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Original article

The prevalence of overweight and obesity, and distribution of waist circumference, in adults and children in the French Overseas Territories: The PODIUM survey

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Abstract

Aim. – This study aimed to describe the prevalence of overweight (excluding obesity) and obesity, and distribution of waist circumference, in children and adults in four French Overseas Territories (Guadeloupe, Martinique, French Guiana in the Caribbean and French Polynesia in the Pacific Ocean).

Methods. – The survey was designed to provide a sample representative of the population in each of the four territories. The protocol aimed to evaluate 600 adults (aged ≥ 15 years) and 300 children (aged: 5–14 years) in each territory.

Results. – In children, the differences were small among the territories in the prevalence of overweight (excluding obesity), as defined by the International Obesity Task Force (IOTF): Guadeloupe, 15.4%; Martinique, 17.0%; French Guiana, 13.2%; and French Polynesia, 17.2% ($P = 0.49$). Larger, significant, differences were observed for obesity, with prevalences of 7.2%, 7.7%, 5.4% and 15.9%, respectively ($P < 0.002$). In adults, the prevalence of obesity also differed significantly among the territories: 22.9%, 22.0%, 17.9% and 33.1% in Guadeloupe, Martinique, French Guiana and French Polynesia, respectively ($P < 0.001$, adjusted for age and gender). However, overweight (excluding obesity) was again more homogeneously distributed, with prevalences of 31.7%, 33.6%, 30.3% and 34.4%, respectively ($P = 0.43$, adjusted for age and gender). Waist circumference was larger in French Polynesia than in the other territories in both genders, and in both children and adults.

Conclusion. – While the distribution of overweight was relatively homogeneous, the prevalence of obesity differed considerably across the four territories. It was especially high in French Polynesia, and in children and women. Appropriate programmes are urgently needed in these populations, especially in children, to avoid the morbidity associated with obesity.

Keywords: French Overseas Territories; Guadeloupe; Martinique; Polynesia; Guiana; Epidemiology; Adults; Children; Obesity; Overweight; Prevalence; Waist circumference

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Résumé

Prévalence du surpoids et de l'obésité, et distribution du tour de taille chez des adultes et des enfants de quatre Territoires français d'outre-mer. L'enquête PODIUM.

Objectif. – Décrire la prévalence du surpoids (excluant l'obésité), de l'obésité chez les enfants et les adultes, au sein de la population de Guadeloupe, Martinique, Guyane et Polynésie, ainsi que décrire la distribution du tour de taille.

Patients et méthodes. – La méthodologie de cette enquête a été conçue pour établir un échantillon représentatif de la population (600 adultes ≥ 15 ans, 300 enfants cinq à 14 ans) dans chacun des Territoires.

Résultats. – Chez les enfants, de légères différences ont été observées entre territoires pour la prévalence du surpoids (excluant l'obésité) définie selon l'*International Obesity Task Force* (IOTF) : Guadeloupe (15,4 %), Martinique (17,0 %), Guyane (13,2 %) et Polynésie (17,2 %), $P = 0{,}49$. Des différences significatives plus importantes sont observées pour l'obésité, respectivement 7,2 %, 7,7 %, 5,4 % et 15,9 %, ($P < 0{,}002$). Chez les adultes, les prévalences d'obésité diffèrent également selon les territoires : 22,9 %, 22,0 %, 17,9 %, et 33,1 % en Guadeloupe, Martinique, Guyane et Polynésie, respectivement (après ajustement sur l'âge et sexe $P < 0{,}001$). De même, les prévalences de surpoids excluant l'obésité se répartissent de façon homogène entre territoires : les valeurs correspondantes sont respectivement 31,7 %, 33,6 %, 30,3 %, et 34,4 %, (ajustement sur l'âge et sexe $P = 0{,}43$). Le tour de taille est plus élevé en Polynésie que dans les autres territoires, dans les deux sexes, chez les enfants et chez les adultes.

Conclusion. – Il existe des différences dans la prévalence de l'obésité entre les territoires, alors que les prévalences de surpoids excluant l'obésité sont plus homogènes. Les valeurs d'obésité les plus élevées sont observées en Polynésie, chez les femmes, et chez les enfants. Le besoin de programmes de prévention dans ces populations est urgent, surtout chez les enfants, pour éviter la morbidité associée à l'obésité.

