



Obesity in 18-25-year-olds in relation to their physical activity, and lifestyle

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Abstract

The quality of life is a multidimensional notion. When studying it, one should take the physical, the psychological, the social, and the professional aspects into consideration. Among them, the notion of the influence of obesity, understood as a modern-age disease, relates the quality of life to the notion of health, in the aspect of physical activity. The aim of the study carried out, was to determine the relationship between obesity in 18-25 year-olds, and their physical activity, as well as the quality of their lives. The study was carried out by means a WHOQOL-BREF, and IPAQ survey questionnaires carried out on a group of 100 participants. The control group included people whose BMI was within the norm, whereas the study group comprised people whose BMI was over 25. The results of the study have shown obesity to have a statistically significant negative impact on the quality of life in the physical, and mental domains, and as far as the general perception of health was concerned. In the study group, the mean weekly energy expenditure, was lower than in the control group. The physical activity of the obese, includes, mainly, activities based on light effort, and to a lesser extent, those based on moderate effort. A comparative analysis has shown the level of physical activity to be significantly lower in obese women, in each type of physical effort, except light effort. This difference does not exist between the study, and control groups of men.

Keyword: physical activity, overweight, obesity, health promotion.

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INTRODUCTION

The progress which has been made in the field of science, has also enabled the research of a greater number of aspects of the human life, as well as the factors influencing it [1,2,3]. The essential goal of medicine, has always been to prolong life, however, at present, the improvement of quality of the prolonged life, is the challenge [4,5,6,7]. Research on the quality of life goes back to the 1970s. Dalkey, Rourke [8] stated that the basic components of the quality of life were: satisfaction with one's life, and a feeling of happiness. According to Campbell [9], the degree of satisfaction in such fields of life as: marriage, family life, health, neighbours, friends, household chores, working life, living in a given country, place of residence, free time, education, and the standard of living, is important. Flanagan [10] used an importance indicator which let determine how important the analysed spheres of life were for each particular respondent. In his definition, Flanagan [10] took the relevance of various factors into account. Two families may represent two different qualities of life: (...) The quality of life, should, in this context, be understood as a set of spatio-environmental, production, and culture factors composing the reality, in which an individual lives. Each individual, each family has a specific life quality model (...) Many models of living, family life, the future of the children, ways of making investments, one's career, promotions, ways of resting, and spending free time, the rhythm of life, the ecological situation, doing sports, and solving conflicts constitute the quality of life. The essence (...) of the quality of life does not depend on the choice of particular models, but on the whole that they create [10]. In 1993, the World Health Organization (WHO) coined up the following definition, which states, that the quality of life is: the perception, by an individual, of their own life situation, within the context of their cultural conditions, system of values, and in relation to their goals, standards, and interests [11]. This definition later became the basis for creating the WHOQOL-BREF questionnaire [12]. There are many definitions of the quality of life, which proves the multi-dimensionality of the notion. However, this also entails a lack of understanding, which conditions the existence of many questionnaires on the quality of life. When studying the issue, we should, thus, take such aspects as: the physical aspect, the psychological aspect, the social aspect, and the occupational aspect into consideration. Such great multidimensionality of the notion of the quality of life, forces us to take the components influencing its final image, into consideration. The quality of life is closely associated with the notion of health, not only physical, but also mental, and social. Taking the WHO definition into account, one can distinguish a division into domains, and factors, which define [13]:

- The physical condition – pain, discomfort, the level of tiredness, and the length of sleep;
- The mental condition – thinking, learning, memory, concentration, positive, and negative feelings, the image of the body, appearance;
- The degree of independence – the capability of performing certain tasks, daily activity, mobility;
- Social relations – interpersonal relations, sexual activity, the support of the people surrounding a given individual;
- Environment – health, and social care, the home environment, financial resources, the physical environment (the climate, pollution, noise), the opportunities of gaining new information, and skills;
- Spirituality, religion, and beliefs – spirituality, the conviction that life has a meaning, a sense of fulfilment and integration, inner peace.

