

ORIGINAL ARTICLE

Badminton improves neuromotor skills and functioning: Encouraging sports among older adults of United Arab Emirates

EXERCISE IS MEDICINE



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Abstract

Background: In United Arab Emirates, the prevalence of non-communicable diseases such as diabetes, hypertension, obesity, and anxiety disorders are very high and physical inactivity is the major risk factor. Physical inactivity not only affects the cardiovascular system but also

dampens the neuromuscular systems. The older adults are the most susceptible age group for developing neuromuscular disorders due to lack of physical activities.

Methodology: This research was conducted in Body & Soul Badminton court inside Gulf Medical University. A total of 30 participants were recruited. The protocol was followed for 45-60 mins a day, 3 days a week at mild to moderate intensity for 2 months duration; Modified Borg scale was used during the sessions to track the exertion level.

Results: The findings of the study indicated that there was significant improvement in neuromotor skills such as reaction time, hand eye coordination as well neuromotor functioning like improved muscle length and strength.

Conclusion: The engagement of physical activity through badminton could improve neuromotor skills and functions among older adults. Since the improvement was both statistically and clinically significant recreational sports could be incorporated into the daily routine of older adults to reduce the ill effects of physical inactivity.

Résumé

Contexte: Aux Émirats arabes unis, la prévalence des maladies non transmissibles telles que le diabète, l'hypertension, l'obésité et les troubles anxieux est très élevée et l'inactivité physique est le principal facteur de risque. L'inactivité physique affecte non seulement le système cardiovasculaire, mais aussi le système neuromusculaire. Les personnes âgées constituent le groupe d'âge le plus susceptible de développer des troubles neuromusculaires en raison du manque d'activités physiques.

Méthodologie: Cette étude a été menée sur le terrain de badminton Body & Soul de l'Université médicale du Golfe. Au total, 30 participants ont été recrutés. Le protocole a été suivi pendant 45 à 60 minutes par jour, 3 jours par semaine, à une intensité légère à modérée pendant 2 mois; l'échelle de Borg modifiée a été utilisée pendant les séances pour mesurer le niveau d'effort.

Résultats: Les résultats de l'étude indiquent une amélioration significative des capacités neuromotrices telles que le temps de réaction, la coordination main-œil ainsi que le fonctionnement neuromoteur comme l'amélioration de la tension et de la force musculaire.

Conclusion: La pratique d'une activité physique par le badminton pourrait améliorer les capacités et les fonctions neuromotrices chez les personnes âgées. L'amélioration étant statistiquement et cliniquement significative, les sports récréatifs pourraient être incorporés dans la routine quotidienne des personnes âgées afin de réduire les effets néfastes de l'inactivité physique.

Mots-clés: Badminton, compétences neuromotrices, personnes âgées, Émirats arabes unis

Introduction

Research from a variety of scientific fields suggests that physical activity in nature and feelings of connection to nature enhance psychological health and well-being [1]. Outdoor physical activity has higher benefits in lowering the levels of stress, anxiety, depression, and parameters related to non-communicable diseases in particular. It is well known that the presence of non-communicable disease has higher correlation with morbidity related to cardiovascular disorders and the aerobic training directly reflects the cardiovascular fitness of an individual. There are multiple studies that prove the effectiveness of physical activity and aerobic training for non-communicable disease globally. However, there is dearth in literature while reporting the neuromotor skills through outdoor sports activities among the sedentary adults in United Arab Emirates. Given that adherence to physical activities is poor among the older adults in form of general aerobic training, engaging them into outdoor sports activities could be more useful to dampen the course of the non-communicable disorders as well prevent future complications. There is a disparity in classifying adulthood among various researchers; one of the studies has classified (≥ 56 years) age as an older adult [2]. In the proposed study we have included the age group of (40–70 years) as older adults, defined under the operational definition of this study. A lower end was kept as 40 years since non-communicable disease such as type 2 diabetes mellitus is often marked with its onset whereas the higher end was set as 70 years to reduce the risk of sports injuries due to ageing consequence and higher chances of falls above 70 years. In addition, neuromotor skills may deteriorate where loss of balance and coordination, delayed reaction time and hand eye coordination are very commonly seen as a factor of reduced physical activity among the older adults in addition to ageing effects [3,4]. Literature also suggests that the ill effects of ageing can also be controlled with physical activities promotion. Sports play a significant role in the promotion of physical activity. Badminton holds a significant position in popularity for outdoor sports. The game requires constant engagement of the individual which improves their psychological and mental abilities. In United Arab Emirates, Football is considered the most popular sport. However, due to the contact nature, older adults may be prone for higher risk of injuries. Badminton is a non-contact and gender friendly sport which makes it more comfortable to the female participants, and thus increase participation and motivation towards physical activity otherwise. Thus, the purpose of the study was to analyze the effects of Badminton sports on the neuromotor skills and functioning among older sedentary adults (male and females) of United Arab Emirates (UAE). The proposed research is also focused on improving physical activity and well-being of older adults in UAE through sports engagement and thereby reduces the burden of non-communicable disease in the country. In UAE, the prevalence of non-communicable diseases such as diabetes, hypertension, obesity, and anxiety disorders are very high and physical inactivity is the major risk factor. The engagement of older adults into Badminton sports could prevent the risk of non-communicable diseases with desired effects on the cardiovascular system apart from the proposed research hypothesis. The objective of the study was to determine the pre and post changes in the neuromotor skills

