Alcohol drinking, smoking and food insecurity in Venezuelan parents as potential determinants of their children's growth

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Abstract

Life conditions are key factors for defining growth and development of future generations. Exposure of parents to alcohol, tobacco, food insecurity conditions and adverse socioeconomic environment as part of their lifestyle and quality of life, have been reported to affect their children's health and wellbeing. Prenatal exposures have been extensively documented, but less is known about influences from parental harmful habits and disadvantaged environment during children's school years. The aim of this study is to examine potential associations between parental habits and environmental socioeconomic conditions, including food security status, and anthropometric characteristics of their children. Parental smoking, alcohol intake, food security, and socioeconomic status (SES) were explored in parents of 1730 children recruited at private and public schools in eight Venezuelan cities. These qualitative variables were collected through a semi-structured questionnaire. Weight, height and body mass index were measured using standardized methods in children. Height and BMI were converted to z-scores according to WHO international growth reference. Low BMI z-scores in children were significantly associated with mothers consuming alcohol. The frequency of children with short height was higher in households with impaired access to quality foods and where mothers reported low and very low food security status. In brief, our study indicates that social environment could have detrimental effects on child anthropometry thus, affecting their wellbeing.

Background

Evidence based literature (1) shows that environmental conditions and population nutrition status influence children's growth (2). While the majority of the world's child population lives in low and middle income countries, most research on interactions between the environment and growth or development of children originates from Northern American or West-European countries. Housing conditions, emotional behaviors and quality of parental care are factors known influencing children's wellbeing. Additionally, altered BMI –low and high-, substance use including alcohol and tobacco and adverse socioeconomic conditions of parents, contribute to an impaired nutritional status in offsprings (3). Thus, parental risky behaviors such as alcohol drinking and smoking and living in food insecurity are among the factors that increase the odds of a child to become obese or undernourished; particularly during critical periods when parental care is key (4). While low-income countries are underrepresented in these studies, studying countries with economic uncertainties could lead to a better understanding of these interactions, on a larger and worldwide scale.

Venezuela has been exposed to the most severe crisis on recent years, and changes in life conditions have been enormous for its citizens. From being one of the largest and most solid economies in Latin America, the country is currently facing an economic downturn with negative consequences for wellbeing of its population. These changes have been installing slowly and correspond to what WHO defines as a complex emergency, as stated by several local experts and NGOs (5). This event means a slow deterioration by causes other than natural disasters and wars.

According to a FAO/PAHO report on Food Security in Latin America and the Caribbean, the inflation of goods reached 253% (6) for Venezuela in 2016, whereas the levels in other countries in the region were two low digits only. In addition, a nationally representative survey on Living Conditions in Venezuela (known as ENCOVI by its acronym in Spanish) reports that 80% of Venezuelan households did not have enough income to buy foods in 2014 (7). This situation worsened during the following three years, and the number of households with an income that does not allow to buy the basic foods to cover their needs increased to 90% and 80% of households were living in food insecure conditions by 2017 (8).

During the period of data collection for this study, the year 2011, the National Survey of Food Consumption (ESCA, 2011), already reported a diminished consumption of certain strategic foods such as dairy products, sources of proteins of animal origin, legumes and fruits and vegetables (9). It is important to understand what this previous path was before the official countrywide food insecurity crisis started, and to document and report which determinants of child wellbeing were present at that time.

Our research team was interested in understanding the environment school-aged children during these years preceding this crisis, had at home. Hence, the aim of this study is to identify parental risky behaviors (smoking and alcohol intake), food security status of the household and socio-demographic characteristics; and if there is an association with children's anthropometrics' measures.

Methods

A total of 2081 children (937 girls and 1067 boys) were recruited in eight Venezuelan cities, between May 1st and October 31st, 2011. At each of these cities: Caracas, Maracaibo, Maracay, Valencia, Maturin, Mérida, Puerto Ordaz and Coro, one private and one public school was involved. Inclusion criteria were: being a student in the first to sixth grade, being 7 to 12 years old, and having a written consent form signed by parent or legal guardian. After exclusion criteria were applied, our analytic database included 1730 children (798 boys and 932 girls); 5

boys who had just turned 13 years of age were not excluded, but grouped together with the 12 year old. The study was approved by the ethics committee of the Venezuelan Scientific Society for Obesity, and conducted in accordance with the ethical standards specified in the World Medical Association (2000) Declaration of Helsinski. Informed consent was obtained from a parent or legal guardian of each participating child.

