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Impact of an Online Physical Exercise Intervention on the Mental Health of Older Mexican Women in a Context of Social Distancing

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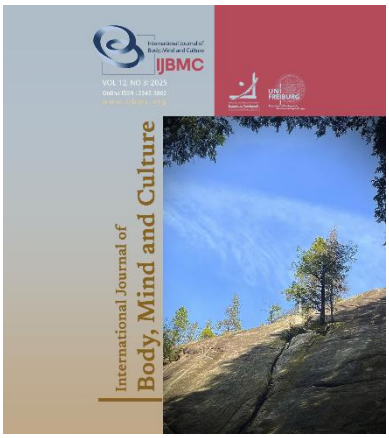

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ABSTRACT

Objective: The present study evaluated the effects of an online physical exercise intervention, delivered via Facebook, on the mental health of older Mexican women during the social distancing caused by COVID-19.

Methods and Materials: A quasi-experimental design with mixed methods was adopted, involving 37 participants divided into an experimental group (EG; n = 17) and a control group (CG; n = 20). The EG participated in a 16-week exercise program, with three sessions per week, while the CG received no intervention. Data were obtained using the Beck Anxiety Index (BAI), Beck Depression Index (BDI-II), and International Physical Activity Questionnaire (IPAQ).

Findings: Quantitative results showed that EG decreased significantly the anxiety levels (p = 0.002), although no significant differences in depression levels between group's (p = 0.111). Nevertheless, some EG participants reported individual improvements in depressive symptoms. Furthermore, qualitative results revealed that participants positively appreciated the flexibility and accessibility of the online sessions, as well as the support from their families during the intervention, which contributed to improving their emotional and physical well-being.

Conclusion: This study highlights the feasibility of using social networks like Facebook to implement physical exercise interventions for older women, particularly in contexts of social distancing, and it reinforces the importance of regular exercise for both physical functionality and mental health in this vulnerable population.

Keywords: Anxiety, depression, physical activity, older adults, social networks.

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Introduction

Human beings are social by nature, as people survive and thrive through interactions with others. However, the physical and psychological changes associated with aging often lead to increased periods of loneliness (National Institute on Aging, 2021). The isolation experienced during aging can negatively affect the health

and well-being of older adults (OA), as confirmed by data gathered during and after the COVID-19 pandemic (Ayuso et al., 2021).

The COVID-19 pandemic profoundly impacted both the physical and mental health of people worldwide, especially OA. Declared pandemic by the World Health Organization (WHO) in March 2020, it resulted in prolonged confinement, disrupting daily lives and exacerbating issues in vulnerable populations, such as sedentary behaviors, anxiety, and depression. In Mexico, OA, particularly those with comorbidities, faced an elevated risk of mortality due to COVID-19 (Ayuso et al., 2021).

One of the key measures to reduce the spread of the virus was social distancing, which had negative consequences for the physical and mental health of OA. Reduced physical activity and isolation have increased the prevalence of problems such as frailty, sarcopenia, and cognitive decline, exacerbating chronic non-communicable diseases (Sepúlveda-Loyola et al., 2020). Furthermore, the decrease in social contact during the pandemic heightened the anxiety and depression levels in this population, effects that were particularly severe among OA women, who tend to report higher morbidity rates associated with physical inactivity and isolation (Newman & Zainal, 2020)

Maintaining physical functionality in older adults is essential to ensuring healthy aging and preventing dependency. Regular physical exercise is an effective tool for improving both physical functionality and mental health in OA (Jiménez-Pavón et al., 2020). Physical exercise not only helps to maintain strength and mobility but also releases endorphins and other biochemical substances in the brain that can alleviate symptoms of anxiety and depression (González et al., 2018). According to the American College of Sports Medicine (2009), physical exercise interventions should include components of resistance, flexibility, and balance to effectively improve the quality of life in older adults (American College of Sports Medicine, 2009).

In recent years, Information and Communication Technologies (ICT) have emerged as feasible solutions to mitigate the negative effects of social isolation on OA (Hackney et al., 2015). Through these platforms, older adults can stay connected with their families, receive social support, and engage in activities that promote healthy aging.

The potential of social networks as tools for health intervention has been explored previously, highlighting their efficiency in promoting physical activity, improving quality of life, and reducing feelings of loneliness (Cavallo et al., 2014). In the context of the pandemic, online exercise interventions have proven to be a viable and effective alternative for maintaining physical activity in OA (Muellmann et al., 2019; Vitale et al., 2020).

