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ORIGINAL CONTRIBUTIONS

Health Literacy and Weight Loss After Bariatric Surgery

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Abstract

Background There are many factors that affect weight loss after bariatric surgery. The present study evaluated the impact of health literacy on weight loss after bariatric surgery in morbidly obese patients.

Methods The data of 118 patients who underwent laparoscopic sleeve gastrectomy for morbid obesity (body mass index-BMI ≥ 40 kg/m^2) and completed a 1-year follow-up period were recorded and evaluated, prospectively. The Turkish version of the 47-item European Health Literacy Survey Questionnaire (HLS-EU-Q47) was used to evaluate the health literacy of these patients. Their demographic characteristics, preoperative and postoperative weight (at 6 and 12 months), BMI, the percentage of excess weight loss (% EWL), excess BMI loss (% EBL) and total weight loss (%TWL), comorbidities, socioeconomic characteristics (marital status, income level, educational status, and duration), and HLS-EU-Q47 results were recorded and compared.

Results A significant inverse relationship was identified between preoperative BMI and scores for health promotion health literacy and general health literacy indexes ($p = 0.024$ and $p = 0.032$, respectively). A significant positive relationship was noted between % EWL and % EBL at 6 and 12 months, and health promotion health literacy index scores (6 months: $p = 0.004$, $p = 0.006$; 12 months: $p < 0.001$ and $p < 0.001$, respectively). A similar significant positive relationship was recorded between the % EWL and % EBL at 12 months and the health care health literacy index scores ($p = 0.042$ and $p = 0.036$, respectively). There was also a significant positive relationship between general health literacy index scores and % EWL and % EBL at 12 months ($p = 0.022$ and $p = 0.021$, respectively). % EWL at 12 months increased by 0.39, with a 1-point increase in health promotion and health literacy index scores.

Conclusions A high health literacy index score in morbidly obese patients is associated with successful weight loss after bariatric surgery.

Keywords Morbid obesity · Health literacy · Bariatric surgery · HLS-EU-Q47 · Weight loss · Sleeve gastrectomy

Introduction

Obesity and its associated comorbidities constitute important health problems and are seeing an increasing prevalence in modern society [1]. As medical therapies for obesity and the promotion of lifestyle changes are often not sufficient or effective, bariatric surgery procedures are increasingly relied on for sustainable weight loss [2]. Bariatric surgery procedures also enable the resolution of comorbidities, while increasing quality of life and survival [3]. However, weight loss outcomes after bariatric surgery vary from patient to patient, with these diverse outcomes being attributable to various factors such as chronic obesity syndrome, operator-dependent technical factors, psychological factors, eating disorders, and success in implementing lifestyle changes [4–8].

Health literacy (HL) is defined as the ability of an individual to obtain, understand, and process the basic health information and services required to make appropriate decisions, and to develop appropriate behaviors [9]. As quality of life, personal care, and communication with healthcare providers improve, patients are better able to make decisions regarding treatment selection, and an improvement can be achieved in health outcomes parallel to the increase in health literacy [10].

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A clear relationship between health literacy and obesity has been demonstrated, where an increased HL index favorably affects the weight loss process and enhances the pursuit of therapies for obesity [11–13]. Different scales are in use around the world to determine the level of HL. The present study, however, made use of the European Health Literacy Survey Questionnaire (HLS-EU-Q47), being a multidimensional, multinational, interdisciplinary, and comprehensive scale [14]. The HLS-EU-Q47 is a 47-item questionnaire on health care, disease prevention and health promotion, that assesses patients access to, understanding of, appraisal of and application of health information, and their ability to make judgments based on this.

Data supporting the impact of HL on weight loss following bariatric surgery in morbidly obese patients is limited. Therefore, the present study aimed to evaluate the effects of health literacy on weight loss after bariatric surgery.