Height was measured to the nearest 0.1 cm using a wall-mounted flexible measuring tape and weight to the nearest 0.1 kg with a digital scale (Tanita HD). Anthropometric measures were obtained by trained personnel assisted by the school teacher. Children were requested to stand in light clothing and without shoes at the center of the measuring tape with the back of the head, shoulder blades, buttocks, and heels touching the wall and the Frankfort plane in a horizontal position (10,11). The BMI was calculated as weight (kg) divided by the square of height (m^2) (kg/m^2). Height and BMI were converted to z-scores (HAZ, BMIZ), according to the WHO international growth reference with the Anthropo Plus software for evaluation of children growth and development (12). Height was classified as tall (HAZ > 2), normal, or stunted (HAZ < -2), and BMI was classified as underweight (BMIZ < -2), at risk for underweight (-2 ≤ BMIZ < 1), normal (-1 ≤ BMIZ ≤ 1), overweight (1 < BMIZ ≤ 2), or obese (BMIZ > 2) (11). Based on these categories three groups for BMI were obtained: low BMI (Including underweight and risk for underweight), normal BMI and high BMI (including those overweight or obese). This simplified classification was used for the analysis of associated factors. Target height was calculated as (height mother + height father - 13)/2 in girls, and (height mother + 13 + height father)/2 in boys (13).

The nutritional status of both parents was obtained by self-reported weight and height. Parents were classified according to their BMI as underweight (BMI < 18.5 kg/m^2); normal weight (BMI 18.5-24.9 kg/m^2), overweight (BMI 25-29.9 kg/m^2) or obese (BMI >30 kg/m^2) (14, 15).

Data on sociodemographic and parental lifestyle factors were obtained with a semi-structured questionnaire that included maternal education, occupation of the head of household, type of income, and housing conditions. Socioeconomic status (SES) was defined according to Graffar as modified by Méndez Castellano (16). This classification has five socio-economic levels from the high (level I) to low (level V), but for the purposes of this study we combined levels I and II as “high” and levels IV and V as “low” (three levels of SES). Harmful lifestyle habits were assessed by current smoking and alcohol use (yes/ no).

Food security was evaluated according to the 6-item short module questionnaire of the US Department of Agriculture. A food insecure household was defined by more than 3 positive items. In addition, we identified households who were unable to buy quality foods by the second item of the questionnaire ("I/we couldn’t afford to eat balanced meals for (you/your household) in the last 12 months? ") (17).

Statistical Analysis

Anthropometric variables are presented as mean values and standard deviation. Sociodemographic, biological and lifestyle factors in children and their parents are presented as frequency tables. Chi-squared tests were used to assess the statistical significance of associations and risk between categorical variables, and Spearman or Pearson correlations to summarize the association between ordinal (qualitative) and continuous (quantitative) variables respectively. The correlation analyses excluded one child with impaired growth. Principal Component Analysis (PCA) was used to analyze the association between anthropometric variables in children and parents, between parental habits and children’s growth, The objective of PCA in this analysis is to find a way to find which variables cluster together in a complex multidimensional analysis (18).

Continuous variables included in the PCA were children’s height, BMI, and target height and height of the mother, height of the father, BMI of the mother, BMI of the father. In order to establish the associations between these anthropometric characteristics, sociodemographic characteristics, harmful lifestyle habits and food security status, categorical variables were projected over the factorial components: smoking, alcohol consumption, socioeconomic status, level of education and food security of the mother and father respectively. Statistical significance was assumed when test values were larger than 2 or smaller than -2, similar to a z value (18, 19).

Data was analyzed using Statistical Package for the Social Sciences software version SPSS 21.0 (20), and SPAD software (Système Portable pour l’Analyse des Données, version 5.6.0) (21) to perform the PCA.

Results

Children’s anthropometrics variables and parental characteristics

Descriptive statistics for anthropometric characteristics of children are presented in Table 1. Z scores for height and BMI are shown in Table 2. Parental and children's frequencies of sociodemographic and anthropometric characteristics are shown in Table 3. Study subjects were

grouped in 3 groups: : a first group including the 56.0 % of mothers classified high and medium high SES, whereas 30.8% were categorized as medium- low and 13.2 as low and very low SES.

It was verified if SES and choice of school system were related and found no significant correlations. In families with middle-high SES 43.7% children attended public schools and 56.3% private schools. In medium low SES 49.9% attended public schools and 50.2% private school, and in low-very to low SES 43.9% went to public schools and 56.1% to private schools (data not shown).

The majority of fathers and mothers had completed high school education or had a technical degree. Fathers were more likely to consume alcohol than mothers. Frequencies of obesity and overweight were also higher in fathers than in mothers.

