Scholastic Orthopaedics (ISSN: 3108-1606)

Research Article

Volume 2 Issue 3 March 2026

Sedentary Behavior and Recreational Sports Participation as Determinants of Musculoskeletal Disorders in Bahraini Adult Women: A Mixed-Methods Epidemiological Study to Inform Preventive Health Policy

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Received: March 10, 2026; **Published:** March 26, 2026

Abstract

Musculoskeletal disorders (MSDs) are a significant public health concern, particularly among women, contributing to pain, disability, and reduced quality of life. Behavioral, occupational, environmental, and sociocultural factors, including prolonged sedentary behavior and limited recreational sports participation, influence MSD risk. Evidence among Bahraini women remains limited. This study examined behavioral determinants of MSDs among adult Bahraini women, focusing on sedentary behavior and recreational sports participation, and explored sociocultural and environmental contexts affecting physical activity. An explanatory sequential mixed-methods design was used. The quantitative phase surveyed 400 Bahraini women aged 25–60 years to assess MSD prevalence, sedentary behavior, and physical activity using validated instruments. Logistic regression identified predictors of MSDs. The qualitative phase involved semi-structured interviews with 20 purposively selected participants to explore barriers, facilitators, and lived experiences. Findings from both phases were integrated to provide a holistic understanding of MSD determinants. MSDs were reported by 44% of participants, most commonly affecting the lower back, neck, and knees. Prolonged sitting (>6 hours/day) and low physical activity were significant predictors (OR 2.3 and ~4.0, respectively). Qualitative insights revealed that cultural expectations, family responsibilities, occupational demands, limited women-only facilities, and environmental constraints further reinforced high-risk behaviors. Integration highlighted a complex interplay of behavioral, occupational, environmental, and sociocultural factors influencing MSD risk. MSDs among Bahraini women are highly prevalent and shaped by multidimensional determinants. Effective interventions should combine individual-level strategies, such as exercise promotion and ergonomic adjustments, with structural and culturally sensitive approaches, including improved access to safe physical activity facilities and workplace ergonomics. These findings provide actionable evidence for policymakers and healthcare providers to reduce MSD risk and improve women's musculoskeletal health.

Keywords: Musculoskeletal disorders; sedentary behavior; physical activity; women's health; Bahrain; mixed-methods, Bahraini women, sports participation in Bahraini women

Introduction

Musculoskeletal disorders (MSDs) represent a major public health concern worldwide, contributing significantly to pain, disability, and reduced quality of life among adult populations (4). Globally, MSDs are among the leading causes of chronic pain and physical impairment, with a disproportionate burden observed in women. Epidemiological studies indicate that women are more susceptible than men to conditions such as lower back pain, neck pain, osteoarthritis, and repetitive strain injuries, with prevalence estimates ranging from 30% to 50% in adult female populations, depending on geographic region and occupational exposure (24). Factors including biological differences, hormonal influences, and gender-specific occupational roles contribute to this increased vulnerability.

Regionally, in the Middle East and North Africa, the prevalence of MSDs among women is similarly high. Studies from Gulf Cooperation Council (GCC) countries report that over 40% of adult women experience chronic musculoskeletal pain, with lower back and knee pain being particularly common(3). Cultural and societal norms, sedentary lifestyles, and limited engagement in recreational physical activity exacerbate the risk of MSDs in this population. Despite growing awareness,

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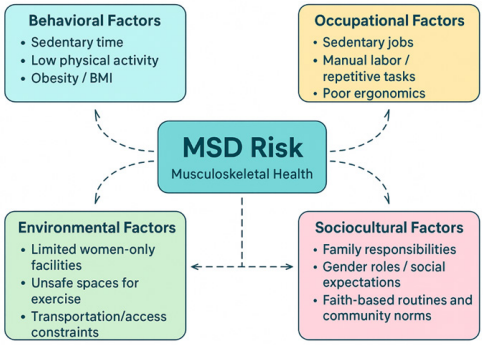
there remains a paucity of research examining the behavioral determinants of MSDs among women in the region, particularly in Bahrain, where national data on sedentary behavior, recreational sports participation, and musculoskeletal health are limited (5).

Understanding the prevalence and determinants of MSDs in women is crucial for informing preventive health policies, designing targeted interventions, and reducing the burden of these conditions on individuals and healthcare systems(15). This study aims to address this knowledge gap by examining the role of sedentary behavior and recreational sports participation as determinants of MSDs among adult Bahraini women.

Health Impact of Sedentary Behavior and Benefits of Recreational Sports



Sedentary behavior, defined as any waking activity characterized by low energy expenditure while in a sitting or reclining posture, has emerged as a significant determinant of adverse musculoskeletal and metabolic health outcomes(25). Prolonged sitting and reduced physical activity are strongly associated with the development and exacerbation of musculoskeletal disorders (MSDs), particularly in the lower back, neck, and lower extremities(26). Mechanistically, sedentary behavior contributes to muscle weakness, joint stiffness, postural imbalance, and decreased bone mineral density, thereby increasing vulnerability to chronic pain and functional impairment. Furthermore, sedentary lifestyles are often accompanied by obesity, reduced cardiovascular fitness, and metabolic dysregulation, which can indirectly exacerbate musculoskeletal strain and impede recovery from injury(29).

In contrast, engagement in recreational sports and structured physical activity offers protective effects against MSDs through multiple physiological and psychosocial mechanisms(2). Regular participation in moderate-to-vigorous physical activity promotes muscle strengthening, joint flexibility, and postural stability, all of which reduce the risk of musculoskeletal pain and functional limitations. Additionally, recreational sports enhance balance, coordination, and endurance, contributing to overall musculoskeletal resilience(7). Beyond physical benefits, such activity is associated with improved mental well-being, stress reduction, and enhanced social interaction, factors that further support musculoskeletal health by mitigating pain perception and promoting adherence to healthy lifestyles(21).

Despite the well-documented benefits of recreational sports, cultural, occupational, and environmental factors often limit women's participation, particularly in the Middle East(10). Sedentary occupations, household responsibilities, and insufficient access to safe recreational facilities contribute to low levels of physical activity, exacerbating the prevalence and severity of MSDs. Identifying behavioral patterns such as sedentary time and sports participation is therefore critical for developing targeted interventions and preventive health policies aimed at reducing musculoskeletal morbidity among women(20).

Gaps in Bahraini-Specific Data

While the global and regional burden of musculoskeletal disorders (MSDs) in women has been well-documented, research focusing specifically on Bahraini women remains limited. Existing studies in the Kingdom of Bahrain have primarily addressed general health outcomes or lifestyle behaviors, with minimal attention to the interplay between sedentary behavior, recreational sports participation, and musculoskeletal health. Consequently, there is a lack of comprehensive, population-specific data regarding the prevalence, severity, and behavioral determinants of MSDs in adult Bahraini women (17).

Moreover, much of the regional literature relies on cross-sectional surveys with heterogeneous methodologies, limiting the ability to draw causal inferences or to develop evidence-based interventions tailored to the Bahraini context. Cultural, occupational, and environmental factors unique to Bahrain—such as gender-specific roles, recreational facility access, and sociocultural attitudes toward physical activity—remain largely unexplored in relation to MSD risk(18). This absence of context-specific evidence restricts policymakers' capacity to implement targeted preventive health strategies and hampers the design of culturally sensitive interventions to reduce sedentary behavior and promote recreational sports participation among women.

Addressing these gaps is essential to understanding the behavioral and environmental determinants of MSDs within the Bahraini population(16). The present study seeks to fill this void by employing a mixed-methods epidemiological approach that integrates quantitative assessment of sedentary behavior and recreational sports participation with qualitative exploration of sociocultural barriers and facilitators, providing actionable insights for preventive health policy.