Materials and Methods

Study Design

Data of 118 patients who underwent laparoscopic sleeve gastrectomy for morbid obesity (body mass index-BMI ≥ 40 kg/m^2) in the general surgery clinics of the Health Sciences University, Bursa Yuksek Ihtisas Teaching and Research Hospital between November 2016 and November 2018 were recorded and evaluated, prospectively. Operations were performed between November 2016 and November 2017 and all patients completed their first year by November 2018. Patients were given detailed information about the study and their written informed consent was obtained. The study was conducted in accordance with the principles of the Helsinki Declaration, and the local ethics committee approved the study.

Sampling

The study included literate patients aged 18–60 years, with a BMI ≥ 40 kg/m^2 who attended follow-up visits at 6 and 12 months after bariatric surgery. Patients who did not give consent for involvement in the survey, illiterate patients, healthcare professionals, patients with a BMI < 40 kg/m^2, and those who presented for revision surgery after the initial bariatric surgery were excluded. All patients were operated on in the same center and by the same surgical team. These morbidly obese patients were evaluated preoperatively for bariatric surgery eligibility by specialists from the endocrinology, pulmonary diseases, psychiatry, and general surgery departments. On discharge from the hospital, patients were started on a standard regime, given dietary instructions, and were advised to attend follow-up visits at 6 and 12 months, postoperatively.

Study Procedure

The Turkish version of the HLS-EU-Q47 was applied in face-to-face interviews in the outpatient clinics, during the preoperative period. The 47 items were rated on a 4-point scale: 1 = very difficult, 2 = difficult, 3 = easy, 4 = very easy. Unanswered questions were not rated. The survey questions were divided into subgroups as follows: health care questions 1–16, disease prevention questions 17–31, and health promotion questions 32–47. At the end of the study, 0–25 was accepted as insufficient, > 25–33 as problematic, > 33–42 as sufficient, and > 42–50 as perfect.

Formula Index = (M − 1) * (50 / 3), where index was specific index calculated, *M* was the mean of all participating items for each individual, 1 was the minimal possible value of the mean, 3 was the range of the mean, and 50 was the chosen maximum value of the new metric [14]. The % TWL was defined as operative weight minus the follow-up weight, divided by the operative weight, and multiplied by 100.

The demographic characteristics of the patients, along with their socioeconomic characteristics (marital status, educational status and duration, income level), comorbidities, preoperative and postoperative (at 6 and 12 months) weight and BMI, percentage of excess weight loss (EWL), excess BMI loss (EBL), and total weight loss (%TWL), were recorded and compared together with HLS-EU-Q47 results.

Statistical Analyses

Shapiro-Wilk test was used to determine whether data distribution was normal. Continuous variables were expressed as median (minimum, maximum) and mean ± standard deviation (minimum, maximum), while categorical variables were expressed as number (*n*) and percentage (%). Independent samples *t* test or Mann-Whitney *U* test was used for the comparison of two groups, based on the results of the normality test. The relationship between continuous variables was evaluated using a correlation analysis by calculating the Spearman correlation coefficient. Cronbach's alpha was calculated to evaluate the internal consistency of the health literacy scale. A multiple linear regression analysis was used to determine independent risk factors in predicting the % EWL at 12 months. SPSS (IBM Corp. Released 2012. IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp.) software was used for the statistical analysis and a *p* value of less than 0.05 was considered statistically significant.

Results

The study comprised 118 patients, all of whom underwent laparoscopic sleeve gastrectomy. No complications occurred in the postoperative period. The relationship between

demographic characteristics of the patients and HL is presented in Table 1. The mean age of the patients was 39.3 ± 9.8 years, with a predominance of women of moderate income level. In the preoperative period, the mean weight was 121.3 ± 14.9 kg (91:164) and the mean BMI was 45.8 ± 5.4 kg/m^2 (40:64.5). Comorbidities were seen at a rate of 41.5%. The duration of education was 9.5 years (9.1 ± 4.1), with 58.1% of the patients as high school or university graduates. HL levels were found to be high in patients with good income (p = 0.003). The overall HL level was higher in patients with high school and higher education level (p = 0.001).