According to the WHO (2016), telehealth includes the use of digital tools to prevent diseases, promote health, manage chronic diseases, and facilitate medical training. This has positioned ICT-based physical exercise interventions as a prominent, safe and effective option for maintaining physical and mental health in confinement settings (Goethals et al., 2020). Exercise interventions delivered through platforms such as Facebook Live provide greater flexibility in accessing sessions, which translates into increased adherence and participant satisfaction (Ibrahim et al., 2021).

The COVID-19 pandemic accelerated the use of virtual platforms for physical exercise, offering advantages such as cost reduction and the possibility of exercising from home without requiring specialized equipment (Vitale et al., 2020). Interventions conducted in virtual environments during confinement have proven effective in improving physical activity and mental health levels in older adults, aligning with previous benefits of virtual settings highlighted for vulnerable populations (Ratz et al., 2021).

However, it is crucial to emphasize that the efficiency of these interventions depends on factors such as access to technological devices, and digital literacy–limitations that must be addressed in future research, and public policies to ensure greater equity in access to these tools (Peçanha et al., 2020).

ICT-based physical exercise interventions, particularly in social networks, represent a valuable resource in maintaining and improving the mental and physical health of older adults in isolation. Research on online interventions suggests that such programs are effective and practicable in the current context, especially for older adult women, who can significantly benefit both physically and psychologically from regular exercise. This study, aimed to evaluate the effects of an online physical exercise intervention on the mental health of older Mexican women, builds on growing evidence of the effectiveness of digital interventions in

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mitigating the negative effects of social distancing. Additionally, the intervention's impact on physical activity levels was assessed to characterize the study population.

Methods and Materials

Study Design and Participants

This study employed a quasi-experimental design with mixed methods, integrating both quantitative and qualitative approaches to assess the impact of an online physical exercise intervention on the mental health of women OA during the COVID-19 confinement. The mixed approach allowed for the integration of quantitative data on anxiety, depression, and physical activity, with qualitative insights that enrich the understanding of the program's effects.

The study took place between October 2020 and February 2021, using the Facebook Live platform to deliver the exercise sessions. The intervention was implemented by the team from the CAFAMEP (Physical Conditioning Club for Older Adults, by its Spanish words) and the Facultad de Organización Deportiva (Faculty of Sports Organization) at the Universidad Autónoma de Nuevo León, in collaboration with the Universidad Autónoma de Occidente.

50 older Mexican women from the northern region of Mexico were invited to participate, all affiliated with CAFAMEP. The inclusion criteria were to be a woman over 60 years of age, having access to a device with an Internet connection, and signing the informed consent form. Women with medical contraindications to exercise or uncontrolled chronic diseases were excluded. A total of 37 participants (17 in the experimental group [EG] and 20 in the control group [CG]) completed the intervention.

The sample size calculation was based on previous research suggesting a minimum of 15 participants per group in quasi-experimental studies (Hernández, Fernández, & Baptista, 2014). However, due to the difficulty of accessing the target population due to the pandemic, convenience sampling was employed, which limits the generalizability of the results.

The control group (CG) did not participate in any intervention during the study process but were offered to participate in the sessions after the end of the study as part of an ethical commitment.

Instruments

Validated instruments for evaluating physical and mental health were used for data collection, ensuring the reliability and validity of the measures. Each of these instruments is described below:

Clinical Record: to characterize the population, the study authors designed a form with sections related to sociodemographic data, clinical history, and health background.

International Physical Activity Questionnaire (IPAQ): In its short version, it measures the physical activity levels. The IPAQ has demonstrated good reliability in previous studies (Tolosa & Gómez-Conesa, 2007).

Beck Anxiety Inventory (BAI): Used to assess anxiety symptoms. This inventory has shown high internal consistency ($\alpha = 0.87$) and validity in the Mexican context (Díaz-Barriga & González-Celis, 2019).

Beck's Depression Inventory II (BDI-II): Used to evaluate the severity of depressive symptoms. The inventory has a reliability of $\alpha = 0.91$ in studies with the Mexican population (González et al., 2015).

Data collection was carried out at two points in time: before initiating the intervention (initial evaluation) and after the 16-week intervention (final evaluation). The evaluations were conducted virtually through video calls on platforms such as Zoom and WhatsApp. Participants completed the online questionnaires, guided by the study leaders to ensure a correct understanding of the items.

