



The Effectiveness of Web Base Programs on the Reduction of Obesity among Adults at Makkah Al-Mukarramah, 2022. Experimental Study.

Mashaal Meshal Althagafi , Jumanah Mujib Khan

Family medicine consultant, ministry of health, Saudi Arabia

Clinical dietitian , ministry of health, Saudi Arabia

Abstract

Background: Individual behavioral habits that contribute to overweight and obesity include a poor diet and a lack of physical activity. These are linked to more diseases, a worse quality of life, early weakness, and higher mortality. Individualized web-based therapies show promise in changing behavior and achieving successful weight loss at a low cost. The long-term implications, however, have not yet been fully examined. Aim: The aim of the study was to investigate the effects of regular attendance in a 12-week web-based weight loss program. Setting: The study was carried out in PHCS. at Makkah. Research Design: Experimental study used a pragmatic approach, with enrollment and outcomes assessment being exclusively online. Subject: After randomization, they attended the first medical examination and the second after completing the 12-week weight loss program. N = 50 of the intervention. Results: Regarding the number of hours of sleep, there is no significant differences between before and after web base programs on the reduction of obesity; related to the amount of water you drink per day there is statistically significant differences between before and after web base programs on the reduction of obesity. There are statistically significant differences before and after participants' dietary intakes from baseline to 12 weeks with full-fat milk, low or skimmed milk, Fish and Brown bread, fruits, Vegetables, Fruit juices, Soft drinks, Desserts (cake - cookies...), French fries, or chips and fast food ($p < 0.001^*$). Recommendation: should be enhanced web-based program features, such as personalized feedback, is required to determine what features are necessary to elicit and support individuals to positively change their eating habits.

Keywords: Web base programs, Reduction of obesity.

I. Introduction

Numerous health issues and a possible rise in mortality are linked to obesity. The pillars of weight control are interventions that focus on behaviors related to a balanced diet and physical exercise⁽¹⁾. These therapies continue to be essential because of their added advantages, including as the prevention of diabetes and early death, despite their modest efficacy, particularly in terms of long-term weight loss maintenance⁽²⁾. In many parts of the world, obesity has pandemic proportions, and unless effective measures are taken to prevent the trend, its effects will place unprecedented health, financial, and social costs on society at large⁽³⁾.

According to the World Health Organization, 13% of people worldwide are obese and 39% of adults are overweight. Considering 650 million individuals globally are obese as a result of this prevalence, addressing overweight and obesity is a major public health concern⁽⁴⁾. To counteract the obesity pandemic, many measures at the individual, interindividual (social support by family and close friends), and environmental levels are necessary⁽⁵⁾. The economic costs associated with obesity are significant for families, healthcare systems, and the global economy in addition to the diseases it is linked to. Preventive, diagnostic, and treatment services for obesity and its co-morbidities are included in direct medical expenses⁽⁶⁾.

The definitions of overweight and obesity include abnormal or excessive fat buildup that might harm one's health⁽⁷⁾. Body mass index (BMI) is a straightforward measure of weight in relation to height that is frequently used to categorize overweight and obesity⁽⁸⁾. It is determined by dividing the individual's weight in kilograms by the square of his or her height in meters (kg/m²)⁽⁹⁾. Overweight is defined by the World Health Organization as having a BMI of 25 or higher, and obesity as having a BMI of 30 or higher⁽⁴⁾.

Dietary modification is necessary for effective and long-lasting weight loss. However, few scientific research papers have examined the effects of weight reduction regimens on food consumption or the dietary modifications made by those who are successful in losing weight that really is clinically significant⁽¹⁰⁾. This makes it more difficult to pinpoint the eating habits that may be modified and lead to good weight reduction results⁽¹¹⁾. Moreover, it's critical to determine if diet quality is improved or harmed while participating in the program since a deficient diet might undermine the beneficial properties of reducing weight⁽¹²⁾.

