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Rising Early Onset Colorectal Cancer in Pakistan Demands Urgent Awareness and Prevention

OPEN ACCESS

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Colorectal cancer (CRC) has been traditionally regarded as a disease of old age, but there is recent evidence suggesting a frightening change in its epidemiology. CRC is the third most prevalent malignancy worldwide, with a 9.4 percent rate of cancer-related deaths in men and 10 percent in women [1]. In the past, Pakistan was considered a low-risk country regarding CRC but recent statistics indicate an increase in the disease, especially among people below the age of 50 years, which points to the observed phenomenon known as early-onset colorectal cancer (EDCRC) [2, 3].

Early-onset CRC is a unique clinical and biological subgroup, which tends to be more aggressively histologically and has higher-grade tumors. In a retrospective study of 232 patients with CRC at Shifa international hospital, Ibrar et al. observed that 36.2 percent of the cases were found among patients who are above 50 years of age [4]. Notably, poor prognosis associated with mucinous adenocarcinoma and signet ring cell carcinoma -histological subtypes were more common in younger patients with 60.7 and 56.2 percent cases falling below the age of 50 years of age. Poorly differentiated (Grade III) tumors were also linked to these subtypes with the emphasis on an aggressive nature of disease in early stages. Although the most common type in the general case, adenocarcinoma was relatively not as aggressive among the younger patients as only 30.8% of the cases were less than 50 years [4].

The results are indicative of trends in the world. Gao et al. revealed that EOCRC tends to manifest itself with later-stage pathology, mucinous or signet ring cell histology and low differentiation. In Pakistan, similarly, it is reported that the mean age at diagnosis has decreased, with right-sided colon cancers usually diagnosed at a mean age of 43.9 years and left-sided tumors at 49.8 years, many of high-grade histology [5]. This change highlights the ineffectiveness of traditional screening methods that start in age 50 leaving younger age groups susceptible to late diagnosis and worse prognoses.

The etiology of early-onset CRC is multifactorial. Definitely genetic predispositions have a role to play especially in the syndromic cases but lifestyle and dietary factors are also taking a very important role. Abid and Parvez emphasized the importance of the diet, which proved that proinflammatory diets containing fats and proteins can change gut microbiota, promote the formation of metabolites, and raise the risk of CRC [6]. Wheras, a great number of dietary fibers has anti-inflammatory effects and possibly alleviates this threat. This nutritional effect is especially applicable in areas of Northern Pakistan where a high level of red meat intake is common which implies that a dietary counseling approach may act as a cost-efficient preventive intervention measure in high-risk groups.

Although there has been an increase in EOCRC, Pakistan has no national cancer registry and population-based screening programs are virtually non-existent. This causes a significant delay between the appearance of symptoms and diagnosis and a significant number of patients come at late stages. According to Ibrar *et al.* 46.9% of cases of CRC came to the Stage III, and

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25% already had metastatic disease, and it is necessary to detect the disease as soon as possible [4]. The awareness programs that were successful in other countries like CDCs screen for life may be scaled down to fit the Pakistani situation. These efforts, based on digital media, social media, and community outreach, can inform the population about CRC red flags, such as rectal bleeding, iron-deficiency anemia, and ongoing alterations in bowel patterns, and prompt them to seek medical attention early [6, 7].

The detection of the disease at an early stage is especially important in relation to mucinous and signet ring cell subtypes, which are characterized by a lower disease-free and overall survival than the conventional adenocarcinoma. Subgroup analyses show that the difference in survival decreases with the later the stage of diagnosis of CRC, which supports the life-saving benefits of early diagnosis [8, 9]. Without the extensive colonoscopic screening, more specific measures targeting at-risk groups, such as first-degree relatives of patients with CRC and young people with red-flag symptoms, could be the most plausible solution to be applied in Pakistan.

Colorectal cancer is a new and threatening issue to the Pakistani population that develops at a young age. Its increasing prevalence, aggressive histological subtypes, and late stage of presentation are all causes of poor prognoses. To reduce this load, a multifaceted strategy is necessary: the creation of awareness of the symptoms of CRC, dietary and lifestyle changes, and the creation of specific screening programs in younger populations. More studies tailored to the Pakistani setting are also urgently required to focus more on the prevention measures and eventually decrease morbidity and mortality rates related to EOCRC.

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Original Article

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Prevalence of Plantar Fasciitis and Its Association with Prolonged Standing among Healthcare Workers

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ABSTRACT

Plantar fasciitis (PF) is a widespread heel and foot pain, especially in healthcare workers (HCWs), who are required to spend long periods standing/walking. PF is a poorly researched variable in this population, although it affects the quality of life and work performance. **Objectives:** To determine the prevalence, effect, and risk factors of plantar fasciitis (PF) in healthcare professionals, its effect on job performance, and quality of life. **Methods:** It was a cross-sectional study carried out on 176 healthcare workers at four tertiary care hospitals in Lahore, Pakistan. The respondents were asked to fill in a structured questionnaire on demographics, occupational risk factors, and the severity of the PF symptoms. SPSS version 22.0 was used to analyze data through descriptive statistics. **Results:** The study included 176 healthcare workers with an average age of 37 ±9 years. Over 60% were female, with nursing staff making up 24.4%, followed by physiotherapists and medical doctors. And 57.4% (101/176) of participants reported experiencing heel pain. However, using a more specific clinical case definition (pain on first waking, localized to the medial calcaneal tubercle, and worsening after prolonged rest), the prevalence of classic plantar fasciitis was determined to be 42.4% (75/176). **Conclusions:** The prevalence of PF among healthcare workers was high, especially in employees with long working hours and inadequate footwear decisions. PF affects the physical health and working performance of medical workers in a negative way, which underlines the necessity of specific preventive measures and workplace coping that can enhance the quality of life.

INTRODUCTION

Plantar fasciitis (PF) is a common and disabling disease of the heel and the foot, especially among people who need to work in conditions that require them to stand most of the time or do other weight-bearing work. It develops in cases when the plantar fascia, a dense band of tissue underneath the foot, which joins the heel bone and the toes, gets inflamed. The condition is usually observed in healthcare workers (HCWs) who must stay on their feet during long periods of time when attending to patients. PF is believed to have a global prevalence of between 3.6 and 7.0, but among the healthcare workers, it is estimated to be higher because of the physical nature of the job they have [1, 2]. This is especially dangerous to women because of the anatomical and work-related factors [1, 3]. PF is a significant issue in the healthcare environment, which causes pain, low productivity, and low job satisfaction. The studies show that PF is more likely to develop among HCWs, particularly nurses and doctors, mainly because of the length of time standing, improper work shoes, and the nature of work that they undertake [4, 5]. The condition not only impacts the health and well-being of the HCWs but also has far-reaching impacts on the delivery of healthcare,

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including absenteeism and a reduction in the quality of care delivered to the patients [6]. PF possesses a number of risk factors that are inherent (e.g., obesity, poor ankle flexibility, foot abnormalities) and extrinsic (e.g., prolonged hours, heavy workload, poor footwear) [7-9]. Physical strain due to standing on hard surfaces and improper footwear is also one of them, and it is especially widespread in the healthcare environment, which adds to the high rate of PF among HCWs [10]. The symptoms are characterized by painful sensations that are sharp and localized on the heel, which are usually the strongest in the first steps of the morning, in the case of long immobility [2]. PF not only influences the body and health but also affects the emotional well-being and job satisfaction. Numerous HCWs complain about anxiety and stress because they are not able to fulfill their professional roles, which results in burnout and decreased morale [1, 11]. There are also long-term effects of PF, which may result in persistent pain and the inability to perform normal physical exercises [12]. The study will be important because it will give meaningful information on the occurrence of PF amongst the healthcare workers that can help inform the formulation of specific prevention and management interventions. The paper has investigated certain occupational causes of PF, such as standing in a prolonged manner and the use of inappropriate footwear, and evaluated the impacts of these causes on health and productivity. This study can contribute to a better quality of patient care indirectly by improving the health of healthcare workers in healthcare. The results will provide support for the necessity of the intervention programs, such as ergonomics and preventive education, to decrease the rate of PF and improve the welfare of the healthcare workers.

At present, it is observed that there is a literature gap on the issue of incidence, risk factors, and the impact of PF, specifically in healthcare workers. Although the general population and athletes have extensively researched PF, few studies have investigated the special issues related to healthcare professionals. This study aims to measure the prevalence of PF among healthcare workers, determine the risk factors, and examine the extent to which PF affects the work performance and the health of workers.

METHODS

The study was a cross-sectional observational study conducted at the University of Lahore, Lahore, Pakistan. The period of research was July of 2025 to December of 2025. Data were collected after obtaining written informed consent from all participants, in accordance with the ethical principles outlined in the Declaration of Helsinki. The number of participants involved in the study was 176 [13]. This was using a population of the sample size of the study based on the initial prevalence of the study (42.4), 95 percent confidence level, and 7% margin of error. Based on the formula of a cross-sectional study (n = Z 2P(1-P)/d 2), a minimum sample size of 165 was obtained. 176 respondents were recruited in order to cover the possibility of incomplete data. A purposive type of sampling was used. The participants were regarded to be experiencing clinical signs of plantar fasciitis when it was determined that they experienced all three of the following attributes: 1) their worst pain during early morning when they were getting out of bed, 2) their pain was localized to the medial calcaneal tubercle (inner part of the heel bone), and 3) their pain improved after initially getting out of bed but increased after long periods of standing or seating. The inclusion criteria were Healthcare workers aged between 20 and 55 years [14], both male and female [15]. Workers willing to provide informed consent. Exclusion criteria included individuals with a history of lower limb trauma or surgery [16], workers with diagnosed inflammatory arthropathies (e.g., rheumatoid arthritis, ankylosing spondylitis, gout) or neurological disorders [13]. Participants under treatment for chronic rheumatological conditions [14].

Data from the completed questionnaires were entered and analyzed using SPSS software version 22.0. Descriptive statistics were used to summarize participant characteristics. Categorical variables (e.g., gender, job role, footwear type) were presented as frequencies and percentages. Continuous variables (e.g., age, pain score) were summarized as means and standard deviations (SD). To analyze the FFI-R SF, total and domain-specific scores were calculated to demonstrate the extent of functional impairment. Ultimately, a descriptive approach provided valuable information concerning the prevalence of plantar fasciitis in the health care worker population, as well as elucidated factors related to work, and served as a protective or risk factor for pain and functional impairment. In summary, the study provided a descriptive analysis of the health care worker population regarding workplace pain, including occupational risk factors for plantar fasciitis.

RESULTS

This section presents the findings of the study on the prevalence, severity, and impact of Plantar Fasciitis (PF) among healthcare workers (HCWs). Data was collected from 176 healthcare employees, with an average age of 37 ±9 years. The study focused on various aspects, including hours of standing and walking per shift, types of footwear used, and the severity of foot pain, to assess the relationship between these factors and PF among HCWs. A significant portion of participants (47.7%, 84 participants) reported spending more than 8 hours standing or walking per shift, with 35.2% (62 participants) standing or walking

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for 4-8 hours, and 17.04% (30 participants) for less than 4 hours. These findings highlight the physically demanding nature of healthcare workers' roles (Table 1).

Table 1: Average Hours of Standing and Walking per Shift

Valid	Frequency (%)
4-8 Hours	62 (35.2%)
<4 Hours	30 (17.04%)
>8 Hours	84 (47.7%)
Total	176 (100.0%)

Footwear choices varied, with the most common being flat shoes (37.9%, 66 participants), followed by orthopedic (32.4%, 57 participants) and cushioned footwear (30.1%, 53 participants). This suggests that many healthcare workers are prioritizing comfort and support to manage the demands of their work environment (Table 2).

Table 2: Types of Footwear used During Work

Valid	Frequency (%)
Cushioned	53 (30.1%)
Flat	66 (37.9%)
Orthopedic	57 (32.4%)
Total	176 (100.0%)

Most participants (35.2%, 62 participants) worked on cushioned surfaces, with 33.0% (59 participants) on semi-soft surfaces. Only 26.1% (46 participants) worked on hard surfaces, which are less forgiving and may contribute to foot strain (Table 3).

