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Prevalence and determinants of weight misperception in an urban Swiss population

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Summary

AIM: Weight misperception precludes effective management of pre-obesity and obesity, but little is known regarding its status in the Swiss population. Our study aimed to assess the prevalence and determinants of weight over- and underestimation in an adult urban Swiss population.

METHODS: Cross-sectional study conducted between 2009 and 2012 in the city of Lausanne. Height and weight were measured using standardised procedures. Weight perception and other socio-demographic variables were collected through questionnaires.

RESULTS: Data from 4284 participants (2261 women, 57.5 ± 10.4 years) were analysed. Overall, almost one-fifth (18%) of participants underestimated their weight, while only 7% overestimated it. One quarter of women and half of men with overweight underestimated their weight; the corresponding values for obese subjects were 7% and 10%. Multivariate analysis showed male gender (odds ratio [OR] 3.09, 95% confidence interval [CI] 2.54–3.76), increasing age or body mass index (p-value for trend <0.001), being born in Portugal (OR 2.10, 95% CI 1.42–3.10), low education (OR 1.90, 95% CI 1.47–2.47), and absence of diagnosis of pre-obesity or obesity by the doctor (OR 5.61, 95% CI 4.51–7.00) to be associated with weight underestimation. Overestimation was significantly higher in women (19.6%) than in men (8.5%). Weight overestimation was negatively associated with male gender (OR 0.29, 95% CI 0.22–0.39), increasing age (p-value for trend <0.001), being born in Portugal (OR 0.37, 95% CI 0.16–0.87) and positively associated with absence of diagnosis (OR 3.11, 95% CI 2.23–4.34).

CONCLUSION: Almost one quarter of the Swiss population aged 40 to 80 has weight misperception, underestimation being over twice as frequent as overestimation. Adequate diagnosis of overweight or obesity might be the best deterrent against weight misperception.

Key words: weight perception; body mass index; epidemiology; diagnosis; Switzerland

Introduction

Prevalence of pre-obesity and obesity is increasing worldwide [1, 2]. Several studies have suggested that weight perception is a stronger determinant in motivation to lose weight than objectively measured body mass index (BMI) [3, 4]. Still, recent US and Asian studies showed that over 40% of the population has weight misperception, i.e. over- or underestimating his/her true weight status [4, 5].

Several factors have been associated with weight misperception. Women tend to overestimate while men underestimate their weight [5, 7–9]. In the USA, African-Americans and Hispanics underestimate their weight more frequently than whites [7]. Low educational and socioeconomic levels also predispose to weight misperception [5, 8], whereas marital status does not [6]. Finally, subjects aged over 70 tend to underestimate their weight more frequently than younger subjects [10]. Still, most findings come from studies conducted in Asia [6] and North America [10, 11] and less information is available regarding adult Europeans [12, 13].

In 2012, one out of six Swiss adults was found to be obese (18% men, 16% women) and two out of five are pre-obese (48% men, 31% women), although these figures might be even higher [14–16]. Assessing the prevalence of weight misperception in the Swiss population is important, as a high misperception rate (i.e. underestimation) will probably reduce the effectiveness of public health policies to prevent pre-obesity and obesity [3, 4]. Only one study has assessed weight misperception among Swiss adolescents [15] and no data are available regarding the adult population.

Thus, our study aimed to estimate the prevalence and the determinants of weight misperception (over- and underestimation) in an adult, population-based sample collected in Switzerland.

Materials and methods

Participants

The CoLaus study is a population-based, prospective study assessing the clinical, biological and genetic determinants of cardiovascular disease in the city of Lausanne, Switzer-

land. Details of the sampling procedure have been published previously [18]. Baseline data were collected in 2003–2006 and the first follow-up was conducted between April 2009 and September 2012 in 5064 participants.

Data collected
All data were from the first follow-up of the CoLaus study. Participants attended a single visit which included an interview and a physical examination.

Body weight and height were measured with participants standing without shoes in light indoor clothes. Body weight was measured in kilograms to the nearest 100 g using a Seca® scale, which was calibrated regularly. Height was measured to the nearest 5 mm using a Seca® height gauge. BMI was defined as weight (kg)/ height (m)^2. Pre-obesity was defined as BMI $\geq$25 and <30 kg/m^2, and obesity as BMI $\geq$30 kg/m^2.

