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ORIGINAL ARTICLE
EPIDEMIOLOGY AND CLINICAL MEDICINE

Opportunities for physical activity within clinical care: positive healthcare effects of exercise interventions delivered *via* telehealth services with evidence-based fitness resources

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ABSTRACT

BACKGROUND: This article is an overview of the scientific research on the effectiveness of the original weight management program delivered *via* telehealth services for middle-aged overweight women – the summary of three original scientific studies that complement each other (N.=55, N.=105, N.=62).

METHODS: The manuscript presents theoretical analysis of special scientific and methodological literature, anthropometric and pedagogical methods and methods of mathematical statistics. The physical fitness profile of the middle-aged overweight and obese women was assessed by factor analysis.

RESULTS: The pilot feasibility study involving women with an average age of 37.2 years (N.=55) was designed to explore the possibility of remote implementation of primary and ongoing measurement for main anthropometric indicators characterizing excessive body weight. The cross-sectional study involving overweight and obese women (*via* the Body Mass Index [BMI] from 25.00 to 32.10 kg/m^2) with an average age of 38.9 years (N.=105) explored the data with factor analysis and identified the major factors, which determined the structure of physical condition in middle-aged obese women and selected the most informative criteria for designing self-training exercise programs. These criteria were used to evaluate the effectiveness of the original weight management program delivered *via* telehealth services for middle-aged overweight women in interventional cohort study (N.=62). Participation in the weight management program resulted in significant changes in the morpho-functional status of the women.

CONCLUSIONS: This article consisting of three blocks presents the original weight management program whose detailed description and proved effectiveness make this article valuable from a practical point of view for health care professionals who consider telemedicine tools possible for implantation in their practice with obese people.

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KEY WORDS: Middle aged; Overweight; Obesity; Telemedicine; Women.

The COVID-19 pandemic generated a request for distance interaction with clients and patients in the public health area. This concerns such medical and near-medical fields as rehabilitation, physiotherapy, and medical consultations in different branches of medicine. The results of systematic review and meta-analysis of exercise interventions delivered *via* videoconferencing for chronic diseases demonstrate positive effects of exercise interventions.[1-3] Several authors link these positive effects with ease of access and benefits of digital technology.[1, 3, 4] Different re-

searchers suggest that exercise interventions delivered *via* videoconferencing or digital services may have the same effectiveness as individual services for patients with chronical diseases.[5-8] These and other results around the topic gradually build the base for telehealth service development.

Telehealth service is defined by The International Organization for Standardization as a "healthcare activity supported at a distance by information and communication technology service(s)".[9] Telehealth includes telemedicine, which is defined by The International Organization for Standardization as a "*use of advanced telecommunication technologies to exchange health information and provide health care services across geographic, time, social and cultural barriers*."[10] In both explanations we can see the perspectives for public health services development through the digital options growth. Telehealth may be considered as a key part of expanding access to health care among the population.

Researchers have noted that the areas of telehealth and telemedicine are perspective for future investigations.[1] Telehealth has not reached its full potential yet – it is opened for expanding its influence frames and it encourages infusion of new ideas, trials, data and advances. Exercise intervention knowledge development for chronic diseases may be used by telehealth as one of the possible ways of their further evolution. The positive exercise effects for various diseases have been proven in different investigations.[11-26] Recently American College of Sports Medicine has advocated for the physical activity integration within clinical care, connecting patients and providers with evidence-based fitness resources.[27] Such collaboration may be beneficial for both independent fields – telehealth and fitness – as well as for ultimate beneficiaries – public health area and ordinary people for chronic disease resistance.

Exercise interventions delivered *via* digital services for overweight women could reduce existing health risks related with obesity and overweight. Obesity and overweight may be a reason or a determinant for the development of different noncommunicable diseases including cancer and cardiovascular diseases. Worldwide obesity is increasing, and its risks are more associated with women health than with men's.[28] The reason for obesity increase worldwide among women is twofold. Last studies show stronger connection between such obesity factors as genetic and epigenetic factors, a level of physical activity, eating disorders, and gut microbiota status, contributing to obesity increase and overweight more for women than men.[29] On the other hand, there are some special factors contributing to decreased physical activity by women which is an independent factor for obesity increase. It includes limited time and energy for gym and exercises for a reason of women's social, occupational, and family care roles.[30]

The model of on-line weight reduce that consists of three blocks (diagnostic, methodical and management blocks) and that are presented in detail in this article may show the possibility of distance interaction between patients and health care professionals (physiotherapists, personal fitness trainers, family doctors and doctors of narrow specialties) to integrate physical activity into clinical care and to help reduce the existing health risks associated with obesity and overweight for women.