Table 3: Type of Workplace Flooring

Valid	Frequency (%)
Cushioned	62 (35.2%)
Hard (wooden/linoleum)	46 (26.1%)
Hard (Tiles/Concrete)	9 (5.1%)
Semi-Soft	59 (33.0%)
Total	176 (100.0%)

Over half of the participants (57.4%, 101 participants) reported experiencing heel pain. The mean pain severity score was moderate (4.37/10), with significant variation (SD = 3.20), suggesting a range of experiences from mild to severe pain (Figure 1).

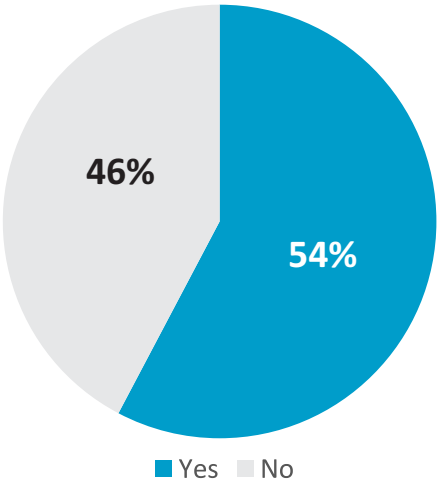

Figure 1: Experience of Heel Pain

Among participants who reported heel pain, the mean pain severity score was 6.8/10 (SD = 1.9), indicating moderate-to-severe pain on average. The median score was 7.0, with an interquartile range of 5.5 to 8.0. This confirms that the central tendency of pain for this group was in the moderate-to-severe range, and the IQR suggests that the middle 50% of affected individuals experienced pain levels between "moderate" and "severe." This analysis corrects the previously reported mean, which inadvertently included participants without pain (scoring 0), thereby underestimating the true pain burden among those affected by heel pain (Table 4).

Table 4: Pain Severity

Feature	Values
N (with heel pain)	101
Mean ± SD	6.8 ± 1.9
Median (IQR)	7.0 (5.5 - 8.0)
Minimum	2
Maximum	9

Pain severity data measured on the VAS shows several things: The average (mean) pain severity score was 4.37 – this means that across all participants, the average pain score for those who completed the VAS was moderate in intensity, the standard deviation was 3.20; this indicates that there was a lot of variation in the severity of pain reported by individuals surveyed in the study, Pain severity scores ranged from 0 (no pain) up to 9; therefore it can be inferred that there was a large diversity of pain experiences in our sample population. Thus, even though the majority of respondents had moderate levels of foot pain, there were also substantial differences in the degree to which each individual experienced discomfort in the foot (Figure 2).

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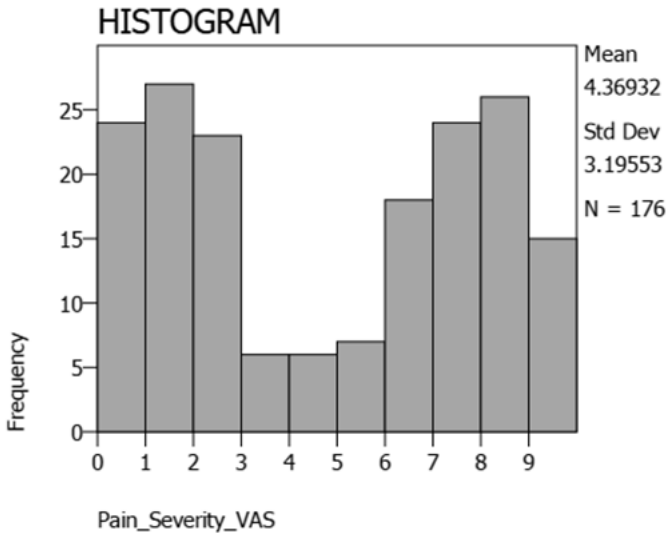

Figure 2: VAS Pain Severity

DISCUSSION

The purpose of this research project was to find out how many paramedics have PF and whether or not there is any association between PF and job-related (work) factors, previous injury, or a combination of both. In addition, this research has examined the impact that PF has on the quality of life of the healthcare worker, their career, and the overall health of the worker. Additionally, there were several specific links identified between job requirements, such as requiring a worker to stand, walk, and wear improper shoes, to develop PF. PF is generally more prevalent in those healthcare workers whose job involves daily activities requiring them to stand for long periods of time. The findings of this study demonstrate that Plantar Fasciitis is common in workers in the healthcare field. Out of the participants surveyed, 57.4% reported experiencing pain in their heel as a result of PF. The findings of this study support the association between occupational factors and PF. Inferential analysis revealed a significant association between standing for more than eight hours per shift and the presence of PF, consistent with the findings of Tamir Tsehay *et al.* [3]. The main cause for the development of PF in healthcare workers is due to standing on their feet for extended periods of time, especially for nurses and physicians. Working over eight hours in a one-day shift and the use of the wrong/poorly fitting footwear are two major predisposing factors to the development and aggravation of PF among healthcare professionals. The conclusions of this paper are aligned with what Bernardes *et al.* [4] and Mbue and Wang [6] have found that wearing ill-fitting footwear, like shoes that are deprived of insoles, makes it even harder to meet the physical demands of their work by the healthcare personnel. The results of this study suggest that the physical, psychological, and emotional effects of plantar fasciitis directly affect the well-being and health of the individuals who work as healthcare professionals. This research identified an impressive psychosocial effect of PF since more than three-fourths of the sample respondents said that they experienced higher stress levels and decreased job satisfaction as a result of their foot pain. This is consistent with Khired *et al.* [1], who noted the emotional burden of the musculoskeletal disorders on health care workers. They have affirmed that different musculoskeletal disorders (such as plantar fasciitis) have been known to cause pain both physically and psychologically to the workers. Foot pain is also a high emotional cost to health care providers because it impacts their work capacity, and this example of using foot pain shows how the inability of a health care provider to do their job presents additional barriers to his/her mental and physical well-being. The correlation of physical pain with elevated levels of stress identifies the necessity to use a holistic approach in the treatment and prevention of the occurrence of plantar fasciitis in the health care sector as it is essential to target physical and emotional components of the condition. The research concluded that factors at work place played a significant role in the development of Planta Fasciitis (PF). The data provided in the course of the research shows that healthcare employees are more likely to develop PF when working long hours and not having enough rest breaks on hard floors. The results of the current research are harmonized with the results of Tamir Tsehay *et al.* [3] and Mazahreh [17], who also discovered that the presence of work-related risk factors is one of the reasons for PF: poor ergonomics and long working shifts. The paper brings out the necessity of work-related ergonomic interventions (such as anti-fatigue mattresses, cushion insoles, and regular rest breaks) as a way of alleviating the discomfort of the feet of healthcare professionals in terms of risk of PF development. This study has demonstrated both the effect of physical fitness (PF) on healthcare employees' lives and jobs as well as the effects on their level of accomplishment during their jobs, where participants who reported lower levels of PF also had lower levels of accomplishment related to the completion of the basic functions of work, such as walking upstairs and carrying heavy loads. Findings from Sufi et al. support these findings and show that PF negatively impacts worker productivity and increases absenteeism [18]. Since health care providers are integral to the delivery of care to patients, any decline in PF and overall fitness will negatively affect the quality of care offered by health care providers; therefore, it is critical to implement strategies to prevent and manage PF. One of the critical outcomes of this research is that the study showed that one of the main effects of having plantar fasciitis for many of the participants was the stress and anxiety of being a healthcare worker, as well as job dissatisfaction. In addition

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to this, Khired pointed out that the emotional distress that many of our study participants experienced due to PF resulted in feelings of "burnout" [1]. This concerns all healthcare professionals because PF is a prevalent issue among the majority of healthcare workers. A holistic approach that includes psychological and mental health care services for healthcare workers in conjunction with treating PF will benefit both the workers' physical and emotional well-being, job satisfaction, and retention as employees within their field. The cross-sectional design used in this study prohibits an examination of long-term outcomes and will not provide information regarding changes in the effect of plantar fasciitis (PF) on a person's career or overall quality of life, as stated by Ikram *et al.* [19]. As stated by Ikram *et al.* the evolution of how PF affects the careers and well-being of health care workers may vary over time; thus, only a longitudinal study is capable of tracking the changes experienced [19]. Investigating PF over a longer period of time will allow for a determination of how symptoms may worsen with continued exposure to risk factors and whether or not early detection and intervention may be able to interrupt or prevent any long-term damage to the body's associated structures. Having longitudinal data also enables us to evaluate the various PF prevention techniques that are used (e.g., braces, stretching exercises) over a longer period of time; therefore, the evidence gathered would strongly support evidence-based changes to policy for health care facilities [20]. To sum up, through specific ergonomic interventions, changes to policy around footwear choices for healthcare workers, and access to anti-fatigue mats, the amount of time a person stands will reduce the chance they develop plantar fasciitis (PF). The health of our feet is an important part of being healthy, and educating people about how to care for their feet and encouraging them to participate in foot care as part of a wellness program will help decrease some of the burden that Plantar Fasciitis (PF) places on the healthcare workforce. By gaining a better understanding of just how many healthcare workers are affected by PF and the impact on the workers who treat patients with PF, the researcher will be able to develop more focused interventions for those healthcare workers who are at greater risk as a result of their jobs.

This research has a number of limitations that ought to be taken into account when analysing the findings. The cross-sectional nature of the study does not allow one to get causal relationships among occupational factors and plantar fasciitis, but only associations at a given moment. The narrow scope of the study to four tertiary care hospitals in Lahore does not allow generalizing to other areas in Pakistan with different work settings, patients, and healthcare delivery models. The future research should include objective diagnostic verification by ultrasound or MRI to verify self-reported symptoms. Preventive strategies would be supported by evidence of intervention in interventional studies of ergonomic interventions (anti-fatigue mats, cushioned insoles, regular rest breaks), footwear education, and workplace stretching schemes through randomised controlled study designs.

CONCLUSIONS

In conclusion plantar fasciitis is common among healthcare personnel, particularly those whose occupations require long standing. The majority of the study participants experienced the growth of felt pain in their heels, and most of the participants shared other complaints that were related to the development of the walking way. Prevention of plantar fasciitis can be done by sitting on ergonomic chairs and wearing suitable shoes, taking adequate rest to unload the physical load on the feet. The findings of this study may indicate that further awareness on the topic of foot health and the establishment of wellness initiatives at the workplace to facilitate the health and well-being of healthcare professionals is required. The programs should result in better job performance and quality of care provided.

Authors' Contribution

Conceptualization: AK
Methodology: KFC, AK, AF, AM
Formal analysis: AK, AF, AM
Writing and Drafting: KFC, AK, ST, SA
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All authors approved the final manuscript and take responsibility for the integrity of the work.

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Obstacles Faced by Adults in Utilization of Reproductive Health Services in Jhelum, Pakistan: A Qualitative Study

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ABSTRACT

A large number of reproductive healthcare services are available, but many individuals are reluctant to use these facilities due to high cost, limited availability of centers in rural areas, poor behavior of support staff, lack of knowledge, and concerns about privacy and confidentiality. **Objective:** To explore the barriers to the utilization of reproductive health services among adults in Jhelum, Pakistan. **Methods:** Data were collected from November 2023 to April 2024 through semi-structured, face-to-face interviews conducted in participants' local communities to ensure inclusivity, particularly in rural areas with limited digital access. An interview guide was developed based on existing literature and expert input to explore participants' perceptions and experiences regarding barriers to reproductive health services. **Results:** The factors that prevent the participants from availing reproductive healthcare facilities are the behavior of the healthcare provider, the cost of healthcare, their knowledge of the services that are available, confidentiality, and a lack of privacy. These barriers are mostly faced by rural participants as compared to urban participants. According to reproductive healthcare providers, the participants face the barrier of gender discrimination, cultural context, and unfeasible timing. **Conclusions:** The most common obstacles in utilizing reproductive healthcare facilities are the behavior of support staff and the cost of services. These barriers need to be addressed at the national level to increase the use of reproductive health services in public facilities.

