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ACKNOWLEDGEMENT

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Smoking in Pregnancy: An Invisible Threat to the Developing Brain

OPEN ACCESS

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Cigarette smoking during pregnancy is a widely recognized public health issue, with a growing body of evidence documenting its harmful effects on the health of the unborn child [1]. While long-term consequences such as low birth weight and respiratory problems are now well-known, the impact on the particularly vulnerable developing nervous system deserves specific and urgent attention. Prenatal exposure to toxic substances from smoking can leave a lasting imprint, compromising the complex neuronal architecture and future cognitive functions. Nicotine, the most well-known component in cigarette smoke, not only easily crosses the placental barrier but is also one of the few lipid-soluble substances capable of passing through the blood-brain barrier by passive diffusion, thus acting directly on the expression of genes and transmitter systems essential for the development of the nervous system [2-4].

In particular, it can act as an agonist on acetylcholine receptors, crucial for neuronal proliferation, differentiation, synaptogenesis, and above all, it can interfere with the development of nerve centers essential for coordinating the vital functions of the fetus. Furthermore, it should be noted that smoke is not just nicotine. Cigarette smoke is a complex mixture of over 7,000 chemical substances, many of which are neurotoxic. Carbon monoxide, for example, reduces the availability of oxygen for the fetus, creating a condition of hypoxia that can irreversibly damage brain cells. Epidemiological studies have consistently shown a correlation between maternal smoking and an increased risk of neurobehavioral and developmental disorders in the child. A higher incidence of Attention Deficit/Hyperactivity Disorder (ADHD), autism spectrum disorders, and cognitive delays is observed in children exposed to smoke in utero [5]. These problems are not simply transient; they often persist into adolescence and adulthood, affecting school performance, social relationships, and overall quality of life.

On the cellular and molecular level, studies have demonstrated the accepted mechanisms of these effects. Exposure to smoke during pregnancy has the capacity to distort the expression of genes governing signal pathways, specifically impairing myelination, which is required to transmit impulses efficiently [6]. Moreover, it has been learned that smoking can cause oxidative stress and inflammation in the fetal brain tissue, which are some of the reasons that lead to cell death and deterioration of the neurons. The problem is not related to the active smoking of the mother alone. Prenatal exposure to secondhand smoke can also be regarded as a major risk factor. There is a need to make sure that the awareness of this problem is conveyed not only to the expectant mothers but also to the partners and all other people who spend time in the same home, so that the atmosphere of the place is totally smoke-free and the fetus can be well taken care of.

In summary, it is not only an ethical and scientific requirement but also scientific to protect the fetal nervous system against exposure to smoke. Each cigarette smoked by a pregnant woman is not only a threat to the pulmonary or cardiac system of the unborn child, but also a potential strike to the wholeness of their brain and the likelihood of delivery without health complications. This should be targeted in information campaigns and health policies, where women and their families are

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given help that will enable them to stop smoking and give their child the best possible start in life, and a neuro-cognitive future.

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Original Article

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Association Between Guyon's Canal Syndrome and Hypothenar Muscle Weakness Among Call Center Agents: A Cross-Sectional Study

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ABSTRACT

Guyon's Canal Syndrome is an ulnar nerve entrapment often caused by repetitive wrist use and poor ergonomics. **Objectives:** To investigate the association between Guyon's Canal Syndrome and hypothenar muscle weakness among call center agents. **Methods:** This cross-sectional study was conducted on 56 participants using convenience sampling. The study was completed within six months. Data were collected from call center agents in Lahore using Tinel's sign to assess ulnar nerve irritation, and testing of the hypothenar muscles, abductor digiti minimi, and opponens digiti minimi was performed using Manual Muscle Testing (MMT). **Results:** A positive Tinel test was noted in 83.9% of subjects. MMT revealed that 60.7% exhibited grade 4 and 35.7% displayed grade 5 strength in the abductor digiti minimi, while 66.1% showed grade 4 and 28.6% demonstrated grade 5 strength in the opponens digiti minimi. A notable negative correlation emerged between Tinel test outcomes and abductor digiti minimi strength ($r=-0.442$, $p<0.001$), whereas the correlation with opponens digiti minimi strength was not statistically significant ($r=-0.190$, $p=0.064$). **Conclusions:** The study found a significant negative correlation between Tinel test results and abductor digiti minimi strength.

INTRODUCTION

The evolution of the modern workplace into a digital and work-from-home environment has exposed millions of workers worldwide to work-related musculoskeletal disorders (WMSDs) [1]. Hypothenar muscle weakness occurs when the muscles on the side of the little finger—primarily the abductor digiti minimi, flexor digiti minimi brevis, and opponens digiti minimi fail to function properly; these muscles are supplied by the ulnar nerve and are essential for controlling little finger movements [2]. Repeated wrist flexion and extension, repetitive finger movements, and prolonged pressure from the palm on hard surfaces can cause ulnar nerve entrapment in Guyon's Canal, leading to progressive motor deficits of the hypothenar muscles [3]. The call center sector, characterized by prolonged sitting, static wrist postures, extensive keyboard and mouse use, and telecommunication device handling, places employees at high risk for nerve compression syndromes such as carpal tunnel syndrome and Guyon's Canal Syndrome [1, 3]. Factors such as acute injury, repetitive minor trauma, and certain work demands may also predispose individuals to hypertrophy of variant muscles, further contributing to nerve compression [4]. Despite extensive research on WMSDs, limited studies have focused on ulnar nerve conditions like Guyon's Canal Syndrome. Call center employees' prolonged static wrist positions and repetitive

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hand movements make them particularly susceptible to hypothenar muscle weakness due to ulnar nerve compression, highlighting the need to investigate the association between Guyon's Canal Syndrome and hypothenar muscle weakness in this population.

Despite growing evidence on work-related musculoskeletal disorders, limited research specifically examines ulnar nerve entrapment such as Guyon's Canal Syndrome and its functional impact on hypothenar muscle strength among call center workers. Existing literature mainly focuses on carpal tunnel syndrome or general ergonomic risks, leaving a gap regarding the motor consequences of distal ulnar nerve compression in occupational settings. Call center agents are exposed to repetitive wrist movements and prolonged static postures that may predispose them to hypothenar weakness, yet empirical association data remain scarce. Therefore, this study aimed to investigate the relationship between Guyon's Canal Syndrome, assessed through Tinel's test, and hypothenar muscle strength among call center agents to provide evidence for early occupational risk identification.

METHODS

This cross-sectional study was conducted over six months, from January 2025 to June 2025, after obtaining ethical approval from the institutional ethical committee of Hajvery University Lahore, Pakistan (Ref. No. HU-ECRB-DPT-2025-59). A total of 56 participants were recruited using convenience sampling, with the sample size calculated via Rao software [5]. Data were collected from call center agents in Lahore who were aged 25–40 years and had at least six months of work experience in the call center. Participants included those reporting symptoms of hand pain, numbness, or weakness. Informed written consent was obtained from all the participants. Exclusion criteria were a previous history of traumatic hand injuries, prior hand or wrist surgery, or refusal to participate. Assessment tools included Tinel's test and Manual Muscle Testing (MMT). Tinel's Sign was performed by gently tapping over Guyon's canal at the wrist, with a positive sign indicated by tingling or paresthesia along the ulnar nerve distribution (ring and little fingers). MMT was used to evaluate the strength of hypothenar muscles, specifically the abductor digiti minimi (ADM) and opponens digiti minimi (ODM). For ADM testing, participants abducted the little finger away from the ring finger while resistance was applied laterally at the fifth digit; for ODM testing, participants opposed the little finger toward the thumb while resistance was applied at the fifth metacarpal in a dorsolateral direction. Muscle strength was graded from 0 (no contraction) to 5 (movement against gravity with maximal resistance). Data were analyzed using SPSS version 26.0, and the Chi-square test was applied to determine the association between Tinel's test outcomes and hypothenar muscle strength (ADM and ODM), with p-values <0.050 considered statistically significant.

RESULTS

The research involved 56 individuals with an average age of 29.21 ± 4.75 years (Table 1).

Table 1: Demographics of Age

Variable	Mean ± Sd
Age	29.21 ± 4.75

Most participants were male (80%) and right-handed (75%). The majority had 1 to 5 years of professional experience (66%) and spent 7 to 10 hours at work each day (75%). A positive Tinel test was observed in 83.9% of subjects. Manual muscle assessment showed that 60.7% exhibited grade 4 and 35.7% exhibited grade 5 strength in the abductor digiti minimi, while 66.1% showed grade 4 and 28.6% showed grade 5 strength in the opponens digiti minimi (Table 2).

Table 2: Frequency and Percentage of Gender, Dominant Hand, Years of Experience, Working Hours, Tinel Test, and MMT (N = 56)

Variables	Category	Frequency (%)
Gender	Male	45 (80%)
	Female	11 (19.6%)
Dominant Hand	Right	42 (75%)
	Left	14 (25%)
Years of Experience	1-5	37 (66%)
	6-10	17 (30.4%)
	10-15	2 (3.6%)
Working Hours/day	2-6	5 (8.9%)
	7-10	42 (75%)
	11-16	9 (16.1%)
Tinel Test	Positive	47 (83.9%)
	Negative	9 (16.1%)
Abductor Digiti Minimi (ADM)	0 – No contraction	0 (0%)
	1 – Flicker	0 (0%)
	2 – Movement with gravity eliminated	0 (0%)
	3 – Movement against gravity	2 (3.6%)
	4 – Movement against resistance	34 (60.7%)
	5 – Normal strength	20 (35.7%)
Opponens Digiti Minimi (ODM)	0 – No contraction	0 (0%)
	1 – Flicker	0 (0%)
	2 – Movement with gravity eliminated	0 (0%)
	3 – Movement against gravity	3 (5.4%)
	4 – Movement against resistance	37 (66.1%)
	5 – Normal strength	16 (28.6%)

A notable negative correlation was found between Tinel test outcomes and abductor digiti minimi strength ($r=-0.442$, $p<0.001$), whereas the correlation with opponens digiti minimi strength was not statistically significant ($r=-0.190$, $p=0.064$) (Table 3).

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Table 3: Association Between Tinel Test and Hypothenar Muscle

Muscle	r-Value	p-Value
Abductor digiti minimi	-0.442	<0.001
Opponens digiti minimi	-0.190	0.064

DISCUSSION

The present study investigated the association between Guyon's Canal Syndrome and hypothenar muscle weakness, as assessed by Tinel's tests, among call center agents. Although the Tinel's sign was positive in a large number of cases (83.9%), suggesting potential involvement of the ulnar nerve, our results showed an inconsistent correlation with motor strength, where the correlation with abductor digiti minimi was moderate and significant, whereas with opponens digiti minimi it was weak and not statistically significant. These findings indicate that the level and/or presence of motor weakness is low even when sensory symptoms are present. This is consistent with previous reviews indicating that sensory impairments, including numbness and tingling, are the most frequently described and consistent symptoms in early-stage entrapment syndromes, whereas motor deficits, including weakness or atrophy, occur later and in fewer affected patients [6]. In early-stage entrapment syndromes such as GCS, the sensitivity of manual muscle testing may be insufficient to detect subtle neuromuscular compromise [6]. Repetitive biomechanical exposures have been significantly associated with ulnar nerve abnormalities diagnosed by nerve conduction studies (NCS); however, clinical signs such as muscle weakness are often less clear and inconsistent in patients with early-stage nerve injuries, suggesting that nerve conduction abnormalities and subjective complaints can be present without obvious motor deficits [7]. Despite being the second most common focal peripheral neuropathy after carpal tunnel syndrome (CTS), the prevalence of ulnar neuropathy at the elbow (UNE) in the general population is rarely reported. Population-based studies indicate that the crude annual incidence rate of UNE is approximately 24.7 cases per 100,000 person-years, with a higher incidence in men than in women, and increasing with age, highlighting occupational exposure as a significant risk factor. UNE incidence is about one-thirteenth that of CTS, emphasizing its relative yet clinically important impact, especially in populations performing repetitive upper limb activities [8]. Distal compression at the wrist, as seen with GCS, may result in less severe or gradual motor dysfunction compared with proximal entrapments [9]. Work-related musculoskeletal symptoms and ergonomic factors have been widely reported among call center and home-based office workers. Multicomponent ergonomic interventions have been shown to reduce musculoskeletal symptoms, mental workload, and fatigue among call center workers [10], while ICU nurses and other office populations report predictors of WRMSDs related to prolonged repetitive tasks [11]. Longitudinal studies during the COVID-19 pandemic have shown associations between working from home and musculoskeletal pain in the neck, back, and upper extremities [12-15]. Ergonomics knowledge and posture management have been identified as factors reducing musculoskeletal risk [16-18]. Interventions to reduce sedentary behavior in contact centers have also demonstrated feasibility [19]. Additionally, characteristics of surgically treated Guyon canal syndrome have been documented in multicenter studies [20].

The study was limited by a small sample size, convenience sampling, and a cross-sectional design, which restricts generalizability and prevents causal inference. Reliance on clinical tests and manual muscle testing without nerve conduction studies may have reduced diagnostic precision, particularly in early-stage neuropathy. Self-reported symptoms and single-center data collection may also introduce reporting and selection bias. Future research should include larger multicenter samples, longitudinal designs, and objective electrophysiological assessments to confirm nerve involvement. Additionally, intervention-based studies evaluating ergonomic modifications and preventive workplace strategies are recommended.

CONCLUSIONS

In conclusion, the findings indicate a significant negative association between Tinel's test outcomes and abductor digiti minimi strength among call center agents. No statistically significant relationship was observed with opponens digiti minimi strength, suggesting variable motor involvement in Guyon's Canal Syndrome. The results highlight that sensory signs may appear earlier than measurable motor weaknesses. Early screening and ergonomic interventions may help reduce occupational risk and prevent progression of ulnar nerve dysfunction.

Authors' Contribution

Conceptualization: FM, IZ, TF
Methodology: MR, TF
Formal analysis: FM, IZ, MR, TF
Writing and Drafting: FM, IZ, MR, TF, EG, AA, RT
Review and Editing: FM, IZ, TF, MR, EG, AA, RT

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

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Conflicts of Interest

The authors declare no conflict of interest.