Frequencies of the categories for children's height were obtained and classified as low, normal and tall height. 4.3% of children were classified as short, 91.6% as normal and 4.1% as tall height for age. The weight of the children reported that 2.5% of children had low weight, 83.1% had normal weight and 14.4% had high weight. Children's BMI categorization shows that 0.8% of children were underweight, 12.8% were at risk of underweight, 47.9% were normal, 22.8% were overweight and 15.7% were obese.

Associations between Children's anthropometrics variables and parental characteristics

Frequencies for the three categories of children's height (short, normal and tall) were compared according to the following variables for each parent: smoking, alcohol consumption, BMI, socioeconomic status (SES), level of education and food security status (total score and question number 2, described in materials and methods).Tables 4 and 5 show frequencies for each category of children's height and BMI compared to the following variables for each parent: smoking habit, alcohol consumption habit, BMI, socioeconomic status (SES), and food security status (total score and question number 2 related to the access of quality foods). We found a significant association between food insecurity (reported by the mother) and short height in children (χ^2=8.205. 2 df; p=0.017). Furthermore, alcohol consumption by the mother was significantly associated with low BMI in children (χ^2=8.597. 2 df; p=0.014). Also, mother's SES was significantly associated with children's BMI, meaning a higher BMI if SES was high, and a lower BMI if SES was low (χ^2=10.979. 4 df; p=0.027), showing a trend to lower BMI is present in this sample when mother's SES is low and alcohol consumption exists.

A trend toward short height in children can be observed when mothers belong to low SES, and were overweight or obese. On the other hand, a trend toward higher heights in children can be observed when the father was overweight or obese, but this was not significant (data not shown).

The frequency of short height children was larger and presented a significant relationship within households with low and very low food security status reported by mother (χ^2=8.205; 2 df; p=0.017). A similar result was found if a question related to access to quality foods was asked (χ^2=7.347; 2 df; p=0.025).

A stratified analysis by gender of the children showed no significant correlation.

Relationships between parent's variables

Correlation between parent's BMI was low and children's BMI was not significantly associated with parent's BMI (Data not shown). Height and weight of the mother was not associated with height and weight of the father. However, a high correlation was observed between the age of parents (r^2=0.167; p=0.00017), their level of education (rho=0.326; P<0.0001), food security status reported by father and by mother (rho=0.197; P<0.0001), smoking habit and alcohol consumption of mother (rho=0.197; P<0.0001), and smoking habit and alcohol consumption of father (rho=0.147; P<0.0001).

Results of Principal Component Analysis (PCA)

By using PCA analysis, five components were extracted from the variables grouping the children and their parents examined characteristics as well as the supplementary variables (Table 6). The axes defined by the PCA were characterized as follows, as PCA was run on the influence of the variables on children's anthropometrics measurements: a first principal component (PC1) formed by target height and mother height; a PC2 characterized by BMI and height; a PC3 representing mother BMI and father height; a PC4 formed by birth weight and father BMI; and a PC5 also characterized by father BM. PC1, PC2 and PC3 had Eigen values higher that 1 explaining the 55.9% of the total variance in the data set.

The PC1 is represented by target height and height of the mother, followed by father's height; lower values of PC1 axis can be found with higher values for these three variables. PC2 is defined by children's BMI and height and a correlation directly proportional to the factorial axis, meaning higher values for PC2 show higher values of BMI and height. Significant associations within the PC1 were children's target

height and parent's tall height with higher socioeconomic status of parents and with higher level of education, particularly of fathers, on the other hand, children's target height were associated with lower socioeconomic levels and lower level of education of the parents, particularly of the mother. PC2 shows the association between higher BMI and higher height of children with high level of education and high-marginal food security of the mother. PC3 reports the association between mothers and fathers height and mothers' BMI represented in a lesser extent in the total variance.

Graphic representation of the factorial plans can be observed at figure 1. The PCA analysis and the graphic representation of anthropometric, habits, food security and socioeconomic variables all together, allowed us to describe the reported associations observed in the two ovals on the graphic 1. On the first quarter the association between the highest values of height and BMI in children with better socioeconomic conditions of the parents: higher education level and food security. Below, the disadvantaged categories are grouped: low education level of parents, low socioeconomic level and very low food security which are associated with low height of parents and low target height.

Discussion

In the current study we report an association between socioeconomic conditions of parents and BMI or nutritional status of Venezuelan children. We show that maternal SES, food security/insecurity status and alcohol consumption have an independent impact on the anthropometric measures of her child. By no means had we intent to talk about causality, however, the observed trends deserved a discussion to at least establish the complex interactions of environmental characteristics on children's development.