The need for comprehensive weight loss solutions rises as the prevalence of obesity increases⁽¹³⁾. The expansion of Internet connectivity over the last few years has made it possible for web-based therapy methods to potentially reach a large population. Web-based therapies can help people lose weight, and programs with extra features like counselling and/or personalized feedback may be more successful than those that only provide information⁽¹⁴⁾.

The majority of web-based weight reduction intervention trials have documented food consumption changes insufficiently, typically simply mentioning decreases in overall calorie intake⁽¹⁵⁾. Only three web-based randomized controlled trials (RCTs) for weight reduction have thoroughly assessed nutritional consumption; all three found only modest improvements between treatment groups but no between-group differences^(16, 17). As a result, there is presently insufficient data to determine whether web-based weight reduction programs are effective in improving food intake or if the inclusion of web-based elements (such as individualized feedback) leads to higher dietary intake changes. Therefore, the present study aimed to investigate the effects of regular attendance in a 12-week web-based weight loss program.

II. Subjects and Methods

Research design: Experimental study used a pragmatic approach, with enrollment and outcomes assessment being exclusively online to fulfill the aim of this study. Setting: The study was conducted at Makkah.

Subjects Sample: Study participants were recruited October to December 2022. After randomization and successful screening, they attended the first medical examination and the second after completing the 12-week weight loss program. N = 50 of the intervention.

Data Collection Tools: Data was collected through the utilization of two tools as follows:

Tool (1): Socio - demographic Data and clinical characteristics: It was used to collect data about participants, Part I: Socio - demographic Data it encompasses item such as age, sex, marital status, educational level and income. Part II: clinical characteristics. It encompasses item such as smoking, medication use before diet, health problems, weight and sleeping pattern.

Tool (2): the Brazilian food frequency questionnaire: It included two parts:

Part I: Patient personal data developed by the researcher: It was used to collect data about patients. It included five items related to gender, age, level of education and length of stay. Part II: Patient Satisfaction Scale: This

scale was developed by⁽¹⁸⁾ to assess the number of daily vegetable and fruit portions and the weekly consumption of sweetened beverages and ultra-processed foods.

Validity of the tool: The tools were tested for the face validity by a jury of five experts in the field of study and necessary modifications were done.

Data collection procedure: Permission from participants was obtained to collect the data after the researcher explain the importance and purpose of the study. Statistical Analysis The data obtained from the study tools were categorized, tabulated, analyzed and data entry was performed using the SPSS software (statistical package for social sciences version (22.0). Descriptive statistics were applied (e.g. mean, standard deviation, frequency and percentage). Shapiro-Wilk test to test for differences in weight and dietary intake at 12 weeks between the participants. Tests of significance were performed to test the study hypotheses (i.e. t- test, and ANOVA test). Pearson's correlation coefficient was applied between quantitative variables. A significant level value was considered when $p < 0.05$.

III. Results

Table (1) Distribution of the participants data characteristics (n=50) show that more than third are (42.0%) in age group ranged between 35-45 years; more than two third of participants (62.0%) are married; the majority of participants (80.0%) have collegiate degree. Regarding sex, male and female are equal (50%).

Table (1) Distribution of the participants data characteristics (n=50).

	N	%
Age		
<35	14	28.0
35-45	21	42.0
>45	15	30.0
Range	22-64	
Mean±SD	39.26+9.176	
Sex		
Female	25	50.0
Male	25	50.0
Education		
Primary	1	2.0
Preparatory	1	2.0
Secondary	8	16.0
Collegiate	40	80.0
Marital status		
Single	11	22.0
Married	31	62.0
Divorced	7	14.0
Widower	1	2.0
Income		

	N	%
<5000	14	28.0
5000-10000	16	32.0
10000-15000	13	26.0
>15000	7	14.0

Table (2) distribution of clinical characteristics data of participants (n=50) show that the majority of the participants were non-smoking and free health problems (82.0%, 84.0%) respectively; more than half (56.0%) of them are having a diet program to lose weight; also, the majority (96.0%) of them do not use medication before the diet.

