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RESEARCH ARTICLE
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LOW BACK PAIN IN PEOPLE WITH LOWER LIMB AMPUTATION: A CROSS-SECTIONAL STUDY

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Abstract
Low back pain (LBP) is the most prevalent type of musculoskeletal disorder affect quality of life among large numbers of individuals. (LBP) after (LLA) can occurs on various multi factor like prosthesis use, sedentary lifestyle, physical inactivity, psychological factor. To determine the prevalence of LBP and identify associated risk factors among unilateral and bilateral below-knee amputees in Karachi. A cross sectional study based on physical questionnaire. The aim was to investigate the prevalence and intensity of low back pain (LBP) in people with lower limb amputation (LLA). Physical questionnaire include six section, demographic information, comorbid conditions, history of LLA, history of LBP, and acceptance of the amputation. the study was conducted in Jinnah post graduate medical center (jpmc), Dr. ruth k.pfau civil hospital diabetic foot center. Data collected by interview base questionnaire with participants base on unilateral and bi-lateral lower limb amputee atleast 1 one year before participation. Chi-square tests will assess associations between categorical variables, using SPSS version 22. This study will help to determine the factors which initiate the low back pain (LBP) in lower limb amputee (LLA) in Karachi. The result will help clinician and rehabilitation centers to improve patient's quality of life.

Keywords: Low Back Pain, Lower Limb Amputation, Prosthetics, Prevalence, Risk Factors, Rehabilitation

Introduction
1. Lower limb amputation (LLA) is a severe surgery of the removal of part or the entire lower extremity. It is typically performed to cure the diseases of severe trauma, peripheral vascular disease (PVD) and diabetes mellitus and intractable infections, as life-saving or life-enhancing intervention (Kim et al., 2020). The burden of LLA is significant worldwide, and its incidence rates are likely to rise with the rise in the level of diabetes and vascular diseases, and impact approximately one million individuals annually (Kris-Etherton et al., 2021). The impact of LLA is much higher than actual physical loss, and it provokes immense problems with mobility, their own autonomy, and the quality of life (Seves et al., 2021). Rehab of individuals with LLA is a complex process that is complicated and, in most occasions, accompanied with other secondary physical and psychological

issues. Those are phantom limb pain, dermatology in relation to the usage of the prostitute, and psychological adapting to altered body image (Calabrese et al., 2023). A comorbidity in this group of people is chronic low back pain (LBP), which is very important and should not be overlooked. Both amputation and the use of prosthetics provoke biomechanical alterations that expose the whole musculoskeletal system to special loads, and patients with LLA are particularly susceptible to the further progression of LBP, additional impaired functional recovery and quality of life.

1.2 Low Back Pain (LBP) and Its Relevance

LLA One of the most common musculoskeletal disorders in the entire world is low back pain, the lifetime prevalence of which exceeds 80 percent in the general population, and it is among the top reasons behind disability (Oosterhoff et al., 2022). It can manifest itself in acute or chronic pains, which can have a great impact on everyday life and well-being. Multifactorial Aetiology of LBP Multifactorial in nature because it encompasses muscular strain, degenerative disc disease and postural abnormalities and is typically exacerbated by lifestyle factors lent by sedentary behavior and obesity. Incidences and impacts of LBP, however, are much more prevalent in patients with a lower limb amputation. Epidemiological studies show that 52 to 89 percent of amputees do develop LBP at some point post amputation and this proves to be very high compared to the non-amputated population (Mazzone et al., 2020). The radical changes in biomechanics are the primary issue that has contributed to this augmented threat. The loss of a limb disturbs natural balance of the body and leads to modification of the gait patterns and compensatory movements as well as alteration of the center of gravity. The adaptations also often cause the uneven loading of the lumbar spine and muscles surrounding it (Hudson, 2022). The benefit of the prosthesis is already conflicting; on the one hand, it is mandatory to recover the mobility, on the other hand, it can develop LBP. The poor socket fit, misalignment, and the low dynamic response of some of the components of the prosthetic may also force the user to assume abnormal posture and movement further subjecting the lower back to mechanical stress (Bischoff, 2024). Consequently, LBP within the group is not some by-product of the functional and biomechanical fact of being an amputee. It can be a debilitating aspect that highly restricts participation in the rehabilitation process, the training of the prosthetic and the resultant cycle of reduced activity, deconditioning and heightened pain, which consequently has its own serious effects on mental and social interactions.

1.3 Rationale of the Study

Even though LLA has been reported as common, its aetiology, predisposing factors, and the best management practices in patients with LLA are not well known. Even though a number of studies have explored LBP in the general population, the size of the research has resulted in establishing the number of amputees (Miyamoto et al., 2022). The LBP causes, such as the level of amputation, specific gait components, nature of the prosthetic equipment, and lifestyles of patients such as their physical activity level are less evident determinants that are more important in designing specific rehabilitation plans (Kasher et al., 2023). Besides, most available studies are cross-sectional, and do not present data concerning the slope and persistence of LBP post-amputation (Sadowski et al., 2022). It is certain that there is a need of research that will quantify the problem and also identify the risk factors that can be altered. The knowledge on the multifactorial processes of LBP in LLA patients is broadly unknown to be and this is the reason why this study is warranted. This study must provide evidence that would assist in influencing clinical practice through examining prevalence and the most critical factors connected to it, which would lead to more effective preventive actions, more effective rehabilitation programs, and ultimately, the better long-term health outcomes of this patient population..

1.4 Objectives and Research Questions

The primary aim of the study will be to examine the burden and correlates of the low back pain in people with lower limb amputation in a systematic way.

The specific objectives are:

- To determine the prevalence and severity of low back pains in a sample of individuals whose lower limbs are amputated.
- To identify the risk factors (e.g., the degree of amputation, the use of the prostitute and the fit of the prostitution, the number of physical activities and comorbidities such as diabetes and obesity) that are associated with the development and severity of LBP in this population.
- The research questions that will be applied in the study are the following:
- Precisely what is the point prevalence of clinically significant low back pain among individuals who undergo lower limb amputation?
- What are the significant demographic, clinical and prosthetic associated variables that are associated with the occurrence and intensity of LBP?
- What are the dimensions to which specific problems of the design and installation of prosthetics are connected to the experience of LBP?

1.5 Significance of the Study

The outcomes of the current research will have a considerable impact on different areas of care, particularly in the rehabilitative medicine and prosthetic. This research will provide a critical evidence base by precisely stating the area of scope, as well as specifying the key etiological factors behind low back pain (LBP) in the population of lower limb amputation (LLA). This will directly inform development of evidence-based rehabilitation protocols that are focused. The results will offer a more precise patella of patient examination to the clinicians and physiotherapists and would render it crucial to incorporate to the regular patient care the dynamic gait analysis and a specific core muscle strengthening program. The outcomes will make visible to the prosthetists the broad impact of accurate positioning of the prosthetic, socket fit and potentially the selection of improved prosthetic materials on musculoskeletal well-being other than just mobility and long term well-being of the spine. This study plays a role on legitimizing and magnifying a fairly un-rationalized aspect of their health to patients with LLA. It spurs the recognition of the high burden of LBP as a component of post-amputation care, a holistic aspect and not a nuisance that is accepted and valued by systematically recording the same. This will bring about active communication between the patients and the caregivers to seek management of back pain. Lastly, preventative measures can be opened up in this study by identifying the risk factors that can be changed whether it is through the use of prosthesis, exercise or some form of compensation. The potential outcomes are enormous: the significant reduction of the chronic pain, the decrease in the number of the analgesic drugs intake and their side effects etc., the functional mobility will be significantly enhanced. This domino effect can be directly translated into a better social involvement capacity, to become more self-reliant, and the end-stage of this outcome is better life quality, in general, or in other words, not only functionality, but also the quality of life.

