

Research Article

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The Effect of 12-Week Sports Ergonomics Exercises on Musculoskeletal System Disorders in Housewives

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Abstract

Background/purpose – Musculoskeletal disorders are common among housewives and are one of the important health problems that negatively affect the quality of life. Ergonomic factors and lack of physical activity are known to play a role in the occurrence of these disorders. The aim of this study was to evaluate the effects of a 12-week exercise program on ergonomic musculoskeletal disorders in housewives and to provide an effective approach for the prevention and management of these disorders.

Materials/methods – 135 women (age: 43,94±8,809 years, height: 158,28±5,96 cm) participated in our study. A program including ergonomic exercises was applied to the participants three days a week (Monday, Wednesday, Friday) for 12 weeks. A standardized ergonomic musculoskeletal disorders questionnaire was administered before and after the exercises. The obtained data were analyzed using the SPSS 25 software package. The Wilcoxon signed-rank test, a nonparametric two sample test based on the ratio of two dependent population differences, was used in the analysis of the data.

Results/Conclusion – Statistically significant differences were found between pre-exercise and post-exercise data for BMI, body weight, waist, neck and back region variables ($p<0,05$). In conclusion, 12-week ergonomic exercises applied to housewives decreased low back, neck and back pain. It is recommended that sedentary housewives should exercise to reduce pain topographically.

1. Introduction

Musculoskeletal complaints have become a prevalent health issue worldwide due to factors such as the sedentary lifestyle brought about by modern living, non-ergonomic working conditions, and physical strain (Briggs et al., 2018; Briggs et al., 2016; Woolf & Pfleger, 2003; Woolf et al., 2012). The prevalence of these conditions increases with age and is expected to rise further due to lifestyle factors such as ageing populations, obesity, and physical inactivity (Briggs et al., 2018; Briggs et al., 2016; Woolf & Pfleger, 2003; Woolf et al., 2012). The musculoskeletal system, comprising muscles, bones, joints, and connective tissues, facilitates bodily movement (Dischiavi et al., 2018; Huang, 2017; Murphy, 2018), and any dysfunction within this system can adversely affect an individual's daily life and work performance (Briggs et al., 2016; Briggs et al., 2018; Rombaut et al., 2010; Sunay et al., 2020). Common musculoskeletal complaints include low back pain, neck pain, shoulder pain, carpal tunnel syndrome, tendinitis, rheumatoid arthritis, and osteoarthritis, each of which can lead to disability and a diminished quality of life (Woolf & Pfleger, 2003; Briggs et al., 2018; Brooks, 2006). These complaints are often associated with factors such as repetitive strain, poor posture, prolonged immobility, heavy lifting, and stress (Antwi-Afari et al., 2017; Engels & Gulden, 1996; Gallagher & Barbe, 2022; Punnett, 2014; Yassi, 2000). Specifically, housewives are particularly susceptible to musculoskeletal complaints due to the various roles and responsibilities they undertake in their daily lives. Repetitive movements, heavy lifting, bending, and poor posture during activities such as cleaning, cooking, childcare, and other household chores can frequently result in low back, neck, shoulder, and knee pain among housewives (Fong & Law, 2008; Hasan, 2020; Mondal & Bhattacharjee, 2022; Ranasinghe et al., 2016). Such complaints can significantly reduce the quality of life by making household tasks more challenging.

The treatment and management of musculoskeletal complaints generally require a multidisciplinary approach. Methods such as physical therapy, ergonomic adjustments, regular exercise, medication, and, when necessary, surgical intervention can be employed (Iolascon et al., 2019; Koele et al., 2014; Takahashi et al., 2019; Ünver, 2023). Physical therapy and rehabilitation programs are crucial for strengthening muscles, enhancing joint mobility, and managing pain. Additionally, making ergonomic adjustments to improve the healthiness of work environments and household activities is an effective method for preventing musculoskeletal complaints (Amick et al., 2003; Lee et al., 2020; Robertson et al., 2013).

