ORIGINAL PAPER

International Journal of Occupational Medicine and Environmental Health 2019;32(5):677–693
https://doi.org/10.13075/ijomeh.1896.01455

DETERMINANTS OF OVERWEIGHT IN THE POPULATION OF PARENTS OF SCHOOL-AGE CHILDREN

MAŁGORZATA RESIAK[1], ANNA WALENTUKIEWICZ[1], ANNA ŁYSAK-RADOMSKA[2], KAMILA WOŹNIAK[3], and PAWEŁ SKONIECZNY[4]

Gdansk University of Physical Education and Sport, Gdańsk, Poland

[1] Faculty of Rehabilitation and Kinesiology, Department of Health Promotion and Posturology

[2] Faculty of Rehabilitation and Kinesiology, Department of Physiotherapy

[3] Faculty of Physical Education

[4] Faculty of Physical Education, Department of Methodology and Statistics

Abstract

Objectives: The pathological increase in the amount of fat in the body is the cause of many diseases. The review of literature and the still current topic suggests the need to continue research on the relationship of obesity in adults with socio-demographic factors, the place of residence, the environment and health behaviors. The aim of the study was to identify factors conducive to the occurrence or coexistence of overweight or normal body weight among Gdańsk residents having school-age children. **Material and Methods:** The primary research tool was a survey questionnaire to be filled in individually, concerning such issues as neighborhood, health behaviors, physical activity and the factors that affect these behaviors, and the risk of obesity. To examine the relationship between neighborhood, health behaviors and overweight, the logistic regression method was applied to determine the odds ratios (OR), showing the extent to which the probability of overweight or obesity increases/decreases. **Results:** A higher level of education as well as a higher income per family member were associated with more correct values of the body mass index (BMI). A statistically significant relationship between the selected health behaviors in non-obese and overweight/obese groups was found. The significance of these was related to such variables as the duration of sleep, eating fast food products, drinking sweetened soft drinks, and eating canned and fried foods. The number of hours of sleep turned out to be significant. There was no significant relationship between the weight status and neighborhood. **Conclusions:** The identification of the risk factors for overweight and obesity among parents of school-age children allows for the implementation of educational activities in this area to interdisciplinary procedures for the health of Tri-City residents. Int J Occup Med Environ Health. 2019;32(5):677–93

Key words:
obesity, physical activity, overweight, health behaviors, socio-demographic aspects, neighborhood

INTRODUCTION

According to the World Health Organization (WHO), overweight and obesity occur in all age groups and are considered an abnormal or excessive accumulation of fat in the body, which in turn leads to the deterioration of one's health status [1]. The pathological increase in the amount of fat in the body is the cause of many diseases, including cardiovascular and metabolic diseases, those affecting internal organs, and even cancer [2]. It is estimated that 1 in 3 people in the world suffers from excessive weight. In some countries, obesity affects more than half of adult residents [1].

It may seem that the prevalence of overweight and obesity in the adult population in developed countries is

Received: March 7, 2019. Accepted: July 12, 2019.
Corresponding author: Anna Walentukiewicz, Gdansk University of Physical Education and Sport, Faculty of Rehabilitation and Kinesiology, Department of Health Promotion and Posturology, Górskiego 1, 80-336 Gdańsk, Poland (e-mail: anna.walentukiewicz@awf.gda.pl).

stabilizing. Nevertheless, it is still growing in the group of children and adolescents, as well as in the adult population of developing countries. The costs associated with abnormal levels of body fat put restrictions on the physical, emotional, social and professional functioning. The risk factors for the development of obesity are numerous, and the relationships between them are complex.

An important role in the occurrence of overweight is attributed to lifestyle, including physical activity [3], particularly that undertaken in free time [4], as well as eating habits [5] or employment characteristics [6]. An independent factor for the development of obesity and the amount of abdominal fat is, according to the authors, neighborhood [7]. Reducing the amount of physical activity in leisure time in favor of sedentary behaviors correlates with socio-demographic factors [8]. When describing the epidemiological situation, the authors most often point to socio-economic factors, proving that a low status is a risk factor for obesity in both childhood and adulthood [4]. This relationship can also be determined by the level of developed countries, e.g., in highly developed countries there is a relationship between a lower socio-economic status (SES) and a larger body size, while in moderately developed countries it is associated with income and material possessions [8,9].

Some authors argue that the relationship between neighborhood and obesity is greater than that determined by the socio-economic standing [10]. Positive correlations have been confirmed between the time spent in front of the TV or computer and a higher body mass index (BMI), a medium or lower educational level and the time spent in front of the screen, and the employment status and BMI. A similar relationship has been observed between an increased body mass and having children, as well as the status of being in a relationship and living in a rural area [8,11]. The review of literature and the still current topic suggests the need to continue research on the relationship of obesity in adults with socio-demographic factors, the place of residence, the environment and health behaviors.

The aim of the study was to identify the factors, including socio-demographic ones, neighborhood and health behaviors, conducive to the occurrence or coexistence of overweight or normal body weight among Gdańsk residents having school-age children. The analysis aimed to assess the extent to which the risk of overweight or obesity increased or decreased when changing from one predefined category of the analyzed variables to other categories.

MATERIAL AND METHODS

Study

Surveys among parents of school-age children in the city of Gdańsk were conducted in October and November 2016. The primary research tool was a survey questionnaire to be filled in individually, concerning such issues as neighborhood, health behaviors, physical activity and the factors that affect these behaviors, and the risk of obesity. In each of the 34 districts of Gdańsk, based on the current list of schools available on the website of the Board of Education, a primary school and a junior high school were drawn, with 100 questionnaires delivered to each school. Before commencing the research, the approval of the Office of the City of Gdańsk and the school headmasters to carry out the surveys was obtained.

The survey questionnaires were distributed to parents during parent–teacher conferences. The filled in questionnaires were inserted into individual envelopes, which in turn were put into a bulk envelope with the name and address of the school on it. Eventually, 1445 parents of children attending 68 schools were examined. Incorrectly completed questionnaires were rejected. The analysis included in the study was based on data on 1066 people (Figure 1).

Measurements

The questionnaire included sections in which the study participants were asked about:

Socio-demographic variables

Standard demographic characteristics were obtained from the survey questionnaire, including age, gender, household composition, employment, marital status, social care and educational status.