Table 1 The relationship between socio-demographic characteristics and health literacy

n = 118		General HL index
Age (years)	r_s	− 0.18
	p value	0.056
Gender		
Female (n = 103)		35.5 ± 7.5 (14.5:50)
Male (n = 15)		39 ± 6.4 (30.5:48.9)
p value		0.082[a]
Preoperative weight	r_s	− 0.02
	p value	0.809
Preoperative BMI	r_s	− 0.20
	p value	0.032
Comorbidity		
Present (n = 49)		36.6 ± 6.6 (23.5:48.9)
Absent (n = 69)		35.5 ± 7.5 (14.5:50)
p value		0.429[a]
Marital status		
Single (n = 86)		36.9 ± 7.2 (14.5:50)
Married (n = 21)		37.6 ± 7.1 (23.7:48.2)
Divorced (n = 11)		36.9 ± 7.2 (14.5:50)
p value		0.148[b]
Level of Income		
Low (n = 6)		41.6 (26.1:47.8) (39.8 ± 7.6)
Moderate (n = 83)		33.3 (14.5:50) (34.4 ± 6.8)
High (n = 29)		41.1 (29.2:48.9) (39.7 ± 6.4)
p value		0.002[c]
Level of education		
Primary school (n = 50)		33.3 ± 6.5 (14.5:50)
High school (n = 37)		38.7 ± 6.3 (23.4:48.9)
University (n = 31)		37.1 ± 7.6 (20.9:48.2)
p value		0.001[b]

The data is presented as median (minimum, maximum), mean ± standard deviation (minimum, maximum), and number (%)

r_s, Spearman correlation coefficient

[a] Independent samples t test

[b] ANOVA test

[c] Kruskal-Wallis test

Health literacy levels were determined according to results of the HLS-EU-Q47 questionnaire (Table 2). The score was inadequate or problematic-limited in 45 patients (38.1%) and sufficient or excellent in 73 patients (61.8%). The health literacy index is based on the general health literacy index (GEN-HL) and the subgroups: health care health literacy index (HC-HL); disease prevention health literacy index (DP-HL); and health promotion health literacy index (HP-HL). Internal consistency was excellent for the four health literacy indices examined (GEN-HL, HC-HL, DP-HL, and HP-HL; Cronbach's alpha = 0.96, 0.89, 0.89, and 0.91).

Preoperative and postoperative (at 6 and 12 months) weight, BMI, % EWL, % EBL, and TWL were evaluated (Table 3, Fig. 1). A significant inverse relationship was identified between preoperative BMI and health promotion health literacy and general health literacy index scores (p = 0.024 and p = 0.032, respectively). There was a significant negative correlation between preoperative and postoperative 12th month BMI values and health care health literacy index (p = 0.046, p = 0.031, respectively). There was a significant negative correlation between BMI values and health promotion health literacy index score at postoperative 6th and 12th months (p = 0.004, p = 0.001, respectively). There was a significant inverse relationship between BMI values and general health literacy score at 12 months (p = 0.018). There was a significant negative correlation between weight and health promotion health literacy index score at 12 months (p = 0.012).

The mean % EWL and EBL at postoperative 6 months were 65.3% ± 17.2 (23.6–112.2) and 67.1% ± 20.8 (23.7–191:57), respectively. At postoperative 12 months, the mean % EWL 78.9 ± 18.4 (31–122.9), % EBL 79.6 ± 18.4 (31.6–122.9), and % TWL 34.8 ± 6.7, a significant positive relationship was noted between these % EWL and EBL and the health promotion health literacy index scores at 6 months (p = 0.004, p = 0.006, respectively) and at 12 months (p < 0.001 and p < 0.001, respectively). There was also a significant positive relationship between the % EWL and EBL at 12 months and the health care health literacy index scores (p = 0.042 and p = 0.036, respectively). A further significant positive relationship was seen between the % EWL and EBL at 12 months and the general health literacy index scores (p = 0.022 and p = 0.021, respectively). There was a significant relationship between %