Awareness of excess weight was defined as a positive answer to the question "Has the doctor ever told you that you were overweight?" Participants could choose between "too thin", "adequate weight" or "too fat" when answering the question "Currently, how do you consider your weight?" The questions on weight and body image were answered before physical examination, in order not to influence the participants. Weight underestimation was considered to exist when a participant with normal weight answered "too thin" or when a participant with pre-obesity or obesity answered "adequate weight" or "too thin"; weight overestimation was considered to exist when a participant with normal weight answered "too fat". Weight misperception was defined as weight under- or overestimation.

Educational level, country of birth, marital status and smoking status were collected by questionnaire. Educational level was defined as high (university degree), middle (secondary school) and low (compulsory education or apprenticeship). Country of birth was separated in six categories: Switzerland, France, Italy, Portugal, Spain and other (>20 countries altogether); categorisation was performed in order to have a minimum of approximately 150 participants in each category. Marital status was defined as living alone (single, divorced or widowed) and living as a couple (married or not). Smoking status was defined as never, former (irrespective of the time since quitting) and current. The questionnaire can be provided upon written request to the principal investigator. Consult www.colaus.ch for more information.

Exclusion criteria
Participants were excluded if they had no data for BMI or any other variable necessary for the analysis.

Data analysis
Statistical analyses were performed using Stata version 13.1 for Windows (Stata Corp, College Station, Texas, USA). Descriptive results were expressed as number of participants (percentage) or as mean ± standard deviation. Bivariate analyses were performed using chi-square or Fishers exact test for categorical variables and one-way analysis of variance for continuous variables. Multivariable analyses were performed using logistic regression separately for each condition (under and overestimation) and

results were expressed as odds ratios and 95% confidence interval (CI). Statistical significance was considered for a two-sided test p <0.05.

Ethical statement
The study was approved by the Institutional Ethics Committee of the University of Lausanne and all participants provided written informed consent.

Results

Exclusions and characteristics of the retained sample
Of the initial 5064 participants with follow-up, 278 (5.5%) and 502 (9.9%), respectively, were excluded owing to missing data or to unintentional weight loss during the last 12 months, leaving 4786 (94.5%) participants for analysis. As only 1.3% of the sample presented with underweight (BMI <18.5 kg/m^2), it was not possible to analyse them as a separate category and they were included in the normal BMI group. The characteristics of the included and the excluded participants are summarized in table 1. Excluded participants were more frequently women, were older, lived more frequently alone, had a lower BMI and were more frequently of low educational status. Excluded subjects also reported lower frequency of having been diagnosed with pre-obesity or obesity.

Prevalence and determinants of weight misperception
Overall, one out of four participants (25%) had weight misperception: one-fifth (18%) underestimated their weight, while only 7% overestimated it. The distribution of weight under- and overestimation according to gender and BMI category is summarised in table 2. One out of five women with normal BMI considered her weight as excessive (9% for men), while one quarter of women and half of men with pre-obesity considered themselves as having an adequate weight.

Bivariate analysis showed that male gender, older age, being overweight, living as a couple, low educational level and being born outside Switzerland were associated with higher rates of weight underestimation and with lower rates of weight overestimation (table 3). Interestingly, having been diagnosed with excess weight was associated with lower rates of weight under- and over-estimation (table 3). Multivariate analysis using adequate weight estimation as the reference category showed male gender, older age, higher BMI, being born in Portugal, low education and absence of diagnosis of pre-obesity or obesity by the doctor to be positively associated with weight underestimation (table 4). Similarly, male gender, older age and being born in Portugal were negatively associated with weight overestimation, while absence of diagnosis of pre-obesity or obesity by the doctor was positively associated with weight overestimation (table 4).

