higher obesity prevalence is observed in men. According to this review the highest obesity prevalences are observed in Southern and Eastern European countries: Greece, Cyprus, Malta and the Czech Republic. This comparison is indicative, but should be taken with some caution because of the discrepancies among the different surveys. Wherever possible the data used by IOTF are drawn from national and measured surveys, but in some cases (Estonia, France, Italy, Poland, Slovenia) the only data available are from self-reported surveys, which may underestimate the true prevalence. Furthermore, the sampling procedure and the methods used are not uniform in the different surveys. In addition, the year of the data collection and the age range of the different surveys may differ.

Keeping in mind these limitations, the situation in Flanders regarding the prevalence of overweight and obesity is considerable, but less problematic in comparison with the US and other European countries such as Greece, Cyprus, Germany, England, the Czech Republic, Slovakia and Finland.

Waist circumference is another criterion, proposed by Lean et al. (31) and later by WHO (28), to determine abdominal obesity. WC is a good predictor of cardiovascular disease (15-17), type 2 diabetes (21-22), the metabolic syndrome (18, 20) and all-cause mortality (19). WC is also relatively easy to measure and to understand. Until now, waist measurements in nationally representative studies are scarce. However, to confirm the original classification based on BMI, it is useful to also measure WC, as weight and height, during large scale population studies (23,24). In addition, this would help to better document the impact of the worldwide obesity epidemic.

The data collected in the SPAH Study enable us to give a unique overview of the distribution of mean WC and the prevalence of moderate and high-risk AO among Flemish adults. The mean WC increases with age in both sexes, and is significantly higher among Flemish men than among Flemish women. From age 55y on, more than one in four Flemish adults has an AO corresponding to a moderate risk level. From the age group 35-44y on, at least 10% of Flemish adults has a high risk AO.

The Scientific Institute of Public Health recently published the results of the Belgian National Food Consumption Survey 2004 (44), including

data of measured WC in Belgian individuals aged 15y and older. The mean WC was 94.0 cm in Belgian men and 85.4 cm in Belgian women. In the National Food Consumption Survey report men and women were not analysed separately and different age groups (15-18, 19-30, 31-59, 60-74, 75+) were used. Consequently, a statistical comparison with the present SPAH Study is difficult.

Comparison of WC data is not always possible because of variation in the WC measuring method among different studies. In the NHANES study (45,46), for instance, the WC is measured at the highest point of the iliac crest at minimal respiration, while in the SPAH Study it was measured at the natural waist midpoint between the lowest aspect of the rib cage and the highest point of the iliac crest. This indicates the need for standardization of waist measurements.

Waist and hip circumferences were measured in the SPAH Study in a similar way as in the MONICA survey (1987-1992), in which more than 32,000 men and women, aged 25-64y, from 19 populations in ten different European countries, China and Australia participated (47). Age-standardized mean WC differed between populations from 83-98 cm in men and from 78-91 cm in women. In the SPAH Study, the age-standardized mean WC is 90 cm in men and 79 cm in women. They are comparable to the mean WC in other European countries such as Italy, Sweden and Denmark. This comparison should also be approached with some caution because the MONICA survey was carried out more than 10 years ago, and because small discrepancies in anatomical measurement levels between the participating centres may have occurred.

The present study has some important strengths. The sample of the present study is population-based, covers a wide age range, and may be considered as sufficiently representative for age, gender, geographic distribution and educational level. In addition, all body measurements were executed by trained staff. Next to the presented strengths, some limitations should also be mentioned. One of the limitations is the low participant rate (28%). A low participant rate is nearly inevitable in epidemiological studies where the participants are invited to come to the test location themselves and to perform some tests. Such low participation is likely to induce some degree of selection bias. Sick individuals and people with an unhealthy lifestyle are more likely not to participate. Consequently, the actual overweight and obesity prevalence in Flanders will probably be even higher than the present results of the SPAH Study. The questionnaire sent to the non-participants had the intention to shed some light on this. The fact that no significant differences were found in

weight and BMI between the participant and the responding non-participant group can conceal possible differences between the responding non-participants and non-responding non-participants. Another limitation of this approach is that one must be cautious when comparing measured with self-reported height and weight. Notwithstanding these limitations, we believe that the present study adds relevant data concerning the present prevalence of overweight, obesity and abdominal obesity in Flemish adults.

