



## Trabajo Original

Obesidad y síndrome metabólico

### No effect of combined tele-exercises and nutritional coaching on anthropometric, body composition or exercise capacity outcomes in overweight and obese women: a randomized clinical trial

*Ningún efecto de la combinación de ejercicios a distancia y entrenamiento nutricional sobre los resultados antropométricos, de composición corporal o de capacidad de ejercicio en mujeres con sobrepeso y obesidad: un ensayo clínico aleatorizado*

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### Abstract

**Background:** we aimed to investigate the isolated effect of tele-exercises (TE) and their combined effect with nutritional coaching (NC) on health-related parameters of overweight and obese individuals.

**Methods:** forty-one overweight (body mass index  $\geq 25$  kg/m<sup>2</sup>) and obese (body mass index  $\geq 30$  kg/m<sup>2</sup>) women were randomly assigned to the experimental groups: TE (n = 20) or TE+NC (n = 21). TE was applied 3 days/week in both groups, while TE+NC also received NC 1 day/week. Anthropometric, body composition, and exercise capacity-related outcomes, quality of life, and eating behavior were assessed before and after 8 weeks of the intervention.

**Results:** a significant main time effect ( $p < 0.01$ ) was detected for flexibility, isometric muscle strength and dynamic muscle endurance, but no main group effect was noted ( $p > 0.05$ ). On the other hand, neither a significant main time nor group effect ( $p > 0.05$ ) was detected in the anthropometric and body composition measures, quality of life, or eating behavior. Similarly, no significant between-group difference was observed in the absolute or relative change analysis (all comparisons,  $p > 0.05$ ).

#### Keywords:

Obesity. Exercise training.  
Nutrition. Health promotion.

**Conclusions:** an 8-week TE program enhanced exercise capacity, but did not impact anthropometric or body composition-related outcomes. The combination of NC+TE did not have a clinical advantage in the management of overweight and obesity.

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## Resumen

**Introducción:** nuestro objetivo fue investigar el efecto aislado de los tele-ejercicios (TE) y su efecto combinado con el *coaching* nutricional (CN) sobre los parámetros relacionados con la salud de las personas con sobrepeso y obesidad.

**Métodos:** cuarenta y una mujeres con sobrepeso (índice de masa corporal  $\geq 25$  kg/m<sup>2</sup>) y obesas (índice de masa corporal  $\geq 30$  kg/m<sup>2</sup>) fueron asignadas aleatoriamente a los grupos experimentales: TE (n = 20) o TE+CN (n = 21). La TE se aplicó 3 días/semana en ambos grupos, mientras que el grupo TE+CN también recibió NC 1 día/semana. Se evaluaron los resultados antropométricos, la composición corporal y la capacidad de ejercicio, la calidad de vida y la conducta alimentaria antes y después de 8 semanas de intervención.

**Resultados:** se detectó un efecto de tiempo principal significativo ( $p < 0,01$ ) para la flexibilidad, la fuerza muscular isométrica y la resistencia muscular dinámica, pero no se observó ningún efecto de grupo principal ( $p > 0,05$ ). Por otro lado, no se detectó ningún efecto de tiempo principal ni de grupo significativo ( $p > 0,05$ ) en las medidas antropométricas y de composición corporal, calidad de vida o conducta alimentaria. De manera similar, no se observaron diferencias significativas entre los grupos en el análisis del cambio absoluto o relativo (todas las comparaciones,  $p > 0,05$ ).

**Conclusiones:** un programa de TE de 8 semanas mejoró la capacidad de ejercicio pero no afectó los resultados antropométricos o relacionados con la composición corporal. La combinación de CN + TE no obtuvo ninguna ventaja clínica en el manejo del sobrepeso y la obesidad.

### Palabras clave:

Obesidad. Entrenamiento de ejercicio. Nutrición. Promoción de la salud.

## INTRODUCTION

Updated data from the World Health Organization (WHO) have shown that more than 39 % of adults are overweight (body mass index [BMI]  $\geq 25$  kg/m<sup>2</sup>), and 13 % are obese (BMI  $\geq 30$  kg/m<sup>2</sup>) (1). Since 1980, the prevalence of these conditions has doubled (2). Overweight and obesity impair muscle strength, flexibility, and peak oxygen consumption (3,4), negatively affecting quality of life. Furthermore, overweight and obesity are major risk factors for cardiovascular and metabolic disorders (5), and all-cause mortality (6). Despite some diseases, medications and genetics may account for fat accumulation (7), the leading cause of overweight and obesity is the imbalance between calories consumed and expended, and hence, dieting, physical activity, and cognitive behavioral therapy play essential roles in the treatment of these conditions (8). Women are impacted by body image and beauty as imposed by society (9), which results in impairments in physical health as well as in quality of life. Given this, specific intervention programs to combat obesity in women are recommended to maintain homogeneity groups (discussions, themes, and, consequently, adherence) (9).