Table 2 Level of HL according to the HLS-EU-Q47 questionnaire results

Score	HL level (n = 118)
Inadequate (0–25)	7 (5.9%)
Problematic-limited (> 25–33)	38 (32.2%)
Sufficient (> 33–42)	45 (38.1%)
Excellent (> 42–50)	28 (23.7%)

Data is expressed as n (%)

Table 3 Relationship between health literacy and postoperative weight loss

$n = 118$	Health care health literacy index (Q1–16)		Disease prevention health literacy index (Q17–31)		Health promotion health literacy index (Q32–47)		General health literacy index (Q1–47)	
	r_s	p	r_s	p	r_s	p	r_s	p
Preoperative weight	0.037	0.688	0.022	0.810	−0.101	0.278	−0.023	0.809
Postoperative weight at 6 months	−0.03	0.719	0.02	0.813	−0.18	*0.055*	−0.06	0.502
Postoperative weight at 12 months	−0.05	0.604	−0.03	0.774	−0.23	*0.012*	−0.11	0.255
Preoperative BMI	−0.184	*0.046*	−0.142	0.126	−0.208	*0.024*	−0.197	*0.032*
Postoperative BMI at 6 months	−0.18	0.054	−0.10	0.305	−0.26	*0.004*	−0.18	0.058
Postoperative BMI at 12 months	−0.20	*0.031*	−0.14	0.130	−0.31	*0.001*	−0.22	*0.018*
Percentage of EWL at 6 months	0.173	0.061	0.061	0.510	0.263	*0.004*	0.154	0.096
Percentage of EBL at 6 months	0.168	0.069	0.066	0.478	0.254	*0.006*	0.150	0.106
Percentage of EWL at 12 months	0.188	*0.042*	0.131	0.156	0.328	*< 0.001*	0.211	*0.022*
Percentage of EBL at 12 months	0.193	*0.036*	0.136	0.143	0.325	*< 0.001*	0.213	*0.021*
Percentage of TWL at 12 months	0.10	0.264	0.06	0.516	0.26	*0.005*	0.13	0.164

r_s, Spearman's correlation coefficient, *BMI* body mass index, *EWL* excess weight loss, *EBL* excess BMI loss, *TWL* total weight loss

TWL value and health promotion health literacy index score at 12 months ($p = 0.005$).

A multiple linear regression analysis was performed to predict the % EWL at 12 months (Table 4). The general HL and subscale scores, preoperative weight and BMI, age, gender, income level, comorbidities, marital status, and duration of education were included in the analysis as independent variables. The variables that remained significant in the final step of the analysis were the HL index health promotion score and preoperative BMI. Regression equation for the relevant analysis is as follows: $\hat{y} = 152.58 + 0.39$*(health promotion)−1.91*(preoperative BMI). A 1-point increase in the score of the health promotion subscale of the HL index corresponds to a 0.39-point increase in the % EWL at 12 months.

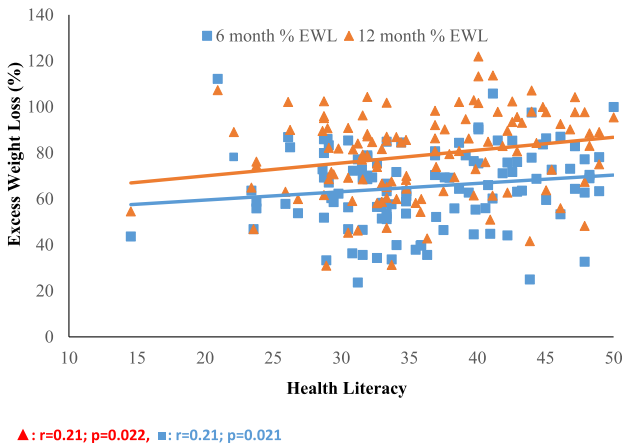

Fig. 1 The relationship between general HL scores and the percentage of EWL at 6 and 12 months

