RESEARCH ARTICLE

REVISED The effects of telenutrition in overweight and obese adults in a nutritional center in Lima, Peru. [version 2; peer review: 2 approved]

Carolina Castrillón Liñan [1,2], Jimy Henry Alvarez Mayorga[3], Michelle Lozada-Urbano[4]

[1]Universidad Nacional Mayor de San Marcos, Av Carlos Germán Amezaga # 375, Cercado de Lima, Lima, 15081, Peru
[2]Centro Nutricional Allikay, Calle de las Artes Norte 269A, San Borja Lima, 15037, Peru
[3]Facultad de Medicina Humana, Universidad Peruana Cayetano Heredia, Av Honorio Delgado # 430, San Martín de Porres, Lima, 15102, Peru
[4]South American Center for Education and Research in Public Health, Universidad Privada Norbert Wiener, Av. Arequipa # 444, Cercado de Lima, 15046, Peru

Abstract

Background: COVID-19 pandemic has been challenging for health services and systems around the world, including Peru. A viable alternative in the telemedicine field to guarantee patient nutritional care is telenutrition. Telenutrition involves the interactive use of electronic information and telecommunications technologies to implement the nutrition care process with patients at a remote location. Information regarding the experience with this methodology and its potential effect on patients' nutritional goals, does not exist in Peru. The aim of the study was to report the effect of the evaluation type (telenutrition vs. in-person) on weight, body mass index (BMI), waist circumference (WC) and relative fat mass (RFM) in overweight and obese adult patients. **Methods:** This retrospective study included 100 eligible patients in a single nutritional center, from January 2019 to March 2021. Telenutrition and in-person continuous variables were compared with independent sample t-test or U Mann-Whitney test. **Results:** There were significant differences in weight, BMI, WC and RFM by the end of follow-up period, in both evaluation modalities. Patients on the telenutrition group had a mean decrease of 6.80 ± 4.87 cm in WC, whereas the mean difference observed for the in-person group was 6.74 ± 4.55 cm. There were no significant differences in the changes of any anthropometric parameters when comparing both systems. Reductions were observed in weight (5.93 ± 3.88 kg vs. 4.92 ± 3.29 kg), BMI (2.23 ± 1.39 kg/ m2 vs. 1.83 ± 1.23 kg/ m2), WC (6.80 ± 4.87 cm vs. 6.74 ± 4.55 cm) and RFM (2.43 ± 1.78 vs. 2.63 ± 1.73) in telenutrition and in-person

evaluation, respectively by the end of the follow-up period.

Conclusions: Telenutrition may be regarded as an alternative to in-person evaluation offering anthropometric changes and nutritional goals similar to those reported through the in-person modality, in overweight and obese adult people.

Keywords

Overweight, Obesity, Telemedicine, Waist Circumference, Nutrition Assessment

---

Corresponding author: Michelle Lozada-Urbano (michelle.lozada@uwiener.edu.pe)

How to cite this article: Castrillón Liñan C, Alvarez Mayorga JH and Lozada-Urbano M. **The effects of telenutrition in overweight and obese adults in a nutritional center in Lima, Peru. [version 2; peer review: 2 approved]** F1000Research 2021, **10**:545 https://doi.org/10.12688/f1000research.53564.2

First published: 07 Jul 2021, **10**:545 https://doi.org/10.12688/f1000research.53564.1

REVISED Amendments from Version 1

The revised version of this manuscript addresses comments and suggestions that were pointed out by the reviewers. The updates are meant to improve the report and are as follows:

1. Abstract: Statistical analysis information updated.
2. Overall manuscript: Clarification on the retrospective nature of the study.
3. Methods: Allocation clarification given the study design.
4. Methods: Added information regarding the nutritional plan and monitoring.
5. Methods: Clarification on outlier management.
6. Methods: Complementary information on level of education data.
7. Results: Tables formatting and corresponding text updated accordingly. No results have been eliminated, just redistributed.
8. Discussion: Additional information on the potential explanations for the findings.
9. Discussion: Complementary information on the WC changes.
10. Discussion: Complementary information on the clinical role of RFM parameter.
11. Discussion: Complementary information on the confounders potential effect.
12. Discussion: Additional information on the strengths of the study.