The contemporary world is facing two serious problems. On the one hand, there are 600 million people suffering from hunger, while on the other, 310 million are struggling with obesity. This number is growing constantly, and the WHO has deemed obesity the greatest threat to health. In many EU member states, half of the adult population is overweight, whereas about 20-30% of adults can be referred to as obese [14,15,16,17]. The fact which may provoke anxiety is the growing number of children with increased body mass [18,19,20,21]. The aim of the study carried out, was to determine the relationship between obesity in 18-25 year-olds, and their physical activity, as well as the quality of their lives.

MATERIALS AND METHOD

The study was carried out by means of a survey questionnaire, in a group of 100 people. They were divided into two groups of 50 – the control group and the respondents of the study. The control group consisted of people whose BMI did not exceed the norm, whereas the respondents of the study were those whose BMI exceeded 25. The criteria for taking part in the questionnaire were: age between 18 and 25, and the capability of filling the questionnaire in on one's own. Table 1 contains a detailed characteristics of the respondents of the study, divided into groups.

Table 1. The characteristics of the respondents of the study.

Group	All	Women	Men	Age			
	n	n	n	x ± SD	min	max	median
Control	50	30	20	22 ± 1.0	18	25	21
Investigation	50	30	20	21±1.5	18	25	22

The WHOQOL-BREF questionnaire [22,23], was a tool by means of which the quality of life was researched. The questionnaire was created for the WHO, on the basis of the WHOQOL-100 questionnaire. It comprised 26 questions, rated by the respondents on a 1-5 scale. Twenty four questions were rated in one of the four fields (domains) of the quality of life: the physical, the mental, the social, and the environmental. The survey also contained two questions which were analysed separately, and were related to the general perception of the quality of life, and of one's own health. The results collected by means of the questionnaire were counted, and processed according to the following procedure:

Checking the adequacy of the answers written down (if they fit within the 1-5 range).

In questions Q3, Q4, and Q26 the answers were decoded to be positive according to the following key: (1=5) (2=4) (3=3) (4=2) (5=1).

The result answer median was calculated for each of the four domains:

The physical domain (Q3, Q4, Q10, Q15, Q16, Q17, Q18);

The mental domain (Q5, Q6, Q7, Q11, Q19, Q26);

The social domain (Q20, Q21, Q22);

The environmental domain (Q8, Q9, Q12, Q13, Q14, Q23, Q24, Q25).

The median result for each of the domains was multiplied by 4 to enable the comparison of the results, with the WHOQOL-100 version of the questionnaire.

The medians attained on a 4-20 scale were transformed onto a 0-100 scale according to the formula: (the result of the domain-4) × (100/16).

IPAQ – International Physical Activity Questionnaire (brief version), served to determine the energy expenditure expressing physical activity in $\text{kcal} \times \text{kg}^{-1} \times \text{week}^{-1}$, determined on the basis of MET (metabolic equivalent), which is a unit of energy corresponding to the consumption of oxygen in basic conditions that is in rest conditions, and amounts to $3.5 \text{ ml} \times \text{kg}^{-1} \times \text{min}^{-1}$. The survey contains 7 questions concerning each type of physical activity, related to leisure, daily life, and work (occupational activity). However, only activities which are carried out for at least ten minutes non-stop, are taken into consideration. The level of physical activity for each of its types, was calculated by means of the following formula:

physical activity coefficient × the number of days a week of carrying out the activity × the duration of the activity per day.

The weekly physical activity was attained by summing up the results of all the physical activities [26]. Each respondent was classified on the basis of their physical activity, and assigned to one of these three groups:

- 1) High physical activity – the people classified into this group, meet one of the two criteria that follow:
 - undertake intensive effort at least 3 days a week (a minimum of 1500 MET-min a week);
 - undertake a combination of intensive effort, moderate effort, or walking every day (a minimum of 3000 MET-min a week).

- 2) Sufficient physical activity – the people classified into this group, meet one of the three criteria that follow:
 - undertake intensive physical effort at least 3 days a week (minimum 20 min daily);
 - undertake moderate effort or walking at least five days a week (a minimum of 30 min daily);
 - undertake intensive, moderate effort, or walking at least 5 days a week (a minimum of 600 MET-min a week).
- 3) Insufficient physical activity – the people classified into this group do not meet the above requirements.

