

Relationship between dietary behaviours and obesity in European children

ANTJE HEBESTREIT & WOLFGANG AHRENS, ON BEHALF OF IDEFICS CONSORTIUM

(International Journal of Pediatric Obesity, Supplement 1, 19th European Childhood Obesity Group

Meeting "MOVING TOWARDS HEALTH", p.45-47)

Bremen Institute for Prevention Research and Social Medicine (BIPS), University of Bremen, Germany

Purpose: To understand the association of unbalanced dietary habits, an increasingly sedentary lifestyle and a changing social environment on the health and well-being of 2- to 10-year old children and to develop effective prevention strategies are the two main aims of the IDEFICS study (Identification and prevention of dietary- and life-style-induced health effects in children and infants), a five-year project funded under the sixth EU framework. The IDEFICS study has enumerated a huge cohort of children from various socio-cultural backgrounds and a broad spectrum of geographic areas in Europe (1).

Methods: Between September 2007 and June 2008, a total of 16,857 children aged 2-9 years were examined, together with their parents, in 8 European survey centres (Sweden, Estonia, Hungary, Cyprus, Spain, Italy, Belgium, Germany). Each survey centre established an intervention and non-intervention group which were recruited in two different communities that were geographically distant enough to avoid contamination effects during the intervention period and whose populations were similar with regard to selected socio-economic indicators.

The instruments and examinations of the survey include several components which were applied after informed consent by both, children and their parents (2). Family socio-economic characteristics and sedentary behaviour like TV-watching or Computer games were assessed by means of a self-administered parental questionnaire (PQ). Physical activity (PA) was assessed by accelerometry and an activity diary for a three-day period. Body composition was assessed by anthropometry (weight, height, skin fold thickness and circumferences) and bioelectrical impedance analysis. Based on measured weights and heights, prevalence of overweight, obesity, and thinness were calculated using definitions by Cole et al (3). Blood pressure was measured using the automatic Welch-Allyn device. Blood samples were obtained by venipuncture or as capillary blood from the finger tip. Measured blood markers are related to the metabolic complications of obesity, biomarkers of dietary intake and hormones related to energy balance or chronic stress. Genetic polymorphisms in selected genes will also be analysed on the basis of saliva samples. Further markers will be assessed in urine, like glucose, minerals and cortisol.

11,126 parents completed a single 24h dietary recall SACINA ("Self Administered Children and Infant Nutrition Assessment") to assess the child's food consumption; 2,809 completed a second and 1,662 a third SACINA. 16,392 parents filled a questionnaire describing their children's eating habits and usual consumption of approximately 50 foods hypothesized to be associated with obesity. In addition, questions about food-related behaviours on the family level were answered. The food frequency questions were standardized, but country-specific adaptations were made. All questionnaires were developed in the English language based on established instruments. These instruments were then translated into local language and back-translated into English. Final amendments were made after instruments and examination procedures had been pre-tested by each study centre before the final versions were provided for the study. In order to further improve the comparability of data between study centres, survey staff from all countries were trained centrally and thereafter locally on all instruments and measurement procedures.

Data from all countries were checked for errors and plausibility. Implausible values and errors were reported back to the study centres and corrected where possible, based on the original questionnaires. All datasets were then compiled into a common data base for the statistical analysis using SAS (Version 8.2). Associations between weight Status (thin, normal weight, overweight and obese) and consumption of specific food items were tested using chi-square tests for trend.

Results: The cohort comprises 16,857 kindergarten, pre-school and primary school children. The sample sizes varied by study centre (Table I). Of all eight centres Hungary, Cyprus and Italy had the largest number of children, followed by Germany, Belgium, Sweden, Estonia and Spain. The number of children recruited in the intervention/ control communities was balanced in all countries. The willingness to take part in specific examinations and to provide biological samples was good on average but it varied by country (Table II).

First results show an obvious north-south gradient, with the highest overweight/ obesity prevalence in Italy and the lowest in Sweden: in Italy over 40% of the children are overweight or obese; followed by Cyprus with approximately 23% and Spain with over 18%. The lowest prevalence of overweight and obesity was observed in the northern and middle European countries Estonia (14%), Sweden (10%) and Belgium (8%). The data indicate a general tendency towards a higher prevalence of obesity and overweight in girls as compared to boys.

The percentage of children consuming fresh fruits at least daily varied significantly with weight Status: 56%, 56%, 54%, and 53% in thin, normal weight, overweight and obese children respectively (p for trend=0.04). Corresponding figures for daily consumption of cooked vegetables were: 22%, 20%, 16%, and 13% (p for trend=0.0001). In both, fruit and vegetable consumption, Sweden showed the highest intake.

Table I. Distribution of enumerated children by age-group, country, region and sex (dataset June 29th 2009)

	Country									
	Italy	Estland	Cyprus	Belgium	Sweden	Germany	Hungary	Spain	Total	
Enrolled (N)	2258	1777	2594	2066	1831	2132	2607	1592	16857	
Boys (N)*	33 missing	1167	877	1332	1043	942	1080	1302	815	8558
Girls (N)*		1089	899	1257	1021	881	1051	1305	763	8266
Kindergarten (N), 2 to 5 years	251 missing	975	882	1047	1112	930	895	1046	728	7615
Primary School (N), 6 to 10 years		1280	874	1488	911	893	1207	1538	800	8991
Intervention Region (N)*	7 missing	1157	836	1572	1074	909	1215	1303	835	8901
Non-intervention Region (N)*		1101	941	1022	992	920	917	1300	756	7949

For age at baseline 2 to 10 years.