Any further responses from the reviewers can be found at the end of the article

Introduction

Clinical practice has gone through adaptative processes during the COVID-19 pandemic due to isolation and social distancing policies to reduce virus transmission. Telemedicine, a discipline that has been developing for many years,[1] provides an alternative to ensure continued patients' access to health services, while minimizing the risks for health workers.[2]

Telehealth is the use of electronic information and telecommunication technology to facilitate clinical healthcare and patient education remotely. Whereas telenutrition is defined as a modality of Telehealth that provides an opportunity for a registered dietitian nutritionist to implement patients' nutritional care remotely.[3]

Studies in Western China have shown that telemedicine practices are feasible, acceptable, effective and improves health care outcomes,[4] by providing the healthcare worker with information about the patient's surroundings and how homecare is maintained. In New Mexico, USA, telemedicine-related barriers were identified through a survey that included 2016 nutrition professionals.[5] In this study, 29% of the professionals reported lack of client interest, 26% reported not having internet access, and 28% mentioned not being able to perform client assessment or monitor activities by this modality. In regard to the benefits of telemedicine, 66% of the professionals stated that it contributed to social distancing compliance, while 50% acknowledged the flexibility in arranging appointments.[5]

Australian nutrition professionals regard telehealth evaluations as profitable and well-received by patients. They report that this practice improved healthcare access for people with chronic diseases.[6]

Regarding potential obstacles in telenutrition practices, anthropometric parameters are key for nutritional assessment and are widely discussed when comparing this modality to in-person evaluation. It is known that standard anthropometric assessment involves direct contact, however, there is evidence that self-reported weight and height measurements may have adequate precision.[7] Besides, reports state that self-reported WC measurement may be reliable in cases where scales are not available.[8,9] Precise measurement can be achieved by providing video instructions for the patient.[10,11]

In Lima, Peru we are facing these challenges as well. In 2020, the Allikay nutritional center started providing virtual appointments for nutritional care to patients, guaranteeing safe conditions based on the COVID-19 pandemic-related recommendations. There is no information regarding the impact of this modality on the patients' nutritional status measured by anthropometric parameters in Lima, Peru. The aim of this study was to report the effect of the evaluation type (telenutrition vs. in-person) on anthropometric parameters such as weight, body mass index (BMI), waist circumference (WC) and relative fat mass (RFM), in overweight and obese adult patients in a nutritional center in Lima.

Methods

This is an observational retrospective study that took place between January 2019-March 2021. This study included overweight and obese patients that were assessed by a Registered Dietitian Nutritionist through in-person or virtual appointment, in a nutritional center in Lima. At the moment of the study conception and design, this data had been already generated as part of standard clinical practice and procedures at the nutritional center, which makes this a secondary data analysis.

The samples were obtained through a non-probability convenience sampling. Due to the type of sampling, it is acknowledged that bias is possible and considering this, authors recommend caution when interpreting results in terms of generalization. The final sample size was 100 patients which was arrived by assessing eligibility in every patient evaluated during the established study period (January 2019-March 2021). There were 50 patients evaluated with telenutrition and 50 with in-person assessment. Since this is a secondary analysis, no prospective allocation strategy and no specific eligibility criteria for the allocation was applied. At the moment of the study, there had already been patients evaluated through both modalities and data from those evaluations generated. This study included overweight or obese males and females aged 18 years and older, who had both their baseline and three-month assessment data available. Overweight (BMI $\geq$ 25) and obesity (BMI $\geq$ 30) was defined as proposed by the World Health Organization (WHO).[12] Patients that had bariatric surgery before the recruitment period or were on weight-loss medication at the time of the recruitment, were excluded. All anthropometric parameters were collected twice, at baseline and during the three-month follow-up measurements.

Assessment modalities were either in-person or by telenutrition. The in-person appointment starts with a thorough examination of food habits including two nutritional questionnaires: food consumption frequency and 24-hour dietary recall (Extended data: https://doi.org/10.6084/m9.figshare.14832345.v2).[13]

Height measurement is self-reported, WC measurement is performed by the nutritionist following standard procedures (middle area between the lower edge of the rib cage and the upper edge of the iliac crest) with a Lufkin measurement tape. Weight measurement was taken by the Inbody 120 scale.[14] Body fat percentage was calculated with the use of the following RFM formula described by Woolcott OO and Bergman RN:[15]

Male adults: $64-(20 \times$ (height cm/waist circumference (cm))

RFM $\geq$ 22.8 for obesity in males.

Female adults: $76-(20 \times$ (height cm/waist circumference cm))

RFM $\geq$ 33.9 for obesity in females.

Once the anthropometric data is taken, the nutritionist creates a personalized nutritional plan adapted to the patients' nutritional status, food habits and preferences. The nutritional plan was developed based on the patient information on health status, food habits, consumption frequency and attitude towards food obtained during the baseline assessment. Then a set of nutritional goals for the short and long term are established and agreed. The nutritional plan is individualized and provided after every assessment, it includes 10 menu options for the next twenty days with the following macronutrient distribution: 50% of carbohydrates, 20% of proteins and 30% of fat. During the following evaluation a new nutritional plan (same macronutrient distribution) was developed according to the goal achievements. The patients' indicators that were monitored during the evaluations for both modalities were: weight, WC, BMI and RFM. The follow-up and monitoring are performed through e-mail or by the multimedia messaging application (WhatsApp), once a week. The monitoring was performed through weekly WhatsApp messaging by questioning about plan adherence and providing reminders for weight and WC weekly measurements and reporting. The weekly WhatsApp message started with: "Good day, I hope you are fine. How are you feeling regarding the nutritional plan these past few days? Please let me know". A new nutritional plan was provided when the weekly weight loss was below 500 g or the reduction in WC was below 0.2 cm, this updated nutritional plan included a carbohydrate reduction to 30 g per day. This procedure was conducted every week until the next in-person or telenutrition assessment. Standard follow-up appointments are performed every 20 days. The three-month follow up assessment includes WC, weight measurements and RFM.