The evaluation of growth characteristics and development of children are key elements to define children's wellbeing. Only if nutritional and socially related environmental conditions are adequate, a fulfilled and successful development of a child can be reached (22). The multidimensional aspects of food security and poverty expressed in this work are complex and most likely mimic other related conditions, including lack of economic growth, social inequities, level of education and per capita income among others. The web of interactions of these factors may influence health status of individuals in a society (22) (23)(24).

The achievement of a good health status for individuals has been accepted as one of the main objectives of development in modern societies (23). Venezuela once was an economically growing country, but its downturn and especially the health consequences thereof may be similar to how populations in other poor regions of the world respond to harmful environmental (or parental negative behaviors) exposures. In poor countries children's growth and development are seldom studied in relation to parental characteristics. Thus, understanding the course of the Venezuelan crisis and identifying the signs -that remained unnoticed during the years previous to the acute crisis- may not only help to comprehend these kind of situations, but can also be important to predict potential health consequences.

In the previous years to the Venezuelan acute crisis, characteristics of school age children presented a trend toward overweight; as observed in this study. In 2008 27.44% of school age children were overweight or obese (25) according to the national obesity survey, yet there was a proportion of children in deficit showing what is called: the double burden of malnutrition. The current study is relevant to learn more about the transition period right before the crisis officially started. We categorized 15.7% of children as above the standards, while recent data reports no overweight or obese children in some schools in Venezuela (26). Furthermore, the current scenario is that infant mortality rates are increasing (27), acute undernutrition in children under five years old is elevated (28), and stunting and chronic undernourishment in school age children are not uncommon (26).

We found that low BMI in this sample of Venezuelan children was significantly associated with maternal alcohol consumption. In addition, alcohol consumption was correlated with smoking in mothers. Probably because living in disadvantaged conditions, deteriorates quality of life since efforts to achieve success in surviving daily life might be large and efforts in reaching a good and productive life might be challenging. Being a parent in difficult conditions might lead to harmful habits such as alcohol intake and smoking. It has been reported that children of alcoholic parents receive less discipline, less emotional support, decreased parental monitoring and less care for child's nutrition and wellbeing in general (29,30).

In Venezuela, traditionally alcohol consumption has been reported as relevant. Since the colonization days, aboriginals and conquerors showed consumption of beverages with alcohol component, and certain beverages continue to be culturally accepted (31). The latest available survey on alcohol consumption conducted by the National Anti- Drugs Department in 2005 and reported by the Panamerican Health Organization shows that 62.64% of the population over 15 years old considered themselves as an alcohol drinker (32). One can argue that in Venezuela there are no limits to define drinkers on a daily basis such as in other countries that have explicit limitation in order to avoid the misuse of alcohol.

PCA allowed to evaluate the interaction of qualitative and quantitative variables to establish how the previous associations were grouped altogether and prioritize the relevance of the interactions of variables through the factorial components (18)

Among these associations it is important to highlight that children with low height showed a relationship with the mother's perception of living in food insecure household. Casey et al. showed in a US-based study that risks for children living in a food insecure household for becoming obese were: being a girl, between age 12 and 17, white and belonging to families with income < 100% poverty level (33). Also Herrera et al, identified in a systematic review that obesity and overweight can be associated with food insecurity as a sign of consumption of cheap affordable foods (2). Recent data shows that food insecure households in Venezuela are the majority (80%) (34) and that alcohol consumption is low (35). We hypothesize that currently, families cannot afford buying enough foods for feeding themselves, thus the traditional drinks consumed by mother and fathers to deal with life challenges are now sacrificed as a collateral symptom of food insecurity.

It is important to remember that according to FAO food security exists when all people at all times have physical and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life. Four dimensions can be identified: 1) physical availability of foods 2) economic and physical access to foods. 3) food utilization and 4) stability of the other three (36). Venezuela has been progressively going into a deep crisis in availability of certain foods in the last seven years according to recent surveys and other studies and reports which at the time of the recruitment of the children and taking the samples was shown as the instability on the availability of certain idiosyncratic foods and other basic products such as pre-cooked corn flour, sugar, rice, legumes and milk (7,8, 9, 34, 37). Along with the economic crisis and huge levels of inflation particularly for foods (6) the economic capacity of disadvantaged families has deteriorated for acquiring quality foods.

The installation of the crisis in Venezuela has been slow, and has been recently defined as a complex humanitarian emergency, since it was not a consequence of a natural disaster nor an armed conflict (5). Although purely hypothetical, during the years 2011-2013 (previous to the crisis) a deterioration in quality of life could have been happening so the population started making adaptations such as migration to the public subsidy food program to acquire foods at affordable prices. Also, migration from private to public (free) schools is an acceptable explanation giving the fact that the public school system was traditionally mainly populated with low income families, while our data show that 89.05% of children in public schools also come from middle class.