Discussion

According to the results gleaned from the HLS-EU-Q47 questionnaire, the scores in our study were inadequate or problematic-limited in 38.1% of cases, and sufficient or excellent in 61.8%. In fact, the level of health literacy varies considerably between countries, with inadequate and problematic-limited levels ranging between 7 and 47% [15, 16]. Studies show that a higher level HL increases presentation for bariatric surgery [11], and the sufficient and excellent level of health literacy among a large proportion of our patients was attributed to this fact. In the first year after LSG, EWL ranged from 65.6 to 81.4% and TWL 33.4–35.8% [17–19]. In the present study, EWL was 78.9% and TWL was 34.8% at the end of the first year and these results were consistent with the literature.

In the present study, an increased BMI matches a decreased health literacy in our obese patients during the preoperative period (inverse relationship between BMI and general health literacy index score and health promotion health literacy index score: $p = 0.032$ and $p = 0.024$, respectively). There was a

Table 4 Results of linear regression analysis in predicting the percentage of EWL at 12 months

	B	Std. error	*T*	*p* value
Constant	152.5	14.1	10.8	*< 0.001*
Health promotion	0.39	0.17	2.37	*0.020*
Preoperative BMI	−1.91	0.25	−7.51	*< 0.001*
	$R^2 = 37\%$ ($F = 35.96$, $p < 0.001$)			

B, unstandardized regression coefficient

significant inverse relationship between BMI values and general health literacy score at 12 months ($p = 0.018$). There was a significant negative correlation between weight gain and health promotion health literacy index score ($p = 0.012$) (R1: 10). There was a significant negative correlation between BMI values and health promotion health literacy index score at postoperative 6th and 12th months ($p = 0.004$, $p = 0.001$, respectively). It was also observed that a high health promotion health literacy index score affected weight loss at 6 and 12 months, and that a 1-point increase in the health promotion health literacy index corresponded to a 0.39-point increase in the % EWL at 12 months. Moreover, a significant positive relationship between the health care health literacy index score and the general health literacy index score and the % EWL and EBL at 12 months was noted. Thus, high general health literacy scores at the end of 1 year were accompanied by a more effective weight loss. This relates to reports that a low level of HL increases the prevalence of obesity in children and adults [20]. Furthermore, adults with a low level of HL have a poorer understanding of their health problems related to obesity, make fewer attempts to undergo surgical treatment for obesity, and achieve poorer success in losing weight than patients with a high level of HL [11, 12].

The patients in the present study were at a young age, were married, and had a moderate level of income. Older patients are reported to have a lower level of education and income, make fewer attempts at surgical treatment, and have a higher rate of comorbidities [11, 21–25]. In the present study, HL level was found to be higher in patients with higher income and higher education level. Moreover, as the state insurance system in Turkey offers free healthcare, income level does not affect bariatric surgery procedures here. A lower level of HL and a higher rate of obesity have been reported in low socioeconomic conditions and it is recognized that increasing the duration and level of education increases the demand for bariatric surgery [11, 26–28]. Certainly, high school and university graduates constituted a large proportion of the patients in our study (61.8%). Reports also indicate that as education level decreases, a patient's ability to perceive their excess body weight and associated diseases, follow sensible eating habits, make correct product choices, and benefit from publications on nutrition is compromised [29, 30].

The rate of comorbidities was 41.5% among our patients, and it has been demonstrated that morbidly obese patients with comorbidities and a low level of HL are less likely to present for surgical treatment [11]. It has further been stated that the level of HL has a particularly important impact on the treatment of chronic diseases (hypertension, diabetes mellitus, chronic obstructive pulmonary disease) and that increasing the HL level of patients increases treatment success [11, 23, 31–34].