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Original Article

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Prevalence of Genu Varum and Genu Valgum in Osteoarthritis, Association with BMI, Age, Gender and Grade 3, 4 of Osteoarthritis

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ABSTRACT

A joint disease known as osteoarthritis is a degenerative disease in which cartilage breakdown, leading to pain, stiffness, and reduced joint function, especially in weight-bearing joints like the knees. Skeletal deformities, such as bandy leg and knock-knees, can worsen the symptoms and limitations of OA in the lower extremities. **Objective:** To evaluate the relationship between angular deformities (Genu Varum and Genu Valgum) and osteoarthritis (OA) in individuals between the ages of 35 and 80, with an emphasis on OA grade, age, and BMI. **Methods:** A cross-sectional survey of 163 male and female patients with grade 3 and 4 OA from different hospitals in Lahore, ranging in age from 35 to 80 years, was conducted. Intercondylar and intermalleolar distances were measured with a scale, and the Q angle was determined with a goniometer using non-probability convenient sampling. The BMI was computed by dividing weight by the square of height in meters. **Results:** In this study out of 163 individuals, genu varum and valgum were diagnosed by Q angle, intercondylar distance, and intermalleolar distance. Data analysis using SPSS 27 revealed 52% of OA patients had genu valgum and 47% had genu varum. A strong association was found between these deformities and OA, particularly with increasing age and advanced OA grades. **Conclusions:** The study indicated that individuals aged 40 to 60 with grade 3 OA are at higher risk of developing genu valgum than genu varum. A significant association between these deformities and OA was found, with a p-value of less than 0.05. A strong correlation between age and angular deformities shown, while BMI and gender were less correlated.

INTRODUCTION

With an estimated 302 million cases globally, osteoarthritis is the most prevalent kind of arthritis and a major contributor to disability in older persons. Joints including the hands, hips, and knees are frequently impacted. Joint-wide pathology, such as bone remodeling and cartilage deterioration, is a hallmark of osteoarthritis [1]. Osteoarthritis (OA) is a degenerative joint disease characterized by bone and cartilage degradation. The articular cartilage thins and becomes fibrillated in knee OA due to a variety of reasons. Sections of sclerosis and cysts develop deeper within the bone structure. The fact that knee OA also affects other tissues, including the synovium, ligaments, and menisci, has now been recognized. For many persons, these total joint modifications ultimately result in pain, stiffness, deformity, and impairment [2, 3]. Urban living, decreased physical activity, increased caloric intake, and a sedentary lifestyle. Because of its scope and complications, accurate measurement of Body Mass Index (BMI) is important [4]. MRI and ultrasound may be utilized to visualize and assess for features of bone for OA such as cartilage loss, synovial inflammation etc. Biomarkers may be measured in serum or synovial fluid to aid in diagnosing and monitoring disease activity [5]. If distal most lateral, this is called valgus; when the points are medially shared,

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the resulting deformity is called valgus. The varus and valgus angles are related to the angle, which is the value of the bone or joint's closeness [6]. Adults between the ages of 45 and 65 participated in this study. People sixty years of age and older are considered "elderly" for the purposes of this statistical analysis. By 2050, it is anticipated that there will be 117.4 million senior people in SSA [7]. For this demographic, primary care healthcare services are mostly provided by the public health system [8]. The majority of primary care doctors in SSA have little to no geriatric training, increasing the number of older individuals in need of primary care [9]. The majority of health interventions for older folks are grounded upon data gathered from individuals in wealthy nations. Lower extremity deformities such as tibial varus and tibial valgus represent specific bone diseases that can affect the patient's musculoskeletal system and overall quality of life [10]. Tibia Vara and Valga can result from congenital factors, genetic predisposition. Tibia Vara in children is often caused by rickets, leading to knee pain, deformity and walking difficulties. It may be congenital or acquired, causing knee pain, gait abnormalities and associated symptoms. Both deformities can increase the risk of OA, especially in the elderly. This research aims to examine the prevalence and clinical implications of these deformities in geriatric patients with OA, highlighting the challenges they pose in patient care [11]. By elucidating these relationships, healthcare providers can better tailor treatment strategies, potentially enhancing the well-being of this vulnerable demographic.

Although osteoarthritis is widely studied, limited research has specifically examined the prevalence and comparative patterns of genu varum and genu valgum in advanced OA (grade 3 and 4) within the Pakistani population. Existing studies mainly focus on children, obesity, or general knee alignment rather than detailed angular deformity assessment in older adults with severe OA. There is also insufficient evidence regarding the association of these deformities with demographic and clinical factors such as age, BMI, and gender. Therefore, this study aimed to determine the prevalence of genu varum and genu valgum and evaluate their association with BMI, age, gender, and severity of osteoarthritis among affected individuals.

METHODS

This study employed a cross-sectional design, utilizing non-probability convenient sampling technique [12]. This study was conducted at Hajvery University from July 2024 to December 2024, after taking ethical approval (HU-ECRB-DPT-2024-44). Data were collected from various hospitals in Lahore for six months. The sample size of 163 participants, determined using Raosoft sample size calculator, based on a population size of 280 [13]. The inclusion criteria encompassed patients aged 35 to 80 with a diagnosis of grade 3 or 4 OA, able to communicate and comprehend study instructions, and in stable medical condition. Exclusion criteria included patients with prior lower extremity orthopedic surgery, systemic or localized infections, neurological disorders, severe limitations in passive lower extremity range of motion, non-standard metabolic therapy for rickets, non-idiopathic coronal knee deformity, and obesity [14, 15]. Data collection involved a self-administered questionnaire, adhering to ethical standards and Helsinki Declaration. Informed written consent was obtained from all participants. The Q angle, intercondylar distance, and intermalleolar distance were being measured using non-radiographic techniques. The patient was placed in a supine posture to measure the Q angle, which is the angle produced by the lines from the tibial tubercle through the patella and from the patella to the ASIS. Genu varum was denoted by an angle larger than 20 degrees, and genu valgum by an angle smaller than 12 degrees. The patient was standing with their legs closed when the intercondylar distance was measured. Both the presence and severity of the patient's knee deformity and BMI were noted. The patient was measured for height while standing flat against a stadiometer. IBM SPSS version 27.0 was used to analyze the data, and descriptive statistics were used to show the categorical data. Any significant difference is indicated by a p-value of less than 0.05.

RESULTS

Out of 163 participants, the maximum falls within the 51-65 age range, with 68 people, while the minimum is aged in the group of 35-50 with 40 people. The Mean and SD of given data is 53.64 ± 8.414. There were males 84 (51.4%) and females 89 (48.5%). Q angle of Right side affected knee. There were total 105 patients with right side OA. Out of 105 patients 73 were diagnosed with genu valgum and 22 patients were diagnosed with genu varum. Total 163 participants 74 have intercondylar distance less than 3cm hence they have genu valgum and 48 participants have more than 5cm which means they have genu varum. The correlation between age and intercondylar distance show negative correlation. The relationship between age and intermalleolar distance show slight negative correlation. The relationship in between gender and right knee Q-angle. The trend line showed a negative correlation line, indicating that as the Q angle increases, the grade of OA tends to decrease. Intercondylar distance increases, the grade of OA tends to decrease (Table 1).

Table 1: Descriptive Statistics of Study Variables

Variables	N	Minimum	Maximum	Mean ± SD
Gender	163	0.00	1.00	0.484 ± 0.501
Age	163	35.00	78.00	53.644 ± 8.413
BMI (Kg/m)	163	22.00	84.00	26.344 ± 4.807
Grade of Osteoarthritis	163	3.00	4.00	3.380 ± 0.486

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Right Knee Q Angle	163	10.00	26.00	14.423 ± 2.234
Left Knee Q Angle	163	12.00	25.00	15.932 ± 2.073
IntercondylarDistance	163	1.10	11.00	4.254 ± 1.416
Intermalleolar Distance	163	1.90	19.00	9.764 ± 2.429

A substantial negative correlation between intercondylar distance and age (r = -0.158, p-value < 0.05) and intercondylar distance and intermalleolar distance (r = -0.350, p < 0.01) was found in table 2. Age and the right knee Q angle also showed a strong positive link (r = 0.211, p-value < 0.01)(Table 2).

Table 2: Correlation between Measured Orthopedic Parameters and Age

Variables	Categories	Intercondylar Distance	Intermalleolar Distance	Right Knee Q Angle	Age
Intercondylar Distance	Pearson Correlation	1	-0.350**	-0.099	-0.158*
	Significant (2-Tailed)	-	0.000	0.207	0.044
	N	163	163	163	163
Intermalleolar Distance	Pearson Correlation	-0.350**	1	-0.126	-0.130
	Significant (2-Tailed)	0.000	-	0.110	0.098
	N	163	163	163	163
Right Knee Q-angle	Pearson Correlation	-0.099	-0.126	1	0.211**
	Significant (2-Tailed)	0.207	0.110	-	0.007
	N	163	163	163	163
Age	Pearson Correlation	-0.158*	-0.130	0.211**	1
	Significant (2-Tailed)	0.044	0.098	0.007	-
	N	163	163	163	163

** Correlation is significant at the 0.01 level (2-tailed)

*Correlation is significant at the 0.05 level (2-tailed)

Intercondylar distance was significantly correlated negatively with both intermalleolar distance (r = -0.350, p-value < 0.01) and osteoarthritis grade (r = -0.236, p-value < 0.01), according to table 3's analysis. The grade of osteoarthritis also showed a strong positive link with the right knee Q angle (r = 0.285, p-value < 0.01)(Table 3).

Table 3: Correlation between Measured Orthopedic Parameters and Grade 3, 4 of Osteoarthritis

Variables	Categories	Intercondylar Distance	Intermalleolar Distance	Right Knee Q Angle	Grade of OA
Intercondylar Distance	Pearson Correlation	1	-0.350**	-0.099	-0.236**
	Significant (2-Tailed)	-	0.000	0.207	0.002
	N	163	163	163	163
Intermalleolar Distance	Pearson Correlation	-0.350**	1	-0.126	0.151
	Significant (2-Tailed)	0.000	-	0.110	0.055
	N	163	163	163	163
Right Knee Q-Angle	Pearson Correlation	-0.099	-0.126	1	0.285**
	Significant (2-Tailed)	0.207	0.110	-	0.000
	N	163	163	163	163
Grade of OA	Pearson Correlation	-0.236**	0.151	0.285**	1
	Significant (2-Tailed)	0.002	0.055	0.000	-
	N	163	163	163	163

**Correlation is Significant at the 0.01 Level (2-Tailed)

The right knee Q-angle and BMI showed a substantial but unfavorable connection in figure 1, suggesting that the Q-angle tends to decrease as BMI rises. This suggested that individuals with higher BMI may exhibit altered knee alignment, which could have implications for joint mechanics and osteoarthritis progression.

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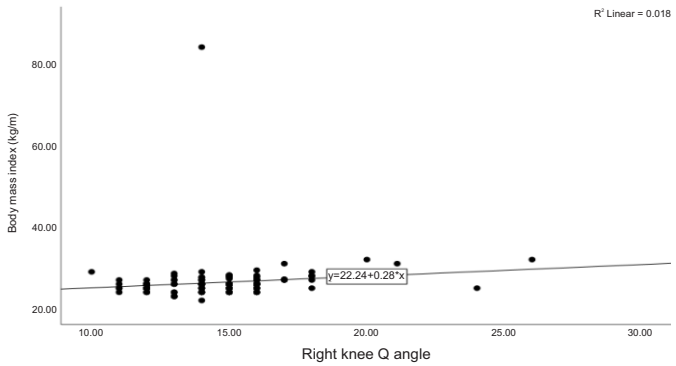

Figure 1: Correlation between BMI and Right Knee Q-Angle

Age and the right knee Q-angle were shown to be significantly positively correlated in figure 2 (r = 0.211, p = 0.007). This indicated that as age increases, the Q-angle tends to widen, which may contribute to age-related changes in knee alignment and potentially impact joint stability and function.

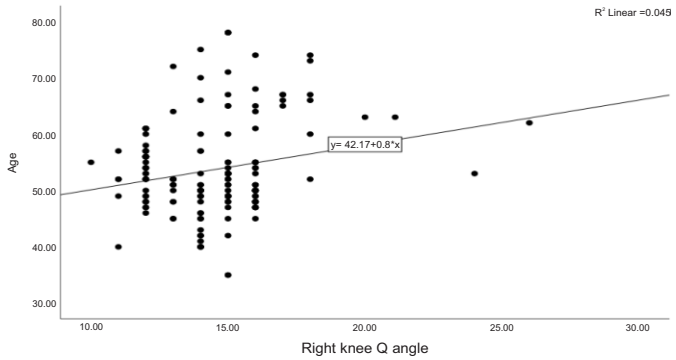

Figure 2: Correlation between Age and Right Knee Q-Angle

DISCUSSION

There is a strong link between OA and knee abnormalities, particularly genu varum and genu valgum. In patients with Grade 3 OA, genu varum was least common while genu valgum was very prevalent. This showed that between knee deformities and advanced OA is independent of gender and age. These findings are novel, as no previous studies have specifically investigated the incidence of these knee angular deformities in the advanced stages of OA in geriatrics. Ciaccia MC *et al.*, 2017 study is one of several studies that have found the prevalence of knee deformity in children [16]. Genu valgum was 7.1% common in elementary school children and adolescents, greater in overweight and obese pupils, and did not correlate with age or gender [16]. While other research concentrate on other traits like BMI, these studies differed in how common genu varum and genu valgum were in children and the elderly. Furthermore, in a 2020 study by Soheilipour F *et al* [17]. Evaluating the association between body mass index and knee angular deformities in people who are overweight or obese and the prevalence of genu varum and genu valgum [17]. According to a study by Smith TO *et al.*, a higher prevalence of genu valgum was seen in obese children ages 11 to 12 whose musculoskeletal state was assessed [18]. Additionally, Schoenau E *et al.*, found that obese women had a higher prevA. According to Samma L *et al.*, obese women were more likely to have knee deformities, while this was not verified for obese men [19]. Finding the knee deformity that was related to the grade of OA in finding the association between knee deformity and OA grade in grades 3 or 4 was an intriguing aspect of this study. In this study, there is a weak positive correlation as compare to other factor like age. In study Yoon JR *et al.*, relationship between angular deformity and primary OA of the knee.This study is different from this study as it specifies two knee deformities and their measurement accuracy was found by three methods and this study focused on two stages of OA [20].

The study used a cross-sectional design and convenience sampling, limiting causal inference and generalizability beyond the selected hospitals in Lahore. Non-radiographic measurement techniques may reduce diagnostic precision compared with imaging-based assessment. Inclusion of only grade 3 and 4 OA patients restricts comparison with early-stage disease progression. Future research should employ longitudinal multicenter designs with larger, more diverse samples and include radiographic or advanced imaging tools for more accurate deformity evaluation. Comparative studies involving different OA grades and interventional approaches are also recommended.

