



Prevalence of overweight, obesity, underweight and normal weight in French youth from 2009 to 2013

Jeremy Vanhelst, Jean-Benoit Baudelet, Paul S. Fardy, Laurent Beghin,
Jacques Mikulovic, Zekya Ulmer

► To cite this version:

Jeremy Vanhelst, Jean-Benoit Baudelet, Paul S. Fardy, Laurent Beghin, Jacques Mikulovic, et al..
Prevalence of overweight, obesity, underweight and normal weight in French youth from 2009 to 2013.
Public Health Nutrition, 2017, 20 (6), pp.959-964. 10.1017/S1368980016003244 . hal-02177261v3

HAL Id: hal-02177261

<https://hal.univ-lille.fr/hal-02177261v3>

Submitted on 28 May 2021

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Prevalence of overweight, obesity, underweight and normal weight in French youth from 2009 to 2013

Jérémy Vanhelst, Jean-Benoît Baudelet, Paul S Fardy, Laurent Béghin, Jacques Mikulovic, Zékya Ulmers

ABSTRACT

Objectives: To determine the prevalence of underweight, overweight and obesity in French youth from 2009 to 2013 and to determine if there are differences in weight categories according to socioeconomic status.

Design: Cross-sectional study performed in different regions of France. Physical measures included weight, height and body mass index. Underweight, overweight and obesity were defined according to age- and gender-specific BMI cut-off points from the International Obesity Taskforce.

Setting: France

Subjects: 9 670 children and adolescents (4836 Boys, 4834 girls) from in the French national BOUGE program between 2009 and 2013.

Results: The prevalence of obesity was higher in boys than girls ($p < 0.05$). In contrast, underweight was more prevalent in girls ($p < 0.05$). Although there were no significant changes in overweight or underweight boys or girls from 2009 to 2013, there was a significant increase in obesity in boys and girls ($p < 0.05$) during the same time period. The prevalence of underweight increased in girls from 12 to 16.7% ($p > 0.05$) and remained unchanged in boys (7.1%-7.3%) between 2009 and 2013. Overweight and obesity were higher in low socioeconomic families ($p < 0.0001$).

Conclusions: Findings suggest that prevalence of overweight was stable although high in French children and adolescents while the prevalence of obesity increased significantly. Changes in underweight, although not significant, were high in girls and merit further attention. Improving public health interventions, especially in high-risk low socio-economic populations, may help to modify the behavior that contributes to underweight, overweight and obesity in young boys and girls.

Keywords: prevalence; obesity; underweight, youth, public health

1 Introduction

2 Overweight and obesity are associated with increased body fat, a consequence of positive
3 energy balance over a prolonged period of time, i.e. energy intake exceeds energy expenditure⁽¹⁾.
4 Recent studies suggest that the prevalence of overweight and obesity is high, although stable, in
5 children and adolescents ⁽²⁻⁴⁾. The prevalence of underweight, however, is high and continues to
6 increase⁽⁵⁻⁷⁾. Overweight and obesity in youth are associated with type 2 diabetes, metabolic
7 syndrome, poor quality of life, lower physical fitness and self esteem, and, in later life, with
8 increased risk of coronary heart disease and cancer⁽⁸⁻¹¹⁾. Underweight in children and adolescents is
9 associated with a poor quality of life, lower physical fitness, amenorrhea, decreased bone mineral
10 content, negative body image and fatigue, and, in later life, increased mortality⁽¹²⁻¹⁶⁾.

11 Monitoring underweight, overweight and obesity in children and adolescents is essential for
12 accurate tracking and to evaluate effectiveness of public health recommendations and intervention
13 programs. Studies of French children and adolescents found that overweight and obesity were stable
14 between 1996 and 2006, although data were limited to Central and Western France⁽¹⁷⁾. To our
15 knowledge, obesity and overweight have not been updated in France since 2009. Furthermore, few
16 data are available on the prevalence of underweight in French children and adolescents⁽¹⁸⁾. Previous
17 studies reported a prevalence of underweight of 7% and 15% in French boys and girls, respectively,
18 in 2006⁽¹⁸⁾.

