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Effects of Recreational Football on Static Balance Skills of Male Older Adults: An Experimental Study

Rekreasyonel Futbolun Erkek Yaşlı Erişkinlerin Statik Denge Becerileri Üzerindeki Etkileri: Deneysel Bir Çalışma

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Bu çalışma, birinci yazarın ikinci yazar danışmanlığında hazırladığı doktora tezinden üretilmiştir.

ABSTRACT Objective: The purpose of this study was to investigate how olderly men's leg static balancing skill levels were effected by recreational football. **Material and Methods:** 57 (65.05±2.5). The study involved the random assignment of 28 older men to the football group (FG) and 29 men to the control group (CG). Data were collected with SportKAT 2000 device and analyzed by two-way analysis of variance. Data were analyzed considering the significance level of $p<0.05$. **Results:** The dominant leg in the FG group and CG was the right-leg respectively (89.4%, 93.1%). In double-leg static balance, there was a statistically significant difference between thegroup*timeinteraction ($p<0.014$, $\eta^2p=0.053$), between groups in left-leg static balance ($p<0.005$, $\eta^2p=0.071$), between groups and times in right-leg static balance ($p<0.001$, $\eta^2p=0.093$; $p<0.001$, $\eta^2p=0.134$, respectively). Rate of perceived exertion was found 3.7(au) and the participation rate was 89.5%. **Conclusion:** It can be said that recreational football has a positive effect on the balance skills of elderly men, facilitates adaptation to loading by providing autonomic flow, reduces the possibility of falls and contributes to mobilization.

Keywords: Elderly; recreational football; balance

ÖZET Amaç: Bu çalışmanın amacı, rekreasyonel futbolun yaşlı erkeklerin statik denge beceri düzeyleri üzerindeki etkilerini incelemektir. **Gereç ve Yöntemler:** Çalışmaya katılan 57 (65,05±2,5) yaşlı erkek rastgele futbol grubu (FG, n=28) ve kontrol grubu (KG, n=29) olarak ayrıldı. Veriler SportKAT 2000 cihazı ile toplandı ve iki yönlü varyans analizi ile analiz edildi. Veriler $p<0,05$ anlamlılık düzeyi dikkate alınarak analiz edildi. **Bulgular:** FG grubunda ve KG'de baskın bacak sırasıyla sağ bacaktı (%89,4, %93,1). Çift bacak statik dengede grup*zaman etkileşimi arasında ($p<0,014$, $\eta^2p=0,053$), sol bacak statik dengede gruplar arasında ($p<0,005$, $\eta^2p=0,071$), sağ bacak statik dengede gruplar ve zamanlar arasında (sırasıyla $p<0,001$, $\eta^2p=0,093$; $p<0,001$, $\eta^2p=0,134$) istatistiksel olarak anlamlı bir fark görüldü. Algılanan zorluk derecesi 3,7(au) ve katılım oranı %89,5 olarak bulundu. **Sonuç:** Rekreasyonel futbolun yaşlı erkeklerin denge becerileri üzerinde olumlu etkide bulunduğu, ototelik akış sağlayarak yüklenmeye uyumu kolaylaştırdığı, düşme olasılıklarını azaltabileceği ve mobilizasyona katkı sağlayacağı söylenebilir.

Anahtar Kelimeler: Yaşlılar; rekreasyonel futbol; denge

The decline in physical-physiological performance and cognitive abilities with age leads to coordination and balance putting people at higher risk of falls.[1] Postural control, often known as balance, is the capacity to maintain a base statically and dynamically the capacity to carry out an action while maintaining a stable posture.[2] The balance system must produce appropriate stimuli to keep the center of body mass in a balanced position in all situations. These notifications consist of information sources from three sensory systems: proprioceptive, visual and vestibular. Sensory organs cause problems in balance functions due to anatomical and physiological transformations in old age.[3]

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Signals collected from somatosensory receptors located in muscles, tendons, joints and other tissues contribute the central nervous system with considerable date about the position of body components and about movements in space. These systems undergo quantitative and qualitative changes with age. This causes perceptual difficulties in older adults, leading to increased postural instability.[4] In older adults, the muscular system experiences a loss of muscle mass and strength. Muscle strength, particular in the lower limbs, plays an important role in continue a balance.[5] Limitation of movability and flexibility in the spine and limb joints can impair the balance of older adults.[6]