Mots clés : Territoires français d'outre-mer ; Guadeloupe ; Martinique ; Polynésie ; Guyane ; Obésité ; Prévalence ; Excès pondéral ; Tour de taille ; Épidémiologie ; Enfants ; Adultes

1. Introduction

Obesity is a challenging public-health problem leading to cardiovascular disease and diabetes [1,2]. Its epidemiological characteristics have been described in continental France [3,4], whereas information on the prevalence of obesity and overweight in the French Overseas Territories is sparse, particularly for children. The few surveys available have been carried out separately, and differences in methodology do not allow accurate overall assessment. Overweight and obesity were respectively found in 37% and 14% of men, and 34% and 31% of women, aged more or equal to 25 years in 2007 in Guadeloupe [5]. In Martinique during 2003–2004, obesity was found in 14% of men and 26% of women aged more or equal to 16 years [6]. Overweight was observed in 29.4% of women, whereas no data were available for men. In French Polynesia, 38% of men and 40% of women were reported to be obese in 2002, and 34% and 26%, respectively, were reported to be overweight [7]. No data have been published for adults in French Guiana, nor any for children in any territory. Data are also sparse on the distribution of waist circumferences in these territories.

In summary, data on overweight and obesity in these four Overseas Territories have been obtained from surveys carried out at different times and in populations with different compositions, and have failed to include information on children. This is especially worrying as the data indicate an alarmingly high prevalence of obesity in these territories.

For this reason, the present PODIUM survey was designed to assess the prevalence of overweight and obesity in the four French Overseas Territories of Guadeloupe, Martinique, French Guiana and French Polynesia, using representative samples of both adults and children. In addition, the prevalence of underweight (thinness) was assessed, and waist circumferences were also described.

2. Methods

2.1. Survey population

The sample size determined for the cross-sectional surveys was 600 in the adult population that was at least 15 years of age, and 300 in children aged 5–14 years, in each territory. This allowed the estimation of obesity prevalence to within 4.0% for adults and 5.7% for children, with 95% confidence.

The surveys were conducted sequentially in each territory, during the period from December 2007 to November 2008. Each territory was stratified into administrative districts and sampling points were randomly selected, with the number of sampling points weighted according to the population distribution in the most recent census (1999) by the French National Institute for Statistics and Economic Studies (INSEE) for all territories except French Polynesia, which used 2002 census data. The number of sampling points was 98 in Guadeloupe (population 400,000 in 2006), 111 in Martinique (400,000), 71 in French Guiana (220,000) and 101 in French Polynesia (260,000). The first house was designated at each sampling point, with the subsequent houses selected by the random-route method for inclusion in the survey: turning either left or right at each junction, every fourth house was selected until the predetermined number of houses had been visited. The selected homes were visited between 08 00 and 20 00 h at least four times, after which, if there was still no one at home, the house was abandoned for the survey. In each household, only one person was selected according to the Kish method [8]; however, if that person did not agree to participate, the house was not included in the survey. Thus, the surveys covered a wide geographical area in each territory, with the sampling proportional to the size of the administrative district.

The populations of the four territories were informed of the survey through the local media (newspapers, radio and

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television). All participants gave their informed consent to participate in the study, and all data were kept anonymous. The study protocol was approved by the French National Commission of Data Protection and Individual Liberties (*Commission nationale de l'informatique et des libertés* [CNIL]; dossier N° 1262786).

2.2. Measurement methodology

The bilingual survey staff completed a three-day training course, and their work was monitored throughout the survey. They interviewed and measured the survey participants in their homes. Quality control of both the methodology and data was also performed. Questionnaires were checked for missing data and to ensure their adherence to the Kish selection method. Where the protocol had not been properly followed (1% of the households surveyed), the individuals concerned were not included in the analysis.

Body weight was measured with a Tanita BF 522 W balance (Tanita Corporation, Tokyo, Japan), height with an electronic device (Soehnle Professional GmbH, Backnang, Germany), and waist circumference with a constant-tension measuring tape placed, according to World Health Organization (WHO) recommendations, midway between the iliac crests and the lowermost ribs [9].