Intervention

The intervention consisted of a 16-week physical exercise program, with three live sessions per week conducted through Facebook Live. Each 60-minute session included a warm-up, strength exercises, aerobic endurance, flexibility, coordination and balance, and a final relaxation phase. The structure of the sessions followed the guidelines from the American College of Sports Medicine (2009) and the WHO (2020). The program was developed by a team of sports science specialists and delivered by instructors trained to work with the OA population. The intervention was regularly monitored and evaluated to ensure proper implementation.

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Table 1

Activities carried out during one of the sessions

Type of Exercise	Description	Duration/Series
Warm-up	Joint mobility in head, shoulders, arms, waist, legs, and feet.	10 minutes
Normal Squats	Standing, simulate sitting in a chair, using the chair for support if necessary.	2-3 series 8-12 repetitions
Push-ups on the Wall	With your hands resting on the wall, bend your arms while keeping the body in a straight position.	2-3 series 8-12 repetitions
Bicep Curl	With elastic bands or bottles, bend the elbows by raising the hands towards the shoulders.	2-3 series 8-12 repettions
Lateral Leg Lift	From a standing position, lift one leg laterally while maintaining balance.	2-3 series 10 repetitions
Lateral Lunge	From a standing position, take a sidestep, bend the knee, and return to the starting position.	2-3 series 8-10 repetitions
Gentle Zumba or Aerobic Dance	Moderate dance movements following gentle rhythms to improve endurance.	20-30 minutes
Arms Coordination	Coordinated arm movements in different directions, alternating forward and backward.	2-3 series 1-2 minutes
Heel-to-Toe Walking	A slow walk focusing on placing the heel first, then the toe, alternating legs to improve balance."	2-3 series 2-3 minutes
Relaxation and Stretching	Stretching of the main muscle groups, from the feet to the head.	10 minutes

Data Analysis

Quantitative data analysis was performed using SPSS software, version 25.0. The normality of the numerical variables was assessed using the Shapiro-Wilk test. For variables with a normal distribution Student's t-test was applied for related and independent samples. For nonparametric variables, the Mann-Whitney U test, and the Wilcoxon signed-rank test were used. The significance of $p < 0.05$ was established for all tests.Additionally, the effect size was calculated through Cohen's d, with results categorized as small ($r = 0.2$ to 0.5), medium ($r = 0.5$ to 0.8), or large ($r > 0.8$).

In addition to the quantitative data, a qualitative analysis was conducted to explore the perceptions and experiences of the EG participants. Informal interviews and spontaneous comments were collected during and at the end of the intervention. The interviews were recorded with the consent of the participants and transcribed for later analysis.

The qualitative analysis employed thematic analysis, a methodology that identifies recurring and meaningful patterns in the data (Braun & Clarke, 2006). Comments were coded and grouped into themes reflecting participants' main experiences with the exercise program, perceived barriers, motivation, and impact on their physical and emotional well-being. This approach provided deeper insights into the quantitative results and the mechanisms through which the intervention affected the participants.