In March 2020, WHO declared the coronavirus disease-2019 (COVID-19) a pandemic. Due to COVID-19 lethality and consequent crisis, lockdown measures to mitigate the disease progress have brought to all countries the need to implement social distancing and impede economic activities across a broad spectrum of nonessential occupations (10). These adjustments caused changes in food consumption and physical activity patterns that may exacerbate the current trends in the prevalence of overweight/obesity (11), strengthening the need for strategies to promote increased caloric expenditure and reduced caloric intake, while respecting the COVID-19-associated social distancing policies. Among them, home-based tele-exercises (TE) (12) and online nutritional coaching (NC) (13) have emerged as potential supporting tools for health professionals to overcome the behavioral barriers associated with overweight and obesity while still maintaining social distancing.

TE is based on video conferencing, which involves simultaneous and real-time two-way video and audio transmission. This allows both the exercise instructor and the participant to undergo supervised training in their own homes while see-

ing and hearing each other. Although the employment of TE is a relatively new methodology, emerging evidence has demonstrated its efficacy in improving exercise adherence in children with cystic fibrosis (14) and free-fat mass and flexibility in older adults (12). However, the efficacy of TE in improving exercise capacity, body composition, and quality of life in overweight/obese individuals has not yet been investigated. In parallel, NC is a derivative of the health and wellness coaching behavioral strategy that promotes eating habits and may be employed in person or remotely (15). The NC professional supports the clients by helping them achieve self-directed goals aligned with their identified personal values. Hence, NC is a patient-centered process based on behavior change theory that encourages self-discovery and active learning processes during weight and fat loss, on a process of enlightenment and empowerment of the client by looking to the future and not the past (16). While emerging studies (17-19) have highlighted NC as a promising and far more effective intervention than energy-restricted diets, most studies examining NC efficacy were limited by short duration, small sample sizes, and the lack of control groups. Furthermore, the potential additive effect of NC combined with other interventions also aimed at promoting weight loss still requires clarification.

Therefore, the present study aimed to investigate the combined effect of TE and NC and compare it with the isolated effect of TE on the quality of life and exercise capacity, as well as anthropometric and body composition measures in overweight and obese women. Based on the previous findings of studies employing TE (12,20), we hypothesized that TE would positively affect all health-related outcomes. We also hypothesized that the combination of TE and NC would promote an even greater enhancement of these outcomes since previous studies have demonstrated that strategies targeting anthropometric and body composition improvements also led to an improved exercise capacity (21).

## MATERIALS AND METHODS

### EXPERIMENTAL DESIGN

According to the guidelines of the CONSORT Statement, an 8-week randomized, parallel-group clinical trial was conducted

between August 2020 and October 2020 in Maringa (Brazil). Using a computer-generated randomization code, participants were randomly assigned (1:1) to receive either tele-exercises (TE) or tele-exercises + nutritional coaching (TE+NC). Both experimental groups underwent a TE program for 8 weeks, while the TE+NC group received NC once a week. The participants were assessed at baseline (PRE) and 8 weeks after the intervention (POST). The assessments were conducted at the same time of the day to avoid circadian variation-derived influence and at 2 hrs after the last meal. Throughout the study, participants in the TE group were asked to maintain their food habits, which was confirmed by food recalls. Quality of life, anthropometric, body composition, and exercise capacity measures were obtained at PRE and POST. Adverse events and adherence towards the protocols were recorded throughout the trial.

## PARTICIPANTS

A convenience sample of women was recruited from the basic health units near the university through a local community extended project. The inclusion criteria were as follows: being overweight (BMI  $\geq 25$  kg/m<sup>2</sup>) or obese (BMI  $\geq 30$  kg/m<sup>2</sup>), 18-60 years of age, and not engaged in an exercise training program for at least one year before the study. Exclusion criteria included cancer in the past five years, use of psychotropic or glucocorticoid medication, acute myocardial infarction  $\leq 6$  months, current engagement in dieting programs, and any cardiovascular, neurological or musculoskeletal disorders that would contraindicate exercise practice.

Eighty-four women were initially screened, and 72 patients met the inclusion criteria and were randomly assigned to the TE or TE+NC groups. Due to lack of motivation and difficulty accessing electronic media, 16 and 15 participants from the TE+NC and TE groups, respectively, declined to proceed in the study after the PRE assessments. Figure 1 depicts a flowchart of the participants throughout the study. The participants' characteristics at the PRE are presented in table I.

All procedures were performed according to the ethical standards of the local research committee (approval number: 4.001.666/2019) and the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. All patients also provided a written informed consent. This trial was registered at the Brazilian Registry of Clinical Trials (REBEC) as RBR-98mbrw.

## ANTHROPOMETRIC MEASUREMENTS AND BODY COMPOSITION ASSESSMENT

Bodyweight was measured using a digital scale (W200, Welmy, Santa Bárbara do Oeste, Brazil) with a maximum capacity of 200 kg and 100 g divisions (22), while height was measured using a stadiometer coupled to the scale with 0.1 cm divisions. BMI calculation and cut-off points were based on the values established by the WHO (23). Abdominal and waist circumferences were

measured using a flexible non-stretchable tape measure (T87-2®, Wiso, Florianopolis, SC, Brazil) and analyzed using pre-determined standards (24). Body composition was measured using the tetrapolar bioimpedance method (*InBody 570*, *Biospace Co Ltd.*, Seoul, Korea) according to the manufacturer's instructions, following recommendations to improve validity (25) and reliability (26).