In conclusion, musculoskeletal complaints are significant health issues that reduce individuals' quality of life and lead to loss of workforce productivity. These complaints are particularly common among housewives due to repetitive movements, heavy lifting, and non-ergonomic working postures during household chores. To prevent and manage these complaints, it is necessary to increase ergonomic awareness, develop regular exercise habits, and implement appropriate treatment methods. Therefore, the aim of this study is to evaluate the effects of a 12-week program of sports ergonomics and core stabilization exercises on musculoskeletal disorders in housewives, and to present an effective approach for the prevention and management of these disorders.

2. Materials and Methods

Population and Sample: As part of the Kocaeli Metropolitan Municipality Mother City Project, 135 sedentary women (age: $43,94 \pm 8,809$ years, height: $158,28 \pm 5,96$ cm) participated in the study. A standardized Ergonomic Musculoskeletal Disorders Questionnaire (EKISBA) was administered to the housewives who voluntarily participated in our study both before and after a 12-week ergonomic exercise program (EEP).

Data Collection Tool: In the study, a standardized Ergonomic Musculoskeletal Disorders Questionnaire (EKISBA) (Ekberg et al., 1994; Colak et al., 2017) was administered to participants before and after the EEP to determine the current state of their musculoskeletal disorders. Following the initial survey, a 12-week ergonomic exercise program (EEP) was implemented. The EKISBA includes questions that identify which anatomical regions of the human body experience pain and at what times, with the body topographically divided into anatomical regions. In our study, the EKISBA addressed ergonomic approaches for three topographical regions: the neck, back, and lumbar areas, which constitute the core of the human body. In the EKISBA, responses for these regions are given using a Likert scale and are addressed separately for each region through the following questions: “Question 1: Did you experience any soreness, pain, or discomfort in the past week?” “Question 2: If you experienced soreness, pain, or discomfort, how severe was it?” “Question 3: If you experienced soreness, pain, or discomfort, did it affect your daily life?” In the scale, Question 1 uses a 5-point Likert scale, defined as: Never (1), Sometimes (2), Often (3), Very Often (4), and Always (5). Questions 2 and 3 use a 3-point Likert scale, defined as: Not at All (1), Slightly (2), and Very Much (3).

Personal Information Form: The Personal Information Form was created by the researcher. This form includes variables such as the participants’ age, height, and body weight, which are relevant to the objectives of the study.

Training Program: Participants followed the training program presented in Table 1, conducted three days a week (Monday, Wednesday, Friday) over a period of 12 weeks.

Table 1. Weekly Training Program

1st, 2nd, 3rd, and 4th WEEKS	
Preparation Phase	Main Phase - Completion
Dynamic Warm-Up: 30%-40% intensity -Warm-Up Exercises - Lower and Upper Extremity Stretching Spine Stretching, etc. -Hamstring Stretch, etc. Single Leg Stretch, etc.	-1 minute walking at 20%-30% intensity (short-duration aerobic) -30 seconds active rest. -2 minutes walking at 20%-30% intensity (short-duration aerobic) -1 minute active rest -3 minutes walking at 20%-30% intensity (short-duration aerobic) -1 minute active rest (Repeat sets, increasing each by 1 minute up to 8 minutes) Completion Phase: 10 minutes of stretching
	Circuit Training X 3 Sets -30 seconds Pulse Squats / 30 seconds rest -30 seconds Jumping / 30 seconds rest -30 seconds Crunch / 30 seconds rest -30 seconds Toe-High Fixed Tempo Running / 30 seconds rest Completion Phase: 10 minutes of stretching
	Materials: -Resistance Band, Hurdles, Cones, Ladder -Triangle (Diagonal) Running: 5 rounds -Slalom Running: 2 rounds -Resistance Band Exercises -Shoulder Girdle Muscle Group Exercises -Chest (Pectoral) Exercises -Back (Trapezius) Exercises -Abdominal (Abdominal Obliques) Exercises Completion Phase: 10 minutes of stretching

