ORIGINAL ARTICLE

Influence of physical activity and interest for food and sciences versus weight disorders in children aged 8 to 18 years

A. FAIK, E. VANDERHULST, I. VAN ROSSEM, D. DEVROEY
Department of Family Medicine and Chronic Care, Vrije Universiteit Brussel, Belgium

Keywords

Physical activity • Weight disorders • Children • Adolescents

Summary

Introduction. *Being overweight and obesity are a growing problem and are often related to a lack of physical activity among younger people. This study aims to describe the prevalence of weight disorders in Belgian schoolchildren. Secondly, this study examines the association between physical activity, weight disorders and the interest in food and sciences.*
Methods. *We examined 525 children aged between 8 and 18 years old, who attended the Brussels Food Fair or the Belgian Science Day in 2013. They completed a standardized questionnaire about lifestyle and physical activity. Their weight, height, blood pressure and waist circumference were measured. The physical condition of participants was estimated using the Ruffier test.*
Results. *The average age of all participants was 11.2 years (95% CI: 8.7-13.7), the prevalence of being overweight and obesity was 16.3% and 5.4%, respectively. For all participants in the representative group the affiliation to a sports club was associated with a normal weight ($P < 0.05$). According to this study, the kind of transportation to school (foot/bike or car/bus) had no effect on their body mass index (BMI). Neither was there a significant relationship between the physical activity of the children and the result of their Ruffier test.*
Conclusions. *The prevalence of being overweight and obesity in children aged 8 to 18 years is alarming. Membership to a sports club was linked significantly to a normal weight and a lower prevalence of being overweight and obesity.*

Introduction

The prevalence of being overweight and obesity in children has increased worldwide and rapidly in recent years [1-4]. Despite all efforts from media and experts, the number of children with weight disorders is still increasing. Obesity is officially registered - since 1998 - as a chronic disease [5].
The rising prevalence of being overweight and obesity is a major public health problem in most industrialized countries. The consequences in the short and long term place a heavy burden on our public health system. An increase of cardiovascular diseases, diabetes, hypertension, various cancers, sleep disorders, musculoskeletal and psychosocial problems is expected [1-4]. The World Health Organization (WHO) considers being overweight and obesity, and its consequences, as avoidable diseases and therefore prevention has become a priority for public health [5]. A healthy diet and regular physical activity are the most important preventive measures recommended by WHO.
The WHO European Childhood Obesity Surveillance Initiative (COSI) was set up as a response to the need for harmonized and comparable data on overweight/obesity among primary-school children. Countries participating in COSI routinely measured trends in overweight and obesity in primary school children (6-9 years). Twenty-five countries participated, including Belgium [6]. Large between-country differences were found in the availability of food. BMI levels increased in all countries compared to the 2007 WHO levels.
The Health Behaviour in School-aged Children study (HBSC) is a collaborative cross-national study that examines the physical and mental health of young people aged 11, 13 and 15 years in 44 countries [7]. The findings highlight important health inequalities and contribute to a better understanding of the social determinants of health and well-being among young people.
A Belgian study shows that a lower educational level is associated with higher prevalence of indicators of an unhealthy lifestyle. The results are less straightforward for the relationship between socio-economic status and lifestyle behaviors [8].

Prevalence of weight disorders

The increase in the prevalence of being overweight and obesity in children is a global problem. The International Obesity Task Force (IOTF) reported a worldwide prevalence of 20% of overweight and obesity in children and adolescents in 2004 [9]. In the United States, the prevalence of obesity increased in children from 6.5% in the late Seventies up to 19% in 2003 [10]. In the United

Kingdom, the incidence of obesity among teenagers increased between 1995 and 2007 from 2.7% to 4.8% among boys, and from 4.7% to 6.1% among girls [11].
A 2012 study in seven European countries showed a prevalence for being overweight among schoolchildren between 19% in Norway, and 50% in Greece. Obesity was found in 4% in Norway, and 21% in Greece [12]. For Belgium overweightness was found in 21% and obesity in 6%. The prevalence of being overweight and obesity was higher in the countries where children watched more television and used their bike less, to go to school. In Belgium, the National Health Interview Survey (HIS) is a good instrument to monitor the evolution of overweightness in the general Belgian population. The prevalence of overweightness was 8.9%, 11%, 18%, 18% and 20% in 1997, 2001, 2004, 2008 and 2013, respectively. For obesity the prevalence was 4.4%, 4.3%, 6.0%, 5.0% and 7.1%, respectively [13].

