

- Tracking of overweight from mid-adolescence into late adolescence and from late adolescence into early adulthood is a consistent pattern independent of sex and SEP.

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Short Report

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

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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 Guadeloupean (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-dependant.

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 originally discriminated the normal corpulence from overweight, which has been 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.¹

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 Asians² in Asia and after migrations. Whether this pattern occurs early in life has not been clearly demonstrated. The body fat distribution of adolescents of Indian origins has not been extensively studied, but the BMI cut-off points published on adolescents from India suggest that the question is relevant.³

Our aim was thus to define the nature of the relationship between body composition and body size in India-originating Guadeloupeans (IOG), as a subgroup with increased diabetes risk, and Guadeloupeans 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 Guadeloupeans 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.⁴ 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 sex-specific references. Waist and hip circumferences (measured in centimetres with tape) and bicipital, tricipital, subscapular and iliac thicknesses (measured in millimetre with Harpenden skinfold caliper) were measured twice. The latter values were added to give the sum of four skinfold thicknesses (S4ST).

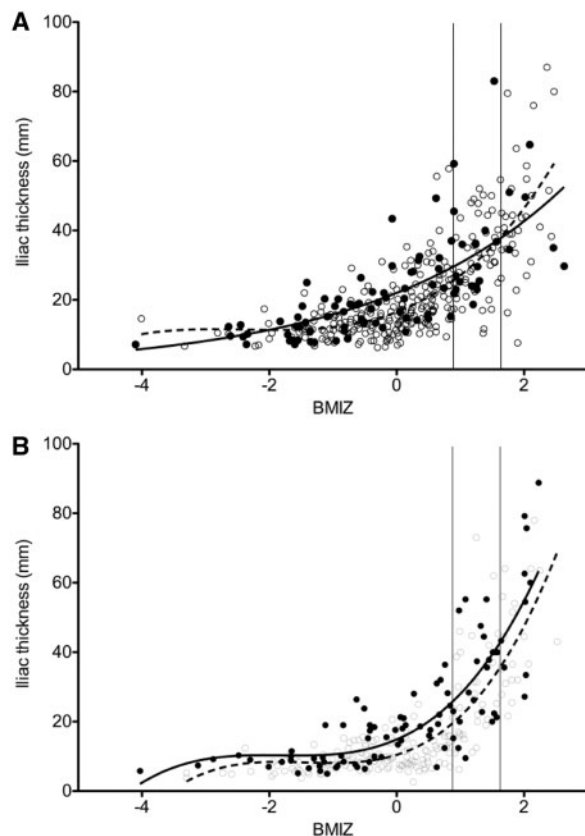


Figure 1 Relationship between iliac skinfold thickness (mm) and BMIZ. Girls (A) and boys (B) India-originating Guadeloupian (filled circle) and control (unfilled circle) individuals and populations (curve fitting in IOG: solid line, in controls: dashed line). The limits for overweight and obesity corresponding to the 85th and 95th percentiles (Centers for Disease Control and Prevention age- and sex-specific references) are represented with black vertical lines

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.

Data were analysed with Open Office 3.1.1 and SPSS v18.0.

The automated treatment of personal information was declared to the adequate national commission (Commission Nationale de l'Informatique et des Libertés) and the principles outlined in the Helsinki Declaration were followed.

Results

The IOG were lighter and smaller than their counterparts (52.3 ± 14.7 and 55.0 ± 14.0 kg, $P = 0.03$, and 160.2 ± 8.9 and 162.7 ± 9.2 cm, $P < 0.01$, respectively). The two ethnic subgroups were comparable for age ($P = 0.06$), BMI ($P = 0.31$), BMIZ ($P = 0.10$), waist circumference ($P = 0.65$), bicipital ($P = 0.85$), tricipital ($P = 0.84$) and subscapular ($P = 0.43$) thicknesses and S4ST ($P = 0.23$). They differed for hip circumference (88.7 ± 10.4 in IOG vs. 90.7 ± 10.5 cm in controls, $P = 0.04$) and