BMI

Self-reported height and weight were used to calculate BMI (BMI: weight in kilograms divided by height in meters squared) [1]. According to WHO guidelines, the weight status was classified into 4 categories: underweight (BMI ≤ 18.5), normal weight (BMI 18.5–24.9), overweight (BMI 25–29.9) and obese (BMI ≥ 30). Underweight men and women (BMI < 18.5) (N = 26) were excluded from the analysis, as the study aimed to compare the characteristics of proper weight and overweight or obese participants. Unless otherwise specified, the term "overweight" in this study refers to the participants with BMI > 25 and includes obese participants.

Educational level

The participants were classified into the low (primary school), moderate (secondary school) or high (college or university) educational level.

Green space availability

On the territory of the city of Gdańsk – the sixth largest city in Poland – there are 21 parks with a total area of over 180 ha that can be freely used by the population to engage in leisure and physical activities. The distribution of parks within the city covering over 26 300 hectares is uneven and refers to the band housing development. The areas of forests and greenery constitute a total of 18% of the city's area. The distances used in the literature that people have to cover to take advantage of the green areas are within a short walk [12], around 800 m [13],

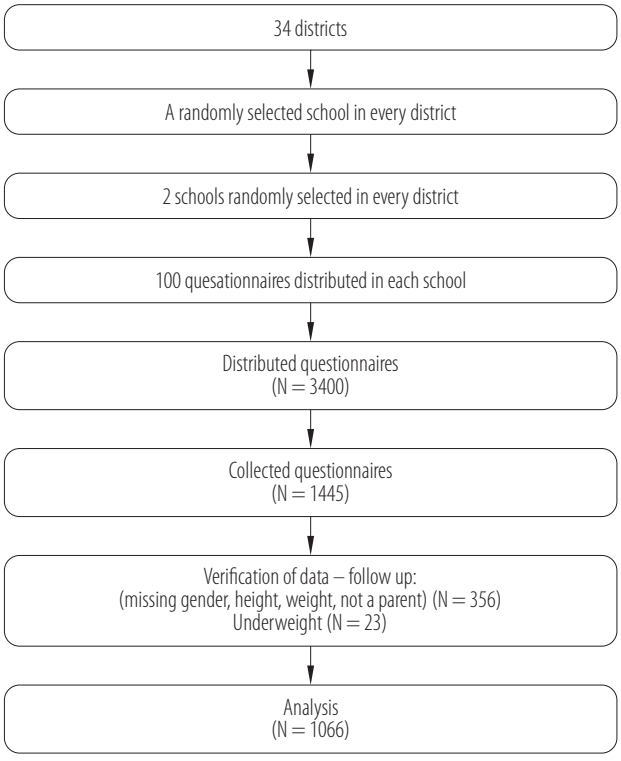

Figure 1. A study design of the determinants of the weight status in the population of parents of school-age children living in Gdańsk (a study conducted in 2016)

and up to 3000 m [14]. In this study, the authors used the thresholds of < 1000 m, 1000–3000 m, and > 3000 m.

The proximity of fast food restaurants/fitness clubs

The authors were also interested in the proximity of fast food restaurants and fitness clubs in the neighborhood of the respondent's residence. Distances were classified into 3 categories: < 1000 m, 1000–3000 m, and > 3000 m [15].

Smoking habits

The surveyed parents were asked about their smoking habits. They were all categorized as smokers or non-smokers.

Drinking behavior

For drinking behavior, the subjects were categorized as never drinkers, moderate drinkers (1–3 drinks/week) or frequent drinkers (≥ 4 drinks/week).

Sleep duration

The participants provided information on their hours of sleep during an average night. Because both short and long sleep had previously been associated with unfavorable health outcomes, the authors classified sleep into 3 categorical variables: short sleep duration (< 6 h), normal sleep duration (6–8 h), and long sleep duration (> 8 h), according to the cut-off points used in previous studies [16,17].

Physical activity

The assessment of the level of physical activity was made based on the short version of the *International Physical Activity Questionnaire* (IPAQ). The IPAQ has been validated in a study conducted in 12 countries, with good reliability and acceptable validity criteria [18]. The national/Polish version of the questionnaire was used in the research [19]. The questionnaire is designed to collect information on the frequency, duration and intensity of physical activity during the last 7 days. Each time the subjects reported the frequency, time and intensity of the effort lasting without a rest break for > 10 min. By summing up individual efforts: intensive, moderate and walking, the IPAQ allows classifying the level of physical activity the respondents undertake, according to the procedure protocol, as high, sufficient, and insufficient.

Eating behavior

The study used the *Questionnaire of Eating Behavior* (QEB), developed and validated by the Behavioral Conditions of Nutrition Team, the Committee of Human Nutrition Science, the Polish Academy of Sciences [20]. The questionnaire allows for a comprehensive characterization of dietary habits and the frequency of food consumption by respondents.

The recommended indicators were assigned to the individual categories of the frequency of consumption, expressing the frequency of consumption as times/day: never, 1–3 times a month, once a week, several times a week, once a day, and several times a day.

The questionnaire has 6 categories of the frequency of consumption which in further data-processing have been transformed into 2 categories according to the specified methodology. The study uses the basic range of the assessment of the dietary habits and the frequency of food consumption of the respondents, concerning the number of consumed meals during a day, and the frequency of consuming wholemeal bread, vegetables, fruit, fish, legumes, sweets, fast foods, fried foods, sweetened soft drinks, and alcohol.

Statistical analysis

Descriptive statistics were performed to evaluate the participants' characteristics. For quantitative variables, numerical characteristics were used, i.e., the arithmetic mean, the standard deviation, the minimum, and the maximum. Correlations between BMI (standard – overweight or obesity) and qualitative variables were presented in a table using the χ^2 test of independence to determine their significance. Due to the multiplicity of comparisons, the Sidak-Hochberg correction was used and the significance of correlations was additionally confirmed with the Jonckheere-Terpstra test.

Associations between BMI and socio-demographic, health behavior and neighborhood variables were evaluated by calculating odds ratios (OR) – only the significant correlations were presented. Computed estimates and OR are reported with 95% confidence intervals and a 2-side p-value of 0.05 used as the cut-off point for statistical significance. Multivariate logistic regression was used for evaluating the association of explanatory variables for the outcome of BMI. To assess the significance of particular independent variables included in the model, the Wald test was applied. The verification of the hypotheses was made assuming the significance level of 0.05. All statistical analyses were performed with Dell Statistica version 13.