2.3. Statistical analyses

Body mass index (BMI) was calculated as weight (kg) divided by height (m) squared. In adults, WHO criteria [9] were used to define obesity (BMI $\geq 30\,kg/m^2$), severe obesity (BMI 35–39.9 kg/m^2), morbid obesity (BMI $\geq 40\,kg/m^2$), overweight excluding obesity (BMI 25–29.9 kg/m^2) and underweight/thinness (BMI $< 18.5\,kg/m^2$).

In children, three definitions were used to define the thresholds for obesity, overweight (including obesity) and underweight (thinness), according to age:

- the WHO reference [10,11], based on Z values (obesity: +2 standard deviations (SD); overweight: +1 SD; and thinness: –2 SD);
- the International Obesity Task Force (IOTF) recommendations, which were tabulated [12,13], and used BMI percentiles corresponding to obesity (30 kg/m^2), overweight (25 kg/m^2) and thinness (18.5 kg/m^2) at age 18 years;
- and the French references [14], which used BMI percentiles (overweight: the 97th percentile; and thinness: the 3rd percentile), but has no definition of obesity.

Also, for all three definitions, the reference thresholds were used as half-years: for example, for an 8-year-old child, the reference thresholds used for each definition were those for 8.5 years. For participants aged 15–17 years, a sensitivity analysis was done for the prevalence of obesity, comparing the three above definitions for children with the adult definition.

To define abdominal obesity, the commonly accepted criteria described by Lean et al. [15] were used (waist circumferences ≥ 94 cm and > 102 cm for men, and ≥ 80 cm and > 88 cm for women). These thresholds are also recommended by the WHO [9], and are often referred to as the International Diabetes Federation (IDF) and the National Cholesterol Education Program Adult Treatment Panel III (NCEP–ATP III) criteria, respectively [16,17]. However, as no reference data were available for waist circumferences for children, only the descriptive data are presented here.

Prevalence was calculated as the ratio of the number of observed cases in a particular stratum to the total number in that stratum.

Quantum software (v5d version) was used for the data analysis. Results were expressed as percentages, means (SD) and prevalences ± standard error (SE). Differences in percentages across the territories were evaluated using the χ^2 test or Fisher's exact test for small samples. For continuous variables, analysis of variance (Anova) was used, with analysis of covariance (Ancova) to adjust for age.

3. Results

3.1. Participating population

The individuals investigated in each of the four French Overseas Territories were similar to the populations in the last census prior to the survey (INSEE/ISPF 2007 for French Polynesia and INSEE 2006 for the other territories). Although there was a slightly larger percentage of women in our survey, the age structure followed that of the census population.

Participation in our survey varied across the four territories: 45% of the households visited in French Guiana participated compared with 63% in French Polynesia ($P < 0.001$; Table S1; see supplementary material associated with this article online). The main reason for non-participation was because no one was at home during the survey hours. A further 1% of individuals were not included because of missing data for age (children only), gender, weight or height. The only other missing data in the PODIUM survey were waist circumference (for 12 participants in Guadeloupe and three participants in French Polynesia) and age for adults (two participants in Guadeloupe and one in Martinique).

3.2. Overweight and obesity

French Polynesia had the highest rates of obesity among children compared with the other territories (Table 1), as defined by the IOTF and WHO. Overweight and obesity (defined according to the IOTF) were found in 17.2% and 15.9%, respectively, of children in French Polynesia. The corresponding values were 15.4% and 7.2% in Guadeloupe, 17.0% and 7.7% in Martinique, and 13.2% and 5.4% in French Guiana. Using the IOTF definition of obesity, the prevalences differed significantly in both boys and girls across all four territories (boys: $P = 0.02$; girls: $P < 0.001$).

In Martinique and French Guiana, the prevalence of obesity was higher in boys than in girls (Table 1). Also, girls aged 5–9 years were more obese than those aged 10–14 years, with

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Table 1
Characteristics of the children (aged 5–14 years) participating in the PODIUM survey.

