



Home-based Bodyweight Training: An Emergency Approach to Enhance Students' Quality of Life

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Abstract

Background: A sedentary lifestyle declines quality of life and would be a critical threat to the future. Planning for post-COVID life must be a strategy during confinement. In this paper, we aimed to investigate the effect of home-based training as an available program on students' quality of life.

Methods: This was a quasi-experimental study with a pretest-posttest design. The participants were selected from male high school students in Tehran, Iran, during 2020-2021. Thirty high school students were randomly assigned to home-based training (HBT, n=15) and non-exercise control group (CG, n=15). Simple random sampling method was used to randomly assign the study participants to test and control groups. HBT was performed four times a week, 60 minutes per session, for eight weeks. The short version of the World Health Organization Quality of Life (QoL) instrument was used to evaluate QoL, covering four domains: self-perceived physical health, psychological health, social relationships, and environment. Following the confirmation of data normality via the Kolmogorov-Smirnov test, ANCOVA was employed to assess training effectiveness, and Levene's test was used to verify variance homogeneity assumptions.

Results: After post-test, mean self-perceived physical health (CG) stood at (60.91±14.81), markedly lower than that of the HBT group (86.14±12.54) (P=0.001). Furthermore, mean psychological health in the CG and HBT groups were (54.03±23.98) and (73.49±14.28), respectively, exhibiting statistical significance (P=0.001). However, no remarkable changes occurred in the social (P=0.992) and environmental domain (P=0.146) after training protocol. None of the variables exhibited significant alterations in the CG group.

Conclusion: Noticeable outcomes of home-based bodyweight training discerned in the physical, psychological, and general domain of QoL after the program. It is suggested to evaluate other aspects of students' lives like home-based family training to make a passable bridge from COVID-pandemic to post-COVID life.

Keywords: Bodyweight, Quality of life, Home-training, Adolescent, COVID-19

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1. Introduction

The pandemic is triggered by SARS-CoV-2, a beta coronavirus that causes a new form of acute respiratory infection and atypical pneumonia, potentially progressing to SARS (1). Many governments have implemented social isolation measures which, in numerous countries, have swiftly escalated into comprehensive confinement, with severe consequences for all students (2). By April 3, 2019, nearly four billion individuals globally had engaged in home isolation and quarantine (2). While numerous students are responsibly adhering to official recommendations for self-isolation and staying home, these measures are likely to detrimentally impact individuals' physical activity patterns, resulting in prolonged periods of sedentary screen time and consequent repercussions on physical health, well-being, and

quality of life. The well-documented positive impacts of consistent physical activity on various health parameters are widely recognized (3, 4).

The COVID-19 disease has emerged as a major health concern for the lives of students. Beyond the stressful situation that appears for students, home-confinement (including a stay-at-home order, quarantine, and isolation) is new to students and raises a concern about how students react and also how they can pass this pandemic by the best strategy. The findings indicated that individuals in quarantine experienced higher levels of anxiety and a lower quality of life (QoL) in stark contrast to the general population prior to the pandemic. Additionally, those with elevated levels of anxiety generally had a lower QoL (2).

QoL assessments are essential during

emergencies and assessing QoL in the COVID-19 pandemic helps identify factors affecting the overall well-being of the population. Additionally, these assessments can pinpoint students vulnerable to anxiety and depression during the current crisis (5).

Students are undergoing significant changes, such as school shutdowns, residential confinement, and adherence to public distancing protocols, which may lead to a decline in their QoL (5-7). Moreover, reports indicated a surge in violence against children during home confinement, placing students at heightened risk of maltreatment and distress (8). Particularly vulnerable are students from poor socioeconomic backgrounds and those with antecedent psychological issues, as supported by ample prior research linking low socioeconomic status (9-11), parental educational attainment, and migration standing (12, 13) to mental health challenges among students. Additionally, the limited living space experienced by children in small apartments during home confinement can exacerbate stress, drawing from literature suggesting that constrained living arrangements can impact mental well-being (14). Furthermore, the closure of outpatient daycare centers during the pandemic has resulted in reduced access to pediatric healthcare, leaving some children's illnesses untreated (15). Workout is a crucial element of a well-being habits. Bodyweight training (BwT) is a form of exercise that uses the body's weight as resistance against gravity (16). Examples of BwT for the upper and lower body encompass push-ups, squatting, lunge, burpees. Resistance exercises with bodyweight exercises do not require special equipment or costs, and you can even exercise at home. During the Corona virus quarantine, it can be the best choice for maintaining and improving students' quality of life. The advantages of BwT for health and functional capacity are well established for students. In particular, high levels of physical activity positively influence mental health and QoL (17).