Table 1. Anthropometric characteristics of parents of school-age children living in Gdańsk (a study conducted in 2016)

Variable	Participants (N = 1066)	
	Males (N = 362)	Females (N = 704)
Age [years]		
M±SD	40.33±5.47	40.27±5.36
range	26–58	26–58
Height [cm]		
M±SD	179.26±6.86	165.9±6.17
range	150–198	149–190
Weight [kg]		
M±SD	87.33±13.38	66.19±10.77
range	55–140	46–115
BMI [kg/m^2]		
M±SD	27.16±3.84	24.02±3.51
range	19.14–40.56	18.56–38.8

RESULTS

Characteristics of the study participants

After excluding the participants with missing data (gender, height, weight, not a parent), the analysis involved 1066 parents from randomly selected schools in Gdańsk. Among the surveyed men (34.0% of the study participants), the average BMI was higher compared to the surveyed women. The mean age was 40.29 years (SD 5.39 years). The average age difference between the participants with different body mass statuses was low. Basic descriptive statistics of the study participants are presented in Table 1.

Socio-demographic variable

Of all participants in the study, almost half (44.93%) were classified as overweight or obese (Table 2). The incidence of excess body weight (overweight and obesity in total) was higher in the group of men, and it was 69.34%, while among women it was 32.39%. Apart from the youngest test group, the prevalence of excess body weight also increased with age. However, the observed trend was not statistically significant. The number of offspring also turned out to be a factor conducive to abnormalities in body weight. The reverse relationship was observed after taking into account the respondents' educational level and household income; a higher educational level as well as a higher income per one family member were associated with a more correct value of BMI. Nevertheless, also in this case, the

Table 2. Demographic, home neighborhood and health behavior characteristics of the participants living in Gdańsk by body mass index (a study conducted in 2016)

Variable	Participants (N = 1066)						p
	normal weight[a]		overweight/obese[b]		total		
	n	%	n	%	n	%	
Weight status	587	58.7	479	44.93	1066	100	
Demographic							
gender							< 0.001
male	111	30.66	251	69.34	363	34.05	
female	476	67.61	228	32.39	722	67.72	
age category							0.049
26–30	17	58.62	12	41.38	29	2.72	
31–40	332	58.87	232	41.13	564	52.9	
41–50	215	50.59	210	49.41	425	39.89	
> 51	23	47.92	25	52.08	48	4.5	

Table 2. Demographic, home neighborhood and health behavior characteristics of the participants living in Gdańsk by body mass index (a study conducted in 2016) – cont.

Variable	Participants (N = 1066)						p
	normal weight[a]		overweight/obese[b]		total		
	n	%	n	%	n	%	
Demographic – cont.							
children [n]							0.490
1	131	57.96	95	42.04	226	21.67	
2	317	54.37	266	45.63	583	55.9	
≥ 3	123	52.56	111	47.44	234	22.44	
educational level							0.015
elementary	79	47.87	86	52.12	165	15.63	
secondary	178	52.04	164	47.95	342	32.41	
university	324	59.12	224	40.87	548	51.94	
marital status							< 0.001
marriage	506	53.43	441	46.56	947	91.32	
no partner	65	72.22	25	27.77	90	8.68	
social assistance/social welfare							0.368
yes	54	60.00	36	40.00	90	8.67	
no	522	55.06	426	44.94	948	91.33	
employment							0.591
yes	515	55.02	421	44.98	936	90.87	
no	49	52.13	45	47.87	94	9.13	
household income							0.409
< 1000 PLN	185	52.41	168	47.59	353	35.69	
1001–2000 PLN	199	47.59	154	43.63	353	35.69	
> 2001 PLN	162	57.24	121	42.76	283	28.61	
Neighborhood							
feeling safe, stable, and secure							0.233
high	245	51.26	233	48.74	478	71.34	
medium	84	57.53	62	42.47	146	21.79	
low	28	60.87	18	39.13	46	6.87	
green space availability							0.028
< 1 km	399	52.64	359	47.36	758	71.51	
1–3 km	131	62.38	79	37.62	210	19.81	
> 3 km	55	59.78	37	40.22	92	8.68	

Table 2. Demographic, home neighborhood and health behavior characteristics of the participants living in Gdańsk by body mass index (a study conducted in 2016) – cont.

Variable	Participants (N = 1066)						p
	normal weight[a]		overweight/obese[b]		total		
	n	%	n	%	n	%	
Neighborhood – cont.							
proximity of a fitness club							0.250
< 1 km	255	57.30	190	42.70	445	43.2	
1–3 km	172	54.43	144	45.57	316	30.68	
> 3 km	137	50.93	132	49.07	269	26.12	
proximity of a fast food restaurant							0.267
< 1 km	259	54.87	213	45.13	472	45.21	
1–3 km	224	57.73	164	42.27	388	37.16	
> 3 km	93	50.54	91	49.46	184	17.62	
Health behavior							
smoking status							0.991
never smoker	268	55.14	218	44.86	486	45.72	
current smoker	318	55.11	259	44.89	577	54.28	
drinking behavior							0.125
never drinker	172	60.14	114	39.86	286	12.04	
moderate drinker (1–3 drinks/week)	348	53.62	301	46.38	649	61.05	
frequent drinker (≥ 4 drinks/week)	66	51.56	62	48.44	128	26.9	
sleeping							0.012
≤ 5 h	43	42.16	59	57.84	102	9.8	
6–7 h	441	55.68	351	44.32	792	76.08	
≥ 8 h	89	60.54	58	39.46	147	14.12	
physical activity							
< 150 min/week	50	55.56	40	44.44	90	9.05	
≥ 150 min/week	496	54.87	408	45.13	904	90.95	
sedentary behaviors							
≤ 4 h	286	53.76	246	46.24	532	52.36	
5–10 h	269	57.23	201	42.77	470	46.26	
≥ 11 h	9	64.29	5	35.71	14	1.38	
Eating behavior							
meals [n]							0.139
> 3/day	342	57.19	256	42.81	598	56.63	
≤ 3/day	241	52.62	217	47.38	458	43.37	

Table 2. Demographic, home neighborhood and health behavior characteristics of the participants living in Gdańsk by body mass index (a study conducted in 2016) – cont.