Discussion

Overestimation of one's weight and adequate estimation by the overweight may be strong motivations to lose weight [3, 4]. In this study, one quarter of the Swiss population

aged 40 to 80 years had weight misperception; almost one-fifth of the sample underestimated their weight, while only 7% overestimated it. Importantly, the relatively high prevalence of weight underestimation among overweight subjects suggests that a significant part of the Swiss population with overweight will not be receptive to preventive measures directed against excess weight.

Factors associated with weight misperception

Men underestimated their weight more frequently, while women overestimated it, a finding in agreement with the

Table 1: Characteristics of participants included and excluded from the analysis.			
	Included	Excluded	p-value
Sample size (%)	4786 (94.5)	278 (5.5)	
Gender (%)			0.098
Women	2545 (53.2)	162 (58.3)	
Men	2241 (46.8)	116 (41.7)	
Age (years)	57.7 ± 10.5	59.7 ± 11.6	0.002
Age group (%)			0.001
40 to <50	1363 (28.5)	68 (24.5)	
50 to <60	1466 (30.6)	76 (27.3)	
60 to <70	1280 (26.7)	71 (25.5)	
>70	677 (14.2)	63 (22.7)	
BMI (kg/m^2)	26.2 ± 4.6	27.1 ± 4.1	0.002
BMI status (%)			<0.001
Normal weight	2117 (44.2)	63 (29.6)	
Pre-obesity	1857 (38.8)	103 (48.4)	
Obesity	812 (17.0)	47 (22.1)	
Country of birth (%)			0.106
Switzerland	3028 (63.3)	156 (56.1)	
France	302 (6.3)	16 (5.8)	
Italy	257 (5.4)	21 (7.6)	
Spain	166 (3.5)	12 (4.3)	
Portugal	240 (5.0)	13 (4.7)	
Other	793 (16.6)	60 (21.6)	
Marital status (%)			<0.001
Alone	2043 (42.7)	159 (57.2)	
Couple	2743 (57.3)	119 (42.8)	
Education (%)			0.012
High	1040 (21.7)	39 (14.3)	
Middle	1233 (25.8)	73 (26.7)	
Low	2513 (52.5)	161 (59.0)	
Smoking status (%)			0.320
Never	1935 (40.4)	100 (45.3)	
Former	1809 (37.8)	74 (33.5)	
Current	1042 (21.8)	47 (21.3)	
Diagnosis of overweight/obesity (%)			0.633
Yes	1508 (31.5)	32 (29.4)	
No	3278 (68.5)	77 (70.6)	

BMI = body mass index
Results are expressed as number of participants (column percentage) or as average ± standard deviation. Statistical analysis with chi-square for categorical variables or by Student's t-test for continuous variables.

Table 2: Distribution of weight under- or overestimation according to gender and body mass index category, CoLaus study, Lausanne, Switzerland, 2009–2012.			
	Currently, how do you consider your weight?		
	Too thin	Adequate	Too fat
Normal weight			
Women (n = 1370)	40 (2.9)	1068 (78.0)	262 (19.1)
Men (n = 747)	40 (5.4)	645 (86.4)	62 (8.3)
Pre-obese			
Women (n = 777)	0 (0)	205 (26.4)	572 (73.6)
Men (n = 1080)	1 (0.1)	561 (51.9)	518 (48.0)
Obese			
Women (n = 398)		27 (6.8)	371 (93.2)
Men (n = 414)		38 (9.2)	376 (90.8)

Results are expressed as number of participants and (row percentage). Pre-obesity was defined as 25≤ BMI <30 kg/m^2 and obesity as BMI ≥30 kg/m^2. Table cells corresponding to weight misperception are in grey background.

literature [5, 6]. Possible explanations include the fact that men associate high weight with professional and social achievement, or wrongly perceive excess weight as increased muscular mass. Conversely, women might be more influenced by social pressure, advertising and fashion dictates [19, 20], making them more critical towards their weight and appearance and leading to inadequate dietary behaviours [21].

Older age and low educational level were positively associated with a higher likelihood of weight underestimation, a finding also in agreement with the literature [5–7]. The fact that less educated people tend to underestimate their weight more frequently is worrisome because this part of the population tends to be less receptive to preventive messages [24]. Conversely, and contrary to some studies [5, 25], no significant association was found between marital status and weight misperception.