Materials and methods

In this article we use theoretical methods of systematization, explanation, and generalization of recent investigations for describing the program of weight loss intervention exercises program for overweight middle-aged women. The study was conducted in the National University of Ukraine on Physical Education and Sport (Kyiv, Ukraine) and lasted nine months. Inclusion criteria for the women were as follows: women between the ages of 25 and 45, overweight and obese (*via* the Body Mass Index [BMI] from 25.00 to 32.10 kg/m^2), received medical clearance to participate, and provided informed consent. Exclusion criteria were diagnosis of type I diabetes mellitus and/or hypertension; decompensated state at the beginning of the study; taking weight-loss, antihypertensive or insulin-resistance drugs; pregnancy; inflammatory disease in the acute phase. At the beginning of the study, women were inactive and led a sedentary lifestyle.

Anthropometric methods that ensured quantitative measurement of physical development indicators were used in compliance with international standards. BMI was calculated by the formula: BMI=Body weight (kg) /Body height (m).^{2} The waist-to-height ratio (WHtR) was calculated by the formula: WHTR=Waist circumference (cm) /Body height (cm). The Waist-to-Hip Ratio (WHR) was calculated by the formula: WHR=waist circumference (cm)/hip circumference (cm). Body composition was assessed using a body composition analyser Tanita (Tanita Europe GmbH, Japan). For calculation of basic metabolism *via* a remote approach the Muffin-Geor formula for women was used:

$$P=(10\times\text{weight in kg})+(6.25\times\text{height in cm}) - (5\times\text{age in years}) - 161$$

Body fat *via* a remote was estimated from the Body Mass Index by Deurenberg and co-workers' formula

Adult body fat percentage=(1.39×BMI) + (0.16×age)-9.

To assess the cardiorespiratory system, physiological methods were used. Measurements were performed using a digital blood pressure and heart rate monitor UA 767 (AND, Japan). Heart rate (HR) was assessed using Polar RS800G3 (Finland) and Garmin Forerunner 305 heart rate monitors. Oxygen saturation was measured using a Beurer PO 80 pulse oximeter (Germany). To assess the level of physical fitness and to determine maximum oxygen uptake (VO_{2max}), aerobic and anaerobic thresholds, a cardiorespiratory test (Hanson, 1984) was performed on a treadmill LE-200 CE (Jaeger, Germany). During the cardiorespiratory exercise test, the following conditions were applied: for women with BMI≤30 kg/m^{-2}, initial speed and incline were 5 km/h and 0%, speed and incline were increased by 1 km/h and 0.5%, respectively, and after reaching the speed of 20 km/h, only incline was increased; for women with BMI≥30 Kg m^{-2}, initial speed and incline were 4 km/h and 0%, incline was increased by 1%. The adaptation potential (AP) of the cardiovascular system was calculated using the Bayevsky's by the formula:

AP=0.011×HR+0.014×BPsyst+0.008×BPdiast+
0.009×Body weight(kg)+0.0014×age(years)-
0.009×Body height (cm)-0.27

The index of physical condition (IPC) of the body was calculated by the Pirogova (1989) as follows:

IPC=(700-3×HR-2.5×BPav-2.7×age+0.28×Body weight)/
(350-2.6×age+0.21×Body height)

The Oxycon Pro Ergospirometry System (USA) was used to determine the lung vital capacity (VC). Physical fitness testing included performing several motor tests from the Eurofit battery.

Statistical analysis

The results of the study were analyzed using conventional tools of Statistica 10.0 statistical software. The statistical analysis of experimental data was started with the verification of the assumption of normality using the Shapiro-Wilk test. Factor analysis was used in the study as an independent research method.

To measure the strength of the relationships between normally distributed variables, correlation analysis was used. Since the analysis of correlation fields showed the presence of linear relationship, we used the Pearson correlation coefficient.

Results

The pilot feasibility study involving women with an average age of 37.2 years (N.=55) was designed to explore the possibility of remote implementation of primary and ongoing measurement for main anthropometric indicators characterizing excessive body weight (Table I).[31,32] Data collecting was exclusively done using remote digital tools – on-line calculators are embedded on the website of the original weight management program.

