Introduction

The body-mass index (BMI) has been widely used to stratify the risk of metabolic and cardiovascular disease because of its simplicity and strong association with body fat. In adults, a BMI of 25 kg/m² or higher is considered to be overweight and is associated with increased risk for non-communicable diseases, including type 2 diabetes mellitus. However, the World Health Organization has noted that BMI cut-offs are not clearly demonstrated. The body fat distribution of adults and adolescents is not well understood.

Abdominal fat has been implicated in the development of insulin resistance. Then, an increased amount of fat is expected in populations with high diabetes prevalence. This has indeed been observed in Asians in Asia and after migrations. Whether this pattern occurs early in life has not been clearly demonstrated. The body fat distribution of adolescents of Asian Indian origin has not been extensively studied, but the BMI cut-off for 25 kg/m² in Asian populations has not been clearly demonstrated. The body fat distribution of adolescents of other origins, as the control group. The main hypothesis was that part of the normal range of BMI would be associated with a higher quantity of body fat, in particular abdominal fat, in IOG.

Methods

The participants were 178 IOG adolescents and 481 Guadeloupian adolescents of other origins (mainly African and mixed African and European descents) from five schools in Guadeloupe, French West Indies. They were 13.3 ± 1.4 years of age (mean ± SD). They agreed to participate in the experiment running from September 2006 to January 2008. More information was provided in an earlier publication. Subjects were lightly clothed for their stature (cm) and body mass (kg) measurements, used to calculate the BMI (kg/m²) and BMI for age z-scores (BMIZ) from the Centers for Disease Control and Prevention age- and ethnicity-specific references. Waist and hip circumferences (measured in centimetres with tape) and bicipital, tricipital, subscapular and iliac thicknesses were determined in 178 India-originating Guadeloupians (IOG) adolescents and 481 controls of other origins. Various equations were tested in a regression approach to fit the relationship between BMIZ and iliac thickness, and BMIZ and sum of skinfold thickness. A shift towards higher iliac thickness for a given BMIZ was observed in IOG adolescents. This supports the idea that the relationship between BMI and risk for non-communicable diseases is ethnicity-dependent.

The aim was to compare the relationship between body composition and body size in two subgroups with different metabolic risk. Body-mass index z-scores (BMIZ), bicipital, tricipital, subscapular and iliac thicknesses were determined in 178 India-originating Guadeloupians (IOG) adolescents and 481 controls of other origins. Various equations were tested in a regression approach to fit the relationship between BMIZ and iliac thickness, and BMIZ and sum of skinfold thickness. A shift towards higher iliac thickness for a given BMIZ was observed in IOG adolescents. This supports the idea that the relationship between BMI and risk for non-communicable diseases is ethnicity-dependent.

References


Short Report

Relationship between body mass index and body composition in adolescents of Asian Indian origin and their peers

Sophie Antoine-Jonville, Stéphane Sinnapah, Olivier Hue

ACTES Laboratory EA3596, University of the French West Indies and French Guiana, Pointe-à-Pitre Cédex, Guadeloupe, French West Indies

Correspondence: Sophie Antoine-Jonville, ACTES Laboratory EA3596, University of the French West Indies and French Guiana, BP 250, 97157 Pointe-à-Pitre Cédex, Guadeloupe, French West Indies, tel: +590 590 48 31, fax: +590 590 48 31 79, e-mail: s_antoine@ymail.com or sophie.jonville@univ-ag.fr

The body-mass index (BMI) has been widely used to stratify the risk of metabolic and cardiovascular disease because of its simplicity and strong association with body fat. In adults, a BMI of 25 kg/m² or higher is considered to be overweight and is associated with increased risk for non-communicable diseases like diabetes mellitus. However, the World Health Organization has pointed out that the risk corresponding to overweight varies from 22 to 25 kg/m² in Asian populations. Abdominal fat has been implicated in the development of insulin resistance. Therefore, an increased amount of fat is expected in populations with high diabetes prevalence. This has indeed been observed in Asians in Asia and after migrations. Whether this pattern occurs early in life has not been clearly demonstrated. The body fat distribution of adolescents of Asian Indian origin has not been extensively studied, but the BMI cut-off points published on adolescents from India suggest that the question is relevant.