(reaction time and hand eye coordination) and functioning (upper and lower limb muscle length, strength) following 8-week physical activity session through Badminton.

Methodology

Research design and Setting: A Quasi Experimental Study was conducted at indoor badminton court, Sports Complex, Gulf Medical University, Ajman, United Arab Emirates.

Study population: A total of 30 older sedentary adults (40-70 years), both male and female were recruited in the study under the purposive sampling method. Participants with any joint disorders, cancer, neurologically unstable, athletes & physically active individuals, regular alcohol consumption, consumption of any medication that can interfere with performance were excluded.

Study outcome variable and measures

Reaction time: The reaction time was generated using the Digital wall (D-Wall) from Techno Body, Italy. A specific task was given to the participants for 2 minutes, which required them to step on the markers location whenever they appear on the screen, as fast as possible. Through a 3D camera and a force platform, this device recognized the mean interval time between the stimulation and response of each participant and presents the result in seconds (*Fig. 1*).



Fig. 1: Showing Reaction Time analysis over D wall, Techno Body, Italy

Hand Eye-Coordination: Hand-Eye coordination was also generated using the Digital wall (D-Wall) from TechnoBody. A specific task (cutting the fruits) was given for 2 minutes, the participant was instructed to use the dominant upper limb, and the result was represented by the final score (Fig. 2).



Fig. 2: Hand eye coordination analysis over D wall, Techno Body, Italy

Muscle Strength: Manual Muscle Testing of the dominant upper and lower limb, using Oxford Grading Scale. It included the following muscles: Upper Limb (Biceps, Triceps, and Rotator Cuff), Lower Limb (Quadriceps, Hamstring, Dorsiflexors, and Calf Muscles) bilaterally.

Muscle Length: Clinical test of muscle tightness in the dominant lower limb. It included the following muscles: Iliotibial Band, Adductors, and Calf muscles in the lower limb bilaterally.

Study procedure and analysis: Participants were recruited from all seven emirates of the United Arab Emirates based on the inclusion and exclusion criteria. An informed consent and pre-participation screening questionnaire (PAR-Q) was obtained from each participant after the ethical approval. All participants were allowed to play Badminton in the University indoor court for 45-60 minutes per day. The protocol was followed for 3 days a week at mild to moderate intensity for 2 months duration. Per protocol analysis, SPSS v 21 was used for descriptive and analytical tests. A test of normality was conducted following which the paired t test was used for pre and post changes analysis.

Dropouts: A total of 4 participants dropped out from the study. The main reason for all of them was session's commitment issues, as they faced difficulties in coordinating between their work, personal life, and badminton sessions. Two participants dropped out in the 1st week itself, while the other two decided to withdraw by the 3rd week.

Results: Important findings of the study have been presented in tables below.

Discussion: In the present study, 26 participants were taken for data analysis where the demographic data for all has been presented in *Table 1*. The mean age was 49 years as most of the participants were within the age of 40-60 years. The mean body mass index (BMI) was 27 suggesting that the population was overweight. The present study included female participants who generally are considered physically inactive particularly through engagement of outdoor sports. The findings of the study suggested improved neuromotor skills and functioning among the female also which contributed to around 30 percent of the population (8/26).