In order to analyse the recorded data, a statistical analysis was conducted. Median values, and standard deviations were determined. The values of the particular parameters were ranked. In order to find the differences between the two groups (respondents with the right BMI value, and the obese ones) the Mann-Whitney U test was applied, which compared the ranked results of the dependable variable, and was the counterpart of the t-test test for independent samples. The statistical analysis was performed by means of the statistical software package Statistica 13.1 PL. The compilation of variables' distribution was presented by means of frequency tables, descriptive statistics and contingency tables.

RESULTS

The results of researching the quality of life, and the statistical significance of the differences between the control group, and the study group (obese respondents), are presented in tables 2-4. The general perception of health was rated the highest, whereas the environmental domain – the lowest in the control group (table 2). The domain rated the highest in the study group was the general perception of the quality of life, whereas the domain rated the lowest was the environmental one. The women belonging to the control group rated their general perception of health the highest, and their environmental domain – the lowest. The women from the study group, rated the social domain the highest, and the environmental one the lowest. The men belonging to the control group, rated the physical domain the highest, and the environmental one the lowest. Men from the study group, rated the general perception of life the highest, and the perception of health – the lowest. An analysis of the differences between the control group, and the study group has shown a statistically significantly lower level of the physical, and mental domains, as well as of the general perception of health. There were no statistically significant differences in the evaluation of the remaining domains. In the group of men, the differences between the control group, and the study group were not statistically significant. A comparative analysis of women, in the control, and study groups, shows that the control group rates their quality of life statistically significantly higher in the physical, mental, and environmental domains, as well as in the general perception of the quality of life, and the general perception of health. Only in the social domain no statistically significant differences were stated.

Table 2. Statistical significance of the differences between control and study group in domains.

Domain	Statistical significance of the differences		
	All	Men	Women
physical	0.003	0.227	0.003
mental	0.033	0.637	0.010
social	0.204	0.793	0.194
environmental	0.099	0.875	0.327
general perception of the quality of life	0.601	0.713	0.035
general perception of the health.	0.005	0.248	0.011

In the study carried out by means of the IPAQ questionnaire, the control group (n=20) attained the result of a median, weekly energy expenditure at the level of: 5459.7±4817.45 MET – min/week), women (n=12) attained the result of a median energy expenditure equal to 5906.92 MET – min/week (±5066.14), and men 4788.88 MET – min/week(±4669.42). In the study group, the whole median weekly energy expenditure, amounts, on average, to 2182.48 MET – min/week (±3105.53), respectively 1448.63 MET – min/week (±2875.81) for women, and 3283.25 MET – min/week (±3297.47) for men. The table 3 contains the statistical analysis of each of the groups. The comparison of the median week energy expenditure of the control, and study groups was placed in tables 3, and 4. A comparative analysis of the control, and study groups, showed that the control group attained a higher weekly median energy expenditure, to a statistically significant degree, in low and medium intensity efforts, as well as spending, on average, less time in a sedentary position than the study group. In low intensity efforts, no statistically significant differences were shown between the groups. In the group of women, the differences between the study group, and the control group were of a different nature in comparison with the groups, where the sex of the respondents was not indicated. The study group of women, to a statistically significant degree differed from the control group, attaining lower values as far as the time of carrying out of intensive, and medium efforts was concerned, as well as spending more time in a sedentary position. As far as the time of carrying out light effort was concerned, no statistically significant differences were stated. Between the control and study groups of men, the median week energy expenditure for each type of physical effort, and the mean time spent in a sedentary position were statistically insignificant. In the control group 14 respondents (8 women, and 6 men) declared carrying out intensive effort at least once a week, for at least 10 minutes. Fifteen respondents (10 women, and 5 men), declared carrying out effort of medium intensity. As many as 19 out of 20 respondents (12 women, and 7 men) declared to carry out low intensity effort. In the study group (women, and men), 5 respondents (men) declared carrying out intensive effort. Eleven respondents (5 women, and 6 men) declare carrying out effort of medium intensity. nineteen respondents (12 women, and 7 men) declared carrying out low intensity efforts.