Balance disorders can lead to falls, reducing a person's independence, increasing their dependence on their environment and leading to more falls a mong older people.[7] Cases and events related to falls in older people have significant social and public health consequences and account for 40% of all injury-related deaths in this group.[8]

Many systematic reviews and meta-analyses report that balance exercises have an important place among other interventions to lessen the risk and frequency of falls in the elderly.[9] Additionally, according to Thomas et al., balance outcomes were improved by 16% to 42% with resistance and aerobic exercise, balance training, aerobic step training, and balance ball training.[10] In addition, Chen et al. reported in an analysis of twenty articles from five electronic databases (PubMed, EMBASE, Web of Science, Cochrane Library, and MEDLINE) up to 2020 that an exercise-game intervention called exergame caused greater improvement in postural control and dynamic balance in healthy older adults.[10] Filar-Mierzwa et al. reported that both dance and general exercise improved parameters affecting posture and balance (29.1±11.44 vs. 34.2±11.91; p=0.059).[11]

Proprioceptive neuromuscular facilitation exercises, the Joseph Pilates-created plate approach that blends strength and flexibility training, are becoming more and more common, particularly in programs for rehabilitation.[12] Bisson et al. reported that 10-week dynamic and static balance exercises in the elderly provided significant improvement in functional balance, mobility and reaction times of the group participating in the application.[13] Gouveia et al. reported that gait, balance and functional training improved the quality of life of elderly individuals in multiple ways and balance performance.[14] In addiction Taguchi et al. reported that a 12-month program consisting of flexibility, strength, balance and aerobic exercises reduced the risk of falls as well as lower extremity strength, but did not affect other quality of life measures.[15] Halvarsson et al. reported that specially designed, developmental and balance training for 12 weeks reduced elderly people's anxiety and fear of falling.[16] Lelard and Ahmaida reported that physical activity programs in groups create social belonging and encourage participation and continuity.[17]

12-week recreational soccer practice had a 46% effect on the postural balance of middle-aged male participants.[18] Andersen et al. reported that 16-week soccer training significantly increased the functional movement performance of elderly men by 29%.[19] Fløtum et al. reported that 18-week soccer practice with 2.1% of elderly participants increased postural balance and agility skills by 45% and 6%, respectively ($p<0.05$).[20] In addition, Jakobsen et al. reported that significant improvements were achieved in postural balance after 12 weeks of football training, and centrifugal distance decreased by 17-19% ($p<0.05$) compared to the pre-application period.[21] In their meta-analysis study, Luo et al. stated that recreational soccer practice is less sensitive to the development of postural balance in older adults. In addition to aerobic, balance, strength and flexibility exercises, which are classified as common and traditional exercises.[22] Pilates are among the important exercise modules that have increased in popularity among older adults.[23] However, the increasing proportion of older adults in the total population is exacerbating the individual and societal health and socio-economic cumulative effects. However, it is becoming increasingly important to provide practical alternatives to encourage a higher proportion of older adults to engage in physical activity and to encourage their continuation. In addition to providing physiological and psycho-social benefits, these modules should be recreational in nature to maintain functional movement skills such

as balance and coordination for older adults to maintain their functional lives. One of the group activities that has become popular in the last decade, especially among older adult men, is recreational soccer.

Modified soccer content for older adults is a very popular group activity in recreational content in terms of physical, social and psychological benefit integrity as well as ease of understanding, facility and material provision. Within the scope of recreational awareness, football is a source of driving force that reduces the safety concerns of older adults, contributes to mental exercise within the scope of dual task, and encourages participation and continuity by providing an autotelic environment. In this context, it is assumed that recreational soccer will positively affect balance, which is one of the basic components of functional and independent movement skills of older adults with more than 900 movement content.

