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Effects of a Multidisciplinary Telehealth Program with Functional Exercises in Patients Eligible for Metabolic Bariatric Surgery: A Pilot Feasibility Study

Rinaldo Silvino dos Santos
Universidade de Pernambuco
Karina Souza da Silva
Universidade de Pernambuco
Wlaldemir Roberto dos Santos
Universidade de Pernambuco
Fabiano Ferreira de Lima
Universidade de Pernambuco
Igor Henriques Fortunato
Universidade de Pernambuco
Rodrigo Montenegro Wanderley
Universidade de Pernambuco
Laila Barbosa de Santana
Universidade de Pernambuco
Tamires Pires Ferreira Jorge da Silva
Universidade de Pernambuco
Márcia Giovana Nunes de Jesus
Universidade de Pernambuco
Augusto Batista da Silva
Universidade de Pernambuco
Layane Sobral Araújo
Universidade de Pernambuco
Sérvio Fidney Brandão de Menezes Correia
Universidade de Pernambuco
Aline de Freitas Brito
aline.brito@upe.br

Universidade de Pernambuco

Article

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Abstract

Background: Patients awaiting metabolic bariatric surgery frequently face prolonged waiting times, a period during which physical function and cardiometabolic health can deteriorate. Multidisciplinary, telehealth-based interventions may represent a viable strategy to optimize patients health status prior to surgery, however, evidence regarding the feasibility and preliminary effects of such interventions remains limited.

Methods: This pilot study was conducted with 29 patients with severe obesity awaiting surgery under the Brazilian Unified Health System (SUS). The intervention was delivered remotely over 12 weeks and integrated nutritional and psychological counseling, weekly health education sessions, and supervised functional exercises.

Results: Sixteen participants completed the study, yielding a retention rate of 55.2% and a mean adherence rate of 29.3%. Despite partial adherence, significant reductions were observed in body mass (-2.1%; $p = 0.034$; $d = 0.60$) and BMI (-2.8%; $p = 0.006$; $d = 0.80$). Significant increases were also found in estimated cardiorespiratory fitness (+ 12.7%; $p = 0.013$; $d = 0.97$ and + 14.5%; $p = 0.001$; $d = 1.19$), handgrip strength (+ 12.0%; $p = 0.017$; $d = 0.67$), and performance on both the 30-second chair stand test (+ 26.6%; $p < 0.001$; $d = 1.19$) and the 60-second chair stand test (+ 24.2%; $p < 0.001$; $d = 1.39$) and the weekly physical activity levels increased by 123.0%.

Conclusion: The findings suggest that multidisciplinary telehealth prehabilitation is a potentially viable strategy for patients on the bariatric surgery waiting list, exerting favorable effects on anthropometric parameters and functional capacity.

Keypoints

- Telehealth prehabilitation is viable for public health bariatric candidates.
- The 12-week program significantly reduced body mass and BMI before surgery.
- Cardiorespiratory fitness and functional capacity improved significantly;
- Weekly physical activity levels increased by 123%.

INTRODUCTION

Obesity is established as a chronic condition affecting more than one billion people worldwide; in Brazil, its prevalence reaches 31% of adults, exerting a direct impact on public health [1, 2]. At higher severity levels, obesity is commonly associated not only with the development of multiple associated medical problems but also with severe anthropometric alterations [2], reduced cardiorespiratory fitness (CRF) [3, 4], functional impairments [5, 6], and a sharp decline in physical activity levels (PAL) [7]. These alterations significantly compromise individuals' functional capacity and quality of life, increasing the risk of morbidity and mortality while inflating healthcare related costs.

In this context, an increasing number of individuals with severe obesity seek metabolic bariatric surgery as a primary therapeutic tool for body mass reduction and remission of metabolic diseases [8, 2]. However, metabolic bariatric surgery candidates frequently present significant body composition impairment, characterized by excess adipose tissue and deterioration of muscle quality [2, 6], as well as reduced functional and cardiorespiratory capacity, placing them in a state of physiological vulnerability when facing surgical stress [5, 7]. This clinical scenario can negatively influence postoperative recovery and long-term clinical outcomes.

Additionally, patients in the Brazilian Unified Health System (SUS) eligible for metabolic bariatric surgery often face prolonged waiting times before undergoing the procedure, which promotes the worsening of clinical and functional conditions during the preoperative period [2, 9]. Within this context, this waiting period represents a strategic window for implementing accessible and scalable prehabilitation interventions with the potential to optimize patients' clinical, functional, and behavioral status prior to surgery [10].

Among potential prehabilitation strategies, the multidisciplinary approach has been widely recommended in obesity management due to its capacity to promote behavioral changes, improve health-related habits, and increase PAL, especially within the perioperative context [11, 12, 2]. A multidisciplinary approach is defined by the integrated efforts of three or more healthcare fields committed to a common goal, yet with complementary and specific responsibilities, providing diverse perspectives for patient care [11]. This integration favors a more comprehensive approach to obesity, addressing physical, nutritional, psychological, and educational factors involved in the disease. However, implementing a multidisciplinary approach frequently faces geographic and socioeconomic limitations experienced by patients, as well as a scarcity of infrastructure and specialized teams available within the SUS.