19 The purpose of the present study was to measure the prevalence of underweight, overweight
20 and obesity in French children and adolescents from 2009 to 2013, to compare test scores with
21 findings prior to 2009 and to measure differences in weight categories according to socioeconomic
22 status.

23

24 Methods

25 *Study design*

26 Data for the study are from the French health promotion campaign “Move, a priority for your
27 health” (<http://www.bougetasante.fr/>), the BOUGE Program. The objectives of BOUGE were: 1) to
28 assess physical fitness of children and adolescents, and, 2) to promote the benefits of physical
29 activity and physical fitness on the health of youth, ages 9 to 16 years in French schools
30 (<http://www.bougetasante.fr/>). The program was developed by a French health care organisation
31 (Fédération Nationale Mutualité Française; <http://www.mutualite.fr>) and the National School Sport
32 Union (Union Nationale du Sport Scolaire; unss.org) and consisted of two days during the school
33 year; one day to assess physical fitness (including anthropometric characteristics) and the second
34 day to promote the health benefits of physical activity. Children and adolescents participating in the
35 BOUGE Program were assessed only one time during the study. Each year a different group of

students was measured. The study was approved by the Research Ethical Committee (CPP Nord-Ouest IV, Lille, France). All procedures were performed in accordance with the Helsinki Declaration of 1975 as revised in 2008, and the European Good Clinical Practices. As the study did not involve an intervention and data were collected retrospectively by the study organizational structure (<http://www.mutualite.fr/>), the study was approved by a Research Ethical Committee (CPP Nord-Ouest IV, Lille, France) as an epidemiological study. In this context, written informed consent was not required according to French human research regulations. Data collection was approved by the French National Commission of the Informatics Personal Data (Commission Nationale Informatique et Liberté).

A manual of operations was developed for teachers and participants in order to standardize test procedures (http://eps-bergpfad.fr/Sante_Bouge_Sommaire.html). Included in the manual were: rationale of the study, test procedures, and how data were collected. Teachers recorded test results into an electronic data system provided by the trial sponsor. An audit of the complete data set was performed and the aberrant data were excluded.

Data were collected in 16 regions of France in 101 schools. All schools in France were invited to participate in the study. Each school director decided whether or not to participate. If the school agreed to participate, the students, between 9 and 16 years were invited to participate. In total, 12082 adolescents, 6107 girls and 5975 boys volunteered to participate. Of this number, 9 670 were included in the present study. Two thousand four hundred twelve were excluded because of missing or incomplete.

Measurements

Anthropometric Measures

Weight and height, respectively, were measured in shorts and T-shirts without shoes to the nearest 0.1 kg using an electronic scale and the nearest 0.1 cm using a standard physician's scale in a private room. Body mass index (BMI), a valid estimate of body fatness in children and adolescents⁽²⁰⁾, was calculated from weight (kg) divided by height (m²). Underweight, overweight and obese was assessed using international age- and gender-specific cut-off points⁽²¹⁻²²⁾.

Socioeconomic status (SES)

The Human Development Index (HDI), developed by the United Nations Development Program (<http://hdr.undp.org/en>), was used to assess SES of the family living in a city. The HDI considers the following factors: (i) a long and healthy life: life expectancy at birth; (ii) education index: mean years of schooling and expected years of schooling; and (iii) standard of living: gross income per capita. A city scores higher HDI when the life expectancy at birth is longer, the

education period is longer, and the income per capita is higher. The HDI score was collected using zip code of the school (www.insee.fr).

Statistical analysis

Data are presented as percentages for qualitative and mean \pm standard deviation (SD) for quantitative variables. Normality of distribution was checked graphically and by using the Shapiro–Wilk test.

Comparisons of underweight, overweight and obesity between boys and girls were assessed by Chi square. Changes in underweight, overweight and obesity from 2009 to 2013 were assessed using the Cochran-Armitage trend test. Analysis of variance (ANOVA) was used to compare SES among different BMI categories (underweight, overweight and obesity).

All statistical tests were performed at the 2-tailed α level of 0.05. Data were analyzed using the Statistical Package for the Social Sciences, Windows 22 (SPSS Inc., Chicago, IL, USA), Excel 2010 (Microsoft Inc., Redmond, WA, USA).