## CARDIORESPIRATORY EVALUATION

Peak oxygen consumption ( $VO_{2peak}$ ) was evaluated through the six-minute walking test, where participants were instructed to walk as fast as possible to reach the greatest distance within 6 min. According to the American Association of Cardiovascular and Pulmonary Rehabilitation guidelines, the test was performed on a circular track with a length of 30 m, without verbal encouragement. Participants only received standardized information every minute about the remaining time until the end of the test.  $VO_{2peak}$  was calculated according to the previous studies (27).

## FLEXIBILITY ASSESSMENT

Using a Wells Bench, the sit-and-reach test was employed to evaluate the flexibility of the posterior chain (paravertebral muscles, maximal glutes, hamstrings, and sural triceps). The testing procedures have been described elsewhere (28). Participants were instructed to repeat the test three times, with a 60-second interval between attempts. The highest value obtained was recorded and expressed in cm.

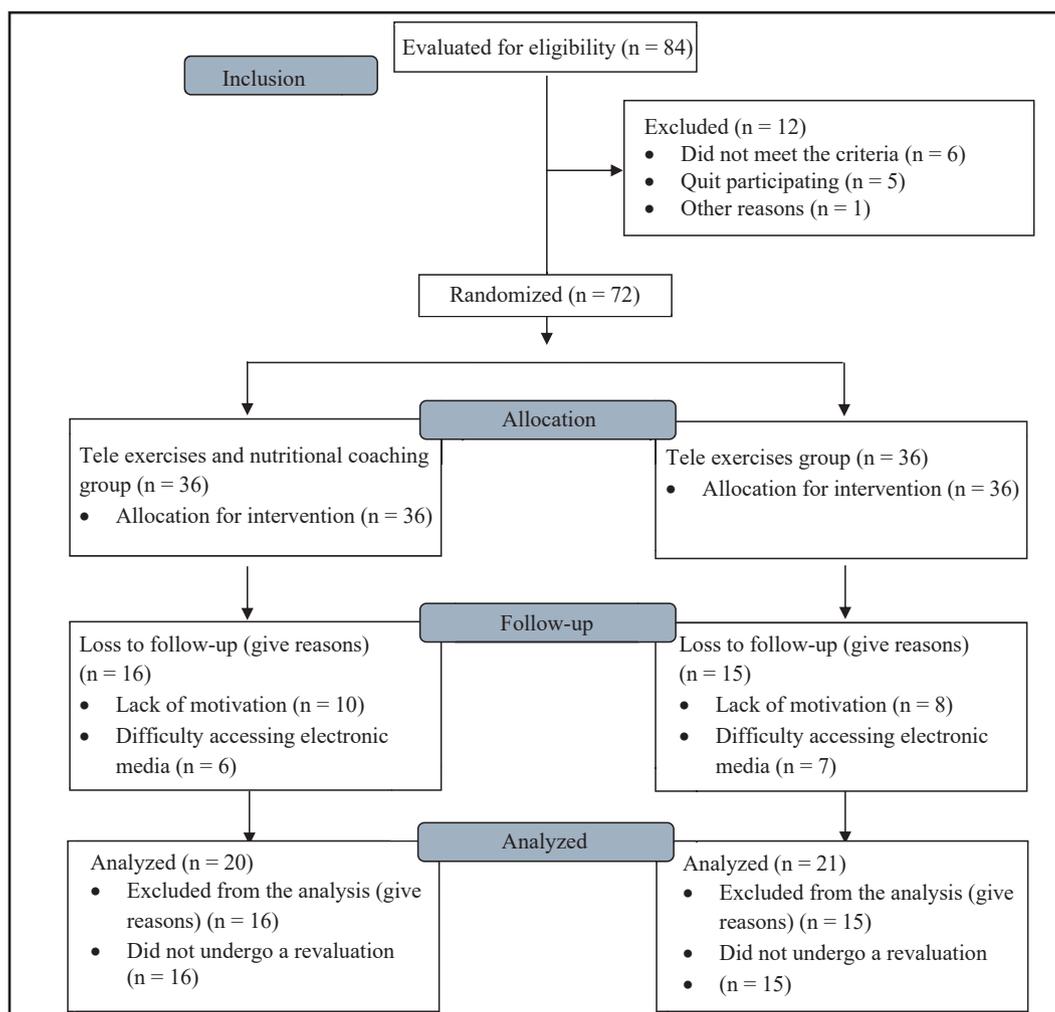
## ISOMETRIC MUSCLE STRENGTH AND DYNAMIC MUSCLE ENDURANCE ASSESSMENT

Following previous recommendations (29), isometric muscle strength was assessed using handgrip (TKK 5101, Takei Physical Fitness Test®, Tokyo, Japan) and lumbar (TKK 5002, Takei Physical Fitness Test®, Tokyo, Japan) dynamometers, with capacities of 100 and 300 kgf, respectively. Three attempts lasting 3-5 sec each was allowed, with 1 min of passive recovery between each other. The highest values were recorded.

Abdominal and push-up resistance tests were performed according to procedures described elsewhere (30,31) to assess dynamic muscle endurance. For both tests, the maximum number of repetitions achieved in 60 sec was recorded.