Therefore, the use of telehealth emerges as a promising alternative, enabling the mitigation of geographic barriers, expanding access to healthcare services, fostering communication among professionals, and promoting continuous patient monitoring [11]. In this framework, the 'Movement On, Obesity Off' program proposes an innovative telehealth-based approach, combining supervised sessions of nutrition, psychology, health education, and functional exercises. This strategy seeks to increase intervention accessibility, promote treatment adherence, and stimulate sustainable behavioral changes while maintaining safety and applicability in a home environment [13].

In this regard, a systematic review and meta-analysis conducted by Marshall et al. [2020] demonstrated that a multidisciplinary approach has the potential to promote improvements in different parameters of physical and mental health. However, the literature still presents limitations regarding the definition, description, and operationalization of this concept, given that many studies classify their interventions as multidisciplinary without adequately detailing the components involved or the obtained outcomes. Furthermore, evidence remains scarce regarding multidisciplinary programs conducted entirely via

telehealth and combined with functional exercises in patients eligible for metabolic bariatric surgery treated within the SUS.

Thus, this pilot study aimed to evaluate the effects of a 12-week multidisciplinary program conducted via telehealth and combined with functional exercises on the anthropometric, cardiorespiratory, and functional profiles, as well as PAL, of patients eligible for metabolic bariatric surgery treated within the SUS in the state of Pernambuco, Brazil.

MATERIALS AND METHODS

Study Design and Ethical Considerations

This is a pilot, single-arm, quasi-experimental study [14, 15] with pre- and post-intervention assessments, conducted over 12 weeks via telehealth. The study is derived from the research and extension program entitled “Movement On, Obesity Off” and was approved by Research Ethics Committee of the Oswaldo Cruz University Hospital/Pernambuco Cardiology Emergency Hospital (CEP-HUOC/PROCAPE) under opinion no. 4,848,599, in compliance with the ethical principles of the Declaration of Helsinki and its subsequent updates. The study was conducted in the state of Pernambuco, Brazil, and data collection took place from August to November 2025. All assessments were carried out by previously trained researchers following standardized procedures. All participants were informed about the objectives, benefits, and possible risks of the study and agreed to participate by signing an Informed Consent Form prior to the baseline assessments.

Population, Sample, and Eligibility

The study population consisted of patients with severe obesity who were eligible for metabolic bariatric surgery and treated under the SUS in the state of Pernambuco, Brazil. The inclusion criteria were: age between 18 and 60 years; body mass index (BMI) > = 35 kg/m² associated with at least one medical problem or BMI > = 40 kg/m²; currently undergoing follow-up and awaiting metabolic bariatric surgery under the SUS; and having regular access to the internet and a digital device compatible with the program's remote activities. The exclusion criteria were: medical contraindication for physical exercise; severe orthopedic limitations preventing the performance of assessments or the intervention; uncompensated clinical conditions compromising program participation; or pregnancy.

Eligible participants were recruited through informational meetings, invitations from healthcare professionals, and active screening at the following hospitals: Hospital Universitário Oswaldo Cruz, Hospital Agamenon Magalhães, and Instituto Professor Fernando Figueira de Medicina Integral, all located in Recife, Pernambuco, Brazil, which serve as reference centers for metabolic bariatric surgery preparation. Following recruitment, candidates received detailed information regarding the program's objectives and procedures and were contacted to schedule in-person physical assessments at the sponsoring institution's laboratory.

Initially, 29 participants were enrolled in the study. During the intervention period, 13 participants failed to complete all proposed stages and were considered dropouts. Attrition occurred primarily due to adherence difficulties: 4 patients reported limitations related to personal routines, 2 were fast-tracked for metabolic bariatric surgery, 1 reported an incapacitating health issue, and 6 were absent from final assessments without justification. At the end of the 12-week intervention, 16 participants completed the program, corresponding to a retention rate of 55.2%. Given the pilot nature of the study and the occurrence of missing data in certain variables, analyses were conducted using a complete-case approach, including only participants with valid data for each investigated outcome. Consequently, the analyzed sample size varied across specific assessments.

Study Design Structure

The program lasted 12 weeks and included assessments before and after the intervention. The study design comprised three distinct phases: baseline assessment, the intervention period, and the final reassessment. Initially, participants underwent an in-person assessment at the laboratory. Sociodemographic and clinical information was collected through a structured medical history, along with a questionnaire to evaluate PAL. Subsequently, anthropometric measurements and functional performance tests were performed. Following baseline assessments, participants entered the remote, telehealth-based phase of the program. The intervention integrated four primary areas: nutritional counseling, psychological support, health education, and functional exercise circuits. A general overview of the study design and intervention structure is presented in Fig. 1.

During the 12 weeks, participants were offered three weekly functional exercise sessions, one weekly psychological support session, and one weekly health education session, all delivered remotely at pre-established times. Additionally, participants received a monthly individual nutritional consultation for personalized dietary guidance. Participation was monitored throughout the program using attendance records maintained by the multidisciplinary team. At the end of the 12 weeks, participants returned for an in-person reassessment following identical baseline procedures, allowing for pre- and post-intervention outcome comparisons.

Experimental Approach

The intervention consisted of a 12-week multidisciplinary telehealth program for metabolic bariatric surgery candidates within the 'Movement On, Obesity Off' framework, integrating psychological support, nutritional counseling, health education, and supervised functional training. All activities were delivered remotely via digital platforms (*WhatsApp, Google Meet, and YouTube*) to expand access and reduce geographic and logistical barriers.