LITERATURE REVIEW;

2. One common musculoskeletal ailment that has a major influence on functional ability, quality of life, and psychological well-being is lower back pain (LBP). Due to biomechanical changes, compensatory gait patterns, and postural adaptations, people with lower limb amputation (LLA) are especially vulnerable to lower back pain (LBP). The lumbar area is under more stress as a result of amputation, which modifies the typical load distribution over the spine and pelvis. According to the literature, prosthesis use, comorbidities, physical activity levels, and psychological support are some of the factors that contribute to the wide range of LBP prevalence in amputees (Sadowski et al., 2022; Highsmith et al., 2019). One of the main causes of disability worldwide and a significant factor in the general population's decreased functional ability and quality of life is lower back pain (LBP). The issue is exacerbated in individuals who have had a lower-limb amputation (LLA) because the amputation results in basic alterations to mobility, load distribution, and neuromuscular control that raise spinal loading and increase the risk of chronic LBP. Designing successful preventative and treatment plans for this high-risk group requires an understanding of the epidemiology, biomechanical causes, neuromuscular contributions, psychosocial modifiers, and

rehabilitative data for LBP in LLA patients. LBP is significantly more common in amputees than in the non-amputee population, according to recent systematic reviews and cross-sectional research, which also associate LBP with decreased prosthesis use, impaired mobility, and a lower quality of life. To improve functional results and design focused rehabilitation techniques, it is crucial to comprehend the multifaceted aetiology of LBP in this population. With a focus on demographic traits, biomechanical adaptations, pain prevalence, functional effects, and psychosocial factors, the current literature review summarizes findings from research published within the past ten years.

2.1 Frequency and Demographic Features;

Lbp is quite prevalent among people with LLA, according to several research. More than 90% of participants in a cross-sectional research by Sadowski et al. (2022) reported having back pain after an amputation. With 94.3% of individuals reporting pain, the current study supports these findings and emphasizes the significant burden of LBP in this community. In terms of demographics, men make up the majority of participants, which reflects the global trend of rising rates of traumatic amputation among men as a result of traffic accidents and workplace hazards (Yuan et al., 2023). Those that are impacted are usually middle-aged (between 50 and 55 years old) on average aligning with years of economic productivity and emphasizing possible socioeconomic repercussions when pain restricts activity or work. Because physically demanding employment are linked to increased musculoskeletal strain, gender and occupational characteristics may have an impact on both the experience of LBP and the risk of amputation (Sadowski et al., 2022). LBP is significantly more prevalent following LLA than in the general population, according to the majority of recent cross-sectional research and reviews. The definition (lifetime, 1-year, point prevalence), sample composition, and level/etiology of amputation all affect prevalence figures. However, recent large samples and systematic reviews generally report post-amputation prevalences in the range of 50%–90%, with many studies clustering around 60%–82% (lifetime or post-amputation) and 50%–70% (1-year). For instance, a cross-sectional study conducted in 2022 found that among a sample of 239 individuals, the post-amputation prevalence was 82% and the one-year prevalence was 70%. Elevated prevalence compared to non-amputee controls has been validated by systematic studies of traumatic amputees and mixed etiology cohorts. These reviews also observe that prevalence frequently rises with time post amputation, perhaps due to cumulative mechanical stressors and deconditioning. The majority of studies report a mean participant age in the 40–55 age range and a preponderance of male participants, which reflects higher rates of traumatic amputation among working-age men. These demographics affect exposure to physically demanding occupations as well as the likelihood of comorbid conditions (like diabetes) that complicate rehabilitation. Higher LBP rates are frequently linked to occupational characteristics (hard physical labor) and the degree of amputation (transfemoral > transtibial).

2.2 Physical and Biomechanical Aspects;

Limb Differences and Prosthesis Use Asymmetric gait, compensatory trunk motions, and greater loading on the contralateral limb are some of the major changes in post-amputation biomechanics. Roeder (2008) highlighted that while non-use or improperly fitted prostheses worsen lumbar strain, prosthesis use and good alignment might lessen spinal stress. 51.4% of patients in the current study wore a prosthesis, whereas 48.6% did not, indicating possible diversity in biomechanical load distribution and LBP risk. Secondary musculoskeletal pain, phantom limb pain, and residual limb discomfort are common. In the examined study, 60% of participants felt pain in the non-severed leg and 71.4% in the amputated limb. These results are consistent with earlier studies showing that misuse of the intact limb might lead to lower back pain (LBP) (Sadowski et al., 2022). Differences in limb length between intact and prosthetic limbs worsen compensatory mechanisms, leading to altered lumbosacral motions, postural asymmetry, and chronic pain (Brown, 2019). Increased lumbar moments, changed kinematics, and recurrent asymmetrical loading are the main mechanisms causing or aggravating LBP following LLA. The literature frequently discusses three interconnected biomechanical themes: increased spinal loading during daily tasks; prosthesis alignment/fit and limb-length discrepancies; and gait asymmetry and trunk compensation.

2.3 Trunk compensation and asymmetrical gait ;

Redistributing support, propulsion, and balancing techniques is necessary when a limb is lost. Greater pelvic rotation, changed step length and stance time asymmetry, greater lumbar rotational excursions while walking, and increased lateral trunk lean toward the prosthetic or intact side (depending on task) are typical compensations. The amount and frequency of lumbar shear and compressive loads are increased by these compensations. Larger trunk motions and stronger spinal loads in individuals with LLA compared to controls have been measured in a number of gait-analysis and musculoskeletal modeling investigations, and these changes have been linked to reported LBP. Because of the increased mechanical loss at the knee and hip levels, transfemoral amputees are known to use more significant compensating measures.

2.4 Limb-length disparity, socket fit, and prostheses alignment;

Pelvic obliquity and lateral trunk lean are increased by malalignment and socket-fit issues; even little differences in limb length, whether functional or actual, result in pelvic tilt, which leads to long-term asymmetric spinal loading. Although there is insufficient data from randomized trials, observational research and case reports demonstrate that prosthetic modifications that restore symmetry (alignment, socket geometry, component selection) lessen compensatory trunk motion and subjective back pain.

2.5 Effects of task and speed on spinal loading;

Spinal loads in amputees are task-dependent, according to musculoskeletal modeling study (walking speed, stair negotiation, sit-to-stand). bigger trunk motions during quicker walking, for instance, are correlated with bigger spinal loads, according to studies that mimicked walking at different speeds. Repeated exposure to high spinal loads during regular activity may therefore raise the risk of cumulative injuries and chronic discomfort. These results imply that spinal load exposure can be influenced by both pacing (changing activity exposure) and gait retraining. Low back pain (LBP) is very common in individuals with lower-limb amputation (LLA), according to several cross-sectional studies and systematic reviews. Prevalence estimates vary greatly depending on sample and criteria, but they are significantly higher than population estimates.biomechanicalto recent cross-sectional statistics, lifetime or post-amputation prevalence often between 50 and 82%, and 1-year prevalence figures are frequently close to 50 to 70% in numerous samples. Additionally, compared to amputees without LBP, these studies demonstrate that LBP in LLA is linked to decreased function, lower quality of life, and greater disability scores. Key points: According to some recent cross-sectional studies, reported prevalence following amputation ranges up to about 82%. Phantom pain and residual limb pain frequently coexist with LBP, and the presence of one type of pain frequently predicts the existence of others.