Causes of weight disorders

Excess eating, a sedentary lifestyle and too little physical exercise, are a few of the main causes for overweightness, resulting in an energy intake which is higher than the energy consumption of the human body [13].
A healthy lifestyle is important for everyone. This includes a healthy diet and regular physical exercise. The concept of "health-related physical activity" was introduced in 1992 [14]. This concept refers to all movements of the body produced by striated muscles, which result in a significant increase in the energy consumption. It applies to all forms of physical activity, performed in leisure time, household activities, transfers and in the workplace.
Many studies have shown the beneficial effects of regular exercise on health. Even moderate physical activity such as gardening has a beneficial effect on health [15]. Also among adolescents physical activity showed health benefits [16]. Every individual should do almost every day of the week for at least 30 minutes some (moderate) exercise [17]. There is an international consensus that children and adolescents should have at least one hour of moderate to intense physical activity every day. Moreover, they need adapted exercises at least three times per week to improve muscle strength and bone quality [15, 16].
The aim of this study is to describe the prevalence of weight disorders in Belgian children and to find associations between the (lack of) physical activity and these weight disorders.

Material and methods

Study population

This research was conducted at the Brussels Food Fair from the 5th to 20th of October 2013 and at the National Science Day on November 24th, 2013. A total of 525 children were enrolled during these two occasions.
Three study groups were defined. The first study group was a representative sample of children between 8 and 18 years of age. They were recruited during class visits of schools who organized a trip to the Brussels Food Fair.
The second were children with special interest for food. They were recruited during the weekends among the children who visited the Brussels Food Fair with their parents.
The third were children with special interest in science, who were recruited during the National Science Day. During that yearly event, scientific institutes and universities demonstrate scientific experiments on different locations, to make children familiar with practical science.
The accompanying parents received a brief explanation about the design of the study and the investigated parameters at both occasions. For the three groups the parents had to give their informed consent prior to participation.
The assignment to the different subgroups was made on the basis of their presence at one of the activities. The first group were school children from a general population who did not chose to attend the food fair but their school organized the visit. This group was considered as the reference group. The children from the second group or at least their parents chose to visit the food fair. The children of the third group or their parents chose to visit the Science Day. The children themselves were not questioned about their interest in food or science.

Inclusion and exclusion criteria

The two inclusion criteria for this study were having an age between 8 and 18 years, and having an informed consent signed by one of the parents. The two exclusion criteria were pregnancy, or alcohol, drug or medication abuse reported by the participants.

Questionnaire

The study consisted in part of completing a standardized questionnaire, developed by the Netherlands Nutrition Centre, to identify the dietary habits of the participants (Appendix 1) [18]. This questionnaire was completed by the participants with (neutral) assistance of one of the researchers. The children were asked if they had some sweats or soft drinks the day before the fair, if they had breakfast, lunch and dinner, if they ate fruits, vegetables, meat and bread and if they drank milk.

Physical examination

Weight, height, waist circumference, and blood pressure were measured for all participants. For the measurements we used a weighing scale (Seca Sensa 804), a measuring stick (Seca Body Meter 206), a measuring tape, a sphygmomanometer (Welch Allyn DS54) together with a stethoscope (Littmann Classic II SE).
After the examination, the children received a personalized advice, based on the answers they gave to the questionnaire, their eating habits, and body mass index (BMI). The determination of normal BMI values was based on the Flemish Growth curves of the Vrije Universiteit Brussel [19]. On these curves, the calculated BMI values were plotted as a function of the sex and age of the children studied. If the BMI values were located on these curves in the gray area, above the P50, the diag-

nosis of overweightness was made. BMI values above this gray zone corresponded to the category of obesity. The upper and lower limits of that gray zone correspond to respective BMI values of 25 and 30, at the age of 18 years.