INTRODUCTION

Reproductive health pertains specifically to the reproductive system, its function, and is a crucial aspect of overall health [1]. Adults between the ages of 15 and 40 constitute a significant segment of the population in Pakistan and globally, with many residing in low-resource settings [2,3]. Access to and utilization of high-quality reproductive health information and services remain limited for this group due to financial, social, and infrastructural barriers [4]. Obstacles that hinder the utilization of reproductive healthcare facilities are acceptability, availability, accessibility, and equity to health services [5]. Moreover, disparities in availing healthcare facilities based on factors such as gender, color, religion, and sexual orientation can further exacerbate these issues [6]. In rural areas of Pakistan, the inability to access the offered healthcare was found to be a barrier to utilizing these services [7]. To address and cope with these barriers, reproductive health services have been developed, which include counseling, family planning, volunteer counseling and testing (VCT), and treatment for

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Sexually Transmitted Diseases (STDs) [8]. Regardless of these efforts, limited community awareness, poor healthcare infrastructure, and the high cost of services remain significant obstacles in the utilization of maternal and child health services [9]. The International Conference on Population and Development Program of Action in 1994 introduced reproductive health services for adults, such as education and counseling to prevent early marriage and high-risk pregnancy that are associated with maternal mortality [10]. Adolescent health concerns have been acknowledged in the National Health Policy 2001, which was developed by the International Conference on Population and Development. It emphasizes the importance of increasing awareness about safe maternal care, newborn health, and family planning among eligible couples, and the deployment of lady health workers to develop skilled human resources [11]. The research done in Pakistan's urban and rural settings, where the expense of medicines and transport, a long distance from private sector facilities, and inadequate transport facilities are barriers to accessing antenatal care [12]. Moreover, young adults between the ages of 15 and 24 make up a significant proportion (45%) of all new Human Immunodeficiency Virus (HIV) infections globally [13]. More than 500,000 adults get STIs every day, and almost 80 million women experience unintended pregnancies each year [14]. In 2017, 808 females died each day globally due to pregnancy and childbirth-related complications. The vast majority of these deaths occurred in low-resource settings and underdeveloped countries [15]. The benefit of this study is to address the barriers that could lead to a decrease in maternal mortality rate, lower risks of HIV/AIDS and STIs, and reduce the number of abnormal newborns. Eventually, this study improves the quality of reproductive health services and increases their availability by addressing these barriers

There is no qualitative research on reproductive health barriers in medium-sized cities such as Jhelum; the majority of the studies are in large cities. There is no independent research done to compare the urban and rural adults in the same district. There can be purposive sampling where there is selection bias favoring articulate or motivated respondents. There is a possibility that there is a social desirability bias in dealing with sensitive reproductive health issues. The research determines the barriers but fails to estimate their relative significance and interventions to address them. No quantitative data or facility-level assessment triangulation was conducted. The main objective of this study is to explore the obstacles to the utilization of reproductive health services. This study aims to raise awareness about the challenges and encourage researchers and healthcare providers to find solutions to these obstacles by identifying the barriers to accessing reproductive health services.

METHODS

This study employed a qualitative exploratory research design to investigate the barriers faced by adults in utilizing reproductive health services in Jhelum, Pakistan. The study was conducted from November 2023 to April 2024. A purposive sampling technique was used to recruit participants aged 15–40 years from both urban and rural areas of Jhelum. Participants were selected based on their ability to provide detailed insights into their experiences and perceptions regarding reproductive healthcare services. Data collection continued until data saturation was achieved, resulting in a total of 20 participants. Data were collected through semi-structured, face-to-face interviews conducted in participants' local communities to ensure inclusivity, particularly in rural areas with limited access to digital platforms. An interview guide was developed after reviewing relevant literature and consulting public health experts to ensure comprehensiveness and clarity. All interviews were conducted in a private setting to maintain confidentiality. Informed consent was obtained from all participants before data collection. With permission, selected interviews were audio-recorded and later transcribed verbatim. Field notes were also maintained to capture contextual information and non-verbal cues.

The collected data were analyzed using thematic analysis following Braun and Clarke's approach [18]. Transcripts were read multiple times for familiarization, after which initial codes were generated and organized into categories. These categories were then used to develop and refine key themes representing participants' experiences. To ensure the trustworthiness of the data, strategies such as peer review, consistent coding procedures, and maintaining an audit trail were applied throughout the analysis process.

RESULTS

A total of 20 participants were included in the study, comprising both males and females from urban and rural areas of Jhelum. Participants varied in age, education, and marital status, providing diverse perspectives on the barriers to utilizing reproductive health services (Table 1).

Table 1: Sociodemographic Characteristics of Participants (n=20)

Participant ID	Age Group	Gender	Residence	Education	Marital Status
P1	15–25	Female	Rural	Primary	Unmarried
P2	26–40	Male	Urban	Higher Education	Married
P3	15–25	Female	Rural	No Formal Education	Unmarried
P4	26–40	Female	Urban	Higher Education	Married

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P5	26-40	Male	Rural	Primary	Married
P6	15-25	Female	Urban	Higher Education	Unmarried
P7	26-40	Female	Rural	Primary	Married
P8	15-25	Male	Urban	Higher Education	Unmarried
P9	26-40	Female	Rural	No Formal Education	Married
P10	15-25	Female	Urban	Primary	Unmarried
P11	26-40	Male	Rural	Primary	Married
P12	15-25	Female	Urban	Higher Education	Unmarried
P13	26-40	Female	Rural	Primary	Married
P14	15-25	Male	Urban	Higher Education	Unmarried
P15	26-40	Female	Rural	No Formal Education	Married
P16	15-25	Female	Urban	Primary	Unmarried
P17	26-40	Male	Rural	Primary	Married
P18	15-25	Female	Urban	Higher Education	Unmarried
P19	26-40	Female	Rural	Primary	Married
P20	15-25	Male	Urban	Higher Education	Unmarried

Thematic analysis of the interview data revealed several key barriers influencing the utilization of reproductive health services. The major themes identified were: lack of knowledge, financial constraints, healthcare system barriers, and sociocultural factors.

Lack of Knowledge

Participants from rural and less-educated backgrounds reported limited awareness of available reproductive health services. Many did not know where to go or how to access these services. Misconceptions and cultural myths discouraged care, while language barriers made communication with providers difficult.

"I did not know that the local health center offered family planning services. There is no one in my village who can explain how to access these facilities"(P13).

"Even when I visit the clinic, the staff explain things in a way I do not understand. I leave without getting the proper advice"(P5)

These findings align with studies from Pakistan and other low-resource settings, which highlighted lack of knowledge as a key barrier to reproductive healthcare utilization among adults, particularly in rural areas [19, 25].

Cost of Services

Although consultation fees in government hospitals were minimal, participants reported that essential medicines were either unavailable or too expensive. Adults in rural areas often prioritized household expenses over reproductive health, limiting access to care.

"I went to the health center for contraceptives, but they told me that the medicine was not available. The price outside is very high, much more than my monthly income. So, I had to go without it"(P16).

"Even routine tests cost money, and we cannot afford to pay when we have other family expenses like school fees and groceries"(PI1).

Similar studies in South Asia have shown financial constraints as a major barrier for adults seeking reproductive health services, reinforcing the need for subsidized medications and accessible healthcare infrastructure [18,23].

Unavailability of Reproductive Health Care Centers

Reproductive healthcare facilities were concentrated in urban areas, leaving rural adults with limited access. Long travel distances and transportation costs discouraged utilization of services such as contraception, routine exams, and prenatal care.

"The nearest clinic is 15 kilometers away. I cannot afford transport every month, so I just wait until it becomes an emergency"(P8).

"Sometimes we cannot even rent a vehicle for a checkup, and public transport is not reliable. It feels impossible to access these services regularly"(P3).

This finding echo research from rural Pakistan, which reports that geographical inaccessibility significantly reduces the uptake of reproductive health services.[11]

Stigma and Discrimination

Participants highlighted social stigma and discriminatory attitudes as major barriers. Single adults, members of the LGBTQ community, and those engaging in premarital sexual activity reported feeling ashamed or judged when seeking care. This social pressure often prevented individuals from openly discussing their reproductive health needs.

"I feel uncomfortable asking for family planning advice because I know people might judge me or tell my family. Sometimes, even the clinic staff make comments that make me avoid going"(P12)

"As a single man, I am hesitant to ask for reproductive health services. I fear that staff or neighbors might gossip about me"(P14).

These results are consistent with previous studies in South Asia and the Middle East, showing that stigma and discrimination limit adult access to reproductive health services, particularly for vulnerable or marginalized groups [14].

DISCUSSION

Reproductive healthcare centers provide a variety of services include detailed knowledge of the reproductive system, the services required to sustain reproductive health, access safe abortion services, including post-abortion care, and services for the prevention, management, and treatment of infertility; and access appropriate health care services to guarantee a healthy pregnancy, a secure delivery, and healthy infants so that individual can access comprehensive reproductive healthcare [16]. The study found that most females who visit a reproductive healthcare clinic are between the ages

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of 26 and 35, which means females in the older group avail themselves of reproductive healthcare facilities more than younger females. These findings are like those of studies that state females who go to reproductive health care to avail themselves of antenatal services are 25–35 years old [16, 18]. The discrepancies between urban and rural areas in accessing reproductive healthcare services are a significant challenge for ensuring equal distribution of reproductive health for all. Participants in urban areas avail themselves of reproductive health services more because they are better educated, have knowledge about the reproductive health care centers and their benefits, availability of both public and private reproductive health care centers in their area, and trust their doctors. In the current study, the cost of service and feeling ashamed of availing these services were the most prominent barriers. The study conducted in Bangladesh and New York concluded that a lack of money was a barrier to availing these services [19, 20]. Another research done in Nepal, lack of confidentiality was the biggest barrier to accessing reproductive healthcare facilities [21]. In rural areas, lack of education and knowledge about available reproductive healthcare services, limited availability of centers, and transportation issues are some of the noteworthy barriers for both males and females in rural areas. In addition, poverty, low income, and a lack of financial resources limit rural populations' ability to access and afford reproductive healthcare service are barriers which resist rural people from visiting reproductive healthcare. These results are similar to a study, which states that less money, a lack of information, and fewer centers in rural areas are barriers to availing of reproductive health services among rural people [22]. Another study showed similar results: lack of knowledge, no transport, far-off clinics, and low income are the barriers to utilizing reproductive healthcare facilities in rural areas [23]. The current study showed that rural participants faced more barriers in the public sector compared to the private sector. As the services for reproductive health care are quite expensive, most participants visit public centers. Therefore, the burden in these centers rises, which creates more hurdles like a lack of information, time-consuming tasks, rude behavior by staff, and expensive medicine for the participants [24]. Participants from urban areas can afford to visit only private reproductive healthcare centers to save time. The only problem that they mostly face is a lack of confidentiality. Another study found that participants in public reproductive centers face additional barriers such as time constraints, rude staff behavior, and expensive medicine [25]. In light of current research, various obstacles hinder the utilization of reproductive healthcare services for females. These include scarcity of services in remote areas, financial limitations, social stigma, lack of awareness, and knowledge about the services. The use of female reproductive healthcare services is hampered by numerous obstacles. These include the scarcity of services in remote locations, financial limitations, social stigma, ignorance of the issue, language hurdles, privacy worries, unpleasant encounters with healthcare professionals, and restricted decision-making autonomy. Multiple barriers impede the utilization of reproductive healthcare services for females. These include limited availability of facilities in rural areas, financial constraints, societal stigma, lack of awareness and knowledge, language barriers, privacy concerns, negative experiences with healthcare providers, and limited decision-making autonomy.