Telenutrition assessment starts one day before the actual appointment by sending an infographic that includes fasting anthropometric measurement instructions to the patient based on the local recommendations.[14] This is done in order to standardize weight and WC measurements for remote assessments (Figure 1). During the appointment, height value is self-reported and the nutritionist requests the self-measured values (weight and WC) for the RFM calculation. Following this, the nutritional plan adapted to the patients' nutritional status, food habits and preferences is sent to the patient by e-mail. The follow-up and monitoring are once a week and it is done by e-mail or WhatsApp. Standard follow-up appointments are performed every 20 days. The three-month follow -up assessment includes self-reported WC, weight measurements and RFM calculation.

Data analysis
Data analysis was performed with the use of Stata/SE 12.0 for Windows (https://www.stata.com/). Continuous variables were examined for outliers with graphic (box plot) and analytic techniques (interquartile ranges). There were three

Figure 1. Infographic for subjects. Source: created por Castrillón-Liñán C. based on Aguilar Esenarro L, Contreras Rojas M, Del Canto y Dorador J, Vílchez Dávila W. Guía técnica para la valoración nutricional antropométrica de la persona adulta [Internet]. Instituto Nacional de Salud; 2012. Disponible en: https://repositorio.ins.gob.pe/handle/INS/225.

patients in the telenutrition group that showed atypical values in baseline weight (one patient) and follow-up weight (two patients). Once it was confirmed that values were not originated from errors, the decision to handle them during the inference statistical analysis included the use of non-parametric statistical tests (Wilcoxon Rank-sum test or U Mann-Whitney test). Normality was assessed with graphic (histograms) and analytic techniques for skewness and kurtosis (Shapiro Wilk test). For univariate analysis, continuous variables were described with means and standard deviations or medians and ranges. Categorical variables were reported as frequencies. For bivariate analysis, baseline and follow-up continuous variables were compared with paired-samples t-test or Wilcoxon Rank-sum test. Telenutrition and in-person continuous variable values were compared with independent samples t-test or U Mann-Whitney test. Categorical variables were compared with the chi-square test. P-value < 0.05 is considered statistically significant.

Dataset created and analyzed for the study is available as underlying data: https://doi.org/10.6084/m9.figshare.14710296.v1.[16]

Ethical considerations

This study was conducted according to the Declaration of Helsinki principles. Patients were deidentified by being assigned to code numbers, without any reference to the patient information, therefore keeping the data confidential. Patient information was only accessible to the Registered Dietitian Nutritionist who evaluated the patients. Informed consent was not needed for this retrospective study as the data had been anonymized and this was confirmed by the Ethics Committee which approved the study. Ethical approval was obtained from the Institutional Ethics Committee for Research of the Norbert Wiener University with Exp. No 526-2021.

Results

Mean baseline BMI was in the obesity range (31.91 ± 5.53 and 30.36 ± 4.35 kg/m^2 for telenutrition and in-person group respectively) (Table 1).

The baseline weight, BMI and WC values were not statistically different between the two assessment groups. However, significant differences were observed in the mean baseline RFM (41.03 ± 5.30 vs. 37.85 ± 6.53) between the assessment groups (Table 1).

Significant differences between baseline and three-month follow-up weight, BMI, WC and RFM within the assessment groups ($p = 0.0000$) were identified, the greatest difference reported was in WC, which decreased by 6.80 ± 4.87 cm and 6.74 ± 4.55 cm in telenutrition and in-person assessment, respectively (Table 2).

Table 1. Clinical and anthropometric characteristics according to the assessment group.

Variables	Telenutrition (n = 50)	In-person assessment (n = 50)	p
Sex Men Women	 8 (16%) 42 (84%)	 15 (30%) 35 (70%)	0.096
Age (years)	40.66 ± 12.69	38.18 ± 10.17	0.2835
Height (cm)	162.72 ± 7.51	164.32 ± 8.59	0.3585
Baseline weight (kg)	84.93 ±18.21	82.22 ± 14.60	0.6994
Baseline BMI (kg/m^2)	31.91 ± 5.53	30.36 ± 4.35	0.1160
Baseline WC (cm)	100.14 ± 14.40	96.30 ± 11.82	0.1482
Baseline RFM	41.03 ± 5.30	37.85 ± 6.53	0.0088

BMI: body mass index, WC: waist circumference, RFM: relative fat mass. Chi square test for sex, U Mann-Whitney test for baseline height, weight and BMI, T-Student test for age, baseline WC and RFM. P < 0.05.