Large differences can be seen between countries in water consumption of at least 3 times a day: it was most frequent in the southern (and hot) countries of Cyprus, Spain and Italy and least frequent in Belgian children. Unadjusted data shows a rising prevalence of frequent water consumption with rising weight status. However country-stratification does not reveal associations with weight status. Alarming is the weight induced high systolic and diastolic blood pressure in the 2 to 10 year olds (4): almost 5% of the underweight and 6% of the normal children show a systolic hypertension, but 12% and 17% of the overweight and obese children.

This preliminary description of the distribution of dietary habits in small children across Europe used standardized instruments. Our data show that the increasing prevalence of childhood overweight and obesity is in fact, a growing public health concern, especially in the southern countries, who in that past followed a Mediiterranean diet which has been proven to be beneficial in the promotion of health (5). The Mediterranean diet is more a healthy eating pattern, high in monounsaturated and polyunsaturated fats as present

in fish, olive oil and nuts; and low in saturated fats and trans fats. It provides good sources of fiber and antioxidants through encouragement of consuming lots of plant-based foods. Our data does not reveal a higher fresh fruit and vegetable consumption of Italy, Cyprus or Spain but in Sweden. Our data indicate that the difference in fruit and vegetable consumption has changed fundamentally across Europe. We consider plain water to be a healthy option to displace the consumption of sugar-sweetened drinks. However, in the unadjusted analysis consumption of table water was negatively associated with weight status. This may be explained by confounding since the highest water consumption occurred in countries with a high obesity prevalence which may be due to a higher daily need of fluid intake in hot countries. Hence, sugar-sweetened beverages in relation to weight status still have to be examined. More detailed information about energy intake and portion sizes will be obtained from the 24h- dietary recalls. Regarding the increasing hypertension-rates by weight status, Estonia (43%) Cyprus (30%) and Hungary (25%) show the highest risk among the obese children, where Germany (4%), Sweden (6%) and Italy (10%) show the lowest risk. Here, the correlation between the (Mediterranean) diet and

Table II. Proportion of children providing biological material and response for specific examinations by country

Parameter	Country								
	Italy	Estland	Cyprus	Belgium	Sweden	Germany	Hungary	Spain	Total
Complete Measurements/Samples from country N									
Parental Questionnaire (%)	99,9	99,1	95,4	97,1	99,6	100	99,8	94,4	98,2
Parental Questionnaire on Diet (%)	99,9	96,1	63,6	94,8	96,5	96,1	96,4	93,7	91,3
Anthropometric Measurements (%)	99,9	98,9	96,6	94,0	99,4	98,1	99,8	97,9	98,1
Accelerometry (%)	50,4	96,9	24,1	29,5	41,0	64,9	78,1	89,6	54,6
Physical Fitness Test (%)	54,5	43,6	49,1	34,9	44,3	45,5	47,8	48,4	46,2
Bone Stiffness Index (%)	37,3	65,6	9,6	50,3	43,6	84,5	56,3	35,4	47,0
24h Dietary recall, 1 st interview (%)	89,5	80,1	49,6	23,7	85,4	94,5	63,3	42,6	66,0
Venous Blood (%)	57,9	52,6	8,2	52,3	59,5	69,0	84,0	83,7	57,5
Capillary Blood (%)	22,9	21,2	63,8	1,3	26,4	9,0	5,3	5,2	20,3
Blood Total (%)	80,8	73,8	72,0	53,6	85,8	77,6	89,5	88,9	77,8
Saliva (%)	86,7	81,5	68,0	74,4	87,9	92,4	97,7	89,9	84,6
Urine (%)	86,5	81,2	65,2	74,0	87,7	87,9	99,3	89,9	83,8

other lifestyle aspects, e.g. PA, chronic stress and sleep duration will be examined. As socio-economic status is also known to be closely connected to overweight status these results could be confounded, which needs to be checked in further analyses (6).

The preliminary standardized collection of data on potential determinants of overweight and obesity in the IDE-FIGS study gives new and unexpected insights regarding their distribution in a European perspective. Further careful analyses will help to better understand the mechanisms by which various factors act together in the aetiology of overweight/ obesity and related co-morbid conditions in children. This knowledge may provide a lever for more effective intervention programmes in the future.

References

1. Ahrens W, Bammann K, de Henauw S, Halford J, Palou A, Pigeot I, et al. Understanding and preventing childhood obesity and related disorders-IDEFICS: a European multilevel epidemiological approach. *Nutr Metab Cardiovasc Dis* 2006;May 16(4):302-8.
2. Ahrens W, Hassel H, Hebestreit A, Peplies J, Pohlabein H, Suling M, et al. Idefics - Ursachen und Prevention ernährungs- und lebensstilbedingter Erkrankungen im Kindesalter. Springer Gesundheits- und Pharmazieverlag 2007-2007. p. 314-21.
3. Cole TJ, Flegal KM, Nicholls D, Jackson AA. Body mass index cut offs to define thinness in children and adolescents: international survey. *BMJ* 2007Jul 28;335(7612V) 194.
4. NIH-NLHBI. 4th report on the Diagnosis, Evaluation, and Treatment of High Blood Pressure in Children and Adolescents. 2005
5. Martinez-Gonzalez MA, de I F-A, Nunez-Cordoba JM, Basterra-Gortari FJ, Beunza JJ, Vazquez Z, et al. Adherence to Mediterranean diet and risk of developing diabetes: prospective cohort study. *BMJ* 2008Jun 14;336(7657V) 1348-51.
6. Kurth BM, Schaffrath RA. [The prevalence of overweight and obese children and adolescents living in Germany. Results of the German Health Interview and Examination Survey for Children and Adolescents (KiGGS)]. *Bundesgesundheitsblatt Gesundheitsforschung Gesundheitsschutz* 2007;May 50(5-6):736-43.