Diagnosis of weight disorders

Weight disorders are diagnosed from the age of 18 years by means of the BMI and waist circumference. Overweightness is diagnosed when having a BMI between 25 and 30 kg/m², and obesity from 30 kg/m². This definition cannot be used for children [20-22].

The International Obesity Task Force has published international BMI reference values in 2000, for children and adolescents [9]. These BMI-age charts are based on six major growth studies from the Netherlands, Brazil, The United Kingdom, Hong Kong, Singapore, and the United States.

In 2004, specific growth curves were published for Belgian boys and girls aged 2 to 20 years of age. They are based on a representative cross-sectional study of 7920 Flemish boys and 8176 Flemish girls [23].

These growth curves are also based on the calculation of the BMI for each age group, resulting in percentile lines. Overweightness is defined as having a BMI between the 85th and 97th percentile, and obesity for having a BMI above percentile 97. These percentile lines for BMI are different for boys and girls.

The definition of being overweight and obesity described by the IOTF, and those used in the Flemish growth curves, are basically identical because they use both the same BMI cut-off values. They differ only in the reference values used, which are, for what the Flemish growth curves are concerned, adapted to the Belgian population.

Ruffier test

The Ruffier test was used to evaluate the physical condition of the participants [24]. Participants were asked to make 30 knee bends in 45 seconds. Both heart rate and oxygen saturation in the blood were measured using a pulse oximeter (Meditech Fingertip Oximeter Oxyo) prior to exercise, right after and one minute, after the end of the effort. The Ruffier test was selected to measure the physical condition, because it takes only a few minutes, it is not expensive and it has a low chance for adverse events.

The 'degree of physical condition' was estimated with the formula IR = (p0 + p1 + p2 - 200) / 10 with IR = Ruffier Index, p0 = heart rate before exercise, p1 = heart rate just after the exercise and p2 = heart rate one minute after exercise. For the interpretation of the Ruffier index (IR), we used the following values: IR < 0 = very good, 0 < IR < 5 = good, 5 < IR < 10 = moderate, 10 < IR < 15 = poor, IR > 15 = very bad.

Approval ethical committee

For this study, the approval of the Ethics Committee of the University Hospital Brussels was obtained.

Statistical analyses

Statistical analyses were carried out using IBM® SPSS® Statistics 22. Patient data that were incomplete with regard to weight and height, were excluded for the analyses. Two by two tables were used to evaluate the relationship between two dichotomous variables, by means of a Chi-squared test. Two by three tables were used for three dichotomous variables. The Fisher's exact test was used when at least one expected value was below five. The T-test was used to compare the means of two independent samples. ANOVA was used to compare the means of three independent samples.

We also performed multivariable logistic regression to explore characteristics associated with overweight and obesity. The dependent variable compared participants with overweight or obesity with those with normal BMI. The logistic regression included age, sex, membership of a sports club, transportation to school and Ruffier test results as independent variables.

All study results were standardized for age and gender by means of a direct standardization. Comparisons were statistical significant for p-values below 0.05.

Results

Demographics

The records of 522 participants were eligible for our analysis: 287 (55%) in the "representative group", 194 (37%) in the "food group" and 41 (8%) in the "science group" (Tab. I). In all groups, there was an overrepresentation of the girls, except in the science group where more boys than girls participated. The mean age of all participants was 11.2 years of age (95% CI = 8.7-

Tab. I. Baseline characteristics of the participants for the total study population and for the three study groups.