Aim and Scope of the Study

Aim

The primary aim of this study is to investigate the behavioral determinants of musculoskeletal disorders (MSDs) among adult Bahraini women, with a specific focus on sedentary behavior and recreational sports participation. The study seeks to generate evidence that can inform preventive health policies and targeted interventions to reduce MSD risk and improve musculoskeletal health in this population.

Scope

This research addresses both the epidemiological and sociocultural dimensions of musculoskeletal health. It encompasses:

- Assessment of MSD prevalence and severity among adult Bahraini women aged 25–60 years.
- Quantitative evaluation of sedentary behavior and recreational sports participation and their association with MSDs.
- Exploration of personal, cultural, occupational, and environmental factors that influence women's physical activity patterns.
- Integration of mixed-methods findings to provide actionable recommendations for healthcare practitioners, public health policymakers, and community health programs.

By combining quantitative and qualitative approaches, the study offers a comprehensive understanding of behavioral determinants of MSDs within the Bahraini context and informs strategies for preventive health promotion and policy development.

Study Objectives

The objectives of this study are as follows:

- To ascertain the prevalence and anatomical distribution of musculoskeletal disorders (MSDs) among adult Bahraini women.
- To systematically evaluate patterns of sedentary behavior and levels of recreational sports participation within the study population.
- To investigate the relationship between sedentary behavior, recreational sports participation, and the occurrence of MSDs while adjusting for demographic, occupational, and ergonomic covariates.
- To explore the sociocultural, environmental, and personal determinants that influence women's engagement in physical activity.
- To generate evidence-informed recommendations for preventive health policies and intervention strategies aimed at reducing MSD risk and promoting musculoskeletal health among Bahraini women.

Literature Review

2.1 Causal Associations Between Sedentary Behavior, Physical Activity, and Musculoskeletal Disorders

(30) Conducted a rigorous Mendelian randomization study to investigate the causal relationships between sedentary behavior, physical activity, and the risk of 13 common musculoskeletal disorders (MSDs). By using genetic variants as instrumental variables, the study minimized confounding factors often seen in observational research, allowing for a more precise estimation of causality(13). The results demonstrated that prolonged sedentary behavior is strongly associated with an increased risk of specific MSDs, including low back pain, spondylolisthesis, and osteoarthritis. These findings provide compelling evidence that extended periods of inactivity are not merely correlated with, but can causally contribute to, musculoskeletal deterioration.

Conversely, the study highlighted the protective role of regular physical activity. Participants who engaged in moderate to vigorous physical activity exhibited a significantly lower risk of developing these disorders, suggesting that consistent movement may help preserve musculoskeletal integrity and function. The authors emphasized the importance of not only reducing sedentary time but also incorporating structured physical activity as part of preventive strategies against MSDs.

Importantly, situate their findings within the broader public health context, noting that modern lifestyles characterized by prolonged sitting—especially in occupational settings—may predispose adults to chronic musculoskeletal conditions. This aligns with prior epidemiological evidence indicating that both leisure-time physical activity and occupational movement patterns critically influence musculoskeletal health.

In summary, Zhang et al.'s study underscores a dual approach for MSD prevention: minimizing sedentary behavior while actively promoting physical activity. These insights are particularly relevant for adult populations, where lifestyle modifications can have significant long-term impacts on musculoskeletal function and overall quality of life. The study contributes valuable evidence to the growing body of literature advocating for movement-based interventions in public health and occupational settings.

2.2 Sedentary Behavior and Neck Pain

Meng et al., (17) systematically evaluated the associations between daily sedentary behavior and the risk of neck pain across various populations. The study found a significant positive correlation between increased sedentary time and the likelihood of experiencing neck pain. Notably, the risk was more pronounced among individuals with prolonged screen time, such as mobile phone and computer use, underscoring the need for interventions targeting sedentary habits to prevent neck-related musculoskeletal disorders.

2.3 Barriers to Physical Activity Participation Among Women

Abdelhay et al., (1)identified and compared perceived barriers to physical activity participation among women in Saudi Arabia. The study highlighted that sociocultural factors, including traditional gender roles and family responsibilities, significantly hinder women's engagement in physical activity. Additionally, environmental factors such as lack of safe spaces and social support were found to further impede participation, emphasizing the need for culturally sensitive interventions to promote physical activity among women.

2.4 Physical Activity Environment and Mental Wellbeing

Bondarev et al., (8)examined the relationship between the physical activity environment and mental well-being among women. The study found that access to nature-based physical activity opportunities positively influenced mental health outcomes, independent of the physical activity itself. This suggests that the environment plays a crucial role in shaping women's physical activity behaviors and overall well-being, indicating that improving environmental factors could enhance engagement in physical activity and reduce the risk of musculoskeletal disorders.

Methodology

3.1 Study Design

This study adopted an explanatory sequential mixed-methods design**,** which integrates both quantitative analysis and qualitative exploration to provide a comprehensive understanding of the research problem. In this approach, data collection and analysis were conducted in two distinct phases.

The first phase (quantitative) involved the collection of numerical data through a structured questionnaire to identify general patterns, relationships, and trends regarding Bahraini women's physical activity levels, perceived barriers, and attitudes after menopause. The quantitative results served as a foundation for identifying key areas that required deeper exploration.

The second phase (qualitative) consisted of in-depth semi-structured interviews with a selected subgroup of participants from the first phase. This phase aimed to explain and elaborate on the statistical findings by exploring women's lived experiences, perceptions, and motivations toward physical activity after menopause.

By combining these two methods, the study sought not only to measure observable patterns but also to interpret the underlying meanings and contextual factors shaping women's behaviors. The explanatory sequential design thus ensured both breadth and depth of understanding, allowing the qualitative insights to enrich and clarify the quantitative results, leading to more holistic and evidence-based conclusions.

3.2 Quantitative Phase

3.2.1 Research Design

The quantitative phase of this study adopted a cross-sectional analytical design aimed at identifying the prevalence and determinants of

musculoskeletal disorders (MSDs) among adult Bahraini women. This design was selected because it allows for the simultaneous assessment of sedentary behavior, recreational sports participation, and musculoskeletal health outcomes within a defined population, thereby providing valuable epidemiological evidence for understanding behavioral risk factors.

3.2.2 Study Population and Sampling

The target population comprised Bahraini women aged 25–60 years, representing various occupational, educational, and socioeconomic backgrounds. Participants were recruited from community health centers, fitness clubs, and social organizations across the Kingdom of Bahrain to ensure demographic diversity.

A stratified random sampling technique was employed to capture variation across age groups and occupational categories (e.g., office-based, service, and homemaking roles). Based on an estimated MSD prevalence of 40% in regional studies, a 95% confidence level, and a 5% margin of error, a minimum sample size of 370 participants was determined using standard epidemiological formulas. To account for potential non-response, 400 women were invited to participate.

3.3 Data Collection Instrument

Data were collected through a structured, self-administered questionnaire developed in English and Arabic. The instrument was pilot-tested with 30 respondents to ensure clarity, cultural appropriateness, and internal consistency. It consisted of four main sections:

- **Demographic and Occupational Characteristics:** Age, marital status, education level, employment status, and work type.
- **Sedentary Behavior:** Average daily sitting time (hours per day), screen exposure, and occupational/postural habits, measured using adapted items from the Sedentary Behavior Questionnaire (SBQ).
- **Recreational Sports Participation:** Frequency, duration, and intensity of physical activity, assessed using the International Physical Activity Questionnaire (IPAQ – Short Form).
- **Musculoskeletal Health:** Prevalence, location, and severity of pain assessed via the Standardized Nordic Musculoskeletal Questionnaire (NMQ), which captures discomfort in nine anatomical regions over the past 12 months and seven days.