Variable	Participants (N = 1066)						p
	normal weight[a]		overweight/obese[b]		total		
	n	%	n	%	n	%	
Eating behavior – cont.							
breakfast consumption							0.261
yes	304	56.82	231	43.18	535	51.39	
no	270	53.36	236	46.64	506	48.61	
the most important meal							0.107
breakfast	275	58.02	199	41.98	474	44.72	
other	311	53.07	275	46.93	586	55.28	
frequency of consumption							
fruit							0.866
> 3 times/day	111	54.41	93	45.59	204	19.19	
≤ 3 times/day	473	55.06	386	44.94	859	80.81	
vegetables							0.089
> 3 times/day	147	59.76	99	40.24	246	23.1	
≤ 3 times/day	439	53.60	380	46.40	819	76.9	
water							0.465
≤ 2 glasses/day	29	56.86	22	43.14	51	5.08	
3–5 glasses/day	131	51.98	121	48.02	252	25.12	
> 5 glasses/day	395	56.43	305	43.57	700	69.79	
fruit and vegetables							0.977
≥ 5 times/day	61	54.95	50	45.05	111	10.45	
< 5 times/day	524	55.10	427	44.90	951	89.55	
fast foods							0.013
≤ once/week	571	56.04	448	43.9	1019	96.31	
twice or more/week	14	35.90	25	64.10	39	3.69	
wholemeal bread							0.298
once or more/day	188	57.49	139	42.51	327	30.97	
never	394	54.05	335	45.95	729	69.03	
fish							0.461
twice or more/week	107	53.23	94	46.77	201	19.25	
once/week	473	56.11	370	43.89	843	80.75	
pulses							0.263
twice or more/week	76	59.84	51	40.16	127	12.15	
once/week	501	54.58	417	45.42	918	87.85	

Table 2. Demographic, home neighborhood and health behavior characteristics of the participants living in Gdańsk by body mass index (a study conducted in 2016) – cont.

Variable	Participants (N = 1066)						p
	normal weight[a]		overweight/obese[b]		total		
	n	%	n	%	n	%	
Eating behavior – cont.							
frequency of consumption							
sweets							0.857
once/week	240	54.79	198	45.21	438	41.9	
few or more/week	336	55.35	271	44.65	607	58.09	
sugar-sweetened beverage							< 0.001
once/week	459	59.77	309	40.23	768	73.49	
twice or more/week	120	43.32	157	56.68	277	26.51	
energy drinks							0.960
once/week	551	55.21	447	44.79	998	94.87	
twice or more/week	30	55.56	24	44.44	54	5.13	
alcoholic beverages							0.071
1 drink/week	519	56.17	405	43.83	924	88.17	
≥ 2 drinks/week	59	47.58	65	52.42	124	11.83	
tinned (jar) meats							0.042
once/week	504	56.50	338	43.50	892	84.87	
twice or more/week	76	47.80	83	52.20	159	15.13	
fried dishes							0.010
once/week	266	60.32	314	39.68	441	42.36	
twice or more/week	175	52.33	286	47.67	600	57.64	

[a] Normal weight was defined as having a BMI 18.5–24.9 kg/m^2.
[b] Overweight/obese was categorized as having a BMI ≥ 25.0 kg/m^2.
P value significant at 0.05 level.
The number of respondents varies because of missing data on some variables.

observed trends were not statistically significant. Almost half of the respondents (46.56%) remaining in a partner or marital relationship, compared to 27.77% of those not in a relationship, were characterized by excessive body mass. The remaining socio-demographic variables did not significantly differentiate the subjects with normal and excessive body mass.

Environmental variables

The participants with excess body weight less often indicated the use of green space, the proximity of points offering fast food products and the proximity of a fitness club (Table 2). The remaining individual neighborhood elements did not significantly differentiate the subjects with normal and excessive body mass.

Table 3. Statistics of overweight and obesity according to the socio-demographic, neighborhood and eating behavior factors in a model with 1 independent variable (a study conducted in 2016)

Variable	OR	95% CI	p
Gender			
female	reference		
male	4.72	3.59–6.21	< 0.001
Educational level			
elementary	reference		
secondary	0.85	0.58–1.23	0.379
university	0.64	0.45–0,90	0.011
Marital status			
no partner	reference		
partnership/marriage	2.27	1.40–3.66	< 0.001
Green space availability			
< 1 km	reference		
1–3 km	0.67	0.49–0.92	0.012
> 3 km	0.75	0.48–1.16	0.196
Sleeping			
≥ 8 h	reference		
6–7 h	1.22	0.85–1.75	0.275
≤ 5 h	2.11	1.26–3.52	0.004
Frequency of consumption			
fast foods			
< once/week	reference		
twice or more/week	2.28	1.17–4.43	0.015
tinned (jar) meats			
once/week	reference		
twice or more/week	1.42	1.01–1.99	0.043
fried dishes			
once/week	reference		
twice or more/week	1.38	1.08–1.78	0.010
sugar sweetened beverage			
once/week	reference		
twice or more/week	1.94	1.47–2.57	< 0.001

Health behavior variable

A statistically significant relationship between the selected health behaviors in non-obese and overweight/obese groups was found. The significance of these was related to such variables as the duration of sleep, eating fast food products, drinking sweetened soft drinks, and eating canned and fried foods. The detailed list is illustrated by Table 2. In the group of health behavior variables, the number of hours of sleep turned out to be significant.

Correlations between BMI and socio-demographic, health behavior and neighborhood variables

In view of the multiplicity of comparisons (Table 2), the statistical analysis included the Sidak-Hochberg correction, which revealed the following variables as significant for overweight and obesity: gender ($p < 0.001$), the frequency of consuming sugar sweetened beverages ($p < 0.001$), and the marital status ($p = 0.020$). For the remaining variables, the significance of correlations with overweight and obesity was confirmed by the Jonckheere-Terpstra test; this concerns the following variables: age category ($p = 0.005$), educational level ($p < 0.001$), green space availability ($p = 0.016$), sleeping ($p < 0.001$), the frequency of consuming fast foods ($p = 0.023$), the frequency of consuming tinned (jarred) meats ($p = 0.004$), and the frequency of consuming fried dishes ($p = 0.005$). For each of these variables, a separate logistic regression model estimating the risk of overweight or obesity has been designed (Table 3).

