

Research Article



Musculoskeletal Asymmetry and History of Pain in Healthy Adults: Variation in Both Genders in Twin Cities of Pakistan

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Citation Hussain SA, Rafiq A, Ullah Nazir A, Afzal R, Ali S, Kiyani MM, et al. Musculoskeletal Asymmetry and History of Pain in Healthy Adults: Variation in Both Genders in Twin Cities of Pakistan. Journal of Modern Rehabilitation. 2023; 17(4):461-467. <http://dx.doi.org/10.18502/jmr.v17i4.13895>

doi <http://dx.doi.org/10.18502/jmr.v17i4.13895>

Article info:

Received: 5 Apr 2022

Accepted: 28 Jun 2022

Available Online: 01 Oct 2023

Keywords:

Asymmetry; Healthy adults; Iliac crest level; Musculoskeletal pain; Shoulder asymmetry

ABSTRACT

Introduction: Musculoskeletal asymmetries are common and have important consequences for the individual and society. This study aims to determine musculoskeletal asymmetry in healthy adults.

Materials and Methods: A total of 400 healthy individuals with no musculoskeletal pain at the time of data collection were included in the study. Two custom-made wooden devices were used to assess the asymmetry in the participants by measuring their height from the base of the device up to different levels of the body. The modified Nordic pain scale was used to take the history of any regional pain in the last 6 months.

Results: The mean age of male and female subjects was 21.69 ± 2.19 and 23.49 ± 1.72 years, respectively. The dominant side of the body in the majority of both genders was the right side. The most commonly reported painful site was low back with 47(23.5) males and 43(21.5) females affected, followed by neck pain in 40(20) males and 45(22.5) females. Out of 400 participants, only 31(15.5) males and 12(6) females had symmetrical shoulders and 41(20.5) males and 17(8.5) females had symmetry at the level of iliac crests.

Conclusion: Musculoskeletal asymmetries are present in healthy adults at various levels of the body with a history of musculoskeletal pain relatively more prevalent in females compared to males.

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1. Introduction

The musculoskeletal system consists of one of the main tissue or organ systems in the human body. Skeletal muscle's attachment to the bone through tendons produces all actions of the body. All mechanical functions of the human body are performed by the musculoskeletal system. Any abnormality in this system can result in dysfunction [1]. The skeletal system is responsible for the structural framework of the human body, and if there is any abnormality in the skeletal system, it may lead to musculoskeletal problems in the later stages of life. The skeletal system can be affected by various factors during life [2]. Problems in the locomotor system are because of the bones, joints, cartilage, muscles, nerves, and ligaments. They usually occur because of repetitive or strenuous activity and can result in a range of complications, problems, and deformities, causing a significant burden on the individuals' health and financial system in all societies [3].

Problems and dysfunctions in the musculoskeletal system are encountered in all the regions of the world and are considered one of the main causes of disability in 4 out of 6 World Health Organization (WHO) regions in 2017. The prevalence of conditions affecting the musculoskeletal system increases with age; however, the youth is also affected by these conditions in their peak income-earning years [4].

According to a study in 2016, musculoskeletal conditions are the second highest cause of years lived with disability. There are many risk factors for musculoskeletal problems, namely poor nutrition, obesity, a sedentary lifestyle, and so on. Musculoskeletal system disorders can also lead to other chronic conditions [5]. Back pain and neck pain are among the top 10 causes of years lived with disability [6].

Musculoskeletal problems are challenging for physicians and patients. Many adults have experienced one or more incidents of musculoskeletal pain at a certain time in their lives, regardless of gender, age, or socioeconomic status. It affects almost 47 of the overall population [7]. Pain in bones, muscles, tendons, and ligaments is referred to as musculoskeletal pain. There are various causes of musculoskeletal pain, such as trauma, prolonged immobilization, overuse, repetitive movements, and poor postural habits. Musculoskeletal complaints are among the most commonly reported pain conditions in clinical settings [8]. The prevalence of musculoskeletal conditions increases with age; that is, nearly 5 of sub-

jects aged less than 15 years to more than 31 of individuals aged more than 50 years experience this condition and it has a higher prevalence among females [9]. Age, gender, psychosocial behavior, unhealthy lifestyle, and poor ergonomics are the most common factors related to musculoskeletal issues [10]. Musculoskeletal problems lead to poor work performance, limited functional capacity, chronic disability, and poor quality of life. This can lead to the loss of productivity and income as a result of work absenteeism or career termination [11]. The occurrence of postural defects has currently become common in the general population [12]. Any position is called a particular posture. Human posture indicates the position of the body in space and aims to maintain body balance in static and dynamic conditions. There are 2 types of postures, namely good or bad posture. Good posture prevents progressive deformity or injury, whereas poor posture is any position of the body in which there is a poor balance between different components of the musculoskeletal system [13]. A normal human body is considered symmetrical. Asymmetry in the body can lead to increased loading on one side, which may lead to pain and early degeneration, leg length discrepancy, pelvic obliquity, scoliosis, and so on [14]. Although the human body is considered to be completely symmetrical, this is not true as there is asymmetry present between the right and the left side of the body, which can be due to the development or dominant side of the body [15]. According to various resources, poor posture and aggressive physical activity can cause musculoskeletal disorders [16].