3.3.1 Data Collection Procedures

Participants completed the questionnaire either electronically (via Google Forms) or in person under the supervision of trained research assistants. Prior to participation, respondents were informed about the study objectives, confidentiality assurances, and voluntary participation rights. Data were collected anonymously between January and April 2025.

3.3.2 Data Analysis

Quantitative data were analyzed using IBM SPSS Statistics (version 29). Descriptive statistics (means, frequencies, and percentages) were used to summarize demographic variables and prevalence rates of MSDs.

Bivariate analyses using Chi-square tests were conducted to examine associations between sedentary behavior, sports participation levels, and MSD occurrence. Subsequently, binary logistic regression analysis was employed to identify independent predictors of MSDs while adjusting for potential confounders such as age, body mass index (BMI), occupational posture, and ergonomic factors. A p-value < 0.05 was considered statistically significant.

3.3.3 Validity and Reliability

To ensure instrument reliability, Cronbach's alpha was calculated for each subscale, with coefficients above 0.70 considered acceptable. Content validity was established through expert review by specialists in public health, physiotherapy, and sports science to confirm conceptual relevance and cultural appropriateness.

3.4 Qualitative Phase

3.4.1 Research Design

Following completion of the quantitative survey, the qualitative phase was implemented to provide deeper insight into the patterns and associations identified in the first phase. This stage adopted a phenomenological approach using semi-structured interviews to explore women's lived experiences, perceptions, and motivations regarding physical activity, sedentary behavior, and musculoskeletal health. The qualitative inquiry sought to uncover the social, cultural, and environmental contexts that influence women's engagement in recreational sports and their experiences of musculoskeletal discomfort.

3.4.2 Participant Selection and Sampling

Participants for the qualitative phase were purposively selected from the quantitative sample to ensure diversity across age, occupational status, physical activity level, and MSD presence. Selection was guided by the principle of maximum variation sampling, which enhances representativeness and enriches understanding of differing perspectives.

Approximately 20 participants were recruited, a sample size considered adequate to achieve data saturation, where no new themes or insights emerge from additional interviews. Inclusion criteria required participants to be Bahraini nationals, aged 25–60 years, and have completed the initial survey. Willingness to discuss personal experiences related to physical activity and health was also a prerequisite.

3.4.3 Data Collection Procedures

Data were collected through in-depth semi-structured interviews conducted in Arabic by a trained female researcher to ensure cultural appropriateness and comfort. Interviews were held in private meeting rooms at community centers or conducted virtually via secure video conferencing platforms, depending on participants' preferences. Each interview lasted between 45 and 60 minutes and was audio-recorded with participants' consent.

An interview guide was developed based on the quantitative findings, covering key themes such as:

- Perceived barriers and facilitators to engaging in recreational sports;
- Cultural and family influences on women's physical activity behaviors;
- Awareness and perceptions of sedentary risks and musculoskeletal health;
- Occupational and ergonomic challenges related to prolonged sitting;
- Personal strategies or community support systems for maintaining physical activity.
- Field notes were taken to capture nonverbal cues, contextual details, and researcher reflections.

3.4.4 Data Analysis

Interview recordings were transcribed verbatim and translated into

English for coding and analysis. The data were analyzed using thematic analysis following Braun and Clarke's (2006) six-step framework:

- Familiarization with data;
- Generation of initial codes;
- Searching for themes;
- Reviewing themes;
- Defining and naming themes;
- Producing the final report.

NVivo 14 software was used to manage and organize data coding. Themes were developed inductively from participants' narratives and cross-validated against quantitative findings to ensure consistency and complementarity.

Emerging themes were categorized into behavioral, sociocultural, and environmental determinants of sedentary behavior and sports participation. These insights provided explanatory depth for interpreting statistical associations identified in the quantitative phase.

3.4.5 Trustworthiness and Rigor

To ensure the credibility and dependability of the qualitative findings, several strategies were implemented:

- **Credibility** was enhanced through member checking, where participants were invited to review and validate their transcribed responses.
- **Dependability** was maintained by keeping an audit trail documenting all methodological decisions and coding procedures.
- **Confirmability** was ensured through reflexive journaling, minimizing researcher bias during interpretation.
- **Transferability** was supported by providing detailed contextual descriptions of participants' backgrounds and study settings.

3.5 Integration of Quantitative and Qualitative Data

The integration of quantitative and qualitative findings was conducted during the interpretation and discussion phases of the study, following the principles of an explanatory sequential mixed-methods design. Integration aimed to achieve a comprehensive understanding of how sedentary behavior and recreational sports participation interact to influence musculoskeletal health among Bahraini adult women, while also uncovering the sociocultural and environmental contexts that shape these behaviors.

3.5.1 Integration Strategy

A connecting and merging approach was employed. Quantitative results from the first phase were used to inform the design and content of the qualitative interviews, ensuring that the second phase directly addressed key statistical associations and anomalies. For example, if the survey revealed a high prevalence of neck and lower back pain among women reporting low physical activity, qualitative interviews explored the reasons for inactivity, barriers to participation, and perceptions of pain and health in everyday life.

Subsequently, findings from both phases were merged through side-by-side comparison, where quantitative patterns were juxtaposed with qualitative themes to identify convergence, divergence, or complementarity. This process allowed for a nuanced understanding of how behavioral trends observed statistically are influenced by cultural norms, family expectations, occupational constraints, and environmental accessibility.

3.5.2 Interpretive Framework

The integration followed a triangulation logic, ensuring that each dataset reinforced and enriched the other:

- Quantitative data provided breadth by identifying prevalence rates, correlations, and predictive factors of MSDs.
- Qualitative data provided depth by interpreting the lived meanings behind those associations.

Together, they produced context-sensitive insights that neither approach could achieve alone.

3.5.3 Outcome of Integration

Through integration, the study generated a multidimensional model of musculoskeletal health determinants among Bahraini women, combining behavioral, sociocultural, and occupational dimensions. This comprehensive framework informed the development of evidence-based recommendations for preventive health interventions and policies aimed at reducing sedentary behavior, promoting recreational sports participation, and mitigating the burden of MSDs in the Bahraini female population.

3.6 Ethical Considerations

This study was conducted in accordance with the ethical standards of human subjects research and adhered to the principles outlined in the Declaration of Helsinki (2013 revision). Prior to data collection, ethical approval was obtained from the Research Ethics Committee of the European Institute of Management and Technology (EIMT, 2025, Switzerland). Permission to conduct the study was also secured from relevant community health centers and organizations participating in the recruitment process.

3.6.1 Informed Consent

All participants were fully informed about the purpose, objectives, and procedures of the study before participation. They received an information sheet describing the voluntary nature of involvement, the right to withdraw at any time without penalty, and assurances regarding the confidentiality of their responses. Written informed consent was obtained from each participant prior to completing the questionnaire or participating in interviews.

For online participants, consent was recorded electronically through an acknowledgment statement preceding the digital questionnaire.

3.6.2 Confidentiality and Anonymity

Participants' privacy was safeguarded throughout the research process. No identifying information (such as names, addresses, or workplace details) was collected in the survey or interviews. Each participant was assigned a unique identification code to protect anonymity. Data files were stored on password-protected devices accessible only to the principal investigator and research team. Audio recordings from interviews were transcribed, anonymized, and deleted immediately after verification.

3.6.3 Cultural Sensitivity

Given the sociocultural context of Bahrain, particular attention was paid to gender-appropriate communication and data collection procedures. All interviews were conducted by a trained female researcher fluent in Arabic, ensuring cultural respect and participant comfort. Interview venues were chosen based on participants' preferences for privacy and convenience, and questions were framed to maintain sensitivity toward local norms concerning women's health and physical activity.