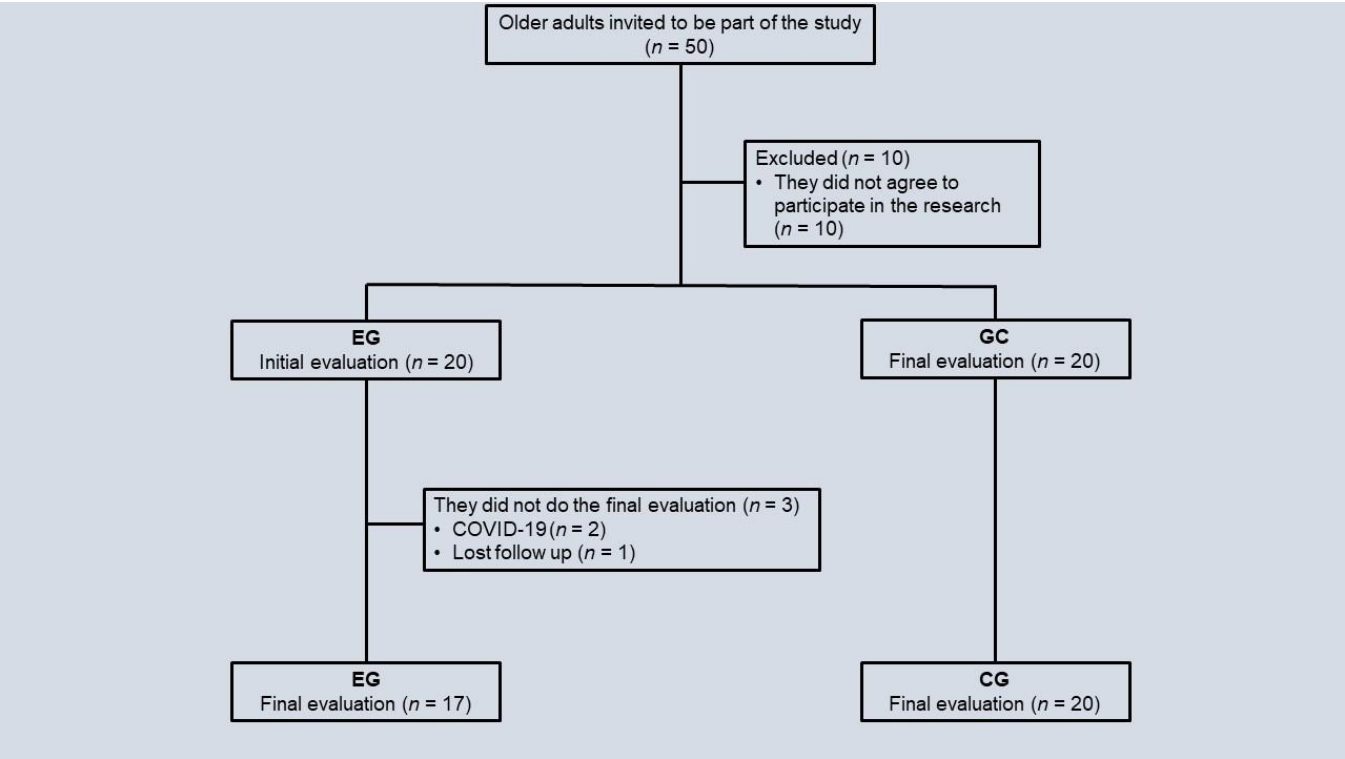
Findings and Results

Sample Distribution

An initial evaluation was conducted with 50 participants, after which ten were excluded for the following reason: they declined to participate in the research. Forty elderly women who met the inclusion criteria and provided informed consent, expressed their interest in participating in the study. The participants were divided into 2 groups (EG [n = 20] and CG [n = 20]). However, three participants from the EG did not complete the evaluations for the following reasons: communication was lost with one participant and two contracted COVID-19. The flow diagram of the participants' behavior is shown in Figure 1.

Figure 1

Flow chart of sample behavior



Personal and Clinical Characteristics of the Sample

The average age of the participants was 63.88 years (± 4.84) for the EG, and 65.15 years (± 4.10) for the CG. All participants were from the northern region of Mexico, and most of them were married (64%). The average height for the EG was 1.58 m (± 0.05) and 1.63 m (± 0.06) for the CG, while the mean weight was 70.44 kg (± 10.57) for the EG and 77.00 kg (± 6.64) for the CG. Regarding health status, 59% of the participants in the EG had a doctor-diagnosed illness, compared to 35% in the CG. Additionally, 30% of the EG participants reported experienced at least one fall in the past year, whereas only 15% of the CG participants reported falls in the same period.

Quantitative results

Physical Activity Level

The initial assessment of physical activity (PA) showed no significant differences between groups (EG mean 643 ± 200; CG mean 550 ± 265; p = 0.224). However significant differences were found in the final evaluation between EG and CG groups (EG mean 3183 ± 595; CG mean 1035 ± 522; p = 0.000; Cohen's d = 3.83) showing large effect size (r = 0.88).

The analysis of physical activity levels among subjects revealed a significant difference in both the EG and CG (p <0.001) with a large effect size for the EG (r = 0.944) and medium for the CG (r = 0.505; Table 2).

Table 2

Inferential analysis of results of physical activity level among subjects assessed through the IPAQ.

Group	IE (Mean ± SD)	FE (Mean ± SD)	*p*	*d*	*r*
EG	643± 200	3183 ± 595	.000**	5.72	0.944
CG	550 ± 265	1035 ± 522	.000**	1.17	0.505

Note. SD = Standard deviation; EG = Experimental group; CG = Control group; IE = Initial evaluation; FE = Final evaluation; p = Significance; d = Cohen's d; r = Effect size; ** = $p < 0.001$

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Mental Health

The group analysis of the anxiety variable revealed statistically significant differences between the EG and CG in the initial evaluation ($p < 0.05$). For the depression variable, no differences were found between the EG and CG during the initial evaluation ($p > 0.05$); similarly, no significant changes were observed between the groups in either variable at the final evaluation ($p > 0.05$; Table 3).