2.6 Suggested risk factors and processes;

The literature divides mechanisms into three categories: neuromuscular, biomechanical, and psychosocial/behavioral.

2.7 Gait-related and biomechanical elements ;

greater and/or abnormal lumbar spine loading results from altered gait mechanics following unilateral amputation, such as uneven step length, pelvic rotation, trunk lean, and greater lumbar moments on the intact side. Although causality is still not fully established, studies employing gait analysis and spine kinematics reveal correlations between the presence of LBP and changes in pelvic/spine motion. These biomechanical alterations are influenced by prosthesis alignment, socket fit, and degree of amputation (transfemoral vs. transtibial); transfemoral amputees frequently exhibit greater compensatory motions and a higher LBP load.

2.8 Neuromuscular factors:
control, endurance, and trunk muscles Neuromuscular variables, including paraspinal muscle atrophy, low trunk endurance, and altered activation patterns, are important in addition to gross kinematics.

2.9 Dysfunction of the paraspinal ;
Many amputees, especially those with persistent LBP, have decreased lumbar extensor function and multifidus, according to imaging and EMG investigations. Pain and increasing dysfunction are encouraged by this loss of local stabilizer function, which diminishes segmental control and increases reliance on passive structures. Reduced trunk muscular endurance is frequently seen and is associated with activity limitation and discomfort severity (e.g., shorter time for repetitive extension tasks). Adults with LLA have been shown to have deficiencies in paraspinal muscular activity, decreased lumbar extensor endurance, and atrophy/insufficient multifidus activation, which are associated with an increased risk of LBP. Studies using electromyography and imaging indicate that deconditioning and poor trunk muscle function are factors in the duration of pain.

2.9 Motor coordination and control Inefficient;
Load distribution may result from altered timing and co-contraction of the hip and trunk muscles. According to several laboratory investigations, amputees utilize compensatory motor patterns (such as greater erector spinae activation) to maintain the trunk during transfers and locomotion, which leads to early lumbar muscle discomfort and fatigue. Targeted retraining may be able to address these neuromuscular impairments (see Interventions).

3. Pain phenotypes in amputees:
residual limb pain, phantom pain, and low back pain Residual limb pain (RLP), phantom limb pain (PLP), and lower back pain (LBP) are three typical pain categories reported by amputees that frequently coexist and interact. According to cross-sectional research, having RLP or PLP raises the likelihood of also having LBP; similar brain pathways and central sensitization mechanisms have been suggested as potential causes. This comorbidity makes evaluation and therapy more difficult since treating one source of pain without taking into account coexisting sources runs the risk of providing insufficient relief.

3.1 Behavioral and psychological aspects;
Increased LBP prevalence or severity in amputee populations has been repeatedly linked to sedentary lifestyle, decreased physical activity, catastrophizing, depression/anxiety, and sleep disturbance. Psychosocial conditions frequently interact with pain experiences (such as phantom pain and residual limb pain) to exacerbate back pain outcomes. The psychosocial causes of chronic pain are highlighted by current pain science. Depression, anxiety, catastrophizing, fear-avoidance behaviors, sleep deprivation, and social isolation are frequently observed in amputees and are linked to increased LBP intensity and disability.

3.1 Lack of exercise and deconditioning ;
High rates of physical inactivity are seen in large studies of amputees. Inactivity restricts opportunities to reestablish symmetrical motor techniques and reinforces compensatory overuse patterns. Sedentary behavior also leads to core deconditioning and worse cardiovascular health. Higher LBP prevalence and severity are linked to lesser physical activity, according to cross-sectional research.

3.2 Pain and mental well-being ;
Particularly common in traumatic amputees, PTSD and depressive symptoms increase the sense of pain and restrict participation in rehabilitation. Psychosocial screening and brief therapies (CBT,

graded exposure) are often advised in multidisciplinary care since catastrophizing and fear of mobility are associated with worse pain outcomes and lower functional recovery.

3.3 Comorbidity, sleep, and smoking ;

Many amputee cohorts have high rates of smoking and multimorbidity (such as diabetes and osteoarthritis); both conditions might worsen tissue regeneration and increase pain sensitivity. Reduced pain tolerance and chronic pain are closely linked to poor sleep. Modifiable targets for secondary prevention include these behaviors and co-occurring diseases.

3.4 Clinical manifestations and outcomes;

LBP in amputees can range from persistent, incapacitating pain to sporadic mechanical low back discomfort. limited walking tolerance, less usage of prostheses, worse balance, limited involvement in sports and work, and a lower quality of life related to health are some of the consequences. Many patients claim that LBP started or got worse after amputation and that discomfort interferes with everyday activities. The --- 4. Research on interventions and proof of their efficacy The body of research supporting LBP therapies, particularly in LLA, is small but expanding. There are various categories for interventions: For amputees, LBP has significant functional implications. Reduced walking distances, higher prosthesis non-usage or intermittent use, poorer balance, challenges with ADLs (such as transfers and stair climbing), and decreased involvement in work and leisure activities are all reported by patients with chronic LBP. Amputees with LBP have lower health-related quality of life and greater disability ratings than those without, according to a number of cohort studies. LBP is also associated with increased use of healthcare services and discontent with the results of rehabilitation.

3.4 Programs for physical activity and recovery;

There aren't many randomized studies that focus on amputee populations. However, task-specific exercise, core stabilization, Pilates, and graded strengthening of the trunk and hip muscles have demonstrated promise in lowering pain and enhancing function, based on general LBP literature and small amputee studies. It is common to propose movement-based therapy and programs that enhance motor control and trunk endurance. Pilates plus postural coaching, for example, has been shown to reduce pain and improve function in amputees in recent pilot and quasi-experimental trials; however, sample numbers are still small and follow-up is brief. A key factor in determining musculoskeletal health is physical activity. Although 60% of participants said they played sports, 82.9% said they did not regularly engage in physical activity, suggesting that most people have sedentary lifestyles. According to earlier research (Alshehri et al., 2023; Sadowski et al., 2022), inactivity causes trunk deconditioning, decreased core stability, and heightened vulnerability to secondary diseases such lower back pain. It has been demonstrated that structured exercise regimens can lessen the severity of LBP in amputees by enhancing posture, spinal alignment, and muscular support (Awad et al., 2025). Sleep, Lifestyle Factors, and Comorbidities With 57.1% of participants having more than one comorbid disease (such as diabetes, hypertension, or arthritis), multimorbidity is widespread among people with LLA and may worsen musculoskeletal deterioration and systemic inflammation (Highsmith et al., 2019). Because insufficient sleep can lead to increased central sensitization, sleep patterns also affect how pain is managed. Longer sleep duration (6–8 hours) was shown to be significantly associated with non-amputated limb pain (OR=6.00, P=0.039), which may indicate compensatory inactivity or underlying discomfort. The prevalence of smoking was 45.7%, which is consistent with research showing nicotine reduces circulation, slows tissue repair, and increases pain perception (Sadowski et al., 2022). When taken as a whole, these health and lifestyle factors affect the degree of pain, functional limits, and the results of rehabilitation. Only a few direct studies were found in systematic reviews on exercise for lower back pain (LBP) in amputees, however the results showed that task-specific training, core stabilization, Pilates, and graded hip/trunk strengthening could improve pain and function. Reviews highlight the dearth of RCTs and demand trials with sufficient power. After 6–12 weeks of supervised trunk and hip training, recent quasi-experimental and pilot trials reveal improved functional scores and clinically significant pain reductions.