	Total study population	Reference study group	Food study group	Science study group
Number	522	287	194	41
Girls (%)	301 (57,7%)	161 (56,1%)	123 (63,4%)	17 (41,5%)
Boys (%)	221 (42,3%)	126 (43,9%)	71 (36,6%)	24 (58,5%)
Mean age (SD)	11,2 (2,5)	10,7 (2)	12,1 (2,9)	10,2 (2,3)
Mean weight (SD)	41,5 (14)	40,9 (13,9)	43,6 (14,6)	36,4 (9,4)
Mean height (SD)	146,9 (13)	144,6 (12)	150,8 (13,9)	144,2 (11,7)
Mean BMI (SD)	18,6 (3,8)	18,9 (4)	18,5 (3,6)	17,1 (2,2)

Tab. II. Prevalence of weight disorder for the total study population and for the three study groups.

	Total study population (N = 522)	Reference study group (N = 287)	Food study group (N = 194)	Science study group (N = 41)	p(2)-value
Underweight	9.8%	7.0%	13.4%	12,2%	0.057
Normal weight	68.6%	65.5%	72.2%	73,2%	0.24
Overweight	16.3%	19.9%	11.3%	14,6%	0.043
Obesity	5.4%	7.7%	3,1%	0.0%	0.026
Overweight + obesity	21.6%	27.5%	14,4%	14,6%	0.002

13.7), the mean weight 41.5 kg (95% CI = 27.5-55,5) and the mean BMI 18.6 kg/m² (95% CI = 14.8-22.4). The mean age differed significantly between the three groups, with a significant higher age for the food group ($p(2) < 0.001$). The mean weight and the mean height were also higher for the food group with p(2) 0.003 and 0.005, respectively. The mean BMI differed also significantly between the three groups with a significant lower BMI for the science group $p(2) = 0.005$).

Prevalence of weight disorders

One third of the reference population has a weight disorder: 7% is underweight, 20% overweight and 8% obese (Tab. II). In the groups with special interest for food or science we found significantly less children with overweightness and obesity.

Influence of physical activity

About two thirds of all participants were member of a sports club (Tab. III). This was also the case in the reference group and subgroups. In the reference population, the membership to a sports club is associated with a normal weight, and children that are not member of a sports club have a higher risk for being overweight and obese. These associations however, were not observed in the food and sciences groups.

About one in two of the children went to school on foot or by bicycle (Tab. VI). Only in the food group we found

Tab. III. Prevalence of weight disorder according to membership to a sportsclub for the total study population and for the three study groups..

	Member of sportsclub	Non-member of sportsclub	p-value
Total study population			
Number (%)	339 (64.9%)	183 (35.1%)	<0.001
Underweight	9.1%	11.5%	0.40
Normal weight	71.7%	62.3%	0.029
Overweight	15.3%	17.5%	0.52
Obesity	3.9%	8.7%	0.020
Overweight + obesity	19.2%	26.2%	0.062
Reference study group			
Number (%)	178 (62.0%)	109 (38.0%)	<0.001
Underweight	6.7%	6.4%	0.92
Normal weight	70.8%	58.7%	0.036
Overweight	18.6%	22.1%	0.47
Obesity	3.9%	12.8%	0.005
Overweight + obesity	22.5%	34.9%	0.022
Food study group			
Number (%)	131 (67.5%)	63 (32.5%)	<0.001
Underweight	10.7%	19.1%	0.11
Normal weight	73.3%	69.8%	0.62
Overweight	13.0%	7.9%	0.30
Obesity	3.0%	3.2%	0.96
Overweight + obesity	16.0%	11.1%	0.36
Science study group			
Number (%)	29 (70.3%)	12 (29.7%)	<0.001
Underweight	13.8%	8.3%	0.63
Normal weight	75.9%	66.7%	0.55
Overweight	10.3%	25.0%	0.23
Obesity	0.0%	0.0%	-
Overweight + obesity	10.3%	25.0%	0.23

Tab. IV. Prevalence of weight disorder according to transportation to school for the total study population and for the three study groups.