Qualitative design does not allow generalizing to a broader population. Single-site research in Jhelum is not a possible way to generalize about all Pakistani adults' experiences. The possibility of language and translation problems during the interviews and transcription can influence the accuracy of the data. The broad age group of 15-40 years is bigger than other typical definitions of adults, which may confound the developmental levels. It did not include any healthcare provider interviews in order to triangulate on the youth's views. A cross-sectional design only records barriers at a given time. Comparative research on the barriers in the various provinces would establish province-specific issues that will need specific interventions. The perspectives of the healthcare providers and facility managers should be included in the research to come up with holistic solutions.

CONCLUSIONS

The current study concluded that these barriers should be addressed at the national level so that people can easily access reproductive healthcare facilities. Public healthcare centers should take steps to improve the quality of care and provide a more supportive environment to individuals seeking reproductive healthcare services. The government should make efforts to increase awareness and education about reproductive healthcare services, particularly in rural areas.

Authors' Contribution

Conceptualization: AS
Methodology: AS
Formal analysis: SF
Writing and Drafting: AS, RS, SF, IF
Review and Editing: AS, RS, SF, IF

All authors approved the final manuscript and take responsibility for the integrity of the work.

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Original Article

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Effectiveness of Instrument-Assisted Soft Tissue Mobilization on Cervical Pain in Upper Trapezius Trigger Points: A Quasi-Experimental Study

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ABSTRACT

Upper trapezius myofascial trigger points (MTrPs) are a common cause of chronic neck pain. Instrument-Assisted Soft Tissue Mobilization (IASTM) has emerged as a soft-tissue technique designed to modulate myofascial restrictions and pain, but evidence comparing IASTM with conventional physiotherapy for upper trapezius MTrPs remains limited. **Objectives:** To compare the effects of IASTM versus conventional physiotherapy on pain intensity and trigger points in patients with chronic neck pain with active upper trapezius MTrPs. **Methods:** This experimental comparative study recruited 50 participants with chronic cervical pain and clinically confirmed active upper trapezius MTrPs from different physiotherapy clinics in Karachi and allocated them to Group A (IASTM; n = 25) or Group B (conventional physiotherapy; n=25). Group A received a Graston-type IASTM protocol while Group B received hot packs, manual stretching, cervical range-of-motion exercises, postural correction, and manual soft-tissue mobilization. Outcomes were assessed pre- and post-intervention after four weeks using the Numeric Pain Rating Scale and trigger-point palpation. Data were analyzed using descriptive statistics, chi-square tests, and repeated measures ANOVA, taking $p<0.050$ as the level of significance. **Results:** Both groups showed significant improvement; however, Group A demonstrated greater reductions in pain and disability. NPRS decreased from 8.68 ± 0.85 to 3.56 ± 0.87 in Group A and from 8.28 ± 0.84 to 5.56 ± 0.82 in Group B ($p=0.001$). **Conclusions:** This study demonstrated that IASTM produces significantly greater improvements in pain and trigger points than conventional physiotherapy in patients with chronic neck pain due to upper trapezius myofascial trigger points.

INTRODUCTION

One of the commonest causes of neck pain, limited mobility, and functional disability in clinical practice is upper trapezius trigger points. The existence of myofascial trigger points (MTrP) has been described as discrete, hyperirritable nodules found in taut bands of skeletal muscle fibers, which are painful to compression and may or may not result in characterized referred pain, motor dysfunction, and autonomic reactivity [1, 2]. Recent reviews highlight that MTrPs are related to abnormal motor end-plate activity, peripheral and central sensitization, and dysfunction of the muscle, which provide the causes of chronic neck pain and disability [1]. Neck pain is now known to be one of the major public-health problems in the world. The Global Burden of Disease (GBD) Study analysis results indicate neck pain as one of the leading causes of years lived with disability (YLDs) globally, with its significant and increasing burden in most areas [3]. Recent GBD 2021 data also validate the fact that neck pain is a major contributor to disability-adjusted life years in both the high- and middle-income nations [4]. Epidemiological results in

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Pakistan reveal the fact that the prevalence of neck pain is high, especially among working-age groups who are exposed to bad ergonomics and long sitting. Software engineers in Karachi have cross-sectional studies that indicate making lifetime neck-pain experience in over 60% of the subjects [5]. Long working hours and poor workstation design have been given as factors that contribute to neck and shoulder-related complaints among the workers in the bank and other offices [6]. In more recent times, neck pain was reported to have a period prevalence of 35% in a multicenter study of Pakistani professional drivers, which was correlated strongly with prolonged forward head posture and lack of awareness about effective ergonomics [7]. Taken together, these results indicate a common occurrence of neck pain in high-risk occupational populations of the Pakistani population, ranging from approximately one-third to more than two-thirds, with the upper trapezius often playing a significant role in symptomatic manifestation. Clinicians apply a broad range of physiotherapy methods in order to treat the upper trapezius MTrPs. Traditional modalities normally involve superficial heat (hot packs), stretching and range-of-motion (ROM) movement, postural re-education, and manual soft-tissue movement. All MTrP-directed approaches, including ischemic compression, strain counterstrain, myofascial release, therapeutic ultrasound, Transcutaneous Electrical Nerve Stimulation (TENS), and dry needling, have been shown to have short-term benefits in pain and functional improvements with variable levels of success, and long-term outcomes have been inconsistent, and the quality of the research is in most cases, moderate [8]. Over the past few years, Instrument-Assisted Soft Tissue Mobilization (IASTM) and its branded versions, like Graston Technique, have been gaining more and more attention as an up-and-coming form of myofascial intervention. IASTM involves scanning soft tissue with instruments that are contoured and made of stainless steel or other materials with the aim of mechanically loading fascia and muscle, breaking adhesions, and activating mechanosensitive nociceptors. The systematic reviews and meta-analyses indicate that IASTM may minimize patient-reported pain (moderate-certainty evidence) and produce small-to-moderate effects on function in a variety of musculoskeletal conditions [9]. Randomized controlled trials have revealed that IASTM, in addition to exercise therapy, has better pain and muscular endurance in chronic neck pain relative to exercise alone [10, 11].

Although the clinical application of IASTM is continuously increasing, as yet, there are not enough studies that could make firm conclusions about its effectiveness over traditional physiotherapy in upper trapezius MTrPs in particular. Recent systematic reviews indicate methodological constraints, lack of sufficient follow-up, and extreme heterogeneity of protocols and outcome measures, and more rigorous randomized trials in well-defined groups of myofascial pain are needed. Since the burden of cervical MPS is high in Pakistan, given the high frequency of the involvement of the upper trapezius in occupational and postural neck pains, and the paucity of high-level data on newer interventions like IASTM, there is great rationale in undertaking well-structured comparative research. The research will assess the efficiency of IASTM compared to conventional physiotherapy in the administration of upper trapezius trigger points to create context-specific evidence that may inform clinical decision-making during Pakistani physiotherapy practice.

METHODS

This was an experimental comparative trial that was conducted in an attempt to determine the effect of Instrument-Assisted Soft Tissue Mobilization (IASTM) versus Conventional Physiotherapy on cervical pain patients with active upper trapeze myofascial trigger points (MTrPs). The research took place in several chosen public and private physiotherapy centers in Karachi, Pakistan, between 21st February 2025 and 16th July 2025, which is a common outpatient environment in the city, and the patients would address the problems of neck pain and myofascial pain disorders. The intervention period was four weeks after the institutional review board had given ethical approval and synopsis. Institutional Ethical Review Committee of the Al-Hamd Institute of Physiotherapy and Health Sciences granted the study ethical approval, and its reference number is AIPHS/IERC/0125/06. The study conduct was also adhered to and was consistent with the Declaration of Helsinki Guidelines. The a priori calculation of the sample size involved the G + Power 3.1 software. According to an estimated high effect size (d = 0.80) [12], power (1– 0.80) = 0.80 and 0.05 as the alpha, the sample size required was 50 participants (25 in each group). The selected effect size indicates the size of change that has been found in earlier studies, where IASTM or other manual treatments result in clinically significant pain and disability improvements in neck and shoulder conditions [13]. The duration of treatment, 2-6 weeks, has been used in neck pain and MTrP trials, and makes it enough time to note short-term changes in pain, disability, and range of motion (ROM) [14]. Participant selection was done using a convenience non-probability sampling. Participants were identified and assigned to those groups randomly: either Group A (IASTM) or Group B (Conventional Physiotherapy) randomly under the random allocation procedure with sealed opaque envelopes that were developed by a

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statistician not involved in the application of interventions and data collection. Those who met the criteria of being adults (male/female) and having 3 months of cervical/upper trapezius/pain and active upper trapezius MTrPs, which are palpable taut bands, hypersensitive nodules, reproduction of familiar pain in palpation, and a typical referred pain pattern [15]. The exclusion criteria were that the participants were not able to provide informed consent and had a bleeding history, head injury with significant cervical trauma or fracture, local skin disease/infection, neuropathic sensory symptoms, cervical surgery within the last 2-3 years, or diagnosed cervical radiculopathy or myelopathy. Group A was provided with instrument-assisted soft tissue mobilization (IASTM), applying standardized stainless-steel tools that are similar to the Graston Technique. The session was structured: (1) a short warm-up with damp heat and/or manual preparation; (2) an approximate of 60-s of scanning strokes over upper trapezius to detect restrictions; (3) specific IASTM strokes over defined MTrPs/taut bands; (4) passive and/or active stretch of upper trapezius; (5) eccentric activity of the affected musculature; and (6) brief cryotherapy to curb the soreness post-treatment. This is an integrated strategy that is consistent with the generally prescribed IASTM protocols that incorporate instrument strokes with stretching and eccentric loading to create soft-tissue remodeling, enhance pain/pressure sensitivity, and augment ROM. Systematic reviews and controlled trials evidence confirm pain and functional improvements in neck pain and MTrP populations, including upper trapezius involvement [12], with regional reports that indicate clinical uptake is on the rise [16]. Group B was provided with conventional conservative physiotherapy of upper trapezius MTraps, as it would be done in Pakistan and other countries. The program itself involved the use of superficial heat (hot packs) to decrease muscle tone and enhance tissue extensibility, manual stretching of the upper trapezius, active and passive cervical ROM exercises, postural correction and ergonomic counseling, and manual soft-tissue mobilization administered by the hands of the therapist. These elements are consistent with evidence-based conservative care of mechanical neck pain and myofascial pain syndrome, where education, heat, stretching, ROM, and mobilizing of the soft tissues are the main part of the first-line treatment [17]. Measurement bias was minimized with all outcome measures being measured pre and post intervention by a qualified physiotherapist who had no involvement in the execution of the interventions. The intensity of pain was assessed with the help of an 11-point Numeric Pain Rating Scale (010) with 0 indicating no pain and 10 indicating the worst imaginable pain. The NPRS is highly applicable in musculoskeletal studies and depicted high reliability, responsiveness, and interpretability in populations of neck and spine pain, with only small clinically significant differences generally reported with the scale ranging from 1-2 points. Identified and counted upper trapezius MTrPs were determined by manual palpation: the palpation of a palpable band, hypersensitive nodule within the band, reproduction of known pain of the patient, referred pain, or local twitch response on sustained compression. The clinical examination plan is aligned with the international consensus work and recent diagnostic algorithms of MTrPs [18].

The analysis of data was done by IBM SPSS Statistics Version 25.0. The descriptive statistics (mean ± standard deviation, frequencies, and percentages) were calculated on all variables. Crosstabulation was used to investigate categorical variables, including sex, categories of severity, and presence/absence of trigger points. Repeated measures analysis of variance (ANOVA) with a significant value $p<0.050$ was used to make between-group comparisons of continuous outcomes (NPRS and number of trigger points). The ANOVA-based methods are frequently used in IASTM and neck-pain RCTs when the changes of pre- and post-intervention in two or more groups should be compared [14]. All the analyses were done using complete datasets, and no missing values, as recommended in standard reporting of randomized trials.

