



Comparison of efficacy between face-to-face and online consultation against overweight and obesity

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ABSTRACT

Introduction: Overweight and obesity have progressively increased in recent years. Online consultation has become a useful tool for healthcare professionals and patients that cannot be assisted through face-to-face consultation. **Objectives:** Our study aimed to compare the efficacy between online and face-to-face consultation as a strategy in the management of overweight and obesity. **Material and Methods:** An experimental, cross-sectional study was carried out in 88 patients between 25-30 years old. Patients were classified into two groups of 44 individuals: online and face-to-face consultation. Nutritional evaluations were conducted in each consultation, which comprised of anthropometric, dietetic, and physical assessments. The therapy consisted of individually designed menus made by a specialist and other recommendations based on the World Health Association (WHO) guidelines. **Results:** Most patients in both groups achieved normal anthropometric measurements after the intervention (41/44 face-to-face group; 39/44 online group). Intragroup analysis (before and after intervention) of body mass index (BMI), weight, and fat percentage in both groups revealed a significant improvement after the intervention ($p < 0.0001$). Intergroup analysis of BMI ($p < 0.4031$), weight ($p < 0.2265$), and fat percentage ($p < 0.3872$) showed no significant difference. The analysis of efficacy revealed an efficacy of up to 95% in the online consultation group when compared to the face-to-face consultation one. **Conclusions:** No significant difference was found between online and face-to-face groups. The efficacy of online consultation was 95%. These results allow us to conclude that online and face-to-face consultation have a similar efficacy.

Key words: obesity; overweight; online consultation; face-to-face consultation.

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RESUMEN

Introducción: El sobrepeso y obesidad han aumentado progresivamente en los últimos años. La consulta virtual es una herramienta útil para el personal de salud y pacientes que no pueden asistir de manera presencial. **Objetivo:** Comparar la eficacia de la consulta presencial contra la virtual, como estrategia para el tratamiento del sobrepeso y obesidad. **Material y métodos:** Se realizó un estudio experimental transversal en 88 pacientes de 25-30 años. Se asignaron dos grupos de 44 individuos: consulta virtual y presencial. La valoración nutricional se realizó en cada consulta, y consistía en analizar datos antropométricos, dietéticos y físicos. El tratamiento consistió en menús individuales diseñados por un especialista y otras recomendaciones de guías de la Organización Mundial de la Salud (OMS). **Resultados:** La mayoría de los pacientes de ambos grupos lograron mediciones antropométricas normales después de la intervención (41/44 presencial y 39/44 virtual). El análisis intragrupal (antes y después de la intervención) del índice de masa corporal (IMC), peso y porcentaje de grasa reveló mejoría significativa ($p < 0.0001$). El análisis intergrupar del IMC ($p < 0.4031$), peso ($p < 0.2265$) y porcentaje de grasa ($p < 0.3872$) no mostró diferencias significativas. La fórmula de eficacia mostró una eficacia del 95% de la consulta virtual. **Conclusiones:** No se encontraron diferencias significativas entre ambos grupos. Se encontró un 95% de eficacia de la consulta virtual. Con esto, podemos concluir que la consulta virtual tiene una eficacia similar a la presencial.

Palabras clave: obesidad; sobrepeso; consulta virtual; consulta presencial.

INTRODUCTION

The prevalence of overweight and obesity has increased in recent decades, reaching up to 24.9% in Latin America. It is estimated that by 2030, 39% of the population in Mexico will be obese.¹ Both obesity and overweight are highly associated with metabolic and cardiovascular diseases, such as systemic arterial hypertension (SAH), hypercholesterolemia, type-2 diabetes mellitus (T2DM), and metabolic syndrome. Every year, over 3.4 million people die because of the previously mentioned diseases. The cost of treatment for obesity and associated diseases was 880 million dollars in Mexico in 2013.²⁻⁴

Several factors are involved in the etiology of obesity, including nutritional and psychological disturbances, sedentarism, genetics, and metabolic/endocrine dysfunction.⁵⁻⁹ Regardless of the etiology, obesity requires immediate and adequate treatment to prevent the development of cardiovascular complications.