Correlation relationships were found between all indicators measured during the study. They are appraised high in the following outcomes: BMI and body fat, BMI and body weight, BMI and waist-to-height ratio, body fat and waist-to-height ratio, basal metabolism and body weight, body weight (r=0.7-0.9 – a high level of correlation). An average level of relationships was established between such indicators as BMI and basic metabolism, the content of the fat component and body weight, body weight and the ratio of height to waist (r=0.5-0.7 – the average level of correlation). A low level of correlation was found between the content of the fat component and the basal metabolism and the basal metabolism and the height-to-waist ratio (r=0.2-0.5, a low level of correlation).

Data from cross-sectional study involving overweight and obese women (*via* the BMI from 25.00 to 32.10 kg/m^2) with an average age of 38.9 years (N.=105) was explored with factor analysis to identify the major factors, which determine the structure of physical condition in middle-aged obese women, and to select the most informative

TABLE I.— *Correlation between the indicators characterizing excessive body weight that were received remote.*

Parameter	BMI. kg·m^2	Fat mass. %.	Basal metabolic rate. kcal	Body weight. kg	The waist-to-height ratio (WHtR). arb. units
BMI, kg·m^2		0.858**	0.568**	0.733**	0.848**
Fat mass, %	0.858**		0.206	0.503**	0.871**
Basal metabolic rate, kcal	0.568**	0.206		0.875**	0.417*
Body weight, kg	0.733**	0.503**	0.875**		0.644**
The waist-to-height ratio (WHtR), arb. units	0.848**	0.871**	0.417*	0.644**	

N.=55; r=0.273 with P<0.05; r=0.354 with P<0.01; r=0.443 with P<0.001.
*the correlation coefficient is statistically significant at the level P<0.01; **the correlation coefficient is statistically significant at the level P<0.001.

criteria for designing self-training exercise programs.[32, 33] As a result of the calculations, a four-factor structure was obtained, which explains 81.4% of the variance of the initial data (Table II). The obtained results of the correlation analysis indicate that the vast majority of indicators characterizing physical fitness and coordination abilities have a high reliable dependence on the waist and abdomen circumferences and VO_{2max} parameter. Then these criteria were used to evaluate the effectiveness of the original weight management program delivered *via* telehealth services for middle-aged overweight women in interventional cohort study (N.=62).[32, 34]

A group of 62 women with an average age of 38.5 was formed to determine the effectiveness of the proposed proprietary 9-month program for weight management. The participants did not have any functional disorders and health conditions that could result in negative consequences during exercise. The vast majority of women, *i.e.* 90.3% (N.=56) had an O-shaped body type that was accounted when choosing the means and methods for weight management. Exclusion criteria: diabetes mellitus; grade 2-3 obesity and other endocrine diseases; acute infectious diseases; acute and chronic kidney and liver diseases; haematological, oncological and systemic inflam-

TABLE II.—*Correlation between the indicators characterizing excessive body weight.*

Parameter	F 1	F 2	F 3	F 4
Body height, cm	0.111	-0.594	-0.038	0.027
Body weight, kg	-0.820	-0.186	-0.032	-0.116
BMI, kg·m²	-0.807	-0.228	-0.019	-0.043
CC, cm	-0.893	0.159	0.234	-0.106
Inspiratory CC, cm	0.875	0.095	0.210	-0.112
Expiratory CC, cm	0.848	0.180	0.201	-0.136
Chest excursion, cm	0.768	0.127	0.102	0.045
Waist circumference, cm	-0.926	-0.095	-0.073	-0.075
Abdomen circumference, cm	-0.927	-0.167	-0.296	-0.181
Hip circumference, cm	-0.732	-0.131	-0.299	-0.161
Waist-to-hip ratio (WHR), arb. units	-0.922	0.236	0.311	-0.012
The waist-to-height ratio (WHtR), arb. units	-0.884	-0.308	-0.090	-0.069
Grip strength (dominant hand), kg	-0.090	0.431	-0.795	0.435
Grip strength (non-dominant hand), kg	-0.032	0.384	-0.782	0.509
Fat mass, kg	-0.457	-0.321	-0.021	-0.116
Fat mass, %	-0.800	0.131	0.077	-0.007
Muscle mass, kg	0.178	0.324	0.369	0.019
Muscle mass, %	0.777	-0.189	-0.075	-0.091
Basal metabolic rate, kcal	0.711	-0.369	-0.037	0.097
Heart rate, bpm	0.286	-0.812	-0.164	0.003
BPsyst, mmHg	0.416	-0.824	0.087	0.495
BPdiast, mmHg	0.263	-0.806	-0.014	0.189
AP, arb. units	0.651	-0.936	-0.004	0.345
VC, mL	0.106	0.791	0.219	0.227
VO_{2max}, mL·kg·min-1	0.339	0.945	0.110	0.544
Bayevsky's Stress Index, arb. units	-0.452	-0.820	-0.087	-0.107
Oxygen saturation, %	0.226	0.202	0.041	0.350
IPC, arb. units	0.213	0.714	0.107	0.136
Robinson Index, arb. units	-0.413	-0.832	-0.081	0.242
Vital capacity-to-body weight ratio, mL·kg-1	0.526	0.715	0.150	0.276
Strength Index, arb. units	0.446	0.484	0.785	0.331
HR recovery time after 20 squats in 30 s, min	-0.121	-0.837	-0.213	-0.23
Sit and Reach Flexibility Test, cm	0.218	0.082	0.412	0.367
Sit-up test for 30 s, number of reps	0.277	0.053	0.771	0.407
Static strength of the back muscles, s	0.239	0.032	0.770	0.463
Shuttle Run Test 10x5 m, s	-0.307	-0.160	-0.798	-0.540
Sharpened Romberg Test, s	0.423	0.229	0.315	0.777
Flamingo Test, number of reps	0.374	0.189	0.425	0.741
Total variance	14.9	7.4	3.7	3.2
D (F), %	42.1	21.2	9.8	8.3