RESULTS

Fifty participants (25 each) were used in the study. The data on NPRS normality was established. A repeated measures ANOVA demonstrated that there was a statistically significant difference between groups at post-treatment ($F(1, 48) = 69.93$, $p=0.001$) with a very large effect size (Cohen d = 2.37; 95% CI: 1.65 to 3.09; partial 71), and it would be considered very large. These results indicate a significant clinical improvement of IASTM compared with traditional therapy (Table 1).

Table 1: Normality analysis of NPRS Scores at Pre and Post Intervention Levels

Time	Group	Mean ± SD	SE	95% CI	Minimum	Maximum	df	F	p-value	Cohen's d (95%CI)	Partial η^2 (95% CI)
Pre	Group A	8.68 ± 0.852	0.170	8.33-9.03	7	10	48	2.784	0.102	0.47 (-0.09 to 1.03)	0.05 (0.00 to 0.18)
	Group B	8.28 ± 0.843	0.169	7.93-8.63	7	10					
Post	Group A	3.56 ± 0.870	0.174	3.20-3.92	2	5	48	69.930	0.001	2.37 (1.65 to 3.09)	0.59 (0.41 to 0.71)
	Group B	5.56 ± 0.821	0.164	5.22-5.90	4	7					

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At baseline, the groups were similar regarding the degree of pain and the disability of the neck. Group A had a mean pre-treatment NPRS of 8.68 ±0.85 whereas Group B had 8.28 ± 0.84 (p=0.102). The post-treatment mean score in Intervention Group (A) decreased significantly to 3.56 ± 0.870 compared to Control Group (B) with a mean of 5.56 ± 0.821 (p-value=0.001), equivalent to the point reduction of approximately 2.7. The comparison of post-treatment pain between groups demonstrated that the difference between IASTM and the other group is statistically significant (p=0.001)(Table 2).

Table 2: NPRS Scores at Pre and Post Treatment Levels

Time		Mean ± SD	SE	95% CI for M	Minimum	Maximum	df	F	p-value
Pre	Group A	8.68 ± 0.852	0.170	8.33-9.03	7	10	48	2.784	0.102
	Group B	8.28 ± 0.843	0.169	7.93-8.63	7	10			
Post	Group A	3.56 ± 0.870	0.174	3.20-3.92	2	5	48	69.930	<0.001
	Group B	5.56 ± 0.821	0.164	5.22-5.90	4	7			

Crosstab analysis of pain severity categories revealed that, before treatment, the majority of both groups showed severe pain, with 21/25 (84%) in Group A and 22/25 (88) in Group B reporting severe pain, and the rest moderate pain. A significant change in the lower pain categories was observed in the two groups after four weeks of intervention, which was more significant in the IASTM group. Group A: 11 participants (44%)- mild, 14 (56%)- moderate, with none left in the severe category. Group B showed 4 (16) respondents (4) to mild pain and 21(84%) respondents to moderate pain at follow-up, and no severe pain. Active upper trapezius trigger points were also equally distributed across the groups at baseline, with most of the patients in either arm reporting three or four trigger points. The results of the post-treatment data indicated a decrease in the number of trigger points in the two groups. In Group A, 7 (28%) participants had no observable trigger points, 9 (36) participants had one trigger point, and 9 (36%) participants had two trigger points. In Group B, 3 (12 percent) participants had no trigger points, 11 (44 percent) had one trigger point, and 11 (44 percent) had two trigger points. Therefore, a larger percentage of complete trigger-point deactivation (0 trigger points) was present in the IASTM group, which supports the suggested mechanism according to which IASTM leads to a decrease in the degree of myofascial stiffness and breaking taut bands and adhesions in the upper trapezius (Table 3).

Table 3: Pain Severity Category Distribution and Number of Trigger Points (Pre and Post)

Category	Sub-category	Frequency (%), Group A	Frequency (%), Group B	Total	χ^2 value	p-value
Pain Severity (Pre)	Moderate	4 (16%)	3 (12%)	7 (14%)	5.565	0.030
	Severe	21 (84%)	22 (88%)	43 (86%)		
Pain Severity (Post)	Mild	11 (44%)	4 (16%)	15 (30%)		
	Moderate	14 (56%)	21 (84%)	35 (70%)		
Trigger Points (Pre)	2	3 (12%)	1 (4%)	4 (8%)	17.500	0.001
	3	12 (48%)	11 (44%)	23 (46%)		
	4	10 (40)	13 (52%)	23 (46%)		
Trigger Points (Post)	0	7 (28%)	3 (12%)	10 (20%)		
	1	9 (36%)	11 (44%)	20 (40%)		
	2	9 (36%)	11 (44%)	20 (40%)		

Both groups had a clinically significant change in pain intensity when the results were interpreted against predetermined minimal clinically important change (MCIC) thresholds of chronic musculoskeletal pain to interpret the results of 11-point NRS (usually 11530 percentage) pain. Nevertheless, the scale of success in Group A (a reduction of about 59 percent at baseline) is evidently greater than smaller estimates of minimal detectable changes and more significant than the changes that were achieved when conventional physiotherapy was used alone.

DISCUSSION

The effects of Instrument-Assisted Soft Tissue Mobilization (IASTM) in comparison to conventional physiotherapy in patients with persistent neck pain and active upper trapezius myofascial trigger points were investigated in this comparative trial. The presented study findings are in line with and add to the emerging body of research on the use of IASTM to manage musculoskeletal pain. The previous systematic reviews proved the large effect sizes in pain and patient-reported function in injured populations undergoing IASTM treatment, which supports the clinical significance of the outcomes of the current study. Some have made similar conclusions and concluded that IASTM is equally effective and, in many cases, better than other types of manual therapy in the short-term treatment of pain and functional outcome [18]. A different study also established that both IASTM and trigger-point release were identical in terms of improving pain and ROM in mechanical neck pain, with the IASTM exhibiting positive trends in pain reduction and function [19]. The study was also reflective of a study by Islam et al. which was a Pakistani randomized controlled trial that reported that IASTM, along with conventional physiotherapy, yielded significantly more reductions of myofascial trigger points and symptoms of the cervix and lumbar areas compared with the conventional treatment alone among sedentary adults [20]. Collectively, these findings indicate that IASTM has incremental value when used in addition to

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conventional physiotherapy, notably trigger-point caused neck and back pain. The difference in the IASTM group is not only statistically significant but also is also important clinically. The minimal clinically important change (MCIC) of patients with neck pain was estimated by Ahmed et al. to be about 1.52 points with reference to an 11-point pain NRS [21]. In this regard, both groups of our study were above the MCIC levels of pain, which validates that traditional physiotherapy is still a valid method of treating upper trapezius MTrPs. Nonetheless, the IASTM group showed a reduction in NPRS of about five points, which is much larger than MCIC and the slightest detectable change estimates, which is an enormous functional gain, and probably very perceptible. These differences are in reasonable contrast with effect sizes in systematic reviews of IASTM, in which pooled pain reductions tend to be of the small-to-moderate order in comparison with control interventions. The better results in the IASTM group could be attributed to a number of postulated processes. The present literature and evidence on neck pain and the up-to-date BMJ state-of-the-art review by Cohen and Hooten highlight the multimodal method of education, exercise therapy, and manual techniques, depending on the mechanisms of pain pathogenesis [22]. This research paper has a number of strengths. It employed a quasi-comparative design and had a reasonable sample size, which, based on a priori calculation of power, minimized the possibility of type II error. Second, the two groups were exposed to plausible and clinically relevant interventions, which enabled a realistic comparison of IASTM and standard physiotherapy as opposed to comparing them with minimal care.

It must be noted that there are a few limitations. The period of follow-up was four weeks only, and therefore, it is not known whether the benefit observed was long-term. Long-term outcomes as observed in studies on IASTM have been found to be very limited, systematic reviews have indicated, and future studies must incorporate medium and long-term follow-up to determine the persistence of the effects. The research took place within one city and clinical setting, and it might not apply to other populations, including older adults, people with important comorbidities, or other occupational requirements. In addition, the sample size was calculated adequately, although this sample size might be a limitation to generalization. Future research ought to: consider long-term follow-up to measure maintenance of benefits; consider alternate dosing schedules and co-administration with certain exercise programs; consider objective mechanistic outcomes (e.g., PPT, imaging, or biomechanical measures); and consider cost-effectiveness and patient preferences to inform clinical guidelines and policy.

CONCLUSIONS

This paper illustrates that IASTM has a much higher outcome in terms of pain and trigger points effects compared to standard physiotherapy in patients with chronic neck pain caused by upper trapezius trigger points.

Authors' Contribution

Conceptualization: WA
Methodology: WA, SRS, MA
Formal analysis: NM
Writing and Drafting: WA, AT, SRS, FS, NM
Review and Editing: WA, AT, SRS, FS, MA, NM

All authors approved the final manuscript and take responsibility for the integrity of the work.

Conflicts of Interest

The authors declare no conflict of interest.

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Plyometric Training Combined with or without Hamstring Strengthening in the Prevention of Anterior Cruciate Ligament Injuries in Female Amateur Athletes

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ABSTRACT

Anterior Cruciate Ligament (ACL) injuries are common among female athletes, especially in sports involving jumping and pivoting. **Objectives:** To study the plyometric training along with hamstring training on the prevention of ACL injuries among female amateur athletes. **Methods:** A total of 60 female amateur athletes aged 18 to 30 were selected as participants of this randomized controlled trial and randomly stratified into two groups (Group A: plyometric strengthening + hamstring strengthening; Group B: plyometric strengthening). The intervention took six weeks, and it was trained twice a week. At baseline, Week 3, and Week 6, the outcome measures were knee strength (flexion and extension), dynamic balance (Star Excursion Test), and functional mobility (KOOS). The data were analyzed in SPSS version 24.0, repeated measures ANOVA and independent t-tests were used ($p<0.05$). **Results:** Time-related within-group improvements were significant in both groups of all outcome measures ($p<0.001$). Group A became stronger (flexion: 24.06-29.89 kg; extension: 30.33-36.60 kg), more stable (SET: 15.59-19.59 cm), and KOOS (56.32-72.11). The same gains were observed with Group B (flexion: 24.39-30.91 kg; extension: 30.24-36.04 kg; SET: 14.12-21.37 cm; KOOS: 58.99-71.88). No statistically significant differences in any of the post-intervention points ($p>0.05$). **Conclusions:** Plyometric training is an effective intervention in enhancing lower limb strength, balance, and functional mobility of female amateur athletes. The inclusion of hamstring strengthening did not result in any extra benefits over 6 weeks and may indicate that plyometric-only programs can be useful and time-efficient in the context of ACL injury prevention in the chosen population.