The health education component focused on improving health literacy and self-care behaviors. Psychological support was guided by Cognitive-Behavioral Therapy (CBT) principles, emphasizing the

modification of cognitive and behavioral patterns associated with eating behavior and treatment adherence. Nutritional counseling was based on dietary education and individualized behavioral goal-setting aligned with the Dietary Guidelines for the Brazilian Population, prioritizing dietary quality and the management of dysfunctional eating habits. Supervised functional training utilized bodyweight exercises organized progressively and adapted to individual capacities, aiming to improve health-related physical fitness, including muscle strength, functional capacity, and CRF. Adherence was monitored across all components.

Procedures

Remote Functional Training

The exercise component consisted of a remote functional training program structured as interval circuit training to develop neuromuscular and cardiorrespiratório capacities simultaneously [16]. A total of 36 group sessions were delivered over 12 weeks (3 sessions/week, ~ 40 min/session), supervised remotely by a Physical Education professional via a digital platform, adhering to guidelines for exercise in individuals with obesity [17]. Each session included a warmup (3 sets of 5 sequential exercises, 30s work/30s rest), a main phase (4 exercise blocks, 2–3 sets per block, 20-30s work/10-30s rest), and a cooldown (stretching and mobility). Intensity was monitored at the end of each block using the Borg Rating of Perceived Exertion (RPE) scale [18], targeting a moderate-to-vigorous intensity. Progression was systematically planned across three phases: weeks 1–4 (adaptation phase, focusing on motor learning); weeks 5–8 (intermediate phase, increasing work time and reducing rest); and weeks 9–12 (intensification phase, increasing density to optimize CRF). Parameter progressions are shown in Fig. 2.

Nutritional Counseling

Delivered individually via telehealth across three monthly consultations with a registered dietitian, using remote counseling frameworks for obesity management [19]. Guidelines aligned with national and international recommendations for obesity treatment [20]. The baseline consultation (60–90 min) established nutritional status, identified eating habits, and co-created behavioral goals. Follow-up consultations (30 min) monitored adherence, addressed barriers, and adjusted goals to reinforce positive dietary modifications.

Psychological Support

Conducted through 12 weekly individual consultations via telehealth with a licensed psychologist (40 min/session), grounded in CBT principles for lifestyle modification [21]. Initial phases prioritized qualitative active listening, therapeutic alliance building, and engagement assessment [13]. Subsequent phases focused on self-awareness, cognitive restructuring of maladaptive eating patterns, and coping skills development [22], aiming to enhance emotional self-regulation and preoperative behavioral preparation.

Health Education

Weekly group sessions delivered remotely on Saturday mornings (12 sessions, ~ 60 min/session) by the multidisciplinary team. Sessions addressed health promotion and surgical preparation, including behavioral change motivation, nutrition, physical activity, mental health, and self-care, an approach linked to superior clinical outcomes in obesity [8]. Complementary educational materials, individualized follow-up messages, and a dedicated WhatsApp group supported continuous engagement [13]. Full session details are listed in Table 1.

Table 1
Comprehensive planning of health education sessions and objectives.

Topic Covered	Core Thematic Axis	Discipline(s) Involved	Primary Objective
Group dynamics for introducing team members, patients, and the general framework of health education	Onboarding and integration	Multiprofessional	Foster the therapeutic alliance, group belonging, and initial engagement in the intervention
Is obesity a disease?	Health education and obesity awareness	Nutrition / Psychology / Physical Education	Promote a biopsychosocial understanding of obesity and reduce weight stigma associated with the condition
The importance of physical exercise beyond weight loss	Physical exercise and holistic health	Physical Education	Demonstrated the benefits of exercise on cardiovascular health, functionality, quality of life, and mental health
Physical exercise recommendations and adaptation to daily routines	Promotion of exercise practice and autonomy	Physical Education	Facilitate the integration of exercise into the daily routine in a safe, feasible, and sustainable manner
Motivation for behavioral change	Behavioral change and therapeutic adherence	Psychology	Stimulate readiness for change, self-responsibility, and the maintenance of healthy habits
Making peace with food	Behavioral relationship with eating	Nutrition / Psychology	Address emotional eating, food guilt, and the development of a healthier relationship with food
How do I perceive myself when facing anxious or depressive processes?	Mental health and emotional self-care	Psychology	Encourage the recognition of emotional triggers and psychological coping strategies
Myths and truths about the weight loss process	Nutritional education and eating behavior	Nutrition	Deconstruct misconceptions regarding weight loss and strengthen evidence-based dietary practices
Successful habits in the weight loss process	Lifestyle modification	Multidisciplinary	Identify behaviors associated with weight loss maintenance and therapeutic adherence
Food classification and assembling a healthy plate	Nutritional education	Nutrition	Develop dietary autonomy and an understanding of

Topic Covered	Core Thematic Axis	Discipline(s) Involved	Primary Objective
			healthy food choices
Everything you need to know about bariatric surgery	Preoperative preparation and surgical education	Multidisciplinary	Provide guidance on the surgical procedure, pre- and postoperative care, and treatment expectations

Assessments and Data Collection Instruments

Assessments occurred at baseline and post-intervention. Participants rested in a seated position for 5 minutes prior to testing, with 10–30 minute recovery intervals between tests. Standardized instructions, verbal encouragement, and familiarization were provided.

