Tele-exercise During the Confinement of the COVID-19 Pandemic Could Prevent Psychological Disorders in Community-Dwelling Older Mexican. An Exploratory Study

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Abstract

Background: The confinement of older adults in the face of emerging situations such as the one experienced during the COVID-19 pandemic, represented a great challenge to continue with healthy aging programs at the community level, above all, because isolation is a risk factor for psychological disorders. One of the options to maintain these programs was the implementation of tele-gerontology.

Objective: To determine the adherence and effect of tele-training in physical exercise during the confinement of the COVID-19 pandemic, on depression, anxiety, well-being and quality of life in a sample of older adults Mexicans.

Methods: A exploratory quasi-experimental study was carried out in a convenience sample of 32 older adults. Two groups were formed: (i) Tai Chi Group n= 16; (ii) Strength Exercise Group n= 16. All were trained in the use of computers and smartphones, to use Zoom, WhatsApp. Their health status was evaluated to perform physical exercise and the following instruments were applied: (i) DASS-21 for depression and anxiety, (ii) WHOQOL-OLD for quality of life, (iii) PANAS for subjective well-being and (iv) Athens Insomnia Scale to detect insomnia, before and after supervised tele-exercise for six months.

Results: Participant adherence to the tele-training physical exercise program was 90% in both groups. Likewise, the scores of the depression and anxiety, quality of life, subjective well-being and insomnia instruments did not show statistically significant differences (p>0.05) before and after the intervention in both groups.

Conclusions: Our findings suggest that tele-exercise could prevent psychological disturbances in emergent confinement situations such as that experienced during COVID-19. Clinical Trial: ISRCTN48485253

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Abstract

Background: The confinement of older adults in the face of emerging situations such as the one experienced during the COVID-19 pandemic, represented a great challenge to continue with healthy aging programs at the community level, above all, because isolation is a risk factor for psychological disorders. One of the options to maintain these programs was the implementation of tele-gerontology.

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Conclusions: Our findings suggest that tele-exercise could prevent psychological disturbances in emergent confinement situations such as that experienced during COVID-19.

KEYWORDS
tele-exercise, COVID-19; depression; anxiety; quality of life; insomnia; older adults

Introduction

In November 2019, the first case of COVID-19 was described and on March 11, 2020, the pandemic was declared by the world health organization. To reduce infections and deaths, several strategies were proposed, including social distancing and confinement [1,2]. In this sense, the psychological impact was different in the population groups, since young people maintained greater social contact than older adults did, especially because old age was considered a risk of complications from COVID-19 and lethality. However, confinement represented a greater risk for the decrease in functional capacity, and anticipated physical, psychological and social dependence, in addition to the lack of control of comorbidities and the risk of psychological disorders due to social isolation and fear of the unknown [3]. Among the most prevalent psychological disorders secondary to confinement due to the COVID-19 pandemic, depression, anxiety and stress were reported, mainly in the first months of confinement [4]. In this regard, the risk factors related to confinement due to the pandemic were: (i) fear of becoming infected, (ii) fear of dying, (iii) concern for the health of the most exposed family members, (iv) alarming news in the media, (v) insufficient

knowledge about the emerging disease, (vi) proximity to infected people or loss of family and friends (vii) limited access to purchase food and medicine, (viii) limited access to health services health, (ix) not being able to access community entertainment programs. Furthermore, in the case of divorced or widowed older adults, who live alone, with little social support or difficulty receiving medical care, the risk of psychological problems increases [5].

In this context, it was pointed out that the practice of physical exercise during confinement could have a protective effect on the emergence or progression of psychological disorders during the pandemic [6]. Several studies report that physical exercise improves health, mainly resistance and aerobic exercises [7,8]. Likewise, exercise reduces the risk and control of sarcopenia [9], osteoporosis [10], falls [11], metabolic diseases such as hypertension, diabetes mellitus and arthritis [12,13]. Furthermore, the practice of physical exercise helps people improve their diet, sleep and emotional well-being [14], and reduces the negative effects on quality of life during the COVID-19 confinement [15] and reduces symptoms of depression [16,17].

The restrictive measures implemented during the COVID-19 pandemic, in addition to affecting the mood of older adults, also limited the possibility of performing physical exercise at the community level (face-to-face) [18]. One of the alternatives for people to continue practicing physical exercise and promote communication among older adults is the use of information technologies through computers and mobile devices for training and remote monitoring with the use of platforms, such as Zoom and Google Meet [19]. However, there are several difficulties in using technology, including low education, lack of training, fear and negative attitudes towards technology, insecurity in the use of personal data, few economic resources or inadequate infrastructure and unsuitable applications for older adults [20,21].

The types of exercise that are most frequently practiced in old age in our environment are walking, aerobic and strength exercise, and Tai Chi. In this sense, the op-tions for the implementation of physical exercise training chosen were resistance exercises and Tai Chi, since the training is carried out in open community spaces. Some studies have reported that TC training has a positive effect on the prevention and con-trol of anxiety and depression [22,23] and improves sleep quality [24]. On the other hand, it has been observed that aerobic exercise is useful for the prevention and control of high blood pressure [25].

Regarding aerobic and resistance exercise, it is a type of physical exercise that older adults frequently practice to prevent the progression of sarcopenia and maintain functional capacity, although a positive effect on anxiety has also been reported [26,27].

In this framework, there are few studies carried out on the adherence and effect of physical exercise tele-training programs in older adults, and especially in emerging confinement situations. For this reason, the purpose of the present study was to determine the adherence and effect of tele-training in physical exercise during the con-finement of the COVID-19 pandemic, on depression, anxiety, well-being and quality of life in Mexican older adults.

Methods

Study Design and Population

With prior informed consent, an exploratory quasi-experimental study was carried out in a convenience sample of 32 older adults from Mexico City who were invited to join a tele-exercise program during the COVID-19 pandemic during January-March 2021, proposing two options, Tai Chi and aerobic and strength exercise. In this sense, two groups were formed: (i) Tai Chi Group (TCG) n= 16; (ii) Strength Exercise Group (SEG) n= 16 (Figure 1). The protocol was approved by the Ethics Committee of the Fac-ulty of Higher Studies Zaragoza, UNAM (FESZ/DEPI/CI/03920) (ISRCTN48485253). People between 60 and 74 functional years (physical and cognitive) were included, without uncontrolled chronic non-communicable diseases, without a history of physical exercise in the last 6 months, who have technological communication resources (access to the Internet, computer or electronic tablet or smartphone). Those with cognitive impairment or with uncontrolled chronic non-communicable diseases were excluded. The elimination criteria were (i) participation in the sessions for less than 90% of the sessions, (ii) presenting an illness during the intervention that justifies dropping out the program, (iii) personal decision not to participate in the program, and (iv) incomplete measurements of the study variables.