CONCLUSIONS

The conclusion of the study showed that people with Grade 3 OA especially at age of 40 to 60 years were at higher risk of developing Genu Valgum Deformity than Genu Varum. The age and knee angular deformity were significantly and strongly correlated. Knee deformity in elderly adults can occur regardless of a patient's gender or level of obesity.

Authors' Contribution

Conceptualization: EG, RT
Methodology: SS, TJ, MI, NH
Formal analysis: FM
Writing and Drafting: RW, AA, SFAS
Review and Editing: EG, RT, SS, TJ, MI, NH, FM, RW, AA, SFAS

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

Conflicts of Interest

All the authors declare no conflict of interest.

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Workplace Politics and Its Effect on Postgraduate Obstetrics and Gynecology Training: An Exploratory Study

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ABSTRACT

Power, favoritism, and informal influence are the hallmark features of workplace politics, which can have significant implications on postgraduate medical education. **Objectives:** To investigate the effects of these dynamics on learning, morale, and professional growth among obstetrics and gynecology fellowship trainees in two tertiary care hospitals in Pakistan. **Methods:** Qualitative exploratory study using thematic analysis of semi-structured interviews and open-ended survey responses. Sixteen female obstetrics and gynecology fellows from two different teaching hospitals of Pakistan responded; the names of these hospitals are being kept anonymous. Data were collected via anonymous online questionnaires with quantitative Likert items and open-ended questions, followed by in-depth semi-structured interviews. Responses underwent inductive coding to identify recurrent themes around politics, mentorship, bullying, and workplace culture. **Results:** Six themes emerged: (1) favoritism affecting access to surgical cases and evaluations, (2) lack of supervisory accountability, (3) isolation and reduced self-confidence among non-favored trainees, (4) impaired team cohesion, (5) normalization of political behavior, and (6) absence of formal grievance mechanisms. Quantitatively, 75% of trainees reported that workplace politics substantially hindered their learning, including limited clinical exposure, delayed skill acquisition, and reduced participation in teaching sessions. Additionally, 87.5% felt uncomfortable reporting bias or bullying, highlighting a lack of psychological safety in the training environment. **Conclusions:** Workplace politics in postgraduate obstetrics and gynecology training negatively impact learning outcomes by restricting access to practical training, reducing self-efficacy, and undermining collaborative learning. Implementing transparent case allocation, ethical leadership training, anonymous reporting mechanisms, and structured audits is essential to foster an equitable and supportive educational environment.

INTRODUCTION

Workplace politics can be defined as unofficial practices and influence strategies by an individual or a group of people to achieve a specific goal, usually to their own benefit, at the cost of others [1]. In the healthcare system, politics may influence resource distribution, career advancement, and the distribution of learning opportunities [2]. Postgraduate medical education, especially in the field of surgery, is based on the fairness of access to cases, mentorship, and feedback to become competent and confident [3]. Training environments may suffer the loss of trust, degraded collaboration, and prejudiced learning results when political actions like favoritism, gossip, and power politics find their way into them [4]. Research in various health care facilities has

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shown negative impacts of the political conditions on work-based learning and health. Chang et al. found that negative competition, power games, and blame reduced learning transfer among Taiwanese nurses to a large extent [5]. A different study established that office politics raised the level of employee cynicism and reduced engagement that mediated the decline in learning efficacy [6]. Mitosis and colleagues noted the relation of political stressors and ill-health results among Dutch hospital workers [7]. These results highlight the urgent necessity to learn about the experience of politics in postgraduate medical education. To address this gap, the present study aims to explore the perceived impact of workplace politics on learning, professional development, and interpersonal relationships among obstetrics and gynecology postgraduate trainees in two tertiary care hospitals in Pakistan. The objectives of the study are: (1) to assess how workplace politics affects access to clinical training, surgical opportunities, and educational activities, (2) to examine the effects of workplace politics on trainee morale, self-efficacy, and peer relationships, and (3) to identify trainee-recommended strategies to mitigate the negative impact of workplace politics on learning. The central research question guiding this study is: How does workplace politics influence learning outcomes, professional development, and interpersonal relationships among obstetrics and gynecology postgraduate trainees? The expressions of workplace politics can take a very diverse form, as they may include acts of favoritism and gossip, sabotage, bullying, seclusion, withholding of essential information, and, at least, unethical practices [7, 8]. The existing data indicate that the effects of workplace politics on learning to acquire surgical skills in postgraduate Obstetrics and Gynecology programs are dual, specifically, in the post-training programs that are based on the on-the-job programs [9, 10]. On the one hand, a positive and helpful environment leads to the establishment of positive relations in the workplace and, consequently, enhances the learning process significantly. Such an environment not only contributes to the skills development through mentorship and guidance of the seasoned professionals but also assists in developing a feeling of harmony and teamwork, which are crucial in networking of the professional beings, in addition to personal growth and development [11, 12]. In its turn, the adverse consequences of workplace politics can be displayed in a competitive or hostile work culture, according to which the trainees might feel cornered, marginalized, and even intimidated. This may trigger a chain of negative educational processes, such as isolation, low motivation, and unwillingness to participate in the learning process as a whole. Within this kind of environment, the education system will be compromised by favoritism and prejudice, which might result in stress or anxiety in trainees10. It has been emphasized that too much politics tends to make an employee isolated and demoralized. This, in the case of a trainee, may result in insufficient confidence and failure to do and learn anything at all, with a marked psychological blurring. Moreover, politics may lead to a negative work environment that decreases the quality of training and education, and decreases job satisfaction, in addition to job productivity. It is also capable of stopping learning and acquisition of skills by postgraduate fellows in medicine. It is therefore important to tackle the issue of politics at the workplace in a friendly manner and ensure that a healthy work culture that facilitates learning and development is put in place [13, 14]. Bullying that is usually carried out by people holding power and authority is also deemed to be a major contributing factor through which the adverse effects of workplace politics are magnified [15]. These actions can help create a culture where trainee can avoid responsibility to escape resultant responsibility that can damage their career advancement and judgment of morality. The lack of specific rules can and is likely to enable such behavior and even promote it, making the quality and reliability of medical education difficult, which, in its turn, can lead to the safety of patients as well. Given that learning in this model is based on mentoring and role models, the emergent generation of consultants would be filtered through this culture of politics, thus forming a long-term impact. Therefore, inadequate policies on politics in the workplace, harassment, and bullying are other factors that can aggravate the training environment [16]. To address these potential negative consequences, it is important to establish a culture of transparency, fairness, ownership, and accountability in the workplace, which can help to minimize the negative impact of politics and create an environment in which trainees feel supported and empowered to learn and grow. Additionally, providing opportunities for open and honest feedback on learning, training, and learning environments can help to identify and address potential problems before they become more significant issues [10]. Despite the recognized impact of workplace politics on the learning environment in postgraduate training programs, there remains a gap in the empirical evidence available on this subject. To address this, our study aims to explore the perception of trainees that workplace politics detrimentally influence the efficacy of training programs. Moreover, we aim to identify actionable strategies that can mitigate such negative outcomes, thereby contributing to the enhancement of postgraduate medical education. We anticipate that

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through our proposed interventions, this work can transform some of the 'threats' in post-graduate training into a learning opportunity whereby trainees can develop the coping skills that allow them to effectively deal with the challenges of the new environments [16]. The proposed interventions aim at reducing the levels of engagement of the trainees in workplace politics, as well as seeking their opinion on the same in their own words, and what they think may help them to curb the issue of workplace politics. The research also examines the perceptions of the participants on the presence or absence of a negative impact of workplace politics on student learning as a whole and the learning of surgical skills in particular. This, in its turn, has the potential to bring about a culture of objectivity and underline their clinical and academic duties first. The strategy is also capable of ensuring that trainees are involved in an intense and uninterrupted learning process that can be facilitated by weekly educational classes. Moreover, such sessions have to focus on enhancing not only the clinical competencies but also the endurance of the trainees in the face of the divisive effect of politics in the workplace. In an attempt to determine the effectiveness of our interventions, the study develops measures that can be used before interventions and after the intended intervention, after which it will inform us whether the proposed interventions can lead to some outcomes or not.

Despite recognition that workplace politics can influence healthcare environments, there is limited empirical research specifically exploring its impact on postgraduate Obstetrics and Gynecology training within Pakistan. Existing literature mainly addresses general workplace dynamics or nursing staff, leaving a gap regarding how political behaviors affect surgical learning opportunities, trainee morale, and professional development in residency programs. Additionally, there is insufficient qualitative insight into trainees' lived experiences and suggested solutions. This study aims to investigate the effects of these dynamics on learning, morale, and professional growth among obstetrics and gynecology fellowship trainees in two tertiary care hospitals in Pakistan.

METHODS

The study used a mixed-methods approach to capture both quantitative and qualitative aspects of workplace politics in postgraduate medical training. The study was conducted from January 2024 to January 2025. Written informed consent was taken. This approach was chosen to measure the prevalence and perceived impact of workplace politics (quantitative) while also exploring trainees' personal experiences and suggestions in depth (qualitative). Surveys identified trends and patterns, whereas semi-structured interviews and open-ended responses provided richer insight, allowing a comprehensive understanding of how workplace politics affects learning, professional development, and interpersonal relationships. "Given the exploratory nature of this study and the small sample size (n=16), the quantitative component was designed for descriptive purposes only. Inferential analysis was not intended or performed, as the primary aim was to use the quantitative data to identify general trends and patterns, which would then be explored in depth through qualitative methods." The sample size was determined by convenience and accessibility within the two participating institutions during the study period. The 32% response rate (16/50) was acknowledged as a limitation, which may introduce non-response bias, as the experiences of non-respondents might differ from those who participated. The sample consisted of 16 female postgraduate residents of the Obstetrics and Gynecology (Ob/Gyn) Department from two medical teaching institutions (MTIs) in Sialkot and Lahore, whose names are kept anonymous. The small sample size and inclusion of only female trainees may limit the generalizability of the findings and the diversity of perspectives. "The study employed convenience sampling by distributing the online questionnaire to all eligible Ob/Gyn fellows (n=50) across the two participating hospitals. Participants self-selected through voluntary response, which may limit the representativeness of the sample. The survey was administered online to nearly 50 postgraduate residents, of whom only 16 responded; the remainder declined participation. The questionnaire included items related to workplace politics, job satisfaction, teacher morale, and student learning outcomes. Likert-scale responses were treated as ordinal data, and descriptive statistics (frequencies and percentages) were used to summarize trends and perceived impact. Due to the small sample size, inferential statistics were not performed. These descriptive findings were contextualized using qualitative interview data. However, given the small sample size (n=16), percentages alone may be misleading. Therefore, all tables present both absolute numbers and percentages to provide a clearer representation of the data. Semi-structured interviews were conducted with a subset of participants to explore their experiences with workplace politics in greater depth. A total of 8 interviews were conducted, each lasting approximately 30-45 minutes. Interviews were audio-recorded, transcribed verbatim, and analyzed using inductive thematic analysis to identify recurrent themes. These qualitative findings were integrated with the quantitative survey results to provide a more complete understanding of the impact of workplace politics on learning and professional development. The questionnaire was designed after brainstorming with a group of Ob/Gyn

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medical teachers and reviewing literature primarily focused on workplace politics in healthcare, rather than specifically in medical education. It was piloted with a small group of Ob/Gyn trainees (not included in the main study). The questionnaire included items addressing workplace politics, learning environment, teaching quality, and perceptions of fairness, seclusion, and support mechanisms.

RESULTS

A total of 16 Participants responded to the questionnaire. All were female, Ob/Gyn residents, as this is primarily a female-dominated field in our country, where very few male doctors join training, and there were no male PGRs in the hospitals being studied. The questions were designed to inquire about various aspects of the interplay of workplace politics and learning, and the results are being reproduced in table 1.

Table 1: Relationship of Perceived Impact of Workplace Politics on Student Learning and Learning Environment

Questions	1	2	3	4	5
In your opinion, how much of a negative role does workplace politics play in your ability to learn in your postgraduate fellowship program? 1 is for least, 5 is for most.	1 (6.3%)	0 (0%)	3 (18.8%)	5 (31.3%)	7 (43.8%)
How often have you witnessed workplace politics negatively affecting the learning environment in your fellowship program? 1 is never, 5 is ALWAYS.	0	1 (6.3%)	1 (6.3%)	7 (43.8%)	7 (43.8%)
How often does workplace politics negatively affect the quality of teaching in your fellowship program? 1 is never, 5 is always.	0	0	5 (31.3%)	7 (43.8%)	4 (25%)
In your opinion, how much does the prevalence of workplace politics negatively affect the overall learning environment in your fellowship program? 1 is not at all, 5 is a lot.	0	2 (12.5%)	3 (18.8%)	7 (43.8%)	4 (25%)

Responses to questions on individual perceptions of seclusion, marginalization, and lack of equal opportunity are reproduced in table 2.

Table 2: Individual Perceptions of Seclusion, Marginalization, and Lack of Equal Opportunities

Questions	Yes	No	Maybe
Have you ever felt that you were not given equal opportunities to learn due to workplace politics?	50%	31.3%	18.8%
Do you think that workplace politics has negatively affected your relationships with your peers and colleagues in your fellowship program?	81.3%	0	12.5%
Have you ever felt that workplace politics has affected your performance in your fellowship program?	87.5%	6.25%	6.25%
Do you feel comfortable in reporting Workplace Politics to a superior, someone in authority, or the CPSP (College of Physicians and Surgeons Pakistan)?	0%	87.5%	12.5%

Responses to questions on perceptions of the existence of an anti-politics support group opportunity are reproduced in table 3.

Table 3: Perceptions on Existence of Anti-Politics Support Groups

Questions	Yes	No	Maybe
Have you ever received support from a superior or someone in authority when reporting Workplace Politics?	25%	68.8%	6.4%
Did active counseling on the part of consultants to break away from politics and strategies of how not to engage in politics have any role in reducing the impact of politics on teaching and learning activities in your department?	37.5%	18.8%	43.8%
Do you think that the CPSP should include a confidential column for reporting workplace bullying and politics?	87.5%	0	12.5%

The findings depict the learners' responses as to which measure would be most effective in their opinion to negate the effects of workplace politics on trainee learning and skill development: rate 1 for strongly disagree to 5 for strongly agree, as shown in table 4.