In the 2nd, 3rd, and 4th weeks, while the rest and exercise durations in the main phase remained the same, the intensity of the brisk walking was increased to 40%-50%.	
5th, 6th, 7th, and 8th WEEKS	
<p>Dynamic Warm-Up: 40%-50% intensity</p> <p>-Warm-Up Exercises - Lower and Upper Extremity Stretching Spine Stretching, etc. -Hamstring Stretch, etc. Single Leg Stretch, etc.</p>	<p>-6 minutes walking at 40%-50% intensity (moderate-duration aerobic) -2 minutes active rest -7 minutes walking at 40%-50% intensity (moderate-duration aerobic) -2 minutes active rest -8 minutes walking at 40%-50% intensity (moderate-duration aerobic) -2 minutes active rest -10 minutes walking at 40%-50% intensity (moderate-duration aerobic) Completion Phase: 10 minutes of stretching</p>
	<p>Circuit Training X 2 Sets</p> <p>-45 seconds knee up / knee lift / 45 seconds rest -45 seconds. Forward-Backward Plank Walk Out / 45 seconds. rest -45 seconds Step up-Step down / 45 seconds rest -45 seconds. Crunch / 45 seconds rest -45 seconds Posture Perfect / 45 seconds rest Completion Phase: 10 minutes of stretching</p>
	<p>Materials:</p> <p>-Resistance Band, Coordination Ring, Medicine Ball (3 kg), Step Platform Slalom Equipment -High Hurdle Lateral Transition Running, Lateral Steps (Step): 5 rounds -Medicine Ball Carry: 5 rounds -Resistance Band Exercises -Shoulder Girdle Muscle Group Exercises -Chest (Pectoral) Exercises -Back (Trapezius) Exercises -Abdominal (Abdominal Obliques) Exercises Completion Phase: 10 minutes of stretching</p>
9th, 10th, 11th, and 12th WEEKS	
<p>Dynamic Warm-Up: 30%-40% intensity</p> <p>-Warm-Up Exercises - Lower and Upper Extremity Stretching Spine Stretching, etc. -Hamstring Stretch, etc. Single Leg Stretch, etc.</p>	<p>-10 minutes walking at 50%-60% intensity (low speed) -2 minutes active rest -10 minutes walking at 50%-60% intensity (moderate speed) -2 minutes active rest -10 minutes walking at 50%-60% intensity (low speed) Completion Phase: 10 minutes of stretching</p>
	<p>Circuit Training X 1 Set</p> <p>-90 seconds (Plank Knee Ins / 60 seconds rest -90 seconds Scissor Kicks / 60 seconds rest -90 seconds Squat -10 seconds Passive Rest / 60 seconds rest -90 seconds Russian Twister / 60 seconds rest -90 seconds Leg Curl / 60 seconds rest Completion Phase: 10 minutes of stretching</p>

	<p>Materials:</p> <ul style="list-style-type: none"> -Resistance Band, Hurdles, Cones -Diagonal Running with 5 Cones (Forward and Back): 5 rounds -Spot Running with 5 Hurdles (10 s.) and Forward Running -Squats with Medicine Ball: 15 repetitions <p>Resistance Band Exercises</p> <ul style="list-style-type: none"> -Shoulder Girdle Muscle Group Exercises -Chest (Pectoral) Exercises -Back (Trapezius) Exercises -Abdominal (Abdominal Obliques) Exercises <p>Completion Phase: 10 minutes of stretching</p>
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Data Analysis: The obtained data were analyzed using the SPSS 25 software package. The Wilcoxon signed-rank test, which is a two-sample test based on the ratios of two total differences, was used in the analysis of the data. Data were analyzed with a significance level of 0,05.