FI-FIV – are the major factors, which determine the structure of physical condition in middle-aged obese women. Factor I is associated with physique; Factor II – with energy potential of aerobic function and functional state; Factor III – with endurance and strength; and Factor IV – with coordination abilities.

matory diseases; acquired and congenital heart defects; and pregnancy.

To access objectively the proposed individual programs of the original weight management program delivered *via* telehealth services for middle-aged women, we conducted a comparative analysis of the physical condition at the beginning and at end of the experiment. The design of the experiment did not include a control group. The results of this analysis are presented in tables (Table III, IV, V, VI). Comparison of morphological parameters of women before and after the experiment revealed significant (P<0.05; P<0.01) positive changes.

The proposed program contributed to the normalization of the morphological status of women of the second mature age. Since the reliability of the differences is observed in the indicators – MT, BMI, girth sizes, as well as in the indicators that indicate the harmony of the body structure, we can talk about the pronounced health-improving effect of the proposed methods and means. At the same time, if we compare the data obtained before the start of classes and after nine months, the most significant reliable (P<0.05; P<0.01) changes occurred in women in the indicators: waist to body length ratio (WHTR) decreased

TABLE III.—*Average values of physical development parameters of middle-aged women at the beginning and at the end of the experiment (N.=62).*

Parameter	Before		After		P
	$\bar{x}$	S	$\bar{x}$	S	
Age, years	38.5	1.99	39.3	1.37	
Height, cm	167.9	6.12	167.9	6.12	>0.05
Body weight, kg	81.4	10.87	73.6	5.3	<0.05
BMI, kg·m²	27.5	2.80	22.9	2.12	<0.01
CC, cm	92.7	7.00	88.4	4.8	>0.05
Inspiratory CC, cm	96.3	6.62	94.3	5.28	>0.05
Expiratory CC, cm	89.8	7.11	88.4	5.64	>0.05
Chest excursion, cm	5.8	2.98	6.1	1.86	>0.05
Waist circumference, cm	87.5	6.93	73.9	3.42	<0.01
Abdomen circumference, cm	89.5	9.59	79.9	3.84	<0.01
Hip circumference, cm	110.8	8.40	101.4	5.64	<0.01
Waist-to-hip Ratio (WHR), arb. units	0.79	0.06	0.73	0.06	<0.01
Waist-to-height ratio (WHtR), arb. units	0.53	0.05	0.44	0.04	<0.01
Grip strength (dominant hand), kg	30.4	6.78	31.3	4.75	>0.05
Grip strength (nondominant hand), kg	28.1	6.68	29.3	3.65	>0.05

TABLE IV.—*Average values for the body composition of middle-aged women at the beginning and at the end of the experiment (N.=62).*

Parameter	Before		After		P
	$\bar{x}$	S	$\bar{x}$	S	
Fat mass, kg	29.5	17.89	23.1	3.05	<0.01
Fat mass, %	33.0	5.76	25.9	2.69	<0.01
Muscle mass, kg	27.7	3.27	30.4	1.15	<0.05
Muscle mass, %	36.1	2.80	39.7	1.65	<0.05
Basal metabolic rate, kcal	1698.0	235.10	1508.3	85.35	<0.05