Table (2) distribution of clinical characteristics data of participants(n=50)

	N	%
Smoking		
No	41	82.0
Yes	9	18.0
Health problems		
No	42	84.0
Yes	8	16.0
Having a diet program to lose weight		
No	22	44.0
Yes	28	56.0
Source		
Instagram	15	30.0
The YouTube	5	10.0
What's Up	8	16.0
Read from scientific references	3	6.0
Diet Doctor	2	4.0
Friends	6	12.0
Site	4	8.0
Medication use before the diet		
No	48	96.0
Yes	2	4.0
Waist circumference can be measured before following the diet		
No	19	38.0
Yes	31	62.0

Table (3) distribution of clinical characteristics data of participant. Regarding the number of hours of sleep, there is no significant differences between before and after web base programs on the reduction of obesity; related to the amount of water you drink per day there is statistically significant differences between before and after web base programs on the reduction of obesity.

Table (3) Distribution of clinical characteristics data of participants

	Before	After	Wilcoxon Signed Ranks
--	--------	-------	-----------------------

						Test	
		N	%	N	%	Z	P-value
The number of hours of sleep	From 4-6 hours daily	18	36.0	12	24.0	-1.155	0.248
	From 7-10 hours a day	25	50.0	33	66.0		
	More than 10 hours a day	7	14.0	5	10.0		
The amount of water you drink per day	Less than 5 cups a day	12	24.0	7	14.0	-2.449	0.014*
	From 5-8 cups a day	27	54.0	25	50.0		
	From 8 - 12 cups a day	11	22.0	18	36.0		

Table (4) and figure (1)Weight measure difference before and after program. Show that there are statistically significant differences with weight measure before and after web base programs on the reduction of obesity.

Table (4)Weight measure differencebefore and after program

	Weight			Difference		Paired T-test	
	Range	Mean	± SD	Mean	SD	t	P-value
Before	45 - 180	94.143	± 29.190	12.020	14.140	5.951	<0.001*
After	49 - 172	82.122	± 24.494				