The benefits of weight loss are very clear. For instance, it decreases serum triglycerides, total cholesterol, and low-density lipoproteins (LDL). In patients with T2DM, it is associated with a reduction in glycosylated hemoglobin (HbA1c) and glycemia. In patients with SAH, it is associated with a reduction of blood pressure. In addition, weight loss decreases the prevalence of cardiovascular diseases.¹⁰⁻¹³

The treatment of obese patients must include nutritional assessments and lifestyle modifications. Other options such as medications, surgery or psychological assessments can also be considered. Nonetheless, the most effective therapy is a combination of nutritional assessments and lifestyle modifications.¹⁴⁻¹⁹

The current pandemic has delayed medical care for several diseases due to confinement, which has caused an increase in the incidence of health problems, such as obesity and its related complications.²⁰ This situation has prompted healthcare professionals to seek new ways to provide medical care that is safe and effective. The use of information technologies and telemedicine has emerged as an excellent tool for healthcare professionals in providing medical care through digital platforms.^{21,22} Due to the pandemic, many healthcare professionals suspended face-to-face consultations and began to use telemedicine.²³⁻²⁴ Telemedicine includes a large category of healthcare interventions applied via digital platforms.²⁵ Online consultation -a type of telemedicine service- is superior to telephone consultation and can be particularly useful as an alternative method to face-to-face consultation.²⁶

In this study, we compared the efficacy of online versus face-to-face consultation as a strategy in the management of obesity and overweight.



MATERIALS AND METHODS

Study design

An exploratory clinical trial was carried out to assess the efficacy of online consultation as a treatment strategy against overweight and obesity. All study participants met the following inclusion criteria: individuals between 25-30 years old, with a body mass index (BMI) >25 kg/m² who accepted to participate in the study and signed an informed consent. Patients that did not signed the informed consent, did not attend consultations, or had comorbidities such as T2DM, SAH, cardiopathies, oncological diseases among others, were excluded. Patients that did not attend

at least 12 consultations or did not complete the treatment were eliminated from the study. Eighty-eight patients from three states of Mexico (Tlaxcala, Puebla, and Mexico City) were randomly classified into two study groups: 1) Face-to-face (n=44); 2) Online consultation (n=44). The face-to-face group included 31 women and 13 men, while the online group included 27 women and 17 men. Table 1 shows the characteristics of the participants at baseline. Group one attended consultations at Hospital Francisco de Asís, Tlaxcala, Mexico, every fifteen days during a six-month period. To perform the nutritional and anthropometric evaluations before and after the therapeutic intervention (dietary recommendations, physical activity, and nutritional advice), individuals in group two attended a face-to-face consultation only on the first and last sessions. The rest of the sessions in this group were online.

TABLE 1. Characteristics of the participants at baseline

Characteristic	Face-to-face group (n=44)		Online group (n=44)	
	Males	Females	Males	Females
Sex	13	31	27	17
Body weight (kg, mean \pm SD)	30.26 \pm 3.57		29.95 \pm 2.57	
BMI (kg/m ² , mean \pm SD)	80.67 \pm 11.65		80.41 \pm 11.13	
Arm circumference (cm, mean \pm SD)	29.51 \pm 3.75		30.24 \pm 3.27	
Waist circumference (cm, mean \pm SD)	91.11 \pm 9.9		90.87 \pm 9.7	
Tricipital skinfold thickness (mm, mean \pm SD)	21.72 \pm 6.52		20.72 \pm 6.97	
Mean fat percentage (%)	33.38		33.48	

*BMI: Body Mass Index

This study was carried out in three phases: Phase 1) Recruitment and selection: two groups of 44 patients each were randomly assigned. For group assignment, the names of the eighty-eight individuals were placed in a tombola. Afterwards, each name was randomly selected from the tombola and sequentially allocated to one of the two groups until reaching 44 individuals per group. Phase 2) Online and face-to-face consultation: face-to-face consultations lasted a maximum of 45 minutes, while online consultations lasted a maximum of 30 minutes. A six-month program with consultations every fifteen days was designed for both groups. The consultation methodology was the same in both groups, a nutritional assessment was performed through clinical indicators and anthropometric measures. In the face-to-face consultation group, the