Table 4: Perceived Effectiveness of proposed interventions in the eyes of Learners (1= Strongly Disagree; 5 Strongly Agree)

Proposed Strategy of Political Disengagement	Strongly Disagree=1	2	3	4	Strongly Agree=5
Consultants actively disengaging trainees from politics	1 (6.25%)	2 (12.5%)	3 (18.75%)	4 (25%)	6 (37.5%)
Almost all Consultants are engaging in teaching activities.	1 (6.25%)	2 (12.5%)	1 (6.25%)	2 (12.5%)	10 (62.5%)
Strict schedule of teaching & learning activities in the hands of only one trainer, taking traditional lecture room classes (HOD)	3 (18.75%)	1 (6.25%)	3 (18.75%)	4 (25%)	5 (31.25%)
Trainees are actively engaged in learning rather than being passive learners	3 (18.75%)	1 (6.25%)	3 (18.75%)	4 (25%)	5 (31.25%)
Trainees are constantly reminded by all the consultants to shift focus from politics to learning	1 (6.25%)	2 (12.5%)	3 (18.75%)	1 (6.25%)	9 (56.25%)
Trainees who are actively engaged in politics are favoured more than trainees who try to avoid politics and learn better	1 (6.25%)	1 (6.25%)	3 (18.75%)	3 (18.75%)	8 (50%)

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A fair workplace environment with no perception of favoritism promotes learning more than a culture of workplace politics	1(6.25%)	2(12.5%)	3(18.75%)	1(6.25%)	9(56.25%)
The CPSP Curriculum is religiously adopted in almost all teaching institutions, with no place for workplace politics	3(18.75%)	1(6.25%)	3(18.75%)	4(25%)	5(31.25%)

The questionnaire had a final open ended question, " In your opinion, what steps can be taken to reduce the impact of workplace politics on the learning environment in your fellowship program? (open-ended)" which was not mandatory. 11 out of 16 trainees responded and had different answers, which are being reproduced in inverted commas venue with individual responses as bullet points: "Consultants should end favoritism and should behave equally with all trainees. Should encourage every resident, irrespective of whether they are among their favorites or not. Any resident playing a negative role towards fellow residents should be discouraged. It's very unfortunate when a consultant gels up with the person who is spreading negativity or fake talks about other residents just to make her look low in others' eyes. This halts the process of growth in the department." Just focus on the quality of learning skills and harmony should be created in the environment, Equal opportunities for all, there should be routine lectures on ethics, monitoring system to assess consultants' contribution towards patient's management, as always it is the system that needs to be modified / better policies should be made, discipline should be maintained everywhere by junior and senior fellows. If we have to report at 8 am, that means 8 am. Secondly, favoritism also affects the work environment. Politics only arises when the rules and regulations are not followed properly. For a healthy working environment, the system needs to be maintained and followed, superiors should be open to receiving such incidents, and steps should be taken to minimize workplace politics, regular workshops and counseling sessions for consultants and PGRs, both combined and separate.

DISCUSSION

Our study demonstrates that workplace politics significantly affects postgraduate training and the acquisition of surgical skills among Obs/Gyn fellows, consistent with prior research in healthcare settings. A major theme was favoritism governing access to surgical cases and evaluations, which mirrors findings from studies in surgical specialties, where selective allocation of cases limited hands-on experience for non-favored trainees, undermining both competence and confidence [4, 6]. In Obs/Gyn programs specifically, unequal access to operative opportunities can have lasting consequences, as surgical skills are heavily dependent on repeated, supervised practice. The lack of supervisory accountability was another critical theme [17, 18]. In Obs/Gyn training, structured mentorship is essential for both technical and non-technical skill acquisition [19, 20]. Current findings align with those of Owolabi et al. who reported that inconsistent mentorship and unchecked political behavior hindered career development [6]. Trainees in our study described receiving irregular feedback, which impaired their ability to monitor progress and achieve learning objectives. Isolation and reduced self-efficacy among non-favored trainees emerged as a recurrent concern. This resonates with Paarim et al. who observed that political dynamics in healthcare settings decreased motivation to learn and willingness to collaborate [5]. In ObGyn fellowship programs, where teamwork in labor wards and operating rooms is critical, feelings of marginalization directly reduce engagement in practical learning opportunities, affecting both clinical decision-making and surgical performance. The theme of impaired team cohesion resonates with Mitosis et al. who reported that workplace politics increased employee cynicism, reduced engagement, and consequently hindered learning transfer [7]. In the ObGyn training environment, poor team cohesion manifested as communication gaps and reluctance to collaborate, which further compromised patient care and educational outcomes. Finally, themes such as the normalization of political behavior and the absence of formal grievance mechanisms highlight systemic barriers to equitable learning. These findings suggest that the persistence of unchecked political behaviors not only perpetuates inequities but also reinforces a culture where psychological safety is compromised, ultimately affecting both knowledge acquisition and technical skill development. Taken together, our results extend the literature by explicitly linking specific political behaviors favoritism, lack of accountability, isolation, and normalized politics to measurable negative effects on postgraduate learning outcomes. They underscore the urgent need for structured interventions, such as transparent case-allocation, ethical leadership training, and confidential reporting mechanisms, to mitigate the detrimental impact of politics on learning and professional development in surgical training programs.

The study was limited by a small sample size, convenience sampling, and inclusion of only female trainees from two institutions, which restricts generalizability and diversity of perspectives. The low response rate may introduce non-response bias, and reliance on self-reported perceptions could affect objectivity. The descriptive quantitative analysis without inferential testing limits statistical conclusions. Future studies should involve larger

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multicenter samples including both genders, use mixed data sources with institutional performance indicators, and adopt longitudinal or comparative designs to evaluate the long-term effects of workplace politics and effectiveness of intervention strategies in postgraduate medical education.

CONCLUSIONS

Our findings prove that a culture of workplace politics within ObGyn fellowship programs hinders the learning and development of surgical skills among resident doctors. This additionally has detrimental consequences for individual residents' career trajectories along with an impact on patient care quality and safety in the long run. These results serve as a crucial call to action for residency program directors (RPDs) and healthcare institutions to implement proactive measures to mitigate the negative effects of workplace politics.

Authors' Contribution

Conceptualization: QN
Methodology: QN, SG, SS, JSK
Formal analysis: AN
Writing and Drafting: MA, SN
Review and Editing: QN, SG, SS, JSK, AN, MA, SN

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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Exploring Sleep Quality as a Modifiable Risk Factor for Suicidal Ideation among Young Students

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ABSTRACT

Sleep quality is a key modifiable factor that can influence suicidal ideation. While poor sleep is linked to suicidal thoughts, there is limited research on its effects in non-clinical young Students. **Objectives:** To examine how sleep disturbances, influenced by environmental factors such as living conditions and lifestyle, are related to suicidal ideation among students. **Methods:** A cross-sectional survey was conducted at the University of Punjab, Lahore, Pakistan, from March to June 2025. A total of 150 Young Students aged 15-30 years were recruited through purposive sampling. Participants completed the 13-item Sleep–Suicide Ideation Rating Scale (S-SIRS), a self-developed questionnaire designed to assess sleep quality and its perceived impact on suicidal thoughts. The S-SIRS was validated through reliability testing (Cronbach's α = 0.748) and expert evaluation for content validity. Data analysis included Spearman's correlation to explore the relationship between sleep disturbances and suicidal ideation, non-parametric tests for group comparisons, and Firth's penalized-likelihood logistic regression to identify key predictors and address class imbalance. **Results:** A significant positive correlation was found between sleep disturbances and suicidal ideation (ρ=0.402, p<0.001). Hostel residents and female reported higher levels of both sleep disturbances and suicidal ideation. Sleep impairment was the strongest predictor, with each unit increase in sleep disturbance raising the odds of suicidal ideation by 23.3% (OR = 1.233, p<0.001). Higher education levels were protective against both sleep disturbances and suicidal ideation, while early morning awakening and irritability were key risk factors. **Conclusions:** Sleep disturbances are strongly linked to suicidal ideation among students, with environmental factors influencing this relationship.

INTRODUCTION

Sleep quality is crucial for human health, playing a vital role in cognitive function, emotional well-being, and overall physiological balance [1]. There are frequent sleep disturbances that comprise problems related to falling asleep, maintaining sleep, and getting restful sleep. Poor sleep quality is especially common in young Students who have to cope with academic pressures, social changes, and disrupted schedules [2]. Of course. The following is the corrected paragraph using more natural and flowing academic language: There is a causal relationship between poor sleep and suicidal thoughts that occurs through a complex of harmful neurobiological and psychological processes. Most importantly, the quality of sleep itself is influenced by a variety of essential factors, including the living conditions, including the obstacles of living in a hostel, personal factors, including gender and education level, and the strong burden of academic or professional necessity. Loss of sleep undermines the capacity of the prefrontal cortex to control the emotional response of the amygdala to negative experiences, thereby increasing their reactivity to adverse experiences [3]. It is a neurological change that creates a breakdown in cognitive performance, a failure to solve problems, and constant, negative rumination. The condition creates a deep feeling of despair, resulting in a psychological setting where suicidal thoughts may develop [4]. This paper, thus,

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investigates the question of whether the quality of the sleep of a student can effectively predict that they have suicidal thoughts, and a particular focus is put on how variables such as the place where they reside, their sex, and their education level influence this important relationship. An increasing amount of literature supports this correlation, which gives empirical evidence to the mechanisms involved in the background and the exact factors being studied. As an example, a longitudinal study of university students in China established that the quality of their sleep was a direct predictor of their suicidal ideation and thus the importance of this correlation in academic environments where students are under pressure is high [5]. The influence of environmental context is underscored by research indicating that students in shared living environments, such as hostels, report significantly poorer sleep quality and higher stress levels, creating a fertile ground for mental health challenges [6]. Finally, a recent meta-analysis consolidated evidence that sleep disturbances constitute a robust, independent risk factor for suicidality, reinforcing the need to target sleep health within prevention strategies [7]. Despite this accumulating evidence, significant gaps remain, particularly concerning the application of these findings to non-Western, student-specific populations and the exploration of modifiable environmental predictors [5]. For example, while the longitudinal study by Xu et al. [5] confirms the sleep-suicide link in an academic context, its focus on a Chinese sample limits its applicability to South Asian settings like Pakistan, where unique socio-cultural and academic pressures may alter this dynamic. Furthermore, although research identifies shared living as a risk factor, it does not quantitatively establish hostel residence as a strong predictor of both sleep impairment and suicidal ideation relative to other demographics, a key finding of our study [6]. The employ generic sleep measures that fail to capture the perceived causal link between poor sleep and suicidal thoughts, a nuance essential for targeted screening [9]. This points to a critical methodological shortcoming: the lack of a brief, integrated tool like the S-SIRS used in our study, which is specifically designed to assess how sleep disturbances are subjectively linked to suicidal cognition in a student population. Therefore, this study was conducted to address these gaps by investigating the sleep-suicide nexus in Pakistani students, quantifying the role of the specific environment. This study was conducted to address critical research gaps by examining the link between sleep disturbances and suicidal ideation among students in a non-Western setting. To achieve this, the study developed and validated the Sleep–Suicide Ideation Rating Scale (S-SIRS) as a specific and sensitive tool for this population. Ultimately, these findings contribute to improved screening and timely intervention strategies for student mental health.

Although growing evidence links poor sleep with suicidal ideation, limited research has examined this relationship within non-clinical Pakistani student populations and specific environmental contexts such as hostel residence. Existing studies often rely on general sleep measures and fail to assess the perceived connection between sleep disturbances and suicidal thoughts. Additionally, there is a lack of brief, culturally relevant screening tools tailored to student settings. Therefore, this study addressed these gaps by developing the S-SIRS and evaluating sleep disturbances as a modifiable risk factor for suicidal ideation among young students. The research aimed to determine the strength and nature of this association, identify key environmental and demographic predictors, and assess the S-SIRS's utility.

METHODS

A cross-sectional web-based survey was undertaken at the University of Punjab during the period March 2025 to June 2025 to study the correlation between sleep problems and suicidal thoughts among Young Students [10]. A purposive sampling approach was used to recruit 150 participants who were between the ages of 18 and 30 years. The choice of this non-probability method to conduct this initial validation study of the S-SIRS scale was intentional to ensure that core subgroups are included, namely day scholars and hostel residents, and this will allow making meaningful group comparisons that meet one of the research objectives [11]. This study focuses on young students aged 18 to 30 years, a demographic period encompassing both adolescence and young adulthood as defined by the World Health Organization (WHO, 2021). This age range captures a critical developmental phase where individuals face significant academic, social, and psychological pressures, making them a key population for investigating mental health risk factors. Inclusion criteria were being a currently enrolled university student, age between 18 and 30 years, and provision of informed consent. Exclusion criteria included a self-reported history of a diagnosed psychiatric disorder and incomplete submission of the survey. Data were collected using the self-developed, 13-item Sleep–Suicide Ideation Rating Scale (S-SIRS). The scale was designed to assess sleep quality, specific disturbances, and their perceived impact on suicidal thoughts. <mark>It employs a 5-point Likert scale with responses graded as: 1 = "Never," 2 = "Rarely," 3 = "Sometimes," 4 = "Often," and 5 = "Always." The development process involved a literature review, expert panel

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evaluation for content validity, and a pilot test (n=20) for clarity and comprehension, resulting in the final 13-item instrument. The scale demonstrated acceptable internal consistency in the present sample (Cronbach's α = 0.748). This approach to scale development is consistent with established methodologies for creating culturally relevant instruments in behavioral health research [12]. An online survey hosting the S-SIRS and a demographic questionnaire was disseminated to students of the University of Punjab aged 18 to 30 years. To facilitate recruitment, the survey link was distributed through targeted social media channels, including student-specific groups and forums on platforms like WhatsApp and Instagram. Before participation, all individuals were presented with a digital information sheet outlining the study details, and electronic informed consent was mandatory to proceed. The study protocol was approved by the Institutional Review Board of the University of Punjab, and all procedures were conducted in accordance with the ethical standards of the Declaration of Helsinki. All analyses were performed using R statistical software (version 4.5.1) [13]. Descriptive statistics summarized participant characteristics. The Shapiro-Wilk test confirmed that the data significantly deviated from a normal distribution ($p<0.05$), justifying the use of non-parametric tests [14]. Spearman's rank-order correlation (ρ) examined the association between sleep disturbances and suicidal ideation [15]. The Mann-Whitney U test (with effect size r) and Kruskal-Wallis H test (with effect size η^2) were used for group comparisons [16]. Firth's penalized-likelihood logistic regression was employed to address class imbalance in the outcome variable and to identify predictors of high suicide risk, with results reported as Odds Ratios (OR) and 95% Confidence Intervals (CI) [17]. An Elastic Net regression model was also run to identify the most salient predictor variables. The sample size of 150 was determined based on methodological recommendations for scale validation studies, which suggest a minimum participant-to-item ratio of 10:1 for factor analysis and reliability testing [18]. The Sleep-Suicide Ideation Rating Scale (S-SIRS) is a 13-item self-report instrument designed to assess sleep quality and its perceived impact on suicidal thoughts. The items cover several interrelated domains, including symptoms of insomnia (e.g., difficulty falling or staying asleep), daytime fatigue and impaired function, sleep-related cognitive distortions (e.g., hopelessness, racing thoughts), and the specific link between sleep deprivation and the frequency, intensity, and perceived controllability of suicidal ideation. Responses are recorded on a 5-point Likert scale, where 1 = "Never," 2 = "Rarely," 3 = "Sometimes," 4 = "Often," and 5 = "Always."