	Walking or cycling to school (N = 289)	With car or bus to school (N = 233)	p-value
Total study population			
Number (%)	289 (55.4%)	233 (44.6%)	< 0.001
Underweight	9.0%	11.1%	0.60
Normal weight	71.3%	66.4%	0.24
Overweight	15.0%	17.3%	0.48
Obesity	4.7%	5.2%	0.06
Overweight + obesity	19.7%	22.5%	0.45
Reference study group			
Number (%)	142 (49.5%)	145 (50.5%)	0.80
Underweight	6.2%	7.0%	0.77
Normal weight	69.7%	62.1%	0.16
Overweight	16.5%	23.2%	0.62
Obesity	7.6%	7.7%	0.96
Overweight + obesity	24.1%	29.9%	0.19
Food study group			
Number (%)	126 (64.9%)	68 (35.1%)	< 0.001
Underweight	14.7%	12.7%	0.70
Normal weight	69.1%	73.8%	0.49
Overweight	14.7%	9.5%	0.28
Obesity	1.5%	5.0%	0.34
Overweight + obesity	16.2%	13.5%	0.61
Science study group			
Number (%)	20 (48.8%)	21 (51.2%)	0.83
Underweight	5.0%	19.0%	0.17
Normal weight	90%	57.2%	0.018
Overweight	5.0%	23.8%	0.09
Obesity	0.0%	0.0%	-
Overweight + obesity	5.0%	23.8%	0.09

a significant higher proportion of children going to school on foot or by bicycle. Taking the bus or going to school by car was not associated with weight disorders in the reference group. Only in the science group we found a significant association between going to school on foot or by bicycle, and a normal weight.

Physical condition

In the reference population, 60% had a good to moderate physical condition, according to the Ruffier test (Tab. V). Although the figures in the food group seemed a little better and in the science group a little worse, there was no significant difference between the groups, even not after dichotomizing the groups in good to moderate, and poor to bad (p = 0.41).

The results of the Ruffier test for the members of a sports club were not significantly better than for those who were not member of a sports club, with a good to moderate Ruffier test in 35% and 43%, respectively (p = 0.069). The Ruffier test was not better for those who went to school on foot or by bicycle, as compared to those who went to school by car or bus. Both groups showed good to moderate Ruffier test results in 38% and 37%, respectively (p = 0.73).

A logistic regression associated weight disorders with older age and a poor Ruffier test in the reference group. It could not determine an association in the other study groups (Tab. VI).

Tab. V. Distribution of the physical condition in four classes based on the Ruffier test for the total study population and for the three study groups.

	Total study population (N = 522)	Reference study group (N = 287)	Food study group (N = 194)	Science study group (N =41)
Good	10.4%	9.6%	12.2%	4,5%
Moderate	51.5%	50.3%	52.7%	51,3%
Insufficient	30.1%	32.1%	28.0%	32.7%
Bad	8.0%	8.0%	7.1%	11.5%

Tab. VI. Multivariable logistic regression for variables predicting overweight or obesity in the total study population and for the three study groups.

	Significance	Exp(B)	Lower 95% CI	Upper 95% CI
Total study population				
	No significant independent variables			
Reference study group				
Older age	0.046	1.138	1.002	1.292
Poor Ruffier test	0.038	1.406	1.018	1.940
Sports study group				
	No significant independent variables			
Science study group				
	No significant independent variables			
The logistic regression included age, sex, membership of a sports club, transportation to school and Ruffier test results as independent variables				

Discussion

Prevalence of weight disorders

There is no scientific doubt about the increased prevalence of overweightness and obesity among young people in recent decennia. According to the national HIS of 2013, not less than 20% of young people between 2 and 17 years of age were overweight, and 7% were obese [13]. Compared to the previous HIS, the rates have increased clearly.

This study shows a prevalence of overweightness and obesity of 20% and 8% respectively in an age group between 8 and 18 years of age. It is difficult to compare these figures with other studies, because of the difference in age groups between the studied populations. However, these percentages seem to be similar to the HIS of 2013.

The 2012 surveillance study in the seven European countries (see *supra*), also showed alarming figures, especially for the southern European countries [12]. Other studies in France, the UK and the US, show similar increases of overweightness.