TABLE V.—*Average statistical results of cardiorespiratory tests of middle-aged women at the beginning and at the end of the experiment (N.=62).*

Parameter	Before		After		P
	$\bar{x}$	S	$\bar{x}$	S	
Heart rate, bpm	78.4	7.15	69.9	8.89	<0.05
BPsyst, mmHg	134.5	13.26	120.9	10.00	<0.05
BPdiast, mmHg	86.7	11.35	80.3	10.97	<0.05
AP, arb. units	2.43	0.15	2.02	0.13	<0.001
VC, mL	3784.7	658.27	4361.8	773.98	<0.001
VO_{2max}, mL·kg·min^{-1}	25.6	2.22	28.7	2.92	<0.05
Bayevsky's Stress Index, arb. units	164.8	157.31	116.6	44.32	<0.01
Oxygen saturation, %	97.7	0.94	97.8	0.54	>0.05

TABLE VI.—*Average statistical results of the indicators of motor qualities of middle-aged women at the beginning and at the end of the experiment (N.=62).*

Parameter	Before		After			P
	$\bar{x}$	S	$\bar{x}$	S	%	
Sit and reach flexibility test, cm	12.5	3.56	20.4	3.48	38.7	< 0.01
Sit-up test for 30 s, number of reps	46.5	12.50	59.3	12.56	21.6	< 0.05
Shuttle run test 10x5 m, s	28.4	3.38	26.8	2.35	6.0	< 0.05
Sharpened Romberg Test, s	6.0	1.95	16.1	1.98	62.7	< 0.01
Flamingo Test, number of reps	7.5	1.85	5.2	1.41	44.2	< 0.01

by 20.5%; BMI decreased by 11.9%, waist circumference decreased by 12.1%, abdominal circumference decreased by 9.6%, BMI decreased by 11.6%, hip circumference decreased by 9.3%, and the ratio of waist circumference to hip girth, decreased by 8.2%. Such positive dynamics of indicators of the morphological status of women can be explained by the peculiarity of the construction of classes taking into account the type of figure. The main part of the class lasted at least 30 minutes and included a set of exercises mainly focused on strength with one's own body weight. The positive dynamics of the girth sizes of the waist and abdomen in women of the second mature age were influenced by rotational exercises in the area of the abdominal press. Since in the pedagogical experiment the vast majority of women had an "O-shaped" type of figure, we applied aerobic exercise of moderate or medium intensity for 15 minutes and depending on the individual level of training of the women, we used the interval method.

Analysis of individual indicators of fat mass in percentages at the end of the pedagogical experiment made it possible to identify 75.8% of people in whom this indicator was within the normative interval and 24.2% of women with a slight excess of adipose tissue. The average statistical indicators of fat mass under the influence of the author's program decreased by 27.7% and 27.4% and meet the regulatory requirements. The average statistical indicators of muscle mass increased by 8.9% and 9.1%. In our opinion, the dynamics of the composition of the body was influenced by the complex use of exercises of mainly aerobic and mixed aerobic-anaerobic orientation, while the individual heart rate regime was determined taking into account the level of physical condition, and the regular updating of the program made it possible to support women's interest in classes and prevent getting used to loads on levels between muscle coordination.

A comparative analysis of the variance of the samples at the beginning and at the end of the pedagogical experiment shows a tendency to decrease the variability of morphological status indicators during the experiment, this feature indicates positive changes in accordance with the normative interval and indicates the homogeneity of the sample.

The obtained results at the end of the pedagogical experiment indicate significant changes ($P<0.05$; $P<0.001$) that occurred during nine months. Classes contributed to the improvement of the functional capacity of the cardiovascular system, which was manifested in an increase in the AP by 16.9%, a decrease in heart rate at rest by 12.2%, a decrease in systolic blood pressure by 11.2% and diastolic blood pressure by 8.0%.

Classes contributed to the improvement of the functional capacity of the cardiovascular system, which was manifested in an increase in the AP by 16.9%, a decrease in heart rate at rest by 12.2%, a decrease in systolic blood pressure by 11.2% and diastolic blood pressure by 8.0%. Also, the proposed program helped to increase the functional level of the respiratory system, in particular, the VC increased by 13.2%

Health fitness classes had a positive effect on one of the main physiological markers of the effectiveness of the proposed program, namely the VO_{2max} indicator. In women, at the end of the pedagogical experiment, the average statistical result of VO_{2max} significantly ($P<0.05$) increased by 10.8%, which indicates a significant improvement in the level of physical performance.