Habitual PAL was assessed using the short form of the International Physical Activity Questionnaire (IPAQ), expressed in weekly minutes of physical activity [23].

Anthropometric profile included body mass, height, neck, waist, and hip circumferences. Body mass and height were measured using a mechanical scale with an attached stadiometer (Filizola®, model 160/300, São Paulo, Brazil) with precision 100g and 0.5cm. Circumferences were measured using an inelastic tape (Sanny®, Porto Alegre, Brazil) following WHO guidelines. BMI, waist-to-height ratio, and waist-to-hip ratio were calculated.

Handgrip strength (HGS) was evaluated using a digital dynamometer (Camry EH101) in an orthostatic position with the dominant elbow flexed at 90°. The mean of three maximal trials (60s rest) was recorded in kilogram-force (kgf) [24].

Functional capacity was evaluated via the 30-second and 60-second Sit-to-Stand Test (30STST and 60STST) and the 2-Minute Step Test (2MST). In the STST, participants performed the maximum number of full stands from a chair within 60 seconds with arms crossed over the chest, recording repetitions at 30s and 60s [25].

The 2MST involved stepping up and down an 15 cm portable step for two minutes at a self-selected pace; total up-and-down cycles (UDC) were used to estimate peak oxygen consumption (VO_2peak) using the Ricci et al. [2019] equation.

CRF was evaluated via the 6-Minute Walk Test (6MWT) on a 30-meter flat course [26], recording total distance in meters to estimate maximal oxygen consumption (VO_2max) using the Vanhelst et al. [2013] equation.

Statistical Analysis

Analyses were performed using JAMOVI (version 2.6.44). Data normality was verified via the Shapiro-Wilk test. Continuous variables were presented as mean standard deviation, and categorical variables as frequencies. Pre- and post-intervention comparisons were analyzed using the paired t-test or the Wilcoxon test. Effect size was estimated using Cohen's d and interpreted as small (< 0.50), medium (0.50–0.79), or large (> = 0.80). Significance was set at $p < 0.05$. A complete-case approach was implemented due to missing data, resulting in varying sample sizes per outcome. Due to the sample size and characterization imbalance (13 women vs. 3 men), outcome analyses were not stratified by biological sex.

RESULTS

The detailed participant flow-covering initial recruitment, eligibility screening, exclusion rates, losses to follow-up over the 12 weeks, and the final sample analyzed by outcome is presented in Fig. 3.

6MWT: 6-minute walk test; 2MST: 2-minute step test; STST30 and STST60: 30-second and 60-second sit-to-stand tests.

A total of 70 patients were invited to participate in the study; 60 expressed interest and underwent eligibility assessment. Ultimately, 29 were allocated to the intervention, and of these, 13 discontinued the study: 1 experienced health issues, 2 were called for metabolic bariatric surgery, 4 reported personal or routine-related barriers, and 6 failed to attend the re-assessment.

Of the 16 participants who completed the intervention, 81.2% were female. The mean age was 46.4 ± 8.1 years, with a baseline body mass of 124.3 ± 28.1 kg and a BMI of 47.1 ± 7.1 kg/m², characterizing a severe obesity profile. Associated medical problems included chronic hypertension (62.5%) and type 2 diabetes mellitus (31.8%). Baseline PAL revealed a predominance of insufficiently active individuals, with 12.5% classified as sedentary and 18.8% as irregularly active. Baseline characteristics are detailed in Table 2.

Table 2
Sample characterization (n = 16).

Variable	Men (n = 3)	Women (n = 13)	Total (n = 16)
	Mean ± SD	Mean ± SD	Mean ± SD
Age (years)	49,7 ± 12,1	45,6 ± 7,4	46,4 ± 8,1
Body mass (kg)	158,3 ± 49,1	116,4 ± 15,2	124,3 ± 28,1
Height (cm)	172,3 ± 7,8	160,1 ± 5,5	162,4 ± 7,1
BMI (kg/m²)	52,6 ± 12,3	45,8 ± 5,2	47,1 ± 7,1
Neck circumference (cm)	48,8 ± 6,5	39,8 ± 4,1	41,51 ± 5,67
Waist circumference (cm)	140,1 ± 15,5	117,0 ± 9,9	121,31 ± 14,07
Hip circumference (cm)	151,7 ± 27,8	138,4 ± 13,8	140,88 ± 16,82
Waist-to-height ratio	0,81 ± 0,05	0,73 ± 0,07	0,75 ± 0,08
Waist-to-hip ratio	0,93 ± 0,10$	0,85 ± 0,05	0,87 ± 0,07
BMI = Body Mass Index			

Adherence was calculated as the ratio of attended to scheduled sessions. Over 12 weeks, the global synchronous adherence rate was 29.3%, corresponding to 18.5 ± 14.3 attended sessions out of 63 scheduled. Nutritional counseling had the highest adherence (43.7%), followed by psychological support (36.4%), health education (24.5%), and remote functional exercise sessions (22.3%), as shown in Table 3.

Table 3
Scheduled versus attended sessions per intervention component.