To show which variables contribute important information to predict overweight or obesity, a model of logistic regression has been constructed that takes into account many variables, the results of which are presented in Table 4.

In the developed model including many variables, 4 variables have proven significant, i.e., gender, marital status, sleep and the frequency of consuming sweetened fizzy beverages. The OR values obtained for each category of these variables are similar to the values in the models including one variable, except for the consumption of sweetened fizzy beverages. This significant decrease in

Table 4. Statistics of overweight and obesity according to the socio-demographic, neighborhood and eating behavior factors in a model with many independent variables (a study conducted in 2016)

Variable	OR	95% CI	p
Gender			
male	4.37	3.25–5.88	< 0.001
Marital status			
partnership/marriage	1.95	1.16–3.2	0.012
Sleeping			
6–7 h	1.09	0.74–1.61	0.676
≤ 5 h	2.06	1.16–3.63	0.013
Frequency of consuming sugar sweetened beverage			
twice or more/week	1.38	1.00–1.89	0.048

the OR value may result from a substantial correlation between this variable and gender ($p < 0.001$), where the percentage of men consuming such drinks is > 2.5 times higher than the percentage of women.

DISCUSSION

The purpose of the present study was to identify the factors, including socio-demographic ones, neighborhood and health behaviors, conducive to the occurrence or coexistence of excessive body weight. The authors of this study have shown that sex, marital status, the length of sleep and the frequency of consuming sweetened fizzy drinks allow predicting the occurrence of overweight and obesity. The high prevalence of overweight and obesity observed in this study is consistent with the national data, which each time show higher prevalence rates of excessive body weight [21].

In the authors' own research there has been no statistically significant relationship between income and BMI abnormalities. However, other studies have proven that belonging to a given social class has an impact on health. These observations, in tandem with the growing incidence of excess body weight and related chronic diseases, as well as their relationship with SES, stress the importance of understanding the socio-economic patterns of obesity during one's life. Women with higher SES throughout their lives have a lower BMI; in men, the results of research concerning this variable are not so consistent [22]. Income as one of the determinants of the socio-economic status is inversely related to obesity. The relationships of income and body fat irregularities are interpreted in 2 directions [23]. First, they are illustrated by a causal hypothesis that explains a lower income as a prospect of later obesity and, second, a perspective of reverse causation in which obesity is the cause of lower income [9,24].

There are many possible mechanisms by which the educational level can affect human health. It may be associated with health via the socio-economic status, health literacy, health behaviors, a sense of control and empowerment, and it also changes over time. Reverse relationships between the educational level and BMI are observed in developed countries, while the positive associations are more common in less developed countries [25]. The results of the authors' own research point to the fact that the higher the educational level, the less likely the excess body weight. Nevertheless, the observed trend was not supported by statistical significance. The literature on the subject matter also emphasizes the relationship between BMI and the marital status. According

to the authors' own observations, almost half (46.5%) of married people or those in a relationship were characterized by excess body weight. This is 20% more than in the group that declared being single. These differences were statistically significant.

There are 3 main perspectives that combine body weight and the marital status [26]. The first is the model of social and economic resources available to people with different marital statuses. Married individuals are more likely to have a confidant with whom to eat and may, therefore, eat more regularly, which leads to weight gain [26]. The second model is the attractiveness model. Married men and women are not actively looking for a new partner, hence their lesser interest in their bodies and greater susceptibility to weight gain. The third model is the crisis model, which focuses on the situation of marital status changes dictated by the spouse's death or a divorce. It assumes that psychological, physiological and social consequences of a divorce lead to weight loss, but they are short-lived because the body relatively quickly adapts to the new socioeconomic situation, so the weight loss effect is temporary. However, it should not be forgotten that, in the light of research, loneliness and social isolation may be more lethal than obesity and should be considered as a new threat to public health [27].

The authors of this study considered an answer to the question whether the variables characterizing local neighborhood or individual health behaviors are more often correlated to the prevalence of obesity in adults interesting. Some environments may be more obesogenic than others. They are more likely to promote and facilitate unhealthy behavior, which leads to an increase in body weight in both individuals and populations [28]. Environmental factors offer many possibilities to limit or promote the prevalence of obesity. The results of the authors' own research have shown that the proximity of green areas is not a factor protecting against the occurrence of excess body weight in the studied population.

The link between the proximity of a fast food restaurant and obesity, according to the authors, is unclear, because focusing on the distance or prevalence of fast food restaurants, in relation to the place of residence, did not translate in their studies into the body weight status [29–31]. Other studies have indicated the existence of this dependency [32]. One has to remember that the environmental characteristics are associated only with the possibility/probability of being active physically [33] or being more exposed to fast food [30], and not with body weight [34]. Usually, these are individual behaviors, not necessarily related to body weight, which trigger healthy actions, including those connected with physical activity or diet.

The relationship between one's lifestyle and the body mass status has been confirmed in numerous studies. Individual behaviors may foster overweight and obesity. In the authors' own studies, a significant statistical risk of overweight or obesity was observed due to a too short duration of sleep, low physical activity and some eating behaviors (frequent consumption of sweetened drinks, and consumption of fast food and canned food). The nutrition model presented by the subjects is related to the deterioration of the quality of their diet; it is often described in literature and associated with an increase in BMI [30,35–38].

Researchers highlight the harmful effects of sweetened drinks and their preservatives, flavor enhancers and dyes on one's body weight and health status. They have proven that drinking sweetened drinks can be an independent factor in the development of diseases associated with the progress of civilization [39,40]. There is sufficient scientific evidence that eating fried dishes is associated with an increased risk of chronic diseases [41,42]. The strength of scientific evidence suggests the total abandonment of sweetened drinks and fried products, similarly to fast food products, which influence the increase in body mass through a massive portion, high energy density, high glycemic load, a high content of saturated and trans fat, pal-

atability (appealing to the primordial taste preferences for sugar, fats and salt) and a low content of fiber [43]. The described model of nutrition is more often observed among young people and young adults with a high income status and middle education, more often in men than in women, and in singles rather than in those in a relationship; it increases with the number of children in the family and decreases with age [41,44–46]. The impact on the choice of food, including the preference for healthy eating choices, is complex and includes a variety of predictors, such as family home nutrition education, traditions, peer environment, knowledge, financial resources, etc. [47].