The next indicator that underwent significant changes ($P<0.01$) was the Bayevsky's Stress Index, which characterizes the activity of sympathetic regulation mechanisms, as well as the state of the central regulation circuit. At the beginning of the pedagogical experiment, the variability of the Bayevsky's Stress Index of regulatory systems of middle-aged women reached 95.5%. This fact indicated the mandatory observance of the principle of individualization. During the retesting of women, we found a significant improvement in this indicator, which decreased by 41.3%, and at the same time, the variability of the tension index decreased to 38.0%.

There were qualitative and reliable changes in the indicators that characterize physical fitness of middle-aged women at the beginning and at the end of the experiment.

In the movement test, which characterizes flexibility, the average statistic increased by 24.1%. The indicator of muscular endurance (lifting the trunk to sit from a lying position in 30 seconds) also underwent positive changes by 38.7%. In the test that characterizes the strength (static strength of the back muscles), the indicator improved by 21.6%. The average statistical result of the 10x5 m shuttle race improved by 6.0%. The progress in the tests that characterize coordination abilities is quite indicative. Thus, the average statistical result of the complicated Romberg test increased by 62.7%, and the performance of the "Flamingo" Test improved by 44.2%.

The obtained results proved the positive impact of the original weight management program on the physical condition of middle-aged women with excess body weight.

Discussion

Original weight loss intervention exercises program should include valuation, planning, managing, and controlling certain indicators for realizing effective weight reduction management. This approach is reflected through the block system of the original weight management program delivered *via* digital services (Figure 1).

These blocks are associated with the united process of fitness program design which always includes testing, prescription and management in individual services for patients. In this case we want to show that there is no structural difference between off-line and on-line services of exercise interventions. The fillings of these blocks represent particular interest from the scientific and practical position because of its meaning to be an example of gradual and effective weight reduce management.

Diagnostic block

Client oriented position for fitness is dominant basis for every block. Client orientation is the main thing that distinguishes fitness from sport. We build the diagnostic block according to this rule and should choose the most informative and effective fitness tests for it. It means that we need to fill the diagnostic block with valid, informative, effective tests which might be comfortable for client's self-made implementation and possible for correct interpretation by specialist remotely.

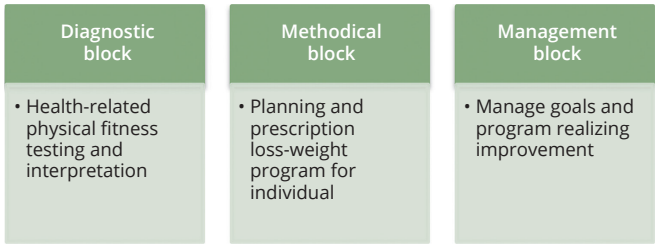

Figure 1.—Exercise interventions model delivered *via* digital services.

To continue discussion about physical activity possibility within clinical care, delivered *via* digital services, to evaluate telehealth perspective we want to demonstrate an opportunity to use fitness health related tests battery that might be used both on-line and off-line.

We consider it appropriate to narrow down the testing list for weight loss programs for obese middle-aged women in accordance with our factor analysis results.[35] The right specific checklist can provide a much clearer picture and understanding of the process, which can also lead to higher client motivation.[36,37] According to the results obtained during the factor analysis, we formalized the physical testing protocol for obese middle-aged women, selecting the most informative criteria for evaluating the effectiveness of the proposed weight loss program (Table VII). This pro-

TABLE VII.—*Exercise testing protocol that is recommended for middle-aged obese women via telehealth intervention.*

Parameter	Available for self-testing	Require off-line assistance	Available for implantation in on-line calculator
Body weight, kg	*	*	
BMI, $kg \cdot m^{-2}$	*	*	*
Inspiratory CC, cm	*	*	
Expiratory CC, cm	*	*	
Chest excursion, cm	*	*	*
Muscle mass, %	*	*	*
Muscle mass, kg	*	*	*
Basal metabolic rate, kcal	*	*	*
Abdomen circumference, cm	*	*	
Waist circumference,cm	*	*	
Waist-to-Hip Ratio (WHR), arb.units	*	*	*
Waist-to-Height Ratio (WHtR), arb.units	*	*	*
Hip circumference, cm	*	*	
VO_{2max}, $mL \cdot kg \cdot min^{-1}$		*	
VC, mL		*	
Vital capacity-to-body weight ratio, $mL \cdot kg \cdot min^{-1}$	*	*	*
IPC, arb.units	*	*	*
AP, arb.units	*	*	*
HR recovery time after 20 squats in 30s, min	*	*	
Robinson' Index, arb.units	*	*	*
BPsyst, mmHg	*	*	
BPdiast, mmHg	*	*	
Bayevsky Stress Index, arb.units		*	*
Heart rate, bpm	*	*	