## QUALITY OF LIFE

Quality of life was evaluated using the short form-12 (SF-12), a 12-item questionnaire created as a short but valid version of the SF-36. This tool aims to detect clinical and socially relevant differences in health status over time in the general population and all patients (30).



**Figure 1.**  
Flowchart of the participants throughout the study.

**Table I.** Anthropometric and body composition outcomes

Outcomes	TE+NC					TE				
	PRE	POST	ES	$\Delta$ abs	$\Delta$ %	PRE	POST	ES	$\Delta$ abs	$\Delta$ %
Body weight (kg)	89.7 ± 18.0	89.2 ± 18.5	0.03	-0.54	-0.56	87.2 ± 19.4	86.6 ± 18.8	0.03	-0.59	-0.69
Height (cm)	164.0 ± 0.7	164.0 ± 0.7	0.00	0.00	0.00	161.4 ± 8.1	161.4 ± 8.1	0.00	0.00	0.00
BMI (kg/m <sup>2</sup> )	33.3 ± 5.3	33.1 ± 5.4	0.04	-0.20	-0.62	33.4 ± 6.3	33.2 ± 6.2	0.03	-0.22	-0.59
WC (cm)	95.8 ± 12.7	95.9 ± 12.9	0.01	0.15	0.18	95.5 ± 12.6	94.9 ± 12.5	0.05	-0.63	-0.60
AC (cm)	106.2 ± 12.8	105.3 ± 12.7	0.04	-0.87	0.71	106.3 ± 14.0	105.2 ± 13.2	0.08	-1.08	-0.89
Absolute free-fat mass (kg)	50.1 ± 9.2	49.5 ± 9.7	0.06	-0.61	-1.26	48.4 ± 8.0	48.7 ± 7.9	0.04	0.32	0.71
Absolute fat mass (kg)	39.7 ± 11.2	39.2 ± 11.4	0.04	-0.46	-1.17	38.5 ± 13.4	37.9 ± 12.7	0.04	-0.59	-0.73
Body fat percentage (%)	44.8 ± 4.1	44.4 ± 4.2	0.06	-0.34	---	44.0 ± 5.9	43.3 ± 5.8	0.12	-0.72	---

Data are expressed as mean ± standard deviation. BMI: body mass index; WC: waist circumference; AC: abdominal circumference;  $\Delta$ : absolute and relative changes; ES: effect size; TE: tele-exercises group; TE+NC: tele-exercises + nutritional coaching group.

## TE PROGRAM

TE was carried out online by a certified personal trainer three times a week, with participants staying at their own houses. Exercises during the sessions included body weight as well as the adaptation of materials from the daily routine (e.g., broom, shopping bags, water bottles). The instructor interacted to correct gesture, and to promote exercise progression, dynamism and empathy, aiming at participant adherence. The classes were transmitted on YouTube through a private link. Possible doubts regarding the materials and adequate clothes were solved through a private WhatsApp group message between the researchers, the personal trainers, and the participants. All the TE sessions started with a general warm-up consisting of a 3-min walk, followed by a 3-min stretching period for both the upper and lower body. Afterward, the main exercises followed, which remained the same during the 8-week intervention. Most TE was performed using the participants' body weight as resistance, and all exercises were performed with three sets. The TE sessions included three exercises for the lower body (i.e., squat, lunge, hip thrust), four exercises for the upper body (i.e., lateral shoulder raise [using water bottles], chest press on the wall, push-ups, triceps bench dip), one exercise for abdominal muscles (i.e., plank), and one exercise for cardiorespiratory fitness (i.e., rope jumping). Exercise sets consisted of 30 sec of active movement interspersed with 30 sec of rest in the first 4 weeks, and these should be performed with a rating of perceived exertion (RPE) of 4-6 a.u., based on the modified RPE scale (30). In the last 4 weeks of training, participants performed 40 seconds of active movement in each set interspersed by 20 seconds of rest, while maintaining the RPE between 7-9 a.u. (31). The TE sessions were completed with a cool-down, consisting of a 3-min walk followed by a 3-min stretching period for the upper and lower body.

## NC APPROACH

The NC approach was carried out by two dietitians certified by the Brazilian Coaching Association. The NC sessions were conducted online, once a week, and are detailed elsewhere (19). Briefly, the sessions included general coaching strategies and tools, such as motivational interviewing, decisional balance, positive psychology, ambivalence, nonviolent communication, mindfulness, setting of short-term goals, and strategies to change habits. No diet was prescribed by the dietitians, and they were not involved in any other procedure related to the current investigation. The size and quantity of food portions, the amount of fat in the diet, and the consumption of fruits and vegetables were analyzed by the dietitians through three 24-h dietary recalls.

## STATISTICAL ANALYSIS

Data are presented as mean  $\pm$  standard deviation. The presence of outliers was visually inspected, while the sphericity and

normality of the data were checked using the Mauchly test and Shapiro-Wilk test, respectively. A two-way mixed model with "Group" (TE and TE+NC) and "Time" (PRE and POST) as fixed factors was used to analyze the intervention effect. Participants were then random factors in all the comparisons. A Tukey post-hoc test was performed whenever a significant F-value was obtained. An unpaired t-test was employed to compare potential between-group differences at the PRE and the between-group absolute (i.e., POST-PRE) and relative changes. Cohen's *d* was calculated to estimate the difference of effect size between two means (32), with the following qualitative descriptors:  $< 0.2$ , negligible effect;  $0.2-0.39$ , small effect;  $0.40-0.75$ , moderate effect; and  $> 0.75$ , large effect. Data were analyzed using the SAS statistical software (v.9.3; SAS Institute, North Carolina, USA), with statistical significance set at  $p \leq 0.05$ .