It is important to mention the trend to the prevalence of high children's BMI (15.7%) when addressing alterations in this study. Noteworthy, during the years 2011 and 2012 a major universal food subsidy program was established in Venezuela distributing cheap foods rich in calories but with low nutritional values (37). A study conducted during this same period in adults found a food pattern rich in calories and low in nutrients in beneficiaries of this program. Also the same study found an association between being overweight and/or obese adult with living in a food insecure household (37).

Poverty is a multidimensional and complex entity which makes it difficult to evaluate its consequences through a single factor approach, especially if health issues are involved (23). Some communities and societies can express the consequences of social inequities through health issues or nutrition related behaviors and status such as an increase in obesity, while others may indicate an existing undernutrition for their population (2). In this study, a trend toward low height in children exists -although not significant- when parents have low level of education. Similarly, Kontogianni et al. reported an association between obese Greek children and low level of education of their parents (38). Differences between populations including cultural dissimilarities approaches to food, genetic and epigenetic environments including the political environment and historic events may influence how a population is fed. It will show the direction in terms of what can be expected of height as an example, if the population is covering the macro and micronutrients requirements (39). According to Venezuelan National Institute of Nutrition 2007 last survey (40) ten percent of children between 7 and 17 years old report growth impairment or low BMI. Other studies in Venezuela report more than ten percent deficit in prepubescent children assessed by different standards (41).

This study shows a predominant amount of children belonging to middle social class and reports a low height prevalence of 4.3% and 4.1% classifies as high height for age, the majority shows normal. The last finding might be because the conditions of surroundings in middle SES for the majority of children, some children might show early maturation characteristics in the case of Venezuelan population particularly girls as shown in other studies (42).

The main limitation of this study is its cross-sectional design; hence, we were unable to measure evolution of growth or weight in our study sample. Among the strengths of this study is the fact that it has included several socio-economic characteristics that affected Venezuela's hard economic and social scenario, present since almost a decade now, that might impact the population's wellbeing particularly children. These characteristics: parent's harmful habits and their relationship with SES and food security status in the context of rising school age children have not been fully studied in Venezuela until the best of our knowledge and constitute new evidence for scientific discussion. On

the other hand, among this research's limitations is the fact that the complete universe of school age children in Venezuela was not evaluated and that it could not investigate parent's past habits for smoking and alcohol drinking which would have added an important element for evaluation of the strength of such habits in this population sample. It is also a limitation that we did not investigate other associated factors that promote growth or BMI alterations in children due to parents pre-conceptional or during pregnancy habits (43).

Conclusions

Adverse environmental conditions have an impact on growth and development of children. This is an important line of research that should be consolidated in Venezuela as well as in the rest of the region in order to establish the interacting factors of growth impairment and most of all what actions and strategies can drive to improve this situation. Being aware that many of the environmental issues affecting living conditions and child care can be prevented with adequate public policies is key. The conclusion is that interaction with environmental sociodemographic conditions are determinants of wellbeing of parents and their children and that parents with lifestyle habits such as regular alcohol intake along with belonging to a food insecure household might deteriorate their children's care and adequate nutrition thus promoting impairments in growth and chronic diseases later in life.

Abbreviations

BMI: Body Mass Index

BMIZ: Body Mass Index ZScore

ENCOVI: Encuesta Nacional de Condiciones de Vida (National Standard Conditions Survey for Venezuelans)

ESCA: Encuesta de Seguimiento al Consumo de Alimentos (Food Consumption Survey Follow-up)

FAO: Food and Agriculture Organization of the United Nations

FSS: Food Security Status

HAZ: Height for age ZScore

PAHO: Pan-American Health Organization

PCA: Principal Component Analysis

Declarations

Ethics approval and consent to participate: The study was approved by the ethics committee of the Venezuelan Scientific Society for Obesity at the time, and conducted in accordance with the ethical standards specified in the World Medical Association (2000) Declaration of Helsinski. Informed consent was obtained from a parent or legal guardian of each participating child.

Consent for publication: All authors agree with the terms and conditions of the publishing house and do not have any hesitation.

Availability of data and material: Data is available upon request and approval of institutions of affiliation.

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Authors' contributions: Dr. Herrera-Cuenca was the leader for data collection in 2011 and conceived the idea of this study when she was an invited professor at KU Leuven, Belgium, she wrote the manuscript and was the leader of the team. Dr. Rodríguez-Arroyo in junction with Dr. Roelants helped with statistics and critically revised the manuscript. Doctors Vansant and Soubry also critically revised the manuscript, and

Doctor López-Blanco, and Professors Landaeta-Jiménez and Macías Tomei, helped with the revision of anthropometrics data and its analysis.