The literature review shows that among the main lifestyle modifiers affecting the weight status the following are the most frequent: smoking cigarettes [48], drinking alcohol [49], a short duration of sleep [50], low levels of physical activity undertaken in free time [51,52], proper nutrition including energy consumption [53], and the frequency and amount of consumption [54]. The analysis of many studies suggests that the number of behaviors associated with a healthy lifestyle adopted by people is inversely proportional to the risk of death for any cause. Compared with people who engage in an unhealthy lifestyle (smoking, the lack of or excessive consumption of alcohol, the lack of physical activity, unhealthy diet, obesity), people with ≥ 4 behaviors referred to as "healthy" have a general risk of mortality lower by 66% [55].

The results of the authors' own research have revealed disturbing data in terms of the prevalence of overweight or obesity and the simultaneous presence of lifestyle-related inappropriate behaviors which should be directed and modified. Statistical significance was found in few of them, but when it occurred, it was consistent with other authors' observations. With regard to the most obesogenic factor, the authors indicate health behavior. There are more lifestyle-related factors than the socio-economic and neighborhood ones. This is an important premise for the health promotion program. It is important to create opportunities for neighborhood and the availability of green spaces, but research indicates the need to conduct adult health education. Education seems to be a more urgent need because improvements in the environment itself will not change the behavior patterns. Research should be extended with an analysis of the factors predisposing to overweight and obesity in whole families, taking into account both parents and children. Such studies have not been conducted in Poland on a large scale. The reason for this conclusion comes from observations conducted among children and youth in the city of Gdańsk at the turn of 2008/2009, indicating excess body weight in nearly one-fifth of the subjects [56].

This study had some limitations. An important limitation stems from the fact that the analysis was based on data provided by the respondents. The authors of this study used the self-report method. However, it should be stressed that this method, despite its extensive use in epidemiological studies, has its limitations related to the risk of underestimation of the body weight status. Nevertheless, the literature review shows that the self-reported height and weight (BMISR) is highly correlated with concurrently assessed BMI calculated from the measured height and weight (BMIM) with r values of approx. 0.90" [57]. The self-reported nature of the research is susceptible to errors and bias. However, many other epidemiological studies have adopted a similar data collection method.

The study was carried out on a particular population of a large city and was limited to parents of school-age children, so it is not representative of the entire adult population of the city of Gdańsk. A relatively large percentage of rejected survey questionnaires, which were not correctly filled in, suggests the need to apply a different data collection method in the future – a direct survey. Undoubtedly, an interpretational limitation lies in omitting the energy balance and information regarding the smoking status (former smokers) from the research, and in taking into account only the socio-economic determinants.

CONCLUSIONS

The identification of the risk factors for overweight and obesity among parents of school-age children allows for the implementation of educational activities in this area to interdisciplinary procedures for the health of Tri-City residents.

REFERENCES

1. World Health Organization. Global status report on noncommunicable diseases 2014. Attaining the nine global noncommunicable diseases targets; a shared responsibility. The Organization; 2014.
2. Engin A. The Definition and Prevalence of Obesity and Metabolic Syndrome. Adv Exp Med Biol. 2017;960:1–17, https://doi.org/10.1007/978-3-319-48382-5_1.
3. Hruby A, Hu FB. The Epidemiology of Obesity: A Big Picture. PharmacoEconomics. 2015;33(7):673–89, https://doi.org/10.1007%2Fs40273-014-0243-x.
4. Steeves JA, Bassett DR, Thompson DL, Fitzhugh EC. Relationships of occupational and non-occupational physical activity to abdominal obesity. Int J Obes. 2012;36(1):100–6, https://doi.org/10.1038/ijo.2011.50.
5. Berg C, Forslund HB. The Influence of Portion Size and Timing of Meals on Weight Balance and Obesity. Curr Obes Rep. 2015;4(1):11–8, https://doi.org/10.1007/s13679-015-0138-y.
6. Park S, Pan LP, Lankford T. Relationship Between Employment Characteristics and Obesity Among Employed U.S. Adults. Am J Health Promot. 2014;28(6):389–96, https://doi.org/10.4278%2Fajhp.130207-QUAN-64.
7. Prince SA, Kristjansson EA, Russell K, Billette JM, Sawada M, Ali A, et al. A Multilevel Analysis of Neighbourhood Built and Social Environments and Adult Self-Reported Physical Activity and Body Mass Index in Ottawa, Canada. Int J Environ Res Public Health. 2011;8(10):3953–78, https://doi.org/10.3390%2Fijerph8103953.
8. Compernolle S, De Cocker K, Abbott G, Verloigne M, Cardon G, De Bourdeaudhuij I, et al. Do sedentary behaviors mediate associations between socio-demographic characteristics and BMI in women living in socio-economically disadvantaged neighborhoods? Int J Behav Nutr Phys Act. 2015;12, https://doi.org/10.1186%2Fs12966-015-0209-1.
9. Kuntz B, Lampert T. Socioeconomic factors and obesity. Dtsch Arztebl Int. 2010;107(30):517–22, https://doi.org/10.3238/arztebl.2010.0517.
10. MacFarlane AM, Abbott GR, Crawford DA, Ball K. Sociodemographic and behavioural correlates of weight status among women with children living in socioeconomically disadvantaged neighbourhoods. Int J Obes. 2009;33(11):1289–98, https://doi.org/10.1038/ijo.2009.167.
11. Pysarenko S, Weiqiu Y. The effects of demographic, socioeconomic and lifestyle component on adult obesity in Canada: empirical study. IJBPA. 2015;12(1):133–51.
12. Ali O, Di Nardo F, Harrison A, Verma A. The link between perceived characteristics of neighbourhood green spaces and adults' physical activity in UK cities: analysis of the EURO-URHIS 2 Study. Eur J Public Health. 2017;27(4):761–5, https://doi.org/10.1093/eurpub/ckx033.
13. Besenyi GM, Kaczynski AT, Stanis SAW, Bergstrom RD, Lightner JS, Hipp JA. Planning for health: A community-based spatial analysis of park availability and chronic disease across the lifespan. Health Place. 2014;27:102–5, https://doi.org/10.1016/j.healthplace.2014.02.005.
14. Schule SA, Gabriel KMA, Bolte G. Relationship between neighbourhood socioeconomic position and neighbourhood public green space availability: An environmental inequality analysis in a large German city applying generalized linear models. Int J Hyg Environ Health. 2017;220(4):711–8, https://doi.org/10.1016/j.ijheh.2017.02.006.
15. Boone-Heinonen J, Gordon-Larsen P, Kiefe CI, Shikany JM, Lewis CE, Popkin BM. Fast Food Restaurants and Food Stores Longitudinal Associations With Diet in Young to Middle-aged Adults: The CARDIA Arch Intern Med. 2011;171(13):1162–70, https://doi.org/10.1001%2Farchinternmed.2011.283.
16. Rathod SS, Nagose VB, Kanagala A, Bhuvangiri H, Kanneganti J, Annepaka E. Sleep duration andmits association with obesity and overweight in medical students: A cross-sectional