Table 2. Anthropometric parameters for subjects evaluated by assessment group.

Variables	Telenutrition (n = 50)			In-person assessment (n = 50)		
	Baseline assessment	Follow-up assessment	p	Baseline assessment	Follow-up assessment	p
Weight (kg)	84.93 ± 18.21	79.00 ± 16.62	0.0000	82.22 ± 14.60	77.30 ± 13.95	0.0000
BMI (kg/m^2)	31.91 ± 5.53	29.68 ± 5.02	0.0000	30.36 ± 4.35	28.53 ± 4.12	0.0000
WC (cm)	100.14 ± 14.40	93.34 ± 13.39	0.0000	96.30 ± 11.82	89.56 ± 11.30	0.0000
RFM	41.03 ± 5.30	38.60 ± 5.53	0.0000	37.85 ± 6.53	35.23 ± 6.73	0.0000

BMI: body mass index, WC: waist circumference, RFM: relative fat mass. Wilcoxon Rank-sum test for weight and BMI, T-Student test for WC and RFM. P < 0.05.

Table 3. Difference in anthropometric parameters according to assessment group.

Variables	Telenutrition change	In-person assessment change	p
Weight (kg)	5.93 ± 3.88	4.92 ±3.29	0.1641
BMI (kg/m^2)	2.23 ± 1.39	1.83 ± 1.23	0.1265
WC (cm)	6.80 ± 4.87	6.74 ± 4.55	0.9510
RFM	2.43 ± 1.78	2.63 ± 1.73	0.5741

BMI: body mass index, WC: waist circumference, RFM: relative fat mass. Wilcoxon Rank-sum test for weight and BMI, T-Student test for WC and RFM. P < 0.05.

In regard to the change in the magnitude of the anthropometric parameter values between the assessment groups, no significant differences were identified for any parameter. Weight (5.93 kg and 4.92 kg), BMI (2.23 kg/m^2 and 1.83 kg/m^2), WC (6.80 cm and 6.74 cm), and RFM (2.43 and 2.63) reductions were similar in both telenutrition and in-person assessment, respectively (Table 3).

Discussion

This study was designed to examine variations in the anthropometric parameters of overweight and obese adults treated in a private nutritional center where telenutrition was additionally implemented. The results showed that weight loss was statistically significant in both groups, with no difference in the variation by the three-month follow-up evaluation. Weight loss is a key factor in reducing non-communicable disease risk and COVID-19 complications, the fact that this nutritional goal is achieved through both assessment modalities, offers the patient a viable alternative for health maintenance.

Significant changes in weight, WC, BMI and RFM were observed within each assessment modality in our study. However, comparing the changes in these anthropometric measures between these two assessment modalities, no

significant difference in these values was identified. Kuzmar IE et al., reported similar results, with no significant differences in weight loss, BMI and waist-to-height ratio (WHtR), when comparing the in-person assessment to telenutrition, in obese women.[17]

Other studies have identified significant changes in anthropometric parameters, such as Huang et al., who had assessed overweight and obese patients with non-communicable diseases by using telenutrition and observed a significant BMI decrease.[18] Whereas Beleigoli et al., used a web-based software with patient feedback for 24 weeks in overweight and obese patients in comparison to non-technological interventions to assess weight loss and lifestyle changes, and indicated improvement in food consumption habits, user adherence and significant weight loss.[19] Likewise, Ventura Marra et al., in a randomized study in cardiovascular patients observed a significant weight loss in a similar follow-up period of 12 weeks, 4.92 ± 3.29 kg and 5.93 ± 3.88 kg for in-person modality and telenutrition, respectively.[20] In five American clinics, a randomized study examined pregnant women to prevent excessive weight gain and promote healthy behavior by comparing telehealth strategies to traditional assessment. Pregnant women assessed traditionally showed an average weekly gestational weight loss of 0.26kg, in comparison to 0.32kg in the telehealth group (the mean difference between the two groups was 0.07 kg per week, CI 95%: -0.09 to -0.04).[21]

A study that compared video conference health coaching with a focus on physical activity and weight management, to in-person modality for adults with high BMI, showed that the intervention group achieved a significantly greater weight loss (8.23 ± 4.5 kg),[22] within 12 weeks.