3.6.4 Data Integrity and Use

Collected data were used solely for academic and scientific purposes. Results were reported in aggregate form to prevent individual identification. The study ensured compliance with institutional data protection guidelines, and participants were informed that their contributions would assist in shaping preventive health policies and community-based interventions to enhance women's musculoskeletal health.

Results

This section presents the comprehensive findings of the study, drawing from both the quantitative and qualitative phases, and is structured to align with the explanatory sequential mixed-methods design employed. The quantitative phase focuses on the prevalence, distribution, and behavioral determinants of musculoskeletal disorders (MSDs) among Bahraini adult women, providing numerical and statistical insights into the extent and risk factors associated with these conditions. Descriptive statistics, prevalence rates, and inferential analyses are reported to identify patterns in demographic variables, occupational exposure, lifestyle behaviors, and ergonomic practices that may contribute to the development or exacerbation of MSDs.

The qualitative phase complements these numerical findings by offering a rich, contextual understanding of the lived experiences, perceptions, and social influences that shape women's musculoskeletal health behaviors. Through in-depth interviews and thematic analysis, insights were obtained into the sociocultural norms, family responsibilities, workplace conditions, and environmental factors that influence daily activities, posture, and physical strain. These narratives reveal not only the challenges faced by women in maintaining musculoskeletal health but also their coping strategies, beliefs about health, and perceived barriers to preventive behaviors.

Finally, an integrated interpretation of the results is provided, bridging the quantitative prevalence data with the qualitative contextual insights. This synthesis highlights how behavioral determinants identified statistically are experienced and navigated in everyday life, allowing for a more nuanced understanding of the interplay between personal, social, and environmental factors in shaping MSD risk. The mixed-methods approach thus offers a holistic perspective, informing potential interventions, policy considerations, and health promotion strategies tailored to the Bahraini female population.

4.1 Quantitative Findings

4.1.1 Participant Characteristics

A total of 400 Bahraini women, aged between 25 and 60 years, participated in the survey, yielding a high response rate of 91%. The mean age of participants was 42.0 ± 10.1 years, reflecting a broad representation of adult women in the Bahraini population. Table 1 summarizes the key demographic and anthropometric characteristics of the study participants.

The majority of respondents (65%) had attained a university-level education or higher, indicating a relatively well-educated sample. Regarding employment status, 45% of participants were employed in office or service sectors, while 40% identified as homemakers, and the remaining 15% were either students or retired. These findings highlight a balance between professionally active women and those engaged primarily in domestic responsibilities, which may influence lifestyle patterns and musculoskeletal health.

Anthropometric assessment revealed that a substantial proportion of participants were affected by overweight and obesity, with 35% classified as overweight (BMI 25–29.9 kg/m²) and 25% as obese (BMI ≥30 kg/m²). Only 40% of the women fell within the normal weight range (BMI 18.5–24.9 kg/m²). This high prevalence of elevated BMI levels underscores the potential contribution of excess body weight to musculoskeletal disorders in this population.

Variable	n	%
Age group (years)		
25–34	120	30.0
35–44	140	35.0
45–60	140	35.0
Education level		
Secondary or less	140	35.0
University or higher	260	65.0
Employment status		
Employed (office/service)	180	45.0
Homemaker	160	40.0
Student/retired	60	15.0
BMI category		
Normal (18.5–24.9)	160	40.0
Overweight (25–29.9)	140	35.0
Obese (≥30)	100	25.0

Table 1: Participant Characteristics (n = 400).

This demographic and anthropometric profile provides a foundation for interpreting subsequent findings related to the prevalence of musculoskeletal disorders and the behavioral and environmental factors that may influence their occurrence.

4.1.2 Prevalence and Distribution of Musculoskeletal Disorders

The prevalence of musculoskeletal disorders (MSDs) among the study participants was assessed using the Standardized Nordic Musculoskeletal Questionnaire (NMQ). Out of 400 respondents, 176 women (44.0%) reported experiencing one or more musculoskeletal complaints over the past 12 months, indicating a substantial burden of MSDs in this population.

Body region	n	% of sample
Lower back	112	28.0
Neck	88	22.0
Knees	72	18.0
Shoulders	56	14.0
Wrists/Hands	40	10.0

Table 2: Anatomical Distribution of Reported MSDs (Past 12 Months).

The distribution of MSDs across anatomical regions is presented in Table 2. The lower back emerged as the most commonly affected region, with 28% of participants reporting discomfort, followed by the neck (22%) and knees (18%). Other regions affected included the shoulders (14%) and wrists/hands (10%). The high prevalence in the lower back

and neck aligns with common musculoskeletal patterns observed in adult women, often associated with prolonged sitting, occupational strain, and household tasks that involve lifting or repetitive movements.

These findings highlight that MSDs are widespread among Bahraini adult women, with certain anatomical regions disproportionately affected. Multiple responses were permitted in the survey, reflecting the fact that many participants experienced complaints in more than one body region, underscoring the multifactorial nature of musculoskeletal discomfort. The observed distribution provides a foundation for exploring behavioral, occupational, and lifestyle determinants that may contribute to the onset and severity of MSDs.

These prevalence patterns underscore the need for targeted interventions focusing on the most affected regions, as well as strategies to reduce risk factors associated with daily activities, occupational tasks, and lifestyle behaviors.

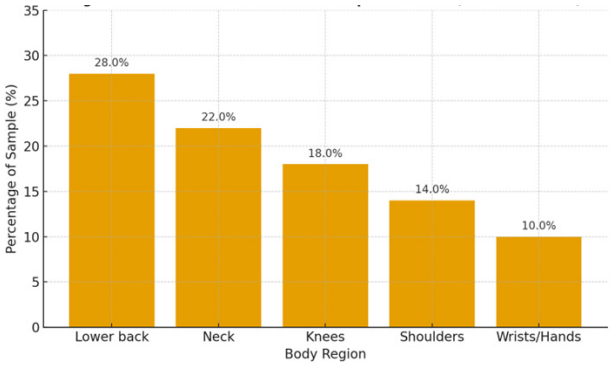


Figure 1: Anatomical distribution of reported MSDs (Past 12 Months)

4.1.3 Sedentary Behavior and Recreational Sports Participation

The study assessed participants' sedentary behavior and engagement in recreational physical activity to explore potential behavioral determinants of musculoskeletal disorders. On average, participants reported 7.2 ± 2.1 hours of sitting per day, indicating a predominantly sedentary lifestyle among many respondents. Notably, half of the participants (50%) reported sitting for more than six hours per day, highlighting prolonged sedentary periods that may contribute to musculoskeletal strain, particularly in the lower back and neck.

Measure	n	%
Sedentary < 4 h/day	80	20.0
Sedentary 4–6 h/day	120	30.0
Sedentary > 6 h/day	200	50.0
IPAQ Low	180	45.0
IPAQ Moderate	140	35.0
IPAQ High	80	20.0

Table 3: Sedentary Time and Activity Levels (n = 400).

Physical activity levels were evaluated using the International Physical Activity Questionnaire (IPAQ) Short Form, classifying participants into low, moderate, and high activity categories. Findings indicated that 45% of women were low active, 35% were moderately active, and only 20% were highly active (Table 3). This distribution suggests that a substantial proportion of Bahraini women engage in insufficient physical activity, potentially increasing their susceptibility to MSDs due to inadequate musculoskeletal conditioning, poor postural support, and limited muscle strength.

These findings demonstrate a clear behavioral pattern in which prolonged sitting and low levels of physical activity coexist in a significant proportion of the population, likely contributing to the prevalence and anatomical distribution of MSDs observed in the study. Understanding these behavioral determinants is essential for developing targeted interventions that promote active lifestyles, reduce sedentary time, and support musculoskeletal health among Bahraini adult women.