Depression and Anxiety

The Depression Anxiety and Stress Scale-21 (DASS-21) was used. It is a self-report instrument with 21 items that is divided into three domains i) depression, ii) anxiety and iii) stress. The items are Likert type with 4 response options from 0 to 3. It has ad-equate internal consistency (α=0.86) [28]. To classify people, the cut-off points were: (i) no

symptoms: depression ≤4, anxiety ≤3, stress ≤7; (ii) mild symptoms: depression=5-6, anxiety=4-5, stress=8 or 9; (iii) moderate symptoms: depression=7-10; anxiety= 6-7, stress= 10-12; (iv) severe symptoms: depression=11-13. Anxiety 8-9, stress=13-16; (v) Extremely severe depression ≥14, anxiety ≥ 10, stress ≥17 [29].

Quality of Life

Quality of life was assessed using the WHOQOL-OLD. It is a 24-item self-report instrument that is divided into six domains of 4 items per subscale: (i) Sensory abilities, (ii) Autonomy, (iii) Past, present and future activities, (iv) Social participation, (v) Death and dying and (vi) Privacy. The grading of the items is Likert type with scores from 1 to 5. Items 1, 2, 6, 7, 8, 9 and 10 are scored with reverse scoring. The interval of the total score is 24 to 120, with higher scores indicating a better quality of life. It has adequate internal consistency (α=0.88) [30].

Subjective Well-being

Positive and Negative Affect Schedule (PANAS) was applied, it is composed of two 10-item factors designed to measure positive affect (PA) and negative affect (NA). The scoring of the items is Likert type with an interval of 1 to 5 points, 1 (very slightly or not at all) to 5 (extremely). Total scores interval between 10 and 50 for positive and negative emotions respectively, with a higher score indicating more positive or nega-tive emotions. Frequency of emotions is requested during the last two weeks. It has adequate internal consistency (PA α= 0.85-0.90 and AN α= 0.81-0.85 (α=0.72) [31]

Insomnia

Athens Insomnia Scale allows you to detect the severity of insomnia. It is made up of 8 items with a Likert-type score with 4 response options. The overall score intervals from 0 to 24 points. A score greater than or equal to 8 indicates insomnia [32].

Tele-training intervention program

Before the implementation of the physical exercise tele-training program, participating older adults were trained by zoom on the use of digital tools that would be used in the program, such as (i) use of the computer and/or or smartphone, (ii) use of Zoom and/or Google Meet;

(iii) Google forms and QR readers, (iv) WhatsApp and email. A manual and a video were provided.

The instructors were standardized to implement tele-physical exercise training, by specialists from the sports activities department of the FES Zaragoza, UNAM.

Tele-training tai chi

The tele-training tai chi program followed the guidelines established by Li et al. [24], for the practice of "Eight-form easy Tai chi for elderly adults," which was carried out remotely supervised by zoom four days by week, in 60 min sessions for 6 months. The participants had a 10-min warm-up, 40 min of practicing easy TC movements/postures, and a 10-min cool-down.

Warm-up and Activation (10 minutes)	Low-impact joint movements from head to toe (10 repetitions). Rotation of head, neck, shoulders, wrists, hips and trunk. Leg stretches, push-ups, lifting knees to chest and heel to gluteus. Heel rotation and lifting.
Main session (40 minutes)	"Eight-form easy tai chi for elderly adults" statically (in a stationary position) for a period of 5 to 10 s. The "Eight-form easy Tai chi for elderly adults" to high stance is as follows: (i) Commencing form: both hands rise to shoulder level; (ii) Curving back arms (repulse monkey): right, left; 3 times each side; (iii) Stepping sideways and moving arms (Grasp Peacock's Tail: ward off, rollback, press, push): to the left, then to the right; (iv) Moving hands (wave hands like "clouds moving in the sky"): left side leads, 3 times; (v) Diagonal strides (fair lady works at shuttles): left, then right; (vi) Standing on one leg (golden cock stands on one leg): right, then left; (vii) Stepping and pushing (brush knees and twist steps): left, then right; (viii) Closing form: both hands fall to the side, left leg drawn to the right leg. Each movement was practiced repetitively (8–10 repetitions) at a slow, self-controlled speed. After some successful initial practice of these static and moving positions, learners/ performers are ready to move on to linking the eight postures of easy TC in a sequential, continuous manner. Each daily session consisted of a minimum of five sets of easy TC, along with repeated practice of each movement.
Cool-down (10 minutes)	Stretching movement of the muscle groups that were worked in the main session, with deep expiration in each stretch (10 repetitions) standing. Trunk, hamstrings, calf, full leg standing. Stretching of biceps, triceps, back, chest and trunk; head to shoulders on both sides; chin to chest.

Tele-training resistance exercise

The subjects practiced a physical resistance exercise program which was designed by the Gerontology Research Unit, and consists of three phases: (i) warm-up and activation (10

minutes), (ii) main session (40 minutes) and (iii) return to calm (10 minutes); four sessions per week (WHO, 2020) [25]. Participants performed their routines under the supervision by zoom of a qualified instructor.