Students are the real wealth of every country and paying attention to their education and health will guarantee the future of societies. Given the significant impact of home confinement on students' physical and mental well-being, this study aimed to investigate the role of BwT in mitigating these adverse effects during the pandemic. Specifically, the objectives are to assess how regular engagement in bodyweight exercises influences students' physical health, mental well-

being, and overall QoL during quarantine. The current research sought to answer the following questions:

(1) Does an eight-week home-based bodyweight training (HBT) program significantly improve the physical and psychological domains of QoL for students during the COVID-19 pandemic?

(2) What are the potential reasons for the lack of significant improvement in the social and environmental domains of QoL after implementing a home-based bodyweight training program?

(3) Can regular engagement in home-based bodyweight training serve as an effective strategy to prepare students for transitioning back to normal life post-pandemic by improving their overall well-being and habit formation?

By answering these questions, this paper endeavored to offer valuable insights into the effectiveness of home-based physical activity as a strategy to support students' health and well-being during prolonged periods of isolation.

2. Methods

2.1. Study Design

This was a quasi-experimental study with a pretest-posttest design. The participants were male high school students in Tehran, Iran.

2.2 Sampling and Participants

During the pandemic, parents were reluctant to give permission for their children to participate in the protocol without hesitation; therefore, the participants were selected using a convenience sampling method (18-20). To ascertain the appropriate sample size, we used the formula for comparing the mean values for two independent groups.

$$n = ((Z_{\alpha/2} + Z_{\beta}) \cdot \sigma \Delta)^2$$

n is the required sample size for each group. $Z_{\alpha/2}$ is the Z-value corresponding to the desired confidence level (for a 95%, $Z_{\alpha/2}=1.96$). Z_{β} , the Z-value, is the desired power of the test (for 85% power, $Z_{\beta}=1.036$). σ is the standard deviation; Δ is the expected disparity between the mean

values for the two groups. The mean QoL score based on related research (18) in the exercise group before the intervention was 48.25 ± 8.15 , and after the intervention, it was 59.75 ± 6.25 . The mean score for the quality of life in the placebo group before the intervention was 49.27 ± 11.50 , and 50.50 ± 13.26 after the intervention. The expected difference between the post-intervention mean value for the two groups (Δ) was calculated to be 9.25. The combined standard deviation (σ) was calculated as the average of the post-intervention standard deviations of both groups. After calculating all parameters, the required sample size for each group was approximately 12 participants; therefore, we carried out the protocol with more required students and used 15 students in each group.

At the initial phase, 34 students participated in the study, but four students withdrew from the study. Thirty people (16.10 ± 1 years) were subjected to random selection and subsequently divided into two distinct groups, each comprising 15 participants. The experimental group included students with an average age of 16.06 ± 1.33 years, standing at an average height of 175.3 ± 9.6 cm. The control group exhibited an average age of 16.13 ± 1.24 years and an average height of 175.4 ± 8.25 cm. A simple random method was used to randomly assign the study participants to test and control groups. Each individual received a specific number from a sealed container. Depending on whether the number was even or odd, individuals were then placed either in the training group or the control group, respectively. The training program began after a series of preparatory sessions and orientation activities that took place two weeks prior.

2.3. Inclusion and Exclusion Criteria

The inclusion criteria were: no engagement in regular sports activities in the past year, completion of a consent form by the student's guardian or legal representative, adherence to COVID-19 preventive measures such as wearing a mask and maintaining proper physical distancing, completion of a health survey questionnaire (19), a physician's approval of the participants' health status, no history of cardiovascular diseases such as hypertension, arrhythmia, no prior infection with the coronavirus, and providing a negative COVID-19 test result. The exclusion criteria were: absence from more than two training sessions and undergoing drug therapy. Assessment of

dietary habits involved completion of a 24-hour food recall questionnaire by the students 48 hours (approximately 2 days) prior to the initiation of the HBT protocol, with instructions to maintain their regular diet throughout the eight-week training period. Additionally, 48 hours before the conclusion of the training sessions, students completed the food recall questionnaire once more.