Another telehealth program for weight loss that used video conferencing for 12 weeks showed a significant difference between the intervention and control groups in body weight (7.16 ± 4.4 vs. $1.5 \pm 4.1\%$, respectively). The significant weight loss was achieved in nine out of 13 individuals (69.2%) in the intervention group compared to one in 12 (8%) in the control group.[23]

Despite the fact that the nature of the telenutrition modality and other not assessed factors as level of education may impact the precision of the remote measurements, a possible explanation for our results could reside on the fact that the level of concern about their own health due to the pandemic may influence their adherence to the recommendations, besides the additional safety advantage associated to the remote evaluation may explain the similar behavior of the nutritional goals in spite of the assessment modality. Moreover, the same dietitian nutritionist and monitoring methodology for the follow-up were involved on both types of assessments. It is important to emphasize that in our study, the greatest decrease obtained in the telenutrition assessment was for WC (mean difference 6.80 ± 4.87 cm), which is an anthropometric index significantly associated with increased risk to cardiovascular and metabolic diseases, as reported in the literature.[24-27]

In spite of the fact that it could be argued that this may be associated with a measurement error due to the remote nature of the assessment, we underscore the fact that we also observed statistically significant reductions in weight and BMI values for this group which makes the original WC decrease plausible since it is expected that a weight loss involves a reduction in WC.

Additionally, this study has included RFM which as an anthropometric parameter has not been extensively examined in Lima, Peru. RFM, is a valuable tool for corporal composition evaluation,[15,28] and for being a great predictor of dyslipidemia and metabolic syndrome.[29] In our study, RFM showed also a significant decrease in both modalities (2.43 ± 1.78 telenutrition vs 2.63 ± 1.73 in-person). Which make it a parameter of interest that could support the nutritional management of patients when assessing and treating metabolic diseases and even preventing potential cardiovascular complications by identifying patients at risk and prompt action with adequate measures.

We consider that local validation initiatives of this parameter may potentially benefit the patient nutritional care. Future studies may address this opportunity.

This study has some limitations, consider the observational and retrospective nature of the study. There may be other variables, such as physical activity, lifestyle changes, previous nutritional consultation or weight-loss concomitant medications, which have not been assessed that could act as confounders. We acknowledge that their potential effects may contribute to the outcome in the parameters assessed besides the sole effect of the evaluation modality. Information on patient's level of education was not available at the time of the study, we acknowledge this is part of the limitations of our study since level of education may impact the ability to understand instructions and conduct the corresponding measurements remotely as recommended. The study was conducted in a private nutritional center and through a convenience sampling strategy which may impact representativity. The follow-up period was three months, so either

stabilization or further variations of the assessed parameters may take place which could be observed with longer follow-up periods.

Our study has some strengths, the fact that nutritional goals can be met despite the assessment modality highlights the fact that the remote evaluable is a feasible option, information that lacking at the local level, furthermore it gives the patient the chance for a safer modality in times of pandemic. Additionally, through the remote use of both questionnaires (consumption frequency and 24-hour dietary recall), we may acknowledge that these tools are applicable and useful through telenutrition. Our study contributes with evidence regarding the applicability of remote anthropometric measurements when associated to standardized remote instructions. Future prospective studies could assess the long-term impact of telenutrition in anthropometric parameters and nutritional health in patients.

Conclusion

In the time of pandemic, telenutrition has become a valuable alternative to nutritional care by reducing the transmission risk through social distancing practices. Telenutrition may well be regarded as a useful tool for current situations such as the COVID-19 pandemic, by offering similar outcomes to those reported as the in-person assessments, while providing ongoing nutritional support to overweight and obese adults in times of isolation and social distancing. Health care providers should attempt to adapt their processes to fulfil the patients' health demands, in order to prevent excessive weight gain and its related comorbidities through interventions like telenutrition.

Data availability statement

Underlying data

Figshare: The effects of telenutrition in overweight and obese adults in a nutritional center in Lima, Peru.

DOI: https://doi.org/10.6084/m9.figshare.14710296.v1.[16]

The project contains the following underlying data:

Database: The data includes baseline and 3-month follow up demographic and anthropometric parameters for overweight and obese adults according to assessment modality (telenutrition vs in-person).

Extended data

Figshare: The effects of telenutrition in overweight and obese adults in a nutritional center in Lima, Peru.

DOI: https://doi.org/10.6084/m9.figshare.14832345.v2.[13]

This project contains the following extended data:

File 1: Consumption Frequency Questionnaire

File 2: 24-hour Dietary Recall Questionnaire

Data are available under the terms of the Creative Commons Zero "No rights reserved" data waiver (CC0 1.0 Public domain dedication): https://creativecommons.org/publicdomain/zero/1.0/.