3.5 Gait training and prosthetic optimisation;

In addition to gait retraining, modifications to prosthetic alignment, socket fit, and component selection (microprocessor knees, suitable feet) can minimize compensatory trunk motions and lumbar strain. Several studies suggest prosthetic optimization as a component of LBP care. Instead of high-quality RCTs, the majority of the evidence is observational or pre-post. Reducing compensatory trunk motions and lowering spinal stresses can be achieved by optimizing prosthetic alignment, socket fit, and componentry (such as microprocessor knees and energy-storing feet). Randomized evidence is sparse, but observational studies show that prosthetic changes improve gait and reduce pain. It is advised to undergo gait retraining that focuses on symmetry, trunk placement, and step length normalization; limited trials have shown encouraging but moderate results.

3.6 Multidisciplinary methods ;

Multidisciplinary care involving prosthetists, pain psychologists, physiotherapists, and, where necessary, pharmaceutical management is supported by the literature. Although there are few conclusive studies in amputee populations, interventions that address both biomechanics (exercise, prosthesis) and psychosocial factors provide the most likely path to long-term recommendations. Multidisciplinary approaches involving prosthetists, physiotherapists, pain psychologists, occupational therapists, and physicians are recommended since LBP in amputees is biopsychosocial. Higher quality evidence is needed, however complex therapies combining exercise, prosthesis tuning, and cognitive-behavioral approaches show potential in observational and pre-post designs.

3.7 Additional modes;

There is little evidence to support manual therapy, spinal injections, or pharmaceuticals; most of the evidence is drawn from general LBP research. Prioritizing functional, conservative methods over invasive ones requires clinicians to balance risks and benefits.

3.8 Literature gaps and current evidence limitations;

Heterogeneity of studies: Small sample sizes, different amputation levels/etiologies (trauma vs. vascular), and different definitions of LBP (point, 1-year, lifetime) all restrict comparability. Few high-quality trials: The majority of the data is cross-sectional, cohort, or pre-post; there are few randomized controlled trials that explicitly test LBP treatments in amputees. Uncertain mechanistic causality: Longitudinal studies relating certain biomechanical patterns to later onset of LBP are scarce, despite the plausible contribution of changed biomechanics to LBP. These mechanistic pathways are being addressed by ongoing prospective procedures. Underrepresentation of non-traumatic amputees: Despite possibly having a significant LBP burden, vascular amputees (older, comorbid) are frequently understudied; many research focus on traumatic or athletic amputees.There are a number of recurring issues with the current body of evidence: Heterogeneity of definitions and measures: Meta-synthesis is hampered by research' disparate LBP definitions (lifetime vs. one-year vs. point), pain scales, and disability instruments. Small sample sizes and sampling bias: External validity is limited by the fact that many studies use small convenience samples, sometimes drawn from sports teams or prosthetics clinics. Underrepresentation of dysvascular amputation: elderly dysvascular amputees with severe multimorbidity are understudied; many studies concentrate on younger, traumatized amputees. The majority of designs are cross-sectional, which restricts the ability to draw conclusions about the causal relationship between gait adjustments and the development of LBP later on. Prospective cohort and mechanistic investigations are also scarce. Few RCTs: Most positive indications come from tiny pre-post or quasi-experimental studies; randomized controlled trials comparing rehabilitation packages are scarce.

3.9 Practice recommendations; (based on available data) ;

1. In the post-amputation follow-up, screen for LBP early and frequently (ask about onset, frequency, intensity, and functional constraints).
2. Combine targeted physiotherapy that focuses on hip strength, motor control, trunk endurance, and gait retraining with prosthesis optimization (alignment, socket fit).
3. Take care of psychosocial factors: encourage exercise, check for depression and catastrophizing, and, when necessary, include behavioral pain management techniques.
4. Promote research: RCTs of exercise + prosthesis therapies with long-term follow-up are required, as are bigger, standardized prospective cohorts. Such research is evident in recent trial methods

3.10 Considering the most recent data and clinical consensus:
1. Regularly check for LBP (onset, frequency, intensity, interference with function) during follow-up visits following amputation.
2. As soon as it is medically possible, early focused therapy with an emphasis on trunk endurance, hip strength, motor control, and gait symmetry should start.
3. Improve prosthesis alignment and fit; routine prosthetist evaluation and modification can lessen pain and asymmetry.
4. Take care of psychosocial issues; check for fear-avoidance, despair, and catastrophizing; when necessary, incorporate psychological treatments.
5. Encourage exercise and adaptive sports when it's safe to do so. Participating in sports and activities can improve posture, strengthen the trunk, and reduce the prevalence of lower back pain in certain populations.

3.11 Conclusion;

LBP is a very common, complex issue among individuals who have had their lower limbs amputated. A significant burden of pain and impairment results from the interaction of neuromuscular deficiencies, psychological variables, and comorbidities with biomechanical concerns (gait asymmetry, prosthesis complications, limb-length discrepancy). The data base is nonetheless constrained by small sample sizes, inconsistent designs, and a dearth of randomized studies, despite the existence of potential therapies, particularly exercise, gait retraining, and prosthetic adjustment. To transfer information from observational signals to clinical treatment recommendations that consistently lower the burden of LBP in this vulnerable population, a research plan that prioritizes prospective mechanistic studies and sufficiently powered RCTs would be crucial.

CHAPTER 3
METHODOLOGY

Study Setting:

This study was conducted across multiple healthcare facilities, including the Department of Foot and Wound Care, Dr. Ruth K. M. Pfau Civil Hospital Karachi, Jinnah Postgraduate Medical Centre (JPMC) Karachi, and Ziauddin Hospital Karachi.

Study Design:

Cross-sectional study design.

Target Population:

Community-dwelling individuals with unilateral or bilateral below knee amputations

Sampling Technique:

Convenient sample technique.

Study Duration:

The duration of this study is arund 6 months after approval of the synopsis.

Sample Size:

The sample size was calculated based on the prevalence of amputated patients calculated in the study titled “Prevalence and determinants of lower extremity amputations among type I and type II diabetic patients: A multicenter-based study". The estimated prevalence of LLA is 1.9 percent, keeping the CI at 95 per the estimated sample size for this N, which equals 29. Applying attrition of 50 percent the sample size has increased to N equals to 50 Sample size n = [DEFF*Np(1-p)]/[(d2/Z21-α/2*(N-1)+p*(1-p)] .

Sample Selection

Samples was selected on the basis of inclusion and exclusion criteria.

Inclusion Criteria:

Participants must meet the following criteria to be included in the study:

Adults aged 18 years or older.

Individuals who have undergone unilateral and bilateral below-knee amputation at least one year before participation.

Ability to understand and respond to the study proforma.

Willingness to provide informed consent and participate in the research.

Exclusion Criteria :

Bed ridden patients with other systemic disease

Inability to understand and respond to the study proforma.

Data Collection Procedure:

The data for this study was collected using a self-designed, close-ended questionnaire specifically developed to assess the prevalence of low back pain (LBP) among lower limb amputees. The questionnaire was administered by the researcher through face-to-face interviews during clinical visits, rehabilitation sessions, or scheduled follow-ups at hospitals, prosthetic clinics, or rehabilitation centers. Before initiating the data collection, the researcher obtained informed written consent from each participant after explaining the purpose of the study, ensuring confidentiality, and emphasizing voluntary participation. The questionnaire was filled out by the researcher based on the participants' responses, covering key areas such as demographic information, details of amputation, presence and severity of LBP, its impact on daily functioning, and any treatment received. Each interview is expected to take approximately 10–15 minutes. All collected data are coded to maintain confidentiality and securely stored for subsequent analysis. A pilot study was conducted on 10 individuals to check the validity and reliability of the questionnaire.