Table 3. The comparison of the median week energy expenditure in the control and study groups (mean ± SD).

Variables	Control group			Study group		
	Women	Men	All	Women	Men	All
Intensive physical effort MET [min/week]	1920±632	1316±227	1678±434	-	2160±688	-
Moderate physical effort MET [min/week]	2087±529	2796±327	2392±366	240±87	620±179	392±128
Light effort MET [min/week]	1900±378	623±70	1389±298	1209±453	503±174	927±393
Sedentary position MET [min/week]	269±72	563±67	387±73	708±216	824±250	755±228

Table 4. Comparison of mean weekly energy expenditure of the control and the study groups.

Effort	Statistical significance of the differences		
	All	Men	Women
Intensive physical	0.034	0.753	0.006
Moderate physical	0.223	0.753	0.008
Light effort	0.144	0.875	0.112
Sedentary position	<0.001	0.128	0.001

DISCUSSION

There are many papers dealing with the subject of the influence of an increased body mass on the quality of life, and the level of physical activity. An increased consumption of energy dense products, and a decrease in physical activity, lead to obesity, which, in turn, may cause such diseases as: atherosclerosis, type 2 diabetes, or the metabolic syndrome [24,25,26,27,28]. During my our studies, I focused on the evaluation of the quality of life, and the level of physical activity of the people with an increased body mass indicator (BMI), and also in comparison with the respondents, whose BMI was within the norm. The results attained from the study carried out by means of the WHOQOL-BREF questionnaire, indicate that people suffering from obesity rate the quality of their lives lower. The environmental domain was rated the lowest, which can be a consequence of the fact that people with increased body mass, are perceived as less ambitious, and less resourceful [29]. When it comes to their professional career, this often translates into lower earnings, which, in turn, influence housing conditions, as well as the capability of pursuing their interests [30,31]. A comparative analysis of the study group, and of the respondents whose body mass was within the norm, indicates that they differ in the physical, and mental domains, as well as in the general perception of health. This result is a consequence of lower physical activity, as well of the coexistence of depression, and obesity [32,33,34,35]. The lack of significant differences in the remaining domains, indicates that the quality of life of the people with increased body mass, does not differ from the quality of life of the people in the same age group. The negative influence of obesity on the quality of life, is confirmed by studies carried out by Gnacińska-Szymańska et al. [36] on a group of 55 respondents (33 women, and 18 men), aged 22-85, by means of the WHOQOL-BREF questionnaire. The results attained in the particular domains, point to a decrease in the quality of life in all the studied domains. Sola et al. [37], carried out measurements by means of the Polish version of the Paediatric Quality of Life Inventory PedsQL TM 4.0, on a scale devised by themselves, on a group of 120 students (60 respondents with normal body mass, and 60 with obesity). The attained results confirm significant differences in all the domains of the quality of life, and the negative influence of obesity upon the health of the respondents. It was stated that their functioning at school, and the self-evaluation of the appearance of the study group of students had the greatest influence on their subjective perception of the quality of their lives [38,39,40,41]. The study carried out by means of the IPAQ questionnaire, showed that the physical activity of the obese consisted in low intensity efforts, such as walks, and to a limited extent, medium intensity efforts. The median weekly energy expenditure during high intensity efforts is just a little lower than during low intensity efforts, but only men declared carrying out activities of high intensity. Therefore, it can, be assumed that such a high median weekly energy expenditure in men, in intensive efforts, is caused by the type of task carried out. In addition, a comparative analysis of respondents whose body mass is within the norm, shows that the high, and medium intensity efforts constitute a significant part of all the types of physical activity. Wołos et al. [42] in their paper concerning the influence of obesity, and environmental risk factors on the occurrence of cardiovascular diseases, state that in the group of 250 student respondents (182 women, and 68 men) aged 18-25, BMI within the norm occurred more often in physically active ones. Together with the decrease in physical activity, there was a decrease in the percentage of people, whose body mass was within the norm. An increased BMI means an increased risk of death [43,44]. Various other authors attained similar study results [45,46,47,48]. Both, my our studies, and an overview of studies by other authors, indicate that an indirect influence of a limited physical activity resulting from obesity, on rating your quality of life as low, does exist.