Warm-up and Activation (10 minutes)	Low-impact joint movements from head to toe (10 repetitions). Rotation of head, neck, shoulders, wrists, hips and trunk. Leg stretches, push-ups, lifting knees to chest and heel to gluteus. Heel rotation and lifting.
Main session (40 minutes)	Initial phase (First and second week): Repeat the exercise session until completing 40 minutes. Chair squats (10 repetitions) Elevation and descent of arms (15 repetitions) Right and left leg extension (15 repetitions) Chair torso twist (15 repetitions) Heel lift (15 repetitions)
Adaptation and reinforcement phase	Besides of activities of the Initial phase (Third to twelfth week) Wall Pushing Pushups (10 repetitions) Wall leaning left leg swings (15 repetitions) Wall leaning right leg swings (15 repetitions) Torso twist standing with legs bent (10 sec.) Static wall squats (10 repetitions) Wall push-ups with right arm (10 repetitions) Left arm wall push-ups (10 repetitions)
Maintenance phase	Besides of activities of the Initial and adaptation phase (Thirteen to twenty-fourth week) Activities from past sessions Boxer punches (15 repetitions) Standing crunches (15 repetitions) Hindu squat (10 repetitions) Shoulder press (10 seg.) Bent over lateral raise (10 repetitions) Lateral flexion right side (10 repetitions) Lateral flexion left side (10 repetitions)
Cool-down (10 minutes)	Stretching movement of the muscle groups that were worked in the main session, with deep expiration in each stretch (10 repetitions) standing. Trunk, hamstrings, calf, full leg standing. Stretching of biceps, triceps, back, chest and trunk; head to shoulders on both sides; chin to chest.

Data Analysis

Means, standard deviation, and percentages were calculated to summarize the data. For the comparison test, the repeated measures ANOVA was used, considering a value of $p<0.05$ as significant. The pre and post treatment effect size per group was calculated, using Cohen's d for repeated measures. The statistical package SPSS version 21 was used to perform the analysis.

Results

Sociodemographic Characteristics and Health

The average age of the SEG was 62.7±6 years and the TCG was 63.8±4.9 years. Likewise, the SEG was made up of 75% women and the TCG group was made up of 93% women. The average years of schooling for the SEG are 11.2±5.4 while for the TCG they are 10.2±4.2. Regarding marital status, most people are married and lived with someone. There was no statistically significant difference in any of the sociodemographic characteristics between the two groups (Table 1).

Tele-training Adherence

An adherence greater than 90% of the participants in both groups of physical exercise tele-training was observed, since only one subject from each group was eliminated because they did not complete 90% of the training program sessions. Technical failures due to internet connectivity were minimal and the participants did not interrupt the program, because they had a video about the type of physical exercise programmed.

Depression, Stress and Anxiety

The scores on the DASS-21 did not show significant changes in the domains of depression, stress and anxiety after tele-training in both groups ($p>0.05$). A marginal decrease was observed in all three variables (Table 2). In this sense, in the TCG before training 87% were detected without mild symptoms of depression and after the intervention the percentage of non-depression increased to 93%, however, in the case of anxiety the percentage of subjects without anxiety decreased from 80 to 73%. In the SEG, an increase in the percentage of subjects without anxiety was observed (pre-intervention, 87% vs. post-intervention, 93%) (Figure 2).

Quality of Life

The scores on the WHOQOL-OLD did not show significant changes in the domains (i) sensory abilities, (ii) autonomy, (iii) past, present and future activities, (iv) social participation, (v) death and dying and (vi) Privacy after tele-training in both groups

(p>0.05). In all domains, the scores are of good quality of life before the intervention and are maintained after the intervention despite the confinement due to COVD-19 (Table 2).

Subjective Well-being

The scores on the Positive and Negative Affect Schedule did not show statistically significant changes after tele-training during the COVID-19 confinement in both groups (p>0.05) (Table 2).

Insomnia

Scores on the Athens Insomnia Scale did not show statistically significant changes after tele-training during the COVID-19 confinement in both groups (p>0.05). In this sense, a marginal decrease in the score was observed in both groups (Table 2).

Discussion

The COVID 19 pandemic highlighted the relevance of telemedicine through the use of information technologies to maintain the health of the population [35]. Exercise training, during confinement, was also adapted to be delivered digitally, using two-way communication or videos, however, little is known about the effect this had.

Some online physical exercise interventions have shown a positive effect on physical performance [36–39]. In this sense, in a study carried out during the pandemic in middle-aged people, using online resistance exercise twice a week for 8 weeks, it was found that exercise reduces depressive symptoms, however, no effect was found on the stress and well-being [40]. Likewise, in another investigation on the effect of tele-calisthenics training for 4 weeks in older adults, a decrease in depressive symptoms was observed [41]. In the present investigation, it was found that tele-training of Tai Chi and strength in older adults for six months allowed maintaining an adequate level of perception of quality of life and positive emotions, as well as preventing participants from presenting high or severe cases of depression, anxiety and stress, during confinement due to COVID-19.

During COVID-19, there was an increase in depression, anxiety and severe stress, mainly in women [42,43]. In contrast, in our study, made up mostly of women, it was found that tele-training prevented depression, anxiety or stress from occurring. This suggests that one of the main factors in the appearance of psychological alterations during confinement was the decrease in physical activity, regardless of sex [44].

A systematic review on physical activity and mental health during the first year of the pandemic found that physical activity is a strategy to improve mental health, but most studies are cross-sectional (26 of 31) [45]. Our study confirms what was reported in the systematic review, having the particularity that it was a longitudinal study, in older adults and carried out by tele-training.

On the other hand, in a tele-training intervention on strength exercise, carried out for 12 weeks during the COVID-19 confinement, in 18 older adults, it was found that the levels of depression, anxiety, stress and quality of life remained stable before and after the intervention [46]. These results are consistent with what was observed in our research.

In our study, Tai Chi tele-training was compared vs. strength exercise, assuming that Tai Chi, being a type of mind-body exercise, would have a better effect than strength exercise, as has been reported in a systematic review study [47], however no statistically difference was observed significant, probably because in both types of exercise it was possible to maintain attention and adherence to the physical exercise program to maintain health.

On the other hand, we found that quality of life indicators were maintained in older adults who participated in the tele-training program. This is consistent with other research [48]. In contrast, in a study carried out with older adults it was found that during confinement there was a decrease in the quality of life factors of death and dying, intimacy and social participation [49]. The indicators of social participation and intimacy are two of those that were most stable in our results. The above highlights the relevance of tele-training to maintain an adequate level of quality of life in confinement situations.

Another problem that occurred during confinement in older adults was insomnia, which in turn was related to depression and anxiety [50]. In our study, it was found that the participants did not present insomnia problems before and after the intervention. In this sense, prior to confinement, it has been found that physical activity improves the quality of life related to sleep [51], it has also been reported that physical exercise was a protective factor to reduce insomnia problems during confinement [52]. Considering the above, our findings suggest that participation in the physical exercise tele-training program during confinement could prevent insomnia from occurring in older adults.