healthcare professional was responsible for performing the anthropometric measurements at each consultation. In the online consultation group however, the healthcare professional only performed the first (before intervention) and last (after intervention) anthropometric measurements. Patients in the online consultation group were trained to take their basic anthropometric measurements for the rest of the consultations. A software called "Nutrimind" was used in both groups, and it allowed patients to have a photographic record of their personalized treatment and anthropometric measurements. This software was used to register medical records, treatment (physical activity and diet), and anthropometric measurements (weight, height, body mass index and fat percentage) recommended by The International Society for the Advancement of Kinanthro-

pometry (ISAK).^{27,28} Healthcare professionals and patients were able to access the records throughout the intervention. Phase 3) Results comparison: the results obtained from both groups during the six-month period were further analyzed to assess the efficacy of the online consultation and compare it with the face-to-face consultation. Efficacy was measured through the efficacy formula designed by Quito Polytechnic University, which measures the percentage over which a goal is achieved. The result obtained through the efficacy formula is classified in 5 groups (number 1 to 5), where a result > 91% indicates that the process is highly efficient, between 61% and 80% that it is efficient, and < 30% that it is inefficient.²⁹

Sample size

As this research was an exploratory study, the sample size was determined by the feasibility of recruitment. A sample of 44 individuals per group was established considering that the number of patients per group in consultation -with the criteria required for the study- fluctuated between 44 and 50 individuals. This sample size allows the detection of an effect size of 0.1 or larger. To reach the established sample, we recruited 44 individuals per group according to the inclusion criteria.

Ethical considerations

This investigation was carried out under the guidelines of the Declaration of Helsinki, the regulations of the General Health Law on Health Research Matters, and the Official Mexican Standard NOM-012-SSA3-2012. A letter of informed consent was obtained from the patients. Patient records were always kept anonymous. All procedures were approved by the Committee of Research of the Faculty of Health Sciences of the Universidad Anáhuac México (No. 201869).

Online consultation

The online consultations were scheduled on a biweekly basis and the time for each one lasted 30 minutes. The initial and final consultations were done face-to-face so that the researcher was able to perform anthropometrical assessments. The subsequent consultations were provided through the application "Zoom" in a videoconference where the patient reported their measurements (weight,

waist, hip and relaxed arm perimeter) with the support of a guide made by the researcher under the ISAK guidelines (2019), using a floor scale at home and an anthropometric tape to measure perimeters. The data registered by the patient was reported to the researcher before starting the videoconference.

Nutritional assessment

The nutritional assessment was performed before, during, and after the intervention by a clinical nutritionist with ISAK anthropometry accreditation level 1,2,3. The nutritional assessment consisted of dietetic, clinical, and anthropometric indicators. We measured the following anthropometric indicators in both groups: BMI, weight, height, and fat percentage estimation. Both groups had an average BMI of 30 kg/m², a weight of over 80 kg, and a fat percentage > 33% (obesity) before the intervention. These indicators were evaluated in every consultation in the face-to-face consultation group. Patients in the online consultation group were trained to take their basic anthropometric measurements, except fat percentage estimation. Body fat percentage was calculated through the Siri formula, the most accepted equation to determine fat percentage in young adults. Siri formula is approved by ISAK.

Implemented treatment

A nutrition specialist designed a nutritional treatment, which contained 1 to 5 different menus to be chosen by the patient. The menus were modified every fifteen days. The distribution of macronutrients was as follows: 60% of complex carbohydrates, 15% of high biological value proteins (proteins that can be completely absorbed by the gastrointestinal system), and 25% of monounsaturated and polyunsaturated fats. Both groups had similar objectives namely the reduction in fat percentage, the maintenance of muscle mass or conversely, the increase in muscle growth according to the patient's requirements, decreases in body weight, and better quality of life. Patients were recommended to perform at least 20 minutes of daily aerobic physical activity, according to the recommendations of the WHO.³⁰

Statistical analysis

The results of the study were analyzed using the Statistical program "Prisma GraphPad". The intragroup analysis was



performed using paired Student T and Wilcoxon Test. In this study we first analyzed in the same group the effects of the nutritional treatment on anthropometric measurements. Afterwards, intergroup comparisons of the efficacy of the treatment were performed using Mann-Whitney U and unpaired Student T Test. Finally, in order to know the efficacy of online consultation, the efficacy formula designed by Quito Polytechnic University, which measures the percentage over which a goal is achieved, was used. In this way, the efficacy was measured by comparing the results obtained in the face-to-face consultation against the results of the online group. The following formula was used: $Efficacy = (Achieved\ (online\ group)\ Result / Expected\ (face-to-face\ group)\ result)$.²⁹ Statistical significance was established at $p < 0.05$.