Conclusions

1. Respondents with an increased body mass index (BMI) evaluate the quality of their lives negatively in all their aspects, in comparison with respondents whose body mass is within the norm. Obesity influences the quality of life negatively to a statistically significant degree in the physical, and mental domains, as well as in the general perception of health. These differences do not occur between men whose BMI is within the norm, and the obese ones. In the case of women,

however, the results indicate differences in each domain but the social one between women whose BMI is within the norm, and the obese ones.

2. In the study group, the mean weekly energy expenditure was lower than in the control group. The physical activity of the obese, consists mainly in low intensity activities, such as walks, and, to a limited extent efforts of moderate intensity. In the case of men, the occurrence of high intensity efforts is caused by the necessary occupational activity.
3. A comparative analysis showed that the level of physical activity in the group of obese women was statistically significantly lower in each type of physical effort with the exception of low intensity efforts. This difference does not occur when we compare men whose BMI is within the norm, and the obese ones. This regularity proves the need of carrying out in-depth studies within the sex-physical activity- quality of life range in groups of young people.

REFERENCES

1. Brodani J, Liparova S, Kral M. The interaction of physical activity and the life quality of students in mid and late adolescence *Physical Activity Review* 2016; 4:124-131. doi: 10.16926/par.2016.04.15
2. Brodani J, Ziskova I. Quality of life and physical activity of kinder garden teachers. *Physical Activity Review* 2015; 3:11-21. doi: 10.16926/par.2015.01.02
3. Polackova B, Halmova N. The relationship between weekly physical activity and quality of life in elderly women (pilot study). *Physical Activity Review* 2016; 4:100-106. doi: 10.16926/par.2016.04.12
4. Berglund A, Ericsson K Different meanings of quality of life: a comparison between what elderly persons and geriatric staff believe is of importance. *Int J Nurs Pract*. 2003; 9(2):112-9.
5. Bilgili N, Arpacı F. Quality of life in older adults in Turkey. *Archives of Gerontology and Geriatrics*. 2014; 59(2): 415-421.
6. Layte R, Sexton E, Savva G. Quality of life in older age: evidence from an Irish cohort study. *Journal of the American Geriatrics Society* 2013; 61(Suppl 2): S299-305.
7. Zaninotto P, Falaschetti E, Sacker A. Age trajectories of quality of life among older adults: results from the English Longitudinal Study of Ageing. *Quality of Life Research*. 2009; 18(10): 1301-1309.
8. Dalkey NC, Rourke DL. The Delphi procedure and rating quality of life factors, Univ. California LA; 1972.
9. Campbell A, Converse PE, Rogers WL. The quality of American Life: perception, evaluation, and satisfaction, New York: Rasel Sage Foundation; 1976.
10. Flanagan JC. Measurement of quality of life: current state of the art, *Arch. Phys. Med. Rehabil* 1982; 56-59.
11. WHO. Study protocol for the World Health Organization project to develop a Quality of Life assessment instrument (WHOQOL). *Qual Life Res* 1993; 2(2):153-9.
12. WHOQOL-BREF. Introduction, administration, scoring and generic version of the assessment. Field Trial Version. WHO, Geneva 1996.
13. The World Health Organization quality of life assessment (WHOQOL): Position paper from the World Health Organization. *Social Science & Medicine* 1995; 41(10): 1403-1409.
14. Crujeiras A, Carreira M, Casanueva F. Obesity and the future. New problems and new solutions *Endocrinologia y Nutricion* 2013; 60(1): 33-35.
15. Faeh A. Obesity in Europe: The Strategy of the European Union from a Public Health Law Perspective. *European Journal of Health Law* 2012; 19(1): 69-86.
16. Pilis K, Pilis A, Stec K, Michalski C, Zych M, Buchta J, Pilis W. Obesity: reversible biological adaptation or disease? *Physical Activity Review* 2016; 4:18-27. doi: 10.16926/par.2016.04.03
17. Sallis JF, Prochaska JJ, Taylor WC, A review of correlates of physical activity of children and adolescents. *Medicine and science in sports and exercise* 2000; 32(5): 963-975.
18. Fryar C, Carroll M, Ogden C. Prevalence of overweight and obesity among children and adolescents: United States, 1963-1965 through 2011-2012. Atlanta, GA: National Center for Health Statistics; 2014.
19. Han JC, Lawlor DA, Kimm SY, Childhood obesity. *The Lancet* 2010; 375(9727): 1737-1748.
20. Must A, Hollander SA, Economos CD, Childhood obesity: a growing public health concern. *Expert Review of Endocrinology & Metabolism* 2006; 1(2): 233-254.
21. Ogden C, Carroll M, Lawman H, Fryar C, Kruszon-Moran D, Kit B, Flegal K. Trends in Obesity Prevalence Among Children and Adolescents in the United States, 1988-1994 Through 2013-2014. *JAMA* 2016; 315(21): 2292-2299.
22. Gholami A, Moosavi Jahromi L, Zarei E, Dehghan A. Application of WHOQOL-BREF in Measuring Quality of Life in Health-Care Staff *Int J Prev Med* 2013; 4(7): 809-817.