Results

Mean heights, weights, BMIs and prevalence rates of underweight, overweight and obesity by age and gender are presented in Table 1. Obesity was significantly greater in boys compared to girls ($p < 0.05$), although there were no significant differences between boys and girls in the prevalence of overweight (Table 1). The prevalence of underweight was higher in girls compared to boys ($p < 0.01$).

Prevalence rates from 2009 to 2013, gender-specific and combined boys and girls, are presented in Table 2. Obesity increased significantly in boys and girls. There were no significant changes in overweight or underweight. While not significant, prevalence of underweight girls increased from 12% in 2009 to 16.7% in 2013. The prevalence of underweight boys remained the same, 7.1% in 2009 and 7.3% in 2013.

Prevalence rates of underweight, overweight and obesity according to SES are presented in Table 3. Socioeconomic status was significantly lower in underweight, overweight and obese boys and girls compared to youth of normal weight ($p < 0.003$). During the course of the study, prevalence of overweight and obesity in boys was higher in low and middle SES compared to high SES ($p < 0.001$). In girls, the prevalence of underweight, overweight and obesity was higher in low and middle SES compared to high SES ($p < 0.001$).

Discussion

Short- and long-term health outcomes associated with underweight, overweight and obesity in children and adolescents are important issues influencing public health policy^(16, 23). Therefore, regular monitoring of body mass index is recommended to track data and to assess effectiveness of intervention programs⁽²⁴⁾. To date, such tracking of children and adolescents in France has been inconsistent^(17-18, 25).

By applying recommended international standards, results of the present study suggest that combined overweight and obesity did not change significantly in boys and girls between 2009 and 2013, although the prevalence was higher compared to data published previously, 21.5% in 2012 v. 15.4% in 2004⁽¹⁷⁾. Differences might be attributed to sampling error because previous data were collected in a specific part of France, i.e. only from two administrative regions ⁽¹⁷⁾ while the present study included most of the country, i.e. 16 of 22 administrative regions. Separating obesity from overweight, our findings showed a significant increase in obese children and adolescents in both boys and girls.

Data from the present study also suggest that the prevalence of overweight and obesity is higher in children and adolescents with low socioeconomic status. These findings are in agreement with previous studies in France^(17, 25), Europe⁽²⁶⁻²⁸⁾ and the United States⁽²⁹⁾. Similarly, our data show that low socioeconomic status is also associated with underweight children and adolescents. Interestingly, the phenomenon of overweight and obesity may coexist with underweight in the same population ⁽³⁰⁾.

Low body fat and lean mass, typical of underweight children and adolescents, is associated with poor quality of life, lower physical fitness, amenorrhea, decreased bone mineral content, negative body image and fatigue⁽¹²⁻¹⁵⁾, and increased mortality as adults when compared with adolescents and children of normal weight⁽¹⁶⁾. Our findings show that the prevalence of underweight French girls increased 39% between 2009 and 2013, from 12 to 16.7%, although the change was not significant. This result may be due to the analysis strategy. Using the Cochran-Armitage trend test, we examined linearity changes and not the differences between each year. Nevertheless, the high prevalence of underweight in young girls suggests a need for health intervention to address this problem. Increased prevalence of underweight from 2009 to 2013 might also be the result of increased numbers of children and adolescents who arrived from other countries and entered into the French school system, especially from Africa. For a variety of reasons the anthropometric measures of these children and adolescents may differ from European children. However, according to regulatory rules in clinical research, we cannot collect any information about the ethnic diversity.

One of the strengths of the present study was the large sample size representing most of France. The large sample size provided investigators an opportunity to assess underweight, overweight and obesity according to age, gender and socioeconomic status. Standardized testing and data collection

1 was another strength. A potential weakness is that subjects volunteered and were not selected at
2 random. Even if we collected data on a large sample in many administrative regions (16 out of 22
3 regions), this study did not use a stratified sample design. Therefore, we cannot establish that this
4 cohort is fully representative of French children and adolescents. The severe economic down turn in
5 France, between 2009 to 2013, could have had an impact on our findings as a consequence of
6 changes in living habits at another time point. As a consequence the authors recommend studies that
7 incorporate random subject selection.