MATERIAL AND METHODS

PARTICIPANTS AND WORKFLOW

After receiving written informed permission and institutional ethics approval, twenty eight males (mean: 65.05±2.5) participated in a 14-week recreational football program as a health intervention. Participants were selected from the local populace of Eskişehir. To be eligible, participants had to be judged they could not have a history of osteoporosis, falls, diabetes, cancer, or cardiorespiratory disease, no known cognitive impairment, no neuromuscular impairment or injury, and no regular exercise in the past year.

The Project was accepted by the institutional ethics committee, which set the exclusion criteria (Figure 1). Kütahya Dumlupınar University Social and Human Sciences Scientific Research and Publication Ethics Committee Report was obtained before the study (date: July 26, 2021; number: 2021/5). The study was carried out in accordance with the "Helsinki Declaration of Ethical Principles for Medical Research on Humans". All phases of the study were explained to the participants, and their agreement was obtained.

Participants were divided into two groups as football group (FG) and control group (CG) (1:1, n=32, n=33 respectively). They were told not to change their living habits during the CK administration process. In addition, FG was divided into two groups (Group A=16, Group B=16) considering their exercise history. Football matches were held in the hall with synthetic floor. Raise, Activate and Mobilize, Mobilize, Potentiate protocol was followed in each session.[24] Based on the recommended guidelines for the implementation of FG recreational soccer programs, they were enrolled in a 14-week, twice-weekly program.[25,26] Rated perceived exertion (RPE) were taken 30 minutes after each session.

The duration of each session and the pitch dimensions were organised taking into account the number of participants, number of sets, set durations, rest periods between sets, and active regeneration periods. The study consisted of 28 sessions with an average session duration of 50 minutes. Small-sided game regulations were changed so that the foot was not placed on the ball and there was no tackling and pushing between players according to the rules pertaining to this kind of exercise and the restart took place with a pass into the field of play.[24,25]

STATIC BALANCE TEST

In this study, SportKAT 2000 device (SportKAT 2000, Breg, Vista, CA) was used as a data tool to determine the static balance levels of the participants and it has a scoring system called the Balance Index (BI). Depending on the participant's ability to hold the platform near the reference point, the system calculates the distance between the platform's center and the reference position and records it 18.2 times per second, thus calculating a BI with the sum of these distances. In the test, the pressure of the pneumatic platform was set at 6 Pounds per Square Inch.

In this study, the static balance test protocol applied by Hansen et al. was applied.[27] The dominant feet of the participants were identified. The subjects were instructed not to carry objects that would weigh them down and disturb their balance and to step on the platform with flat-soled shoes. They were asked to hold the position closest to the target point at the center of the screen with their eyes open for 30 seconds.[27]