## RESULTS

### ANTHROPOMETRIC AND BODY COMPOSITIONS OUTCOMES

No between-group differences were observed at PRE for all the anthropometric and body composition outcomes (Table I) (all  $p > 0.05$ ). Similarly, no significant main time or group effect (all  $p > 0.05$ ) was observed (Table I). No significant between-group differences were detected for the absolute or relative changes in the anthropometric and body composition outcomes.

### EXERCISE CAPACITY

No between-group differences were observed at PRE for the exercise capacity outcomes (Table II) (all  $p > 0.05$ ). A significant main time, but no group, effect was detected for isometric grip strength in both the right ( $p = 0.0006$  and  $p = 0.901$ , respectively) and left hand ( $p = 0.0006$  and  $p = 0.659$ , respectively), lumbar isometric strength ( $p = 0.006$  and  $p = 0.369$ , respectively), flexibility ( $p < 0.0001$  and  $p = 0.285$ , respectively), and total number of repetitions performed during the abdominal ( $p < 0.0001$  and  $p = 0.872$ , respectively) and push-up resistance tests ( $p = 0.004$  and  $p = 0.261$ , respectively). A significant main time ( $p = 0.003$ ), but no group, effect ( $p = 0.596$ ) was also shown for  $VO_{2peak}$ , wherein a significant decrease was detected in the TE+NC group ( $p = 0.007$ ) but not in the TE group ( $p = 0.801$ ) (Table II). No significant between-group differences were detected for the absolute or relative changes in any of the exercise capacity outcomes.

### SF-12, EATING BEHAVIOR, INTERVENTION ADHERENCE, AND ADVERSE EVENTS

The SF-12 score did not significantly differ between the groups across the study (all comparisons,  $p > 0.05$ ). Similar-

**Table II. Exercise capacity outcomes**

Outcomes	TE+NC					TE				
	PRE	POST	ES	$\Delta$ abs	$\Delta$ %	PRE	POST	ES	$\Delta$ abs	$\Delta$ %
Sit-and-reach (cm)	21.3 ± 8.9	24.5 ± 7.8*	0.38	3.24	25.18	24.3 ± 9.1	27.2 ± 7.8*	0.34	2.88	24.23
Right handgrip (kg)	28.9 ± 5.7	31.0 ± 6.8*	0.25	1.76	5.73	28.8 ± 6.0	30.6 ± 7.4*	0.31	1.79	7.02
Left handgrip (kg)	28.3 ± 6.3	30.1 ± 7.5*	0.27	2.07	7.04	27.5 ± 5.4	29.3 ± 6.2*	0.28	1.88	6.74
Lumbar traction (kg)	69.7 ± 18.7	74.3 ± 19.7*	0.17	4.68	8.42	73.9 ± 21.9	81.8 ± 23.4*	0.35	8.90	12.76
Abdominal resistance (reps)	14.8 ± 7.9	19.5 ± 9.1*	0.55	4.74	36.55	14.9 ± 8.2	20.2 ± 6.9*	0.69	5.29	51.41
Push-up resistance (reps)	17.8 ± 6.7	20.2 ± 9.9*	0.28	2.37	23.63	19.1 ± 7.2	23.6 ± 5.5*	0.71	4.57	40.65
VO <sub>2peak</sub> (mL·kg <sup>-1</sup> ·min <sup>-1</sup> )	18.9 ± 3.1	17.5 ± 2.7*	0.36	-1.38	-6.95	17.9 ± 2.4	17.6 ± 3.1	0.12	-0.35	-1.92

Data are expressed as mean ± standard deviation. \*Denotes a significant within-group difference ( $p < 0.05$ ).  $\Delta$ : absolute and relative changes; ES: effect size; TE: tele-exercises group; TE+NC: tele-exercises + nutritional coaching group.

ly, the size and quantity of food portions, the amount of fat in the diet, and the consumption of fruits and vegetables did not significantly differ between the groups throughout the study (all comparisons,  $p > 0.05$ ). Adherence to the TE program was  $71 \pm 11$  % and  $69 \pm 13$  % in the TE and TE+NC groups, respectively. No adverse events were reported.

## DISCUSSION

Obesity is a significant and rapidly increasing global health issue. It is concomitantly accompanied by an increase in multimorbidity (33), burdening many healthcare systems. Due to the COVID-19 pandemic, it is essential to develop strategies for treating overweight and obesity that observe the imposed social isolation policies. Among the emerging strategies, TE and NC have been receiving attention given their capability to be conducted online and their potential to increase energy expenditure and decrease energy consumption. To the best of the authors' knowledge, no other study had investigated the isolated effects of TE or the combined effects of TE and NC on health-related parameters of overweight/obese individuals. Our results showed that most exercise capacity outcomes improved after TE. Conversely, quality of life, body composition, and anthropometric measures TE were not affected by TE, and NC did not have any additional effect on these measures.