RESULTS

This table describes a sample of 150 participants, characterized by a relatively even gender distribution. The cohort is predominantly composed of unemployed individuals (56.7%), single individuals (who appear to make up 56.7% when calculated from the provided data), and urban residents (64.7%). A majority of participants held a Bachelor's degree and were day scholars (73.3%), indicating a sample largely comprised of young, urban adults in transitional or early career stages (Table 1).

Table 1: Demographic Characteristics and Descriptive Statistics (n=150)

Characteristics	Group	Frequency (%)
Gender	Male	78 (48.0%)
	Female	72 (52.0%)
Occupational Status	Employed	40 (26.7%)
	Student	25 (16.7%)
	Unemployed	85 (56.7%)
Educational Level	Bachelors	73 (48.7%)
	Masters	32 (21.3%)
Marital Status	Divorced	10 (6.7%)
	Married	55 (36.7%)
	Single	85 (36.7%)
Residential Status	Hostel Resident	40 (26.7%)
	Day Scholar	110 (73.3%)
Residential Area	Rural	97 (64.7%)
	Urban	53 (35.3%)

A Spearman's rank-order correlation revealed a statistically significant, positive association between sleep disturbance and suicidal ideation, $\rho=0.402$, $p<0.001$. This indicates that as levels of sleep disturbance increase, there is a corresponding moderate increase in levels of suicidal ideation (Table 2).

Table 2: Bivariate Correlation Between Sleep Disturbance and Suicidal Ideation

Variable 1	Variable 2	Spearman's ρ (95% CI)	p-Value	Interpretation
Sleep Disturbance	Suicidal Ideation	0.402 (0.260, 0.530)	<0.001	Significant Weak Positive Correlation

The analysis revealed distinct demographic predictors for sleep disturbances and suicidal ideation. Sleep disturbances were significantly higher among females ($p=0.003$, $r=0.24$), rural residents ($p<0.001$, $r=0.31$), and particularly hostel residents, who also reported the strongest effect for both sleep disturbances ($p<.001$, $r=0.42$) and suicidal ideation ($p<0.001$, $r=0.38$). Furthermore, education level was a significant predictor for both constructs, showing the largest effect sizes among the demographic variables ($\eta^2=0.11$ for sleep, $\eta^2=0.10$ for suicidality) (Table 3).

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Table 3: Significant Group Differences in Sleep Disturbances and Suicidal Ideation

Variables	Group Comparison	Scale	Test Statistic	p-Value	Effect Size
Sleep Disturbances					
Gender	Female vs Male	Sleep Disturbances	W = 2021.5	0.003	r = 0.24
Residential Area	Rural vs Urban	Sleep Disturbances	W = 3455.0	<0.001	r = 0.31
Residential Status	Day Scholar vs Hostel	Sleep Disturbances	W = 1304.0	<0.001	r = 0.42
Occupational Status	Multiple groups	Sleep Disturbances	$\chi^2(2) = 7.16$	0.028	$\eta^2 = 0.05$
Education Level	Multiple groups	Sleep Disturbances	$\chi^2(4) = 16.43$	0.003	$\eta^2 = 0.11$
Marital Status	Multiple groups	Sleep Disturbances	$\chi^2(2) = 9.92$	0.007	$\eta^2 = 0.07$
Suicidal Ideation					
Residential Status	Day Scholar vs Hostel	Suicidal Ideation	W = 1322.5	<0.001	r = 0.38
Education Level	Multiple groups	Suicidal Ideation	$\chi^2(4) = 14.44$	0.006	$\eta^2 = 0.10$
Marital Status	Multiple groups	Suicidal Ideation	$\chi^2(2) = 6.61$	0.037	$\eta^2 = 0.04$

The analysis revealed distinct patterns of group differences, with sleep impairment showing broader demographic variation than suicidal ideation. Notably, residential status emerged as the only factor significantly associated with both sleep impairment and suicidal ideation, suggesting environmental context may play a particularly important role in this relationship. While gender, residential area, and occupational status showed significant effects on sleep impairment, these demographic factors did not translate to differential suicidal ideation, indicating that sleep disturbances may manifest differently across demographic groups without necessarily escalating to suicidal thoughts (Table 4).

Table 4: Predictor Effects

Predictor	Beta (β)	SD Error	Odds Ratio (OR)	95% CI for OR	p-Value
Sleep Impairment Total	0.210	0.055	1.233	(1.110 - 1.384)	<0.001
Age (Numeric)	0.048	0.048	1.049	(0.955 - 1.155)	0.315
Gender (Male)	-0.991	0.431	0.371	(0.154 - 0.853)	0.019
Occup. Status (Student)	-0.482	0.610	0.618	(0.184 - 2.076)	0.433
Occup. Status (Unemployed)	-0.548	0.410	0.578	(0.255 - 1.290)	0.181

Sleep impairment emerged as the strongest statistically significant predictor of high suicide risk (OR = 1.233, p<0.001), indicating a 23.3% increase in odds per unit increase in sleep impairment score. Gender also demonstrated significance, with male showing 62.9% lower odds of high suicide risk compared to female (OR = 0.371, p = 0.019). Age and occupational status were not statistically significant predictors in this model, as their confidence intervals included 1.0 and p-values exceeded 0.05 (Figure 1).

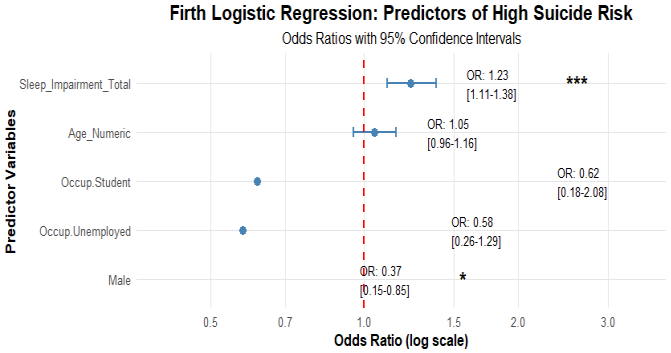

Figure 1: Logistic Regression: Prediction of High Suicide Risk

The Elastic Net regression demonstrated limited predictive utility, explaining only 5.2% of variance in suicidal ideation scores (R^2 = 0.052). Despite this limited explanatory power, the regularized coefficients identified education level as a strong protective factor, while early morning awakening (β = 1.37) and sleep-related irritability (β = 1.34) emerged as the most salient sleep-related risk predictors (Table 5).

Table 5: Elastic Net Regression: Model Performance and Predictor Importance for Suicidal Ideation

Aspect	Parameter	Result
Model Performance	R-squared	0.052
	RMSE	5.154
	MAE	4.282
Optimal Parameters	Alpha (α)	0.5
	Lambda (λ)	0.2363
Top Predictors (by	absolute Coefficient	—
	Education Level: Masters	-4.273
	Sleep: Wake Up Early	1.373
	Sleep: Irritable	1.336
	Occupational Status: Unemployed	-1.319

DISCUSSION

This cross-sectional study provides evidence of a significant association between sleep disturbances and suicidal ideation in Young Students, with sleep disturbances showing a positive correlation (ρ = 0.402) and

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emerging as the strongest identified factor linked to high suicide risk (OR = 1.233). Our findings support a conceptual pathway where specific environmental and demographic factors contribute to sleep deprivation, which in turn is significantly linked to an increased likelihood of suicidal thoughts, accounting for a 23.3% increase in odds per unit increase. These results underscore the critical role of sleep health as a modifiable target in suicide prevention strategies. Our results are strongly supported by recent international research. A large-scale meta-analysis confirmed that insomnia symptoms confer a significant risk for suicidal ideation, independent of depressive symptoms, aligning with our finding of sleep's independent predictive power [19]. Furthermore, a longitudinal study of Chinese university students demonstrated that poor sleep quality directly predicted increased suicidal ideation over 6 months, reinforcing the temporal precedence suggested by our correlational data [20]. The salience of specific sleep components in our study, particularly early morning awakening, is echoed in recent work by Shapiro and Wilk, who identified sleep maintenance problems as a critical marker of near-term suicide risk [14]. The significantly higher sleep disturbances among hostel residents likely stem from a confluence of environmental factors, including chronic noise, lack of privacy, and irregular schedules, which disrupt circadian rhythms and increase perceived stress [21]. These conditions, unique to shared living, create a high-risk environment that demands targeted interventions like sleep hygiene programs within university hostels." The development and initial validation of the S-SIRS address a clear gap in context-specific assessment tools. Our scale demonstrated acceptable reliability (α = 0.748), performing comparably to other recently developed brief screening instruments in low-resource settings [22]. The S-SIRS's focus on the perceived impact of sleep on suicidal cognition offers a nuanced approach that may enhance risk detection in primary care and educational settings, where detailed clinical interviews are often impractical. This study has several limitations that must be considered. The cross-sectional design precludes any causal inference between sleep disturbances and suicidal ideation, a constraint common in observational research [10]. The reliance on self-reported data introduces the potential for recall and social desirability biases [23]. While purposive sampling allowed for targeted recruitment, it limits the generalizability of our findings beyond similar demographic contexts [11]. Furthermore, the sample size, though adequate for initial scale validation, may have limited the statistical power to detect smaller effect sizes and necessitates further validation in larger, more diverse cohorts.

This study has several key limitations. The cross-sectional design prevents causal inference between sleep disturbances and suicidal ideation. The reliance on self-reported data introduces potential for recall and social desirability biases. Furthermore, while purposive sampling facilitated targeted recruitment, it limits the generalizability of findings. Finally, important confounding variables such as academic stress, substance use, and social support were not assessed. Future studies should use longitudinal and multicenter designs to establish causal relationships and improve generalizability. Incorporating objective sleep assessments and clinical mental health screening tools would strengthen diagnostic accuracy. Intervention-based research evaluating sleep hygiene programs and campus mental health strategies is also recommended.

CONCLUSIONS

This study demonstrates a robust association between sleep disturbances and suicidal ideation among university students, identifying sleep quality as an immediate modifiable target for intervention. The heightened risk associated with hostel residence underscores how environmental factors can disrupt sleep, while specific components like early morning awakening offer precise intervention points. These findings strongly support integrating sleep health assessment into campus mental health protocols and implementing evidence-based interventions like Cognitive Behavioral Therapy for Insomnia in student healthcare systems.

Authors' Contribution

Conceptualization: MI
Methodology: MI
Formal analysis: MI
Writing and Drafting: MI, IF, NA
Review and Editing: MI, IF, NA

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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Navigating Challenges Evaluating Health System Responses to Burn Injuries in Quetta, Balochistan

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ABSTRACT

Burns are a significant health issue in the population of low- and middle-income countries such as Pakistan. This is especially acute in the resource-strained province of Balochistan, where the healthcare system in terms of assisting burn victims in Quetta, is compromised due to a great number of systemic flaws. **Objectives:** To assess the effectiveness of the healthcare system to treat burn injuries in Quetta, Balochistan, in terms of analyzing the primary barriers to care, such as infrastructural inadequacy, the lack of staff, and sociocultural issues. **Methods:** The qualitative research design of semi-structured interviews was ascertained by the 24 interviewees in the semi-structured interviews with the professionals in the field of burn care who could reflect the patients, givers, and policymakers. Primary data were collected at the different health facilities of Quetta. Thematic analysis was able to reduce the wide categories and problems in burn care. **Results:** The financial aspect was a great concern, and the treatment was prohibitive expensive. Moreover, an increase in the number of delays in seeking care was caused by sociocultural factors, including gender-based decision-making. All these results indicate the existence of significant barriers, which are founded on insufficient investments, the absence of highly qualified staff, and ineffective infrastructure, which lead to the need to establish the overall changes in the treatment of burns. **Conclusions:** An interdisciplinary Burn Care strategy should be more preoccupied with changes in infrastructure, education of medical workers, and community involvement.

INTRODUCTION

The issue of burn accidents is one of the primary health concerns of the population in the whole world and in particular in low- and medium-income countries (LMIC). The medical facilities available in these locations are highly inadequate, and it is a significant drawback to the management of trauma patients at such locations [1]. These are specialized injuries that would require specialized clinical treatment, yet they would encompass some minor injuries to possibly fatal cases of third-degree burns. According to the WHO report, more than 180,000 deaths are caused by burn accidents annually, and increasing numbers are in the growing countries that have a disproportionate share of the number [2]. This level of mortality is caused by poor facilities, poor access to healthcare, and even loss of specialized training among healthcare professionals [3]. Burn incidents have psychological and financial long-term impacts on their victims and their families, in addition to short-term physical injuries [4]. Burn care-demanding conditions are exacerbated in Balochistan, in the Quetta District, especially, by physical isolation, the presence of socioeconomic disparities, and the availability of special remedy centers [5]. The lack of dedicated burn equipment and inadequate clinical resources are the most significant constraints that the medical device in this location should overcome in its attempt to provide active and sustainable

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burn care. Moreover, cultural stigmas and false ideals usually deprive the sufferers of access to the appropriate clinical care, which postpones the cure and adds to the morbidity and mortality [6]. Balochistan, however, still has numerous empty holes in the healthcare network of burn victims, even though the treatment of burns has improved worldwide. Poor effects for burn sufferers are resulting from some of the factors, along with inadequate pre-health facility care, a loss of complete rehabilitation programs, and a scarcity of emergency delivery services [7-9]. Inequities in access to burn care are made worse through social determinants of health, together with poverty and illiteracy. Research is scarce on burn care practice in Pakistan, primarily in local poor areas such as Balochistan. National fitness regulations habitually overlook specialized terrains such as burn control in the desire for maternal and toddler fitness [10, 11]. By feeding intensive Quetta's healthcare gadget reaction to burn accidents, investigating the infrastructure that is presently in place, establishing the procedure of the limitations, and suggesting strategies for increasing patient outcomes, this study seeks to close this gap. The study uses a qualitative technique to file the lived reviews of sufferers, clinical specialists, and legislators in an effort to inform future initiatives.