tocol can be used by specialists to collect data for design and evaluate the effectiveness of the weight management programs delivered *via* telehealth services for middle-aged overweight women. A significant part of measurements can be carried out independently by customers, some measurements require the participation of an off-line assistant and supplemental equipment. The results of our research also demonstrated significant correlations in the indexes as an independent evaluation method. Calculation of such indicators can be carried out remotely through telemedicine services – online calculators implanted in websites. Calculators with implanted automatic formulas for anthropometric estimate can make the process interesting for the participants as well, giving an automatic calculation result with a description of anthropometric measurements.

Full measurement prescription with correct reference parameters is described in valid international guidelines and study results.[32, 38, 39] The results of initial measurement and testing should be analyzed by a specialist according to referent parameters and explained to a client. The feedback improves the client's motivation and makes his participation in a fitness training process more active. We used the SMART-goals technology for the balanced formation of goals for each specific client. This technology has proved to be good at fitness.[40-44]

Methodical block

According to our model of exercise interventions delivered *via* videoconferencing for middle-aged overweight women all methodical part of training process may be realized by using digital technology. The characteristic feature of our model is a possibility to organize all process only with free digital modules (Figure 2).

Methodical block: training program

The training program components were developed and implemented according to American College of Sports Medicine FITTVP-components model (frequency, intensity, time, type, volume, progressive)[38] (Table VIII).

Training characteristics and prescriptions effectivity for exercise interventions on-line services for overweight middle-aged women was demonstrated and described in published results (N.=62).

Training program, including detailed description with individual prescription and parameters, in text-table format (txt, pdf), might be sent to a client or a patient through a virtual communication channel – by e-mail, for example. In parallel with this, a personal playlist for a client could be created based on the YouTube-platform. The access link should be closed for anyone and personally opened for a particular client. Every client should have a personal link to the personal play-list. Such an approach ensures confidentiality which is preferable need during a weight loss intervention. In our investigations we used the author's YouTube-channel for training-program design. The channel content was specially created for our research. The channel has currently open access and represents 52 video-exercises.[45]

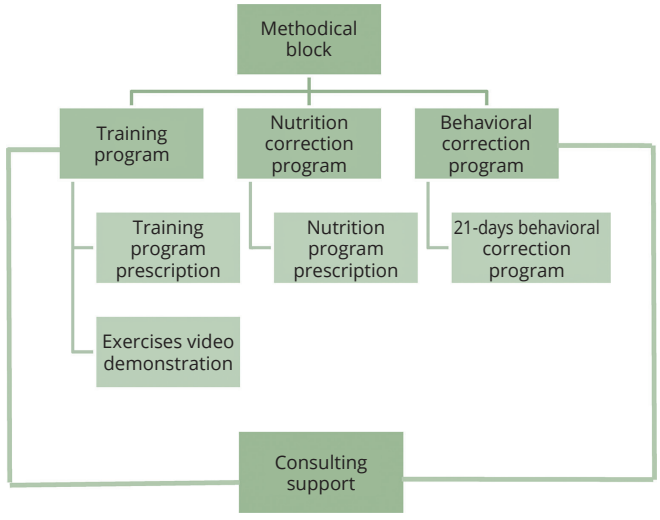

Figure 2.—Methodical block of an exercise intervention model delivered *via* videoconferencing for middle-aged obese women.