Using information and communication technologies to provide cost-effective and flexible healthcare services across geographic, time, and economic barriers (12), TE has emerged as an alternative to conventional, face-to-face, and hands-on exercise services for increasing energy expenditure during the COVID-19-induced social isolation. While this tool has been receiving increasing attention among fragile populations (12,20), little is known about

its therapeutic efficacy in overweight/obese individuals. The most evident finding in our study (i.e., improved flexibility, isometric muscle strength, and dynamic muscle endurance) might have resulted from the greater amount of time spent on exercise volume for the resistance (~ 25 min per session) and stretching (~ 6 min per session) exercises in our TE program. On the other hand, the lack of improvement in VO<sub>2peak</sub> may have been due to the small amount of time spent on the cardiorespiratory aspect (~ 6 min per session), the difficulty associated with the lack of space to do the cardiorespiratory exercises at home, or the non-specificity of the test used to assess the VO<sub>2peak</sub>. Intriguingly, the improvement in most exercise capacity outcomes did not translate into improvements in the participants' perceived quality of life. It is possible that SF-12 may not have enough sensitivity to detect small effects on this outcome resulting from online exercise interventions, although this remains elusive. Finally, TE did not affect the anthropometric and body composition outcomes. This might be explained by the employed training intensity, that despite having been progressively increased throughout the intervention, may not have been sufficiently high to promote large energy expenditures, and consequently, substantial anthropometric and/or body composition changes. The adequate progression of intensity and volume in TE programs remains unelucidated. Despite of the lack of reduction in body weight and fat in the current study, it must be borne in mind that such variables did not increase. In this direction, recent evidence has shown a natural tendency to weight gain during the lockdown (34), which is supported by epidemiological studies reporting weight increases in 48.6 % of their sample (3,533 participants) during the lockdown period (35). Thus, although the present design did not include a control group (i.e., without any intervention) to confirm this hypothesis, the weight maintenance could be seen as a positive outcome considering the context of the COVID-19 pandemic.

Despite being a promising strategy, it should be noted that TE interventions have varying acceptability among different populations and regions worldwide. In this sense, less emphasis has been laid on reporting its feasibility, such as the specific reasons for withdrawal from the intervention and adverse events (36). In our study, despite the absence of adverse events, some participants withdrew from the study due to difficulty in accessing and operating the electronic media, while others withdrew due to lack of motivation to continue. Therefore, identifying the factors affecting adherence to remote exercise interventions and using easier/more accessible tools to participants seems to be a key point for improving engagement in TE programs and achieving greater benefits in health-related parameters.

The use of health coaching, from which NC is derived, is widespread and appears to be ever-increasing. Supporting this notion, a study commissioned by the International Coaching Federation reported that the total number of professional coach practitioners worldwide was ~ 53,300, most of these located in higher-income regions. In addition, the US estimated market value for personal coaching was \$1.02 billions (37). In the present investigation, we showed that eating behaviors did not significantly change in the TE+NC group, contradicting the emerging evidence on NC's efficacy for treating overweight/obesity (16-19). While one could argue against the short duration of the NC approach in our study, our findings are in line with recent meta-analytic data showing a trivial effect of self-reported health coaching strategies for weight loss (38). It is noteworthy that the quality of evidence supporting weight loss in this recent meta-analysis was very low, and studies were deemed to have a high risk of bias, highlighting the need for higher quality research in this area before making any kind of recommendation (38). Therefore, based on our findings and available evidence, health coaching interventions still do not have scientific support for their practice as healthcare interventions.

Our study has limitations. First, recent systematic reviews concluded that interventions provided exclusively online aimed at changing behavior, such as those included in the present examination, led to clinically small benefits when performed in a short period (39). Hence, the lack of benefits on the anthropometric and body composition measures and the small magnitude of effect size on the exercise capacity outcomes in the present study may be due to the short duration of the interventions, reinforcing the need for more extended duration studies for the therapeutic potential of online interventions. Second, all tests included in this research were chosen for their clinical applicability in larger populations and their ability to simulate the real-world conduct of dietitians and fitness/personal trainers. However, despite the methodological precautions adopted in each of the tests, we recognize that some were the gold standard, making them partially susceptible to measurement errors/variations. Therefore, future studies examining the therapeutic efficacy of online interventions should employ gold-standard methods to verify small but clinically meaningful effects. Finally, it was not possible to perform blood collections and laboratory analyses of metabolic and cardiovascular health outcomes, such as fasting blood glucose, insu-

lin, and lipid profiles, which are generally altered in overweight/obese individuals. Future studies must employ these analyses to widely explore the therapeutic effects of TE programs in overweight/obese individuals.

## CONCLUSION

In conclusion, 8 weeks of TE for overweight and obese women effectively improved exercise capacity but did not impact quality of life and anthropometric or body composition-related outcomes. Nonetheless, before recommending TE for overweight/obese individuals, our results call the need for more studies examining the long-term efficacy of TE, how the modulation of its prescription-related variables may influence its therapeutic effects, and the real effect of TE on gold-standard body composition methods. Moreover, no additive effect was detected when NC was combined with TE. As such, the current results do not support the use of NC strategies for improving health-related parameters.