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Tables

Table 1. Anthropometric characteristics by age and sex of 1730 Venezuelan school children

			Weight (kg)				Height (m)				BMI (kg/m^2)			
Age	**Sex**	**N**	**Min**	**Max**	**Mean**	**SD**	**Min**	**Max**	**Mean**	**SD**	**Min**	**Max**	**Mean**	**SD**
7 years	Boys	36	17.40	55.50	27.29	8.18	1.09	1.41	1.24	0.06	12.82	35.52	17.53	4.08
	Girls	39	16.60	40.70	27.49	6.32	1.13	1.38	1.25	0.06	10.28	24.85	17.46	3.54
8 years	Boys	207	18.50	58.20	30.50	8.09	1.17	1.46	1.31	0.06	11.29	29.74	17.53	3.46
	Girls	233	18.00	69.90	29.45	7.31	1.11	1.59	1.30	0.07	12.71	29.09	17.36	2.90
9 years	Boys	187	20.20	68.70	34.96	9.29	1.17	1.52	1.36	0.07	12.65	32.82	18.75	3.83
	Girls	204	19.70	62.30	33.09	8.04	1.17	1.54	1.34	0.07	11.54	30.90	18.16	3.47
10 years	Boys	142	21.30	65.40	37.20	9.66	1.26	1.59	1.41	0.07	12.41	30.33	18.58	3.74
	Girls	200	23.20	74.20	37.33	8.51	1.18	1.63	1.41	0.08	12.14	37.86	18.63	3.50
11 years	Boys	136	20.80	88.40	42.00	11.37	1.23	1.69	1.45	0.08	12.63	32.53	19.73	4.17
	Girls	172	22.20	79.90	43.77	11.10	1.24	1.69	1.48	0.08	11.33	33.69	19.88	3.80
12 years	Boys*	90	27.90	90.70	45.04	12.38	1.35	1.71	1.50	0.08	12.57	37.27	19.92	4.72
	Girls	84	26.70	77.80	45.03	10.86	1.29	1.69	1.51	0.07	12.53	32.25	19.68	4.03
Total	Boys	798	17.40	90.70	36.19	11.07	1.09	1.71	1.38	0.10	11.29	37.27	18.65	3.99
	Girls	932	16.60	79.90	35.90	10.59	1.11	1.69	1.38	0.11	10.28	37.86	18.48	3.58

**The 5 boys of 13 years were included in the 12 year old boys' group*

Table 2. Height and Body Mass Index (z scores) by age and sex of 1730 Venezuelan school children in this study

			Height (m)					BMI (kg/m2)			
Age	Sex	N	Min	Max	Mean	SD	N	Min	Max	Mean	SD
7 years	Boys	36	-2.84	3.02	-0.08	1.13	36	-2.54	7.75	0.87	1.79
	Girls	39	-1.89	2.55	0.28	1.01	39	-4.54	3.23	0.62	1.70
8 years	Boys	207	-2.21	2.76	0.22	1.05	207	-4.29	4.81	0.56	1.64
	Girls	233	-3.10	4.96	0.02	1.21	233	-2.27	3.75	0.50	1.17
9 years	Boys	187	-2.93	2.72	0.11	1.08	187	-3.01	4.81	0.89	1.47
	Girls	204	-2.96	2.95	-0.17	1.17	204	-3.65	3.63	0.52	1.29
10 years	Boys	142	-2.19	2.84	0.07	1.03	142	-3.50	3.64	0.52	1.45
	Girls	200	-3.64	3.25	-0.08	1.16	200	-3.35	4.39	0.45	1.28
11 years	Boys	136	-3.33	3.33	-0.12	1.16	136	-3.57	3.59	0.69	1.44
	Girls	172	-3.58	3.09	-0.09	1.25	172	-4.34	3.39	0.58	1.31
12 years	Boys*	90	-2.40	2.56	-0.39	1.13	90	-3.93	3.96	0.38	1.51
	Girls	84	-3.62	2.18	-0.46	1.07	84	-3.66	2.95	0.18	1.35
Total	Boys	798	-3.33	3.33	0.03	1.10	798	-4.29	7.75	0.65	1.53
	Girls	932	-3.64	4.96	-0.10	1.19	932	-4.54	4.39	0.48	1.29

Min. minimum; Max. maximum; SD. standard deviations; BMI. body mass index.