3. Findings

Table 1: Values of BMI and Weight Variables Before and After Exercise

	N	Mean	Standard deviation	t	p
BMI (pre-test)	135	32,8785	6,22869	7,360	0,000*
BMI (post-test)	135	31,4704	5,29514		
Weight (kg) (pre-test)	135	82,873	16,6798	7,055	0,000*
Weight (kg) (post-test)	135	79,55	14,516		

BMI: Body Mass Index, *: $p < 0,005$

Statistically significant differences were found between the BMI and body weight variables before and after the exercise program ($p < 0,05$).

Table 2: p-values for EKISBA Pain Questions for the Neck Region Before and After Exercise

		N	Mean Rank	Sum of Ranks	Z	p
Q1- neck (post-test)	Negative Ranks	75	42,48	3186,00	-7,256	0,000*
	Positive Ranks	6	22,50	135,00		
	Ties	54				
	Total	135				
Q2- neck (post-test)	Negative Ranks	75	39,47	2960,00	-7,649	0,000*

Q2- neck (pre-test)	Positive Ranks	2	21,50	43,00		
	Ties	58				
	Total	135				
Q3- neck (post-test)	Negative Ranks	71	37,51	2663,00	-7,438	0,000*
Q3- neck (pre-test)	Positive Ranks	2	19,00	38,00		
	Ties	62				
	Total	135				

*: $p < 0,005$

Question 1: Did you experience any soreness, pain, or discomfort in the past week? Question 2: If you experienced soreness, pain, or discomfort, how severe was it? Question 3: If you experienced soreness, pain, or discomfort, did it affect your daily life? There are statistically significant differences between the pre-exercise and post-exercise results for Question 1, Question 2, and Question 3 in the neck region ($p < 0,05$).

Table 3: p-values for EKISBA Pain Questions for the Back Region Before and After Exercise

		N	Mean Rank	Sum of Ranks	Z	p
Q1- back (post-test)	Negative Ranks	70	37,96	2657,00	-7,243	0,000*
Q1- back (pre-test)	Positive Ranks	3	14,67	44,00		
	Ties	60				
	Total	133				
Q2- back (post-test)	Negative Ranks	62	33,03	2048,00	-6,957	0,000*
Q2- back (pre-test)	Positive Ranks	2	16,00	32,00		
	Ties	65				
	Total	129				
Q3- back (post-test)	Negative Ranks	66	35,93	2371,50	-7,207	0,000*
Q3- back (pre-test)	Positive Ranks	3	14,50	43,50		
	Ties	63				
	Total	132				

*: $p < 0,005$

Question 1: Did you experience any soreness, pain, or discomfort in the past week? Question 2: If you experienced soreness, pain, or discomfort, how severe was it? Question 3: If you experienced soreness, pain, or discomfort, did it affect your daily life? There are statistically significant differences between the pre-exercise and post-exercise results for Question 1, Question 2, and Question 3 in the back region ($p < 0,05$).

Table 4: p-values for EKISBA Pain Questions for the Lower back Before and After Exercise

		N	Mean Rank	Sum of Ranks	Z	p
Q1- lower back (post-test)	Negative Ranks	68	37,73	2565,50	-7,079	0,000*
Q1- lower back (pre-test)	Positive Ranks	4	15,63	62,50		
	Ties	63				
	Total	135				
Q2- lower back (post-test)	Negative Ranks	66	35,23	2325,00	-6,897	0,000*
Q2- lower back (pre-test)	Positive Ranks	3	30,00	90,00		
	Ties	66				
	Total	135				
Q3- lower back (post-test)	Negative Ranks	69	36,85	2542,50	-7,124	0,000*
Q3- lower back (pre-test)	Positive Ranks	3	28,50	85,50		
	Ties	63				
	Total	135				

*: $p < 0,005$

Question 1: Did you experience any soreness, pain, or discomfort in the past week? Question 2: If you experienced soreness, pain, or discomfort, how severe was it? Question 3: If you experienced soreness, pain, or discomfort, did it affect your daily life?

There are statistically significant differences between the pre-exercise and post-exercise results for Question 1, Question 2, and Question 3 in the lower back region ($p < 0,05$).