Studies regarding pain in adults as well as in children have mentioned the increased frequency of pain related to the muscles and soft tissues, especially with the age factor. Pain at certain regional locations, mostly in the lower limb, increases in prevalence with increasing age; however, low back pain decreases at mature ages [17]. According to the national health survey of 2012, musculoskeletal pain disorder was reported in 54.5 of U.S. adults [18]. The fourth European survey on working conditions presents the prevalence of some musculoskeletal disorders, reporting a 24.7 prevalence of back pain, 22.8 of muscle pain, and 23 of neck and shoulder pain [19]. Research in Iran shows that the prevalence of symptoms of neck, shoulder, lower back, and upper back pain are respectively 27.9, 20.7, 34, 3, and 19.0 [20]. In Norway, neck and low back pain were most commonly reported in the overall population [21]. Accordingly, this study aims to find out the prevalence of musculoskeletal issues in the healthy adult population of the twin cities of Pakistan, namely Rawalpindi, and Islamabad to help prevent them from the disabilities that result from the long-term musculoskeletal issues.



Figure 1. Asymmetry measurement custom-made device

JMR

2. Materials and Methods

This cross-sectional survey was conducted at a tertiary care hospital in Islamabad City, Pakistan. A total of 400 healthy individuals in the age range of 20 to 35 years with no musculoskeletal pain with normal leg length and foot arches were included. Meanwhile, individuals with scoliosis were excluded. Written and informed consent was taken before they participated in the study. The modified Nordic pain scale was used to collect data alongside a self-structured questionnaire for demographics and history of musculoskeletal pain in the past 6 months. Two custom-made wooden devices were used to assess the asymmetry in the participants (Figure 1). The height was measured from its base on the ground to the following landmarks of the body in cm: Shoulder, inferior angle of scapula, iliac crest, greater trochanter,

knee, and ankle. The study duration was 6 months. The data was analyzed using the SPSS software, version 21.

3. Results

A total of 400 participants were enrolled, out of which 200(50) were male and 200(50) were female. The mean age and weight of male and female participants are shown in Table 1. Out of 200 males, 197(98.5) had the right dominant side and 3(1.5) had the left dominant side of the body. Out of 200 females, 194(97) had the right dominant side and 6(3) had the left dominant side.

A total of 308(77) participants reported pain in different regions of the body. The majority of the female participants reported pain in their neck, upper back, and shoulder regions, whereas most of the male participants

Table 1. Demographics of the participants

Variables	Mean±SD	
	Male	Female
Age (y)	21.69±2.19	23.49±1.72
Weight (kg)	72.45±12.48	58.36±8.32
Height (cm)	174.64±9.31	161.86±6.08

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Table 2. History of the musculoskeletal pain in participants

Location of Pain	No.(%)		
	Total	Male	Female
Neck	85(21.25)	40(20)	45(22.5)
Shoulder	45(11.25)	15(7.5)	30(15)
Upper back	33(8.25)	15(7.5)	18(9)
Lower back	90(22.5)	47(23.5)	43(21.5)
Elbow	4(1)	4(2)	0(0)
Wrist	16(4)	12(6)	4(2)
Hip	16(4)	15(7.5)	1(0.5)
Knee	27(6.75)	14(7)	13(6.5)
Ankle	8(2)	6(3)	2(1)

JMR

Table 3. Frequency of asymmetry at different levels on each side in both genders

Variables	Elevated Body Part	No.(%)	
		Right	Left
Males	Shoulder	54(27)	115(57.5)
	The inferior angle of the scapula	61(30.5)	108(54)
	Iliac crest	71(35.5)	88(44)
	Greater trochanter	44(22)	102(51)
	Knee	74(37)	52(26)
	Ankle	63(31.5)	34(17)
	Females	Shoulder	101(50.5)
The inferior angle of the scapula		74(37)	98(49)
Iliac crest		93(46.5)	90(45)
Greater trochanter		83(41.5)	98(49)
Knee		80(40)	102(51)
Ankle		76(38)	75(37.5)

JMR

reported pain in their lower back, knee, wrist, ankle, and elbow regions (Table 2).