RESULTS

At the beginning of the study, the mean BMI of the face-to-face group was $30.26\ \text{kg/m}^2 \pm 3.57$ (mean \pm SD), while in the online group was $29.95\ \text{kg/m}^2 \pm 2.57$. Mean BMI decreased to $24.03\ \text{kg/m}^2 \pm 2.58$ in the face-to-face group ($p < 0.0001$; Paired Student T Test) and $23.86\ \text{kg/m}^2 \pm 1.48$ in the online group ($p < 0.0001$; Paired Student T Test) after the intervention. Intergroup analysis of BMI showed no significant differences ($p = 0.4031$ before the intervention and $p = 0.1032$ after the intervention; Mann-Whitney U Test; Figure 1). The initial mean weight in the face-to-face group was $80.6\ \text{kg} \pm 11.65$, while in the online group was $80.4\ \text{kg} \pm 11.13$. After the intervention, the face-to-face group mean of percentage of weight loss was $19.92\% \pm 7.14$ ($64.47\ \text{kg} \pm 8.71$) ($p < 0.0001$; Students T Test) and $19.57\% \pm 6.09$ ($64.26\ \text{kg} \pm 8.58$) in the online group ($p < 0.0001$; Students T Test). Intergroup analysis of weight showed no significant differences ($p = 0.2265$ before the intervention and $p = 0.1576$ after the intervention; unpaired Student T Test; Figure 2). When evaluating fat percentage in both groups, similar results were found. Before the intervention, the face-to-face group had a mean fat percentage of 33.38% (obesity). On the other hand, the mean fat percentage in the online group before the intervention was 33.48%. After the intervention, the mean fat percentage decreased to 22.99% in the face-to-face group

(acceptable; $p < 0.0001$; Students T Test) and 23.05% in the online group ($p < 0.0001$; Students T Test). Intergroup analysis of fat percentage showed no significant differences ($p = 0.3872$ before the intervention and $p = 0.3450$ after the intervention; unpaired Student T Test; Figure 3). When comparing the fat percentage in women before and after the intervention, it decreased from 35% to 20% ($p < 0.0001$; Wilcoxon test). Similarly, the fat percentage in men decreased from 32% to 21% ($p = 0.0001$; Wilcoxon test). Both genders achieved acceptable fat percentage levels according to different consensus.³⁰ No significant difference was found when comparing the results of the online and face-to-face groups after the intervention in both women ($p = 0.9511$; unpaired T test) and men ($p = 0.5861$; unpaired T test).

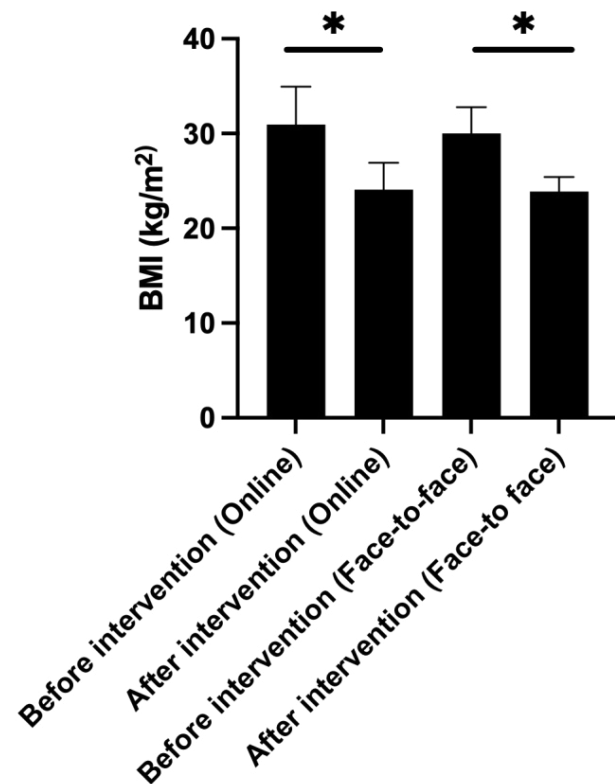


FIGURE 1. BMI in the online and face-to-face groups. A significant decrease in BMI can be observed in both groups after the intervention. Bars represent the BMI mean \pm standard deviation per group (44 individuals each one). * $p < 0.0001$. BMI: Body Mass Index.