Collection Tool:

The first section, Demographic Information, includes questions about age, gender, and employment status to provide a basic socio-demographic profile of the participants. The second section, Amputation Details, collects clinical background data such as the level and side of amputation, duration since amputation, and the use of a prosthetic limb. These variables help in understanding possible correlations between amputation characteristics and the development of LBP. The third section, Low Back Pain (LBP) Assessment, is central to the study and focuses on the presence, frequency, severity, and onset of LBP. This section allows for quantifying the prevalence of LBP and analyzing its progression in relation to the time of amputation. The fourth section, Impact of LBP, explores the consequences of LBP on prosthesis usage, daily activities, work participation, and mental health. Its aim is to identify the extent to which LBP affects the functional and psychological aspects of the participants' lives.

Data Analysis:

The data collected through the structured, close-ended questionnaire was analyzed using **SPSS version 22**. Descriptive statistics used to summarize the data, including frequencies, percentages, means, and standard deviations, to present an overall picture of the sample characteristics and the prevalence of LBP among lower limb amputees. Chi-square tests will be used to assess the statistical significance of associations between categorical variables.

Ethical Considerations:

The Departmental Review Committee (DRC) have addressed for ethics approval. All participants have been requested for their informed consent, ensuring confidentiality and anonymity during the study. Participants had made familiar with their freedom to leave the study at any period and without consequence. All information will be safely kept and employed entirely for research.

CHAPTER 4
Results

4. A descriptive analysis was performed to summarize the demographic and clinical characteristics of the study participants (as presented in Table 1). Continuous variables, such as age, were expressed as means with standard deviations (mean ± SD), while categorical variables were presented as frequencies and corresponding percentages. To ensure data accuracy and consistency, only fully completed questionnaires were included in the final analysis, and all incomplete responses were excluded.

Table 1: Demographic and clinical characteristics of the lower back pain patients.

Variable	**Mean and Standard Deviation**		
Age (Mean ± SD)	53.49 ± 10.34		
Variable	**Category**	**Frequency (n)**	**Percentage (%)**
Gender	Male	26	74
	Female	9	26
Occupation	Retired	7	20.0
	Unemployed	7	20.0
	Worker	12	34
	Housewife	9	26
Practice Sport	Yes	21	60.0
	No	14	40.0
Sport Level	No Sport	29	82.9
	Amateur	6	17.1
Amputation Duration	0–1 year	14	40.0
	1–2 years	4	11.4
	2–3 years	8	22.9
	3–4 years	5	14.3
	4–5 years	4	11.4
Sleep Hours	< 4 hours	2	5.7
	4–6 hours	9	25.7
	6–8 hours	22	62.9
	> 8 hours	2	5.7
Comorbidities	One	15	42.9
	More than one	20	57.1
Smoke	Yes	16	45.7
	No	19	54.3
Side of Amputation	Right	11	31.4
	Left	24	68.6
Pain Disturb	Yes	33	94.3
	No	2	5.7
Etiology of Amputation	Traumatic	32	91.4
	Vascular disease	3	8.6
Non-Amputated Limb Pain	Yes	21	60.0
	No	14	40.0
Amputated Limb Pain	Yes	25	71.4
	No	10	28.6

Prosthesis Use	Yes	18	51.4
	No	17	48.6
Pain Due to Amputation	Yes	35	100.0
	No	0	0
Mental Health Concern	Yes	35	100.0
	No	0	0
Counseling Received	Yes	10	28.6
	No	25	71.4
Family Support	Yes	27	77.1
	No	8	22.9
Activity Involving Pain	Walking	16	45.7
	Sitting	9	25.7
	Bed time	2	5.7
	Bending	2	5.7
	Heavy lift	2	5.7
	Always	1	2.9
	Night	1	2.9
	Standing	1	2.9
	Device at work	1	2.9

Demographic Characteristics

A total of 35 participants with lower limb amputation were included in this study. The mean age was 53.49 years (Table 1). The majority of participants were male (n = 26, 74%), with females comprising 26% (n = 9). Regarding occupational status, the most represented category was workers (n=12, 34%), followed by housewives (n= 9, 26%), and equally unemployed and retired individuals (n=7, 20.0% each).

Age

Mean	N	Std. Deviation
53.49	35	10.342

Table 1: Age of lower back pain patients.

This table presents descriptive statistics for the age of individuals diagnosed with lower back pain. The average age of the patients is **53.49 years**, indicating that lower back pain is most prevalent among middle-aged to older adults in this sample. The data is based on **35 patients**, providing a modest but informative snapshot of the affected population. The **standard deviation of 10.342 years** suggests a moderate spread in age, with most patients falling within approximately **43 to 64 years** of age.

Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	26	74.3	74.3	74.3
	Female	9	25.7	25.7	100.0
	Total	35	100.0	100.0	

Table 2: Gender Distribution of Participants. ***Table representing gender distribution.***

This table summarizes the gender breakdown of the study participants. The sample consists of 35 participants, with a male majority (74.3%) and female minority (25.7%). The valid percent column confirms that there are no missing or excluded cases in the gender data. The cumulative percent shows that all participants have been accounted for, reaching 100% at the end of the table. This gender distribution may reflect demographic trends in the population under study—such as a higher prevalence of lower back pain among males in this sample—or could be influenced by recruitment patterns.

Occupation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Retired	7	20.0	20.0	20.0
	Unemployed	7	20.0	20.0	40.0
	Worker	12	34.3	34.3	74.3
	Housewife	9	25.7	25.7	100.0
	Total	35	100.0	100.0	

Table 3: Table shows occupational status of lower back patients.

This table presents the distribution of occupational categories among 35 individuals diagnosed with lower back pain. The largest group affected by lower back pain in this sample are **workers (34.3%)**, suggesting a possible link between occupational strain and back issues. **Housewives** make up **25.7%**, indicating that domestic responsibilities may also contribute to physical stress. **Retired and unemployed individuals** each represent **20.0%** of the sample, which may reflect age-related degeneration or lack of physical activity. The **cumulative percent** column shows a progressive tally, reaching **100%**, confirming complete data coverage with no missing entries.

Physical Activity and Sports Participation

Of the total participants, 60.0% (n = 21) reported practicing sports, while 40.0% (n = 14) did not engage in any sports activities. However, when asked about the level of sports participation, 82.9% (n = 29) reported no sport involvement, while 17.1% (n = 6) identified as amateur athletes.

Practice Sport

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	21	60.0	60.0	60.0
	No	14	40.0	40.0	100.0
	Total	35	100.0	100.0	

Table 4: Participation in Sports. Bar chart showing 60% practiced some form of sport, while 40% did not.

This table presents data on whether individuals diagnosed with lower back pain engage in sports or physical activity. A majority of patients (**60%**) reported participating in some form of sport or physical activity. The remaining **40%** did not engage in sports, which may correlate with sedentary habits or physical limitations. The **valid percent** confirms that all responses were complete and usable, with no missing data. The **cumulative percent** shows a full accounting of the sample, reaching **100%**.

Sport Level

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No Sport	29	82.9	82.9	82.9
	Amateur	6	17.1	17.1	100.0

Total	35	100.0	100.0	

Table 5: Level of Sports Activity.