References

1. Contreras CM, Metzger GA, Beane JD, *et al.*: **Telemedicine: Patient-Provider Clinical Engagement During the COVID-19 Pandemic and Beyond.** *J Gastrointest Surg. julio de.* 2020; **24**(7): 1692–1697. Epub 2020 May 8.
   PubMed Abstract | **Publisher Full Text** | **Free Full Text**

2. World Health Organization: **Using Telehealth to Expand Access to Essential Health Services during the COVID-19 Pandemic [Internet].** 2020.
   Reference Source

3. **Eat Right PRO Academy of Nutrition and Dietetics [Internet].** 2020.
   Reference Source

4. Hong Z, Li N, Li D, *et al.*: **Telemedicine During the COVID-19 Pandemic: Experiences from Western China.** *J Med Internet Res.* 8 de mayo de 2020; **22**(5): e19577.
   PubMed Abstract | **Publisher Full Text** | **Free Full Text**

5. Rozga M, Handu D, Kelley K, *et al.*: **Telehealth During the COVID-19 Pandemic: A Cross-Sectional Survey of Registered Dietitian Nutritionists.** *J Acad Nutr Diet.* enero de 2021; S2212267221000368.
   PubMed Abstract | **Publisher Full Text** | **Free Full Text**

6. Kelly JT, Allman-Farinelli M, Chen J, *et al.*: **Dietitians Australia position statement on telehealth.** *Nutr Diet.* septiembre de 2020; **77**(4): 406–15.
   PubMed Abstract | **Publisher Full Text** | **Free Full Text**

7. Pursey K, Burrows TL, Stanwell P, *et al*.: **How Accurate is Web-Based Self-Reported Height, Weight, and Body Mass Index in Young Adults?** *J Med Internet Res.* 7 de enero de 2014; **16**(1): e4.
    PubMed Abstract | **Publisher Full Text** | **Free Full Text**

8. Spencer EA, Roddam AW, Key TJ: **Accuracy of self-reported waist and hip measurements in 4492 EPIC–Oxford participants.** *Public Health Nutr.* septiembre de 2004; **7**(6): 723–727.
    PubMed Abstract | **Publisher Full Text**

9. Roberts CA, Wilder LB, Jackson RT, *et al*.: **Accuracy of self-measurement of waist and hip circumference in men and women.** *Public Health Nutr.* 1997; **97**(5): 534–536.
    PubMed Abstract | **Publisher Full Text**

10. Elliott WL: **Criterion validity of a computer-based tutorial for teaching waist circumference self-measurement.** *J Bodywork Movement Therapies.* 2008; **12**: 133–145. Epub 2007 Dec 26.
    PubMed Abstract | **Publisher Full Text**

11. McEneaney DF, Lennie SC: **Video instructions improve accuracy of self-measures of waist circumference compared with written instructions.** *Public Health Nutr.* julio de 2011; **14**(7): 1192–1199. Epub 2011 Mar 31.
    PubMed Abstract | **Publisher Full Text**

12. World Health Organization: **Obesidad y sobrepeso [Internet].** 2020.
    Reference Source

13. **Questionnaire Frequency and 24-hour Dietary [Internet].** *Figshare. Castrillón Liñan, Carolina.* 2021 June – [cited 2021 June 623].
    Publisher Full Text

14. Aguilar Esenarro L, Contreras Rojas M, Del Canto y Dorador J, *et al*.: **Guía técnica para la valoración nutricional antropométrica de la persona adulta [Internet].** *Instituto Nacional de Salud* 2012.
    Reference Source

15. Woolcott OO, Bergman RN: **Relative fat mass (RFM) as a new estimator of whole-body fat percentage ─ A cross-sectional study in American adult individuals.** *Sci Rep.* 2018; **8**: 1–11.
    PubMed Abstract | **Publisher Full Text** | **Free Full Text**

16. **Telenutrition and Anthropometric Parameters [Internet] Figshare.** *Castrillón Liñan, Carolina.* 2021 June – [cited 2021 June 6].
    Publisher Full Text

17. Kuzmar IE, Cortés-Castell E, Rizo M: **Effectiveness of telenutrition in a women's weight loss program.** *PeerJ.* 3 de febrero de 2015; **3**: e748. eCollection 2015.
    PubMed Abstract | **Publisher Full Text** | **Free Full Text**

18. Huang J-W, Lin Y-Y, Wu N-Y: **The effectiveness of telemedicine on body mass index: A systematic review and meta-analysis.** *J Telemed Telecare.* 2019; **7**: 389–401. Epub 2018 May 28.
    PubMed Abstract | **Publisher Full Text**

19. Beleigoli AM, Andrade AQ, Cançado AG, *et al*: **Web-Based Digital Health Interventions for Weight Loss and Lifestyle Habit Changes in Overweight and Obese Adults: Systematic Review and Meta-Analysis.** *J Med Internet Res.* 8 de enero de 2019; **21**(1): e298.
    PubMed Abstract | **Publisher Full Text** | **Free Full Text**