2.4. Ethical Considerations

To adhere to the *research ethical* standards, prior to the commencement of the study, all participants and their guardians were thoroughly informed about the research goals and the voluntary nature of participation. They were assured of the confidentiality of their personal information and were explicitly informed about their right to withdraw from the study at any stage without any repercussions.

2.5. Resistance Training Program

All the students in this study lived in Tehran, Iran. HBT was done in Tehran Pars Sport Complex (Shahid Araghi), Tehran, Iran with the trainer's presence. HBT (20) includes eight weeks, four training sessions considered each week. The duration of the exercise was 30 seconds, followed by a 30-second rest interval. Students worked out HBT four times a week. At the beginning of each day, the students warmed up dynamically, encompassing leg swings, squats with the touch of the big toes, and open leg jumps for 10 to 12 minutes (20). Two weeks of the HBT program is presented as a sample in Table 1.

2.6. QoL Questionnaire

The WHOQOL-Bref, an abbreviated version of the WHOQOL-100, includes 26 items. This tool is designed to measure QoL in a multilingual and multicultural context, and developed collaboratively by 15 field centers (21). "QoL encompasses four domains pertaining to different aspects of life: physical health, psychological well-being, social interactions, and environmental factors. Additionally, it encompasses a facet that assesses overall QoL and general health". The WHOQoL instrument facilitates the derivation of distinct scores for each (QoL) domain. These scores, upon standardization, span from 0 (representing the poorest QoL) to 100 points (representing the optimal QoL).

Table 1: Two weeks of home-based bodyweight training protocol

	Day 1	Day 2	Day 3	Day 4
Week 1	Somo-Squat	Lunge	Sumo-Squat	Lunge
	Cobra	Sumo-Squat	Cobra	Sumo-Squat
	Squat	Squat	Squat	Squat
	Super Man	Burpee	Super Man	Burpee
	Bracer	Glenohumeral Rotation	Bracer	Glenohumeral Rotation
	Hip Tap	Bird Dog	Hip Tap	Bird Dog
	Glenohumeral Rotation	Push Up	Glenohumeral Rotation	Push Up
	Bird-Dog	Scapular Flying	Bird Dog	Scapular Flying
	Hands Walking	Cobra	Hands Walking	Cobra
		Hip Tap	Hip Tap	
Week 2	Hip tap	Burpee	Super Man	Bird Dog
	Sumo-Squat	Lunge	Sumo-Squat	Lunge
	Cobra	Somo-Squat	Cobra	Sumo-Squat
	Squat	Squat	Squat	Squat
	Super Man	Bird Dog	Bracer	Burpee
	Bracer	Push-up	Hip Tap	Push Up
	Glenohumeral-Rotation	Scapular Flying	Glenohumeral Rotation	Scapular Flying
	Bird-Dog	Cobra	Bird Dog	Cobra
	Hands walking	Hip Tap	Hands Walking	Hip tap

An analysis of the WHOQOL-Bref items indicates that scores closely matched those of the WHOQOL-100, with the four domains accounting for approximately 95% of the total variance in facet scores (22). The WHOQOL-Bref domain scores demonstrate strong discriminant validity across physical health, psychological health, social relationships, and environment domains. Additionally, they demonstrate strong content validity, internal consistency (with Cronbach’s alpha values of 0.80 for physical health, 0.76 for psychological health, 0.66 for social relationships, and 0.80 for environment), and reliable test-retest performance (21). Rasafiani and colleagues, in their article titled “Validity and Reliability of the Persian Version of the World Health Organization Quality of Life Questionnaire,” addressed the validity and reliability of the Persian version of this questionnaire. Additionally, Nejat and colleagues translated and standardized WHOQOL-Bref in Persian. (23, 24). Their sample included 1167 people from Tehran, Iran who were randomly selected. In accordance with the methodology outlined, the Content Validity Index (CVI) was calculated as the average proportion of agreement among expert raters regarding the relevance of each item in the questionnaire. Furthermore, the Content Validity Ratio (CVR) was used to assess the essentiality of each item in the questionnaire. Following the approach described by related research (24), items with CVR values meeting or exceeding the critical value were considered essential for measuring the buildup of Qol (24). The scale demonstrated