INTRODUCTION

The Anterior Cruciate Ligament is a notable knee joint ligament, which assists the knee in being stable and mobile. In case of a strained or torn ACL, this can occur when you suddenly stop, shift gears, or when you strike your knee squarely on the ground [1]. Sudden halting, change of direction, or jumping or landing is another cause of ACL injury among athletes who place unnecessary stress on the ligament. Specifically, non-contact forces such as pivoting, cutting, slowing down, etc., may damage the ACL since they apply excessive rotational, anterior shear, and valgus force on the knee [2]. Scientific and physical factors are also many, as to why female athletes have higher chances of injuring their ACLs due to differences in their anatomy, hormone variations, and differences in muscle composition [3]. In addition to that, women also have a smaller intercondylar notch (the groove in the femur where the ACL is) and a more vertical femoral shaft of the femur and this increases the chances of the ACL becoming damaged. Such anatomy-related alterations may alter the normal functioning of the knee joint and increase the risk of ACL ruptures [4]. ACL injuries may be small and severe and result in pain, swelling, and

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instability. They undergo surgery and a lengthy restoration process. The mild and moderate ACL injuries that also involve partial rupture or sprain can be very painful and cause movement difficulty, although they may not require an operation immediately [5]. The type of injuries may result in pain, swelling, and stiffness in the knee, or the feeling of instability or discomfort when placing any weight on it or switching direction. Certain athletes can continue to perform some of the activities, and some cannot play sports and must undergo a rehabilitation program and strengthen the muscles surrounding the knee and improve its functioning [6]. When mild and moderate ACL injuries are treated and rehabilitated, they are usually self-limiting and, therefore, individuals manage to resume regular activities and sports. Nevertheless, in case the knee is not absolutely stable, there is a possibility of getting injured once more [7]. The complete rupture of the ACL may be rather painful, accompanied by swelling and rendering the knee joint unstable. This is highly detrimental, and it can cause difficulty in movement [8]. In case of a torn ACL, the knee gets a feeling that it is giving way or buckling, and it is difficult to support weight on it and perform even basic tasks [9]. ACL injuries that are severe might cause significant emotional impact besides the physical ones. They usually require surgery and a lengthy healing process, and this can make a player miss months or even years of playing their games and carrying out their activities [10]. Moreover, female and male athletes report identical rates of ACL in non-contact sports, such as swimming and distance running, 0.36/10,000 AEs and 0.21/10,000 AEs, respectively [11]. Physical therapy plays a very significant role in preventing and treating ACL injuries. An entire physical therapy program that prevents ACL injuries is a combination of exercises and strategies that increase the strength, power, agility, flexibility, and neuromuscular control. It involves neuromuscular training. It works on enhancing communication between the nerves and muscles so as to render the muscles stronger and easier to manage [12]. Plyometric exercises such as the jump squats and box jumps are also applicable in strength and power building. The example of agility activities that can make you run faster, quicker, and more able to change direction is cone exercises and shuttle runs. Activities such as squats, lunges, and leg presses are improved by strengthening the muscles and making them more effective in managing them. Planks and bridges are core stabilization exercises that strengthen the core and stabilize it [13]. Balance and proprioceptive activities, which include single-leg squats and balance boards, will also aid in making you more conscious of where your body is and also increase your balance. Functional movements such as squats, lunges, and step-ups can also be used to aid in muscular control and movement patterns [14]. Progressive resistance exercises, such as resistance band exercises, and flexibility and mobility exercises, such as foam rolling and stretching, are also covered in the program. Finally, it is highly crucial to teach people about ACL injuries, their prevention, and proper movement to provide athletes and other individuals with the instruments they should use to avoid being injured [15]. A physical therapist has the ability to tailor an exercise program to an individual based on his or her needs and goals. The list of activities that can be part of this plan is single-leg squats, lateral lunges, carioca exercises, box jumps, agility ladder exercises, exercises on a resistance band, and plyometric exercises [16]. Hamstring strengthening is a significant component in ACL preventive programs since it will reduce the load on the ACL, stabilize the knee, enhance landing and deceleration techniques, and reduce the chances of ACL injuries [17]. There are good exercises such as deadlifts, leg curls, glute-ham raise, Romanian deadlifts, single-leg deadlifts, hamstring bridges, and Nordic hamstring curls. It is advisable that you begin with low intensities and then increase [18]. Plyometric exercise is a significant component of the programs that can prevent ACL injury because it makes you stronger, nimbler, and in better command of your muscles, which reduces the risk of an ACL injury. Nonetheless, the question of whether plyometric training and hamstring strengthening can collaborate to prevent the occurrence of ACL problems in female amateur athletes remains to be clarified. The hamstring reinforcement is a significant aspect of preventing ACL injuries as it reduces the load on the ACL and renders the knee more stable, as well as enhances landing and deceleration techniques. Therefore, one should establish the effectiveness of plyometric training and hamstring strengthening to prevent the occurrence of ACL injuries in female amateur sportspeople. This will assist in developing evidence-based prevention measures that may be incorporated in training programs and reduce the incidence of ACL injuries, and will render sporting activities safe for all.

Limited evidence exists on whether adding hamstring strengthening to plyometric training provides additional preventive benefits against ACL injuries in healthy female amateur athletes, as most prior research has focused on elite or rehabilitative populations. Furthermore, few randomized trials have directly compared these training approaches to guide efficient injury prevention strategies in amateur sports settings. This creates uncertainty for clinicians and trainers regarding the most effective and time-efficient program. Therefore, the present study

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aimed to compare the effects of plyometric training alone versus plyometric training combined with hamstring strengthening on lower limb strength, dynamic balance, and functional mobility to determine the optimal approach for ACL injury prevention in female amateur athletes.

METHODS

This randomized controlled trial (NCT07047833) was done to see how plyometric training with strengthening exercises compared to plyometric training alone affected the strength, static balance, and functional mobility of female amateur athletes. Ethical approval was obtained from The University of Lahore Ethics Committee (REC-UOL-/287/24) to take place over nine months from 1 August 2024 to April 2025. The Sports Departments of the University of Lahore, the University of Central Punjab, and the University of Management and Technology, Lahore, were from where the data were collected. The study utilized a purposive sample method to recruit 60 participants. The study randomly assigned 30 athletes to each group. The sample size was calculated using Statulator software. The calculation was based on detecting a medium effect size (Cohen's d = 0.5) with a significance level (α) of 0.05 and a statistical power (1-β) of 80% for an independent t-test comparing two groups. This yielded a minimum required sample size of 25 participants per group. To account for a potential 20% dropout rate, the sample size was increased to 30 participants per group, resulting in a total sample of 60 participants. The formula used was: $n = 2(Z_{1-\alpha/2} + Z_{1-\beta})^2 \sigma^2/\Delta^2$. Where σ is the standard deviation, and delta is the expected difference between groups. To be included, female athletes had to be between the ages of 18 and 30, play sports that required leaping, turning, and cutting, and practice at least six times a week. Athletes had to show that they could leap and land safely. Some of the reasons for exclusion were athletes who only exercised for fun or weren't trained, those who only trained for less than five hours a week, those who had injuries or operations in the past that were treated in different ways, and those who were rehabilitating before surgery. Informed consent was taken. Participants signed a paper giving their written agreement, and they were told that their information would be kept private and that they may leave at any moment without consequence [19, 20]. Participants were randomly assigned to groups using a computer-generated sequence. Outcome assessors were blinded to group allocation. A random number generator was used to divide the eligible participants into two groups randomly. The study was single-blinded, which means that the person doing the assessment didn't know which group the participants were in. At the beginning, week 1, week 3, and week 6 after the intervention, outcome evaluations were done. Group A's workout plan lasted 60 minutes and included 15 minutes of warming up, 20 minutes of plyometric training, 20 minutes of strengthening, and 5 minutes of cooling down. Group B had a similar workout, except it didn't include the strengthening part; thus, it lasted 40 minutes. For all groups, the plyometric part included squat leaps, depth jumps, and lateral jumps. They did 2–3 sets of 6–12 reps, with 30–60 seconds of rest between sets. The study made the exercises harder by making the jumps higher or shortening the breaks. Group A's strength training regimen includes Nordic hamstring curls and machine or free-weight hamstring curls (2–3 sets of 8–12 repetitions), with controlled movement and enough rest between sets. There were 12 sessions in total, with each one taking place twice a week for six weeks [19, 21]. Standardized and proven measurement tools were used to measure outcomes such as muscle strength, static balance, and functional movement. Knee flexion and extension strength were assessed using an isokinetic dynamometer (Cybex Norm, Ronkonkoma, NY, USA), a tool with high test-retest reliability (ICC > 0.90) [22]. Dynamic balance was evaluated using the Star Excursion Balance Test (SET), which has demonstrated excellent intra-rater reliability (ICC = 0.84–0.92) [23]. Functional mobility related to the knee was measured using the Knee Injury and Osteoarthritis Outcome Score (KOOS), a valid and reliable patient-reported outcome measure with high internal consistency (Cronbach's alpha > 0.80) [24]. To control for the effects of recovery after exercise, both groups did the same tests and stretches during cooldown. The study was conducted in accordance with the ethical standards, which included ensuring that the participants were safe, that they wanted to participate in the study, that their data were to be preserved, and that the university regulations were observed. The study design ensured a strict approach to the methods by applying clear eligibility criteria, sufficient randomization, blinding, and uniformity in intervention procedures. This research was aimed at discovering whether the addition of plyometric training to strength training can result in superior changes in athletic performance and functional outcomes. The data were entered and analyzed using SPSS Version 24.0. The numerical data, like age, were presented as mean ± SD. Categorical Data, like gender groups, were presented in the form of frequency (Percentage). The normality of the data distribution was tested by the Kolmogorov-Smirnov test. The data were normally distributed, repeated measures of ANOVA and interdependent t-test were for between-group and within-group comparisons; p-value<0.05 was considered significant.

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RESULTS

The study showed that all measures (strength, balance, and functional mobility) improved significantly within each group over time, which proved that both therapies worked. But inferential statistics indicated that there were no significant differences between Group A (plyometric plus strengthening) and Group B (plyometric only) at Week 6 for any outcome measure (p>0.050). These results imply that plyometric exercise alone may be enough to help healthy female amateur athletes improve their performance in a short amount of time (Table 1).

Table 1: Average Hours of Standing and Walking per Shift

Variables	n	Mean ± SD	Minimum	Maximum
Age (Group A)	30	24.23 ± 3.53	18	30
Age (Group B)	30	24.63 ± 3.66	18	30
BMI (Group A)	30	22.18 ± 1.9	18	30
BMI (Group B)	30	22.13 ± 1.97	18	30

There were no statistically significant differences between Group A (plyometric + strengthening) and Group B (plyometric only) on any of the outcome measures—Strength Dynamometer Flexion (SDF), Strength Dynamometer Extension (SDE), Balance Star Excursion Test (SET), and Functional Mobility (KOOS)—at baseline, Week 3, and Week 6 (all p > 0.050). The between-group effect sizes at Week 6, calculated using Cohen's d, were small for all outcomes: Strength Dynamometer Flexion (d = 0.18), Extension (d = 0.10), Star Excursion Test (d = 0.26), and KOOS (d = 0.01), further supporting the lack of practical significance of the observed differences. Levene's test showed that the variances were the same, and the 95% confidence intervals for the mean differences contained zero. This further supports the idea that there were no differences between the groups. Even though both groups made significant progress over time, the lack of significant differences between the two groups suggests that plyometric training alone was just as effective as the combined intervention in improving lower limb strength, balance, and functional mobility in female amateur athletes during the 6-week intervention period (Table 2).

Table 2: Between-Group Comparison of Strength, Balance, and Functional Mobility

Variables	Levene's F	Levene's Sig.	t-value	df	Sig. (2-tailed)	Mean Difference ± SD Error	95% CI Lower	95% CI Upper
SDF Baseline	0.215	0.645	-0.283	58	0.778	-0.335 ± 1.182	-2.701	2.031
SDF Week 3	0.652	0.423	-0.204	58	0.839	-0.269 ± 1.314	-2.898	2.361
SDF Week 6	1.623	0.208	-0.679	58	0.5	-1.016 ± 1.497	-4.012	1.98
SDE Baseline	0.104	0.748	0.065	58	0.948	0.088 ± 1.349	-2.613	2.789
SDE Week 3	0.172	0.679	-0.303	58	0.763	-0.413 ± 1.363	-3.141	2.315
SDE Week 6	0.143	0.707	0.379	58	0.706	0.563 ± 1.486	-2.412	3.539
SET Baseline	1.658	0.203	1.089	58	0.281	1.471 ± 1.351	-1.234	4.175
SET Week 3	0.096	0.758	0.269	58	0.789	0.378 ± 1.403	-2.431	3.187
SET Week 6	1.642	0.205	-1.278	58	0.206	-1.781 ± 1.394	-4.571	1.008
KOOS Baseline	0.017	0.895	-0.636	58	0.527	-2.664 ± 4.187	-11.045	5.717
KOOS Week 3	0.892	0.349	-0.912	58	0.366	-3.471 ± 3.806	-11.09	4.149
KOOS Week 6	0.128	0.722	0.063	58	0.95	0.277 ± 4.424	-8.579	9.133

DISCUSSION

This research highlighted the significant enhancement of lower limb strength, balance, and functional mobility in female amateur athletes with plyometric training, and no further short-term advantages of isolated hamstring strengthening. These two interventions worked out, yet the fact that the significant differences were not found between groups implies the possibility that plyometric exercise alone can be effective in strengthening neuromuscular performance in healthy athletes. These results are found to be in line with the other studies that have suggested the effectiveness of plyometric training and neuromuscular training in preventing injuries. Equally, Olivares-Jabalera *et al.* achieved positive outcomes regarding functional performance under the exercise programs of plyometrics, agility, and strength training [25]. According to Al Attar et al. neuromuscular control and ACL injury prevention are achieved through plyometric training [22], and Schlick showed that the biomechanics of the lower limbs improved in adolescent female athletes after undergoing plyometric-based training [26]. Conversely, papers that promoted multi-component training or post-injury rehabilitation, including Monajati *et al.* and Kasmi *et al.* showed an added value of training that combined plyometric and hamstring-strengthening activities [17, 19]. These variations could be attributed to the fact that our participants were healthy amateurs with a normal neuromuscular baseline; other studies involved injured or deficient athletes who needed extra hamstring activation.