Participants born in Portugal had a higher likelihood of underestimating their weight. The same finding was observed to a lesser extent for participants born in Spain and Italy. This finding is comparable to studies conducted in the USA, where Hispanic and black people have been shown

to underestimate their weight more frequently [26, 27]. A possible explanation is that participants born in Portugal, a country with a higher prevalence of pre-obesity and obesity than Switzerland [2, 28] consider pre-obesity as being the "norm" and thus underrate their weight status [29, 30]. Another explanation is that migrants tend to cluster and live together, as it has been shown that cultural groups and social networks influence body image and might act as barriers to dietary changes [31, 32].

Not being diagnosed with pre-obesity or obesity (by a doctor) was associated with a very high likelihood of weight misperception, both under- and overestimation. Our results suggest that weight misperception could be efficiently counteracted by simple measures such as weight measurement and management at the medical office. Still, many primary care physicians feel uncomfortable in counselling patients with weight problems [33] and consider weight management as difficult to prescribe, unrewarding and even conflicting [34–36]. Similarly, pre-obese and obese subjects willing to lose weight face difficulties finding professionals able to help them [37]. Pre- and postgraduate

Table 3: Bivariate analysis of factors associated with weight under- or overestimation, CoLaus study, Lausanne, Switzerland, 2009–2012.

	Underestimation	Adequate	Overestimation	p-value
Sample size	912	3550	324	
Gender				<0.001
Women	272 (29.8)	2011 (56.7)	262 (80.9)	
Men	640 (70.2)	1539 (43.3)	62 (19.1)	
Age (years)	60.5 ± 11.1	57.3 ± 10.3	53.4 ± 8.7	<0.001
Age group (%)				<0.001
40 to <50	200 (21.9)	1029 (29.0)	134 (41.4)	
50 to <60	239 (26.2)	1116 (31.4)	111 (34.2)	
60 to <70	268 (29.4)	946 (26.7)	66 (20.4)	
>70	205 (22.5)	459 (12.9)	13 (4.0)	
BMI (kg/m^2)	26.4 ± 2.8	26.3 ± 5.1	23.6 ± 1.2	<0.001
BMI status (%)				<0.001
Normal weight	80 (8.8)	1713 (48.3)	324 (100)	
Pre-obesity	767 (84.1)	1090 (30.7)		
Obesity	65 (7.1)	747 (21.0)		
Country of birth (%)				<0.001
Switzerland	536 (58.8)	2274 (64.1)	218 (67.3)	
France	42 (4.6)	228 (6.4)	32 (9.9)	
Italy	70 (7.7)	178 (5.0)	9 (2.8)	
Spain	44 (4.8)	111 (3.1)	11 (3.4)	
Portugal	71 (7.8)	163 (4.6)	6 (1.9)	
Other	149 (16.3)	596 (16.8)	48 (14.8)	
Marital status (%)				<0.001
Alone	324 (35.5)	1566 (44.1)	153 (47.2)	
Couple	588 (64.5)	1984 (55.9)	171 (52.8)	
Education (%)				<0.001
High	143 (15.7)	788 (22.2)	109 (33.6)	
Middle	195 (21.4)	943 (26.6)	95 (29.3)	
Low	574 (62.9)	1819 (51.2)	120 (37.1)	
Smoking status (%)				0.042
Never	352 (38.6)	1439 (40.5)	144 (44.5)	
Former	334 (36.6)	1368 (38.5)	107 (33.0)	
Current	226 (24.8)	743 (21.0)	73 (22.5)	
Overweight diagnosis (%)				<0.001
Yes	163 (17.9)	1302 (36.7)	43 (13.3)	
No	749 (82.1)	2248 (63.3)	281 (86.7)	

BMI = body mass index; NA = not assessable
Results are expressed as number of participants (column percentage) or as average ± standard deviation. Statistical analysis with chi-square or analysis of variance.

training in diagnosis and management of weight issues might be a solution [38].