The achieved figures show that the situation is worrying and requires an urgent intervention. This is especially important because childhood obesity eventually contributes to the epidemic of obesity in adults.

We initially hypothesized that we would find more persons with overweightness and obesity in the food group, and less in the science group. As the food fair is rather focused on the gastronomic aspects of food and less on healthy food, we assumed that children (and their parents) who attend the food fair would focus less on healthy food than children with an interest in science. We assumed that the latter would have a better knowledge about healthy food. Better nutritional knowledge was correlated with lower body weight in Mexican women with a low socioeconomic level [25]. In high-school students, a better nutritional knowledge increased their self-concept and self-efficacy in order to adopt healthy behaviours [26]. However, the proportion of children with overweightness and obesity was lower in the food and science groups, as compared to the reference group. Probably some selection bias is involved. For the reference group, almost all visiting schoolchildren participated in the study. For the food and science groups it was easier for the children to refuse participation. It is possible that more children with overweightness refused participation because of their potential awareness of the problem.

Age, weight and height were higher in the food group. Most likely, the higher weight and height are related to the higher age.

The causes for the obesity pandemic are well known: bad dietary habits, too little physical exercise, eating disorders, and heritability. Before the eighties, overweightness was not an issue, because most people grew up during or just after the Second World War. The lack of food resulted in a kind of "protective underweightness". But the generation of young people growing up in the eighties never knew the issue of lack of food. Since 1988, up until today, the proportion of people with overweightness has doubled.

However, the Second World War was not the only "factor" in this growing health problem. Since the eighties, the price of food decreased, the amount of food advertising increased, fast food restaurants appeared, more people had sedentary jobs, and more people owned computers and televisions, all resulting in less physical activity. Moreover, more households had two-person jobs and incomes, that resulted in an increased number of restaurant visits.

The problem of overweightness appeared together with the increased welfare, and is for that reason a lifestyle disease.

Effect of physical activity on overweightness

Not less than 64% of the participants in our study were member of a sports club. These children had significantly less weight disorders. Especially children with obesity were not member of a sports club. For those with overweightness, no significant difference was observed. We cannot conclude that membership of a sports club protects against obesity, but we can conclude that those who have the greatest benefit in physical activity are not subscribed in a sports club. Probably the activities in the sports club are not adapted to children with obesity. It would most likely be helpful should sports clubs make

more efforts to provide adapted programs for children (and adults) with obesity.
We found no association between weight disorders, and the transportation method to school. The distance between the homes of the children and the schools in Belgium is quite short on the whole, and probably not lengthy enough to have any effect on weight.
Neither did we find an association between the physical condition on one hand, and the membership to a sports club or the transportation method to school on the other hand. We are aware that the Ruffier test is not the most sophisticated test to detect small differences and association of this kind [27]. However, weigh disorders were associated with a poor Ruffier test and older age in the logistic regression.
The comparative study of the seven European countries showed that children from the countries with the highest proportion of overweightness and obesity (Greece and Hungary) had the lowest physical activity and watched more television than other children [12].
The amount of physical exercise is an important measurement for the prevention of overweightness and obesity, both in children and adults [28-30]. Physical activity improves physical fitness, weight and health in some studies but not in all [31]. However, it reduces the risk of various diseases (cardiovascular diseases, obesity, diabetes, osteoporosis) [1, 2]. Even in obese adolescents, a program promoting physical activity may help to reduce body weight [31].
There is an international consensus that children and adolescents must have at least one hour of daily moderate to intense physical activity. Moreover, they need more thorough exercise, at least three times a week, to improve bone quality and muscle strength [33].
A Cochrane meta-analysis of 55 studies evaluated the effectiveness of various preventive interventions for obesity in children. Regular physical activity was one of the most important actions to prevent it [15].
Some countries already started in the early nineties with prevention programs. The EPODE (Ensemble Prévenons l'Obésité des Enfants) project was launched by the university of Lille in 1992 [34]. The EPODE project consisted of various activities in the community, at school, or in the family, and is based on providing information about healthy food and exercises, involving parents, professionals and the villagers. In 2004, the project was evaluated favorable and implemented in several other countries such as Belgium, Spain, Greece and Australia. The JOGG project (Jongeren op Gezond Gewicht) was based on the French EPODE project [35].