Conclusion

Compared to other European countries and the US, the present obesity and overweight rates in the Flemish part of Belgium are considerable, but less problematic. Obesity remains an important health problem because of the large number of related diseases and high medical costs associated with it. It is therefore important to follow the development of obesity more closely. To allow comparisons between the different countries on a more reliable basis, it would be useful to initiate worldwide similar projects to assess the obesity prevalence. In particular, objective measurements of weight and height, and standardization of WC measurement are needed to achieve reliable comparisons. WC should be adopted universally in large-scale epidemiological surveys, since it can help to better estimate the impact of the obesity epidemic, considering its diagnostic value for obesity-related health problems. As to the Flanders situation, intervention studies should be undertaken by the Flemish Government in order to sensitize about the obesity problem and to induce behavioural changes among the Flemish population.

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Samenvatting

Doelstellingen: *Het weergeven van de prevalentie van overgewicht, obesitas en abdominale obesitas (AO) bij een steekproef van de Vlaamse volwassen populatie, volgens de metingen van het "Steunpunt Sport, Beweging en Gezondheid (SSBG, 2002-2004)". Het vergelijken van deze resultaten met de gegevens van Vlaamse volwassenen uit de "Belgische Gezondheidsenquête" van 1997, 2001 en 2004 en met de prevalentie van obesitas in Europa en in de Verenigde Staten (VS).*

Methodes: *Tussen 2002 en 2004 hebben 5170 subjecten uit een toevallige steekproef tussen 18 en 75 jaar deelgenomen aan deze studie. Naast andere kenmerken werden lichaamsgewicht, lichaamslengte en lendenomtrek gemeten door ervaren medewerkers.*

Resultaten: De huidige prevalentie van overgewicht in Vlaanderen is hoger bij mannen (41,4%) dan bij vrouwen (29,8%). Bij het vergelijken van de resultaten van het SSBG met die van de Belgische Gezondheidsenquête, blijkt de prevalentie van overgewicht toegenomen zowel bij mannen als bij vrouwen. De gewogen prevalentie van obesitas is 10,7% bij mannen en 10,2% bij vrouwen en bijgevolg lager dan in de VS en andere Europese landen. De prevalentie van AO neemt toe met de leeftijd: van 0,9% tot 26,3% bij mannen en van 2,3% tot 38,5% bij vrouwen.

Conclusie: De prevalentie van obesitas bij Vlaamse volwassenen is aanzienlijk, maar minder dramatisch dan in sommige andere Europese landen en de VS. Om tot betere vergelijkingen tussen landen te komen, zouden wereldwijd gelijkaardige projecten moeten opgestart worden om de prevalentie van obesitas na te gaan. Daartoe zijn een uniform gestandaardiseerde meting van lendenomtrek en objectieve metingen van lichaamslengte en lichaamsgewicht nodig.

Résumé

Objectifs: Signaler la prévalence du surpoids, de l'obésité et de l'obésité abdominale (OA) dans un échantillon de la population flamande, d'après les résultats du "Steunpunt Sport, Beweging en Gezondheid (SSBG, 2002-2004)". Comparer ces résultats avec les données de "l'Enquête Belge de la Santé" de 1997, 2001 et 2004 ainsi qu'avec la prévalence de l'obésité en Europe et aux Etats-Unis.

Méthodes: Entre 2002 et 2004, 5170 sujets âgés de 18 à 75 ans, issus d'un échantillon aléatoire ont participé à cette étude. Le poids, la taille et la circonférence abdominale ont été mesurés par des collaborateurs expérimentés.

Résultats: La prévalence actuelle du surpoids en Flandre est plus élevée chez les hommes (41.4%) que chez les femmes (29.8%). D'après la comparaison entre les résultats du SSBG et ceux de l'Enquête Belge de la Santé, la prévalence du surpoids a augmenté dans les 2 sexes. La prévalence de l'obésité en Flandre est de 10.7% chez les hommes et 10.2% chez les femmes, elle est donc moins élevée qu'aux Etats-Unis ou dans d'autres pays d'Europe. La prévalence de l'OA augmente avec l'âge: de 0.9% à 26.3% chez les hommes et de 2.3% à 38.5% chez les femmes.

Conclusion: La prévalence de l'obésité est importante en Flandre, mais moins dramatique que dans certains autres pays d'Europe et qu'aux Etats-Unis. Afin d'améliorer les comparaisons, il faudrait lancer mondialement des projets similaires pour surveiller l'évolution de l'obésité et dans cette optique, une mesure uniforme de la circonférence abdominale, ainsi que des mesures objectives du poids et de la taille s'avèrent nécessaires.

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