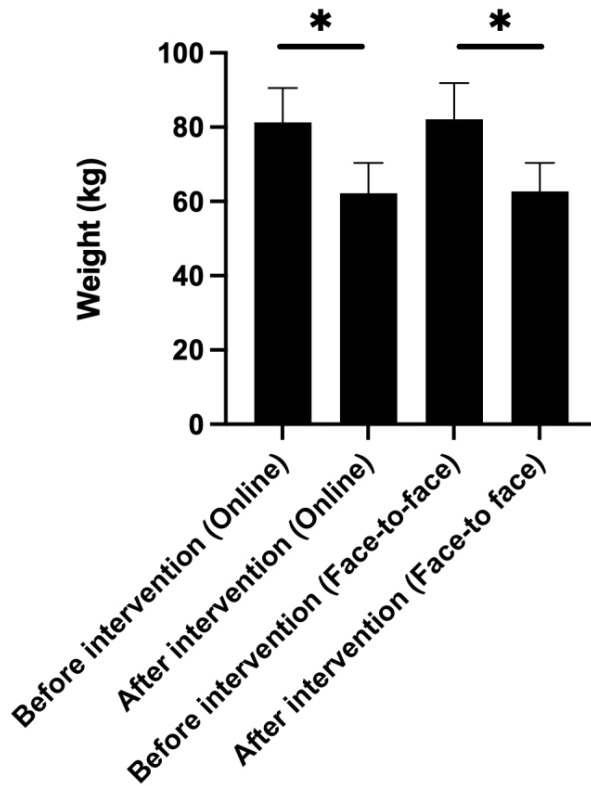


FIGURE 2. Weight in the online and face-to-face groups. A significant decrease in weight can be observed in both groups after the intervention. Bars represent the weight mean \pm standard deviation per group (44 individuals each one). * $p < 0.0001$.

Finally, among the 44 patients who attended the face-to-face consultation, 41 (93%) achieved a normal BMI. Conversely, of the 44 patients who attended the online consultation, 39 (88%) achieved a normal BMI. The efficacy formula revealed an efficacy of up to 95% of the online consultation (Efficacy = achieved result in the online group / achieved result in the face-to-face group = $39 / 41 = 0.95 \times 100 = 95\%$). This result is interpreted as very efficient according to the efficacy formula.²⁹

DISCUSSION

In the present study we aimed to compare the efficacy of online versus face-to-face consultation. A significant decrease in overweight and obesity was found in both groups. Interestingly, no significant difference in BMI, weight, and fat percentage was found when comparing both groups.

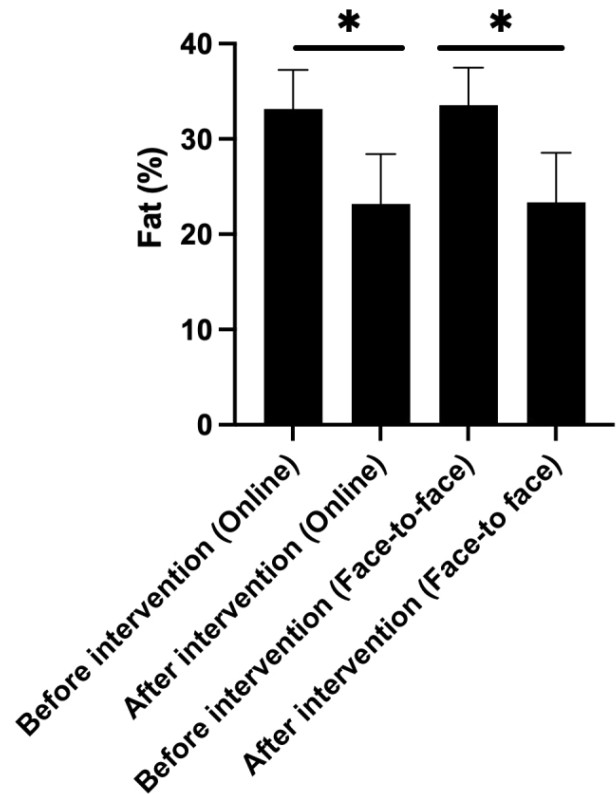


FIGURE 3. Fat percentage in the online and face-to-face groups. A significant decrease in fat percentage can be observed in both groups after the intervention. Bars represent the fat percentage mean \pm standard deviation per group (44 individuals each one). * $p < 0.0001$.