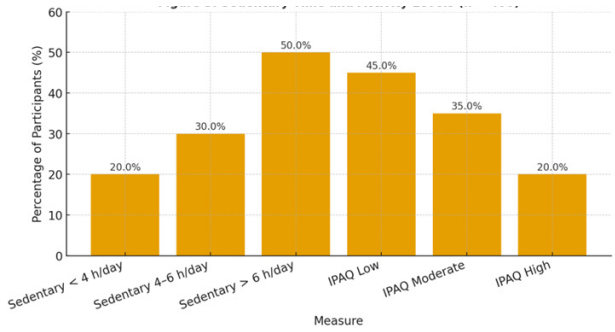


Figure 2: Sedentary time and activity levels (n=400).

4.1.4 Association Between Behavioral Factors and MSDs

The relationship between behavioral factors—specifically sedentary behavior and physical activity—and the presence of musculoskeletal disorders (MSDs) was examined using chi-square tests. Results demonstrated statistically significant associations for both factors ($p < 0.001$), indicating that lifestyle behaviors play a critical role in the risk of developing MSDs among Bahraini adult women.

Behavioral Factor	Category	n	MSD Cases	Prevalence (%)	χ^2	p-value
Sedentary Time	< 4 h/day	80	24	30.0	28.1	<0.001
	4–6 h/day	120	54	45.0		
	> 6 h/day	200	110	55.0		
Physical Activity (IPAQ)	Low	180	110	61.1	62.4	<0.001
	Moderate	140	49	35.0		
	High	80	16	20.0		

Table 4: Prevalence of MSDs by Sedentary Behavior and Physical Activity (n = 400).

Note: Multiple comparisons show that MSD prevalence increases with longer sedentary time and decreases with higher physical activity.

Sedentary behavior: MSD prevalence was strongly influenced by daily sitting time. Among women reporting less than 4 hours of sitting per day, only 30% experienced MSDs. This prevalence increased to 55% in participants who reported sitting for more than 6 hours per day, highlighting a clear positive association between prolonged sedentary periods and musculoskeletal discomfort ($\chi^2 = 28.1$, $p < 0.001$). These

findings suggest that extended sedentary behavior may contribute to strain in commonly affected regions such as the lower back, neck, and knees.

Physical activity: A similar pattern was observed with levels of recreational and occupational physical activity. Participants classified as low-active had the highest prevalence of MSDs at 61.1%, compared to 20.0% among highly active women ($\chi^2 = 62.4$, $p < 0.001$). Moderately active women demonstrated intermediate prevalence rates (35%), reflecting a dose-response relationship between activity levels and musculoskeletal health. This association underscores the protective effect of regular physical activity in reducing the risk and severity of MSDs, likely through improved muscle strength, posture, and overall musculoskeletal resilience.

Collectively, these findings reinforce the importance of behavioral factors in the development and progression of MSDs. Interventions aiming to reduce sedentary time and promote regular physical activity may therefore be effective strategies to mitigate musculoskeletal complaints and enhance quality of life among Bahraini adult women.

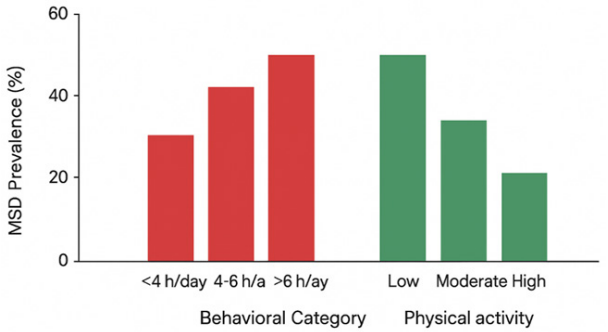


Figure 3: Association between behavioral factors and MSD prevalence.

4.1.5 Predictors of MSDs (Logistic Regression Analysis)

A binary logistic regression analysis was conducted to identify independent predictors of musculoskeletal disorders (MSDs) among Bahraini adult women. Variables included in the model were sedentary time, physical activity level, age, body mass index (BMI), and occupation type. The results are presented in Table 4.

Predictor	OR	95% CI	p
Sedentary > 6 h/day (vs ≤ 6 h/day)	2.30	1.60–3.30	< 0.001
Activity Moderate (vs High)	1.90	1.10–3.20	0.020
Activity Low (vs High)	3.80	2.10–6.80	< 0.001
Age (per 10-year increase)	1.20	1.01–1.42	0.040
Obese (vs Normal BMI)	1.70	1.10–2.70	0.020
Sedentary occupation (vs Non-sedentary)	1.50	1.00–2.30	0.050

Table 5: Logistic regression predicting odds of MSDs (n = 400).

The model demonstrated a satisfactory fit to the data, as indicated by the Hosmer–Lemeshow test ($p = 0.45$), and accounted for 28% of the variance in MSD occurrence (Nagelkerke $R^2 = 0.28$), suggesting a moderate explanatory power.

Interpretation of the findings revealed that sedentary behavior was a strong predictor of MSDs. Women who reported sitting for more than six hours per day had 2.3 times higher odds of developing MSDs compared to those sitting six hours or less. Physical activity also showed a significant protective effect: women with low activity levels were nearly four times more likely to experience MSDs than those with high activity, while moderate activity increased the odds by approximately 1.9 times.

Age emerged as a significant but smaller predictor, with every 10-year increase in age associated with a 20% increase in the odds of MSDs. Obesity independently increased the risk, with obese women having 1.7 times higher odds compared to women with a normal BMI. Finally, occupational factors contributed to risk: women in predominantly sedentary occupations had 1.5 times higher odds of MSDs compared to those in non-sedentary roles.

Overall, these findings highlight the multifactorial nature of MSD risk, emphasizing the combined influence of behavioral, demographic, and occupational factors. Interventions targeting reduction in sedentary time, promotion of physical activity, and weight management may be particularly beneficial in reducing the prevalence of MSDs in this population.

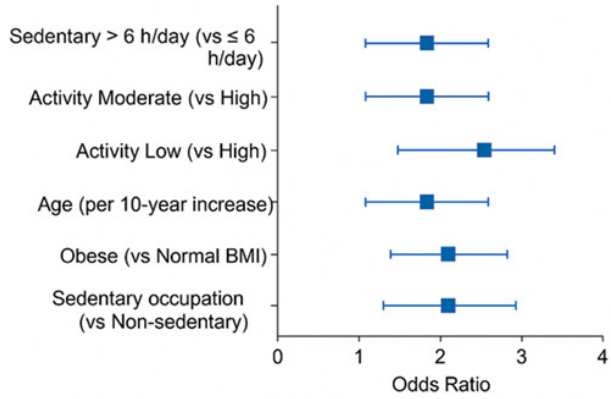


Figure 4: Odds ratio of MSD Predicators.

4.2 Qualitative Findings

4.2.1 Overview of Participants

A total of twenty women who had participated in the quantitative survey were purposively selected for semi-structured interviews to explore in depth the lived experiences and contextual factors associated with musculoskeletal disorders (MSDs). Participants were chosen to ensure diversity in age, occupation, and physical activity levels, reflecting the broader demographic profile of the survey sample.

The age range of participants was 25 to 60 years, encompassing early adulthood to late middle age. Occupational representation included office-based sedentary roles, teaching, healthcare, retail, and manual labor. Physical activity levels varied widely, with some women engaging in regular high-intensity exercise, while others reported low daily activity and prolonged sitting.

Approximately half of the participants reported experiencing MSDs in the previous year, ranging from mild discomfort to more severe pain affecting daily functioning. These women described symptoms primarily in the neck, shoulders, lower back, and wrists, often attributing discomfort to a combination of occupational demands, prolonged sitting, and lack of regular exercise.