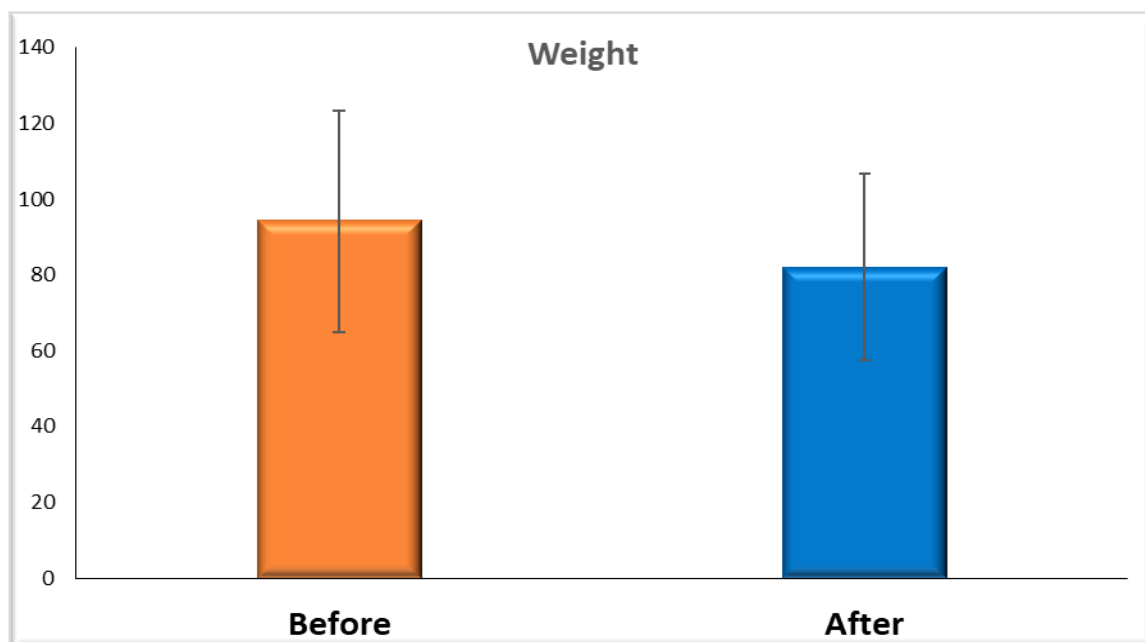


Figure (1)Weight measure difference before and after program

Table (4) Comparison of before and after participants' dietary intakes from baseline to 12 weeks. Show that there are statistically significant differences before and after participants' dietary intakes from baseline to 12 weeks with full-fat milk, low or skimmed milk, Fish and Brown bread, fruits, Vegetables, Fruit juices, Soft drinks, Desserts (cake - cookies...), French fries, or chips and fast food (p= <0.001*)

Table (4) Comparison of before and after participants' dietary intakes from baseline to 12 weeks

									Mean Rank		Wilcoxon Signed Ranks Test	
			I didn't eat it	less than 2	From 2-3 per week	From 3-4 per week	From 4-6 per week	7 times	Negative Ranks	Positive Ranks	Z	P-value
Full-fat milk	Before	N	8	3	10	18	7	4	19.33	9.33	-4.835	<0.001 *
		%	16.0 %	6.0%	20.0 %	36.0%	14.0 %	8.0%				
	After	N	25	9	11	4	0	1				
		%	50.0 %	18.0%	22.0 %	8.0%	0.0%	2.0%				
Low or skimmed milk	Before	N	24	5	12	8	0	1	14.08	16.46	-3.250	<0.001 *
		%	48.0 %	10.0%	24.0 %	16.0%	0.0%	2.0%				
	After	N	7	6	20	12	3	2				
		%	14.0 %	12.0%	40.0 %	24.0%	6.0%	4.0%				
Yogurt	Before	N	9	11	13	9	7	1	14.36	18.17	-1.215	0.224
		%	18.0 %	22.0%	26.0 %	18.0%	14.0 %	2.0%				
	After	N	5	8	16	12	7	2				
		%	10.0 %	16.0%	32.0 %	24.0%	14.0 %	4.0%				
Red meat	Before	N	5	8	20	14	3	0	15.00	16.36	-1.118	0.264
		%	10.0 %	16.0%	40.0 %	28.0%	6.0%	0.0%				
	After	N	8	10	18	11	3	0				
		%	16.0 %	20.0%	36.0 %	22.0%	6.0%	0.0%				
Chicken	Before	N	1	2	7	23	14	3	16.46	13.97	-0.457	0.647
		%	2.0%	4.0%	14.0 %	46.0%	28.0 %	6.0%				
	After	N	1	1	4	28	14	2				
		%	2.0%	2.0%	8.0%	56.0%	28.0 %	4.0%				
Fish	Before	N	7	20	17	5	0	1	19.83	17.83	-4.384	<0.001 *
		%	14.0 %	40.0%	34.0 %	10.0%	0.0%	2.0%				
	After	N	1	8	19	21	1	0				
		%	2.0%	16.0%	38.0 %	42.0%	2.0%	0.0%				
Eggs	Before	N	1	3	11	16	15	4	12.18	13.64	-0.788	0.431
		%	2.0%	6.0%	22.0 %	32.0%	30.0 %	8.0%				
	After	N	1	1	9	22	11	6				

									Mean Rank		Wilcoxon Signed Ranks Test	
			I didn't eat it	less than 2	From 2-3 per week	From 3-4 per week	From 4-6 per week	7 times	Negative Ranks	Positive Ranks	Z	P-value
		%	2.0%	2.0%	18.0%	44.0%	22.0%	12.0%				
Breakfast Cereal	Before	N	12	14	8	11	3	2	12.86	16.14	-0.537	0.591
		%	24.0%	28.0%	16.0%	22.0%	6.0%	4.0%				
	After	N	12	7	15	13	3	0				
		%	24.0%	14.0%	30.0%	26.0%	6.0%	0.0%				
Brown bread	Before	N	24	5	7	8	4	2	14.10	20.19	-3.048	0.002*
		%	48.0%	10.0%	14.0%	16.0%	8.0%	4.0%				
	After	N	8	6	9	22	4	1				
		%	16.0%	12.0%	18.0%	44.0%	8.0%	2.0%				