TABLE VIII.— *Characteristics and prescriptions for on-line services of exercise*

	Training characteristics and prescriptions	
Frequency	Three time a week	
Intensity	50-70% from VO_{2max}	
Time	50-60 minutes	
	Warm-up part	5 min
	Main part	30-35 min
	Final part	15-20 min
Type	special exercises	40-25%
	general exercises	60-75%
	Exercises for strength and general endurance development with one's own body weight in the alternating performance mode and aerobic exercise in the continuous performance mode	
Volume	Number of reps	Number of sets
	≥12	3-4
	Exercises for strength and general endurance development with one's own weight bodies in the alternating performance mode and aerobic loads in the continuous execution mode	
Progressive	Load Increase is provided by: the coordination complexity growth of the exercises performed; superseries use in the exercise performance; use of the circular method of training	

TABLE IX.—*Basic organization principles for nutrition during online services of exercise interventions for overweight middle-aged women.*

	Nutrition characteristics and prescriptions
1. Daily calorie intake	= level of basic metabolism in three time a day eating
2. Balance of nutrients and water	½ of every eating plate – vegetables and fruits; ¼ of every eating plate – whole grains; moderation of healthy plant oils; skip sugary drinks, limit milk and juice; drink water with calculation: 30 mL×1kg of weight.
3. Compliance the regime eating	the same time for breakfast, lunch, dinner; dinner – in four hours before sleep

Methodical block: nutrition correction program

The development of nutritional recommendations and the study of their effectiveness were not included in the scope of our scientific research. But the importance of nutrition in corrective measures to reduce weight was taken into account by us and implemented by summarizing the recommendations of world expert organizations in the field of nutrition and health.[46-51] Comparing the recommendations, we used in our study we noticed that scientists endorse very similar nutrition recommendations.[52] In accordance, we provided general guidelines within our intervention program (Table IX). We think that it should not fundamentally burden the overweight clients or patients with an excessive number of dietary recommendations. It is important to note that the implantation of nutritional recommendations is easily implanted in the original model of weight reduction program delivered *via* telehealth services.

Methodical block: behavioral correction program

The behavior correction program presents an automatic daily educational mailing to study participants. Letters were received from the first day of participation in the project for the next 21 days. The daily letter contained an enlightening preamble and a practical task to be completed during the day. A list of mailing topics day is given below (Table X).

The list of topics for newsletter delivery was formed in accordance with the results of our investigation on the motivation study for fitness activities among overweight and obese women of mature age.[53] The results of our study showed that in the vast majority of overweight women in the second period of adulthood, the results of the questionnaire indicate that 82.7% are aware of the importance of physical activity, which, in their opinion, contributes to the improvement of their own health. For 60.9% of women, physical activity is disease prevention and involutional changes deceleration. Therefore, health for women in the second period of adulthood are the most prioritized and rank first and second. In the third place there are aesthetic motives, for 69.5% of women, increasing physical attractiveness, body weight correction is the main incentive for classes. The next motivational priority is psychological motives, so 49.5% of women in the second period of adulthood engage in physical activity.

TABLE X.—*List of mailing topics of behavioral correction program.*

	Behavioral correction program
1.	Establishing a drinking regime
2.	Health of the spine and posture
3.	Educational information block on nutrients and food hygiene
4.	Practical recommendations for the organization of healthy food in everyday life (information on labels and labeling of products, list dangerous E-additives, recommendations on heat treatment of products and the healthiest ways of cooking).
5.	Rules of healthy sleep
6.	Eye health
7.	Information block about the harm of hypodynamia
8.	Review of tools of psychological self-regulation and information block about stress damage in everyday life
9.	Highlighting the problem of harm to health of excessive body weight and adiposity
10.	The harm of alcohol to health and the importance of healthy habits

Methodical block: consulting support

We recommend using any of the open messengers to provide feedback to clients and patients. In the implementation of our project, we mainly used WhatsApp and Viber. The importance of feedback provided by us with the ability to promptly respond to participants' questions, provide them with current consultations and clarifications. This approach also made it possible to ensure operational accountability on the part of the participants themselves. The possibility of direct access to advisory support also had a positive effect on the participants' motivation. Last but not least, this made it possible to carry out research over such a long period of nine months.

Management block

This block has direct attitude to success communication, motivation, training personalization and results of program realizing. The management consists of weight and anthropometry management, control of the program realizing results and training program characteristics and prescriptions changes according to the actuality outcomes.

In the weight management program, we did not use a complex system of periodization of the training process in accordance with such recommendations for the athletes. Considering the low level of physical condition of the studied contingent, we used one change of the training program within one mesocycle. As our research results show, this was enough to improve physical condition and reduce weight.

Conclusions

The results of the study convince that the proposed author's program is quite effective due to the rational planning of classes and the use of the training effect of the loads determined by the fitness program. The model of online weight reduce that are introduced in this article may show the possibility of distance interaction between clients and patients in a public health area using the example of self-training exercise programs designed for middle-aged overweight and obese women.

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