Implications for clinical practice and public health

Overestimation of one's weight and adequate estimation by the overweight may be strong motivations to lose weight [3, 4]. The fact that a one quarter of pre-obese women and half of pre-obese men (and one out of fourteen obese people) underestimate their weight is worrying, as it suggests that preventive measures aimed at stabilising or reducing overweight and obesity will not be efficient in a sizable part of the target population. The fact that migrants and low educated people are more prone to misestimate their weight further complicates prevention, as these groups tend to be less sensitive to preventive measures.

Interestingly, not being diagnosed with pre-obesity or obesity was strongly associated with a higher likelihood of weight misperception. This finding suggests that weight assessment and management at the medical office could be an effective, cheap and easily achievable preventive measure against obesity. Still, better training and stronger sensitisa-

tion to integrate weight management in their routine daily practice are necessary if general practitioners want to engage in a global effort to curb obesity.

Study limitations

This study has some limitations. Firstly, it was conducted in a sample of volunteers, and it has been shown that people who participate in health surveys tend to be more health conscious than nonparticipants [39], although this statement has been challenged [40]. Thus, the weight misperception rates reported might be underestimated. Still, it would be unethical to include unwilling people in our study, and the reported prevalence rates can be considered as conservative. Secondly, weight perception is a subjective and multidimensional concept of body representation, not well defined in the literature. Comparison with referential silhouette models would partly solve this issue [12], but such an instrument was not available in this study; a semi-structured interview would have been more sensitive, but difficult to realise in a large cohort. Still, other studies have used a similar setting to assess weight misperception [41].

Table 4: Multivariate analysis of the factors associated with weight under- or overestimation, CoLaus study, Lausanne, Switzerland, 2009–2012.

	Underestimation	Overestimation
Gender		
Women	1 (ref.)	1 (ref.)
Men	**3.09 (2.54–3.76)**	**0.29 (0.22–0.39)**
Age group		
40 to <50	1 (ref.)	1 (ref.)
50 to <60	1.16 (0.90–1.49)	0.79 (0.60–1.04)
60 to <70	**1.95 (1.50– 2.53)**	**0.52 (0.38–0.71)**
>70	**3.08 (2.29– 4.13)**	**0.23 (0.13–0.41)**
p-value for trend	<0.001	<0.001
BMI status		
Normal weight	1 (ref.)	–
Pre-obesity	**22.4 (17.3–29.0)**	NA
Obesity	**5.27 (3.58–7.75)**	NA
Country of birth		
Switzerland	1 (ref.)	1 (ref.)
France	0.77 (0.51–1.17)	1.20 (0.79–1.82)
Italy	1.34 (0.92–1.94)	0.74 (0.37–1.49)
Spain	1.47 (0.93–2.31)	1.20 (0.62–2.32)
Portugal	**2.10 (1.42–3.10)**	**0.37 (0.16–0.87)**
Other	**1.46 (1.13–1.89)**	**0.62 (0.44–0.87)**
Marital status		
Alone	1 (ref.)	1 (ref.)
Couple	1.04 (0.86–1.26)	0.99 (0.78–1.25)
Education		
High	1 (ref.)	1 (ref.)
Middle	1.27 (0.95–1.69)	**0.69 (0.51–0.93)**
Low	**1.90 (1.47–2.47)**	**0.51 (0.38–0.69)**
p-value for trend	<0.001	<0.001
Smoking status		
Never	1 (ref.)	1 (ref.)
Former	0.75 (0.61–0.92)	0.91 (0.69–1.19)
Current	**1.33 (1.04–1.69)**	0.95 (0.69–1.29)
p-value for trend	0.021	0.730
Overweight diagnosis		
Yes	1 (ref.)	1 (ref.)
No	**5.61 (4.51–7.00)**	**3.11 (2.23–4.34)**

BMI = body mass index; NA = not assessable

Results are expressed as multivariate-adjusted odds ratio and (95% confidence interval). Statistical analysis conducted using logistic regression separately for each condition (under or overestimation) adjusting for all variables in the table. Significant (p <0.05) odds ratios are indicated in bold.

Conclusion

Almost one quarter of the Swiss population aged 40 to 80 years has a weight misperception, underestimation being more than twice as frequent as overestimation. Adequate diagnosis of pre-obesity or obesity might be the best deterrent against weight misperception.

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