Cont. **Table (4)** Comparison of before and after participants' dietary intakes from baseline to 12 weeks

									Mean Rank		Wilcoxon Signed Ranks Test	
			I didn't eat it	less than 2	From 2-3 per week	From 3-4 per week	From 4-6 per week	7 times	Negative Ranks	Positive Ranks	Z	P-value
white bread	Before	N	3	3	7	17	13	7	19.00	10.00	-4.945	<0.001*
		%	6.0%	6.0%	14.0%	34.0%	26.0%	14.0%				
	After	N	22	6	12	8	2	0				
		%	44.0%	12.0%	24.0%	16.0%	4.0%	0.0%				
Whole grain bread	Before	N	30	6	5	6	3	0	7.30	16.07	-3.830	<0.001*
		%	60.0%	12.0%	10.0%	12.0%	6.0%	0.0%				
	After	N	14	6	9	15	5	1				
		%	28.0%	12.0%	18.0%	30.0%	10.0%	2.0%				
the rice	Before	N	2	3	6	20	8	11	15.06	19.50	-3.643	<0.001*
		%	4.0%	6.0%	12.0%	40.0%	16.0%	22.0%				
	After	N	6	3	17	19	3	2				
		%	12.0%	6.0%	34.0%	38.0%	6.0%	4.0%				

									Mean Rank		Wilcoxon Signed Ranks Test	
			I didn't eat it	less than 2	From 2-3 per week	From 3-4 per week	From 4-6 per week	7 times	Negative Ranks	Positive Ranks	Z	P-value
pasta	Before	N	4	5	13	14	7	7	20.28	13.50	-3.932	<0.001*
		%	8.0%	10.0%	26.0%	28.0%	14.0%	14.0%				
	After	N	11	10	15	13	1	0				
		%	22.0%	20.0%	30.0%	26.0%	2.0%	0.0%				
fruits	Before	N	14	8	12	10	6	0	9.15	15.57	-1.969	0.049*
		%	28.0%	16.0%	24.0%	20.0%	12.0%	0.0%				
	After	N	5	11	17	10	6	1				
		%	10.0%	22.0%	34.0%	20.0%	12.0%	2.0%				
vegetables	Before	N	6	4	15	12	10	3	11.50	14.86	-3.872	<0.001*
		%	12.0%	8.0%	30.0%	24.0%	20.0%	6.0%				
	After	N	2	1	6	15	9	17				
		%	4.0%	2.0%	12.0%	30.0%	18.0%	34.0%				
Fruit juices	Before	N	13	6	18	11	1	1	16.27	15.33	-2.202	0.028*
		%	26.0%	12.0%	36.0%	22.0%	2.0%	2.0%				
	After	N	19	12	8	9	2	0				
		%	38.0%	24.0%	16.0%	18.0%	4.0%	0.0%				
Soft drinks	Before	N	7	1	8	12	9	13	15.76	13.17	-4.012	<0.001*
		%	14.0%	2.0%	16.0%	24.0%	18.0%	26.0%				
	After	N	13	6	10	15	4	2				
		%	26.0%	12.0%	20.0%	30.0%	8.0%	4.0%				
Desserts (cake _ cookies...)	Before	N	3	4	11	21	7	4	14.85	10.00	-4.217	<0.001*
		%	6.0%	8.0%	22.0%	42.0%	14.0%	8.0%				
	After	N	11	13	13	11	2	0				
		%	22.0%	26.0%	26.0%	22.0%	4.0%	0.0%				
French fries, or chips	Before	N	3	5	13	13	13	3	19.22	12.75	-4.470	<0.001*
		%	6.0%	10.0%	26.0%	26.0%	26.0%	6.0%				
	After	N	18	11	12	8	1	0				
		%	36.0%	22.0%	24.0%	16.0%	2.0%	0.0%				