This distribution highlights a significant gap in physical activity, with over four-fifths of the sample not participating in sports. It may reflect lifestyle patterns, access to facilities, or cultural attitudes toward recreational activity. For health promotion or community planning, this could signal a need to encourage more engagement in physical fitness or organized sports. **Majority are inactive** 29 individuals (82.9%) reported **no involvement in sports**. This suggests a predominantly sedentary or non-sporting lifestyle within the group. **Minority are active** only 6 individuals (17.1%) identified as **amateur participants**, meaning they engage in sports at a non-professional level. The cumulative percentage reaches 100% after accounting for both categories, confirming complete data coverage.

Amputation Duration and Side

Amputation had occurred within the last year for 40.0% (n = 14) of participants, 11.42% (n=4) has been amputated for 1-2 years, 22.9% (n = 8) had been amputated for 2–3 years, 14.28% (n=5) has been amputated for 3-4 years, 11.42% (n=4) has been amputated for 4-5 years. The left limb was more frequently amputated (68.6%) compared to the right (31.4%).

Amputation Occur

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 month to 1 year	14	40.0	40.0	40.0
	1 year to 2 year	4	11.4	11.4	51.4
	2 year to 3 year	8	22.9	22.9	74.3
	3 year to 4 year	5	14.3	14.3	88.6
	4 year to 5 year	4	11.4	11.4	100.0
	Total	35	100.0	100.0	

Table 6: Amputation duration. Table illustrating amputation duration.

Comorbidities and Lifestyle Factors

A substantial proportion of participants (57.1%, n = 20) reported having more than one comorbidity, while 42.9% (n = 15) had a single comorbidity.

Comorbidities

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	One	15	42.9	42.9	42.9
	More than one	20	57.1	57.1	100.0
	Total	35	100.0	100.0	

Table 7: Comorbidity distribution. Table representing participants with one vs. multiple comorbidities.

This table outlines the distribution of comorbidities among 35 individuals, distinguishing between those with a single condition and those with multiple health issues.

20 participants (57.1%) reported having **more than one comorbidity**. This indicates that over half of the group faces **complex health challenges**, potentially requiring more intensive medical management. 15 individuals (42.9%) had **only one comorbid condition**. While still medically relevant, these cases may be comparatively easier to manage. The cumulative percentage reaches

100%, confirming that all participants are accounted for in the analysis. This distribution suggests a high prevalence of **multi-morbidity** within the sample, which could have implications for healthcare planning, resource allocation, and patient support strategies. The dominance of multiple comorbidities may reflect aging demographics, lifestyle factors, or underlying chronic disease patterns.

Concerning sleep patterns, the majority (n=22, 62.9%) reported 6–8 hours of sleep, 25.7% (n=9) reported 4–6 hours, and a small proportion (n=2, 5.7% each) reported either <4 hours or >8 hours of sleep.

Sleep Hours

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than 4 hours	2	5.7	5.7	5.7
	4 hours to 6 hours	9	25.7	25.7	31.4
	6 hours to 8 hours	22	62.9	62.9	94.3
	Greater than 8 hours	2	5.7	5.7	100.0
	Total	35	100.0	100.0	

Table 8: Sleep duration. Table indicating most participants reported 6–8 hours of sleep.

This table presents the distribution of sleep duration among 35 individuals, categorized into four distinct ranges. **Majority sleep 6–8 hours.** 22 participants (62.9%) reported sleeping between **6 to 8 hours**, aligning with recommended sleep guidelines for adults. This suggests that most individuals maintain a relatively healthy sleep routine. 2 participants (5.7%) sleep **less than 4 hours**, and 9 participants (25.7%) sleep **between 4 to 6 hours**. Combined, nearly one-third of the group may be experiencing **insufficient rest**, which could impact cognitive and physical health. Another 2 participants (5.7%) sleep **more than 8 hours**, which may reflect individual health needs or lifestyle factors. The cumulative percentages confirm full data representation, totaling 100%. The data reveals that while most participants fall within the optimal sleep range, a notable portion (31.4%) sleep less than 6 hours—a pattern often linked to fatigue, stress, or underlying health conditions. The small group sleeping more than 8 hours might warrant further exploration to understand whether it's due to recovery needs or other factors.

Regarding smoking habits, 45.7% (n = 16) were current smokers while 54.3% (n = 19) were non-smokers.

Smoke

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	16	45.7	45.7	45.7
	No	19	54.3	54.3	100.0
	Total	35	100.0	100.0	

Table 9: Smoking habits. Table illustrating percentage of smokers and non-smokers.

This table presents the smoking behavior of 35 individuals, divided into two categories: smokers and non-smokers. 19 participants (54.3%) reported **not smoking**, making up the majority of the group. This suggests a modest lean toward healthier lifestyle choices in terms of tobacco use. 16 individuals (45.7%) identified as **smokers**, indicating that nearly half of the sample engages in smoking. This is a noteworthy figure, especially when considering potential health risks and the need for targeted awareness or cessation programs. The cumulative percentage reaches 100%, confirming that all participants are accounted for in the data. The near-even split between smokers and non-smokers highlights a community where smoking is still relatively common. This could have implications for public health planning, especially when viewed alongside other variables like comorbidities or sleep patterns. If smoking correlates with multiple health issues or reduced sleep quality, it may point to areas where intervention could be most impactful.

Pain Distribution and Functional Impact

The overwhelming majority of participants (94.3%, n = 33) reported being disturbed by pain. Pain in the amputated limb was reported by 71.4% (n = 25), while 60.0% (n = 21) also experienced pain in the non-amputated limb. Pain affected various activities: walking (n= 16, 45.7%), sitting (n= 925.7%), and to a lesser extent, bedtime (n=2), bending (n=2), heavy lifting (n=2), standing (n=1), and night-time activities (n=1). Notably, 100% of the participants confirmed that amputation had a pain effect.

Pain Disturb

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	33	94.3	94.3	94.3
	No	2	5.7	5.7	100.0
	Total	35	100.0	100.0	

Table 10: Pain involving activity. Bar chart showing percentage of different activities involved in pain.

Etiology and Prosthetic Use

Traumatic amputation was the most prevalent cause (91.4%, n = 32), with only 8.6% (n = 3) resulting from vascular disease. Regarding prosthetic use, 51.4% (n = 18) used a prosthesis, while 48.6% (n = 17) did not.

Etiology of amputation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Traumatic	32	91.4	91.4	91.4
	Vascular disease	3	8.6	8.6	100.0
	Total	35	100.0	100.0	

Table 11: Etiology of amputation. Table displaying traumatic and vascular causes of amputation.

This table presents the underlying medical or physical causes (etiology) of amputation in a sample of 35 individuals, categorized into **traumatic** and **vascular disease-related** origins. A striking **91.4%** of participants (32 individuals) experienced amputation due to **traumatic events**. This could include accidents, injuries, or other external physical harm leading to limb loss. Only **8.6%** (3 individuals) had amputations resulting from **vascular conditions**, such as peripheral artery disease or diabetes-related complications. The cumulative percentage reaches 100%, confirming that all cases are accounted for.The overwhelming prevalence of trauma-related amputations suggests that **accidental or injury-based causes** are far more common in this group than chronic health conditions. This may reflect environmental, occupational, or regional risk factors. The relatively low incidence of vascular disease-related amputations could indicate younger demographics, better chronic disease management, or limited diagnostic reporting.