The remaining participants, who had not experienced MSDs, offered valuable insights into preventive behaviors and lifestyle choices, highlighting strategies such as regular stretching, use of ergonomic workstations, and scheduled physical activity. Collectively, the participants provided a rich and diverse perspective on the social, occupational, and behavioral contexts influencing musculoskeletal health among Bahraini adult women.

4.3 Emergent Themes

Thematic analysis of the semi-structured interviews revealed four overarching themes that illuminate the lived experiences of Bahraini women regarding musculoskeletal disorders (MSDs) and physical activity. These themes provide contextual depth to the quantitative findings and help explain how behavioral, occupational, and sociocultural factors interact to influence musculoskeletal health.

4.3.1 Theme 1: Cultural and Familial Influences on Physical Activity

A predominant theme was the impact of cultural expectations and family responsibilities on women's engagement in physical activity. Many participants reported that social norms dictated their primary role as caretakers, with personal health often taking a backseat to family needs. The competing demands of work and domestic duties created a tension between self-care and fulfilling socially expected responsibilities.

"After work, my family expects me to be home — finding time for exercise feels selfish." (Participant 6, age 38)

Participants emphasized that even when they were aware of the benefits of physical activity, guilt and societal judgment often prevented them from dedicating time to exercise. This aligns with the quantitative observation that low levels of physical activity significantly increased MSD risk. The interviews suggest that behavioral patterns are not purely individual choices but are strongly influenced by entrenched social and familial norms.

This theme also highlighted intergenerational expectations, where older family members reinforced traditional gender roles. Women described how, despite personal interest in exercise or health promotion, family pressures often dictated their daily schedules, leaving limited time for movement.

4.3.2 Theme 2: Barriers to Recreational Sports Participation

Structural and environmental barriers emerged as key constraints to engaging in recreational sports and organized physical activity. Women reported limited availability of women-only fitness centers, high membership fees, and unsafe walking environments as significant deterrents. For many participants, access was compounded by transportation challenges, particularly in suburban or rural areas.

"I want to join a fitness center, but the ones for women are expensive or too far from my home."

(Participant 11, age 45)

Safety concerns were also mentioned, including poorly lit streets and a lack of secure public spaces for outdoor activity. These barriers created a cycle of inactivity, where the inability to access facilities reduced motivation, further increasing susceptibility to musculoskeletal discomfort.

The interviews revealed that financial and infrastructural constraints are critical determinants of physical activity levels. This contextualizes the quantitative finding that low physical activity significantly increased the odds of MSDs. It also underscores the need for policy-level interventions, such as affordable, accessible women-only facilities and safe community spaces for exercise.

4.3.3 Theme 3: Occupational and Environmental Constraints

Workplace demands and ergonomics were frequently cited as contributors to MSDs. Women in office-based, sedentary roles described prolonged sitting, extended screen time, and inadequate ergonomic furniture as primary sources of pain, especially in the neck, shoulders, and lower back.

"I sit in front of the computer all day; my back and neck start hurting before the day ends."

(Participant 3, age 41)

Manual laborers also reported discomfort linked to repetitive movements and heavy lifting. Many participants described cumulative strain, where minor daily aches escalated over time into chronic musculoskeletal problems.

Occupational environments not only contributed to physical strain but also interacted with social and cultural factors. For example, women with long office hours often faced familial expectations to continue domestic work after their jobs, leaving little time for recovery or exercise. This qualitative insight complements the logistic regression findings, which identified sedentary occupations and prolonged sitting as significant predictors of MSDs.

4.3.4 Theme 4: Motivation and Coping Strategies

Despite significant barriers, participants described various strategies to remain active and manage discomfort. Walking, home-based exercises, and stretching routines were commonly cited, though adherence was often inconsistent. Social support, particularly from friends or exercise groups, played a key role in promoting sustained activity.

"When I walk with friends, I feel supported — it's the only time I move consistently."

(Participant 19, age 50)

Religious beliefs and spiritual practices were also cited as motivators. Several participants mentioned that prayer or faith-based routines encouraged mindful movement, serving both physical and psychological well-being.

Participants described self-management strategies for musculoskeletal discomfort, including ergonomic adjustments at home, use of supportive furniture, and periodic rest breaks. However, the effectiveness of these strategies was limited by environmental constraints, such as a lack of space or ergonomic equipment.

This theme highlights the importance of psychosocial and motivational factors in mitigating MSD risk. Interventions that leverage social networks, culturally appropriate exercise programs, and faith-aligned health promotion could enhance women's engagement in physical activity and reduce MSD prevalence.

4.3.5 Integrative Insights

Collectively, these themes illustrate that musculoskeletal health among Bahraini women is influenced by a complex interplay of cultural, environmental, occupational, and behavioral factors. Sedentary behavior, low physical activity, and occupational strain interact with societal norms and structural barriers to shape the risk of MSDs. Moreover, personal motivation and coping strategies can partially mitigate these risks, but are constrained by broader social and environmental contexts.

By integrating these qualitative insights with the quantitative findings, it becomes clear that reducing MSD prevalence requires multidimensional interventions. These should not only promote individual behavior

change but also address occupational ergonomics, cultural expectations, and access to safe and affordable exercise opportunities.

4.4 Integration of Quantitative and Qualitative Findings

The integration of quantitative and qualitative data provided a holistic understanding of the determinants of musculoskeletal disorders (MSDs) among Bahraini adult women. By combining statistical associations with in-depth contextual insights, the study offers a nuanced perspective on how behavioral, occupational, and sociocultural factors interact to influence musculoskeletal health.

4.4.1 Convergence of Findings

The quantitative analysis identified prolonged sitting, low physical activity, age, obesity, and sedentary occupation as significant predictors of MSDs. Specifically, women sitting more than six hours per day had over twice the odds of developing MSDs, and low activity levels increased the risk nearly fourfold.

The qualitative findings provided explanatory depth for these associations. Women's narratives highlighted gender norms, family responsibilities, and occupational demands as barriers to regular physical activity. Limited access to women-only fitness facilities and safety concerns further constrained engagement. Both data strands converged in emphasizing sedentary behavior and insufficient physical activity as central determinants of MSD risk. This convergence strengthens confidence in the robustness of the findings and underscores the multifactorial nature of MSDs.

4.4.2 Divergence and Complementarity

While quantitative results provided numerical estimates of risk and prevalence, the qualitative data revealed psychosocial dimensions and lived experiences that statistics alone could not capture. For example, participants described feelings of guilt, cultural modesty, and time scarcity as barriers to exercise, which are not directly measurable in standard surveys.

This complementarity illustrates that behavioral determinants of MSDs are shaped by both measurable exposures and complex social contexts. For instance, two women with similar sedentary work patterns might have different MSD outcomes depending on family support, cultural expectations, and personal coping strategies. Therefore, qualitative insights enriched interpretation, highlighting the why and how behind the observed quantitative associations.

4.4.3 Integrated Interpretation

Synthesizing both strands suggests that interventions to reduce MSD risk must extend beyond individual-level awareness or behavior change. Effective preventive strategies should address:

Structural barriers: Improving access to affordable, safe, and women-only physical activity facilities, and providing ergonomically optimized workspaces.

Sociocultural constraints: Promoting family and community support for women's self-care and physical activity, challenging restrictive gender norms, and integrating culturally appropriate exercise programs.

Occupational health: Encouraging regular movement breaks, ergonomic training, and workplace policies that reduce prolonged sitting.

Behavioral motivation: Leveraging social support, peer encouragement, and faith-aligned activities to sustain engagement in regular physical activity.

By addressing these intersecting factors, interventions can more effectively reduce sedentary behavior, increase physical activity, and ultimately lower the prevalence of MSDs among Bahraini women. The mixed-methods approach demonstrates that understanding and mitigating MSD risk requires a comprehensive strategy that combines quantitative measurement with qualitative insight into lived experiences.