	Guadeloupe	Martinique	French Guiana	French Polynesia	*P* value
Boys (*n*)	150	151	152	145	
Age (years)	9 (3)	10 (3)	9 (3)	10 (3)	0.10[a]
Body mass index (kg/m^2)	17.9 (3.7)	18.8 (4.4)	17.6 (3.5)	20.6 (5.3)	0.004[b]
WHO definition					
Thinness (underweight)					
5–14 years	6.0 ± 1.9	1.3 ± 0.9	5.9 ± 1.9	2.1 ± 1.1	0.06[c]
5–9 years	6.3 ± 2.7	0 ± –	4.8 ± 2.3	3.5 ± 2.4	0.13[c]
10–14 years	5.6 ± 2.7	2.7 ± 1.9	7.2 ± 3.1	1.1 ± 1.1	0.19[c]
Overweight (excluding obesity)					
5–14 years	17.3 ± 3.1	21.9 ± 3.3	16.4 ± 3.0	31.0 ± 3.8	0.01[c]
5–9 years	13.9 ± 3.9	22.4 ± 4.8	16.9 ± 4.1	29.8 ± 6.1	0.12[c]
10–14 years	21.1 ± 4.8	21.3 ± 4.7	15.9 ± 4.4	31.8 ± 5.0	0.12[c]
Obesity					
5–14 years	11.3 ± 2.6	17.2 ± 3.1	9.9 ± 2.4	21.4 ± 3.4	0.02[c]
5–9 years	6.3 ± 2.7	15.8 ± 4.2	9.6 ± 3.2	19.3 ± 5.2	0.08[c]
10–14 years	16.9 ± 4.4	18.7 ± 4.5	10.1 ± 3.6	22.7 ± 4.5	0.21[c]
IOTF definition					
Thinness					
5–14 years	13.3 ± 2.8	9.3 ± 2.4	12.5 ± 2.7	4.8 ± 1.8	0.05[c]
5–9 years	11.4 ± 3.6	10.5 ± 3.5	8.4 ± 3.0	7.0 ± 3.4	0.84[c]
10–14 years	15.5 ± 4.3	8.0 ± 3.1	17.4 ± 4.6	3.4 ± 1.9	0.01[c]
Overweight (excluding obesity)					
5–14 years	15.3 ± 2.9	16.6 ± 3.0	10.5 ± 2.5	23.4 ± 3.5	0.03[c]
5–9 years	11.4 ± 3.6	17.1 ± 4.3	8.4 ± 3.1	19.3 ± 5.2	0.20[c]
10–14 years	19.7 ± 4.7	16.0 ± 4.2	13.0 ± 4.1	26.1 ± 4.7	0.19[c]
Obesity					
5–14 years	6.7 ± 2.0	11.9 ± 2.6	5.9 ± 1.9	15.2 ± 2.9	0.023[c]
5–9 years	3.8 ± 2.1	7.9 ± 3.1	8.4 ± 3.0	12.3 ± 4.3	0.32[c]
10–14 years	9.9 ± 3.5	16.0 ± 4.2	2.9 ± 2.0	17.0 ± 4.0	0.02[c]
French references					
Thinness					
5–14 years	7.3 ± 2.1	2.0 ± 1.1	5.3 ± 1.8	2.1 ± 1.1	0.06[c]
5–9 years	8.9 ± 3.2	1.3 ± 1.3	4.8 ± 2.3	3.5 ± 2.4	0.16[c]
10–14 years	5.6 ± 2.7	2.7 ± 1.9	5.8 ± 4.8	1.1 ± 1.1	0.30[c]
Overweight (including obesity)					
5–14 years	22.7 ± 3.4	27.8 ± 3.7	17.1 ± 3.1	35.9 ± 4.0	0.17[c]
5–9 years	15.2 ± 4.1	25 ± 5.0	18.1 ± 4.2	31.6 ± 6.2	0.29[c]
10–14 years	31.0 ± 5.1	30.7 ± 5.3	15.9 ± 4.4	38.6 ± 5.2	0.40[c]
Girls (*n*)	142	149	144	151	
Age (years)	10 (3)	10 (3)	9 (3)	10 (3)	0.007[a]
Body mass index (kg/m^2)	18.5 (4.4)	18.0 (4.2)	17.5 (3.6)	19.5 (5.2)	< 0.001[b]
WHO definition					
Thinness					
5–14 years	7.0 ± 2.1	5.4 ± 1.8	5.6 ± 1.9	4.6 ± 1.7	0.86[c]
5–9 years	8.8 ± 3.7	6.7 ± 2.9	5.1 ± 2.5	3.2 ± 2.2	0.61[c]
10–14 years	5.9 ± 2.6	4.1 ± 2.3	6.1 ± 2.9	5.7 ± 2.5	0.96[c]
Overweight (excluding obesity)					
5–14 years	23.9 ± 3.6	15.4 ± 3.0	16.7 ± 3.1	14.6 ± 2.9	0.16[c]
5–9 years	28.1 ± 6.0	17.3 ± 4.4	14.1 ± 3.9	9.5 ± 3.7	0.06[c]
10–14 years	21.2 ± 4.4	13.5 ± 4.0	19.7 ± 4.9	18.2 ± 4.1	0.62[c]
Obesity					
5–14 years	9.2 ± 2.4	6.7 ± 2.0	7.6 ± 2.2	19.2 ± 3.2	0.003[c]
5–9 years	15.8 ± 4.8	5.3 ± 2.6	9.0 ± 3.2	22.2 ± 5.3	0.02[c]
10–14 years	4.7 ± 2.3	8.1 ± 3.2	6.1 ± 2.9	17.0 ± 4.0	0.04[c]
IOTF definition					
Thinness					
5–14 years	12.7 ± 2.8	18.8 ± 3.2	19.4 ± 3.3	14.6 ± 2.9	0.33[c]
5–9 years	19.3 ± 5.2	22.7 ± 4.8	20.5 ± 4.6	19.0 ± 5.0	0.96[c]
10–14 years	8.2 ± 3.0	14.9 ± 4.1	18.2 ± 4.8	11.4 ± 3.4	0.29[c]
Overweight (excluding obesity)					
5–14 years	15.5 ± 3.0	17.4 ± 3.1	16.0 ± 3.1	11.3 ± 2.6	0.46[c]