Non Amputated Limb Pain

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	21	60.0	60.0	60.0
	No	14	40.0	40.0	100.0
	Total	35	100.0	100.0	

Table 12: Non Amputated Limb Pain This table presents data on the presence of pain in the **non-amputated limbs** among 35 individuals.
21 participants (60.0%) reported **pain in their remaining limb(s)**. This highlights a significant concern, suggesting that even after amputation, many individuals continue to face physical discomfort. 14 individuals (40.0%) reported **no pain** in their non-amputated limbs. While this group may have better post-operative recovery or fewer complications, they still represent less than half of the sample. The cumulative percentage reaches 100%, confirming that all participants are accounted for. The high prevalence of pain in non-amputated limbs may reflect **compensatory strain**, **nerve-related issues**, or **underlying musculoskeletal conditions**. This finding is clinically important—it suggests that rehabilitation and pain management should not only focus on the amputated site but also address the broader physical impact on the body.

Amputated Limb Pain

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	25	71.4	71.4	71.4
	No	10	28.6	28.6	100.0
	Total	35	100.0	100.0	

Table 13: Amputated Limb Pain. This table presents data on the presence of pain in the **amputated limbs** among 35 individuals.

25 participants (71.4%) reported experiencing **pain in their amputated limb**.This suggests that **post-amputation pain**—which may include phantom limb pain or residual limb discomfort—is a common issue in this group. 10 individuals (28.6%) reported **no pain** in their amputated limb. While this group may have benefited from effective pain management or surgical outcomes, they represent less than one-third of the sample. The cumulative percentage reaches 100% confirming that all participants are accounted for. The data highlights a significant clinical concern: **amputated limb pain affects the majority of individuals post-surgery**. This has implications for rehabilitation, psychological support, and long-term care. Addressing this pain—whether through medication, therapy, or prosthetic adjustments—should be a priority in post-amputation treatment plans.

Prosthesis Type

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	18	51.4	51.4	51.4
	No	17	48.6	48.6	100.0
	Total	35	100.0	100.0	

Table 14: Prosthesis Type This table presents data on whether individuals in a sample of 35 use a **prosthesis** following amputation.

18 participants (51.4%) reported **using a prosthetic limb**, indicating that just over half have adopted assistive technology to support mobility and function. 17 individuals (48.6%) reported **not using a prosthesis**, which may reflect personal choice, medical limitations, financial constraints, or access issues. The cumulative percentage reaches 100%, confirming that all participants are represented in the data. The near-even split between prosthesis users and non-users suggests a diverse experience among amputees. While many benefit from prosthetic support, a substantial portion may face barriers or opt for alternative coping strategies. This data could inform rehabilitation planning, prosthetic outreach programs, or further investigation into usage patterns—such as comfort, cost, or cultural acceptance.

Amputation n pain Effect

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	35	100.0	100.0	100.0

Table 15: Amputation n pain Effect. This table presents data on whether participants experienced pain as a result of amputation. The findings are strikingly uniform.35 out of 35 individuals (100%) reported experiencing **pain related to their amputation**. This includes both physical discomfort and possibly phantom limb pain, residual limb pain, or secondary musculoskeletal strain. There were **no participants** who reported being pain-free following amputation, underscoring the **universal burden** of post-amputation pain in this group. This data highlights a critical clinical reality: **pain is a consistent consequence of amputation** for all individuals in the sample. It reinforces the need for comprehensive pain management strategies, including medication, physical therapy, psychological support, and prosthetic optimization. Given the 100% prevalence, this variable could serve as a central point in further analysis—especially when cross-referenced with prosthesis use, limb pain (amputated and non-amputated), and sleep quality.

Mental Health

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	35	100.0	100.0	100.0

Table 16: Mental Health. This table presents data on the presence of mental health concerns among 35 individuals in the study.

All 35 participants (100%) reported experiencing **mental health issues**. This indicates that psychological distress is a **shared experience across the entire group**, regardless of other variables. There were **no participants** who reported being free from mental health concerns, underscoring the **pervasive emotional and psychological burden** in this population. The data paints a powerful picture: **mental health challenges are universally present** among individuals in this sample. This could stem from factors such as pain (both amputated and non-amputated limb), lifestyle limitations, social isolation, or trauma related to amputation. It highlights the urgent need for **integrated mental health support**, including counseling, peer support, and psychological rehabilitation as part of holistic care.

Counseling

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	10	28.6	28.6	28.6
	No	25	71.4	71.4	100.0
	Total	35	100.0	100.0	

Table 17: Counseling. This table presents data on whether participants received **counseling support**, likely in relation to their physical or mental health challenges following amputation.

25 individuals (71.4%) reported **not receiving any counseling**. This suggests a significant gap in psychological or emotional support services for this population. Only 10 participants (28.6%) reported **receiving counseling**, indicating limited engagement with mental health professionals or support programs. The cumulative percentage reaches 100%, confirming that all individuals are accounted for. Despite the fact that **100% of participants reported mental health concerns** (as shown in Table 16), only **28.6% received counseling**. This stark contrast highlights a critical shortfall in mental health service delivery. It may reflect barriers such as stigma, lack of access, financial constraints, or limited awareness of available resources. This table could serve as a compelling argument for expanding counseling outreach, integrating psychological support into rehabilitation programs, and promoting mental health literacy among amputees.

Emotional Support From Family

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	27	77.1	77.1	77.1
	No	8	22.9	22.9	100.0
	Total	35	100.0	100.0	

Table 18: Emotional Support from family. This table presents data on whether participants received **emotional support from their family** following amputation or related health challenges.

27 individuals (77.1%) reported receiving **emotional support from their family**. This suggests that most participants benefit from strong familial bonds, which can play a vital role in psychological resilience and recovery. 8 participants (22.9%) reported **not receiving emotional support**, indicating a vulnerable subgroup that may face isolation, emotional strain, or limited family involvement. The cumulative percentage reaches 100%, confirming that all participants are represented. The data highlights the **critical role of family in emotional healing**. While most participants have supportive families, the fact that nearly one-quarter lack this support is significant. These individuals may require additional outreach through counseling, peer networks, or community programs to fill the emotional gap. This table complements earlier findings on mental health and counseling—suggesting that emotional support from family may buffer psychological distress, especially when professional counseling is limited.

Pain Involve Activity

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Walking	16	45.7	45.7	45.7
	Sitting	9	25.7	25.7	71.4
	Bed time	2	5.7	5.7	77.1
	Bending	2	5.7	5.7	82.9
	Heavy lift	2	5.7	5.7	88.6
	Always	1	2.9	2.9	91.4
	Night	1	2.9	2.9	94.3
	Standing	1	2.9	2.9	97.1
	Device at work	1	2.9	2.9	100.0
	Total	35	100.0	100.0	

Table 19: Pain Involve Activity. This table presents data on specific activities that trigger or worsen pain among 35 participants.

It highlights the physical contexts in which pain is most commonly experienced. 16 individuals (45.7%) reported experiencing pain during **walking**, making it the most frequently affected activity. This suggests mobility challenges are a major concern for nearly half the group. 9 participants (25.7%) reported pain while **sitting**, indicating that even passive postures can be problematic. **Bedtime, bending, and heavy lifting** — each reported by 2 individuals (5.7%). **Constant pain ("Always")**, **nighttime pain**, **pain while standing**, and **pain during device use at work** — each reported by 1 participant (2.9%). The cumulative percentage reaches 100%, confirming that all participants are represented. The data reveals that **pain is most commonly linked to movement and posture**, especially walking and sitting. These findings are crucial for designing rehabilitation programs, ergonomic interventions, and pain management strategies. The presence of pain during rest (bedtime, night) and work-related tasks suggests that discomfort extends beyond physical exertion and may affect overall quality of life. This table could be paired with data on prosthesis use, limb pain, and mental health to build a comprehensive picture of daily challenges faced by amputees.