Area	Scheduled sessions	Sessions completed	Adherence %
		Mean ± SD	
Psychology	12	4,4 ± 4,2	36,4
Nutrition	3	1,3 ± 0,9	43,7
Health education	12	2,9 ± 3,3	24,5
Online exercises	36	8,1 ± 10,3	22,3
Program total	63	18,5 ± 14,3	29,3

Regarding the anthropometric profile, significant reductions were observed in body mass, BMI, waist circumference, and hip circumference post-intervention (Table 4). Body mass decreased by a mean of 2.1% ($p = 0.034$; $d = 0.60$), and BMI fell by 2.8% ($p = 0.006$; $d = 0.80$). Reductions were also confirmed for waist circumference (-2.9%; $p = 0.038$; $d = 0.60$) and hip circumference (-3.0%; $p = 0.043$; $d = 0.60$).

For the cardiorespiratory profile, significant improvements occurred across all metrics. The 6MWT distance increased from 350.0 ± 98.4 m to 450.5 ± 78.2 m (Delta = 100,5 m; +28.7%; p = 0.012; d = 0.99). Consequently, estimated VO_2max increased by 12.7% (p = 0.013; d = 0.97). Similarly, 2MST performance increased by 22.5% in UDC (p = 0.001; d = 1.11), with a 14.5% increase in estimated VO_2peak (p < 0.001; d = 1.19).

Neuromuscular performance and functional capacity significantly improved in all tests. HGS increased by 12% (p = 0.017; d = 0.67). Furthermore, participants demonstrated increases of 26.6% in the 30STST and 24.2% in the 60STST, both yielding large effect sizes (d = 1.19 and d = 1.39, respectively; p < 0.001). Sample sizes varied by outcome due to missing data (6MWT: n = 10; 2MST: n = 14). Full data are presented in Table 4.

Table 4
Pre- and post-intervention anthropometric, cardiorespiratory, and functional outcomes.

Variable	N	Pre-intervention (Mean ± SD)	Post-intervention (Mean ± SD)	Δ/Δ% (p;ES)
Body mass (kg)	16	124,3 ± 28,1	121,7 ± 25,9	-2,6/-2,1 (0,034*;0,60)
BMI (kg/m²)	16	47,1 ± 7,0	45,8 ± 6,7	-1,3/-2,8 (0,006*;0,80)
Waist circumference (cm)	16	121,3 ± 14,1	117,8 ± 12,4	-3,5/-2,9 (0,038*;-0,60)
Hip circumference (cm)	16	140,9 ± 16,8	136,6 ± 13,4	-4,3/-3 (0,043*;0,60)
CARDIORESPIRATORY PROFILE				
6MWT (m)	10	350,00 ± 98,42	450,50 ± 78,2	100,5/28,7 (0,012*;0,99)
VO_{2Max} (TC6M) (ml/kg/min)	10	12,8 ± 3,4	14,4 ± 3,6	1,6/12,7 (0,013*/0,97)
2MST (UDC)	14	41,21 ± 13,6	50,50 ± 14,2	9,3/22,5 (0,001**;1,11)
VO_{2Peak} (TD2M) (ml/kg/min)	14	10,3 ± 2,7	11,8 ± 2,9	1,5/14,5 (< 0,001***/1,19)
FUNCTIONAL PERFORMANCE				
Handgrip Strength (kg)	16	28,3 ± 4,9	31,7 ± 6	3,4/12 (0,017*/0,67)
30STST (rep)	15	9,3 ± 2,1	11,73 ± 2,3	2,5/26,6 (< 0,001***/1,19)
60STST (rep)	15	17,9 ± 4	22,27 ± 4,95	4,3/24,2 (< 0,001***/1,39)

BMI: Body Mass Index; 6MWT: 6-minute walk test; 2MST: 2-minute step test; UDC: Up-and-down cycles; VO2max: Maximal oxygen consumption; VO2peak: Peak oxygen consumption; Δ and Δ%: Absolute and percentage difference between means. 30STST and 60STST: 30-second and 60-second sit-to-stand tests. Significance: *p < 0.05; **p < 0.01; ***p < 0.001. ES: Effect size [27]: negligible < 0.20, small 0.20–0.49, medium 0.50–0.79, and large ≥ 0.80.

DISCUSSION

This pilot study evaluated the effects of a 12-week multidisciplinary telehealth program—comprising functional exercises, psychological support, nutritional guidance, and health education—on anthropometric, cardiorespiratory, and functional parameters, as well as physical activity levels, in patients eligible for metabolic bariatric surgery within the Unified Health System (SUS). The intervention produced significant improvements in anthropometric parameters, estimated CRF, functional capacity, and habitual PAL.

These findings align with prior prehabilitation literature. Baillot et al. [5] demonstrated that combining supervised exercise with multidisciplinary support significantly improves anthropometric, functional, and cardiorespiratory profiles in severe obesity. Baillot et al. [7] further confirmed that these preoperative functional benefits persist up to one year post-surgery, resulting in higher PAL and superior aerobic capacity. Similarly, Bond et al. [2015] reported enhanced engagement in active behaviors and functional capacity following behavioral interventions during bariatric preparation. Marshall et al. [8], in a meta-analysis of 1533 patients, concluded that multidisciplinary programs are systematically linked to enhanced physical, behavioral, and quality-of-life outcomes. Together, these data indicate that integrating physical exercise, behavioral strategies, health education, and multidisciplinary monitoring exerts a powerful synergistic effect on preoperative health status.