Therefore, it is possible to conclude that online and face-to-face consultation have a similar efficacy. In fact, when applying the efficacy formula, we found that online consultations had an efficacy of 95%. However, we must consider that the therapeutic adherence played a vital role in these results. If the nutritionist was unable to convince the patient to comply with the nutritional intervention through the online consultation, then the efficacy could have decreased.

Other studies using online consultation have shown similar results. A study performed in the United States by Serdar et al. which aimed to compare face-to-face and online programs to control eating disorders, found that both programs have similar outcomes (decrease in psychiatric symptoms), demonstrating that online and face-to-face interventions have similar effects.³¹ A systematic review and meta-analysis that evaluated the implications of telemedicine in overweight and obesity reported a significant improvement in



at least 1 dietary or physical outcome measure in 4 of the 8 studies evaluated. Furthermore, this same study also established that maintaining therapeutic adherence could be challenging only through eHealth, an online consultation program, thus recommending a combination of both strategies.³²

Online consultation comes to be a practical, secure, and economic option for patients. This type of medical care allows patients to have professional attention without spending money and time on transport, and without the risk of becoming infected with COVID-19 due to the current pandemic. A recent systematic review of the barriers and facilitators of online consultation showed that patients of different age groups and with different health conditions benefited from receiving an online treatment.³³ Additionally, this modality also has benefits for healthcare professionals as it decreases the general costs of consultation, allows them to see more patients per day, and makes it easier for time management purposes.^{22,34} Moreover, online consultation could play an important role in big cities where transportation costs are high and has an impact on the ability to assist to a nutritional consultation.

With the current situation in the world, online consultation is a more than viable option for nutritionists as it ensures the safety of both parties without losing efficacy. However, it is worth mentioning that online consultation has some limitations, such as communication barriers, inadequate infrastructure (absence of adequate digital platforms), poor patient training to perform anthropometric measurements at home, and difficulties in giving instructions for proper treatment.

Communication, as in the face-to-face consultation, plays an important role in online consultation, not only to establish a treatment based on clinical and nutritional assessments, but also to ensure that patients have no doubts about their disease or treatment. In this regard that, a systematic review presented the lack of appropriate training and confidence by a healthcare professional as an obstacle to implementing telemedicine.³⁵

For further inquiries about this topic, we suggest a longer follow-up of at least one year and more precise tools for the evaluation of corporal composition, such as phase angle to assess nutritional state and electric bioimpedance to assess fat percentage. In addition, future studies should also evaluate atherogenic risks and metabolic comorbidities in obese and overweight patients when comparing online and face-to-face consultation.

CONCLUSIONS

In the present study, we found no significant differences between patients who received face-to-face nutritional consultation against those who received online nutritional consultation. Nonetheless, these results can only be conclusive for groups of patients similar to the one evaluated in this trial and cannot be generalized to all obese patients.

Online consultation is an excellent tool for both the nutritionist and the patient, since it provides an efficacy similar to that of a face-to-face consultation, but with greater comfort, privacy, and efficient use of time. In addition, online consultation offers a great alternative to face-to-face consultation due to the current pandemic.

ETHICAL DISCLOSURES

Protection of human and animal subjects. The authors declare that no experiments were performed on humans or animals for this study.

Confidentiality of data. The authors declare that they have followed the protocols of their work center on the publication of patient data.

Right to privacy and informed consent. The authors have obtained written informed consent of the patients or subjects mentioned in the article. The corresponding author is in possession of this document.

Conflict Disclosure. The authors declare no competing interests. The contents of this publication are solely the responsibility of the authors.

REFERENCES

1. OECD. Obesity Update. 2017. Available from: <https://www.oecd.org/els/health-systems/Obesity-Update-2017.pdf>
2. Barquera S, Rivera J. Obesity in Mexico: rapid epidemiological transition and food industry interference in health policies. *Lancet Diabetes Endocrinol.* 2020 Sep; 8(9):746-747. [https://doi.org/10.1016/S2213-8587\(20\)30269-2](https://doi.org/10.1016/S2213-8587(20)30269-2)
3. Davila-Torres J, González Izquierdo J, Barrera-Cruz A. Panorama de la obesidad en México. *Revista Médica del IMSS.* 2015;242-246.