a Cronbach’s alpha of all areas coefficient greater than 0.7. The Content Validity Index (CVI) was determined as the mean CVRs calculated for all items. In this study, the CVI value was found to be 0.81. This value indicated that the instrument has adequate content validity and WAS approved by the experts. Based on the collected data, the Content Validity Ratio (CVR) was calculated to be 0.85. This indicates that the majority of experts considered the items under review to be essential, which means that this questionnaire has excellent and acceptable validity and reliability for Iranian students (24).

2.7. Data Analysis

All variables were assessed using proportions for categorical data and Mean±Standard Deviation (SD) for continuous data. The normality of continuous variables was tested using the Kolmogorov-Smirnov test, and standard deviations were compared using the SD test. After confirming the normal distribution of the data, ANCOVA was employed to gauge the training’s effectiveness, and Levene’s test was conducted to ensure the homogeneity of variances.

3. Results

3.1. Demographics

Thirty students, with an average age of 16.10±1 years, contributed in the present study. They were

Table 2: Examining the impacts of the intervention on domains of quality of life

*	Control group		Training group		P value (Within-groups)		P value
	Before	After	Before	After	Control group	Training group	
Physical	67.96±10.27	60.91±14.81	69.80±11.16	86.14±12.54	0.001	0.001	0.001*
Psychological	60.33±16.59	54.03±23.98	65.03±14.78	73.49±14.28	0.035	0.001	0.001*
Social life	58.40±17.13	52.40±20.42	51.4±9.17	49.5±12.72	0.040	0.313	0.992
Environment	62.76±13.86	56.52±13.80	58.80±13.76	58.67±14.16	0.010	0.340	0.146
General Quality of life	73.10±24.21	65.80±21.73	70.26±15.88	74.70±16.31	0.001	0.041	0.001*

*WHQOL-BREF: World Health Organization Quality of Life - BREF

assigned into two groups: 15 in the experimental group (16.06±1.33 years, height 175.3±9.6 cm) and 15 in the control group (16.13±1.24 years, height 176.28±25.00 cm). There was no statistically significant disparity between the groups in terms of the average age (P=0.696), height (P=0.710), weight (P=0.406), and other demographical profiles. In this study, 80% of the students studied in public schools and 20% in private schools; 93.3% lived with both their parents; 86.6% of mothers were housewives; 26.6% of fathers were employees, 23.3% shopkeepers, 16.6% military, and 33.3% had other jobs.

3.2. Domains of Qol

In this study, 30 participants cooperated regularly with the researchers. The mean and standard deviation for each domain of WHQOL-Bref are reported in Table 1

At the initial phase before starting the training protocol, the mean score for all domains of Qol in the control group reported (64.51±16.41) and (63.05±13.82) in the training group. As shown in Table 2, the specific changes in each QoL domain are detailed, highlighting significant improvements in the physical and psychological domains for the training group in comparison with control group. The analysis of covariance (ANCOVA) indicated that HBT significantly improved each domain of Quality of Life (QoL), including Physical (P=0.001), Psychological (P=0.001), and overall Global QoL (P=0.001). However, no significant changes were observed in the social (P=0.992) and environmental domains of Qol (P=0.146) post home-based training. As it was expected, health related Qol improved significantly. The highest mean score change occurred in the physical domain, which increased dramatically from (69.80±11.16) to

(86.14±12.54) in the training group. Psychological domain of QoL ranked second, increasing from (65.03±14.78 to 73.49±14.28) in the training group. The magnitude of this rise in the training group was deemed remarkable when contrasted with the control group.

4. Discussion

This study is the first to scrutinize the impact of a home-based training protocol on QoL of students quarantined during the COVID-19 pandemic. The main findings indicated that eight weeks of bodyweight resistance training significantly improved the physical and psychological domains of QoL, while no noticeable changes were observed in the social and environmental fields. The improvement in the physical domain, with scores increasing. This suggests that engaging in regular physical activity can enhance physical health and fitness, even in a home-based setting. This is likely due to the physiological benefits of resistance training, such as increased muscle strength, endurance, and overall physical health, which contribute to a better perceived physical QoL. These findings were significant as they not only demonstrate the effectiveness of a home-based training program in improving QoL during a period of confinement but also highlight the potential for such interventions to prepare students for post-COVID life. The fear and anxiety of contracting the virus brought about unprecedented changes in students' ways of thinking, attitudes, and behaviors. Implementing regular physical activity may help mitigate these psychological impacts, supporting students' overall well-being and aiding in their transition back to daily life post-pandemic.