									Mean Rank		Wilcoxon Signed Ranks Test	
			I didn't eat it	less than 2	From 2-3 per week	From 3-4 per week	From 4-6 per week	7 times	Negative Ranks	Positive Ranks	Z	P-value
			%	%	%							
Fast food	Before	N	3	4	11	13	13	6	19.29	9.83	-4.813	<0.001*
		%	6.0%	8.0%	22.0%	26.0%	26.0%	12.0%				
	After	N	12	14	14	9	1	0				
		%	24.0%	28.0%	28.0%	18.0%	2.0%	0.0%				

IV. Discussion

Numerous health issues and a possible rise in mortality are linked to obesity⁽¹⁹⁾. The pillars of weight control are interventions that focus on behaviors related to a balanced diet and physical exercise⁽²⁰⁾. These therapies continue to be essential because of their added advantages, including the prevention of diabetes and early death, despite their modest efficacy, particularly in terms of long-term weight loss maintenance^(19, 20).

This research presents an assessment of the food consumption modifications made by individuals taking part in web-based weight loss programs. Participants showed similar patterns of dietary change. Although there were variations between before and after, the amount of the dietary change appeared to be larger.

The greatness of change in daily energy intake was consistent with other web-based weight loss intervention studies⁽¹⁸⁻²⁰⁾ and was largely because of a significant decrease in the energy contributed by energy-dense, nutrient-poor foods. Intervention participants increased the energy contribution from fruits and moved closer to the recommended two serves per day⁽²¹⁾. Intakes of most macronutrients at baseline were within Australian Nutrient Reference Values⁽²²⁾ and were unchanged after 12 weeks.

Research proposes the establishment of individualized feedback or counselling as part of a web-based weight management intervention is associated with a greater weight loss success,⁽²³⁾ but little is known about its association with dietary intake. In this study, participants lost significantly more weight compared with the participants after 12 weeks.

The recent weight loss maintenance RCT found that increasing fruit and vegetable intakes may help achieve weight loss,⁽²⁴⁾ which is consistent with the findings in this study that successful participants achieved greater increases in the energy contributed by fruits and vegetables.

Similar to other studies, there was no difference in short-term weight loss⁽²⁵⁾ and in changes in diet and physical activity between the group that received computer-based personalized feedback (platform only) and the group that also received the human-delivered personalized feedback (platform plus coaching). Despite this lack of differences in the outcomes, the addition of a health professional coaching service increased platform usage. This suggests that the feeling of having a human factor⁽²⁶⁾ or of being supervised⁽²⁷⁾ increases engagement, which might be particularly important for long-term weight maintenance⁽²⁸⁾.

There are several limitations to consider when interpreting the results of this study. Dietary intake was self-reported and is therefore vulnerable to reporting bias. To address this issue, we identified misreporters of energy intake using the Goldberg method and only included plausible reporters in the analysis. Dietary data were obtained using a validated semiquantitative FFQ in order to reduce participant burden, as well as the research costs⁽²⁹⁾. However, this form of dietary assessment may not have been sensitive enough to detect changes in dietary intake in the short 12-week time frame, nor could it detect changes in portion sizes consumed, only frequency of consumption. Participants in the intervention groups were asked to self-monitor

their dietary intake using an online food diary. Diary completion may have increased their awareness of dietary intake, which may have influenced how the FFQ was completed at 12 weeks.

Our results also suggest that adherence to the behavior change intervention is key to the weight loss outcome. According to our research, there was a higher likelihood for individuals to lose weight by the end of the 12-week period. This demonstrates that engagement is a key factor for the success of online interventions, as reported by other studies, including those for long-term weight maintenance^(30, 31).