4. Discussion and Conclusion

This study aims to comprehensively examine the effects of a 12-week exercise program on ergonomic musculoskeletal disorders among housewives. The findings of the study indicate a significant reduction in neck, lower back, and upper back pain experienced by the participants following the exercise program. Data obtained through three different questions posed to the participants support the positive impact of the exercise program on musculoskeletal health. Additionally, significant reductions in body mass index (BMI) and weight were observed between pre-test and post-test measurements among women who participated in the exercise program ($p < 0,05$). These results contribute positively to maintaining physical body integrity, enhancing healthy living, and reducing the risk of chronic diseases. The study's findings show a notable decrease in neck, lower back, and upper back pain following the exercise program, with a significant difference in pre-test and post-test results ($p < 0,05$). These results demonstrate the positive impact of the exercise program on musculoskeletal health, thereby improving the quality of life for housewives. The primary finding of the study is that a structured exercise program focused on ergonomics can alleviate musculoskeletal disorders among housewives. The reduction in pain and improvement in physical function are likely due to increased muscle strength and stabilization, which are critical for managing and preventing musculoskeletal disorders (Keshmarzi et al., 2018). Colak et al. (2017B) investigated ergonomic approaches and related musculoskeletal disorders among office workers using the EKISBA. Their study showed that even ergonomic seating could change the levels and frequency of pain. In our study, the EKISBA was used to investigate the

effects of the EEP on the neck, back, and lower back regions in housewives. Decreased ergonomic applications are significantly associated with pain in four body regions (lower back, neck/shoulder, arms, and lower extremities) and work interaction caused by this pain (Dennerlein et al., 2012). Poor ergonomic practices lead to musculoskeletal pain, affecting the quality of life both at work and outside work (Aaron et al., 2021).

Chavalitsakulchai and Shahnavaz (1993) stated that poor ergonomic design and working postures, lack of task variety, and inadequate rest breaks are major factors associated with musculoskeletal disorders among female workers. Similarly, Riaz et al. (2022) reported that poor ergonomic posture could lead to frequent musculoskeletal pain and difficulties in performing routine office and household tasks. Consistent with these findings, Norouzi et al. (2021) found that an ergonomics-focused exercise program could reduce the prevalence of musculoskeletal disorders and improve the quality of life for housewives. A study on surgeons also indicated that an ergonomics application and a specific physical exercise program could reduce work-related musculoskeletal disorders among surgeons (Giagio et al., 2019). Another study on office workers found that ergonomic training interventions significantly reduced musculoskeletal disorders in the neck and upper extremities among office workers (Sohrabi and Babamiri, 2021).

These results suggest that the EEP could be an effective approach not only in treating musculoskeletal disorders but also in preventing such disorders. Integrating ergonomic applications into daily routines, combined with regular physical activity, can reduce these risks. Specific and regular exercises targeting the core muscles, as applied in the EEP, can strengthen the muscles around the spine, providing better support and reducing the probability of injury (Akuthota et al., 2008). Additionally, improved neuromuscular control of postural and topographic regions contributes to more efficient functional movements, enhancing body balance, back muscle strength, and endurance (Zemková and Zapletalová, 2022). The repetitive movements, heavy lifting, bending, and incorrect postures encountered during household activities such as cleaning, cooking, childcare, and other household chores often lead to back, neck, shoulder, and knee pain in housewives (Fong and Law, 2008; Hasan, 2020; Mondal and Bhattacharjee, 2022; Ranasinghe et al., 2016), and exercise programs like the EEP have potential benefits in reducing these burdens. In conclusion, the 12-week EEP showed a significant positive impact on reducing musculoskeletal disorders among housewives. These findings emphasize the importance of integrating ergonomic practices and regular physical activity into daily routines to enhance quality of life and prevent musculoskeletal issues. Moreover, a well-structured body composition and improved quality of life through the EEP can positively affect the psychology of housewives. Future studies can explore the potential for implementing similar programs on a larger scale and investigate their long-term benefits.

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