Limitations

Limitations to our present study were its single-center nature, the relatively small number of patients despite its prospective design, and the differences in health literacy levels across the world.

Conclusions

The present study showed that increasing the HL level of patients had a favorable effect on weight loss outcomes. Health literacy has gained increasing importance in the treatment of diseases, with HL level being among the factors affecting successful weight loss after bariatric surgery. The use of effective methods in bariatric surgery and the capabilities of the individual surgeon may not be adequate to guarantee the desired results. Hence, interventions aimed at increasing health literacy levels among patients may contribute to improving surgical outcomes. The authors consider that more studies, involving larger numbers of patients, and evaluating both short-term and long-term outcomes, are needed to determine the true impact of health literacy on successful weight loss after bariatric surgery.

Compliance with Ethical Standards

The study was conducted in accordance with the principles of the Helsinki Declaration, and the local ethics committee approved the study.

Conflict of Interest The authors declare that they have no conflict of interest.

References

1. Fryar CD, Carrol MD, Ogden CL. Prevalence of overweight, obesity, and extreme obesity among adults: United States, trends 1960–1962 through 2009–2010: National Center of Health. Statistics; 2012. p. 2014.
2. Henkel DS, Mora-Pinzon M, Remington PL, et al. Trends in the prevalence of severe obesity and bariatric surgery access: a state-level analysis from 2011 to 2014. J Laparoendosc Adv Surg Tech A. 2017;27(7):669–75.
3. Karlsson J, Taft C, Ryden A, et al. Ten-year trends in health-related quality of life after surgical and conventional treatment for severe obesity: the SOS intervention study. Int J Obes. 2007;31:1248–61.
4. Patel S, Szomstein S, Rosenthal RJ. Reasons and outcomes of reoperative bariatric surgery for failed and complicated procedures (excluding adjustable gastric banding). Obes Surg. 2011;21:1209–19.
5. Bastos EC, Barbosa EM, Soriano GM, et al. Determinants of weight regain after bariatric surgery. Arq Bras Cir Dig. 2013;26(Suppl 1):26–32.
6. de Raaff CA, Coblijn UK, de Vries N, et al. Predictive factors for insufficient weight loss after bariatric surgery: does obstructive sleep apnea influence weight loss? Obes Surg. 2016;26(5):1048–56.