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Table 1 (*Continued*)

Girls (*n*)	142	149	144	151	
5–9 years	17.5 ± 5.0	18.7 ± 4.5	12.8 ± 3.8	7.9 ± 3.4	0.26[c]
10–14 years	14.1 ± 3.8	16.2 ± 4.3	19.7 ± 4.9	13.6 ± 3.7	0.73[c]
Obesity					
5–14 years	7.7 ± 2.2	3.4 ± 1.5	4.9 ± 1.8	16.6 ± 3.0	< 0.001[c]
5–9 years	12.3 ± 4.3	2.7 ± 1.8	6.4 ± 2.7	19.0 ± 4.9	0.001[c]
10–14 years	4.7 ± 2.3	4.1 ± 2.3	3.0 ± 2.1	14.8 ± 3.7	0.02[c]
French references					
Thinness					
5–14 years	4.9 ± 1.8	5.4 ± 1.8	5.6 ± 1.9	4.0 ± 1.6	0.92[c]
5–9 years	5.3 ± 3.0	8.0 ± 3.1	6.4 ± 2.8	3.2 ± 2.2	0.69[c]
10–14 years	4.7 ± 2.3	2.7 ± 1.9	4.5 ± 2.6	4.5 ± 2.2	0.94[c]
Overweight (including obesity)					
5–14 years	19.0 ± 3.3	18.1 ± 3.2	17.4 ± 3.2	27.2 ± 3.6	0.71[c]
5–9 years	24.6 ± 5.7	17.3 ± 5.4	19.2 ± 4.5	27.0 ± 5.6	0.67[c]
10–14 years	15.3 ± 3.9	18.9 ± 4.6	15.2 ± 4.4	27.3 ± 4.8	0.88[c]
Waist (cm)	62 (14)	61 (12)	56 (14)	68 (16)	< 0.001[b]

Data are presented as means (SD) and as prevalences ± SE; $^{\chi}Chi^2$ test.
[a] Anova.
[b] Ancova.
[c] Fisher's exact test.

the exception of Martinique. In contrast, older boys were more obese than the younger ones, except in French Guiana.

Thinness was found in 13.0% of children in Guadeloupe, 14.0% in Martinique, 15.9% in French Guiana and 9.8% in French Polynesia (using IOTF criteria). Across the territories, prevalences were homogeneous among girls ($P = 0.92$), but not among boys ($P < 0.05$). The highest prevalence of thinness among boys was found in Guadeloupe, with the lowest in French Polynesia.