23. WHO: WHOQOL. Measuring Quality of Life. Division of mental health and prevention of substance abuse WHO, Geneva; 1997.
24. Ainsworth B, Haskell W, Whitt M, Irwin M, Swartz A, Strath S, O'Brien W, Bassett D, Schmitz K, Emplalnecourt P, Jacobs D, Leon A. Compendium of physical activities: an update of activity codes and MET intensities. *Med Sci Sports Exerc* 2000; 32(9): S498-S516.
25. Chin YR, Lee IS, Lee HY. Effects of hypertension, diabetes, and/or cardiovascular disease on health-related quality of life in elderly Korean individuals: a population-based cross-sectional survey. *Asian Nursing Research* 2014; 8(4): 267-273.
26. De Vries M, Ouwendijk R, Kessels AG, de Haan MW, Flobbe K, Hunink MG. et al. Comparison of generic and disease-specific questionnaires for the assessment of quality of life in patients with peripheral arterial disease. *J Vasc Surg* 2005; 41: 261-268.
27. Dumville JC, Lee AJ, Smith FB, Fowkes FG. The health-related quality of life of people with peripheral arterial disease in the community: the Edinburgh Artery Study. *Br J Gen Pract* 2004; 54: 826-831.
28. Gohar A, Crystel M. Gijsberts, Saskia Haitjema, Gerard Pasterkamp, Dominique P.V. de Kleijn, Folkert W. Asselbergs, Michiel Voskuil, Gert-Jan de Borst, Imo E. Hoefler, Hester M. den Ruijter Health-related quality of life and outcome in atherosclerosis — Does sex matter? *Int J Cardiology* 2016; 1(212): 303-306.
29. Vallis M. Quality of life and psychological well-being in obesity management: improving the odds of success by managing distress. *Int J Clin Pract*, March 2016; 70(3): 196-205.
30. Clark AE. Measures of Job Satisfaction: What Makes a Good Job? Evidence from OECD Countries, OECD Labour Market and Social Policy Occasional Papers, No. 34, OECD Publishing; 1998.
31. Kim T, Han E. Impact of Body Mass on Job Quality. *Economics & Human*; 2015.
32. Becker ES, Margraf J, Turke V, Soeder U, Neumer S. Obesity and mental illness in a representative sample of young women. *Int J Obes Relat Metab Disord* 2001; 25(1): S5-9.
33. Brown PJ, Roose SP. Age and anxiety and depressive symptoms: the effect on domains of quality of life. *International Journal of Geriatric Psychiatry* 2011; 26(12): 1260-1266.
34. Heo M, Pietrobelli A, Fontaine KR, Sirey JA, Faith MS. Depressive mood and obesity in US adults: comparison and moderation by sex, age, and race. *Int J Obes (Lond)* 2006; 30: 513-9.
35. Zung W, Richards C, Short M Self-rating depression scale in an outpatient clinic. Further validation of the SDS. *Arch Gen Psychiatry* 1965; 13(6): 508-15.
36. Gnacińska-Szymańska M, Dardzińska J, Majkiewicz M, Malgorzewicz S. Ocena jakości życia osób z nadmierną masą ciała za pomocą formularza WHOQOL-BREF. *Endokrynologia, Otyłość i Zaburzenia Przemiany Materii* 2012; 8(4): 136-142. [in Polish]