Although burn injuries are a major public health concern in low- and middle-income countries, limited qualitative research has explored how health system responses and sociocultural barriers specifically affect burn care delivery in under-resourced regions like Quetta, Balochistan. Existing literature largely focuses on clinical outcomes rather than systemic infrastructure gaps, financial barriers, and gender-based decision-making influencing access to care. There is also insufficient stakeholder-based insight from patients, providers, and policymakers regarding real-world challenges in burn management. Therefore, this study addressed these gaps by examining healthcare system effectiveness and identifying key structural and sociocultural barriers to burn care. This study aims to evaluate the effectiveness of the healthcare system's response to burn injuries in Quetta, Balochistan, by identifying key barriers to care, including infrastructural deficiencies, staffing shortages, and sociocultural factors. To inform the development of an integrated burn care strategy that enhances service delivery and improves patient outcomes in low- and middle-income settings.

METHODS

A descriptive qualitative study was conducted, utilizing semi-structured in-depth interviews. This design was chosen to provide a comprehensive exploration of burn injury management within the healthcare system in Quetta, Balochistan, and to gather detailed insights into the experiences and perceptions of key stakeholders. The qualitative method was strategically chosen in order to learn about a complex array of social and institutional processes that involved the lived experience of healthcare professionals, patients, and policy makers in burn care. This design would fit a delicate intuition into the fight and hurdles in this essential setting of healthcare. The study was conducted in various locations, namely, the Burn Departments of Bolan Medical Complex Hospital and Civil Hospital Quetta, and the community. This flexibility in settings was to bring in a wide view of burn care management, taking the institutional practices and the issues at a community level into consideration. Ethical approval was granted by the Health Services Academy (HAS) and an Institutional Review Board (IRB) to help with adherence to ethical research dictates (000885/HAS/MSPH-2023). Informed consent was obtained from all participants, and confidentiality was assured with coded identifying data and the use of secure data storage. Participants were also informed of their right to withdraw from study participation at any time without consequence, to emphasize respect for their autonomy. The collection of data was conducted in March-April 2025, and it was done in a triangulation format, comprising semi-structured interviews and analysis of the appropriate documents. Interviews of a length of 45 to 60 minutes are the result of structured discussion guides; they allow discussion in detail about some experiences of participants. Moreover, policy documentation and hospital documentation were taken into consideration in order to identify the systemic issues in delivering burn care that could include a comprehensive account of the situation. Interview Process. The interviews were in the form of semi-structured interviews to make the discussion more open-ended, to allow the participants to narrate their experiences in detail. Such a degree of flexibility stimulated the respondents to present their views and perceptions, thereby enriching the qualitative data in order to make sure that critical themes would be generated in an ad-hoc fashion. Participants of the sampled group had relevant expertise in the field of burn management; the basic strategy of purposive sampling was used in selecting the appropriate subjects. This strategy made sure that there was a rich mix in the viewpoint, such as those specializing in burn care, patients, caregivers, and policymakers. The availability of selectivity of the sample improves the content and application of the data recorded. The purpose of this research was to recruit 15-30 respondents so that they could saturate the themes to get a rich and diverse set of data. The composition of the people served in the breakdown was: 7 patients from Bolan

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Medical Complex Burn Center, 6 patients from Civil Hospital Burn Center, 5 healthcare providers from Bolan Medical Complex, 4 healthcare providers from Civil Hospital, and 2 policymakers. This distribution reflects a balanced representation of key stakeholders involved in burn care. The data were analyzed using a rigorous thematic analysis approach, following the framework outlined by Braun and Clarke (2006). The process was conducted manually by two independent coders to enhance reliability. The analysis involved six key phases: 1) transcription and immersion in the data; 2) generating initial codes; 3) searching for themes by collating relevant codes; 4) reviewing and refining themes; 5) defining and naming themes; and 6) producing the final report. To ensure consistency, the coders first independently analyzed a subset of transcripts and then met to discuss and reconcile coding discrepancies, establishing a unified coding framework. This framework was then applied to the entire dataset using NVivo software (version 14) to manage the codes and themes systematically. Emerging themes were continuously reviewed and contextualized within the existing literature on burn care. To increase the credibility of the findings, member checking was used to validate findings with participants to ensure that their perspectives were represented. Data source triangulation also added a layer of reliability by confirming results on multiple types of data. Reflexivity was sustained through a research journal, enabling the researcher to capture personal reflections and address possible bias in the research over the course of the study.

RESULTS

The total of 24 people from Quetta, Balochistan, participated in this study, and it yielded some valuable insight as to the hindrances to receiving burn care services. Five medical professionals working at Bolan Medical Complex, four from the Civil Hospitals, two legislators, and seven patients with burns from the Bolan Medical Complex Burn Centre and six from the Civil Hospital Burn Centre, comprised the eclectic group. The results showed that there is a serious problem in the Burn Departments, mostly caused by a lack of funding, disorganized infrastructure, and inadequate personnel. The themes that emerged after analysis (Table 1).

Table 1: Key Themes Identified in the Study on Burn Care Services in Balochistan

Theme	Description
Barriers to Burn Care	Highlights obstacles such as inadequate funding, insufficient infrastructure, and personnel shortages.
Financial Strain	Discusses the high costs of treatment and the financial burdens faced by patients and families.
Infection Risks	Addresses the prevalence of hospital-acquired infections (HAIs) and their impact on patient safety.
Inadequate Facilities	Examines the outdated and poorly equipped burn units affecting care quality.
Sociocultural Factors	Explores how gender roles and societal norms influence healthcare decisions, particularly for women.
Knowledge Gaps	Identifies a lack of awareness regarding burn first-aid procedures among the community.
Need for Comprehensive Care	Highlights the absence of essential support services, such as psychological and nutritional care.
Policy and Systemic Reform	Emphasizes the need for systemic changes and investment in dedicated burn care facilities.
Impact of Stigma	Discusses the stigma faced by burn survivors and its effects on mental health and treatment-seeking.

Particular note is nosocomial infections (or HAIs) that are not adequately addressed with infection prevention and control (IPC) specialists. The possibility of HAIs was a major consideration in the participants' minds, particularly when burn patients are transferred to nearby trauma wards that lacked the substantial resources for specialized care. One medical facility, "When burn patients are treated outside of dedicated burn units due to inadequate resources, the incidence of infections skyrockets," the provider said (Table 2).

Table 2: Key Concerns Regarding Burn Care Include Infection Risks, Financial Strain, and Inadequate Facilities, as Reflected in Participant Quotes

Concern Type	Description	Participant Quotes
Infection Risks	High Incidence of nosocomial infection due to a lack of IPC specialists	"When burn patients are treated outside of dedicated burn units, infections skyrocket."
Financial Strain	Exorbitant costs of burn care, particularly in private hospitals.	"The private hospital requested 10,000 rupees to begin the drip."
Inadequate Facilities	Insufficient infrastructure characterized by a lack of isolation facilities.	"Orthopedic or surgical, it doesn't matter; we just place them wherever there is a bed."

Participants frequently expressed concerns about the exorbitant expenses of burn care, particularly in private hospitals, and financial strain surfaced as a significant barrier. One patient revealed, "The private hospital requested 10,000 rupees to begin the drip." I had nothing. Families frequently had to make difficult decisions, selling valuables or taking out loans to pay for therapy. Another major obstacle was the inadequate facilities. With a combined capacity of 10 to 20 beds, the Burn Unit is divided into three sections: an upper plastic surgery ward, a post-burn ward, and a Burn Intensive Care Unit. But the infrastructure is antiquated and devoid of characteristics that are necessary for providing quality care. Due to the lack of appropriate isolation facilities, many burn victims were admitted to regular surgical wards, which raises the risk of infection. "Orthopedic or surgical, it doesn't matter; we just place them wherever there is a bed," a clinical

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officer observed. Furthermore, when accidents happen, patients are frequently transferred to Civil Hospital Quetta, which has between 30 and 50 beds but struggles with inadequate funding and space. Although the private hospital Aria Institute of Medical Sciences offers a Burn ICU, many people cannot afford its treatments. The provincial healthcare system is woefully under-resourced and cannot meet the needs of Balochistan's 4,894,402 residents, as estimated by the 2023 census. Facilities like the Bolan Medical Complex and Civil Hospitals are under tremendous strain due to this shortfall (Table 3).

Table 3: Critical Gaps in Burn Care Services

Gap Types	Description
Resources Shortage	Lack of essential painkillers and grafting equipment.
Absence of Specialists	No psychologists or nutritionists are available in burn departments
Outdated Infrastructure	The current infrastructure in burn wards does not meet the medical quality standard

Nurses emphasized the urgent need for more resources and training, stating, "We lack essential painkillers and grafting equipment. The family has to buy them if they can afford it." The absence of psychologists and nutritionists within the departments further highlights gaps in comprehensive care. An expert in infection prevention and control remarked, "The current infrastructure in the burn ward is outdated and does not meet medical quality standards." This sentiment was echoed by a policymaker, who stressed, "The government needs to prioritize the development of burn wards, especially since the incidence rate of burns is higher here than in other provinces." Sociocultural factors also had a significant impact on patient care, especially for women who frequently relied on male family members to make healthcare decisions, which could cause severe delays. "When I asked my husband to take me, he told me to wait," recalled a 34-year-old patient. My wound got worse. As one 28-year-old survivor noted, "For months, I felt the need to hide my face." Burn survivors also experienced a great deal of stigma. People's perceptions of me varied. All participant groups exhibited a widespread lack of knowledge about critical burn first-aid procedures. An adolescent said, "I recommended applying ice or toothpaste. A crucial knowledge gap that could be filled by focused educational programs is highlighted by the statement, "We lack training for situations like this." The overwhelming burden in areas with high burn event rates was recognized by policymakers, who noted that poor facilities significantly impede efficient management. "We have only a few burn care centers, which is grossly inadequate in a region with a population of 5 million," one legislator underlined. To improve management of burn care in Balochistan, a number of new policy proposals based on these findings have been put out. Among these are the following: setting up comprehensive training programs to equip healthcare professionals in burn management; launching educational campaign to raise awareness of burn prevention and burn first-aid practices; investing in the develop of dedicated burn centers; services of mental health to support burn survivors; and investing in a subsidized burn care programs to reduce financial burden to patients and improve referral system to ensure access to specialized care. It is also suggested that a new policy be established to create an Integrated Burn Care Strategy, which would include the hiring of psychologists, dietitians, and IPC specialists in burn departments. In order to remedy the systemic problems highlighted in the study and promote an efficient and humane approach to the treatment of burns in Balochistan, this would also aim to provide sanitary settings and ensure adequate training for the medical personnel.

DISCUSSION

This observation emphasizes the pressing need for systemic modifications in burn care offerings by highlighting the complicated problems that burn sufferers in Quetta, Balochistan, face. The consequences display that, in view of the fact that many sufferers have to pay for his or her care in full, economic obstacles seriously hinder access to active treatment. This is consistent with worldwide studies displaying that burn sufferers regularly experience delayed or denied care because of financial lack of confidence in low- and middle-income nations [12-14]. These problems are exacerbated by an inadequate healthcare infrastructure, which compromises the quality of care due to a lack of specialized burn care equipment and essential supplies. According to similar research from different LMICs, members said receiving remedy in trendy wards, highlighting the pressing need for stepped forward facilities [15, 16]. Access to remedy is likewise restrained through sociocultural and gender-associated boundaries, specifically for female sufferers who are stigmatized and rely on male decision-makers. These consequences are consistent with observations, which emphasize how gender norms have an effect on healthcare-seeking for behaviors [17-19]. Overall, this observation emphasizes how sociocultural, infrastructure, and monetary elements all have an effect on access to burn care. The diffusion of the head onto halt burn care deliverances in Balochistan, in addition to those terms, requires hot on those fronts through big-sized cover substitutions and web animation demands [20].

The study was limited by a small purposive sample from selected hospitals, which restricts generalizability and may introduce selection bias. Reliance on qualitative self-reported perceptions without quantitative health outcome

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data may affect objectivity and broader comparison. Future research should include larger multicenter mixed-method studies, incorporate patient outcome measures, and evaluate policy interventions and integrated burn care models in similar low-resource settings.

CONCLUSIONS

This study highlights the significant challenges that burn patients face in the specific context of Quetta, Balochistan. The healthcare system in this region may greatly improve the caliber and availability of burn treatment services by putting these context-specific suggestions into practice, which would eventually benefit patients within this province. While the barriers identified may resonate with other low-resource settings, the findings and recommendations of this study are specifically applicable to the local context of Quetta, Balochistan. This study serves as a call to action for <mark>local and regional policymakers and healthcare providers to collaborate in creating a more effective approach to burn care in this region.

Authors' Contribution

Conceptualization: MAA
Methodology: ZK[1], MAA, RHF, ZK[2]
Formal analysis: ZK[1], KR
Writing and Drafting: KA, AK, MA
Review and Editing: MAA, ZK, RHF, ZK, KR, AK, MA

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

Conflicts of Interest

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Serum Electrolytes and Their Combined Effect on Hyperuricemia among Type 2 Diabetic Patients

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ABSTRACT

Hyperuricemia (HU) is a metabolic and kidney dysfunction that is rapidly prevailing. To compare the diabetic, gender, and age-based response of magnesium and potassium in patients with diabetes mellitus (DM) type 2. **Objectives:** To compare the diabetic, gender, and age-based response of magnesium and potassium in patients with diabetes mellitus (DM) type 2. **Methods:** It was a randomized controlled trial (single-blinded) conducted on 290 patients. Four groups were formed: T1 (control), T2 (Magnesium), T3 (Potassium), and T4 (Magnesium + Potassium). Supplements were given for a period of two months. Blood samples from subjects were taken before (phase I) and after (phase II) the supplements. Unpaired t-test and multivariate Analysis of Variance (MANOVA) were applied. **Results:** Among 290 participants, 195 were female (67.2%) and 95 male (32.7%), with 159 (54.8%) of all participants in the age range of 46-65 years. The mean uric acid levels dropped from 5.5 mg/dL to 4.6 mg/dL after medication intervention. Significant differences in BSF/R, HbA1c, and uric acid levels were reported between phase I and phase II; p-values <0.001, 0.0025, and 0.04, respectively. MANOVA determined that T3 was highly significant with respect to gender (0.005) and T4 with respect to age (0.01). While the control group showed the largest absolute drop in uric acid, potassium supplementation (T3) demonstrated a consistent and statistically significant reduction relative to baseline and across gender groups. **Conclusions:** Potassium substantially plays an effective role in lowering the BSF/R and uric acid levels of T2DM patients and is controlled by gender.