Key Dimension	Quantitative Evidence	Qualitative Insight	Integrated Understanding
Sedentary behavior	>6 h/day sitting ↑ MSD odds 2.3×	Women constrained by occupational and domestic roles	Sedentary patterns are socially and structurally reinforced
Physical activity	Low activity ↑ MSD odds 3.8×	Barriers: safety, cost, time, modesty norms	Need for safe, affordable, culturally sensitive exercise options
BMI and Age	Older, obese women are at higher risk	Fear of injury, low motivation	Tailored midlife interventions needed
Work environment	Sedentary jobs ↑ MSD odds 1.5×	Poor posture, long sitting hours	Ergonomic workplace reform is essential

Table 6. Summary of Mixed-Methods Results.

4.5 Result Summary

High Prevalence of MSDs: Musculoskeletal disorders affect nearly half of Bahraini adult women, indicating a substantial public health concern that warrants targeted intervention.

Behavioral and Demographic Predictors: Quantitative analysis identified sedentary behavior, low physical activity, obesity, and increasing age as significant predictors of MSD risk. Women who sit for prolonged periods or engage in minimal physical activity are particularly vulnerable.

Contextual Barriers to Physical Activity: Qualitative findings highlighted sociocultural and environmental factors—including gender norms, family obligations, limited access to women-only facilities, and occupational demands—that constrain women's ability to engage in regular exercise. These barriers help explain why high-risk behaviors persist despite awareness of health risks.

Need for Integrated Interventions: Synthesizing quantitative and qualitative evidence demonstrates that effective MSD prevention requires both individual-level strategies (e.g., promoting exercise, ergonomic adjustments) and systemic interventions (e.g., culturally sensitive health promotion programs, improved facility access, family- and community-supported activity). Addressing both behavioral and structural determinants is critical to reducing MSD prevalence in this population.

Implications for Policy and Practice: These findings underscore the importance of multilevel public health strategies that consider cultural realities, occupational ergonomics, and motivational supports, ensuring that interventions are both feasible and sustainable within the Bahraini context.

Discussion

Prevalence and Anatomical Distribution of MSDs

The study found that 44% of Bahraini women reported experiencing MSDs, with the lower back, neck, and knees being the most commonly

affected regions(Nasaif et al., 2023). This prevalence aligns with global patterns observed in adult women, where prolonged sitting, repetitive movements, and domestic or occupational tasks contribute to musculoskeletal strain(Osinuga, 2021). The high prevalence underscores the need for targeted interventions that address both the most affected anatomical regions and the multifactorial risk factors contributing to MSDs.

The distribution of MSDs across multiple body regions also highlights the complex nature of musculoskeletal discomfort, where cumulative strain from occupational and household activities exacerbates vulnerability(Hilmi & Hamid, 2023). These findings suggest that prevention efforts should consider both localized and systemic approaches, such as strengthening exercises, ergonomic modifications, and activity scheduling.

5.2 Behavioral Determinants of MSDs

Quantitative analyses identified sedentary behavior and low physical activity as significant predictors of MSDs. Women sitting more than six hours per day had 2.3 times higher odds of developing MSDs, and those with low activity levels had nearly fourfold increased odds(Putsa et al., 2022). These findings are consistent with literature emphasizing the deleterious effects of prolonged sitting and insufficient physical activity on musculoskeletal health(Tripathi, 2024).

The qualitative phase provided contextual explanations for these behavioral patterns. Women reported that family responsibilities, cultural expectations, and occupational demands limited their time and opportunities for exercise. Social norms that prioritize caregiving over self-care contributed to low engagement in physical activity, even when participants were aware of its benefits(Cothran et al., 2022). This convergence of quantitative and qualitative evidence indicates that interventions focusing solely on individual behavior may be insufficient; structural and sociocultural barriers must also be addressed.

5.3 Occupational and Environmental Influences

Occupational factors, particularly sedentary work, emerged as significant contributors to MSD risk. Women in office-based roles reported prolonged sitting, poor posture, and inadequate ergonomic support as sources of pain, which aligns with the logistic regression finding that sedentary occupations increased MSD odds by 1.5 times(Shilpy, 2025). Manual laborers also experienced discomfort related to repetitive movements and lifting tasks, indicating that both sedentary and physically demanding occupations carry musculoskeletal risks.

Qualitative insights further highlighted environmental constraints, including a lack of safe spaces for exercise, limited women-only facilities, and transportation challenges. These factors interact with occupational demands and cultural expectations, creating a compounded risk environment for MSDs. Together, these findings underscore the importance of workplace ergonomics, access to physical activity resources, and supportive policies to mitigate musculoskeletal strain.

5.4 Sociocultural Context and Psychosocial Factors

The study's qualitative findings emphasized the influence of sociocultural and familial expectations on women's physical activity. Feelings of guilt, adherence to traditional gender roles, and prioritization of family care over self-care were recurring themes(Britton et al., 2023).These psychosocial factors help explain why high-risk behaviors persist despite awareness of health consequences.

Furthermore, participants highlighted motivation and coping strategies, such as social support, peer encouragement, and faith-based routines, as facilitators of physical activity. These insights suggest that culturally tailored interventions that incorporate community support, social networks, and faith-aligned activities may enhance adherence to preventive behaviors and improve musculoskeletal health outcomes.

5.5 Integrative Interpretation

The integration of quantitative and qualitative findings illustrates that MSD risk among Bahraini women arises from a complex interplay of behavioral, occupational, demographic, and sociocultural factors(Masood et al., 2024). Behavioral determinants, such as sedentary time and low physical activity, are reinforced by occupational and environmental constraints, while social norms and familial responsibilities further shape these behaviors.

Effective interventions must therefore be multidimensional. Individual-level strategies, including promotion of regular exercise, stretching routines, and ergonomic adjustments, should be complemented by systemic interventions targeting workplace ergonomics, access to safe and affordable women-only facilities, and sociocultural support mechanisms. By addressing both behavioral and structural determinants, such interventions are more likely to reduce MSD prevalence and enhance the quality of life for Bahraini women.

5.6 Implications for Practice and Policy

The findings have several practical and policy implications:

- Workplace Health Promotion: Employers should implement ergonomic assessments, adjustable workstations, and regular movement breaks to reduce prolonged sitting and prevent musculoskeletal strain.
- Community and Facility Access: Investment in affordable, safe, and culturally appropriate fitness facilities for women is crucial to promote physical activity.
- Health Education Programs: Public health campaigns should raise awareness about the importance of musculoskeletal health, incorporating guidance on exercise, posture, and self-care, while considering cultural norms and family dynamics.
- Integrated Intervention Models: Programs combining social support, faith-based motivation, and peer networks may enhance adherence to physical activity and coping strategies for MSDs.

These recommendations highlight the need for multilevel strategies that consider behavioral, occupational, environmental, and sociocultural dimensions to effectively reduce MSD prevalence among adult women in Bahrain.

5.7 Strengths and Limitations

A key strength of this study is the mixed-methods design, which allowed for a robust exploration of both statistical associations and contextual experiences, providing a holistic understanding of MSD determinants. Purposive sampling for qualitative interviews ensured diverse perspectives across age, occupation, and activity levels.

Limitations include reliance on self-reported measures for MSDs, sedentary behavior, and physical activity, which may be subject to recall or social desirability bias. Additionally, the cross-sectional design of the quantitative phase limits causal inference. Future longitudinal studies could strengthen the understanding of temporal relationships between behavioral factors and MSD development.

Conclusion

Musculoskeletal disorders (MSDs) are highly prevalent among Bahraini adult women, affecting nearly half of the study population and primarily impacting the lower back, neck, and knees(Nasaif et al., 2023).