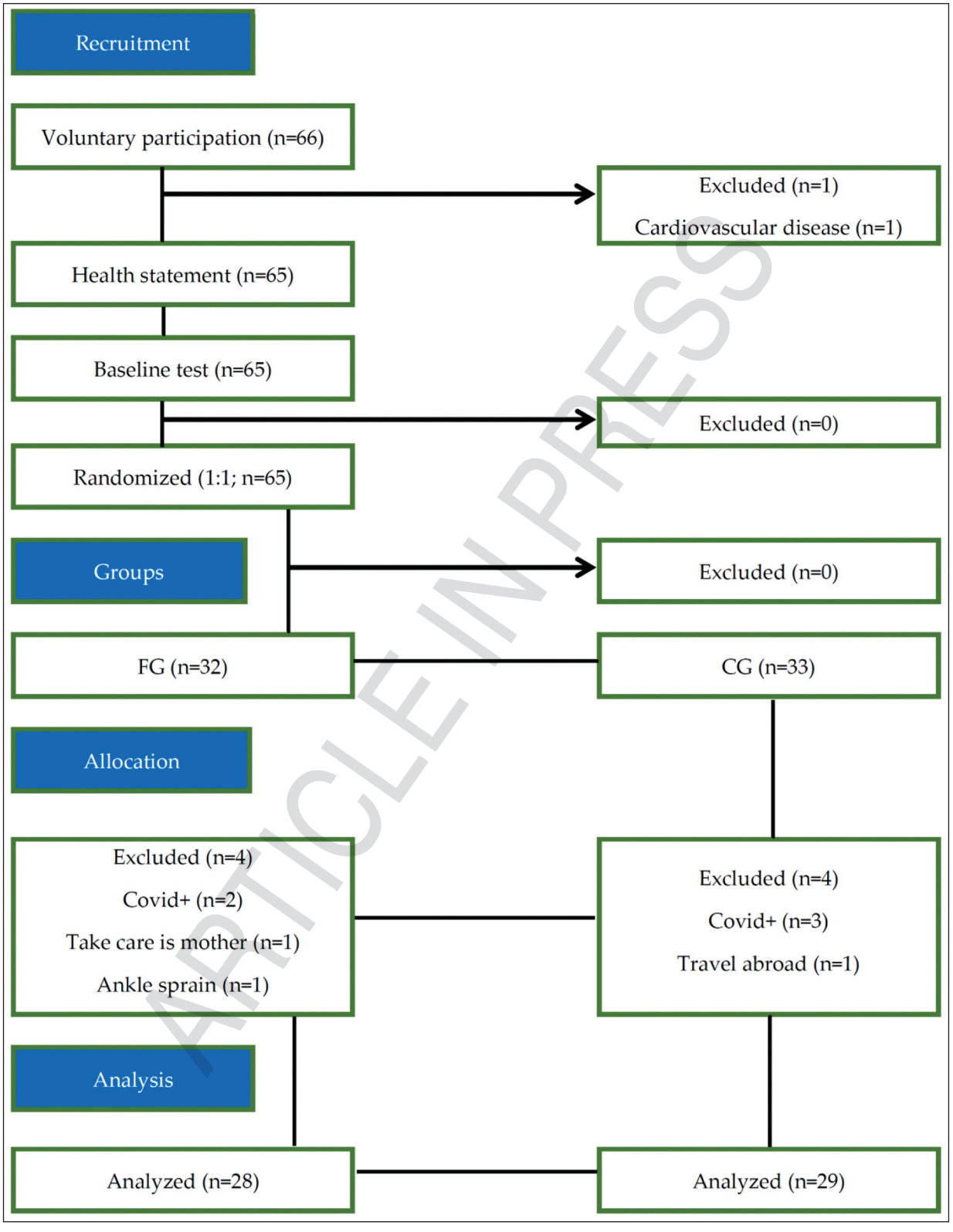

FIGURE 1: Sample and work flow chart.
FG: Football group; CG: Control group.

RPE SCALE

In this study, the RPE scale, developed by Borg and adapted by Foster et al. was applied, which is based on the idea of estimating the level of difficulty caused by physical activity load with a specific rating method.[28,29]

DATA ANALYSIS

Data comparisons using the Bonferroni post hoc test were performed to look for variations in balance parameters between the FG and CG group and time. To quantify the effect size of repeated measures analysis of variance (ANOVA) and two-way ANOVA, partial eta square (η^2p) was utilized. Additionally, η^2p was employed as a measure of effect size, and calculated 95% confidence intervals (95%). The following values were classified as trivial (<0.10), small, moderate, or large, respectively: 0.10-0.24, 0.25-0.39, and ≥0.40.[30] Cohen's d classified effect sizes as negligible (<0.2), small (≥0.2), moderate (≥0.5), and large (≥0.8) based on their importance.[30] 28 sessions of RPE measurements were divided into 4 separate blocks and differences between blocks were determined by repeated measures ANOVA. Blocks were compared using the Bonferroni post hoc test. IBM SPSS software (version 2022) and R studio (version 4.2.1) were used for statistical analysis.

RESULTS

As stated in the workflow process, eight participants were not included in the statistical analysis process and the other participants reported no significant adverse reactions.

Significant were observed group*time interactions for the two-leg balance test ($p<0.014$, $\eta^2p=0.053$) (Table 1). Significant were observed difference between the FG pre-test and the FG post-test in the post hoc comparison of double leg balance (pbonf=0.043) (Table 2). Significant were observed between the groups for the left leg balance ($p<0.005$; $\eta^2p=0.071$). No significant differences times and between group*time interaction (Table 3). The FG post test and CG post test showed a significant difference in the post hoc comparison of left leg balance (Pbonf=0.034) (Table 4).