20. Ventura Marra M, Lilly C, Nelson K, *et al*.: **Pilot Randomized Controlled Trial of a Telenutrition Weight Loss Intervention in Middle-Aged and Older Men with Multiple Risk Factors for Cardiovascular Disease.** *Nutrients.* 22 de enero de 2019; **11**(2): 229.
    PubMed Abstract | **Publisher Full Text** | **Free Full Text**

21. Ferrara A, Hedderson MM, Brown SD, *et al*.: **A telehealth lifestyle intervention to reduce excess gestational weight gain in pregnant women with overweight or obesity (GLOW): a randomised, parallel-group, controlled trial.** *Lancet Diabetes Endocrinol.* junio de 2020; **8**(6): 490–500.
    PubMed Abstract | **Publisher Full Text**

22. Johnson KE, Alencar MK, Coakley KE, *et al*.: **Telemedicine-Based Health Coaching Is Effective for Inducing Weight Loss and Improving Metabolic Markers.** *Telemed J E Health.* febrero de 2019; **25**(2): 85–92. Epub 2018 May 30.
    PubMed Abstract | **Publisher Full Text** | **Free Full Text**

23. Alencar MK, Johnson K, Mullur R, *et al*.: **The efficacy of a telemedicine-based weight loss program with video conference health coaching support.** *J Telemed Telecare.* abril de 2019; **25**(3): 151–157. Epub 2017 Dec 3.
    PubMed Abstract | **Publisher Full Text**

24. Nicklas BJ, Penninx BW, Ryan AS, *et al*.: **Visceral adipose tissue cutoffs associated wwith metabolic risk factors for coronary heart disease in women.** *Diabetes Care.* mayo de 2003; **26**(5): 1413–1420.
    PubMed Abstract | **Publisher Full Text**

25. Wang Y, Rimm EB, Stampfer MJ, *et al*.: **Comparison of abdominal adiposity and overall obesity in predicting risk of type 2 diabetes among men.** *Am J Clin Nutr.* 2005; **81**: 555–63.
    PubMed Abstract | **Publisher Full Text**

26. Bellido D, López de la Torre M, Carreira J, *et al*.: **Índices antropométricos estimadores de la distribución adiposa abdominal y capacidad discriminante para el síndrome metabólico en población española.** *Clínica e Investigación en Arteriosclerosis.* julio de 2013; **25**(3): 105–109.
    Publisher Full Text

27. Bener A, Yousafzai MT, Darwish S, *et al*.: **Obesity Index That Better Predict Metabolic Syndrome: Body Mass Index, Waist Circumference, Waist Hip Ratio, or Waist Height Ratio.** *J Obes.* 2013: 1–9. Epub 2013 Aug 13.
    PubMed Abstract | **Publisher Full Text** | **Free Full Text**

28. Guzmán-León AE, Velarde AG, Vidal-Salas M, *et al*.: **External validation of the relative fat mass (RFM) index in adults from north-west Mexico using different reference methods.** *PLOS ONE.* 31 de diciembre de 2019; **14**(12): 1–15. eCollection 2019.
    PubMed Abstract | **Publisher Full Text** | **Free Full Text**

29. Kobo O, Leiba R, Avizohar O, *et al*.: **Relative fat mass is a better predictor of dyslipidemia and metabolic syndrome than body mass index.** *Cardiovasc Endocrinol Metab.* 2019; **8**(3): 77–81.
    PubMed Abstract | **Publisher Full Text** | **Free Full Text**

Open Peer Review

Current Peer Review Status: ✓ ✓

Version 2

Reviewer Report 07 December 2021

https://doi.org/10.5256/f1000research.78819.r100227

✓ **Katherine Curi Quinto** (iD)

Nutrition Research Institute, Cuernavaca, Mexico

All my previous comments was considered by the authors. I have no further comments, and I believe this article is a key contribution to the field of nutrition counseling.

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Nutrition epidemiology

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Version 1

Reviewer Report 23 September 2021

https://doi.org/10.5256/f1000research.56963.r92606

? **Katherine Curi Quinto** (iD)

Nutrition Research Institute, Cuernavaca, Mexico

Overall comment:

This manuscript is an important contribution to inform current practice/strategies and

intervention to promote a better nutritional and health status in the current context of the COVID-19 pandemic, although it could be sustained over time as a new strategy in the nutritional practice.

Given this importance, I highlight the following aspects to clarify in the manuscript. This will help to improve the scientific quality of the document:

1. **Abstract:** Add the statistical analysis in methods and specify the group of comparison for the last results presented in brackets (weight, BMI, WC, RFM.)

2. **In the overall manuscript:** Explain why the design of the study is retrospective? according to the flow of this study, it seems a quasi-experimental study with "prospective" repeated measurements over the time of the intervention (longitudinal), unless you want to present as a secondary data analysis which could be also adequate mainly because you did not have the inform consent of the participants. If the latter is your case, you must make this clarification in your manuscript.