Table 3

Inferential analysis between groups of anxiety and depression results.

Variable	Evaluation	EG (Mean ± SD)	CG (Mean ± SD)	*p*
BAI	Initial	11.29 ± 10.99	5.80 ± 8.87	0.020
	Final	1.53 ± 1.77	6.75 ± 9.65	0.111
BDI-II	Initial	14.06 ± 11.90	7.60 ± 10.32	0.073
	Final	1.53 ± 1.77	6.75 ± 9.65	0.111

Note. SD = Standard deviation; EG = Experimental group; CG = Control group; BAI = Beck's Anxiety Inventory; BDI-II = Beck's Depression Inventory –second edition; p = Significance

In the inferential analysis of anxiety and depression variables between subjects, significant changes were observed only in the EG for the anxiety variable ($p < 0.05$). However, the depression variable showed significant changes in both groups ($p < 0.05$). Effect size analysis indicated a moderate effect for both variables in the EG (Table 4).

Table 4

Inferential analysis between subjects of depression and anxiety outcomes

Variable	Group	IE (Mean ± SD)	FE (Mean ± SD)	*p*	*d*	*r*
BAI	EG (*n* = 17)	11.29 ± 10.99	1.53 ± 1.77	0.002*	1.239	0.526
	CG (*n* = 20)	5.80 ± 8.87	6.75 ± 9.65	.344	-	-
BDI-II	EG (*n* = 17)	14.06 ± 11.90	1.53 ± 1.77	0.001*	1.472	0.592
	CG (*n* = 20)	7.60 ± 10.32	6.75 ± 9.65	0.021*	0.085	0.042

Note. SD = Standard deviation; EG = Experimental group; CG = Control group; IE= Initial evaluation; FE =Final evaluation; BAI = Beck's Anxiety Inventory; BDI-II= Beck's Depression Inventory –*second edition; p* = Significance; *d* = Cohen's d; *r* = Effect size; ** = $p < 0.001$

Qualitative results

From the comments gathered during the intervention, several important themes emerged that provided deeper insights of the quantitative results:

- Accessibility and flexibility: Participants greatly appreciated the convenience of accessing online classes at any time. One participant shared:

"*Sometimes I couldn't attend the live sessions, but I liked that I could do the exercises whenever I wanted, at any time of the day.*"

- Family support and motivation: Some participants highlighted the involvement of family members, such as spouses or children, during the exercise sessions. This not only boosted their motivation but also strengthened family bonds. One revealing comment was:

"*My daughter, who hardly ever exercises, started doing the routines with me*, and even though she got more tired than I did, it was nice to do it together."

- Physical and emotional well-being: Many participants reported improvements in both physical and emotional health throughout the intervention. They noted increased energy levels and found the sessions an effective way to distract themselves during confinement. One remarked:

"I feel much better than I did at the beginning, with more energy, and it helps me not to think so much about what's going on outside."

- Commitment to continuity: At the conclusion of the program, all participants expressed a strong desire to continue with the exercise sessions beyond the study. Several remarked on the program's positive impact on their overall well-being:

"I will continue with the classes even though the study is over. It's something that makes me feel good."

Discussion and Conclusion

Quantitative findings demonstrated a significant reduction in anxiety levels in the experimental group (EG) after the 16-week intervention, supporting evidence of the positive impact of physical activity on the mental health of older adults (Callow et al., 2020). This improvement may be attributed to the release of endorphins and other well-being-related neurotransmitters generated during exercise (González et al., 2015). Additionally, prior studies suggest that the reduction in cortisol, the stress hormone, may further explain these benefits (Kandola et al., 2019).

Similar findings demonstrated that physical activity, whether aerobic or endurance-based, significantly reduces anxiety and enhances the overall sense of well-being in older adults (Wassink-Vossen et al., 2014). Group exercise interventions, even in virtual format, have proven particularly effective in fostering adherence and social support, which increases perceived benefits (Matteucci, 2022).