8 In summary, data from the present study suggest that obesity increased in French youth
9 between 2009 and 2013, and occurred more frequently in boys and girls of low socioeconomic
10 status. The prevalence of overweight was high but did not change over the course of the study. Our
11 results also indicate that underweight increased substantially in girls. Although the differences were
12 not significant, they warrant careful monitoring. Based on the study findings, the authors support
13 public health initiatives in French children and adolescents to prevent and to treat unhealthy weight
14 issues in this population.

References

1. Ogden CL, Yanovski SZ, Carroll MD *et al.* (2007) The epidemiology of obesity. *Gastroenterology* **132**, 2087–2102.
2. Olds T, Maher C, Zumin S *et al.* (2011) Evidence that the prevalence of childhood overweight is plateauing: data from nine countries. *Int J Pediatr Obes* **6**, 342–360.
3. Schmidt Morgen C, Rokholm B, Sjöberg Brixval C *et al.* (2013) Trends in prevalence of overweight and obesity in danish infants, children and adolescents--are we still on a plateau? *PLoS One* **24**, e69860.
4. Castetbon K. (2015) Recent prevalence of child and adolescent overweight and obesity in France and abroad. *Arch Pediatr* **22**, 111–5.
5. Martin K, Rosenberg M, Pratt IS *et al.* (2014) Prevalence of overweight, obesity and underweight in Western Australian school-aged children; 2008 compared with 2003. *Public Health Nutr* **17**, 2687–2691.
6. Martinez-Vizcaino V, Sanchez Lopez M, Moya Martinez P *et al.* (2008) Trends in excess weight and thinness among Spanish schoolchildren in the period 1992–2004: the Cuenca study. *Public Health Nutr* **27**, 1–4
7. Wang Y, Monteiro C, Popkin BM. (2002) Trends of obesity and underweight in older children and adolescents in the United States, Brazil, China, and Russia. *Am J Clin Nutr* **75**, 971–977.
8. Reilly JJ, Methven E, McDowell ZC *et al.* (2003) Health consequences of obesity. *Arch Dis Child* **88**, 748–752.
9. Ringbäck Weitof G, Eliasson M, Rosén M. (2008) Underweight, overweight and obesity as risk factors for mortality and hospitalization. *Scand J Public Health* **36**, 169–176.
10. Jee SH, Sull JW, Park J *et al.* (2006) Body-mass index and mortality in Korean men and women. *N Engl J Med* **355**, 779–787.

11. Klenk J, Nagel G, Ulmer H *et al.* (2009) Body mass index and mortality: results of a cohort of 184,697 adults in Austria. *Eur J Epidemiol* **24**, 83–91.
12. Stokic E, Srdic B, Barak O. (2005) Body mass index, body fat mass and the occurrence of amenorrhea in ballet dancers. *Gynecol Endocrinol* **20**, 195–199.
13. Vicente-Rodriguez G, Urzanqui A, Mesana MI *et al.* (2008) Physical fitness effect on bone mass is mediated by the independent association between lean mass and bone mass through adolescence: a cross-sectional study. *J Bone Miner Metab* **26**, 288–294.
14. Sato H, Nakamura N, Sasaki N. (2008) Effects of bodyweight on health-related quality of life in school-aged children and adolescents. *Pediatr Int* **50**, 552-556.
15. Mak KK, Ho SY, Lo WS *et al.* (2010) Health-related physical fitness and weight status in Hong Kong adolescents. *BMC Public Health* **23**, 88.
16. Flegal KM, Graubard BI, Williamson DF *et al.* (2007) Cause-specific excess deaths associated with underweight, overweight, and obesity. *JAMA* **298**, 2028-37.
17. Péneau S, Salanave B, Maillard-Teyssier L *et al.* (2009) Prevalence of overweight in 6- to 15-year-old children in central/western France from 1996 to 2006: trends toward stabilization. *Int J Obes (Lond)* **33**, 401-407.
18. Lazzeri G, Rossi S, Kelly C *et al.* (2014) Trends in thinness prevalence among adolescents in ten European countries and the USA (1998-2006): a cross-sectional survey. *Public Health Nutr* **17**, 2207-2215.
19. Vanhelst J, Fardy PS, Chapelot D *et al.* (2015). Physical fitness levels of adolescents in the Ile de France region: comparisons with European standards and relevance for future cardiovascular risk. *Clin Physiol Funct Imaging* Jun 19.