Significant were observed between the groups and between times for the right leg balance respectevly ($p<0.001$; $\eta^2p=0.093$; $p<0.001$; $\eta^2p=0.134$). There was no discernible statistical difference between the groups or the time interaction (Table 5). Significant were observed difference between the FG post test and the CG pre-test, CG pre-test and post-test in the post hoc comparison of the right foot balance respectively (pbonf=0.001, pbonf=0.001) (Table 6).

TABLE 1: Two-way analysis of variance results for double leg static balance.

Variable	Sum of squares	df	Mean square	F	p value	η^2p
Group	19404.480	1	19404.480	0.551	0.459	0.005
Time	71452.809	1	71452.809	2.031	0.157	0.018
Group*time	218099.124	1	218099.124	6.198	0.014*	0.053

*p<0.05, η^2p=partial eta square.

TABLE 2: Post hoc results of football and CGs in terms of paired leg groups and time.

		MD	SE	t value	pbonf
FG post test	CG post test	-113.590	49.699	-2.286	0.145
	FG pre test	-137.571	50.133	-2.744	0.043*
	CG pre test	-76.176	49.699	-1.533	0.769
CG post test	FG pre test	-23.982	49.699	-0.483	1.000
	CG pre test	37.414	49.261	0.759	1.000
FG pre test	CG pre test	61.395	49.699	1.235	1.000

*p<0.05; CG: Control group; SE: Standard error; FG: Football group.

TABLE 3: Left leg static balance two-way analysis of variance results.

Variable	Sum of squares	df	Mean square	F	p value	η^2p
Group	551123	1	551123	8.359	0.005*	0.071
Time	86676.84	1	86676.84	1.315	0.254	0.012
Group*time	79775.43	1	79775.43	1.21	0.274	0.011

*p<0.05; df: Degree of freedom.

TABLE 4: Left leg groups and time post hoc results of football and CGs.

		MD	SE	t value	pbonf
FG post test	CG post test	-191.996	68.031	-2.822	0.034*
	FG pre test	-108.071	68.625	-1.575	0.709
	CG pre test	-194.238	68.031	-2.855	0.031*
CG post test	FG pre test	83.925	68.031	1.234	1
	CG pre test	-2.241	67.431	-0.033	1
FG pre test	CG pre test	-86.166	68.031	-1.267	1

*p<0.05; CG: Control group; SE: Standard error; FG: Football group.

TABLE 5: Right leg static balance two-way analysis of variance results.

Variable	Sum of squares	df	Mean square	F	p value	η^2p
Group	403410	1	403410	11.245	0.001***	0.093
Time	611079.8	1	611079.8	17.035	0.001***	0.134
Group*time	5019.208	1	5019.208	0.14	0.709	0.001

***p<0.001; df: Degree of freedom.

TABLE 6: Right leg groups and time post hoc results of football and CGs.

		MD	SE	t value	pbonf
FG post test	CG post test	-105.719	50.181	-2.107	0.224
	FG pre test	-133.179	50.62	-2.631	0.058
	CG pre test	-265.443	50.181	-5.29	0.001***
CG post test	FG pre test	-27.459	50.181	-0.547	1
	CG pre test	-159.724	49.739	-3.211	0.01*
FG pre test	CG pre test	-132.265	50.181	-2.636	0.058

*p<0.05; ***p<0.001; CG: Control group; SE: Standard error; FG: Football group.

Significant were observed difference between the blocks in RPE ($p<0.01$, $\eta^2p=0.087$). Significant were observed difference between the Blok 1 ile Blok 2, Blok 3 ve Blok 4 in the post hoc comparison of RPE ($p_{bonf}=0.001$). It is seen that the average Block 1 RPE value is 4 (au) points, Block 2 RPE value is 3.6 (au) points, Block 3 RPE value is 3.7 (au) points and Block 4 RPE value is 3.6 (au) points. According to the Borg scale (0-10) applied by Foster et al., it is seen that the difficulty felt in Block 1 corresponds to the expression "Sometimes Difficult"; the difficulty felt in Block 2, Block 3 and Block 4 corresponds to the expressions "Moderate to Sometimes Difficult".[29] It is also stated that there is a relationship between the score of the AZD session and the duration of the session, and their multiplication gives the relative scope of the unit study. In this context, it is seen that the scope of the study is between 240-210 (AU). The results of this study are similar to the AZD studies of Madsen et al. and Matias et al. for the elderly.[31,32]