INTRODUCTION

Diabetes mellitus type 2 is a complex metabolic condition categorized by elevated levels of blood sugar and changes in carbohydrates, lipids, and protein metabolism, primarily due to insulin resistance (IR). T2DM is a prolonged disease that affects adults and can cause symptomatic hyperglycemia, which may be life-threatening. Insulin deficiency, either complete or partial, also disrupts the balance of various minerals and electrolytes. These minerals have an essential role in maintaining the body's electrical gradients, acid-base stability, nerve signaling, blood clotting, and muscle function [1]. In 2011, T2DM was identified in 366 million individuals. Diabetic complications can result in disability and decrease quality of life. Diabetes increases the number of microvascular and macrovascular complications. T2DM is primarily associated with cardiovascular disease (CVD), kidney diseases and is a major cause of mortality [2, 3]. By 2040, it is estimated that T2DM, a significant lifestyle disease, will affect over 640

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million adults worldwide, posing a global burden [4]. Research evidence suggests a direct relationship between serum uric acid (SUA) levels and the development of diabetes. Obesity and diet are well-known risk factors for this association. Hyperuricemia promotes insulin resistance partly through inhibition of endothelial function. Approximately 17% more people are at risk of developing diabetes for every SUA increment of 59.5 mm/L [5]. In addition to DM, CVD, and CKD, HU is involved in the origin and progression of various chronic diseases, commonly associated with gout [6]. Uric acid and metabolic diseases are closely related. To maintain optimal insulin sensitivity and glucose tolerance, uric acid levels should be monitored and managed [7]. Data from epidemiological studies show roughly 21.4% of adult's experience hyperuricemia, while prevalence rates in several Asian countries range from 13% to 25.8% [6, 7]. Those with diabetes may experience both hyper- and hypo-electrolyte levels due to electrolyte imbalances [8-10]. Hyperuricemia is characterized by serum urate concentrations above 400 µM. Magnesium (Mg^{2+}) regulates excitability in the central nervous system through ion channel conductivity, and significant amounts are lost during food processing [11]. Mg^{2+} is one of the body's fourth most abundant positive ions and is involved in over 300 enzymatic reactions [12]. Potassium (K^{+}) is abundant in saliva, and its concentration is regulated by cellular transporters in the salivary duct. Although the mechanisms regulating salivary creatinine and uric acid are not fully understood, increased plasma UA and creatinine may facilitate their diffusion through cell membranes or intercellular junctions [13].

Although electrolyte imbalances and hyperuricemia are recognized in type 2 diabetes mellitus (T2DM), limited randomized trials have examined the combined and comparative effects of magnesium and potassium supplementation on uric acid regulation and glycemic control. Existing studies mainly focus on observational associations rather than intervention-based outcomes or gender- and age-specific responses. Furthermore, evidence from Pakistani populations remains scarce. This study aims to evaluate the role of magnesium and potassium in regulating uric acid levels in type 2 diabetic patients and improving their quality of life.

METHODS

A randomized controlled trial (single-blinded) was conducted for nine months from September 2022 to May 2023 on the use of supplements of magnesium and potassium and their combined effect on hyperuricemia of diabetic patients. The study setting was Lahore Garrison University (LGU) (RCT trial registration: NCT04642313). Each participant received the assigned intervention (magnesium, potassium, or their combination) for a duration of 2 months. Participants were randomly assigned to one of the four intervention groups (T1–T4) using a computer-generated simple randomization sequence with equal allocation. The trial was single-blinded: participants were unaware of their group allocation, and outcome assessors analyzing blood samples were blinded, while investigators administering the supplements were aware of group assignments." Blood samples of 290 subjects were collected from Akhuwat Medical Services, Lahore, with written consent. All diabetic patients of both genders and an age range of 26-85 years were included in the study. Individuals with the following condition(s) were not included: gestational diabetes, diabetic nephropathy, and psychiatric illness. To test the effects of potassium and magnesium supplements on hyperuricemia in T2DM patients, four groups were formed. Group 1 (T1) called as placebo group was administered with inert placebo capsule containing starch (250mgx2); Group II (T2), magnesium group, was provided with magnesium in form of Ostin (250mgx2); Group III (T3) received potassium supplements in form of Paravit (250mgx2); and Group IV (T4) received both magnesium and potassium through Bionta administration (250mgx2). Samples were taken before the intervention of supplements (Phase I) and after 60 days of intervention (Phase II). Serum uric acid was measured by the uricase-peroxidase method, blood glucose by the glucose oxidase-peroxidase method, and HbA1c by HPLC, using standard protocols with internal quality control. Statistical analysis was performed using IBM SPSS® version 26.0. Ethical Approval was taken from LGU.

RESULTS

Among 290 participants, 195 were female (67.2%) and 95 were male (32.7%), with 159 (54.8%) of all participants in the age range of 46-65 years. The mean uric acid levels dropped from 5.5 mg/dL to 4.6 mg/dL after the medication intervention. A significant p-value <0.001 shows that there are significant differences in the BSF/R (fasting blood sugar, random blood sugar) of subjects before and after the medication intervention. The R-squared value implies that 88.2% of the significant change observed in BSF/R values during Phase II is due to the medication intervention. Moreover, the T3 group has the highest drop in BSF/R levels, i.e., by 41 units. Further, the significant p-value of 0.005<0.05 highlights that the variance between phase I and phase II HbA1C levels was due to the intervention medication. Moreover, the R-squared value indicates that 70% of this significant variance was affected by the supplements. HbA1c levels drop substantially in the T4 group, i.e., by 1.3 units (Table 1).

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Table 1: Unpaired t-Test for BSF/R Levels and HbA1C Levels

Variables	Phase I	Phase II	p-Value	R-Squared Value
BSF/R Levels				
T1	160.6 ± 67.12	134.6 ± 27.1	<0.001	0.8812
T2	179.6 ± 80.96	138.9 ± 32.29		
T3	186.6 ± 88.66	137.9 ± 32.6		
T4	185.5 ± 83.96	146.5 ± 58.22		
Overall	178.4 ± 81.04	139.5 ± 39.57		
HbA1C Levels				
T1	7.816 ± 2.115	6.783 ± 1.385	0.005	0.7003
T2	6.881 ± 1.711	6.492 ± 1.145		
T3	7.965 ± 2.079	6.777 ± 1.448		
T4	8.244 ± 2.155	6.968 ± 1.458		
Overall	7.72 ± 2.075	6.705 ± 1.3		

The differences between phase I and phase II uric acid levels are statistically significant (0.04<0.05). The significant differences are due to the supplementation intervention, which is responsible for 40% of the differences. The highest drop is observed in the T3 group, i.e., by 0.9 units in uric acid levels (Table 2).

Table 2: Unpaired t-Test for Uric Acid Levels

Variables	Phase I	Phase II	p-Value	R-Squared Value
Uric Acid Levels				
T1	6.718 ± 1.804	4.2 ± 1.445	<0.001	0.8812
T2	5.216 ± 0.9887	4.724 ± 1.427		
T3	5.443 ± 1.083	4.520 ± 1.362		
T4	4.433 ± 1.313	4.514 ± 1.082		
Overall	5.538 ± 1.644	4.641 ± 1.339		

To compare the gender and age-based response of the medication intervention on hyperuricemia in T2DM patients, MANOVA (Multivariate Analysis of Variance) was applied on the uric acid levels for each group (T1, T2, T3, T4). The data was adjusted for normality. The homogeneity of variances in uric acid levels across different categories of gender and age group is validated by the insignificant p-values for Levene's Test of Equality of Error Variances for all the intervention groups. i.e. 0.595 (T1), 0.136 (T2), 0.652 (T3), and 0.709 (T4). The Multivariate Test table 4 indicates significant differences in uric acid levels pre- and post-medication intervention with respect to gender, age, and the combined effect of gender and age. The results manifest that in the control group, the uric acid levels are significantly affected by whether the subject is male or female (0.01<0.05). Similarly, when only K+ is given, uric acid levels deviate significantly with respect to gender (0.005<0.05). However, when Mg+2 and K+ are ingested together, age will largely affect the uric acid balance (Table 3).

Table 3: Multivariate Test Results for Age, Gender, and Combined Effect

Intervention Groups	Multivariate Testa, Wilk's Lambda P-Values		
	Age	Gender	Age * Gender
T1	0.519	0.01	0.599
T2	0.099	0.407	0.153
T3	0.242	0.005	0.268
T4	<0.001	0.193	0.191

The study indicates the shift in the proportions of males and females with low, normal, and high uric acid levels after receiving the medical intervention. There is an increase in the frequency of both male (by 7.4%) and female (by 21.5%) with normal uric acid after the treatment. Whereas, drastic drops are observed in the high uric acid of male (by 13.7%) and female (by 14.3%) (Table 4).

Table 4: Cross Tabulations Between Uric Acid Levels, Age, and Weight

Uric Acid Levels		Phase I, n (%)	Phase II, n (%)
Male (n=95)	Low	0	6 (6.3%)
	Normal	71 (74.7%)	78 (82.1%)
	High	24 (25.2%)	11 (11.5%)
Female (n=195)	Low	0	4 (2.0 %)
	Normal	125 (64.1%)	167 (85.6%)
	High	70 (35.8%)	24 (21.5%)

Cutoff values for uric acid categories: Low (<4.0 mg/dL), Normal (4.0–6.0 mg/dL), High (>6.0 mg/dL)

DISCUSSION

The current study is a trial-based investigation into the effects of serum electrolytes' administration on hyperuricemia regulation, which poses a grave danger in escalating T2DM-associated hormones. This is evident by a study which stated that among the various investigative variables in T2DM patients, hyperuricemia causes the worst diabetic outcomes if left unattended [14]. The reason for reporting the values of BSF/R and HbA1C along with uric acid levels lies in the findings of a study that for each 0.1mmol/l increase in serum uric acid, the risk of diabetic complications increased by 28% [15]. The results in this study further add that the medication intervention not only combats hyperuricemia but also manages diabetes. The increased levels of serum magnesium reduce the serum uric acid levels, as the odds of the prevalence of HU were decreased by 0.65 times [6]. This supports our general idea of the study, where Mg administration reduced uric acid levels along with levels of BSF/R and HbA1C. In research on a predictive model for hyperuricemia among T2DM patients, sex was included among the risk factors for hyperuricemia as reported by LASSO regression analysis [16]. This study also entails that the effect of K supplementation in reducing hyperuricemia is controlled by gender. The control group (T1) exhibited a

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larger absolute reduction in uric acid compared to potassium alone, which suggests that the role of potassium may be less direct than initially assumed. The apparent benefit may therefore be influenced by baseline variation or unmeasured confounders, and this should be interpreted with caution. This study is the first of its kind that explores the effectiveness of Mg, K, and their combined effect on hyperuricemia in managing T2DM as suggested in a review [17]. Previous studies regarding this topic have explored hyperuricemia in predicting the risk of T2DM, hypertension, and CVD. A study concludes that serum uric acid levels strongly varied with hyperinsulinemia and plasma glucose levels in female. This supports our gender-based frequency distribution findings of the drops in uric acid levels after the intervention, where more female had reduced serum uric acid levels and ultimately reduced glucose levels. The present study showed a higher baseline prevalence of hyperuricemia in females (35.8%), several large-scale studies have reported the opposite trend, with higher prevalence in males (up to 69.55%) [18–20]. This apparent contradiction may reflect differences in study population, dietary patterns, or regional factors. This study highlights that more females had hyperuricemia (35.8%) before the medication trial, whereas other studies declare that hyperuricemia was abundant in males (69.55%) [18–20]. Taken together, these findings suggest possible sex-specific responses to electrolyte supplementation that merit further investigation in larger and more diverse populations.

This study had some limitations, including a relatively small sample size, short trial duration, and lack of detailed control for dietary intake, lifestyle factors, and electrolyte dosage levels. These may have influenced both uric acid and glycemic outcomes. The potassium dose used was modest and selected for safety; stronger reductions in serum uric acid may require higher therapeutic doses. Future studies should include longer follow-up, larger multicenter samples, detailed dietary monitoring, and dose-response trials to better clarify the therapeutic role of electrolyte supplementation in T2DM.

CONCLUSIONS

Potassium supplementation was associated with reductions in BSF/R and modest decreases in uric acid among T2DM patients, while combined potassium and magnesium showed age-related effects. However, since the control group showed a greater uric acid decline than the intervention groups, these findings should be interpreted cautiously. Larger, well-controlled studies are required to clarify whether potassium has a specific role in uric acid regulation in T2DM.

Authors' Contribution

Conceptualization: NB
Methodology: NB
Formal analysis: NB, SH, RHU
Writing and Drafting: UR, SK, NI, TAF
Review and Editing: NB, SH, RHU, SK, NI, TAF

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

Conflicts of Interest

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Assessment of Occupation-Related Lower Limb Venous Disorders Using Doppler Ultrasonography: A Cross-Sectional Study

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ABSTRACT

The lower limb contains the hip, femur, knee joint, tibia, fibula, and foot. Some common abnormalities of lower limbs are varicose veins, followed by deep vein thrombosis, fractures, tumors, etc. **Objectives:** To evaluate lower limb venous abnormalities in patients related to their occupation using Doppler ultrasonography. **Methods:** This was a descriptive cross-sectional study conducted within the Radiology Department. A high-frequency linear probe, a TOSHIBA ultrasound machine, and the patient table were used in the equipment for this study. The patients were included after written consent. A sample size of 117 patients was considered using a convenience sampling technique. All patients with lower limb pain, swelling, tortuous veins, and tenderness were included in the study. The data were entered and analyzed using SPSS version 26.0. **Results:** Lower limb abnormalities are most common at the age of 41-50 years, 46 (39.3%). There were 75 (64.1%) male in the study and 42 (35.9%) female in the study. Most of the patients, 41 (35.0%), were housewives, followed by businessmen, 4 (20.5%). Superficial femoral vein 55 (47.0%) was involved in most patients. The most common diagnosis was varicose veins, 71 (60.7%), followed by deep vein thrombosis (DVT), 32 (27.4%). Lower limb venous abnormalities are seen to be more common in male than in female. These abnormalities are common at the age of 41-50 years. **Conclusions:** In conclusion, the most common occupation is seen to be housewives. The most common venous abnormality was left-sided varicose veins, followed by Deep Vein Thrombosis.