study. Natl J Physiol Pharm Pharmacol. 2018;8(1):113–7, https://doi.org/10.5455/njppp.2018.8.1040219102017.

17. Stranges S, Dorn JM, Shipley MJ, Kandala NB, Trevisan M, Miller MA, et al. Correlates of Short and Long Sleep Duration: A Cross-Cultural Comparison Between the United Kingdom and the United States The Whitehall II Study and the Western New York Health Study. Am J Epidemiol. 2008;168(12):1353–64, https://doi.org/10.1249/01.MSS.0000078924.61453.FB.
18. Craig CL, Marshall AL, Sjostrom M, Bauman AE, Booth ML, Ainsworth BE, et al. International physical activity questionnaire: 12-country reliability and validity. Med Sci Sports Exerc. 2003;35(8):1381–95.
19. Biernat E, Stupnicki R, Gajewski AK. [Międzynarodowy Kwestionariusz Aktywności Fizycznej (IPAQ) – wersja polska]. Wych Fiz Sport. 2007;51(1):47–54. Polish.
20. Jeżewska-Zychowicz M, Gawęcki J, Wądołowska L, Czarnocińska J. Galiński G, Kołłajtis-Dołowy A, et al. [Kwestionariusz do badania poglądów i zwyczajów żywieniowych dla osób w wieku od 16 do 65 lat, wersja 1.2 – kwestionariusz do samodzielnego wypełnienia przez respondenta]. In: Gertig J, editor. [Kwestionariusz do badania poglądów i zwyczajów żywieniowych oraz procedura opracowania danych]. Warszawa: Wydawnictwo Komitetu Nauki o Żywieniu Człowieka Polskiej Akademii Nauk; 2014. s. 21–33. Polish.
21. Piekarzewska M, Wieczorkowski R, Zajenkowska-Kozłowska, A. Health status of population in Poland in 2014. Warszawa: GUS, Departament Badań Społecznych i Warunków Życia; 2016.
22. Newton S, Braithwaite D, Akinyemiju TF. Socio-economic status over the life course and obesity: Systematic review and meta-analysis. Plos One. 2017;12(5).
23. Kim TJ, von dem Knesebeck O. Income and obesity: what is the direction of the relationship? A systematic review and meta-analysis. BMJ Open. 2018;8(1), https://doi.org/10.1136/bmjopen-2017-019862.
24. Dinsa GD, Goryakin Y, Fumagalli E, Suhrcke M. Obesity and socioeconomic status in developing countries: a systematic review. Obes Rev. 2012;13(11):1067–79, https://doi.org/10.1111/j.1467-789X.2012.01017.x.
25. Cohen AK, Rai M, Rehkopf DH, Abrams B. Educational attainment and obesity: a systematic review. Obes Rev. 2013;14(12):989–1005, https://doi.org/10.1111/obr.12062.
26. Teachman J. Body Weight, Marital Status, and Changes in Marital Status. J Fam Issues. 2016;37(1):74–96, https://doi.org/10.1177%2F0192513X13508404.
27. Holt-Lunstad J, Smith TB, Baker M, Harris T, Stephenson D. Loneliness and Social Isolation as Risk Factors for Mortality: A Meta-Analytic Review. Perspect Psychol Sci. 2015;10(2):227–37, https://doi.org/10.1177%2F1745691614568352.
28. Matozinhos FP, Gomes CS, Andrade AC, Mendes LL, Pessoa MC, de Lima Friche AA, et al. Neighbourhood environments and obesity among adults: A multilevel analysis of an urban Brazilian context. Prev Med Rep. 2015;2:337–41, https://doi.org/10.1016/j.pmedr.2015.04.019.
29. Inagami S, Cohen DA, Brown AF, Asch SM. Body Mass Index, Neighborhood Fast Food and Restaurant Concentration, and Car Ownership. J Urban Health. 2009;86(5):683–95, https://doi.org/10.1007/s11524-009-9379-y.
30. Jeffery RW, Baxter J, McGuire M, Linde J. Are fast food restaurants an environmental risk factor for obesity? IJBNPA. 2006;3:35, https://doi.org/10.1186/1479-5868-3-2.
31. Nago ES, Lachat CK, Dossa RAM, Kolsteren PW. Association of Out-of-Home Eating with Anthropometric Changes: A Systematic Review of Prospective Studies. Crit Rev Food Sci Nutr. 2014;54(9):1103–16, https://doi.org/10.1080/10408398.2011.627095.
32. Hollands S, Campbell MK, Gilliland J, Sarma S. Association between neighbourhood fast-food and full-service restaurant density and body mass index: A cross-sectional study of Canadian adults. Can J Public Health. 2014;105(3):E172–8.
33. Lachowycz K, Jones AP. Greenspace and obesity: a systematic review of the evidence. Obesity Rev. 2011;12:e183–9, https://doi.org/10.1111/j.1467-789X.2010.00827.x.
34. Crawford DA, Timperio AF, Salmon JA, Baur L, Giles-Corti B, Roberts RJ, et al. Neighbourhood fast food

outlets and obesity in children and adults: the CLAN Study. Int J Pediatr Obes. 2008;3(4):249–56, https://doi.org/10.1080/17477160802113225.