4. Barquera S, Campos I, Rivera J. Mexico attempts to tackle obesity: the process, results, push backs and future challenges. *Obes Rev.* 2013;14:69-78. <https://doi.org/10.1111/obr.12096>
5. Casanueva E, Kaufer-Horwitz M, Pérez-Lizaur AB, Arroyo P. *Nutriología Médica*. En: Kaufer-Horwitz M, García García E, Vázquez-Velázquez V, editores. *Obesidad en el Adulto*. México: Editorial Médica Panamericana; 2008;557-593.
6. Rajan TM, Menon V. Psychiatric disorders and obesity: A review of association studies. *J Postgrad Med.* Jul-Sep 2017;63(3):182-190. https://doi.org/10.4103/jpgm.JP_GM_712_16
7. De Luis R, Bellido Guerrero D, García Luna PP. *Dietoterapia, Nutrición Clínica y Metabolismo*. Vidal-Casariago A., Calleja-Fernández A, Palacio-Mures JM, Ballesteros-Pomar MD, Cano-Rodríguez I. Madrid: Aula Médica. 2017;109-117.
8. G. López M, Rodríguez-Cruz M. Epidemiología y genética del sobrepeso y la obesidad. Perspectiva de México en el contexto mundial. *Medigraphic Artemisa.* 2008;65:426.
9. Alvarez-Castro P, Sangiao-Alvarellos S, Brandóm-Sánda I, Cordido F. Función endocrina en la obesidad. 2011; 58(8):422-424.
10. Heymsfield S, Wadden T. Mechanisms, Pathophysiology, and Management of Obesity *New England Journal of Medicine.* 2017;376(3):254-266. <https://doi.org/10.1056/NEJMra1514009>
11. Serevalle G, Grassi G. Obesity and Hypertension. *Pharmacol Res.* 2017;122:1-7. <https://doi.org/10.1016/j.phrs.2017.05.013>
12. Lecube A, Monereo S, Rubio M, Martínez-de-Icaya P, Martí A, Salvador J. Posicionamiento de la Sociedad Española para el Estudio de la Obesidad de 2016. *Endocrinología y Nutrición.* 2017; 63(10):15-22. <https://doi.org/10.1016/j.endonu.2016.07.002>
13. Pereira-Despaigne O, Palay-Despaigne M. Importancia de la reducción de peso en los pacientes con obesidad. *Medisan.* 2015;19(8):1046-1048.
14. Wharton S, Lau D, Vallis M, Sharma A, Biertho L, Campbell-Scherer D, Adamo K. Obesity in adults: a clinical practice guideline. 2020;192(31):E875-E891. <https://doi.org/10.1503/cmaj.191707>
15. Heymsfield S, Aronne L, Eneli, I, Kumar R, Michalsky M, Walker E. Clinical perspectives on obesity treatment: challenges, gaps, and promising opportunities. *NAM Perspectives. Discussion Paper.* National Academy of Medicine, Washington. 2018. <https://doi.org/10.31478/201809b>
16. Baile J, González-Calderón M, Palomo R, Rabito-Alcón M. La intervención psicológica de la obesidad: desarrollo y perspectivas. *Rev. Clínica contemporánea.* 2020;11(11):5-8. <https://doi.org/10.5093/cc2020a1>
17. Cano R, Soriano J, Merino J. Causas y tratamiento de la obesidad. *Nutrición Clínica y Dietética Hospitalaria.* 2017;37(4):90. <https://doi.org/10.12873/374rodrigo>
18. WHO, PAHO. Plan de acción para la prevención y el control de las enfermedades no transmisibles en las Américas 2013-2019. 2014. Available from: https://iris.paho.org/bitstream/handle/10665.2/35010/9789275318447_spa.pdf?sequence=1&isAllowed=y
19. WHO. Recomendaciones de OPS/OMS para hacer frente a la obesidad en México. Available from: <https://www.paho.org/es/noticias/1-3-2021-recomendaciones-ops-oms-para-hacer-frente-obesidad-mexico>
20. Minsky C, Pachter D, Zacay G, Chishlevitz N, Ben-Hamo M, Weiner D. Managing Obesity in Lockdown: Survey of Health Behaviors and Telemedicine. *Nutrients.* 2021;13(4):1359. <https://doi.org/10.3390/nu13041359>
21. Sociedad Española de Endocrinología y Nutrición. Teleconsulta en Endocrinología y Nutrición en tiempos de la pandemia COVID-19 y más allá. 2020. Available from: https://www.seen.es/ModulGEX/workspace/publico/modulos/web/docs/apartados/1433/160620_105727_7128864936.pdf
22. Kaufman-Shirqui V, Sherf-Dagan S, Boaz M, Birk E. Virtual nutrition consultation: what can we learn from the COVID-19 pandemic? *Public Health Nutr.* 2021(5):1166-1173. <https://doi.org/10.1017/S1368980021000148>
23. Peine A, Paffenholz P, Martin L, Dohmen S, Marx G, Loosen S. Telemedicine in Germany During the COVID-19 Pandemic: Multi-Professional National Survey. *J Med Internet Res.* 2020;22(8):e19745. <https://doi.org/10.2196/19745>
24. Rozga M, Handu D, Kelley K, Yakez-Jimenez E, Martin H, Schofield M, Steiber A. Telehealth During the COVID-19 Pandemic: A Cross-Sectional Survey of Registered Dietitian Nutritionists. *J Acad Nutr Diet.* 2021;121(12):2524-2535. <https://doi.org/10.1016/j.jand.2021.01.009>
25. Ufholz K, Bhargava D. A Review of Telemedicine Interventions for Weight Loss. *Curr Cardiovasc Risk Rep.* 2021;15(9):17. <https://doi.org/10.1007/s12170-021-00680-w>
26. Donaghy E, Atherton H, Hammersley V, McNeilly H, Bicker A, Robbins L. Acceptability, benefits, and challenges of video consulting: a qualitative study in primary care. *Br J Gen Pract.* 2019;69(686): 586-594. <https://bjgp.org/content/69/686/e586>