In children, obesity and overweight were more frequent according to the WHO definition in both genders whereas, for thinness, the IOTF definition yielded the highest estimated prevalence. In the group aged 15–17 years, considered adults in the present survey, the estimated prevalence of obesity remained similar whether using paediatric or adult definitions of obesity.

In adults in Guadeloupe, the prevalences of thinness (underweight), overweight and obesity were 3.8%, 31.7% and 22.9%, respectively. Corresponding values were 3.5%, 33.6% and 21.9% in Martinique, 4.2%, 30.3% and 17.9% in French Guiana, and 2.0%, 34.3% and 33.0% in French Polynesia. The prevalence of obesity was lowest in French Guiana and highest in French Polynesia for both men and women (Table 2). The average age in these two territories was similar and in contrast to Guadeloupe and Martinique, where adults were, on average, 5 years older. The prevalence of obesity in the latter two territories was also similar. In general, the prevalence of overweight and obesity increased with age (Fig. S1; see supplementary material associated with this article online). Furthermore, obesity was more frequent in women than in men; in contrast, the prevalence of overweight was similar or higher in men than in women.

3.3. Waist circumference

Children in French Guiana had the smallest mean waist circumference (56.9 ± 13.1 cm), while those in French Polynesia had the largest (69.7 ± 15.7 cm). In Martinique and Guadeloupe, the corresponding values were 61.1 ± 13.6 cm and 61.6 ± 12.5 cm. Boys had a larger mean waist circumference than girls except in Guadeloupe (Table 1).

Among adults, waist circumference was 88.9 ± 16.6 cm in Guadeloupe, 88.1 ± 14.6 cm in Martinique, 82.9 ± 15.2 cm in French Guiana and 97.9 ± 18.2 cm in French Polynesia. Men in French Polynesia had a mean waist size 13 cm larger than those in French Guiana, and the difference was even larger (17 cm) among women. Men and women in Guadeloupe and Martinique had similar average waist circumferences. Also, waist circumference increased with age in all territories in both genders (Fig. S2; see supplementary material associated with this article online). Using the waist circumference thresholds of greater than 102 cm for men and greater than 88 cm for women, central adiposity was three times more prevalent in French Polynesian men than in men in French Guiana, and two times more than in men in either Guadeloupe or Martinique (Table 2). Among women, central adiposity was two times more frequent in French Polynesia than in French Guiana, and about 50% more frequent than in either Guadeloupe or Martinique.

4. Discussion

The present survey provides estimates of the prevalence of overweight and obesity in four French Overseas Territories, using representative samples from each population and covering the entire geographical area of each territory. Thus, the specific age structure and ethnic composition of the population in each territory were taken into account.

In children, the prevalence of obesity, using the IOTF definition, ranged from 3.4% to 16.6%, with an alarmingly high prevalence in French Polynesia in both boys and girls. The prevalence in adults ranged from 13.4% to 36.9%. Again, French Polynesia had the highest prevalences, along with high rates of

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Table 2
Characteristics of adults (aged ≥ 15 years) participating in the PODIUM survey.