35. Bhutani S, Schoeller DA, Walsh MC, McWilliams C. Frequency of Eating Out at Both Fast-Food and Sit-Down Restaurants Was Associated With High Body Mass Index in Non-Large Metropolitan Communities in Midwest. Am J Health Promot. 2018;32(1):75–83, https://doi.org/10.1177%2F0890117116660772.
36. O'Connor L, Brage S, Griffin SJ, Wareham NJ, Forouhi NG. The cross-sectional association between snacking behaviour and measures of adiposity: the Fenland Study, UK. Br J Nutr. 2015;114(8):1286–93, https://doi.org/10.1017/S0007114515002692.
37. Alkerwi A, Crichton GE, Hebert JR. Consumption of ready-made meals and increased risk of obesity: findings from the Observation of Cardiovascular Risk Factors in Luxembourg (ORISCAV-LUX) study. Br J Nutr. 2015;113(2):270–7, https://doi.org/10.1017/S0007114514003468.
38. Vadiveloo M, Scott M, Quatromoni P, Jacques P, Parekh N. Trends in dietary fat and high-fat food intakes from 1991 to 2008 in the Framingham Heart Study participants. Br J Nutr. 2014;111(4):724–34, https://doi.org/10.1017/S0007114513002924.
39. Malik VS, Li Y, Pan A, De Koning L, Schernhammer E, Willett WC, et al. Long-Term Consumption of Sugar-Sweetened and Artificially Sweetened Beverages and Risk of Mortality in US Adults. Circulation. 2019;139:2113–25, https://doi.org/10.1161/CIRCULATIONAHA.118.037401.
40. Arsenault BJ, Lamarche B, Després JP. Targeting Overconsumption of Sugar-Sweetened Beverages vs. Overall Poor Diet Quality for Cardiometabolic Diseases Risk Prevention: Place Your Bets! Nutrients. 2017;9(6):600, https://doi.org/10.3390/nu9060600.
41. Sun Y, Liu B, Snetselaar LG, Robinson JG, Wallace RB, Peterson LL, et al. Association of fried food consumption with all cause, cardiovascular, and cancer mortality: prospective cohort study BMJ. 2019;364:k5420.
42. Gadiraju TV, Patel Y, Gaziano JM, Djousse L. Fried Food Consumption and Cardiovascular Health: A Review of Current Evidence. Nutrients. 2015;7(10):8424–30, https://doi.org/10.3390/nu7105404.
43. Nurwanti E, Uddin M, Chang JS, Hadi H, Syed-Abdul S, Su EC, et al. Roles of Sedentary Behaviors and Unhealthy Foods in Increasing the Obesity Risk in Adult Men and Women: A Cross-Sectional National Study. Nutrients. 2018;10(6):704, https://doi.org/10.3390/nu10060704.
44. Satia JA, Galanko JA, Siega-Riz AM. Eating at fast-food restaurants is associated with dietary intake, demographic, psychosocial and behavioural factors among African Americans in North Carolina. Public Health Nutr. 2004;7(8):1089–96, https://doi.org/10.1079/PHN2004662.
45. Seguin RA, Aggarwal A, Vermeylen F, Drewnowski A. Consumption Frequency of Foods Away from Home Linked with Higher Body Mass Index and Lower Fruit and Vegetable Intake among Adults: A Cross-Sectional Study. J Environ Public Health. 2016;12, https://doi.org/10.1155/2016/3074241.
46. Van der Horst K, Brunner TA, Siegrist M. Fast food and take-away food consumption are associated with different lifestyle characteristics. J Hum Nutr Diet. 2011;24(6):596–602, https://doi.org/10.1111/j.1365-277X.2011.01206.x.
47. Hardcastle SJ, Blake N. Influences underlying family food choices in mothers from an economically disadvantaged community, Eating Behaviors 2016;20:1–8, https://doi.org/10.1016/j.eatbeh.2015.11.001.
48. Dare S, Mackay DF, Pell JP. Relationship between Smoking and Obesity: A Cross-Sectional Study of 499,504 Middle-Aged Adults in the UK General Population (vol 10, e0123579, 2015). Plos One. 2017;12(2), https://doi.org/10.1371/journal.pone.0123579 .
49. Shelton NJ, Knott CS. Association Between Alcohol Calorie Intake and Overweight and Obesity in English Adults. Am J Public Health. 2014;104(4):629–31, https://doi.org/10.2105/AJPH.2013.301643.
50. Meyer KA, Wall MM, Larson NI, Laska MN, Neumark-Sztainer D. Sleep Duration and BMI in a Sample of Young

Adults. Obesity. 2012;20(6):1279–87, https://doi.org/10.1038/oby.2011.381.

51. Gómez LF, Moreno J, Gómez OL, Carvajal R, Parra DC. Physical activity and health-related quality of life among adult women in Cali, Colombia: a cross-sectional study. Qual Life Res. 2013;22(9):2351–8, https://doi.org/10.1007/s11136-013-0378-9.
52. Ferreira AP, Szwarcwald CL, Damacena GN. Prevalence of obesity and associated factors in the Brazilian population: a study of data from the 2013 National Health Survey. Rev Bras Epidemiol. 2019;22:e190024, http://doi.org/10.1590/1980-549720190024.
53. Hill JO, Wyatt HR, Peters JC. Energy Balance and Obesity. Circulation. 2012;126(1):126–32, https://doi.org/10.1161/CIRCULATIONAHA.111.087213.
54. Munoz-Pareja M, Guallar-Castillon P, Mesas AE, Lopez-Garcia E, Rodriguez-Artalejo F. Obesity-Related Eating Behaviors Are Associated with Higher Food Energy Density and Higher Consumption of Sugary and Alcoholic Beverages: A Cross-Sectional Study. Plos One. 2013;8(10), https://doi.org/10.1371/journal.pone.0077137.
55. Loef M, Walach H. The combined effects of healthy lifestyle behaviors on all cause mortality: A systematic review and meta-analysis. Prev Med. 2012;55(3):163–70, https://doi.org/10.1016/j.ypmed.2012.06.017.
56. Resiak M, Walentukiewicz A, Łysak A, Drabik J, Niedzielska A, Jankowski M, et al. Prevalence of overweight and underweight in children and adolescents in districts of Gdańsk. J Pre Clin Clin Res. 2014;8(1):23–6, https://doi.org/10.26444/jpccr/71459.
57. Niedhammer I, Bugel I, Bonenfant S, Goldberg M, Leclerc A. Validity of self-reported weight and height in the French GAZEL cohort. Int J Obes. 2000;24(9):1111–8.