The study was limited to female amateur athletes over six weeks with no long-term follow-up; future research should include longer interventions, diverse athletes, and sport-specific assessments. Future studies should extend the

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intervention period beyond six weeks and include long-term follow-up to assess sustained benefits and injury incidence. Research should also explore these training protocols in diverse populations, including male athletes and different skill levels. Additionally, incorporating sport-specific drills and direct biomechanical or injury rate outcomes would strengthen the evidence for injury prevention programs.

CONCLUSIONS

The study showed that plyometric exercise, either by itself or with hamstring strengthening, made female amateur athletes stronger, better at balancing, and more able to move around. However, there were no large differences between the groups. This implies that plyometric training may be sufficient to prevent the occurrence of ACL injuries in the short term. It did not help to strengthen the hamstrings further. The results of these short-term studies, which are female-specific among amateur athletes, support the idea of basic and fast programming in an amateur sports environment. The short period of intervention does not allow for the assumption of conclusions regarding the long-term effectiveness, and further studies are necessary to investigate those interventions over a longer period of time and in a more extensive population.

Authors' Contribution

Conceptualization: FR
Methodology: FR, FM
Formal analysis: FR
Writing and Drafting: FR, FM, RY, MT
Review and Editing: FR, FM, RY, MT

All authors approved the final manuscript and take responsibility for the integrity of the work.

Conflicts of Interest

The authors declare no conflict of interest.

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Gender and Family Medical History as Determinants of Type-2 Diabetes Mellitus Complications: A Cross-Sectional Assessment from Haripur, Pakistan

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ABSTRACT

Type-2 diabetes mellitus (T2DM) has emerged as a leading cause of disability worldwide. In recent years, non-communicable diseases (NCDs) have been responsible for approximately 41 million deaths annually, with the majority occurring in low- and middle-income countries (LMICs). **Objectives:** To explore type 2 diabetic associated complications, and investigate the factors associated with type 2 diabetes complications in patients at the District Headquarter Hospital (DHQ) in Haripur, Pakistan. **Methods:** A cross-sectional study was conducted at DHQ Hospital, Haripur, using a convenience sampling technique. A study involving 422 patients diagnosed with type 2 diabetes mellitus. Data were collected using a self-structured questionnaire that assessed diabetes-related complications. The collected data were analyzed using SPSS version 22.0. **Results:** Significant associations were found between gender and several health indicators, including blood glucose levels, HbA1c, eye pain/redness, and sleep disturbances ($p<0.050$). Additionally, family medical history showed significant associations with multiple diabetic complications, including blurred vision, blindness, eye redness, swelling of feet/ankles/hands, loss of sensation in feet, ingrown toenails or fungal infections, and changes in skin color ($p<0.050$). These relationships were supported by significant crude odds ratios (CORs), indicating strong statistical relevance. **Conclusions:** The study found a strong link between type 2 diabetes complications and factors such as family history, gender, income, and lab results (HbA1c, RBS, FBS). It is recommended to strengthen routine screening and early intervention, especially among high-risk groups, to prevent complications.

INTRODUCTION

Type-2 diabetes mellitus (T2DM) is a persistent state of hyperglycemia and glucose intolerance that occurs when the body cannot respond fully to insulin, followed by an increase in insulin production and a subsequent insulin deficiency [1]. The largest cause of death in 2019 was diabetes. According to the World Health Organization (WHO), the prevalence is high in low and middle-income countries, and Pakistan is the country that has diabetes related death [2]. In a recent survey, the second National Diabetes Survey of Pakistan (NDSP), conducted between 2016 and 2017, it was estimated that around 26.3% of the population above 19 years of age in the country had diabetes. Among them, 19.2% were known diabetics, while 7.1% were newly diagnosed cases [3]. According to

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estimates from the Global Burden of Diseases, Injuries, and Risk Factors Study, diabetes was the 8th leading cause of death and disability combined in the world, with nearly 460 million people across every country and age group living with the disease in 2019 [4]. The number of adults living with Type-2 Diabetes (T2D) is estimated to increase from 463.0 million to 700.2 million between 2019 and 2045 [5]. International Diabetes Federation IDF data states that Pakistan ranks 4th in the world, and the prevalence of diabetes is 19.4 million [6]. There were so many complications that 76.4% of diabetic individuals reported having at least one [7]. Recent studies propose that irregular sleep patterns may be just as significant a risk factor for diabetes as obesity and physical inactivity [8]. Nephropathy and retinopathy are among the microvascular complications that can result from diabetes mellitus. Global prevalence of diabetic retinopathy and projection of burden through 2045 [9]. According to reports, diabetic retinopathy (DR) is the primary cause of blindness in people with diabetes [10]. Additionally, it has been estimated that 4.1% and 6.2% of diabetics, respectively, have sight-threatening conditions [11]. Therefore, assessment of diabetic complications plays a central role in clinical practice. The early detection of these complications through regular assessments enables timely intervention, slows disease progression, and helps prevent irreversible damage [12, 13].

The majority of research in Pakistan has been on large metropolitan areas; there is a dearth of region-specific data on T2DM issues in rural areas like Haripur. The distinct effects of family medical history on particular microvascular vs macrovascular issues in the local population have not been well investigated. Gender, family history, and diabetes problems cannot be causally linked due to the cross-sectional methodology. This study aimed to explore the factors associated with T2DM complications in patients at the District Headquarter Hospital (DHQ) in Pakistan.

METHODS

A cross-sectional study was conducted from March to May 2023 among patients with T2DM at the District Headquarter Hospital in Haripur, Khyber Pakhtunkhwa, Pakistan. Before participation, all eligible individuals were informed about the procedure and objective of the study, and written informed consent was obtained, in accordance with the ethical principles outlined in the Declaration of Helsinki. A self-structured questionnaire was used to assess T2DM complications and demographic characteristics. The questionnaire was divided into two sections: the first section focused on the demographic characteristics, such as gender, age, and marital status, while the second section comprised diabetic complications. Data were collected through face-to-face interviews to ensure accurate and complete response and questions were explained in simple terms when necessary to facilitate participant understanding were conducted with the participants. The sample size for this study was calculated using the single population proportion formula for an infinite population: $n = (Z^2 \times p(1-p)) / e^2$, where $Z = 1.96$ for a 95% confidence level, $p = 0.5$ (assuming a 50% proportion to maximize sample size), and $e = 0.05$ as the margin of error. Applying these values, the calculation was $n = (1.96^2 \times 0.5(1-0.5)) / 0.05^2 = (3.8416 \times 0.25) / 0.0025 = 0.9604 / 0.0025 = 384.16$, which was rounded up to 385 participants. To account for potential non-response and incomplete questionnaires, an additional 15% was added ($385 \times 0.15 = 58$), resulting in a target sample size of 443 participants. A final analyzable sample of 422 participants resulted from some people not responding during data collection. Convenience sampling was used. To ensure that the study addressed the appropriate group, participants had to be 18 years of age or older and have a verified diagnosis of type 2 diabetes. Pregnant patients, those with mental illness or cognitive impairment that precluded informed consent, and those with inadequate medical records pertinent to the research variables were also eliminated. To evaluate dependability in terms of internal consistency, Cronbach's alpha statistics were computed for the entire scale.

The Statistical Package for the Social Sciences (SPSS), version 22.0, was used to analyze the data. Demographic traits and complications associated with diabetes were compiled using descriptive statistics. Categorical data were represented as frequencies and percentages, whilst continuous variables were shown as means with standard deviations. Associations between independent factors and complications associated with diabetes were examined using the chi-square test; a p-value of less than 0.050 was considered statistically significant.

RESULTS

According to an analysis of the demographic data, there were more women (65.6%) than men in the research sample, and more than one-third of participants (37.0%) were older than 60 years, with a significant number of those over 60 (37.0%). A significant percentage (22.7%) of individuals had a family medical history, and the majority were married. A significant portion had either no qualifications (25.2%) or "10 years or less of education" (29.3%). Agriculture accounted for 57.6% of all occupational categories. Government employees (19.2%) and those with other specified occupations (20.6%) came next. The majority of participants had one to three children, and 65.2% of them earned less than $25,000 a month. It's

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interesting to note that 50% of individuals either had cultivable land or did not. The examination of relationships between these characteristics and the medical parameters indicated in the study is contextualized by these demographic findings. The research participants' sociodemographic details, such as gender, age, marital status, education, employment, income, number of children, and land ownership, are displayed. To investigate their relationship to pertinent medical indicators in the research, these factors were examined (Table 1).

Table 1: Socio-Demographic Characteristics of Respondents

Variables	Category	n (%)
Gender	Male	145 (34.4%)
	Female	277 (65.6%)
Age (Years)	18-26	21 (5.0%)
	27-37	65 (15.4%)
	38-48	93 (22.0%)
	49-59	87 (20.6%)
	Above 60	156 (37.0%)
Marital Status	Married	366 (86.7%)
	Single	26 (6.2%)
	No Response	326 (77.3%)
Qualification	Nil	92 (25.2%)
	10 Years or Less of Education	107 (29.3%)
	12 Years of Education	50 (13.7%)
	Undergraduates	60 (16.4%)
	Graduates	56 (15.3%)
Occupation	Farmer	243 (57.6%)
	Businessman	11 (2.6%)
	Govt Employee	81 (19.2%)
	Other Specify	67 (20.6%)
Monthly Income (PKR)	<25000	275 (65.2%)
	25000-50000	144 (34.1%)
	>50000	3 (0.7%)
How Many Children Do You Have?	1-3	180 (42.7%)
	4-8	227 (53.8%)
	>8	15 (3.6%)
Have any Cultivatable Land	Yes	211 (50%)
	No	211 (50%)

Source= primary data, n = frequency, % = Percentage

The findings revealed a high prevalence of diabetes indicators: 75.1% had fasting blood sugar >125 mg/dl, 90.5% had random blood sugar >180 mg/dl, and 68.7% had HbA1c >6.5%. Common complications included blurred vision (73.2%), numbness (93.6%), tingling (86.3%), limb swelling (69.4%), and increased urination (92.2%). Elevated blood pressure was noted in 69.0% of participants, with weight loss (76.5%) and sleep disturbances (83.4%), further suggesting serious health burdens (Table 2).