	Guadeloupe	Martinique	French Guiana	French Polynesia	*P* value
Men (*n*)	278	273	299	310	
Age (years)	40 (19)	42 (18)	37 (16)	35 (15)	<0.001[a]
Body mass index (BMI, kg/m^2)	25.6 (4.5)	25.6 (4.5)	25.4 (4.6)	28.0 (5.7)	<0.001[b]
WHO classification of BMI					
Underweight (%)	3.6 ± 1.1	2.6 ± 1.0	4.7 ± 1.2	0.3 ± 0.3	0.002[d]
Overweight excluding obesity (%)	32.0 ± 2.8	35.9 ± 2.9	35.1 ± 2.7	38.4 ± 2.7	0.47[c]
Obesity (%)	18.0 ± 2.3	16.1 ± 2.2	13.4 ± 2.0	29.4 ± 2.6	<0.001[c]
Severe (%)	1.8 ± 0.8	1.8 ± 0.8	2.3 ± 0.9	7.1 ± 1.5	<0.001[d]
Morbid (%)	0	1.1 ± 1.2	1.3 ± 0.7	4.5 ± 1.2	<0.001[d]
Waist circumference (cm)	88 (16)	89 (14)	85 (14)	98 (16)	<0.001[b]
≥ 94 cm (%)	32.6 ± 2.8	36.6 ± 2.9	22.4 ± 2.4	55.0 ± 2.8	<0.001[c]
> 102 cm (%)	14.9 ± 2.1	15.8 ± 2.2	9.7 ± 1.7	29.1 ± 2.6	<0.001[c]
Women (*n*)	324	328	321	295	
Age (years)	43 (19)	42 (18)	37 (16)	36 (15)	<0.001[a]
BMI (kg/m^2)	27.0 (6.0)	26.9 (6.0)	25.9 (5.6)	29.0 (7.8)	<0.001[b]
WHO classification of BMI					
Underweight (%)	4.0 ± 1.2	4.3 ± 1.1	3.7 ± 1.1	3.7 ± 1.1	0.98[d]
Overweight excluding obesity (%)	31.5 ± 2.6	31.7 ± 2.5	25.9 ± 2.4	30.2 ± 2.6	0.29[c]
Obesity (%)	27.2 ± 2.4	26.8 ± 2.4	22.1 ± 2.3	36.9 ± 2.8	<0.001[c]
Severe (%)	7.7 ± 1.5	6.1 ± 1.3	5.9 ± 1.3	7.8 ± 1.6	0.76[d]
Morbid (%)	3.1 ± 1.0	3.0 ± 1.0	2.5 ± 0.9	10.5 ± 1.8	<0.001[d]
Waist circumference (cm)	90 (17)	87 (15)	81 (16)	98 (16)	<0.001[b]
≥ 80 cm (%)	70.4 ± 2.5	66.5 ± 2.6	50.8 ± 2.8	85.0 ± 2.1	<0.001[c]
> 88 cm (%)	48.1 ± 2.7	44.2 ± 2.7	27.4 ± 2.5	64.3 ± 2.6	<0.001[c]

Data are presented as means (SD) and as prevalences ± SE.
[a] Anova.
[b] Ancova.
[c] Chi^2 test.
[d] Fisher's exact test.

morbid obesity, in both men and women. The high prevalence of overweight was equally worrying, as these individuals are at high risk of becoming obese.

However, it is difficult to extrapolate trends of obesity among children from the PODIUM survey, as no published data were available in most of the territories. In French Polynesia in 1996, obesity (according to the IOTF definition) was observed in 10% of school children aged 9–14 years and overweight in 19% [18]. The corresponding values in our PODIUM survey for children aged 10–14 years were 16% for obesity and 20% for overweight. Thus, the prevalence of obesity appears to have increased in French Polynesia between 1996 and 2008, while overweight has remained stable. This pattern is at odds with what has been observed in many other countries, including continental France, where the prevalence of obesity and overweight in children appears to have stabilized [19,20].

Thinness, according to the IOTF definition, was relatively frequent in children, ranging from 5% to 19% (according to gender and territory) compared with a prevalence of 14% in continental France in 2007 for children aged 7–9 years [20]. In adults, thinness ranged from 0% in men in French Polynesia to 5% of those in French Guiana.

In adults, the prevalence of obesity seems to have been relatively stable in Guadeloupe and Martinique over the past few years. The frequencies reported in Guadeloupe in 2007 (14% of men and 31% of women) [5] and in Martinique in 2003 (14% of men and 26% of women aged more or equal to 25 years) [6] were similar to the values observed in the present PODIUM survey (16% of men and 27% of women) in these territories. In French Polynesia, however, direct comparisons with previous estimations were more difficult because of differences in the methods used in the surveys available. The first survey in 1995 identified obesity in 35% of men and 43% of women [18]. Another survey in 2002 in adults aged more or equal to 16 years yielded prevalences of 38% and 40%, respectively [7,18]. In the PODIUM survey, the prevalences were lower: 29% and 37% in men and women, respectively. In French Guiana, no previous data were available at all.