In this study, we investigated the effect of eight weeks of HBT on different domains of Qol as

critical parameters in the Corona virus pandemic for students. After eight weeks of training, health-related quality of life (HRQoL) consists of: physical, psychological, and general quality of life improved significantly. In environment and social domains, no significant increases were reported. In many studies, results showed that training is one of the best ways to enhance HRQoL. Few studies have investigated the relationship between QoL and training protocols during corona pandemic. In a study with 40 students divided randomly into two groups and training group performing 12 sessions of online training in a month, reported that regular physical activity improved QoL in students during the Corona virus pandemic (25). In line with the present research, Chaeroni and colleagues showed that regular sports movement activities have a significant effect on the physical and mental condition of students (26). Kvalø and Natlandsmyr, in a similar study, confirmed that school-based physical activity intervention improved HRQoL significantly (27). Consistent with our study, Gu and co-workers found that improving children's physical fitness can lead to favorable outcomes, such as enhanced health-related QoL (28). There are some hypotheses that can justify no change in social and environmental domains of QoL after HBT in the training group: first, HBT is an isolated protocol that students do without collaborative learning. Improvement of social and environmental fields of QoL needs planning the bodyweight training combined by a group game that enhances the collaboration of students; second, economic and sociocultural factors may interfere with social and environmental fields of QoL. The participants in this study were selected from a public school in South of Tehran, Iran; third, students' obligations at home can coincide with the training time and students may suffer from home-training. Taking all reasons into account, for future studies, home-based family training and home-based game training, based on a resistance training protocol, would have salient effects on social and environmental fields of QoL.

Despite the benefits of quarantine in preventing further propagation of the coronavirus and lessen the number of cases and subsequently reducing the costs of treatment and mortality in people, researchers showed that home quarantine, according to the environmental conditions, and also the spread of the infectious disease is possible. It leads to the reduction of mental health

and occurrence of some psychological disorders in students (29). Given that most of the students spent their lives in home quarantine during the coronavirus pandemic, their gradual return to post-Corona conditions will be faced with difficulties and problems. It may be impossible for some students as they cannot transit their life to the post-COVID era and prefer the same period of life in quarantine, which can be known as an alarm for different societies.

Students' life-style serves as a crucial indicator of health, with personal and environmental factors of self-perception warranting consideration (30). Implementing public policies to foster the growth of students' social skills can positively influence their engagement in self-care (31). Moreover, school health programs within the educational environment can perform a pivotal task in enhancing the physical and mental well-being of students, thereby improving their overall QoL (31). Given the circumstances of the COVID-19 pandemic, it is plausible to attribute the reduction in activity levels among members of the control group to the imposed restrictions and lifestyle alterations during this period. This underscores the significance of temporal and environmental factors as potential contributors to observed outcome discrepancies, necessitating their consideration in data analysis and interpretation. The impact of quarantine measures during the COVID-19 pandemic (32) probably do a critical function in the observed reduction of activity levels within the control group. Quarantine restrictions inherently limit opportunities for physical activity and lead to sedentary behaviors among individuals, thereby influencing the study outcomes.

Students are the most valuable wealth of each country as they hold the key to shaping the future of the society. Participating in sports and physical activities brings students out of lethargy, depression and increases vitality, hope, and enhances the motivation to participate in social activities. The mentioned items ultimately lead to maximizing QoL (31). Keeping QoL at a high level is an available approach to getting into a new lifestyle after a long period of quarantine. The most noteworthy difference between pre- and post-COVID life is a transition from an active lifestyle to a virtual one, which is caused by closing schools, gyms, and other public services. If students try