3. **In the methods:**

   a) Explain how you did the allocation of the 50 participants per each group of intervention and add the inclusion criteria for eligibility.

   b) Give more detailed information about the intervention itself: characteristics of the nutritional plan, how and what indicators did you follow & monitor? in case you did for both groups. You could also specify what kind of messages/mail/text, etc. you included.

   c) In data analysis, add which values you considered outliers and report: how many and how you handled the outliers (based on your results, it appears there were no outliers).

   d) Since this is a convenience sample, it will be contributed to the internal validity of your study if you add information on key sociodemographic factors such as level of education. In case you did not collect this information, this must be reported as a limitation and explain why the impact in the results you could be are reporting.

4. **In the results:**

   a) In the footnotes of the tables indicate the test from which you obtained the p-value.

   b) The tables repeat information. It would be better if you avoid these types of repetitions. As a suggestion, you could present in Table 1 only the initial characteristics. Tables 2 and 3 can be joined without presenting the differences between the groups. The reader has enough information to know the differences. Then you could keep table 4 as is.

5. **In the discussion:**

   a) The discussion needs to be stronger. Add a possible explanation of your results and discuss it in the context of the previous evidence related to the comparison of traditional and telenutrition intervention. The explanation could be in terms of differences or

advantages/disadvantages of the method used and why it could influence the results, or it could be for the difference in the intervention itself (frequency, intensity, different ways to monitor, the same nutritionist give the same intervention, some baseline sociodemographic characteristics such as literacy, etc.).

b) The greater differences in WC in the telenutrition group could be associated with a measurement error, so how do you control that? Can you make cross-validation with the self-reported weight and BMI data? It is more likely that people with weight loss also have a reduction in WC and other parameters. Discuss a little more about this finding that you highlighted in the manuscript.

c) Add the clinical implication of the RFM. This is a non-common measure, as you presented in the manuscript, but there is little information about its relevance in the clinical nutrition field. Moreover, consider adding information about the validation in the Peruvian population of the equation you used to estimate the RFM.

d) In the limitation specify how the no inclusion of confounders could affect your results.

e) Consider highlighting the strengths of your study, I think it has several. You provide important material in terms of methods to the assessment of the Food intake as well as the Food habits.

Is the work clearly and accurately presented and does it cite the current literature?
Yes

Is the study design appropriate and is the work technically sound?
Partly

Are sufficient details of methods and analysis provided to allow replication by others?
Partly

If applicable, is the statistical analysis and its interpretation appropriate?
Partly

Are all the source data underlying the results available to ensure full reproducibility?
Yes

Are the conclusions drawn adequately supported by the results?
Partly

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Nutrition epidemiology

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

F1OOOResearch

Author Response 11 Nov 2021

Michelle Lozada-Urbano, Universidad Privada Norbert Wiener, Av. Arequipa # 444, Peru

Suggestion acknowledged and clarifications described in the Amendments from Version 1 and specified on the manuscript in detail.

Competing Interests: No competing interests were disclosed.

Reviewer Report 20 September 2021

https://doi.org/10.5256/f1000research.56963.r93552

✔ **María Del Mar Morales Hernández**

Internal Medicine, University of Florida College of Medicine, Gainesville, FL, USA

Clinically relevant retrospective study about the effects of telenutrition in obese and overweight patients in Lima, Peru. The study includes both study and control groups. The authors used easy-to-follow questionnaires and imaging to guide patient's nutritional care. Also provided good weekly follow-up for patients with aid of the technology. Would have liked to see an example of the nutritional plan utilized and if those were similar to in person vs telemedicine patients. Having no statistical significance in changes on anthropometric parameters between groups will suggest that patients could still receive benefits of nutritional care during the pandemic and expect to have similar results as in person encounters in their weight control. This study showed changes in weight, waist circumference, BMI, and RFM. Improvement of nutrition is key to decrease disease burden in the times of COVID 19 pandemic and this study adds to the usefulness of telemedicine and in this specific case telenutrition to help address risk factors during these challenging times.

Is the work clearly and accurately presented and does it cite the current literature?
Yes

Is the study design appropriate and is the work technically sound?
Yes

Are sufficient details of methods and analysis provided to allow replication by others?
Yes

If applicable, is the statistical analysis and its interpretation appropriate?
Yes

Are all the source data underlying the results available to ensure full reproducibility?

Yes

Are the conclusions drawn adequately supported by the results?
Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Endocrinology disorders, diabetes technology

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

The benefits of publishing with F1000Research:

- Your article is published within days, with no editorial bias

- You can publish traditional articles, null/negative results, case reports, data notes and more

- The peer review process is transparent and collaborative

- Your article is indexed in PubMed after passing peer review

- Dedicated customer support at every stage

For pre-submission enquiries, contact research@f1000.com