37. Sola M, Gajewska E, Manikowski W. Wpływ otyłości na jakość życia związaną ze stanem zdrowia wśród dziewcząt i chłopców. *Nowiny Lekarskie* 2012; 81(4): 321-329. [in Polish]
38. Miranda-Rios L, Vasquez-Garibay EM, Romero-Velarde E, Nuno-Cosio ME, Campos-Barrera L, Caro-Sabido EA, Ramírez-Díaz J. Factors associated with physical activity and body mass index among schoolchildren from Arandas, Jalisco, Mexico. *Rev Med Inst Mex Seguro Soc.* 2017; 55(4): 472-480.
39. Moreno L. Obesity in children and adolescents. A critical review. *Endocrinología y Nutrición* 2013; 60(1): 7-9.
40. Qiao Y, Zhang T, Liu H, Katzmarzyk PT, Chaput JP, Fogelholm M, Johnson WD, Kuriyan R, Kurpad A, Lambert EV, Maher C, Maia JAR, Matsudo V, Olds T, Onywera V, Sarmiento OL, Standage M, Tremblay MS, Tudor-Locke C, Zhao P, Hu G; Joint association of birth weight and physical activity/sedentary behavior with obesity in children ages 9-11 years from 12 countries. *ISCOLE Research Group. Obesity (Silver Spring)* 2017; 25(6): 1091-1097.
41. Zurita-Ortega F, Castro-Sánchez M, Rodríguez-Fernández S, Cofré-Boladós C, Chacón-Cuberos R, Martínez-Martínez A, Muros-Molina J. Physical activity, obesity and self-esteem in Chilean schoolchildren. *Rev Med Chil* 2017; 145(3): 299-308.
42. Wołos J, Tarach J, Klatka M. Występowanie otyłości i środowiskowych czynników ryzyka miażdżycy w grupie studentów uczelni wyższych w Lublinie. *Endokrynologia, Otyłość i Zaburzenia Przemiany materii* 2009; 5(2): 66-72. [in Polish]
43. Fogelholm M. Physical activity, fitness and fatness: relations to mortality, morbidity and disease risk factors. A systematic review. *Obes Rev.* 2010; 11(3): 202-221.
44. Lew E, Garfinkel L. Variations in mortality by weight among 750,000 men and women. *J Chronic Dis* 1979; 32: 563-576.
45. Bray G, Clearfield M, Fintel D, Nelinson D. Overweight and obesity: the pathogenesis of cardiometabolic risk. *Clin Cornerstone* 2009; 9(4): 30-40.
46. Farzianpour F, Hosseini Sh, Rostami M, Pordanjani Sh B, Hosseini SM. Quality of life of the elderly residents. *Am J Applied Sci* 2012; 9 (1): 71-74.

47. Hu G, Tuomilehto J, Silventoinen K, Barengo NC, Peltonen M, Jousilahti P. The effects of physical activity and body mass index on cardiovascular, cancer and all-cause mortality among 47 212 middle-aged Finnish men and women. *Int J Obes (Lond)* 2005; 29(8): 894-902.
48. Forjaz MJ, Rodriguez-Blazquez C, Ayala A, Rodriguez-Rodriguez V, de Pedro-Cuesta J, Garcia-Gutierrez S, Prados-Torres A. Chronic conditions, disability, and quality of life in older adults with multimorbidity in Spain. *European Journal of Internal Medicine* 2015; 26(3):176-181.