That the prevalence of obesity decreased (or, at least, has not increased) among adults in French Polynesia while an opposite trend was observed among children is surprising first because it is the opposite of what is happening in France and in other industrialized countries and, second, because the prevalence is increasing in children and, as most obese children become obese adults [21], the prevalence of obesity in adults is expected to increase as well. More regularly performed surveys should certainly shed some light on this apparent discrepancy. However, in any case, increased rates of obesity among children herald alarmingly high rates of obesity among adults in the years to come.

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Taken as a whole, the present PODIUM survey has indicated that the prevalence of obesity is similar in Martinique and Guadeloupe, and lower in French Guiana, while French Polynesia displays alarmingly high rates of prevalence. That Guadeloupe and Martinique displayed similar prevalences is not surprising, as these islands are similar in their location, geographical size, environment, socioeconomic conditions and healthcare systems. Previous data on hypertension have also shown similarities [22]. Thus, the PODIUM survey suggests that the obesity epidemic might be addressed by similar health policies in these two islands. As for French Guiana, its younger population could at least partly explain its lower prevalence of obesity. However, further studies are necessary to determine whether such findings truly indicate a wider acceptance of healthier lifestyle behaviours in French Guiana. In contrast, French Polynesia has a very high prevalence of obesity. Indeed, the region has a different ethnic composition compared with the other territories; however, it was not possible to analyze ethnic differences in our present study as the responses to the question of ethnicity were poorly completed. Nevertheless, the PODIUM survey has clearly indicated that, whatever the relationship to ethnic characteristics or the possible causal role of genetics, obesity is a far more urgent health problem in French Polynesia than in the other territories.

Another important result of the present study was the differences found in the prevalence of obesity between most of the French Overseas Territories and mainland France. The latest estimation of the prevalence of obesity in continental France was 16.9% (men: 16.1%; women: 17.6%), according to the French National Nutrition survey in 2006 [23]. These estimations are separated by only 2 years from our PODIUM survey, so it is unlikely that major changes have occurred in mainland France during this period. Two main aspects can be identified: first, differences in prevalence among men remain small between mainland France and the French Territories, with the exception of French Polynesia; and, second, while the prevalence of obesity is similar for men and women in France, a significant gender gap can be observed across all of the French Overseas Territories. The prevalence of obesity is almost doubled in French Guiana among women (22.1%) compared with men (13.4%), for example. Several hypotheses for the differences observed between mainland France and the French Overseas Territories, especially among women, may be proposed. Differences in ethnic and genetic backgrounds might be factors but, unfortunately, these differences cannot be evaluated by the PODIUM survey due to the poor-quality answers to the question concerning the ethnic characteristics of the participants. In addition, the gender gap in the prevalence of obesity might reflect differences in parental education and socioeconomic status, as well as in food intakes and/or levels of physical activity [24,25]. This suggests that the widespread adoption of healthier lifestyle habits, especially targeting women, could be required to limit the obesity epidemic in these Overseas Territories.

The strengths of the PODIUM survey were the uniform methodology used in all four territories, the method of selection of the participants and the wide geographical coverage of the studied population, resulting in samples representative of the entire population. Lack of adherence to the study protocol was minimal: only 2% of the participants were excluded for this reason.

However, the main limitation of our present survey was the low participation rate due to no one being available at some of the selected households, despite the fact that these homes were revisited a number of times. The refusal rate of up to 19% was relatively low in comparison to other similar surveys.

5. Conclusion

The present PODIUM survey showed alarmingly high prevalences of overweight and obesity in all four French Overseas Territories, with the prevalence of obesity reaching a record high in French Polynesia. Severe morbid forms of obesity were observed particularly among French Polynesian men and among women in all four territories. These data herald the occurrence of diabetes, coronary heart disease and stroke. Thus, the results of the PODIUM survey call for urgent emphasis on both primary and secondary obesity-prevention programmes in these French Overseas Territories, targeting especially obese and overweight children [26].

Disclosure of interest

Beverley Balkau has received financial support for editing the article. Hélène Chevalier is employed by the institute CSA, which was engaged by Sanofi-Aventis for the conception of the survey protocol, the survey management in the French Overseas Territories, and the statistical analyses.

The other authors have not declared any conflicts of interest.

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Appendix A. Supplementary data

Supplementary material (Table S1, Figs. S1 and S2) associated with this article can be found at http://www.sciencedirect.com, at http://dx.doi.org/10.1016/j.diabet.2012.03.008.

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