Telemedicine consists of a synchronous consultation using a telephone or video device. Its use in older adults was well accepted during COVID-19 [53,54]. However, in the case of exercise, some difficulties occurred such as lack of space to perform the exercise, connection problems [55], low selfefficacy regarding the use of technology, little

generational support [56]. In our research, the aforementioned conditions did not prevent older adults from participating and maintaining adherence to the tele-physical exercise program; this could be due to the fact that i) continuous training and supervision was provided on the use of the devices, ii) the Exercise was always demonstrative (the trainer also performed it), iii) the training was reinforced by highlighting the benefits and iv) it was carried out based on a structured exercise program. In this regard, it has been reported that these characteristics facilitate acceptance in online exercise programs [57].

In the case of exercise, it was found that when performed with pre-recorded videos, no health benefits are observed and the dropout rate is higher than synchronously [58]. Other research reports that synchronous intervention has a greater impact compared to mobile applications [59]. In our study, the training was synchronous, having a low dropout rate and maintaining adequate well-being and quality of life. The above suggests that exercise interventions may be more effective synchronously than with recorded programs or only with the use of applications.

The results of this research suggest that tele-training, both in strength physical exercise and Tai Chi, managed to prevent older adults from developing depression, anxiety, stress and insomnia, and maintain levels of quality of life and positive emotions during confinement due to COVID-19. However, there were several limitations in the study, among which the sample size stands out, the majority of participants were women, in addition to the fact that a control group was not included for ethical reasons.

Although the confinement situation due to COVID-19 decreased after the distribution of the vaccines, tele-health in general and tele-training in particular, are activities that were increasingly incorporated into everyday life, so it is It is necessary to know its effects, as well as generate tools that allow the elderly to maintain their autonomy.

Conclusions

Our results suggest that synchronous tele-training of strength physical exercise or Tai Chi are useful to prevent depression, anxiety or stress, and maintain quality of life, as well as positive emotions, and avoid insomnia in older adults, during emergent situations that warrant confinement as occurred during the COVID-19 pandemic. It is necessary to carry out more research on tele-training of different types of physical ex-ercise to understand its effects in different contexts and life situations.

Author Contributions

Conceptualization, V.M.M-N; methodology, M.S-N., O.A.R-A., N.A.V-B; formal analysis, V.M.M-N., M.S-N, O.A.R-A., E.C-M; investigation, E.C-M., N.A.V-B, O.A.R-A., M.S-N.; writing—original draft preparation, M.S-N; writing—review and editing, V.M.M-N.; supervision, N.A.V-B., O.A.R-A.; V.M.M-N. All authors have read and agreed to the published version of the manuscript.

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Institutional Review Board Statement

The protocol was approved by the Ethics Committee of the Faculty of Higher Studies Zaragoza, UNAM (FESZ/DEPI/CI/03920) (ISRCTN48485253).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement

The data presented in this study are available on request from the corresponding author.

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Conflicts of Interest: The authors declare no conflicts of interest.

Referencias

1. Holmes EA, O'Connor RC, Perry VH, Tracey I, Wessely S, Arseneault L, et al. Multidisciplinary research priorities for the COVID-19 pandemic: a call for action for mental health science. Lancet Psychiatry. 2020;7(6):547-560. doi: 10.1016/S2215-0366(20)30168-1.
2. Mahase E. Covid-19: UK starts social distancing after new model points to 260 000 potential deaths. BMJ. 2020;368:m1089. doi: 10.1136/bmj.m1089.
3. Mushtaq A, Khan MA. Social isolation, loneliness, and mental health among older adults during COVID-19: a scoping review. J Gerontol Soc Work. 2024;67(2):143-156. doi: 10.1080/01634372.2023.2237076.
4. Alqahtani IM, Al-Garni AM, Abumelha MS, Alsagti SA, Alshehri FAD, Alqahtani AA, Alkhidhran SSS. Prevalence of depression, anxiety, and stress among the general population during COVID-19 pandemic: A systematic review. J Family Med Prim Care. 2023;12(6):1030-1037. doi: 10.4103/jfmpc.jfmpc_1943_22.
5. Silva C, Fonseca C, Ferreira R, Weidner A, Morgado B, Lopes MJ, Moritz S, Jelinek L, Schneider BC, Pinho LG. Depression in older adults during the COVID-19 pandemic: A systematic review. J Am Geriatr Soc. 2023;71(7):2308-2325. doi: 10.1111/jgs.18363.
6. Jiménez-Pavón D, Carbonell-Baeza A, Lavie CJ. Physical exercise as therapy to fight against the mental and physical consequences of COVID-19 quarantine: Special focus in older people. Prog Cardiovasc Dis. 2020;63(3):386-388. doi: 10.1016/j.pcad.2020.03.009.
7. Wu ZJ, Han C, Wang ZY, Li FH. Combined training prescriptions for improving cardiorespiratory fitness, physical fitness, body composition, and cardiometabolic risk factors in older adults: Systematic review and meta-analysis of controlled trials. Sci Sports. 2023. doi: 10.1016/j.scispo.2022.03.015.
8. Khalafi M, Sakhaei MH, Rosenkranz SK, Symonds ME. Impact of concurrent training versus aerobic or resistance training on cardiorespiratory fitness and muscular strength in middle-aged to older adults: A systematic review and meta-analysis. Physiol Behav. 2022;254:113888. doi: 10.1016/j.physbeh.2022.113888.
9. da Silva Gonçalves L, Santos Lopes da Silva L, Rodrigues Benjamim CJ, Tasinafo Junior MF, Bohn L, Ferreira Abud G, et al. The Effects of Different Exercise Training Types on Body Composition and Physical Performance in Older Adults with Sarcopenic Obesity: A Systematic Review and Meta-Analysis. J Nutr Health Aging. 2023;27(11):1076-1090. doi: 10.1007/s12603-023-2018-6.
10. Chang X, Xu S, Zhang H. Regulation of bone health through physical exercise: Mechanisms and types. Front Endocrinol (Lausanne). 2022;13:1029475. doi: 10.3389/fendo.2022.1029475.
11. Papalia GF, Papalia R, Diaz Balzani LA, Torre G, Zampogna B, Vasta S, et al. The Effects of Physical Exercise on Balance and Prevention of Falls in Older People: A Systematic Review and Meta-Analysis. J Clin Med. 2020;9(8):2595. doi: 10.3390/jcm9082595.
12. Nunes PRP, Castro-E-Souza P, de Oliveira AA, Camilo BF, Cristina-Souza G, Vieira-Souza LM, Carneiro MADS. Effect of resistance training volume on body adiposity, metabolic risk, and inflammation in postmenopausal and older females: Systematic review and meta-analysis of randomized controlled trials. J Sport Health Sci. 2024 Mar;13(2):145-159. doi: 10.1016/j.jshs.2023.09.012.
13. Ciolac EG, Rodrigues da Silva JM, Vieira RP. Physical Exercise as an Immunomodulator of Chronic Diseases in Aging. J Phys Act Health. 2020;17(6):662-672. doi: 10.1123/jpah.2019-0237.
14. Liu M, Mei DH, Zhang YL, Kang N, Wang DM, Chen G. Meta-analysis of exercise