The implementation of telehealth warrants specific emphasis. Sponsoring program data revealed that 72.3% of participants lived in municipalities distant from the capital's reference hospitals, and historical in person retention was low [13]. Thus, these results validate telehealth as a robust mechanism to circumvent geographical, financial, and logistical barriers within public health systems, transforming long surgical waiting lists into active windows for clinical optimization.

Anthropometric reductions in body mass (-2.1%), BMI (-2.8%), waist circumference (-2.9%) and hip circumference (-3.0%) although modest, carry vital clinical relevance. Evidence suggests that reductions in body weight and abdominal adiposity are associated with decreased surgical risk, reduced liver volume, less technical difficulty during the procedure, shorter operative time, and improved postoperative recovery [29, 30, 31, 32]. Furthermore, studies indicate that reducing central anthropometric measurements can facilitate surgical access and contribute to better postoperative clinical outcomes [33, 34]. Thus, the observed results reinforce the importance of structured preoperative interventions capable of promoting clinical benefits even before metabolic bariatric surgery is performed.

The effects observed on CRF also deserve highlighting. In absolute terms, increases of approximately 1.6 mL·kg⁻¹·min⁻¹ in VO_2max estimated by the 6MWT and 1.5 mL·kg⁻¹·min⁻¹ in VO_2peak estimated by the 2MST were observed. Although these values may appear modest at first glance, they represent percentage increases of 12.7% and 14.5%, respectively, comparable to results reported in previous studies involving individuals with severe obesity [5, 7]. These gains are of high clinical relevance, given that relatively small increases in cardiorespiratory fitness are associated with reduced cardiovascular risk and all-cause mortality [35, 4].

Additionally, individuals with severe obesity often exhibit low levels of CRF, a condition associated with a higher risk of perioperative complications, longer hospital stays, and slower recovery [5, 10, 2]. The observed gains may be related to central and peripheral physiological adaptations induced by physical exercise, including improved cardiovascular function, increased efficiency of tissue oxygen utilization, and peripheral muscular adaptations [36]. A particularly relevant aspect is that these improvements occurred despite a relatively low overall adherence rate, suggesting that partial exposure to the intervention was sufficient to produce clinically significant adaptations. Thus, the results reinforce the importance of strategies that prioritize not only weight loss but also improvements in functional reserve and cardiorespiratory fitness.

Substantial gains were also observed in functional capacity. The distance covered in the 6MWT increased by 100.5 meters, representing a 28.7% increase and far exceeding the minimal clinically important difference proposed for this test, estimated at between 45 and 50 meters [37]. Similarly, performance on the two-minute step test improved by 22.5%, indicating enhanced exercise tolerance. Significant increases were also observed in grip strength (12%), 30STST (26.6%), and 60STST performance (24.2%).

These results suggest that the program was effective in promoting improvements in neuromuscular function, functional capacity, and force production. Such adaptations may be associated with the use of functional bodyweight exercises, characterized by multi-joint movements capable of stimulating the coordinated recruitment of motor units and improving neuromuscular efficiency [16]. Given that individuals with severe obesity often exhibit significant functional limitations and an increased risk of mobility impairment [6, 38] the observed improvements are of significant clinical relevance. In this context, the ability to perform activities of daily living more efficiently and better tolerate physical exertion may represent a benefit as important as weight loss itself, contributing to a reduced risk of sarcopenia [6, 39] and better preparation for surgical stress and the subsequent recovery process [40, 41].

Finally, the observed results appear consistent with the substantial increase in the participants' habitual physical activity levels—rising from 134.5 to 300 minutes per week, an increase of approximately 123%. Previous studies have demonstrated that multidisciplinary interventions combined with behavioral strategies can significantly increase engagement in physically active behaviors within this population [28, 42]. Similarly, Marshall et al. [2020] observed that programs integrating physical exercise, nutritional

support, and behavioral strategies foster sustainable lifestyle changes, improved functionality, and better clinical outcomes. Furthermore, the Brazilian guideline for obesity management highlights that adopting a physically active lifestyle is a fundamental element for improving CRF, reducing cardiovascular risk, and optimizing clinical prognosis [2].

CONCLUSION

The results of this pilot study suggest that a multidisciplinary telehealth program—incorporating functional exercises, psychological support, nutritional guidance, and health education—may be a viable strategy for patients eligible for metabolic bariatric surgery within the public health system (SUS). After a 12-week intervention, significant improvements were observed in anthropometric, cardiorespiratory, and functional parameters, as well as in habitual physical activity levels. Taken together, these findings indicate that multidisciplinary telehealth interventions, even with an average adherence rate of 29.3%, have the potential to optimize clinical and functional status during the preoperative period for metabolic bariatric surgery. However, studies with larger samples, control groups, and longitudinal follow-up are needed to confirm the effectiveness and sustainability of these benefits.

Declarations

Authors

Rinaldo Silvino dos Santos; Karina Souza da Silva; Wlaldemir Roberto dos Santos; Fabiano Ferreira de Lima; Igor Henriques Fortunato; Rodrigo Montenegro Wanderley; Laila Barbosa de Santana; Tamires Pires Ferreira Jorge da Silva; Márcia Giovana Nunes de Jesus; Augusto Batista da Silva; Layane Sobral Araújo; Sérvio Fidney Brandão de Menezes Correia; Aline de Freitas Brito (corresponding author)

Conflict of Interest:

The authors declare that they have no conflict of interest.