iliac thickness (23.1 ± 16.0 in IOG vs. 19.7 ± 14.3 mm in controls, $P = 0.02$). Iliac thickness and BMIZ, as well as S4ST and BMIZ, were significantly associated (all $P < 10^{-4}$, Supplementary material). When compared with the linear and other models, the cubic model consistently revealed the best. It improved the quality of the fit, as reflected by r^2 superior of $16.6 \pm 4.4\%$ compared with the linear model in all subgroups, except in IOG girls. In this subgroup, the exponential model provided the best fit ($+12.9\%$ as compared with the linear model, $+3.2\%$ with the cubic model). The graphic representation highlighted a shift toward higher iliac thickness on most of the observed BMIZ range in IOG girls, and on all the observed BMIZ range in IOG boys as compared to the controls (figure 1).

Discussion

In this study, an original approach based on curve fitting complementary to statistical means comparison was used. The main finding was that the relationship between iliac skinfold thickness and BMIZ is ethnically specific. The improvement in the quality of the model after stratification between IOG and controls, both in boys and girls, demonstrated such a specificity. The three other skinfold thicknesses being comparable in the IOG and controls, similar results were found for the relationship between S4ST and BMIZ.

The anthropometry of India originating adolescents has been studied before. It is characterized by smaller body size⁵ and fatter body composition.^{3,4} 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 childhood⁶ and lower fat mass, total abdominal and intra-abdominal adipose tissue as compared to European admixture in a study on peripubertal Americans.⁷

Visceral, but also subcutaneous abdominal fat have been shown to relate to adverse cardiometabolic risk factors.⁸ 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.⁹ It supports the recent proposition of age- and sex-specific BMI cut-off points in 14- to 18-year-old Asian Indian adolescents.³

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,¹⁰ 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.

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Conflicts of interest: None declared.

Key points

- The BMI is used to stratify the risk of metabolic and cardiovascular disease but in adults, BMI cut-offs for similar risks are lower in Asian populations.
- From observations of Guadeloupean adolescents with and without Asian Indian origins, the relationship between body mass index and body composition appeared ethnic-specific.
- We reported in adolescents a shift toward higher iliac thickness on most of the observed corpulence range in India-originating Guadeloupean girls, and on all the corpulence range in India-originating Guadeloupean boys as compared to the controls. This is compatible with the high prevalence of diabetes and complications in adults of this ethnicity.

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Civil society organisations, social innovation and health research in Europe

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Background: European Union strategies and programmes identify research and innovation as a critical dimension for future economic and social development. While European research policy emphasizes support for industry, the health field includes not-for-profit civil society organisations (CSOs) providing social innovation. Yet, the perspectives of CSOs towards health research in Europe are not well understood. **Methods:** STEPS (Strengthening Engagement in Public Health Research) was funded by the European Commission's Science in Society research programme. Within the study, we interviewed by telephone respondents of 13 European health CSOs, which represented collectively local and national organizations. **Results:** Research was valued positively by the respondents. Health CSOs did not seek to do research themselves, but recognized the opportunity of funds in this field and welcomed the possibility of collaborating in research, of using the results from research and of providing input to research agendas. Links between research and users provides knowledge for the public and improves impacts on policy. Research and evaluation can help in demonstrating the benefit of innovative activities, and give support and legitimacy. However, the cultures of, and incentives for, researchers and health CSOs are different, and collaboration requires building trust, a shared language and for the power relations and objectives to match. **Conclusions:** Health CSOs contribute social innovation in organising services and activities such as advocacy that cannot be satisfactorily met by industry. Engaging CSOs in research and innovation will strengthen the European Research Area.

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.¹ The European Commission has proposed an 'Innovation Partnership on Active and Healthy Ageing', linking programmes for health, research and enterprise.² 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.³ 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'.⁴ Complementing the major contributions of the public sector and business to research, CSOs form an important 'third way' in contributing