

Evaluation of the BigO behavioral indicators in overweight and obese children and adolescents

Penio Kassari^{1,2}, Athanasia Tragomalou^{1,2}, Aikaterini Vourdoumpa^{1,2}, Diamanto Koutaki^{1,2}, Marina Papadopoulou^{1,2}, Maria Manou^{1,2}, Ioannis Ioakeimidis³, Konstantinos Filis⁴, Eleni Theodoropoulou⁴, Giorgos Lymperopoulos⁴, Daniel Ferri⁵, Youla Karavidopoulou⁶, Leandros Stefanopoulos⁶, Ioannis Sarafis⁷, Christos Diou⁷, Eirini Lekka⁶, Nicos Maglaveras⁶, Anastasios Delopoulos⁷, Evangelia Charmandari^{1,2}

¹ Division of Endocrinology and Metabolism, Center of Clinical, Experimental Surgery and Translational Research, Biomedical Research Foundation of the Academy of Athens, Athens, Greece; ² Out-patient Clinic for the Prevention and Management of Overweight and Obesity, Division of Endocrinology, Metabolism and Diabetes, First Department of Pediatrics, National and Kapodistrian University of Athens Medical School, "Aghia Sophia" Children's Hospital, Athens, Greece; ³ Department of Biosciences and Nutrition, Karolinska Institutet, Stockholm, Sweden; ⁴ Cosmote Mobile Telecommunications SA, Athens, Greece; ⁵ MySphera, Valencia, Spain; ⁶ Department of Medicine, Lab of Computing Medical Informatics and Biomedical Imaging Technologies, Aristotle University of Thessaloniki Medical School, Thessaloniki, Greece; ⁷ Department of Electrical and Computer Engineering, Aristotle University of Thessaloniki, Thessaloniki, Greece



Background: Obesity represents one of the most challenging public health problems of our century. According to the World Health Organization, there is a need to create reliable monitoring and behavioral systems, and to investigate their effectiveness in preventing childhood obesity.

Objective: To evaluate the BigO behavioral indicators in a pediatric population in Greece.

Methodology: The study was carried out as part of the four-year European BigO project (<http://bigoprogram.eu>, Horizon2020, No. 727688). Overweight and obese children and adolescents aged 9-18 years participated in the study following approval by the local Committee on the Ethics of Human Research. Written informed consent was obtained by parents/guardians in all cases. The data collection system included the BigO technology platform, which interfaces with a Smartphone and Smartwatch, and records data objectively (using inertial sensors and GPS) for each patient. Participants used the BigO system for at least 4 weeks. Data were then transmitted to BigO servers to extract behavioral indicators, including: (a) physical activity/exercise and (b) dietary habits. Behavioral indicators included: average steps per hour daily, average activity counts per hour daily, average food visits daily, average public park visits daily, average fast food (take away) visits daily, average supermarket (grocery stores) visits daily, average athletic sports visits daily, average food outlets visits daily, average cafe visits daily, average bars visits daily and average food cafe bar visits daily. For the correlation analysis, data with zero values have been omitted.

Results: The study population consisted of 867 children and adolescents (448 males, 419 females; mean age \pm SD: 12.645 \pm 2.445). Subjects were classified as having obesity (n=644, 74.3%), overweight (n=203, 23.4%) or normal BMI (n=20, 2.3%) according to WHO cut-off points. In subjects with obesity, BMI correlated positively with average steps per hour daily ($\rho=0.102$, $p=0.010$), average activity counts per hour daily ($\rho=0.117$, $p=0.003$), average food visits daily ($\rho=0.221$, $p=0.001$), as well as average daily visits to fast food (take away) places ($\rho=0.262$, $p=0.001$), food outlets ($\rho=0.274$, $p<0.001$), café shops ($\rho=0.288$, $p<0.001$), and food cafe bars ($\rho=0.154$, $p=0.007$). In overweight subjects, BMI correlated positively with average athletic sports visits daily ($\rho=0.287$, $p=0.041$).

Table 1. Associations between BMI and BigO behavior data in children with obesity (n=644)

Daily average	n	rho	p-Value
Steps per hour	644	0.102	0.010
Activity counts per hour	644	0.117	0.003
Food visits	233	0.221	0.001
Public parks visits	17	0.169	0.516
Fast food (take away) visits	146	0.262	0.001
Supermarkets (grocery stores) visits	138	0.132	0.122
Athletic sports visits	187	0.075	0.309
Food outlets visits	165	0.274	<0.001
Cafe visits	152	0.288	<0.001
Bars visits	215	-0.017	0.807
Food cafe bar visits	304	0.154	0.007

Table 2. Associations between BMI and BigO behavior data in overweight children (n=203)

Daily average	n	rho	p-Value
Steps per hour	203	0.034	0.626
Activity counts per hour	203	0.051	0.467
Food visits	74	0.035	0.765
Public parks visits	3	0.500	0.667
Fast food (take away) visits	36	-0.171	0.320
Supermarkets (grocery stores) visits	47	0.075	0.618
Athletic sports visits	51	0.287	0.041
Food outlets visits	54	-0.071	0.608
Cafe visits	51	0.121	0.399
Bars visits	73	0.067	0.576
Food cafe bar visits	100	0.027	0.789

Conclusions: These novel methodologies will enable scientists and public health authorities to collect and analyze objective daily behavioral data in children and adolescents with overweight and obesity, and implement appropriate public health policies and/or strategies at a local level.

The authors have no financial relationship(s) to disclose



European
Commission

Horizon 2020
European Union funding
for Research & Innovation

This work was funded by the European Community's Health, demographic change and well-being Program under Grant Agreement No. 727688, 1/12/2016 – 31/3/2021