Table 3. Sociodemographic characteristics, anthropometric classification, and lifestyle factors in children and their parents

	Children			Mother		Father	
	n	%		n	%	n	%
Sex			**Tobaco use status**				
Boys	798	46.1	Smoking yes	72	7.2	127	17.0
Girls	932	53.9	Smoking no	927	92.8	619	83.0
			Alcohol consumption				
School			Alcohol yes	236	24.1	429	57.6
Public	756	47.7	Alcohol no	743	75.9	316	42.4
Private	828	52.3					
			SES				
			I-II (High + medium-high)	443	56.0	331	54.8
Weight			III (Medium-low)	244	30.8	185	30.6
Underweight	23	2.5	IV-V (Low + very low)	104	13.2	88	14.6
Normal weight	753	83.1					
Overweight	130	14.4	**Level of education**				
			Primary	47	5.1	64	9.3
			Secondary	307	33.3	274	39.9
Height			Technical	225	24.4	160	23.3
Shortheight	75	4.3	Bachelor	241	26.1	114	16.6
Normal height	1585	91.6	Master/Doctoral	103	11.2	75	10.9
Tall height	70	4.1					
			BMI classification				
			Underweight	7	1.2	4	0.9
BMI			Normal range	273	46.7	93	21.1
Underweight	13	0.8	Overweight	180	30.8	196	44.4
Risk underweight	221	12.8	Obese	124	21.2	148	33.6
Normal range	829	47.9					
Overweight	395	22.8	**Foodsecurity**				
Obese	272	15.7	High/marginal food security	562	60.0	436	62.9
			Low food security	285	30.4	206	29.7
			Very lowfood security	89	9.5	51	7.4

Three levels of socio-economic status were grouped: I-II (High + medium-high), III (Medium-low) and IV-V (Low + very low)

Table 4. Association between Children's Height and Parent's characteristics

			Children Height						
			Short height		Normal height		Tall height		
Mother		N	n	%	n	%	n	%	p-value
Food security status	High/marginal	562	16	40.0	517	60.5	29	69.0	**0.017**
	Low/very low	374	24	60.0	337	39.5	13	31.0	
Socioeconomic status	High - Medium	564	23	48.9	513	54.2	28	60.9	0.410
	Medium low	325	13	27.7	300	31.7	12	26.1	
	Low - Very low	151	11	23.4	134	14.1	6	13.0	
Alcohol intake	Yes	236	7	16.3	216	24.2	13	30.2	0.313
	No	743	36	83.7	677	75.8	30	69.8	
Smoking	Yes	72	2	4.4	68	7.5	2	4.5	0.584
	No	927	43	95.6	842	92.5	42	95.5	
Father									
Alcohol intake	Yes	429	19	65.5	385	56.7	25	67.6	0.290
	No	316	10	34.5	294	43.3	12	32.4	
Smoking	Yes	127	7	24.1	117	17.2	3	8.1	0.208
	No	619	22	75.9	563	82.8	34	91.9	

P values > 0.05 considered significant for ji square test

N= Total of category n= referred to height within category

Table 5. Association between Nutrition Status in Children and Parent's characteristics

			Children BMI						
			Low BMI		Normal BMI		High BMI		
Mother		**n**	**n**	**%**	**n**	**%**	**n**	**%**	**p-value**
Food security status	High/marginal	562	10	45.5	453	60.1	99	61.9	0.337
	Low/verylow	374	12	54.5	301	39.9	61	38.1	
SES	High - Medium	564	11	35.5	443	53.1	110	62.9	**0.027**
	Medium low	325	12	38.7	268	32.1	45	25.7	
	Low - Verylow	151	8	25.8	123	14.7	20	11.4	
Alcohol intake	Yes	236	12	48.0	190	24.0	34	21.1	**0.014**
	No	743	13	52.0	603	76.0	127	78.9	
Smoking	Yes	72	3	12.0	58	7.2	11	6.7	0.630
	No	927	22	88.0	752	92.8	153	93.3	
Father									
Alcohol intake	Yes	429	18	60.0	346	57.4	65	58.0	0.955
	No	316	12	40.0	257	42.6	47	42.0	
Smoking	Yes	127	2	6.7	107	17.7	18	16.2	0.284
	No	619	28	93.3	498	82.3	93	83.8	

Low BMI includes low weight and at Risk
High BMI includes overweight and Obesity
P values > 0.05 considered significant for ji square test

Table 6. PCA correlations and test-values of active and supplementary variables of Venezuelan children and their parents