Amongst the male participants, 169(84.5) had asymmetrical shoulders while only 31(15.5) had symmetrical shoulders. The occurrence of symmetry at the level of the inferior angle of the scapula, iliac crest, greater

trochanter, knee, and ankle in the male participants was 31(15.5), 41(20.5), 54(27), 74(37), and 103(51.5), respectively. Amongst the female participants, the occurrence of symmetry at the level of the shoulder, inferior angle of the scapula, iliac crest, greater trochanter, knee, and ankle was 12(6), 28(14), 17(8.5), 19(9.5), 18(9), and 49(24.5), respectively (Table 3).

4. Discussion

This study aimed to determine the sites of musculoskeletal pain and levels at which asymmetry often occurs in healthy adults. In female participants, mostly reported areas of pain were the neck, upper back, and shoulder region while in male participants the areas were the lower back, knee, wrist, ankle, and elbow regions. According to Pereira et al., the legs and spine are the most commonly affected sites in terms of musculoskeletal pain [22]. Das noticed that 70 of woman workers reported back pain due to uncomfortable working posture for extended periods [23]. According to the current study, 54(27) males and 101(50.5) females have elevated right shoulder, whereas Batistão et al. reported a higher prevalence of postural deviations among school children, especially in terms of forward head posture (53.5) and shoulder elevation (74.3) [24]. According to the findings of the current study, the dominant side's shoulder is depressed in males while the dominant side's shoulder is elevated in the majority of females. Matsuki et al. reported changes in the motion of the scapula among the dominant and non-dominant arms in the healthy population. When movement stops, the dominant scapula was moving downward further [25].

Grabara et al. conducted a study to compare volleyball players and individuals with no training. They concluded that the right-side shoulder was ≥ 5 mm elevated compared to the left side in 37 of volleyball players and 29 of non-training participants. However, 40 of volleyball players and 45 of non-training participants demonstrated the absence of any asymmetry. The left-side scapula was positioned higher when compared to the right side in 45 of players and 43 of non-training participants, with 34 of the whole study subjects lacking any asymmetry [26].

In this study, the dominant side's level of iliac crest was depressed in most of the male participants while it was elevated in a relatively large number of females. Greater trochanter level was elevated in the non-dominant side in both genders. Knee joint level was elevated in males at their dominant side while in most females, the dominant side's knee was depressed. However, the level of the ankle joint was elevated in both genders on the dominant side. Males tend to have more symmetrical knees as compared to females. Rodby Bousquet et al. also reported that asymmetries of posture were existing in adolescents at all levels of the gross motor function classification system, but were more common at lower levels of motor function and vary in different sites [27]. Zolghadr et al. examined the lateral abdominal muscle thickness in female patients with chronic non-specific unilateral

low-back pain and concluded that asymmetry in the abdominal muscles cannot be interpreted as a pathologic phenomenon in the low-back pain participants [28]. Concerning the asymmetries among both condyles, i.e. medial as well as lateral, Yue et al. reported that the radius of the lateral extension facet was considerably lesser in contrast to the medial condyle in both genders, resulting in asymmetries leading to various dysfunctions in the musculoskeletal system [29]. Moudy and Menegaz reported that able-bodied asymmetry is a limb difference greater than 10. Larger musculoskeletal asymmetries, up to 68, were observed in individuals with amputation, denoting asymmetrical biomechanical loading, and possibly compensations related to prosthesis use [30].

5. Conclusion

Musculoskeletal asymmetries are present in all healthy adults at various levels of the body, predominantly at the shoulder and iliac crest levels with a history of musculoskeletal pain relatively more prevalent in females compared to males. The most commonly reported areas of pain were the neck, upper back, and shoulder in females and the lower back, knee, wrist, ankle, and elbow regions in males. Early screening for musculoskeletal asymmetries can help in possibly reducing the risk of musculoskeletal injuries and disorders.

Ethical Considerations

Compliance with ethical guidelines

The study was approved by the Ethics Committee of the [Riphah College of Rehabilitation Sciences](#) (Code: RIPHAH/RCRS/REC/Letter-00406).

Funding

This research did not receive any grant from funding agencies in the public, commercial, or non-profit sectors.

Authors' contributions

Conceptualization and study design: Syed Ali Hussain; Data collection: Arslan Rafiq and Aman Ullah Nazir; Writing the manuscript: Rabia Afzal and Samina Ali; Statistical support: Mubin Mustafa Kiyani and Noman Malik.

Conflict of interest

The authors declared no conflict of interest.

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