INTRODUCTION

The lower limb contains the hip, femur, knee joint, tibia, fibula, and foot. The femur is one of the longest, heaviest, and strongest bones in the body. The femur contains a pyramid neck attached to the proximal side, two bony protrusions, and a lesser and greater trochanter that move the hip and knee [1]. The hip is a kind of ball-and-socket joint composed of the acetabulum, which is connected by the ligament femoris. The knee, also called the patella, is the largest joint of the human body. The knee contains the medial collateral ligament, the lateral collateral ligament, the anterior cruciate ligament, and the posterior cruciate ligament. Its main functions are to provide movement and weight-bearing to the human upper skeleton [2, 3]. The venous system of the lower limbs is divided into two parts: superficial veins and deep veins [4]. The femur is supplied by the femoral artery (a branch of the external Iliac artery), medial and lateral circumflex arteries, and obstructer artery (IIA) [5]. Deep Vein anatomy in the lower limbs varies quite a bit. Veins typically follow arteries. The posterior tibial, peroneal, and anterior tibial veins run with the major arteries in the leg; there are often two, but seldom three, veins with each artery. The gastrocnemius veins, which are the greatest of these, are visible in the upper calf as they ascend to join the other deep veins in the lower popliteal area. The small saphenous vein is located subcutaneously on the fascia surrounding the calf, whereas the

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gastrocnemius vein can be followed distally down into the muscle [6]. Some common abnormalities of lower limbs are varicose veins, followed by deep vein thrombosis, fractures, tumors, etc. DVT can be symptomatic or asymptomatic and can cause severe complications in the human body [7]. Some risk factors of DVT are ankle, femoral fractures, diabetes, and pulmonary embolism. The incidence of DVT in adult populations is 1.6 1.8 approximately 1 per 1000 annually. In one month, approximately 6% died with DVT and 10% with PE [8]. Diagnoses of DVT are lower in the United States, while 25% higher in America. It is seen to be more common in men than in women. The mortality rate of DVT is higher in the early years, while the annual mortality rate noted was 1.6% [9]. DVT is mostly asymptomatic and cannot be detected on physical examination. Prolonged work- and computer-related seated immobility also increases the risk of venous thromboembolism, highlighting the occupational component of venous disorders [10]. When it is symptomatic, some common symptoms can be a warm affected site, swelling, pain, redness of the area, and engorged superficial veins of the legs. Some other symptoms, including discoloration, dilated superficial veins, and swelling, can be noted in case of calf vein thrombosis [11]. A symptom called Homan's sign is noted during examination, suspecting DVT, in which when the knee is extended, DVT with dorsiflexion or the foot will experience calf pain [12, 13]. Varicose veins are another type of lower limb pathology. In varicose veins, dilatation of veins occurs most commonly in the lower limbs, often linked to occupational strain and prolonged standing [14]. Discomfort in legs, discoloration of the area around the ankle, cluster of veins, enlarged veins, and dark veins are common clinical features. Some common causes are prolonged sitting, standing, damage to the valves of the lower limbs, and loss of elasticity in the veins. Another abnormality is a thrombus in the lower limb [15]. After surgery, most tiny thrombi in the lower extremities usually resolve on their own. However, these thrombi may expand into the proximal femoral venous system of the leg in roughly 15% of patients [16, 17]. Blood flow in the veins slows and even stops in certain places when there is no regular contraction of the leg muscles, such as while walking or moving, which puts patients at risk for thrombosis. Around 15% of isolated calf vein thrombi in the postoperative patient extend to the femoral vein, whereas up to 50% of all isolated calf vein thrombi resolve spontaneously within a few hours [18]. The current study shows that Color Doppler ultrasound depicts the type and level of incompetence, venous reflux, and presence of varicose veins and superficial thrombosis. The study suggests that Doppler ultrasound can help in the early detection of clinically suspected cases. Furthermore, it emphasizes the association between occupational risk and venous abnormalities, encouraging early screening in professionals with prolonged standing or sitting jobs. The current study creates awareness among people of several professions involving long conditions to get scanned early in case of any discomfort to prevent pulmonary embolus and other complications of the lower limbs.

Although Doppler ultrasonography is widely used to diagnose lower limb venous disorders, limited research has specifically explored the relationship between occupational factors and venous abnormalities in symptomatic Pakistani populations. Previous studies mainly focused on disease frequency or diagnostic accuracy rather than occupation-related risk patterns and side predominance. There is also a lack of local descriptive data on vein involvement and demographic distribution. Therefore, this study aimed to assess occupation-related lower limb venous disorders using Doppler ultrasonography and to describe the prevalence, patterns of vein involvement, and common diagnoses among symptomatic patients.

METHODS

This was a descriptive cross-sectional study conducted within the Radiology Department of Aziz Bhatti Teaching Hospital, Gujrat, Pakistan. The primary aim of this analysis was to describe the sample characteristics and the prevalence of findings. Therefore, the results are presented using descriptive statistics (frequencies and percentages) to summarize the data. Inferential statistics were not employed as the study design was not geared towards testing specific hypotheses or associations between variables. Data were obtained from the hospital in the period of 6 months from September 2022 to February 2023. A high-frequency (7–10 MHz) linear probe, a TOSHIBA ultrasound machine, and a patient table were used in the equipment for this study. The patients were included after written informed consent. Ethical approval was taken from the institute. The subjects were informed that there are no bio-effects of Doppler USG, and the procedure was non-invasive. Patients were scanned in the supine and standing positions. The probe was placed in the longitudinal plane. The scan started from the iliac veins, followed by the saphenous, inferior calves, and superficial veins. Then the patient was turned into a decubitus position to scan the knee and lower leg partially. A sample size of 117 patients was calculated by taking the mean of three previously published articles, using convenient sampling techniques. The sample size was calculated using the formula for estimating a single population proportion for descriptive

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cross-sectional studies. Based on previous literature, the proportion (p) of lower limb venous abnormalities in symptomatic patients was assumed to be 50% to obtain the maximum sample size, with a 95% confidence level and a 9% margin of error (d). This calculation yielded a minimum sample size of 119 participants. The final sample of 117 was therefore adequate and aligns closely with this calculated requirement. Convenience sampling was used as patients were enrolled from those presenting to the Radiology Department during the study period; although this may introduce selection bias, it was the most feasible approach to achieve the required sample size within the available time frame. Patients who had lower limb symptoms were included in the study and were included in the Radiology Department. All patients with lower limb pain, swelling, tortuous veins, and tenderness were included in the study. Patients diagnosed with scrotal hernia, femoral hernia, and carcinoma were excluded from the study. The data were collected using data sheets according to the variables of the questionnaire, including age, gender, diagnosis, site, occupation, and USG findings. All examinations were performed using a TOSHIBA ultrasound machine with a 7–10 MHz linear probe. Patients were examined in supine and standing positions. Scanning was performed in a longitudinal plane from the iliac to the calf veins, including common femoral, superficial femoral, popliteal, great and lesser saphenous veins. B-mode imaging assessed vein morphology and compressibility, while Color and Spectral Doppler evaluated flow direction and reflux. Venous reflux was defined as reverse flow >0.5 seconds in superficial and >1.0 seconds in deep veins after compression or during the Valsalva maneuver. Non-compressibility with absent color flow indicated deep vein thrombosis (DVT). All findings were recorded on standardized data sheets, and machine settings were kept uniform to ensure consistency. The data were entered and analyzed using SPSS version 26.0. Given the descriptive nature of this cross-sectional study, the analysis was focused on summarizing the sample characteristics and the prevalence of findings. Descriptive statistics were employed: categorical variables (e.g., gender, occupation, diagnosis) are presented as frequencies and percentages (n, %). Continuous variables (e.g., age) were categorized and also presented as frequencies and percentages. No inferential statistical tests (e.g., chi-square, t-tests) were applied, as the study objective was to describe the distribution of venous abnormalities and not to test formal hypotheses or associations between variables.

RESULTS

Findings show the age of the patients. The age was divided into different groups. The first age group was 20-40 years, 45 (38.5%), followed by 41-50 years, 46 (39.3%), and 61-70 years, 26 (22.2%). Lower limbs abnormalities are most common at the age of 41-50 years, 46 (39.3%). The study illustrated the distribution of patients' ages in relation to lower limb abnormalities. This suggests that lower limb abnormalities are most prevalent among middle-aged patients. There were 75(64.1%) male in the study and 42(35.9%) female. 41 (35.0%) were housewives, 24 (20.5%) were businessmen, 24(20.5%) were storekeepers, 20 (17.1%) were painters, and 8 (6.8%) were jobless. Most of the patients, 41 (35.0%), were housewives, followed by businessmen (Table 1).

Table 1: Age and Gender of the Patients

Variables	Frequency (%)	Valid Percent	Cumulative Percent
Age			
20-40 Years	45 (38.5%)	38.5%	38.5%
41-50 Years	46 (39.3%)	39.3%	77.8%
61-70 Years	26 (22.2%)	22.2%	100.0%
Total	117 (100%)	100.0%	–
Gender			
Male	75 (64.1%)	64.1%	64.1%
Female	42 (35.9%)	35.9%	100.0%
Total	117 (100.0%)	100.0%	–
Occupation			
Housewife	41 (35.0%)	35.0%	35.0%
Businessman	24 (20.5%)	20.5%	55.6%
Storekeeper	24 (20.5%)	20.5%	76.1%
Painter	20 (17.1%)	17.1%	93.2%
Jobless	8 (6.8%)	6.8%	100.0%
Total	117 (100.0%)	100.0%	-

Common femoral veins were involved in 35 (29.9%) patients, followed by the popliteal vein in 3 (2.6%), the great saphenous vein in 13 (11.1%), the lesser saphenous vein in 3 (2.6%), deep calf veins in 8 (6.8%), and the superficial femoral vein in 55 (47.0%). In most of the patients, superficial femoral veins are 55 (47.0%), followed by common femoral veins 35(29.9%)(Table 2).

Table 2: Vein involvement

Variables	Frequency (%)
Common Femoral Vein	35 (29.9%)
Popliteal Vein	3 (2.6%)
Great saphenous vein	13 (11.1%)
lesser saphenous vein	3 (2.6%)
Deep Calf veins	8 (6.8%)
Superficial femoral vein	55 (47.0%)
Total	117 (100.0%)

The study presents the distribution of venous abnormalities according to the affected side. Findings revealed that venous abnormalities were predominantly left-sided, observed in 82 patients (70.1%), whereas 35 patients (29.9%) showed right-sided involvement. This indicates that left lower limb venous abnormalities were

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more frequent among the study participants (Table 3).

Table 3: The Side of the Leg

Variables	Frequency (%)
Right	35 (29.9%)
Left	82 (70.1%)
Total	117 (100.0%)

Normal patients referred to symptomatic patients who presented with lower limb complaints but showed no detectable venous abnormalities on Doppler ultrasonography. These patients were included because they met the clinical inclusion criteria, although their scans were reported as normal. The most common diagnosis was varicose veins, 71 (60.7%), followed by DVT, 32 (27.4%), and cellulitis, 7 (6.0%) (Table 4).

Table 4: Diagnosis of the Patients

Variables	Frequency (%)
Cellulitis	7 (6.0%)
Varicose Veins	71 (60.7%)
DVT	32 (27.4%)
Normal	7 (6.0%)
Total	117 (100.0%)

DISCUSSION

A study was done by Sharma et al. in which 100 patients of all ages and genders were included. All patients were present in the radiology department complaining about lower limb pain or swelling, etc. The objective of the study was to evaluate the frequency of lower limb venous abnormalities using color Doppler ultrasonography. In the study, it was concluded that lower limb venous abnormalities are most commonly seen in the aged 21 to 40 years. The study also revealed that the frequency of varicose veins is most seen in patients who were presented to the radiology department and were followed by DVT [19]. The current study also concluded that the most common disease diagnosed in patients using Doppler ultrasonography is varicose veins. Varicose veins are more common in males, including lower limb tortuous veins. One retrospective study was done by Zaria *et al.* in which a total of 252 patients were included. All patients visiting the Radiology Department for the scan of the lower limbs were included in the study. The scanning of patients was done by using DC-3Mindray Ultrasound machines. The most common focus on lower limbs venous abnormality was on DVT. Out of 252 patients, 122 were male and 130 were female. The objective of the study was to determine the role of USG in diagnosing DVT as a lower limb venous abnormality. The results of the study revealed that DVT is more common in females in middle age. Left-sided leg DVT was more common than right-sided DVT. DVT was most noted in the area above the knee joint. The study concluded that DVT can accurately be diagnosed by using ultrasonography as a gold standard [20]. The current study also concluded that DVT is common in patients after varicose veins in which is commonly noted above the knee joint, and it is seen to be more common in the left-sided leg than the right-sided leg. A study was done by Abou-ElWafa *et al.* in which a questionnaire was used to record the answers of patients. A sample size of 201 patients was taken. The study aimed to evaluate the varicose veins and their associated risk factor in patients. It was concluded in the study that prolonged standing is one of the major risk factors with a prevalence of 18.4% for developing varicose veins in patients referred to the radiology department [21]. In the current study, most of the patients were housewives and had a history of prolonged standing and sitting. It is proven that prolonged sitting and standing are the cause of lower limb venous abnormalities. Another study done by Subramani and fellows concluded that one of the most common and accurate tools for diagnosing venous abnormalities of the lower limb is ultrasound. Color Doppler ultrasound is also useful for assessing blood flow, edema, and other important parameters to evaluate venous abnormalities. The study revealed that ultrasound is a noninvasive, portable, and cheap modality for diagnosing lower limb pathologies [22]. The current study also proved that venous abnormalities of the lower limb can be accurately diagnosed using color Doppler ultrasonography. The study was limited by a single-center descriptive cross-sectional design, convenience sampling, and reliance on descriptive statistics without inferential analysis, which restricts generalizability and causal interpretation. The inclusion of only symptomatic patients may introduce selection bias. Future research should include multicenter analytical studies with larger representative samples and apply inferential statistics to evaluate occupational risk associations more robustly.

CONCLUSIONS

In conclusion, this study found that varicose veins were the most common lower limb venous abnormality, followed by deep vein thrombosis. These conditions were more frequently observed in the left lower limb and were most prevalent among individuals aged 41–50 years. Housewives constituted the largest occupational group affected, highlighting a potential association between prolonged standing and venous disorders.

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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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