27. Esparza-Ros, Vaquero-Cristobal R, Marfell-Jones M. Protocolo Internacional para la valoración antropométrica, UCAM Universidad Católica de Murcia. 2019.
28. Suverza-Fernández A, Haua-Navarro K. Manual de antropometría para la evaluación para la evaluación del estado nutricional en el adulto. 2009.
29. Chachipiendo-Vásquez M, Mosquera D. Análisis a los indicadores de gestión en empresas consultoras del distrito metropolitano de Quito. <https://doi.org/10.1136/bjsports-2020-102955>
30. Bull F, Al-Ansari S, Biddle S, et al. World Health Organization 2020 guidelines on physical activity and sedentary behaviour. *Br J Sports Med* 2020;54:1451-1462. <https://doi.org/10.1136/bjsports-2020-102955>
31. Serdar K, Kelly N, Palmberg A, Lydecker J, Thornton L, Tully C, et al. Comparing online and face-to-face dissonance-based eating disorder prevention. *Eat Disord*. 2014;22(3):244-60. <https://doi.org/10.1080/10640266.2013.874824>
32. Hammersley M, Jones R, Okely A. Parent-Focused Childhood and Adolescent Overweight and Obesity eHealth Interventions: A Systematic Review and Meta-Analysis. *J Med Internet Res*. 2016;18(7):203. <https://doi.org/10.2196/jmir.5893>.
33. Almathami H, Win K, Vlahu-Gjorgievska E. Barriers and Facilitators That Influence Telemedicine-Based, Real-Time, Online Consultation at Patients' Homes: Systematic Literature Review. *J Med Internet Res*. 2020;22(2):16407. <https://doi.org/10.2196/16407>
34. Calcaterra V, Verduci E, Vandoni M, Rossi V, Di Profio E, Carnevale V et al. Telehealth: A Useful Tool for the Management of Nutrition and Exercise Programs in Pediatric Obesity in the COVID-19 Era. *Nutrients*. 2021;13(11):3689. <https://doi.org/10.3390/nu13113689>
35. Hazenberg C, Aand Stegge W, Van Baal S, Moll F, Buss S. Telehealth and telemedicine applications for the diabetic foot: A systematic review. *Diabetes Metab Res Rev*. 2020;36(3):3247. <https://doi.org/10.1002/dmrr.3247>