Gender (n=26)		Age		BMI	
Male	Female	Mean	S.D	Mean	S.D
18	8	49.43	4.19	27.29	4.13

Table 1: Showing demographic data of all participants

Table 2 represents the pre and post changes in the neuromotor skills and functioning including reaction time, hand eye coordination, muscle strength and muscle length which improved significantly. It was observed that the reaction time improved by 1.13 seconds with a p value <0.001 suggesting that participants were able to react quickly after the badminton session compared to the pre session. This could be suggestive of the better neurological engram developed over the period of 8 weeks following badminton session. The findings of our study were in consensus with previous study done by Duncan et al. which also suggested improved quality and execution of motor skills following badminton in a different age group [5]. These findings could be attributed to better concentration and ability to choose the correct task and inhibit unnecessary movements. The study conducted in 2019 compared the effects of badminton on inhibitory function comprising the ability to control attention or emotion to overcome a strong internal bias or external attraction and instead do what is most appropriate or necessary [6]. In accordance with the stop-signal paradigm developed by Logan [7], our study suggested that participants could successfully inhibit their responses during the stop signal. Also, another study conducted in 2018 suggested consequent improvement in brain executive function as a result of higher levels of brain neurotrophic factor and better task switching performance [8]. Many research shows that sports activity improves reaction time, which is a good reliable indicator of the processing rate of the sensory stimulus by the Central Nervous System [9]. An experimental study published by Sushil Et al. which concluded that visual reaction time of bilateral limb for the badminton players was significantly less than that of the reaction time for participants who were not practicing any type of sports activity [10]. The study results highlighted that playing badminton sport is effective in improving eye-hand reaction time, muscle coordination, cognitive functions, concentration, and alertness. The speed of the shuttle and the variable distance it travels between opponents allows a very minimal amount of time to react to hit shots. Badminton players must give proper and quick response during the session. They must strike the shuttle with a racket in proper direction which demands better hand eye coordination with relatively shorter reaction time [11]. Also, the improved reaction time and hand eye coordination directly reflects better static and

dynamic balance, muscle coordination, and alertness as improved neuromuscular functioning. For clinical assessment like muscle length and strength, we found clinically significant changes among the participants pre and post sessions. The tightness of muscles such as iliotibial band (IT band) and adductor reduced whereas the muscle strength improved (4 to 5) for both upper and lower limb muscle with clinical manual muscle testing. The findings were consistent for majority of muscles bilaterally. It is well known that soft tissues have viscoelastic properties, and they exhibit creep and stress–relaxation phenomena, which leads to improved muscle length and strength. Engaging into badminton sessions could have improved the viscoelastic properties of the muscle and bone leading to such improvement in neuromuscular functions.

Neuromotor Skills (N=26)		Pre Session		Post Session		P value
Variables		Mean	S.D	Mean	S.D	
Reaction Time (s)		2.98	0.56	1.85	0.41	<0.001
Hand-Eye Coordination (Score)		43.02	10.33	68.49	9.54	<0.001
Neuromotor Functions- Clinical Findings (N=26)		Pre		Post		
Muscle Length (Tightness)	ITB	Mild		Normal		
	Adductors	Mild		Normal		
	Calf	Moderate		Normal		
Manual Muscle Testing (MMT) (Strength)	Biceps	4		5		
	Triceps	4		5		
	Rotator Cuff	4		5		
	Quads	4		5		
	Hams	4		5		
	Calf	4		5		
	Dorsiflexors	4		5		

Table 2: Comparison of neuromotor skill and function pre and post badminton session for all participants

Conclusion: It is evident from the present study that Badminton sessions lead to improved neuromotor skills and functioning among sedentary older adults as seen with the other younger age groups and athletes. Thus, physical activity through sports among such age groups should be encouraged to achieve the desired beneficial effects. This could also help to combat the non-communicable disease complications which are very prevalent among the given age groups.

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Trial Registration: The study has been registered under the Clinical Trial Registry (REF/2022/02/051455)

Conflict of Interest

As the corresponding author, I take the responsibility to state that there is no conflict of interest.

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BADMINTON NEUROMOTOR SKILLS OLDER ADULTS UNITED ARAB EMIRATES