V. Conclusion

It can be concluded from the current study that: Up to 12 weeks into the program, a behavior modification program for weight reduction given using a web-based platform resulted in higher weight loss, increased fruit and vegetable intake, and decreased ultra-processed food consumption. A computer-based, personalized approach that was improved for weight reduction.

Recommendations: will be suggested to further evaluation of enhanced web-based program features, such as personalized feedback, is required to determine what features are necessary to elicit and support individuals to positively change their eating habits.

References:

- [1] GBD 2015 Obesity Collaborators, Afshin A, Forouzanfar MH, Reitsma MB, Sur P, Estep K, et al. Health Effects of Overweight and Obesity in 195 Countries over 25 Years. *N Engl J Med* 2017 Jul 06;377(1):13-27
- [2] Ma C, Avenell A, Bolland M, Hudson J, Stewart F, Robertson C, et al. Effects of weight loss interventions for adults who are obese on mortality, cardiovascular disease, and cancer: systematic review and meta-analysis. *BMJ* 2017 Nov 14;359: j4849.
- [3] Pappa GL, Cunha TO, Bicalho PV, Ribeiro A, Couto SAP, Meira W, et al. Factors Associated with Weight Change in Online Weight Management Communities: A Case Study in the LoseIt Reddit Community. *J Med Internet Res* 2017 Jan 16;19(1): e17
- [4] Obesity and overweight. World Health Organization. URL: <https://www.who.int/en/news-room/fact-sheets/detail/obesity-and-overweight>
- [5] Bray GA, Bouchard C. The biology of human overfeeding: a systematic review. *Obesity reviews*. (2020) 21: e13040.
- [6] Bowden Davies KA, Pickles S, Sprung VS, Kemp GJ, Alam U, Moore DR, et al. Reduced physical activity in young and older adults: metabolic and musculoskeletal implications. *Ther Adv Endocrinol Metab*. (2019) 10:1– 15.
- [7] P. A. Centers for Disease Control and Prevention. URL: http://www.cdc.gov/obesity/health_equity/addressingtheissue.
- [8] Blackburn M, Stathi A, Keogh E, Eccleston C. Raising the topic of weight in general practice: perspectives of GPs and primary care nurses. *BMJ Open* 2015 Aug 07;5(8): e008546.
- [9] American Nurse Practitioner Foundation. Nurse practitioners and the prevention and treatment of adult obesity—A White Paper of the American Nurse Practitioner Foundation (electronic version). (2013). Summer. Retrieved from <https://international.aanp.org/Content/docs/ObesityWhitePaper.pdf>
- [10] Araghi, M. H., Chen, Y. F., Jagielski, A., Choudhury, S., Banerjee, D., Hussain, S., ... Taheri, S., et al. Effectiveness of lifestyle interventions on obstructive sleep apnea (OSA): Systematic review and meta- analysis. *Sleep*, (2013). 36(10), 1553–1562, 1562a–1562e.
- [11] Barnes, R. D., & Ivezaj, V. (2015). A systematic review of motivational interviewing for weight loss among adults in primary care. *Obesity Reviews*, 16(4), 304–318.
- [12] Berge, J. M., Wall, M., Hsueh, T. F., Fulkerson, J. A., Larson, N., & Neumark-Sztainer, D. The protective role of family meals for youth obesity: 10- year longitudinal associations. *Journal of Pediatrics*, (2015). 166(2), 296–301.
- [13] Berrington de Gonzalez, A., Hartge, P., Cerhan, J. R., Flint, A. J., Hannan, L., MacInnis, R. J., Thun, M. J., et al. Body- mass index and mortality among 1.46 million white adults. *New England Journal of Medicine*, (2010). 363(23), 2211–2219.