Our aim was thus to define the nature of the relationship between body composition and body size in India-originating Guadeloupian (IOG), as a subgroup with increased diabetes risk, and Guadeloupian of other origins, as the control group. The main hypothesis was that part of the normal range of BMI would be associated with a higher quantity of body fat, in particular abdominal fat, in IOG.
To obtain a general overview of the data, the means for IOG and controls, with boys and girls combined, were compared by t-tests for equal or different standard deviations, depending on the Levene test results (all significance set at $P<0.05$). Then, in a regression approach, various equations (exponential, inverse and natural logarithmic functions, using a constant to analyse positive data if necessary, and polynomials with different degrees) were tested to fit the relationship between BMIZ and iliac thickness, and BMIZ and S4ST. Based on the coefficient of determination $r^2$, the best or the two best models were identified for all subgroups stratified for sex and ethnicity. Regarding the polynomial models, the addition of 1 or more degrees was not selected because it did not improve $r^2$ by >2% compared with the cubic model. This was considered to reflect complexity related more to the sampling of this study than to physiological mechanisms.

To obtain a general overview of the data, the means for IOG and controls, with boys and girls combined, were compared by t-tests for equal or different standard deviations, depending on the Levene test results (all significance set at $P<0.05$). Then, in a regression approach, various equations (exponential, inverse and natural logarithmic functions, using a constant to analyse positive data if necessary, and polynomials with different degrees) were tested to fit the relationship between BMIZ and iliac thickness, and BMIZ and S4ST. Based on the coefficient of determination $r^2$, the best or the two best models were identified for all subgroups stratified for sex and ethnicity. Regarding the polynomial models, the addition of 1 or more degrees was not selected because it did not improve $r^2$ by >2% compared with the cubic model. This was considered to reflect complexity related more to the sampling of this study than to physiological mechanisms.

The anthropometry of India originating adolescents has been studied before. It is characterized by smaller body size and fatter body composition. Accordingly, the IOG adolescents in this study had smaller body size and body mass, although similar BMI. The control group was of African genetic admixture, associated earlier with taller stature during childhood and lower fat mass, total abdominal and intra-abdominal adipose tissue as compared to European admixture in a study on peripubertal Americans. Visceral, but also subcutaneous abdominal fat have been shown to relate to adverse cardiometabolic risk factors. We report here that the Guadeloupian adolescents of Indian descent have higher iliac thickness than their counterparts for any normal or high given BMI. This shift is interestingly compatible with the high exposure to diabetes and cardiovascular complications, observed in migrant Asians. It supports the recent proposition of age- and sex-specific BMI cut-off points in 14- to 18-year-old Asian Indian adolescents.

We acknowledge that the cross-sectional study design is a limitation and the reasoning linking our results with public health issues remains speculative. There is no experimental evidence that the third of Guadeloupian adults of Asian origin who develop diabetes were fatter as adolescents than their counterparts, nor that a higher proportion of the IOG adolescents studied here will suffer from cardiometabolic disorders. The absence of data on the pubertal stage is another limitation. This information would have been able to orientate the interpretation of these results.

Whether the ethnic–specific relationship we evidenced is the reflect of a strong disposition to store energy abdominally, the early consequence of lifestyles, or their combination remains to be determined.

**Acknowledgements**

The authors are grateful to Marylène Troupé and Alain Pietrus from the Mathematics Department of the University of the French West Indies and French Guiana for their contribution.

**Funding**

This work was made possible by a grant of the Office of Scientific Research by the University of the French West Indies and French Guiana.

**Conflicts of interest:** None declared.
Introduction

In its forward strategy for 2014–20, the European Union identifies research and innovation as critical for economic and social development, and has stated that, along with industry and the public sector, civil society should contribute. The European Commission has proposed an ‘Innovation Partnership on Active and Healthy Ageing’, linking programmes for health, research and enterprise. Although the European Commission emphasizes collaboration with business as the primary force for economic innovation, the objectives of education and health require broader perspectives of social innovation. We have investigated the perspectives for research of health civil society organisations (CSOs).

CSOs in the definition of the European Commission are ‘non-governmental, non-profit organizations that do not represent commercial interests, and pursue a common purpose in the public interest’. CSOs in the definition of the European Commission are ‘non-governmental, non-profit organizations that do not represent commercial interests, and pursue a common purpose in the public interest’. Complementing the major contributions of the public sector and business to research, CSOs form an important ‘third way’ in contributing.