Table 2: Description of Complications of Type-2 Diabetic Patients

Variables	Category	n (%)
Fasting Blood Sugar	Less than 100mg/dl	13 (2.0%)
	100-125mg/dl	92 (19.0%)
	More than 125mg/dl	317 (70.0%)
Random Blood Glucose Level (mg/dl)	100-180	40 (9.0%)
	More than 180	382 (90.5%)
HbA1c	Below 6%	18 (4.3%)
	6%-6.4%	1 (0.2%)
	Greater than 6.5%	290 (68.7%)
	None	113 (26.8%)
Blurred Vision	Present	309 (73.2%)
	Absent	113 (26.8%)
Blindness	Present	114 (27.0%)
	Absent	308 (73.0%)
Eye Pain / Redness	Present	296 (70.1%)
	Absent	126 (29.9%)
High Blood Pressure	Present	291 (69.0%)
	Absent	131 (31.0%)
Swelling of Feet, Ankles and Hands	Present	293 (69.4%)
	Absent	129 (30.6%)
Increased Need to Urinate	Present	389 (92.2%)
	Absent	33 (7.8%)
Numbness	Present	395 (93.6%)
	Absent	27 (6.4%)
Tingling Sensation	Present	634 (86.3%)
	Absent	58 (13.7%)
A Burning or Sharp Pain in the Feet	Present	365 (86.5%)
	Absent	57 (13.5%)
Loss of Feeling in Feet	Present	115 (27.3%)
	Absent	307 (72.7%)
In-Grown Toenail or Toenail Infected with Fungus	Present	64 (15.2%)
	Absent	358 (84.8%)
Change in Skin Color	Present	69 (16.4%)
	Absent	353 (83.6%)
Length of Stay in Hospital (Days)	0	221 (52.4%)
	<10	107 (25.4%)
	10-20	88 (20.9%)
	>20	6 (1.4%)
A Problem in Work Life	Yes	350 (82.9%)
	No	72 (17.1%)
Decreased Energy Level	Yes	373 (88.4%)
	No	49 (11.6%)
Comorbidity	Heart Disease	113 (31.5%)
	Liver Disease	32 (7.6%)
	Kidney Disease	69 (16.4%)
	Other	63 (14.9%)
	None	125 (29.6%)
Duration of Illness	<1	–
	1-5	154 (36.5%)
	6-10	138 (32.7%)
	>10	85 (20.1%)

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Antibiotic Drug Prescribed	1	119 (28.2%)
	2	175 (41.5%)
	3	126 (29.9%)
	4	2 (0.5%)
Antibiotic Medication	Insulin	8 (1.9%)
	Oral	266 (63.0%)
	Insulin + Oral	148 (35.1%)
Weight Change	Loss	323 (76.5%)
	Gain	16 (3.8%)
	No Change	83 (19.7%)
Sleep Disturbance	Present	352 (83.4%)
	Absent	70 (16.6%)
Delayed Wound Healing	Present	252 (59.7%)
	Absent	170 (40.3%)
Dry Skin and Mouth	Present	403 (95.5%)
	Absent	19 (4.5%)
Current Status	Present	292 (69.2%)
	Absent	130 (30.8%)

Except for eye irritation or redness, most problems were more common in women, and there was no statistically significant difference in the likelihood of suffering them. For instance, the odds ratio was not significant (COR = 0.723, 95% CI: 0.463-1.129, p=0.950), despite the fact that hazy vision was more prevalent among females in the chi-square analysis. The difference between the two tests, chi-square, determines if a connection exists, whereas logistic regression measures the strength of that correlation, which explains this apparent disparity. Even little variations in prevalence can provide significant chi-square values in large samples, but if the impact size is tiny, the related odds ratios might not be significant. Eye pain/redness was the only complication that maintained significance in both analyses (COR = 0.592, 95% CI: 0.385-0.910, p=0.012), indicating that males had significantly lower odds of reporting this symptom compared to females. The findings present the association between gender and diabetes-related complications using crude odds ratios (CoR), 95% confidence intervals (CI), and p-values from binary logistic regression. A p-value less than 0.050 was considered statistically significant (*)(Table 3).

Table 3: Associated Factors of Gender with Complications of Type 2 Diabetes Mellitus

Variables	Gender		COR (CI)	p-value
	Male	Female		
Blurred Vision				
Present	100	209	0.723 (0.463-1.129)	0.950
Absent	45	68		
Blindness				
Present	45	70	1.288 (0.825-2.012)	0.159
Absent	101	207		
Eye Pain /Redness				
Present	91	205	0.592 (0.385-0.910	0.012*
Absent	54	72		
High Blood Pressure				
Present	100	191	1.001 (0.648-1.545)	0.545
Absent	45	86		
Swelling of Feet, Ankles, and Hands				
Present	97	196	0.835 (0.542-1.286)	0.239
Absent	48	81		
Increased Need To urinate				
Present	133	256	0.909 (0.434-1.905)	0.469
Absent	12	21		
Numbness				
Present	135	260	0.883 (0.393-1.981)	0.455
Absent	10	17		
Tingling Sensation				
Present	129	235	1.441 (0.779-2.664)	0.154
Absent	42	16		
Loss of Sensation in the Feet				
Present	40	75	1.026 (0.65-1.610)	0.499
Absent	105	202		
In Grow Toenail or Toenail Infected with Fungus				
Present	22	42	1.001 (0.572-1.752)	0.552
Absent	123	235		
Change in Color				
Present	21	48	0.808 (0.463-1.411)	0.272
Absent	124	229		
Sleep Disturbance				
Present	120	232	0.931 (0.545-1.592)	0.447
Absent	25	45		
Delayed Wound Healing				
Present	89	163	1.112 (0.737-1.677)	0.345
Absent	56	114		
Dry Skin and Mouth				
Present	138	265	0.893 (0.344-2.319)	0.469
Absent	7	12		

CoR = Crude Odds Ratio; CI = Confidence Interval; *p<0.050

The findings showed many significant associations between a positive family medical history and certain diabetes-related issues in females. Women with a favourable medical history were much less likely to experience blurred vision, ocular discomfort or redness, and loss of foot feeling. However, adverse effects include blindness, swelling of the hands, ankles, and feet, fungal infections or ingrown toenails, and changes in skin tone were more common. No statistically significant associations with other symptoms were discovered. Significant findings are indicated (p<0.050) and presented as crude odds ratios (CoR) with 95% CI and p-values. The results show crude odds ratios (CoR) with 95% confidence intervals (CI) and p-values assessing the association between female medical history (Yes/No) and diabetes-related complications. Significant results are highlighted

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where the p-values are less than 0.050 (Table 4).

Table 4: Association of Family Medical History with Complications of Diabetes Mellitus

Variables	Female Medical History		COR (CI)	p-value
	Yes	No		
Blurred Vision				
Present	53	225	0.351 (0.217-0.569)	<0.001***
Absent	42	71		
Blindness				
Present	38	57	2.193 (1.351-3.559)	<0.001***
Absent	76	250		
Eye Pain /Redness				
Present	56	239	0.523 (0.324-0.842)	0.006**
Absent	39	87		
High Blood Pressure				
Present	67	223	1.105 (0.671-1.820)	0.398
Absent	28	103		
Swelling of Feet, Ankles, and Hands				
Present	80	212	2.868 (1.579-5.208)	<0.001***
Absent	15	114		
Increased Need To urinate				
Present	89	299	1.339 (0.536-3.347)	0.352
Absent	6	27		
Numbness				
Present	88	306	0.822 (0.336-2.006)	0.409
Absent	7	20		
Tingling Sensation				
Present	85	278	1.468 (0.712-3.025)	0.192
Absent	10	48		
A Burning and Sharp Pain in the Feet				
Present	84	280	1.255 (0.622-2.530)	0.328
Absent	11	46		
Loss of Sensation in the Feet				
Present	18	96	0.560 (0.318-0.986)	0.027*
Absent	77	230		
In a Toenail or Toenail Infected with Fungus				
Present	26	37	2.943 (1.671-5.184)	<0.001***
Absent	69	289		
Change in Color				
Present	29	39	3.233 (1.865-5.605)	<0.001***
Absent	66	287		
Problems in Work				
Present	82	267	1.394 (0.728-2.669)	0.199
Absent	13	59		
Decrease Energy Level				
Present	85	287	1.155 (0.553-2.410)	0.430
Absent	10	39		
Sleep Disturbance				
Present	81	270	1.200 (0.635-2.267)	0.349
Absent	14	56		
Delayed Wound Healing				
Present	52	199	0.772 (0.487-1.224)	0.163
Absent	43	127		
Dry Skin and Mouth				
Present	93	309	2.558 (0.580-11.276)	0.157
Absent	2	17		

CoR = Crude Odds Ratio; CI = Confidence Interval; *p<0.050, **p<0.01, ***p<0.001

DISCUSSION

Patients at the District Headquarter Hospital in Haripur, Pakistan, had their type-2 diabetes mellitus (T2DM) problems evaluated. The results showed that several microvascular and macrovascular problems were highly prevalent and offered important new information about the relationships between these complications and gender and family history. Gender and a family history of diabetes were the main exposure variables in this study, while a variety of microvascular and macrovascular problems linked to type 2 diabetes were the outcome variables. While family history acts as a stand-in for genetic predisposition influencing disease susceptibility and progression [14], gender was examined due to data suggesting biological and healthcare-seeking differences influence diabetes complications [15]. The findings complement and contribute to our knowledge of type 2 and its complex health outcomes. The chronic and progressive nature of untreated type 2 diabetes is evident in the fact that most of the patients had sequelae, including reduction in eyesight, neuropathy, hypertension, oedema of limbs, sleep problems, and delayed wound healing (high frequency of sequelae in the study) [16]. The results presented support other recent studies carried out to prove that complications of diabetes are more prevalent in those groups with poor glycaemic control or limited access to healthcare services [17, 18]. On the same note, studies in the rural areas of Asia have revealed similarities in that women tend to develop complications that are related to diabetes, but this is related to late diagnosis and under management [19, 20]. Moreover, studies in Saudi Arabia and India prove that people whose family has a history of diabetes experience more serious metabolic problems and develop the problems more quickly [21, 20]. However, the same research in the rural Asian areas found that females had higher chances of developing diabetic complications, which were linked to late diagnosis and insufficient treatment [19]. Other parallel relations were observed in research performed in Saudi Arabia and India; the participants who reported a family history of diabetes exhibited higher metabolic derangements and rapid progression of the complications [21, 20]. A study by [22] has established that there were significant differences in the glycaemic control measures (fasting blood sugar, random blood glucose, and HbA1c) in participants who had a family history of diabetes. In these persons, there might be a need to treat them using more intensive and specific

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measures, including early medication interventions and lifestyle change. Foot issues like ingrained toenails and colour change of the skin were also the most related to the gender and family history. The findings are consistent with estimates around the world, which show approximately 6 percent of diabetic people have diabetic foot ulcers [12]. Interestingly, a number of the characteristics, including delays in wound healing and some chronic conditions, were not found to have a significant relationship with gender, although many of the issues were revealed to significantly vary across groups. This suggests that alternative forms of variables like disease duration and glycaemic control might have a greater effect [23]. Such a conclusion could be justified by the findings of the research that indicate chronic hyperglycemia is the strongest predictor of complications of diabetes, no matter gender [18].

There are some limitations to consider when interpreting the results. The weaknesses include a low level of generalizability, as convenience sampling is performed in one tertiary care facility, and causal relationships are not possible, as the study has a cross-sectional design. Using self-reported problems only can cause recall bias, and the lack of HbA1c results in over 25% of patients would also impact the assessment of glycaemic control. The objective clinical assessment and longitudinal research design using multi-center random sampling methods would help future research comprehend the issue in greater detail and formulate focused intervention measures in high-risk populations.

CONCLUSIONS

The present study indicates that diagnosis with a high burden of comorbidities related to diabetes is strongly correlated with poor glycaemic control, a favourable family history, and the gender of women. These findings highlight the pressing need for targeted screening of high-risk groups and early intervention efforts. Strengthening national diabetes policy to incorporate risk-based prevention strategies could improve patient outcomes and help reduce rates of long-term complications.

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Authors' Contribution

Conceptualization: SA, KM, IR, MJ
Methodology: SA, KM, IR, MJ, MSN, M, HA, VK
Formal analysis: SA, KM, IR, MJ, MSN, M, HA, VK
Writing and Drafting: SA, KM, IR, MJ, MSN, M, HA, VK
Review and Editing: SA, KM, IR, MJ, MSN, M, HA, VK

All authors approved the final manuscript and take responsibility for the integrity of the work.

Conflicts of Interest

The authors declare no conflict of interest.

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