DISCUSSION

Bisson et al. reported that 10-week dynamic and static balance exercises provided significant improvement in functional balance in the elderly, while Dunsky et al. reported that there was no statistical difference between elderly women and men in terms of dynamic and static balance results. Furthermore, Schorderet's systematic review and meta-analysis findings Schorderet et al. covering forty-six studies in PubMed, CINAHL, Cochrane and Embase show that balance performance is not affected by leg dominance. Sun et al. reported that Tai Chi Chuan and brisk walking had a positive effect on balance in terms of all variables.[13,33-35]

In scientific studies investigating the effects of recreational soccer on older adults in the last decade, it has been reported that this module provides an increase in postural balance, functional movement performance and postural balance and agility skills.[19-22] In this study, it is seen that there were statistically significant decreases in the biped, left foot and right foot static balance oscillations of the soccer group, which is similar to the results of the studies conducted in this context in the last decade.

This result can be explained by 5 possible conditions. These can be considered as (a) the vibrational nature of recreational football, (b) the frequency of autogenic stimuli, (c) the dual task structure, (d) the continuous activity of coordinative abilities, and (e) the practices that take place in the form of balance-disrupting stimuli on the one hand and purposeful reorganization of the disrupted balance on the other.

CONCLUSION

As a result, it was observed that recreational soccer contributed to a significant decrease in the frequency and distance of swing of the double leg, left leg and right leg in elderly men. In this context, it can be suggested that it may reduce the risk of falls due to a decrease in BI scores, contribute to increased mobilization and have the potential to provide long-term exercise adherence.

SUGGESTIONS FOR PRACTITIONERS

Recreational soccer is a powerful exercise option for older men. However, it is important in terms of sustainability that the age difference between the participants is not high, physical fitness and skill levels are close to each other, some age-appropriate limitations are introduced in the rules of the game, and awareness is raised about the recreational purpose of the activity. In addition, recreational football activity for the elderly should include long-term planning and periodization in the light of scientific data. To guarantee progressive development, it is necessary to act in accordance with the principles of loading. In this context, considering the number of participants and the readiness level of the population, the field dimensions, the number of weekly sessions, the duration of the sessions, the sets and rest between sets are the parameters that should be considered when creating the content.

In the first 4-6 weeks (mesocycle) period of the recreational football practice for the elderly, it is thought that it would be useful to organize the number of weekly sessions as two, the duration as 60 minutes, the number of sets as two and the rest periods between the sets by considering the principle of productive rest. In the first mesocycle of the program, the session duration should consist of three main parts, and the first part should have a content aiming physiological adaptation including flexibility, balance, coordination and reaction speed (1/5). It is thought that playing football over three sets in the second part (3/5) and including practices that will provide active regeneration in the third part (1/5) are necessary for the health of the participants and the sustainability of the program. Finally, it would be appropriate to follow up the electrocardiography values of the participants in long-term studies.

Source of Finance

During this study, no financial or spiritual support was received neither from any pharmaceutical company that has a direct connection with the research subject, nor from a company that provides or produces medical instruments and materials which may negatively affect the evaluation process of this study.

Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: *Cemal Polat, Alparslan Ünveren;* ***Design:*** *Cemal Polat, Alparslan Ünveren;* ***Control/Supervision:*** *Cemal Polat, Alparslan Ünveren;* ***Data Collection and/or Processing:*** *Cemal Polat;* ***Analysis and/or Interpretation:*** *Cemal Polat, Alparslan Ünveren;* ***Literature Review:*** *Cemal Polat;* ***Writing the Article:*** *Cemal Polat;* ***Critical Review:*** *Cemal Polat, Alparslan Ünveren;* ***Materials:*** *Cemal Polat, Alparslan Ünveren.*

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