- [14] Schienkiewitz, A.; Mensink, G.; Kuhnert, R.; Lange, C. Übergewicht und Adipositas bei Erwachsenen in Deutschland. *J. Health Monit.* 2017, 2.
- [15] Flegal, K.M.; Kit, B.K.; Orpana, H.; Graubard, B.I. Association of All-Cause Mortality with Overweight and Obesity Using Standard Body Mass Index Categories: A Systematic Review and Meta-Analysis. *JAMA* 2013, 309, 71–82.
- [16] Beleigoli AM, Andrade AQ, Cançado AG, Paulo MN, Diniz MDFH, Ribeiro AL. Web-Based Digital Health Interventions for Weight Loss and Lifestyle Habit Changes in Overweight and Obese Adults: Systematic Review and Meta-Analysis. *J Med Internet Res* 2019 Jan 08;21(1): e298
- [17] Gold BC, Burke S, Pintauro S, Buzzell P, Harvey-Berino J. Weight loss on the web: a pilot study comparing a structured behavioural intervention to a commercial program. *Obesity* 2007; 15: 155–164
- [18] Molina MDCB, Benseñor IM, Cardoso LDO, Velasquez-Melendez G, Drehmer M, Pereira TSS, et al. Reprodutibilidade e validade relativa do Questionário de Frequência Alimentar do ELSA-Brasil. *Cad Saúde Pública* 2013 Feb;29(2):379-389.
- [19] Harvey-Berino J, Pintauro S, Buzzell P, DiGiulio M, Casey Gold B, Moldovan C et al. Does using the Internet facilitate the maintenance of weight loss? *Int J Obes Relat Metab Disord* 2002; 26: 1254–1260.
- [20] Tate DF, Wing RR, Winett RA. Using Internet technology to deliver a behavioural weight loss program. *JAMA* 2001; 285: 1172–1177.
- [21] Kellet E, Smith A, Schmerlaib Y. The Australian Guide to Healthy Eating. The Department of Health and Aging: Canberra, 1998.
- [22] National Health and Medical Research Council. Nutrient Reference Values for Australia and New Zealand including Recommended Dietary Intakes. ACT: Department of Health and Aging: Canberra, 2006.
- [23] Neve M, Morgan PJ, Jones PR, Collins CE. Effectiveness of web-based interventions in achieving weight loss and weight loss maintenance in overweight and obese adults: a systematic review with meta-analysis. *Obes Rev* 2010; 11: 306–321.
- [24] Champagne CM, Broyles ST, Moran LD, Cash KC, Levy EJ, Lin PH et al. Dietary intakes associated with successful weight loss and maintenance during the weight loss maintenance trial. *J Am Diet Assoc* 2011; 111: 1826–1835.
- [25] Tate DF, Jackvony EH, Wing RR. A randomized trial comparing human e-mail counseling, computer-automated tailored counseling, and no counseling in an Internet weight loss program. *Arch Intern Med* 2006 Aug;166(15):1620-1625.
- [26] Teixeira PJ, Silva MN, Mata J, Palmeira AL, Markland D. Motivation, self-determination, and long-term weight control. *Int J Behav Nutr Phys Act* 2012; 9:22 [FREE Full text] [doi: 10.1186/1479-5868-9-22] [Medline: 22385818]
- [27] Yardley L, Spring BJ, Riper H, Morrison LG, Crane DH, Curtis K, et al. Understanding and Promoting Effective Engagement with Digital Behavior Change Interventions. *Am J Prev Med* 2016 Nov;51(5):833-842
- [28] Lemstra M, Bird Y, Nwankwo C, Rogers M, Moraros J. Weight loss intervention adherence and factors promoting adherence: a meta-analysis. *Patient Prefer Adherence* 2016; 10:1547-1559
- [29] Rutishauser IH. Dietary intake measurements. *Public Health Nutr* 2005; 8: 1100–1107.
- [30] Thompson FE, Subar AF. Dietary assessment methodology. In: Coulston A, Boushey C editors. *Nutrition in the Prevention and Treatment of Disease*. 2nd edn. Elsevier Inc.: Burlington, MA, USA, 2008.
- [31] Alexander GL, McClure JB, Calvi JH, Divine GW, Stopponi MA, Rolnick SJ, et al. A randomized clinical trial evaluating online interventions to improve fruit and vegetable consumption. *Am J Public Health* 2010 Feb;100(2):319-326