Ethical Approval:

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. The institutional review board approval number has been blinded for peer review.

Informed Consent:

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Author Contribution

Conceptualization: RSR, KSS, WRS, FFL, IHF, RMW, LBS, TPF, MGN, ABS, LSA, SFBMC, AFB. Methodology: RSR, KSS, WRS, FFL, IHF, RMW, LBS, TPF, MGN, ABS, LSA, SFBMC, AFB.Investigation: RSR, KSS, WRS, FFL, IHF, RMW, LBS, TPF, MGN, ABS, LSA, SFBMC, AFB.Formal analysis: RSR, KSS, FFL, IHF, RMW, LBS, TPF, MGN, ABS, LSA, AFB.Data curation: RSR, KSS, FFL, IHF, RMW, LBS, TPF, MGN, ABS, LSA, AFB.Writing – original draft: RSR, KSS, WRS, AFB.Writing – review: RSR, KSS, WRS, FFL, IHF, RMW, LBS, TPF, MGN, ABS, LSA, SFBMC, AFBSupervision: RSR, AFB.

Data Availability

All data, raw and summarized, supporting the conclusions of this study are available in the article and its Supplementary Information.

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Figures

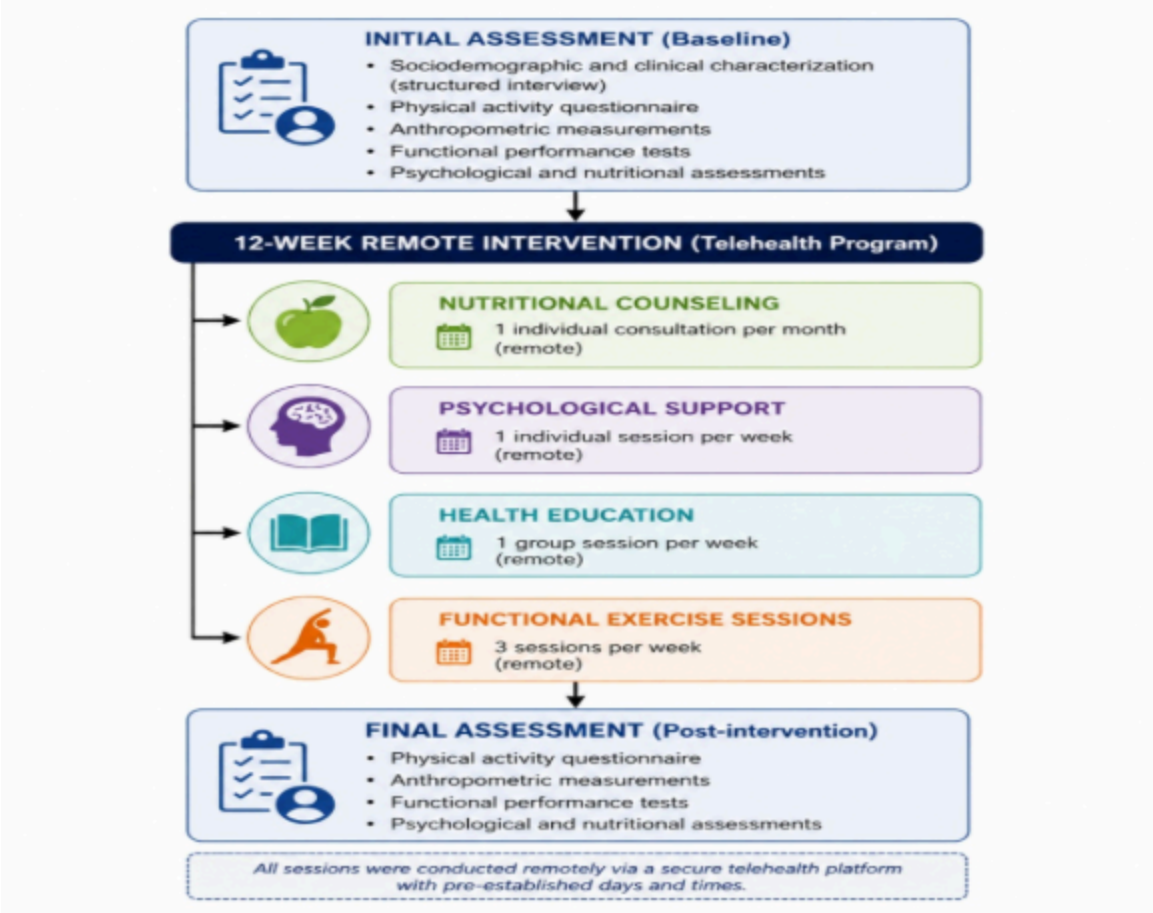


Figure 1

Study design and structure of the 12-week multidisciplinary telehealth intervention program.