Strengths and limitations of the research

The main strength of the study is the use of a representative sample of the young population in Belgium.
In other studies, attention was paid to the difference between girls and boys. In our research, we did not consider these differences as a research question.
To determine the physical condition of children, the Ruffier test was used. In the literature only few data are available on the reliability of this test [24]. However, this test is widely used and practical to estimate the physical condition. It has the advantage of being simple, fast, and reproducible. It requires no special material and can be used both for children and adults.
We did not identify what types of sporting activity was carried out, and at what frequency it was performed. This seems to be of great importance, because there exists a clear dose-response relationship between the intensity of physical activity, and health benefits [3, 4, 35, 36]. Some bias may exist, because some children were not (or no longer) member of a sports club, but they may practice regular physical activity for example by cycling, jogging or swimming outside the regime of a sports club.
The origin of the participants was not taken into account in our research. There was an important proportion of children of non-European origin (Moroccan, Turkish, South African...). Genetic and cultural differences, such as eating habits, play an important role in the development of overweightness and obesity in children. Using the Flemish growth curves is controversial in this population segment, because the prevalence of obesity among young non-European residents is almost twice as high as among the Flemish youth. In the Netherlands, specific growth curves are developed for children of Turkish and Moroccan origin [37].
We did not use the international growth curves, because the local ones are better adapted to the Belgian situation.

Conclusions

The prevalence of overweightness and obesity in children aged 8 to 18 years of age, remains high. Membership to a sports club was significantly linked to having a normal weight and a lower prevalence of overweightness and obesity. The mode of transportation to school was not associated with their BMI. There was also no significant association between the exercise habits of these children, and their physical condition. However, a poor Ruffier test was associated with an increased BMI.

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The authors declare no competing interest.

Authors' contributions

AF: conception, design, analysis and interpretation of data, drafting of the manuscript and final approval of the version submitted. EV: conception, design, analysis and interpretation of data, drafting of the manuscript and final approval of the version submitted. IVR: analysis and interpretation of data, drafting of the manuscript and final approval of the version submitted. DD: conception,

design, analysis and interpretation of data, drafting of the manuscript and final approval of the version submitted.

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Appendix 1

Questionnaire

What is your gender? O Man O Woman

What is your postal code? _____

What is your year of birth? _____

How would you rate your health on a scale from 1 to 100 where 1 corresponds to "very poor" and 100 "very good"? Put a cross on the line.

1----------100

Weight: _____ kg

Height: _____ cm

Abdominal circumference: _____ cm

Blood pressure: _____ /_____ mmHg

Are you affiliated with a sports club?	O Yes	O No	O Don't know
Did you have some sweats yesterday?	O Yes	O No	O Don't know
Did you have some soft drinks yesterday?	O Yes	O No	O Don't know
Did you have breakfast yesterday?	O Yes	O No	O Don't know
Did you have dinner yesterday?	O Yes	O No	O Don't know
Did you have supper yesterday?	O Yes	O No	O Don't know
Did you have some vegetables yesterday?	O Yes	O No	O Don't know
Did you have some fruit yesterday?	O Yes	O No	O Don't know
Did you have some meat yesterday?	O Yes	O No	O Don't know
Did you have some bread yesterday?	O Yes	O No	O Don't know
Did you have some milk or yoghurt yesterday?	O Yes	O No	O Don't know
How do you usually go to school?	O By bus or car		O On foot or by bicycle

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■ Correspondence: Dirk Devroey, Vrije Universiteit Brussel (VUB), Head of the Dept of Family Medicine and Chronic Care, Laarbeeklaan 103, B-1090, Brussels, Belgium - Tel. +32 2 477.43.11 - Fax +32 2 477.43.01 - E-mail: dirk.devroey@vub.ac.be