intervention on health behaviors in middle-aged and older adults. Front Psychol. 2024 ;14:1308602. doi: 10.3389/fpsyg.2023.1308602.
15. Caputo EL, Reichert FF. Studies of Physical Activity and COVID-19 During the Pandemic: A Scoping Review. J Phys Act Health. 2020;17(12):1275-1284. doi: 10.1123/jpah.2020-0406.
16. Bidzan-Wiącek M, Błażek M, Antosiewicz J. The relationship between physical activity and depressive symptoms in males: A systematic review and meta-analysis. Acta Psychol (Amst). 2024;243:104145. doi: 10.1016/j.actpsy.2024.104145.
17. Bigarella LG, Ballotin VR, Mazurkiewicz LF, Ballardin AC, Rech DL, Bigarella RL, Selistre LDS. Exercise for depression and depressive symptoms in older adults: an umbrella review of systematic reviews and Meta-analyses. Aging Ment Health. 2022;26(8):1503-1513. doi: 10.1080/13607863.2021.1951660.
18. Said CM, Batchelor F, Duque G. The Impact of the COVID-19 Pandemic on Physical Activity, Function, and Quality of Life. Clin Geriatr Med. 2022;38(3):519-531. doi: 10.1016/j.cger.2022.04.003.
19. Leale I, Figlioli F, Giustino V, Brusa J, Barcellona M, Nocera V, et al. Telecoaching as a new training method for elderly people: a systematic review. Aging Clin Exp Res. 2024;36(1):18. doi: 10.1007/s40520-023-02648-9.
20. Bertolazzi A, Quaglia V, Bongelli R. Barriers and facilitators to health technology adoption by older adults with chronic diseases: an integrative systematic review. BMC Public Health. 2024;24(1):506. doi: 10.1186/s12889-024-18036-5.
21. Peng R, Li X, Guo Y, Ning H, Huang J, Jiang D, Feng H, Liu Q. Barriers and facilitators to acceptance and implementation of eMental-health intervention among older adults: A qualitative systematic review. Digit Health. 2024;10:20552076241234628. doi: 10.1177/20552076241234628.
22. Dong Y, Zhang X, Zhao R, Cao L, Kuang X, Yao J. The effects of mind-body exercise on anxiety and depression in older adults: a systematic review and network meta-analysis. Front Psychiatry. 2024;15:1305295. doi: 10.3389/fpsyt.2024.1305295.
23. Kuang X, Dong Y, Song L, Dong L, Chao G, Zhang X, Yang J. The effects of different types of Tai Chi exercise on anxiety and depression in older adults: a systematic review and network meta-analysis. Front Public Health. 2024;11:1295342. doi: 10.3389/fpubh.2023.1295342.
24. Li L, Li X, Huang Y, Li H, Li C, Ma Y, Zhang J, Peng F, Lyu S. An RCT META analysis based on the effect of tai chi exercise therapy on the outcome of elderly patients with moderate-to-severe sleep disorders-A systematic review study. Heliyon. 2024;10(2):e24085. doi: 10.1016/j.heliyon.2024.e24085.
25. Gao W, Lv M, Huang T. Effects of different types of exercise on hypertension in middle-aged and older adults: a network meta-analysis. Front Public Health. 2023;11:1194124. doi: 10.3389/fpubh.2023.1194124.
26. Shen Y, Shi Q, Nong K, Li S, Yue J, Huang J, Dong B, Beauchamp M, Hao Q. Exercise for sarcopenia in older people: A systematic review and network meta-analysis. J Cachexia Sarcopenia Muscle. 2023;14(3):1199-1211. doi: 10.1002/jcsm.13225.
27. Figueira HA, Figueira OA, Figueira AA, Figueira JA, Polo-Ledesma RE, Lyra da Silva CR, Dantas EHM. Impact of Physical Activity on Anxiety, Depression, Stress and Quality of Life of the Older People in Brazil. Int J Environ Res Public Health. 2023;20(2):1127. doi: 10.3390/ijerph20021127.
28. Gurrola PGlM, Balcázar NP, Bonilla MMP, Virseda HJA. Estructura Factorial y Consistencia Interna de La Escala de Depresión Ansiedad y Estrés (DASS-21) En Una Muestra No Clínica. Psicología y Ciencia Social. 2006; 8:3–7. Available from:

https://www.redalyc.org/pdf/314/31480201.pdf
29. Antony MM, Cox BJ, Enns MW, Bieling PJ, Swinson RP. Psychometric Properties of the 42-Item and 21-Item Versions of the Depression Anxiety Stress Scales in Clinical Groups and a Community Sample. Psychol Assess. 1998; 10: 176–181, doi:10.1037/1040-3590.10.2.176.
30. González-Celis AL, Gómez-Benito J. Quality of Life in the Elderly: Psychometric Properties of the WHOQOL-OLD Module in Mexico. Health N Hav. 2013;5: 110–116.
31. Moral de la Rubia J. La Escala de Afecto Positivo y Negativo (PANAS) en Parejas Casadas Mexicanas. Ciencia Ergo Sum. 2011; 18: 117–125.
32. Nenclares PA, Jimenez-Genchi A. Estudio de Validación de La Traducción al Español de La Escala Atenas de Insomnio. Salud Ment. 2005; 28: 34–39.
33. Li F, Fisher KJ, Harmer P, Shirai M. A Simpler Eight-Form Easy Tai Chi Forelderly Adults. J Aging Phys Act. 2003; 11: 425–432.
34. Lee PG, Jackson E, Richardson CR. Exercise Prescriptions in Older Adults. Am Fam Physician. 2017; 95: 425–432.
35. Garfan S, Alamoodi AH, Zaidan BB, Al-Zobbi M, Hamid RA, Alwan JK, et al. Telehealth utilization during the Covid-19 pandemic: A systematic review. Comput Biol Med. 2021;138:104878. doi: 10.1016/j.compbiomed.2021.104878.
36. Chang SH, Chiang CC, Chien NH. Efficacy of a multicomponent exercise training program intervention in community-dwelling older adults during the COVID-19 pandemic: A cluster randomized controlled trial. Geriatr Nurs. 2023;49:148-156. doi: 10.1016/j.gerinurse.2022.11.019.
37. Granet J, Peyrusqué E, Ruiz F, Buckinx F, Abdelkader LB, Dang-Vu TT, et al. Web-Based Physical Activity Interventions Are Feasible and Beneficial Solutions to Prevent Physical and Mental Health Declines in Community-Dwelling Older Adults During Isolation Periods. J Gerontol A Biol Sci Med Sci. 2023;78(3):535-544. doi: 10.1093/gerona/glac127.
38. Edna Mayela VC, Miriam LT, Ana Isabel GG, Oscar RC, Alejandra CA. Effectiveness of an online multicomponent physical exercise intervention on the physical performance of community-dwelling older adults: A randomized controlled trial. Geriatr Nurs. 2023;54:83-93. doi: 10.1016/j.gerinurse.2023.08.018.
39. McGarrigle L, Todd C. Promotion of Physical Activity in Older People Using mHealth and eHealth Technologies: Rapid Review of Reviews. J Med Internet Res. 2020;22(12):e22201. doi: 10.2196/22201.
40. Kikuchi N, Ohta T, Hashimoto Y, Mochizuki Y, Saito M, Kozuma A, et al. Effect of Online Home-Based Resistance Exercise Training on Physical Fitness, Depression, Stress, and Well-Being in Middle-Aged Persons: A Pilot Study. Int J Environ Res Public Health. 2023;20(3):1769. doi: 10.3390/ijerph20031769.
41. Tekin F, Cetisli-Korkmaz N. Effectiveness of a Telerehabilitative Home Exercise Program on Elder Adults' Physical Performance, Depression and Fear of Falling. Percept Mot Skills. 2022;129(3):714-730. doi: 10.1177/00315125221087026.
42. Necho M, Tsehay M, Birkie M, Biset G, Tadesse E. Prevalence of anxiety, depression, and psychological distress among the general population during the COVID-19 pandemic: A systematic review and meta-analysis. Int J Soc Psychiatry. 2021;67(7):892-906. doi: 10.1177/00207640211003121.
43. Ruiz FJ, Sáiz PA, García-Portilla MP, González-Blanco L, García-Álvarez L, Madera PZ, et al. Does COVID-19 psychological fatigue exist? Results of three online cross-sectional studies conducted in Spain from April 2020 to March 2021. J Glob Health. 2022;12:05001. doi: 10.7189/jogh.12.05001.

44. Jáuregui A, Argumedo G, Hernández-Alcaraz C, Contreras-Manzano A, Salinas-Rodríguez A, Salvo D. Changes Among Mexican Adults in Physical Activity and Screen Time During the COVID-19 Lockdown Period and Association With Symptoms of Depression, Anxiety, and Stress, May 29-July 31, 2020. Prev Chronic Dis. 2022;19:E13. doi: 10.5888/pcd18.210324.
45. Marconcin P, Werneck AO, Peralta M, Ihle A, Gouveia ÉR, Ferrari G, Sarmento H, Marques A. The association between physical activity and mental health during the first year of the COVID-19 pandemic: a systematic review. BMC Public Health. 2022;22(1):209. doi: 10.1186/s12889-022-12590-6.
46. Daniele de Araújo Silva J, Cândido Mendes Maranhão D, Machado Ferreira Tenório de Oliveira L, Luiz Torres Pirauá A. Comparison between the effects of virtual supervision and minimal supervision in a 12-week home-based physical exercise program on mental health and quality of life of older adults: Secondary analysis from a randomized clinical trial. Geriatr Gerontol Int. 2023;23(11):864-870. doi: 10.1111/ggi.14673.
47. Li Y, Liu M, Zhou K, Dong G, Manor B, Bao D, Zhou J. The comparison between effects of Taichi and conventional exercise on functional mobility and balance in healthy older adults: a systematic literature review and meta-analysis. Front Public Health. 2023;11:1281144. doi: 10.3389/fpubh.2023.1281144.
48. Zengin Alpozgen A, Kardes K, Acikbas E, Demirhan F, Sagir K, Avcil E. The effectiveness of synchronous tele-exercise to maintain the physical fitness, quality of life, and mood of older people - a randomized and controlled study. Eur Geriatr Med. 2022;13(5):1177-1185. doi: 10.1007/s41999-022-00672-y.
49. Kayhan Koçak FÖ, Çavdar S, Savas S, Akçiçek SF. The impact of the COVID-19 pandemic on well-being of seniors attending online programs at University of the Third Age: a follow-up study. Psychogeriatrics. 2022;22(5):642-650. doi: 10.1111/psyg.12866.
50. Cipriani GE, Bartoli M, Amanzio M. Are Sleep Problems Related to Psychological Distress in Healthy Aging during the COVID-19 Pandemic? A Review. Int J Environ Res Public Health. 2021;18(20):10676. doi: 10.3390/ijerph182010676.
51. Hasan F, Tu YK, Lin CM, Chuang LP, Jeng C, Yuliana LT, Chen TJ, Chiu HY. Comparative efficacy of exercise regimens on sleep quality in older adults: A systematic review and network meta-analysis. Sleep Med Rev. 2022;65:101673. doi: 10.1016/j.smrv.2022.101673.
52. Yuan K, Zheng YB, Wang YJ, Sun YK, Gong YM, Huang YT, et al. A systematic review and meta-analysis on prevalence of and risk factors associated with depression, anxiety and insomnia in infectious diseases, including COVID-19: a call to action. Mol Psychiatry. 2022;27(8):3214-3222. doi: 10.1038/s41380-022-01638-z.
53. Şahin E, Yavuz Veizi BG, Naharci MI. Telemedicine interventions for older adults: A systematic review. J Telemed Telecare. 2024;30(2):305-319. doi: 10.1177/1357633X211058340.
54. Alsabeeha NHM, Atieh MA, Balakrishnan MS. Older Adults' Satisfaction with Telemedicine During the COVID-19 Pandemic: A Systematic Review. Telemed J E Health. 2023;29(1):38-49. doi: 10.1089/tmj.2022.0045.
55. Gravesande J, Almeida de Oliveira L, Malik N, Vrkljan B, Zheng R, Gardner PM, Carlesso LC. Feasibility, Usability, and Acceptability of Online Mind-Body Exercise Programs for Older Adults: A Scoping Review. J Integr Complement Med. 2023;29(9):538-549. doi: 10.1089/jicm.2022.0822.
56. Haimi M, Goren U, Grossman Z. Barriers and challenges to telemedicine usage among the elderly population in Israel in light of the COVID-19 era: A qualitative