20. Pietrobelli A, Faith MS, Allison DB *et al.* (1998) Body mass index as a measure of adiposity among children and adolescents: a validation study. *J Pediatr* **132**, 204–210.
21. Cole TJ, Bellizzi MC, Flegal KM *et al.* (2000) Establishing a standard definition for child overweight and obesity worldwide: international survey. *BMJ* **320**, 1240-1243.
22. Cole TJ, Flegal KM, Nicholls D *et al.* (2007) Body Mass Index Cut Offs to Define Thinness in Children and Adolescents: International Survey. *BMJ* **335**, 194
23. Lobstein T, Baur L, Uauy R. (2004) Obesity in children and young people: a crisis in public health. *Obes Rev* **5**, 4–104.
24. Nutbeam D. (1998) Evaluating health promotion—progress, problems and solutions. *Health Prom Int* **13**, 27–44.
25. Klein PLata C, Wagner A, Haan MC *et al.* (2003) Prevalence and sociodemographic determinants of overweight in young French adolescents. *Diabetes Metab Res Rev* **19**, 153-158.
26. Gnani R, Spagnoli TD, Galotto C *et al.* (2000) Socioeconomic status, overweight and obesity in prepuberal children: a study in an area of Northern Italy. *Eur J Epidemiol* **16**, 797–803.
27. Fredriks AM, van Buuren S, Witt JM *et al.* (2000) Body index measurements in 1996-7 compared with 1980. *Arch Dis Child* **82**, 107–112.
28. Kromeyer-Hauschild K, Zellner K, Jaeger U *et al.* (1999) Prevalence of overweight and obesity among school children in Jena (Germany). *Int J Obes Relat Metab Disord* **23**, 1143–1150.
29. Kimm SYS, Obarzanek E, Barton BA, *et al.* (1996) Race socioeconomic status and obesity in 9- to 10-year-old girls: the NHLBI growth and health study. *Ann Epidemiol* **6**, 266–275.

- 1 30. Doak CM, Adair LS, Bentley M, *et al.* (2005). The dual burden household and the
2 nutrition transition paradox. *Int J Obes* **29**, 129–136.
3

Table 1. Mean of prevalence rates in boys and girls according to age class during the period 2009-2013 (n = 9 669)

	Boys				Girls				
	Childhood [†]	Early adolescence	Late adolescence	Total	Childhood	Early adolescence	Late adolescence	Total	P*
<i>Underweight</i>									
Prevalence (%)	7.5	8.9	2.4	8.4	7.5	12.2	17	12.1	0.004
Height (cm)	145.6 ± 7.56	150.2 ± 8.92	157 ± 0.0	148.77 ± 8.77	144.63 ± 8.79	150.09 ± 8.41	153.73 ± 6.76	150.02 ± 8.46	0.02
Weight (kg)	30.56 ± 3.38	33.82 ± 4.53	35.00 ± 0.0	32.8 ± 4.46	29.65 ± 3.97	33.75 ± 4.47	37.21 ± 4.58	33.74 ± 4.58	0.001
BMI (kg.m ²)	14.38 ± 0.65	14.93 ± 0.75	14.2 ± 0.0	14.76 ± 0.76	14.12 ± 0.55	14.92 ± 0.77	15.7 ± 1.09	14.92 ± 0.81	0.001
<i>Overweight</i>									
Prevalence (%)	14.7	16.8	21.0	16.2	17.5	15.1	15.0	15.3	0.252
Height (cm)	149.97 ± 8.21	157.40 ± 8.63	171.22 ± 6.1	155.13 ± 9.31	149.84 ± 6.57	154.94 ± 7.73	161.54 ± 6.76	154.76 ± 7.83	0.40
Weight (kg)	50.34 ± 6.74	58.95 ± 7.87	74.08 ± 7.12	56.31 ± 8.73	49.34 ± 5.49	56.69 ± 7.26	67.13 ± 6.53	56.46 ± 7.61	0.72
BMI (kg.m ²)	22.29 ± 1.42	23.7 ± 1.44	25.23 ± 1.29	23.26 ± 1.59	21.93 ± 1.34	23.53 ± 1.52	25.67 ± 1.34	23.47 ± 1.61	0.009
<i>Obese</i>									
Prevalence (%)	5.0	5.1	4.6	5.0	7.8	3.7	5.2	4.0	0.02
Height (cm)	154.1 ± 7.05	159.46 ± 8.87	176.0 ± 9.90	157.69 ± 8.79	152.24 ± 9.63	155.86 ± 8.69	163.75 ± 9.72	155.72 ± 9.05	0.02
Weight (kg)	65.15 ± 8.85	75.58 ± 11.64	107.6 ± 21.78	72.14 ± 12.29	62.67 ± 8.04	71.89 ± 11.79	91.03 ± 15.14	71.49 ± 12.56	0.58
BMI (kg.m ²)	27.33 ± 2.06	29.61 ± 2.88	34.51 ± 3.14	28.84 ± 2.87	27.07 ± 3.16	29.43 ± 2.91	33.75 ± 3.3	29.3 ± 3.16	0.11