Psychological and Social Aspects

Mental health concerns were universally reported (100%, n = 35). Despite this, only 28.6% (n = 10) had received psychological counseling. Nevertheless, 77.1% (n = 27) reported receiving emotional support from their families.

Moreover, a binomial logistic regression was performed to ascertain the association of the independent variables gender, smoking status, prosthesis use, comorbidity, and sleep duration on experiencing pain in the non-amputated limb (dependent variable) in individuals with lower limb amputation. After applying the full model, only the variable "sleep duration" had a statistically significant association ($P < 0.05$), while the other variables including gender, smoking, prosthesis use, and comorbidity were not statistically significant. Participants who reported longer sleep durations (particularly in the 6–8 hour range) were 6.00 times more likely to report pain in the non-amputated limb (OR = 6.00, 95% Confidence Interval: 1.09 – 32.99, $P = 0.039$). This suggests that increased sleep duration may reflect greater overall discomfort or inactivity potentially associated with musculoskeletal strain on the contralateral limb.

Discussion

The present study provides valuable insight into the high prevalence and multifactorial nature of low back pain (LBP) among individuals with lower limb amputation (LLA). Our findings confirm that LBP is a common and significant comorbidity in this population, impacting functional capacity and overall quality of life. This increased prevalence of LBP may be attributed to various biomechanical and postural adaptations following amputation. The loss of a limb disrupts the body's natural load distribution and movement mechanics, leading to increased stress on the lower back. As individuals adapt to walking with a prosthesis, changes in gait patterns, muscle activation, and spinal alignment can contribute to discomfort and chronic pain. One contributing factor is the difference in leg length between the prosthetic and intact limb. Mismatched limb lengths often result in compensatory movements and postural asymmetries, placing uneven pressure on the spine and increasing the risk of back pain. Conversely, individuals fitted with properly aligned prostheses, closely matched in length to the intact limb, tend to report fewer symptoms, likely due to improved weight distribution and symmetry during walking. However, not all individuals experience back pain to the same degree. Some may not show a clear association between limb length differences and LBP, suggesting that other factors are also at play. Alterations in lumbosacral movement, such as increased axial rotation, rigid trunk-to-pelvis coordination, and reduced flexibility, can further contribute to spinal imbalance. Combined with limited core stability and prolonged compensatory strategies, these biomechanical challenges may help explain the heightened prevalence of LBP among individuals with LLA. Overall, the complexity of interactions between physical, demographic, lifestyle, and psychosocial variables highlights the importance of a comprehensive and individualized approach to rehabilitation in this population.

The sample in our study was predominantly male, which is consistent with global data indicating higher rates of traumatic amputation among men, often attributed to occupational hazards and road traffic accidents. A similarly study reported male dominance among LLA patients, linking it to the higher exposure of men to high-risk environments (Yuan et al., 2023). The average age of 53.49 years in our sample places most participants within the economically productive age group. However, the high unemployment or retirement rate observed raises important socioeconomic concerns. These findings mirror earlier reports, who emphasized the risk of social and economic marginalization among amputees, particularly when pain and disability hinder re-employment or physical reintegration (Sadowski et al, 2022).

Although 60% of our participants claimed to participate in sports, a notable 82.9% admitted not engaging in regular physical activity. This contradiction may stem from the subjective interpretation of "sports participation" or from sporadic engagement rather than sustained exercise. Prior studies, have identified physical inactivity as a key risk factor for secondary musculoskeletal conditions like LBP in amputees, due to deconditioning and compromised trunk stability (Sadowski et al, 2022). Regular, structured exercise has been shown to improve core strength and postural control, thereby potentially reducing the incidence of LBP. Our study revealed a high prevalence of pain (94.3%), with daily activities such as walking and sitting being the most commonly affected. These results are in agreement with other studies, who also reported that functional tasks demanding weight-bearing and postural balance were frequently associated with LBP (Awad et al., 2025; Alshehri et al., 2023). The correlation between LBP and walking may be attributed to abnormal gait mechanics, especially in prosthesis users, as well as compensatory lumbar spine movements in non-prosthesis users.

Interestingly, 60% of participants reported pain in the non-amputated limb, suggesting biomechanical overuse. This finding similar to previous study, who emphasized the disproportionate load borne by the intact limb, potentially resulting in joint strain and referred spinal pain (Sadowski et al, 2022).The presence of pain in both limbs may contribute to poor posture and compensatory spinal curvature, thus perpetuating LBP. Amputation-related pain was reported by 100% of participants, with high rates of pain in both the residual (71.4%) and contralateral limbs. These findings underscore the multifaceted nature of post-amputation pain, including phantom limb pain, residual limb discomfort, neuroma formation, and muscular imbalance. Similar findings of residual limb pain have been documented by other study (Sadowski et al, 2022), who noted that such pain frequently coexists with central sensitization and altered body schema, complicating pain management.

All participants in our study reported experiencing mental health challenges, yet only 28.6% had received professional counseling. This gap indicates a significant unmet need for psychological care, consistent with findings from other study, who highlighted underutilization of mental health services among amputees due to factors like stigma, poor accessibility, and lack of awareness (Singhal et al., 2021). While emotional support from family members (77.1%) was relatively high, it cannot substitute for structured psychological interventions. Given the known bidirectional link between chronic pain and depression, integrated psychosocial support should be a standard component of post-amputation rehabilitation.

The majority of participants (57.1%) reported more than one comorbidity, such as diabetes, hypertension, or arthritis, all of which have been shown to exacerbate systemic inflammation and musculoskeletal degeneration. Our data align with reports od other study, who found that comorbidities significantly reduce functional outcomes in amputees (Highsmith et al., 2019). Poor sleep quality, experienced by over 30% of participants, is another critical concern, given its role in pain amplification through heightened central sensitivity and reduced physiological repair during rest. The prevalence of smoking (45.7%) also mirrors previous literature, which connects nicotine use with impaired circulation, delayed healing, and increased pain perception (Sadowski et al, 2022).

Only half of the participants reported prosthesis use, suggesting barriers that may be financial, functional, or psychological. Non-use of prosthesis has been strongly linked with asymmetrical gait patterns and increased lumbar stress, a relationship supported by other study (Reoeder et al., 2008). Even among users, improper alignment or poor prosthetic fit may cause unnatural trunk movements, which exacerbate LBP. Thus, optimizing prosthetic design, fit, and training is essential to mitigate spinal load. The predominance of trauma as the cause of amputation (91.4%) is noteworthy. Traumatic amputations often involve young, otherwise healthy individuals who may sustain high-energy injuries, with widespread soft tissue and bony involvement. This aligns with other findings (Sadowski et al, 2022), who reported higher rehabilitation demands in trauma-related amputations due to complexity and psychological trauma. Consequently, these cases warrant an integrative rehabilitation model encompassing orthopedic care, neurorehabilitation, and mental health support.

In comparison to previous studies, our findings confirm the high burden of LBP among LLA patients, but also highlight unique trends within our sample population, particularly regarding physical activity, prosthesis use, and mental health access. This study underscores the multifactorial nature of low back pain among individuals with lower limb amputation. The high prevalence of pain, particularly in the lumbar region, reflects the combined burden of altered biomechanics, inactivity, comorbidities, psychological distress, and inadequate prosthetic use. Holistic, multidisciplinary management approaches incorporating physical rehabilitation, prosthetic optimization, psychological counseling, and lifestyle modification are critical in addressing both the causes and consequences of LBP in this vulnerable population.

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