study. Digit Health. 2024;10:20552076241240235. doi: 10.1177/20552076241240235.
57. Teo JL, Bird SR, Wang X, Zheng Z. Using telehealth to deliver Qi Gong and Tai Chi programs: A mixed-methods systematic review on feasibility, acceptability and participant engagement factors. Arch Gerontol Geriatr. 2024;117:105203. doi: 10.1016/j.archger.2023.105203.
58. Wilke J, Mohr L, Yuki G, Bhundoo AK, Jiménez-Pavón D, Laiño F, et al. Train at home, but not alone: a randomised controlled multicentre trial assessing the effects of live-streamed tele-exercise during COVID-19-related lockdowns. Br J Sports Med. 2022;56(12):667-675. doi: 10.1136/bjsports-2021-104994.
59. Wu S, Li G, Shi B, Ge H, Chen S, Zhang X, He Q. Comparative effectiveness of interventions on promoting physical activity in older adults: A systematic review and network meta-analysis. Digit Health. 2024;10:20552076241239182. doi: 10.1177/20552076241239182.

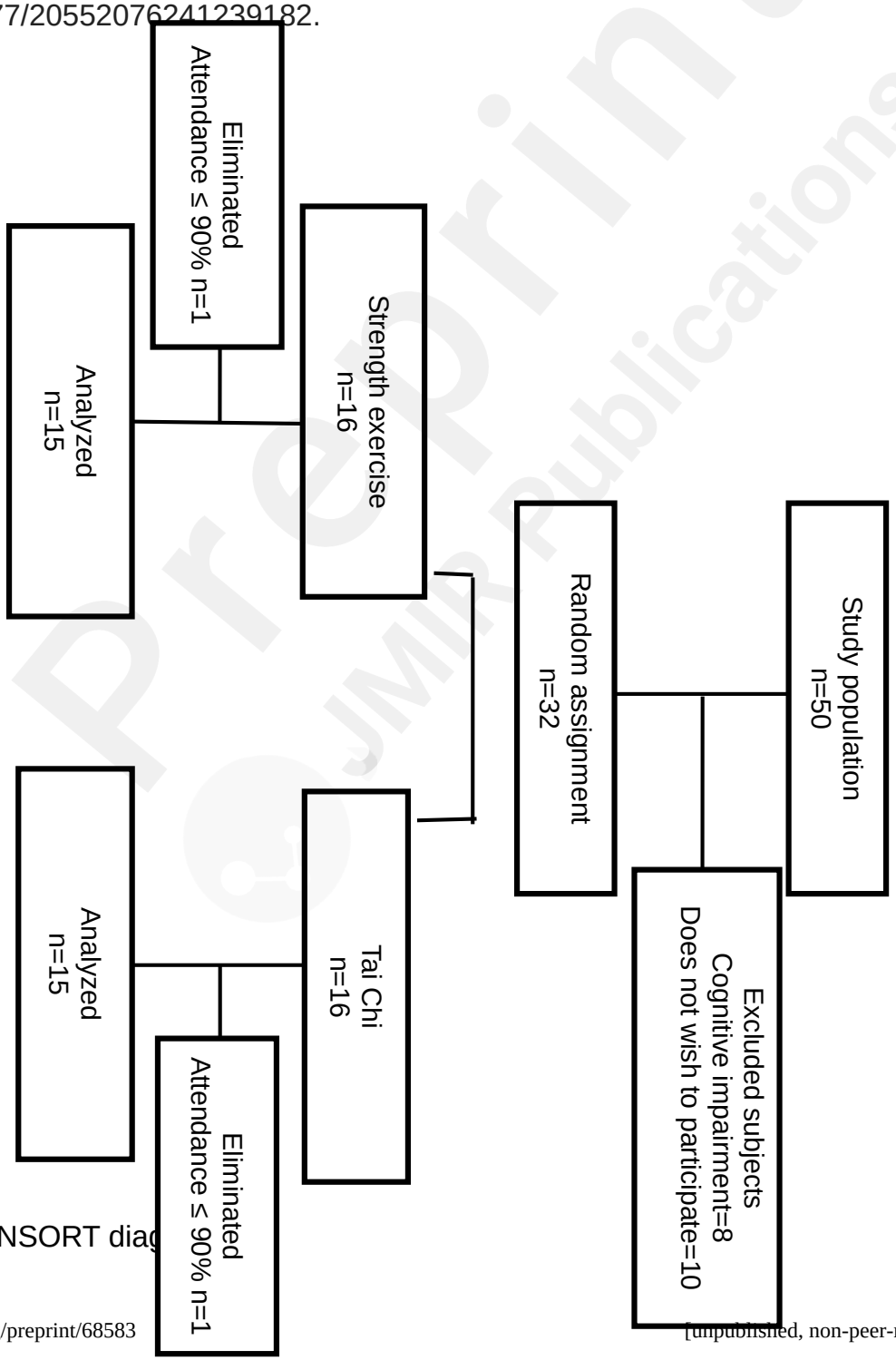

Figure 1. CONSORT diag

Table 1. Sociodemographic characteristics of the study groups

	Strength exercise group n=16		Tai chi group n=16	
	Mean	SD	Mean	SD
Age	62.7	6.0	63.8	4.9
Years of education	11.2	5.4	10.2	4.2
Number of diseases	1.2	1.2	1.3	1.3
Years with type 2 diabetes	2.1	5.9	2.4	4.4
Years of arterial hypertension	4.06	6.5	9.2	12.8
Body mass index	28.9	4.9	31.7	5.2
NPL	1.7	1.3	3.1	3
	n	%	n	%
Sex				
Female	12	75	15	93
Male	4	25	1	7
Type 2 diabetes				
With	2	12.5	5	31.7
Without	14	87.5	11	68.3
Arterial hypertension (%)				
With	5	31.7	8	50
Without	11	68.3	8	50
Civil status				
Married	11	68.8	9	56.2
Divorced or widowed	3	18.8	4	25
Single	2	12.4	3	18.8