* Chi Square test was performed to assess difference for prevalence rates between sex; Student test was performed to assess differences for anthropometric data between sex.

[†] (i) Childhood: 9-11 years in boys and 9–10 years in girls; (ii) early adolescence: 12–14 years in boys and 11–13 years in girls; (iii) late adolescence: 15-16 years in boys and 14–16 years in girls

Table 2. Prevalence rates (overall and gender-specific) from 2009 to 2013

		2009		2010		2011		2012		2013		P for Trend*
		n (1848)	%	n (1818)	%	n (2578)	%	n (2165)	%	n (1260)	%	
Underweight												
	<i>Overall</i>	178	9.6	173	9.5	294	11.4	189	8.7	151	12.0	0.2297
	<i>Boys</i>	65	7.1	75	8.5	122	9.4	93	8.4	46	7.3	0.7695
	<i>Girls</i>	113	12	98	10.5	172	13.5	96	9.1	105	16.7	0.1510
Overweight												
	<i>Overall</i>	280	15.2	298	16.4	409	15.9	347	16	185	14.7	0.8170
	<i>Boys</i>	149	16.4	137	15.6	220	16.9	169	15.3	105	16.6	0.9297
	<i>Girls</i>	131	13.9	161	17.2	189	14.8	178	16.8	80	12.7	0.7928
Obese												
	<i>Overall</i>	70	3.8	75	4.1	94	3.7	120	5.5	77	6.1	0.0003
	<i>Boys</i>	37	4.1	36	4.1	59	4.5	72	6.5	38	6	0.0056
	<i>Girls</i>	33	3.5	39	4.2	35	2.8	48	4.5	39	6.2	0.0209

* Coc2hran-Armitage trend test

1
2

Table 3. Mean values (SD) and prevalence rates of the socioeconomic status (HDI)[§] according to weight categories

	Score	P*	-	Low		Medium		High		P**
	Mean (SD)			n	%	n	%	n	%	
Boys										
Underweight	0.743 (0.040)	0.0001		47	11.72	275	68.58	79	19.7	<0.001
Normal Weight	0.744 (0.041)			306	8.97	2187	64.1	919	26.93	<0.001
Overweight	0.741 (0.043)			214	27.16	471	59.77	103	13.07	<0.001
Obese	0.733 (0.045)			90	37.19	127	52.48	25	10.33	<0.001
Girls										
Underweight	0.741 (0.042)	0.0023		109	18.66	408	69.86	67	11.47	<0.001
Normal Weight	0.744 (0.042)			462	13.92	2086	62.87	770	23.21	<0.001
Overweight	0.741 (0.041)			177	23.95	482	65.22	80	10.83	<0.001
Obese	0.732 (0.042)			54	27.84	121	62.37	19	9.79	<0.001

3 [§] HDI : Human Index Development. A higher HDI is when the life expectancy at birth is longer, the education period is
4 longer, and the income per capita is higher
5 * Anova analysis was used to compare the score of the socioeconomic status among different BMI categories
6 ** Anova analysis was used to compare the prevalence rates of the socioeconomic status among different BMI categories