## REFERENCES

1. Roser M, Ritchie H. Obesity - Our World in Data. [Accessed on 12 December, 2021]. Available from: <https://ourworldindata.org/obesity>
2. Finucane MM, Stevens GA, Cowan MJ, Danaei G, Lin JK, Paciorek CJ, et al. National, regional, and global trends in body-mass index since 1980: systematic analysis of health examination surveys and epidemiological studies with 960 country-years and 9.1 million participants. *Lancet* 2011;377(9765):557-67. DOI: 10.1016/S0140-6736(10)62037-5
3. Tomlinson DJ, Erskine RM, Morse CI, Winwood K, Onambélé-Pearson G. The impact of obesity on skeletal muscle strength and structure through adolescence to old age. *Biogerontology* 2016;17(3):467-83. DOI: 10.1007/s10522-015-9626-4
4. Bittencourt A dos S, Silva Vieira PA, Catarino Ferreira MC, Primo LL, Nara Deiro T, Roberto Avelino P, et al. The Impact of Overweight on Flexibility and Functional Capacity. *J Nov Physiother* 2017;07(06). DOI: 10.4172/2165-7025.1000368
5. Poirier P, Giles TD, Bray GA, Hong Y, Stern JS, Pi-Sunyer FX, et al. Obesity and Cardiovascular Disease: Pathophysiology, Evaluation, and Effect of Weight Loss. *Circulation* 2006;113(6):898-918. DOI: 10.1161/CIRCULATIONAHA.106.171016
6. Flegal KM, Kit BK, Orpana H, Graubard BI. Association of All-Cause Mortality With Overweight and Obesity Using Standard Body Mass Index Categories. *JAMA* 2013;309(1):71-82. DOI: 10.1001/jama.2012.113905
7. Klein S, Wadden T, Sugerman HJ. AGA technical review on obesity. *Gastroenterology* 2002;123(3):882-932. DOI: 10.1053/gast.2002.35514
8. Fock KM, Khoo J. Diet and exercise in management of obesity and overweight. *J Gastroenterol Hepatol* 2013;28:59-63. DOI: 10.1111/jgh.12407
9. Bolognese MA, Franco CB, Ferrari A, Bennemann RM, Lopes SMA, Bertolini SMMG, et al. Group Nutrition Counseling or Individualized Prescription for Women With Obesity? A Clinical Trial. *Front Public Health* 2020;30(08)127. DOI: 10.3389/fpubh.2020.00127
10. Popkin BM, Du S, Green WD, Beck MA, Algaith T, Herbst CH, et al. Individuals with obesity and COVID-19: A global perspective on the epidemiology and biological relationships. *Obes Rev* 2020;21(11). DOI: 10.1111/obr.13128
11. Ali AM, Kunugi H. COVID-19: A pandemic that threatens physical and mental health by promoting physical inactivity. *Sport Med Heal Sci* 2020;2(4):221-3. DOI: 10.1016/j.smhs.2020.11.006
12. Hong J, Kim J, Kim SW, Kong H-J. Effects of home-based tele-exercise on sarcopenia among community-dwelling elderly adults: Body composition and functional fitness. *Exp Gerontol* 2017;87:33-9. DOI: 10.1016/j.exger.2016.11.002