to stay in active-life by home-training during the Corona pandemic, they would face new lifestyle immediately. Bodyweight training is a key to building habit formation for an active lifestyle. In this study, we follow home-based bodyweight training as an opportunity to make it a habit. Habits make up a major part of our behavioral and cognitive lives (33). Hence, participating in short bodyweight workouts on a daily basis can boost the frequency and volume of training, thereby aiding in habit formation (33, 34). Resistance exercises with bodyweight are among the safest exercises for students. The perceived convenience and accessibility of home-based bodyweight training are likely to influence students' motivation and adherence to their exercise regimen. The ability to perform exercises at home eliminates barriers related to transportation, cost, and time constraints associated with attending external fitness facilities. This increased autonomy and flexibility in managing their fitness routines may lead to higher levels of motivation and consistency in exercising (35). Consequently, students who perceive home-based bodyweight training as convenient and accessible are expected to demonstrate greater adherence to their exercise program, resulting in improved psychological satisfaction, reduced stress and enhance QoL (36). To improve the health of adolescents under 17 years of age, WHO has recommended that at least 60 minutes of light to high-intensity workout should be considered for at least 3 days a week (37, 38). Teenagers can increase their strength by 30 to 50 percent after only 8 to 12 weeks of a good strength training program. Besides the physiological benefits of bodyweight training, the most obvious privilege compared with other kinds of training (such as weight lifting) is that it is much more accessible and versatile than others. Home-based bodyweight training is portable and can be done anywhere and anytime and does not need any special equipment (16, 39, 40). Due to the fact that these exercises do not require special equipment and needs and can even be done at home, during the quarantine period, it is the best option to maintain and improve physical factors related to health and improve the immune system. Upon analyzing the facts, HBT is an assessable approach to enhance QoL during the corona pandemic and shift it as a habit to post-COVID life and adjust students to the new lifestyle as soon as possible. It is suggested that future studies investigate concurrent training and their impacts

on QoL which can bridge the gap to a cultivating training program for students. Another suggestion for future studies is that students do bodyweight training with their families at home to investigate whether this would enhance the environmental and social domains of QoL or not.

4.1. Limitations

The present study had certain limitations including: restricted access to sports facilities and specialized equipment in public places or fitness centers due to the prevalence of COVID-19, and impeding comprehensive data collection on students' physical training routines. Laboratory investigations and group exercise trials have been hindered due to strict social and physical distancing measures imposed worldwide. This has made it difficult to determine the effectiveness of different fitness routines in improving students' overall well-being. Qualitative research methods, such as interviews and direct observations with students, have also been impeded, leading to a lack of in-depth data on their lifestyle choices during the pandemic. Additionally, there is a limited ability to assess the long-term impact of HBT interventions on students' quality of life, making it challenging to develop sustainable strategies for optimizing their fitness routines during ongoing crises.

5. Conclusions

The present study illustrated the foster connection between HBT and QoL of high-School students. In conclusion, noticeable outcomes of home-based bodyweight training were observed in the physical, psychological, and general field of QoL after the program. We suggest evaluating other aspects of students' lives like home-based family training to make a passable bridge from COVID-pandemic to post-COVID life. Students might encounter challenges due to their academic responsibilities conflicting with their roles as family members, particularly in fulfilling household tasks and duties during the pandemic. This could potentially explain why the social and environmental fields of QoL have not shown improvement. The imperative necessity of furnishing students with incentives for their well-being becomes evident, serving as a conduit for heightened efficacy in their pursuits, thereby fostering enhanced interpersonal connections and self-relations. In addition, home-

training has had adverse effects on both personal and academic lives of students. Conflicting responsibilities with daily household chores and family or personal obligations at home may lead to unavoidable environmental influences.

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Authors' Contribution

Mohammad Mahdi Eidiyan-Kakhki: Substantial contributions to the conceptualization and design of the research, as well as the acquisition, analysis, and interpretation of data, drafting the manuscript and reviewing it critically. Mojtaba Salehpour: Substantial contributions to the conceptualization and design of the research, as well as the acquisition, analysis, and interpretation of data, drafting the manuscript and reviewing it critically. All authors have read and approved the final manuscript and agree to be accountable for all aspects of the work, such that the questions related to the accuracy or integrity of any part of the work.

Ethical Approval

The Research Ethics Committee of Sport Sciences Research Institute in Tehran, Iran approved the present study with the code of IR.SSRI.REC.1401.1369. Also, written informed consent was obtained from the participants.

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