Regarding the depression variable, while no significant differences were observed between groups at the final assessment, individual EG data revealed improvements in depressive symptoms. This outcome may be related to depression being more resistant to change compared to anxiety and may require more prolonged and multifactorial interventions (Wassink-Vossen et al., 2014). Additionally, prolonged confinement and the uncertainty generated by the pandemic could have limited the overall impact of the intervention on depression (Sepúlveda-Loyola et al., 2020).

The qualitative results provide valuable insight into how the physical exercise intervention influenced the participants. The positive perception of the sessions' flexibility and accessibility translated into high program adherence, with 85% participation. A study suggests home-based online interventions, which eliminate the need for specialized equipment or transportation, enhance significant adherence to programs' exercise among older adults (Vitale et al., 2020).

One of the most notable findings in the qualitative data was that family support served as a motivational factor. Participants reported that having their family members present during exercise sessions provided them with additional support, enhancing their motivation to continue with the exercises. Social support is a strong predictor of adherence to physical activity programs among older adults (Matteucci, 2022). In a similar study, Mouton and Cloes (2015) found that older adults participating in group exercise programs (whether virtual or face-to-face) experienced higher levels of motivation and satisfaction, which in turn increased their continuity in the program (Mouton & Cloes, 2015).

In addition, participants highlighted that the exercise sessions provided them with a sense of normality and control during a time of uncertainty and isolation. This contributed to the observed reduction in anxiety levels in the experimental group (EG). One participant noted, "*It helped me feel good, like I was doing something for myself.*" This perception aligns with the findings of Callow et al. (2020), who reported that physical exercise interventions in older adults during the pandemic not only improved physical and mental health symptoms but also enhanced feelings of self-efficacy and personal control (Callow et al., 2020).

The results of this study are consistent with recent research examining the effects of online physical exercise interventions on mental health during the pandemic. Ibrahim et al. (2021) found that virtual exercise sessions for older adults resulted in significant improvements in anxiety levels and physical functioning, supporting the feasibility of these interventions in home settings (Ibrahim et al., 2021).

On the other hand, telehealth interventions have proven effective in maintaining physical activity levels during prolonged confinement periods, a finding that aligns with the outcomes of this study. A study by Schwartz, Har-Nir, Wenhoda & Halperin (2021) on the feasibility of online group training for older adults during the pandemic reported similar results, emphasizing the importance of information and communication technologies (ICT) in enhancing well-being in this population (Schwartz et al., 2021).

Furthermore, recent studies have highlighted that prolonged interventions (12-16 weeks) are more effective in achieving sustainable changes in the physical and mental health of older adults (Vitale et al., 2020). In this sense, the 16-week duration of the intervention may have been a key factor in improving physical activity and anxiety levels.

This study has some limitations that should be considered. First, the small sample size and lack of randomization may have affected the internal validity of the study, limiting the generalizability of the results. In addition, the use of a quasi-experimental design in the quantitative part, while practical in the context of the study, does not allow for definitive causal conclusions about the intervention and the observed results. Future research should consider more rigorous experimental designs with larger samples sizes and greater diversity in terms of gender and socioeconomic context.

Another limitation is the absence of long-term follow-up to assess the sustained impact of the intervention. Previous studies have suggested that the benefits of physical exercise in older adults may be maintained only if regular physical activity is continued (Jiménez-Pavón et al., 2020). Therefore, longitudinal follow-up is recommended to assess the long-term effect of online physical exercise interventions on the mental and physical health of older adults.

This study contributes to the growing research on the impact of online physical exercise interventions on the mental health and physical activity levels of older adults during situations of social isolation. The findings support the feasibility and effectiveness of online platforms, such as Facebook, for implementing exercise programs that promote physical activity and mental well-being in this population. The use of a mixed-methods approach in this study provided for a richer and deeper understanding of the intervention's effects, demonstrating that participants' perceptions of flexibility, social support, and personal control played a crucial role in improving their mental health and adherence to the program. This study also highlights the importance of designing physical exercise interventions that take into account not only physical benefits but also the emotional and social factors that influence motivation and well-being in older adults.

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Declaration of Interest

The authors of this article declared no conflict of interest.

Ethical Considerations

The study was approved by the Bioethics Committee of the Comité de Bioética de la Universidad Autónoma de Occidente and followed the indications of the General Health Law for human studies, respecting the principles of the Declaration of Helsinki. All participants signed an informed consent form and were guaranteed the confidentiality of the data. Likewise, they were offered to continue participating in exercise sessions after the end of the formal intervention.

Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

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Authors' Contributions

All authors equally contribute to this study.

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