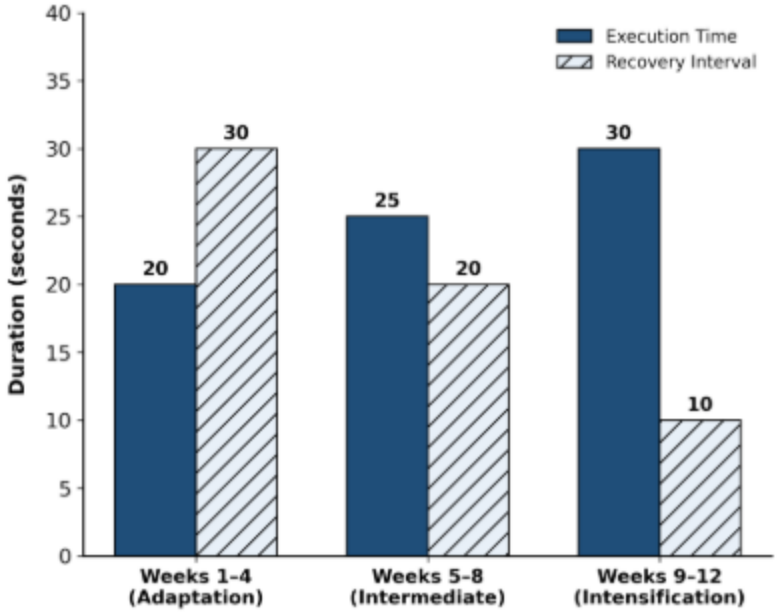


Figure 2

Progression of remote functional training density over 12 weeks.

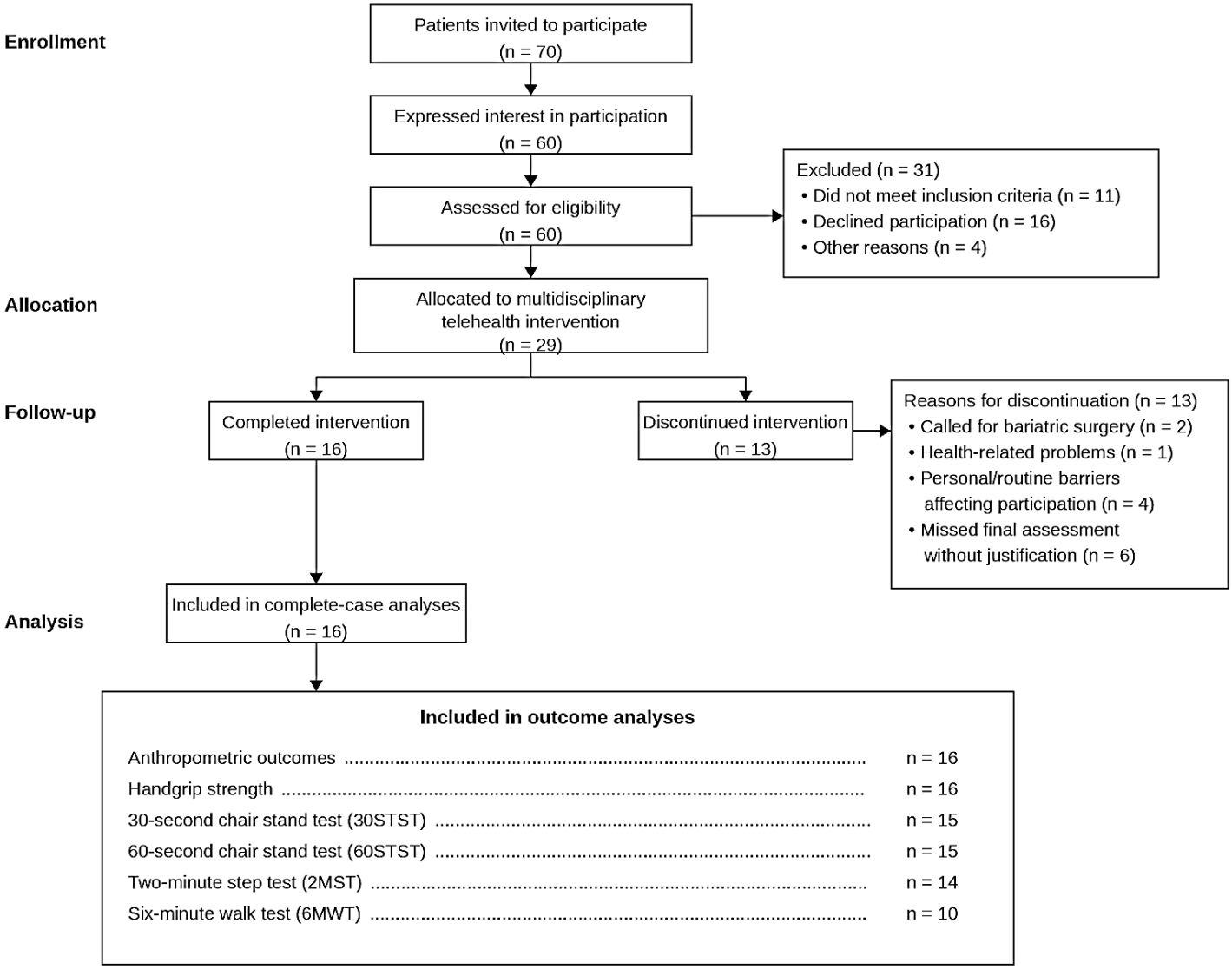


Figure 3

CONSORT flow diagram of participant recruitment, eligibility assessment, allocation, follow-up, and analysis.

Supplementary Files

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