		Component				
	n	1	2	3	4	5
Variables-factors correlations						
Height	1730	-0,394	0,685	0,066	-0,182	-0,111
BMI	1730	-0,394	0,700	-0,047	-0,089	0,072
Heightmother	607	-0,579	-0,263	0,459	0,050	0,483
Heightfather	458	-0,464	-0,208	-0,649	0,132	-0,373
BMI mother	591	0,342	0,232	-0,648	0,100	0,612
BMI father	448	-0,006	0,235	0,161	0,955	-0,063
Target height	230	-0,706	-0,310	-0,276	0,064	0,168
Eigenvalue		**1,476**	**1,276**	**1,162**	**0,986**	**0,797**
Explained variance (%)		**21,1**	**18,2**	**16,6**	**14,1**	**11,4**
Test-values of supplementary categories						
Smoking mother						
Smoking yes	72	0,91	-0,40	-1,29	0,75	1,74
Smoking no	927	-0,99	0,89	0,13	-1,30	-0,48
Alcohol intake mother						
Alcohol yes	236	0,73	0,41	1,46	0,56	0,93
Alcohol no	743	-1,26	0,78	-1,50	-0,99	-0,64
Smoking father						
Smoking yes	127	-0,01	-1,40	-0,66	**-2,65**	0,10
Smoking no	619	0,42	0,62	0,32	1,41	-0,26
Alcohol intake father						
Alcohol yes	429	0,59	0,50	0,09	**2,09**	0,77
Alcohol no	316	-0,04	-0,41	-0,28	**-2,14**	-1,10
Social class						
High - Medium	564	**-4,40**	1,83	0,69	**2,22**	-1,00
Medium low	325	1,93	-0,03	1,03	-1,01	0,83
Low - Verylow	151	**2,91**	-1,15	-1,75	-1,67	0,93
Foodsecuritymother						
High-marginal FS	562	-1,94	**2,20**	1,05	0,60	0,04
Low FS	285	0,34	-0,29	-0,93	-1,98	0,54
Verylow FS	89	**2,00**	-0,37	-0,21	0,21	-0,76
Foodsecurity father						
High-marginal FS	436	-0,71	1,65	0,76	0,56	-0,98
Low FS	206	-0,17	-1,51	-0,67	-0,29	1,14
Verylow FS	51	0,97	-0,18	-0,20	-0,38	0,47
Level of education father						
Primary+secondary	338	**2,60**	-0,90	0,98	-1,97	1,88
Technical	160	-1,57	-0,08	-0,80	-0,83	-0,89
Bachelor+master+PhD	189	**-3,54**	0,19	-0,58	**3,25**	-0,67
Level of education mother						
Primary+secondary	354	**2,03**	**-2,11**	0,09	**-2,08**	0,72
Technical	225	**-2,21**	-0,09	0,42	0,60	1,27

Significant test values (>2,0) in bold

Figures

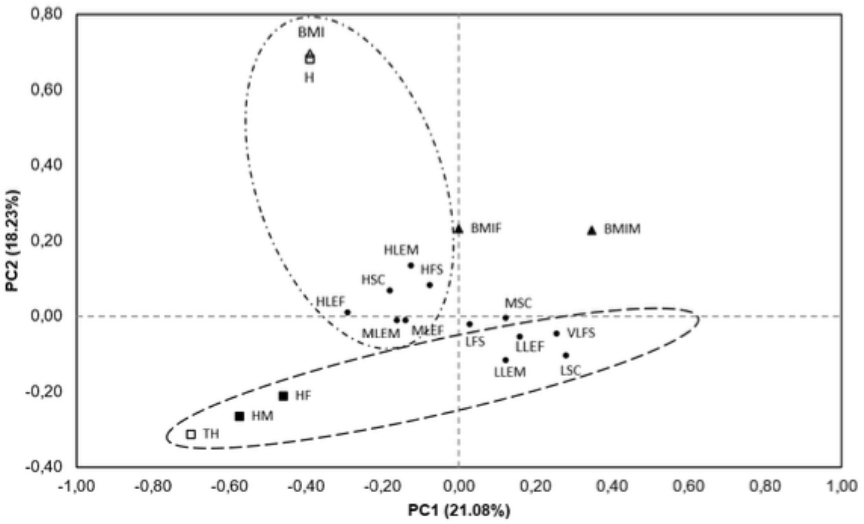

Figure 1

Graphic representation of PC1 and PC2. Abbreviations: H: Height, HM: Height mother, HF: Height father, BMIM: BMI mother, BMIF: BMI father, TH: target height, HSC: high-medium social class, MSC: medium low social class, LSC: low-very low social class, HFS: high-marginal food security, LFS: low food security, VLFS: very low food security, LLEF: low (primary +secondary) level education father, MLEF: medium (technical) level education father, HLEF: high (bachelor +master +PhD) level education father, LLEM: low (primary +secondary) level education mother, MLEM: medium (technical) level education mother, HLEM: high (bachelor +master +PhD) level education mother.