Quantitative findings identified prolonged sedentary behavior, low physical activity, obesity, age, and sedentary occupations as significant predictors of MSD risk. Qualitative insights revealed that sociocultural expectations, family responsibilities, occupational demands, limited access to women-only fitness facilities, and environmental constraints further reinforce high-risk behaviors and hinder preventive practices. The integration of quantitative and qualitative evidence underscores that MSD risk is shaped by a complex interplay of behavioral, occupational, environmental, and sociocultural factors(O'Reilly & Van Eerd, 2025). Effective interventions must therefore be multidimensional, combining individual-level strategies—such as exercise promotion, ergonomic adjustments, and lifestyle modification—with structural and community-level approaches, including culturally sensitive health programs, workplace ergonomics, and improved access to safe physical activity facilities. Addressing both personal behaviors and systemic barriers is essential to reducing MSD prevalence, improving musculoskeletal health, and enhancing the overall quality of life of Bahraini women(Awadalla et al., 2024). These findings provide a strong evidence base for policymakers, healthcare providers, and community organizations to develop targeted, culturally appropriate, and sustainable strategies for MSD prevention and health promotion.

References

1. Abdelhay O, Altamimi M, et al; (2025). "Perceived barriers to physical activity and their predictors among adults in the Central Region in Saudi Arabia: Gender differences and cultural aspects". Plos One, 20(2), e0318798.
2. Afsharian A, Dollard M. F, et al; (2023). "Work-related psychosocial and physical paths to future musculoskeletal disorders (MSDs)". *Safety Science*, 164, pp106177.
3. Al-Ajlouni Y. A, Al Ta'ani O, et al; (2023). "The burden of musculoskeletal disorders in the Middle East and North Africa (MENA) region: a longitudinal analysis from the global burden of disease dataset 1990—2019". *BMC Musculoskeletal Disorders*, 24(1), pp439.
4. Alhashim A. A, Alyousof A. A, et al; (2025). "Work-related musculoskeletal disorders and their impact on quality of life: A comprehensive review". Saudi J Med Pharm Sci, 11(5), pp360–377.
5. Alseminy M. A. M. M, Chandrasekaran B, & Bairapareddy K. C. et al; (2022). "Association of physical activity and quality of life with work-related musculoskeletal disorders in the UAE young adults". *Healthcare*, 10(4) pp625.
6. Awadalla A. M, Alsharifa A. A. G, et al; (2024). "Management of musculoskeletal disorders; a systematic review". *Int. J. Med. Dev. Ctries*, 8(1), pp340.
7. Baldania S, & Baladaniya M. et al:(2024). "Improved Movement, Improved Life: The Vital Contribution of Physical Therapy to Orthopaedic Resilience". International Journal of Physiotherapy (IJPH), 2(1), pp1–18.
8. Bondarev D, Sipilä S, et al; (2021). "Associations of physical performance and physical activity with mental well-being in middle-aged women". *BMC Public Health*, 21(1), pp1448.
9. Britton L. E, Kaur G, et al; (2023). "We tend to prioritise others and forget ourselves': How women's caregiving responsibilities can facilitate or impede diabetes self-management". *Diabetic Medicine*, 40(3), ppe15030.
10. Chaabane S, Chaabna K, et al; (2021). "Barriers and facilitators associated with physical activity in the Middle East and North Africa region: a systematic overview". *International Journal of Environmental Research and Public Health*, 18(4), pp1647.
11. Chunn L. M, Bissonnette J, et al; (2022). "Estimation of ENPP1 deficiency genetic prevalence using a comprehensive literature review and population databases". Orphanet Journal of Rare Diseases, 17(1), pp421.
12. Cothran F. A, Paun O, et al; (2022). "Walk a mile in my shoes:'African American caregiver perceptions of caregiving and self-care". *Ethnicity & Health*, 27(2) pp435–452.
13. Fu R, & Kim S. J. et al: (2021). "Inferring causality from observational studies: the role of instrumental variable analysis". *Kidney International*, 99(6), pp1303–1308.
14. Hilmi A. H, & Hamid A. R. et al; (2023). "Musculoskeletal Disorders: Industrial Insights and Ergonomic Interventions". *Malaysian Journal of Ergonomics* (MJEr), 5, pp61–78.
15. Islam R, Mostofa T. B, & E-Elahi Q. M. (2024). "Human Factors & Ergonomics in Healthcare: Targeting MSDs Prevention for Safer." *Efficient Care*.
16. Masood M. A, Khaled R, et al; (2024). "Occupational health in the Gulf Cooperation Council (GCC): A systematic review and call for comprehensive policy development". Plos One, 19(12), ppe0312251.
17. Meng Y, Xue Y et al; (2025). "The associations between sedentary behavior and neck pain: a systematic review and meta-analysis". *BMC Public Health*, 25(1), ppp453.
18. Naguib R, & Barbar J. et al; (2025). "Factors Shaping Sustainability Through Female Entrepreneurship in the GCC: A Systematic Review with Multi-Level and Institutional Perspective". *Sustainability*, 17(5), pp2163.
19. Nasaif H, Alaradi M, et al; (2023). "Prevalence of self-reported musculoskeletal symptoms among nurses: a multicenter cross-sectional study in Bahrain". *International Journal of Occupational Safety and Ergonomics*, 29(1), pp192–198.
20. Nieste I, Franssen W. M. A, et al; (2021). "Lifestyle interventions to reduce sedentary behaviour in clinical populations: a systematic review and meta-analysis of different strategies and effects on cardiometabolic health". *Preventive Medicine*, 148, pp106593.
21. Núñez-Cortés R, Salazar-Méndez J, & Nijs J. et al: (2025). "Physical Activity as a Central Pillar of Lifestyle Modification in the Management of Chronic Musculoskeletal Pain: A Narrative Review". *Journal of Functional Morphology and Kinesiology*, 10(2), pp183.
22. O'Reilly H, & Van Eerd D. et al: (2025). "Including the ergonomist's voice in integrating MSD prevention and psychological health and safety: Challenges, tools, and considerations". *Applied Ergonomics*, 122, pp104405.
23. Osinuga, A. M. et al: (2021). "How Stressful Is Women's Work? Understanding Rural Nigerian Women's Domestic Work Experience, Characterizing the Physical Demands, and Estimating Associations with Musculoskeletal Pain". *The University of Iowa*.

24. Overstreet D. S, Strath L. J, et al; (2023). "A brief overview: sex differences in prevalent chronic musculoskeletal conditions". *International Journal of Environmental Research and Public Health*, 20(5), pp4521.

25. Pinto A. J, Bergouignan A, et al; (2023). "Physiology of sedentary behavior". *Physiological Reviews*.

26. Putsa B, Jalayondeja W, et al; (2022). "Factors associated with reduced risk of musculoskeletal disorders among office workers: a cross-sectional study 2017 to 2020". *BMC Public Health*, 22(1), pp1503.

27. Shilpy R. A. et al; (2025). "Assessment of workplace ergonomics and its impact on musculoskeletal disorders among office workers in the selected corporate office in Dhaka". *Bangladesh Health Professions Institute, Faculty of Medicine, the University*

28. Tripathi, A. et al: (2024). "Unraveling the Link Between Prolonged Sitting, Sedentary Lifestyle and Mental Health". *In Indian Journal of Behavioural Sciences* (Vol. 27, Issue 1, pp. 1–6). Medknow.

29. Verdú E, Homs J, & Boadas-Vaello P. (2021). "Physiological changes and pathological pain associated with sedentary lifestyle-induced body systems fat accumulation and their modulation by physical exercise". *International Journal of Environmental Research and Public Health*, 18(24), pp13333.

30. Zhang X, & Li Y. et al; (2025). "Causal effects of sedentary behavior and physical activity on the risk of musculoskeletal disorders: Evidence from Mendelian randomization analysis". *Medicine*, 104(38), ppe44390.