Lives with				
Couple	7	43.8	5	31.2
Couple and children	4	25	3	18.8
Other family	2	12.4	5	31.2
Only	3	18.8	3	18.8

* t student for independent samples; **χ^2, chi square; NPL: Number of people with whom they live

Table 2. Comparison of the effect of physical exercise and tai chi on psychological variables

Variables	Strength exercise			Tai Chi			
	Basal n=16 Mean ± SD	6 M n=15 Mean ± SD	d	Basal n=16 Mean ± SD	6 M n=15 Mean ± SD	d	p
DASS-21							
Depression	0.9±1.4	0.8±1.5	0.0	2.2±1.7	2.2±1.5	0.0	0.839

Stress	1.2±1.3	0.9±1.2	5 0.2	3.0±3.2	2.5±1.8	0.14	0.535
Anxiety	1.2±1.5	1.1±1.3	0.0 5	2.9±2.1	2.7±1.7	0.07	0.449
Quality of life							
Sensory skills	17.3±2	17.1±2.2	0.0 7	15.6±3	15.3±2.9	0.07	0.688
Autonomy	16.5±3.0	17.1±2.8	0.1 4	15.6±2.3	15.2±2.9	0.11	0.424
Death and dying	14.5±3.5	15.3±3.4	0.1 6	14.6±4.8	14.4±5.1	0.03	0.216
PPFA	16.2±1.9	16.1±2.5	0.0 3	15.3±1.5	15.8±1.7	0.22	0.262
Social participation	15.5±2.4	15.7±2.8	0.0 5	14.4±2.6	14.6±2.7	0.05	0.927
Intimacy	15.4±3.4	15.4±3.6	0.0	15.0±3.3	14.8±3.6	0.04	0.794
Total quality of life	95.5±10	96.7±11	0.0 8	90.4±10.5	90.1±13.0	0.02	0.604
PANAS							
Positive emotions	37.6±5.6	37.9±5.3	0.0 4	31.9±6.7	32.9±7.2	0.10	0.737
Negative emotions	14.1±4.0	14.3±3.8	0.0 3	19.1±6.3	18.5±6.1	0.07	0.464
Insomnia	4.3±4.0	3.6±4.1	0.1 2	6.0±4.1	5.4±3.7	0.10	0.9

* ANOVA of repeated measures p<0.05;M= Months;SD= standard deviation; d= Cohen's d for repeated measures; PPFA: Present, past and future activities.

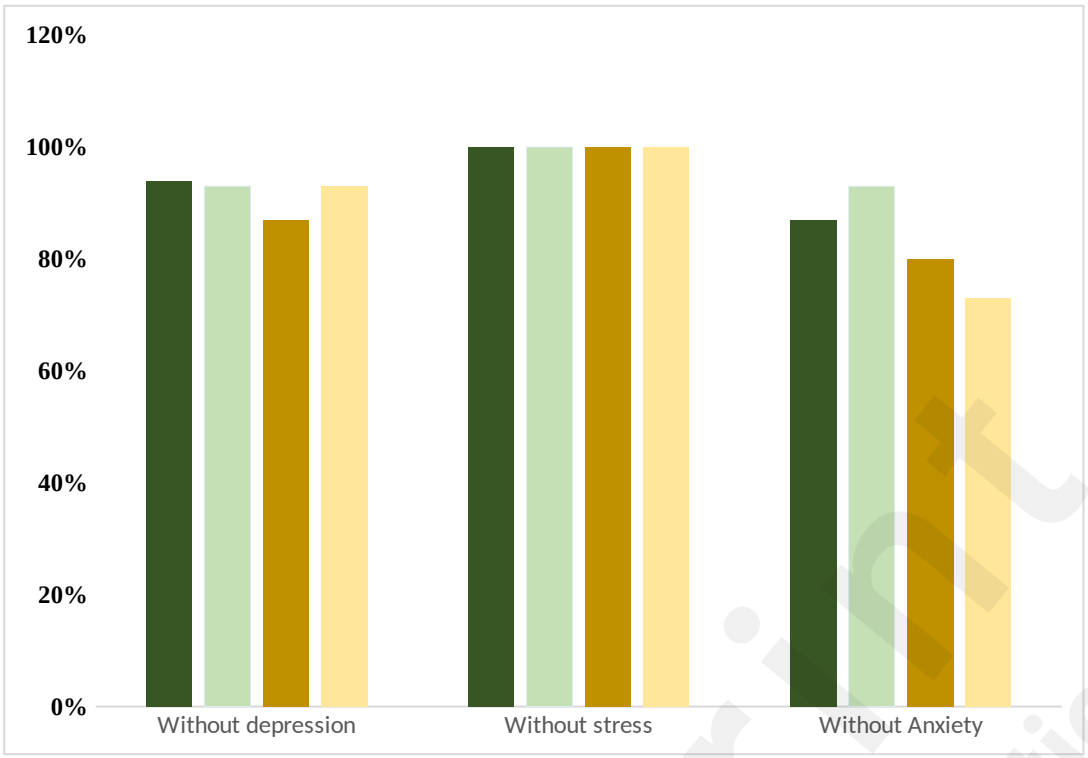

Figure 2. It shows that the SEG and TCG were maintained without depression, stress and anxiety during confinement