13. Olsen JM. Health Coaching: A Concept Analysis. *Nurs Forum* 2014;49(1):18-29. DOI: 10.1111/nuf.12042
14. Chen JJ, Cooper DM, Haddad F, Sladkey A, Nussbaum E, Radom-Aizik S. Tele-Exercise as a Promising Tool to Promote Exercise in Children With Cystic Fibrosis. *Front Public Health* 2018;6:269. DOI: 10.3389/fpubh.2018.00269
15. Giménez Sánchez J, Fleta Sánchez Y, Meya Molina A. Coaching nutricional para la pérdida de peso. *Nutr Hosp* 2016;33(1):135-47. DOI: 10.20960/nh.20
16. Dayan PH, Sforzo G, Boisseau N, Pereira-Lancha LO, Lancha AH. A new clinical perspective: Treating obesity with nutritional coaching versus energy-restricted diets. *Nutrition* 2019;60:147-51. DOI: 10.1016/j.nut.2018.09.027
17. Mehring M, Haag M, Linde K, Wagenpfeil S, Frensch F, Blome J, et al. Effects of a general practice guided web-based weight reduction program - results of a cluster-randomized controlled trial. *BMC Fam Pract* 2013;14(1):76. DOI: 10.1186/1471-2296-14-76
18. Pearson ES, Irwin JD, Morrow D, Battram DS, Melling CWJ. The CHANGE Program: Comparing an Interactive Vs. Prescriptive Approach to Self-Management among University Students with Obesity. *Can J Diabetes* 2013;37(1):4-11. DOI: 10.1016/j.jcjd.2012.12.002
19. Lancha AH, Sforzo GA, Pereira-Lancha LO. Improving Nutritional Habits With No Diet Prescription: Details of a Nutritional Coaching Process. *Am J Lifestyle Med* 2018;12(2):160-5. DOI: 10.1177/1559827616636616
20. Cheng C-C, Hsu C-Y, Liu J-F. Effects of dietary and exercise intervention on weight loss and body composition in obese postmenopausal women: a systematic review and meta-analysis. *Menopause* 2018;25(7):772-82. DOI: 10.1097/GME.0000000000001085
21. Serés L, Lopez-Ayerbe J, Coll R, Rodríguez O, Vila J, Formiguera X, et al. Increased Exercise Capacity after Surgically Induced Weight Loss in Morbid Obesity. *Obesity* 2006;14(2):273-9. DOI: 10.1038/oby.2006.35
22. Jelliffe DB. The assessment of the nutritional status of the community (with special reference to field surveys in developing regions of the world). *Monogr Ser World Health Organ* 1966;(53):3-271.
23. WHO. Physical status: the use and interpretation of anthropometry. Report of a WHO Expert Committee. *World Health Organization technical report series* 1995[Accessed on 23rd July 2019];(854):1-463. Available from: <https://apps.who.int/iris/handle/10665/37003>
24. Dettwyler KA. Anthropometric standardization reference manual, abridged edition. Edited by Timothy G. Lohman, Alex F. Roche, and Reynaldo Martoli. Champaign, Illinois: Human Kinetic Books; 1991. p. 90. DOI: 10.1002/ajpa.1330920214
25. Miller RM, Chambers TL, Burns SP, Godard MP. Validating InBody® 570 Multi-frequency Bioelectrical Impedance Analyzer versus DXA for Body Fat Percentage Analysis. *Med Sci Sport Exerc* 2016;48:991. DOI: 10.1249/01.mss.0000487979.68551.d7
26. Sergi G, De Rui M, Stubbs B, Veronese N, Manzano E. Measurement of lean body mass using bioelectrical impedance analysis: a consideration of the pros and cons. *Aging Clin Exp Res* 2017;29(4):591-7. DOI: 10.1007/s40520-016-0622-6
27. Cahalin LP, Mathier MA, Semigran MJ, Dec GW, DiSalvo TG. The six-minute walk test predicts peak oxygen uptake and survival in patients with advanced heart failure. *Chest* 1996;110(2):325-32.
28. Wells KF, Dillon EK. The sit and reach—a test of back and leg flexibility. *Res Q Am Assoc Heal Phys Educ Recreat* 1952;115-8. DOI: 10.1080/10671188.1952.10761965
29. Branco BHM, Andreato LV, Ribeiro ED, de Oliveira HG, Almeida FN, Junior NN. Development of tables for classifying judo athletes according to maximal isometric strength and muscular power, and comparisons between athletes at different competitive levels. *Sport Sci Health* 2018;14(3):607-14. DOI: 10.1007/s11332-018-0469-7
30. Wee CC, Davis RB, Hamel MB. Comparing the SF-12 and SF-36 health status questionnaires in patients with and without obesity. *Health Qual Life Outcomes* 2008;6(1):11. DOI: 10.1186/1477-7525-6-11
31. Foster C, Florhaug JA, Franklin J, Gottschall L, Hrovatin LA, Parker S, et al. A new approach to monitoring exercise training. *J strength Cond Res* 2001;15(1):109-15.
32. Cohen J. *Statistical Power Analysis*. *Curr Dir Psychol Sci* 1992;1(3):98-101.
33. Agborsangaya CB, Ngwakongni E, Lahtinen M, Cooke T, Johnson JA. Multimorbidity prevalence in the general population: the role of obesity in chronic disease clustering. *BMC Public Health* 2013;13(1):1161. DOI: 10.1186/1471-2458-13-1161
34. Zachary Z, Brianna F, Brianna L, Garrett P, Jade W, Alyssa D, et al. Self-quarantine and weight gain related risk factors during the COVID-19 pandemic. *Obes Res Clin Pract [Internet]* 2020;14(3):210-6. DOI: 10.1016/j.orcp.2020.05.004
35. Di Renzo L, Gualtieri P, Pivari F, Soldati L, Attinà A, Cinelli G, et al. Eating habits and lifestyle changes during COVID-19 lockdown: an Italian survey. *J Transl Med* 2020;18(1):229. DOI: 10.1186/s12967-020-02399-5
36. Saito T, Izawa KP. Effectiveness and feasibility of home-based telerehabilitation for community-dwelling elderly people in Southeast Asian countries and regions: a systematic review. *Aging Clin Exp Res* 2021;(10):2657-69. DOI: 10.1007/s40520-021-01820-3
37. Webwire. U.S. Personal Coaching Market Worth \$1 Billion; 2018 [Accessed on 20th August, 2020].
38. Sieczkowska SM, de Lima AP, Swinton PA, Dolan E, Roschel H, Gualano B. Health Coaching Strategies for Weight Loss: A Systematic Review and Meta-Analysis. *Adv Nutr* 2020;(4):1449-60. DOI: 10.1093/advances/nmaa159
39. Beilegoli A, Andrade AQ, Diniz MDF, Ribeiro AL. Personalized Web-Based Weight Loss Behavior Change Program With and Without Dietitian Online Coaching for Adults With Overweight and Obesity: Randomized Controlled Trial. *J Med Internet Res* 2020;22(11):e17494. DOI: 10.1093/advances/nmaa159