7. Bobbioni-Harsch E, Huber O, Morel P, et al. Factors influencing energy intake and body weight loss after gastric bypass. Eur J Clin Nutr. 2002;56(6):551–6.
8. Gullick AA, Graham LA, Richman J, et al. Association of race and socioeconomic status with outcomes following laparoscopic Roux-en-Y gastric bypass. Obes Surg. 2015;25(4):705–11.
9. Sørensen K, Van den Broucke S, Fullam J, et al; (HLS-EU) Consortium Health Literacy Project European. Health literacy and public health: a systematic review and integration of definitions and models. BMC Public Health 2012;25(12):80.
10. Morris NS, MacLean CD, Littenberg B. Literacy and health outcomes: a cross-sectional study in 1002 adults with diabetes. BMC Fam Pract. 2006;14(7):49.
11. Cayci HM, Erdogdu UE, Demirci H, et al. Effect of health literacy on help-seeking behavior in morbidly obese patients agreeing to bariatric surgery. Obes Surg. 2018;28(3):791–7.
12. Kennen EM, Davis TC, Huang J, et al. Tipping the scales: the effect of literacy on obese patients' knowledge and readiness to lose weight. South Med J. 2005;98:15–8.
13. Faruqi N, Spooner C, Joshi C, et al. Primary health care-level interventions targeting health literacy and their effect on weight loss: a systematic review. BMC Obes. 2015;17:2–6.
14. HLS-EU Consortium. Comparative report of health literacy in eight EU member states. The European Health Literacy Survey HLS-EU 2012. http://www.healthliteracy.eu.
15. U.S. Dept. of Education, National Center for Education Statistics. The health literacy of America's adults: results from the 2003 National Assessment of Adult Literacy. http://nces.ed.gov/ pubs 2006/2006483_1.pdf.
16. Australian Bureau of Statistics 2008: Health literacy, Australia Catalogue No 4233.0. http://www.abs.gov.au
17. Ece I, Yilmaz H, Alptekin H, et al. Comparative effectiveness of laparoscopic sleeve gastrectomy on morbidly obese, super-obese, and super-super obese patients for the treatment of morbid obesity. Obes Surg. 2018;28(6):1484–91.
18. Cayci HM, Erdogdu U. Laparoscopic sleeve gastrectomy versus endoscopic intra-gastric balloon placement: early results of morbidly obese patients. Arch Clin Exp Med 2017;2(2):35–38.
19. Chang WW, Hawkins DN, Brockmeyer JR, et al. Factors influencing long-term weight loss after bariatric surgery. Surg Obes Relat Dis. 2019,9. pii: S1550-7289(18)30599-9;15:456–61.
20. Huizinga MM, Beech BM, Cavanaugh KL, et al. Low numeracy skills are associated with higher BMI. Obesity (Silver Spring). 2008;16:1966–8.
21. von Wagner C, Knight K, Steptoe A, et al. Functional health literacy and health-promoting behaviour in a national sample of British adults. J Epidemiol Community Health. 2007;61:1086–90.
22. Lee SY, Tsai TI, Tsai YW. Accuracy in self-reported health literacy screening: a difference between men and women in Taiwan. BMJ Open. 2013;20(3):e002928.
23. Berkman ND, Sheridan SL, Donahue KE, et al. Low health literacy and health outcomes: an updated systematic review. Ann Intern Med. 2011;155(2):97–107.
24. Kanj M, Mitic W. Health literacy and health behaviour. World Health Organization, 2009. http://www.who.int/healthpromotion/conferences/7gchp/Track1_Inner.pdf.
25. Protheroe J, Whittle R, Bartlam B, et al. Health literacy, associated lifestyle and demographic factors in adult population of an English city: a cross-sectional survey. Health Expect. 2017;20(1):112–9.
26. Watkins K. United Nations Development Programme. New York: Human Development Report 2007/2008; 2007. p. 269.
27. National Health and Medical Research Council. Clinical practice guidelines for the management of overweight and obesity in adults, adolescents and children in Australia. Melbourne: National Health and Medical Research Council; 2013.
28. Thomacos N, Keleher H. Health literacy and vulnerable groups: what works? Melbourne: Department of Health Social Science, Monash University; 2009.
29. Song HJ, Grutzmacher SK, Kostenko J. Personal weight status classification and health literacy among supplemental nutrition assistance program (SNAP) participants. J Community Health. 2014;39:446–53.
30. Baranowski T, Cullen KW, Nicklas T, et al. Are current health behavioral change models helpful in guiding prevention of weight gain efforts? Obes Res. 2003;11(Suppl:23S–43S.
31. Dageforde LA, Cavanaugh KL. Health literacy emerging evidence and applications in kidney disease care. Adv Chronic Kidney Dis. 2013;20:311–9.
32. Sadeghi S, Brooks D, Stagg-Peterson S, et al. Growing awareness of the importance of health literacy in individuals with COPD. COPD 2013;10:72–78.
33. Al Sayah F, Majumdar SR, Johnson JA. Association of inadequate health literacy with health outcomes in patients with type 2 diabetes and depression: secondary analysis of a controlled trial. Can J Diabetes. 2015;39:259–65.
34. Scott TL, Gazmararian JA, Williams MV, et al. Health literacy and preventive health care use among Medicare enrollees in a managed care organization. Med Care. 2002;40:395–404.