Original

Association between Job Stress, Job Demand, and Musculoskeletal Disorders among Academic Staff of Universities in Benue State: A Cross-Sectional Study

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Abstract

Background: Musculoskeletal disorders (MSDs) are prevalent among academic staff, potentially worsened by job-related stress and high job demands. This study examined the correlations between job stress, job demand, and MSDs among academic staff in universities in Benue State, Nigeria.
Method: A cross-sectional survey was conducted among 355 academic staff selected using a multi-stage sampling method across four universities. Data were collected via a structured questionnaire incorporating validated scales for job stress and job demand. Descriptive statistics and Spearman Rank correlation were used for analysis, with $p<0.05$ considered statistically significant.
Results: Most respondents were aged 51 years and above (41.1%), predominantly male (64.8%), and primarily senior lecturers (31.5%). The mean job stress level was moderate (M = 2.68, SD = 0.87), while job demand was high (M = 2.99, SD = 0.66). Key stressors included workload, emotional impact, and physical strain, while responsibilities drove job demand. The prevalence of MSDs was 84.4%. Job stress showed a strong positive correlation with MSDs ($r_s(353) = .80$, $p < .001$), identifying it as a major risk factor. However, job demand had a positive but non-significant correlation with MSDs ($r_s(353) = .328$, $p > .05$).
Conclusion: Occupational stress significantly impacts musculoskeletal health among academic staff. Targeted interventions, including stress management programs and workload optimization, are necessary to enhance well-being and productivity.

Keywords: Musculoskeletal disorders, job stress, Job demand, Academic staff, Occupational health

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Introduction

Musculoskeletal disorders (MSDs) encompass a range of conditions that affect the muscles, bones, joints, tendons, ligaments, and other supportive structures of the body. These disorders are characterized by symptoms such as pain, stiffness, swelling, and reduced mobility, which can significantly impact an individual's ability to perform daily activities and maintain productivity. Around 1.71 billion individuals worldwide suffer from musculoskeletal disorders. Low back pain is the primary cause of disability in 160 countries, and musculoskeletal disorders are the primary cause of disability worldwide .[1] Musculoskeletal disorders severely impair dexterity and mobility, which can result in early retirement from employment, decreased wellbeing, and a diminished capacity to engage in social activities.[1]

Globally, MSDs are a leading cause of disability and are often associated with workplace environments .[1]In academic settings, these disorders are particularly prevalent due to the sedentary and mentally demanding nature of the work. Academic staff often face long hours of desk work, repetitive tasks like typing and writing, and poor ergonomic conditions, which increase their susceptibility to MSDs.[2]

The development of MSDs is influenced by a combination of physical, psychosocial, and individual factors. Physical contributors include prolonged sitting, awkward postures, and repetitive movements, which place excessive strain on the musculoskeletal system.[2,3] Psychosocial factors, such as high job stress, demanding workloads, and limited control over tasks, further exacerbate the risk of MSDs by inducing muscle tension and fatigue. Additionally, individual factors like age, gender, physical fitness, and pre-existing health conditions can modify the likelihood and severity of these disorders.[1]

In academic work environments, MSDs pose significant challenges not only to the health and well-being of staff but also to institutional productivity. Chronic pain and discomfort can lead to reduced job performance, absenteeism, and lower job satisfaction. At an organizational level, these issues can result in increased healthcare costs and a decline in workforce efficiency.[4]

Furthermore, research has shown that the relationship between job stress, job demand, and musculoskeletal disorders (MSDs) is a complex interplay of psychological and physical factors that can significantly impact the health and productivity of academic staff. Academic roles often require prolonged mental engagement, high levels of concentration, and extended hours of sedentary work, all of which can contribute to the development of MSDs.[5]

Job stress refers to the adverse physical and emotional responses that arise when job demands exceed an individual's coping capacity. Among academic staff, job stress is often linked to heavy workloads, pressure to meet deadlines, lack of job control, and the dual responsibility of teaching and research. This chronic stress can manifest physically as muscle tension, particularly in the neck, shoulders, and lower back, which are common sites of MSDs.[6]

Studies have shown that job stress can exacerbate MSD symptoms by triggering the body's stress response, leading to increased muscle stiffness and reduced blood flow to musculoskeletal tissues .[6,7] Over time, these physiological changes can result in chronic pain and functional impairment. Furthermore, the psychological burden of stress can reduce adherence to health-promoting behaviors, such as regular exercise and proper ergonomics, thereby compounding the risk of MSDs.[8]

On the other hand, Job demand refers to the physical, mental, and emotional effort required to meet the expectations of a role.[9]Academic staff in Benue State universities often face high job demands, including large class sizes, administrative duties, research responsibilities, and frequent deadlines. These demands can lead to physical strain and mental fatigue, both of which are risk factors for MSDs.

The combined effect of job stress and job demand creates a synergistic risk for MSDs among academic staff. While job demand directly imposes physical strain, job stress amplifies the impact by inducing physiological and psychological responses that weaken the body's resilience to such strain.[10]For instance, academic staff experiencing both high stress and high demand may report more severe MSD symptoms compared to those exposed to only one of these factors.

In universities in Benue State, unique factors such as resource limitations, large student populations, and socio-economic challenges further exacerbate job stress and demand. These conditions may contribute to higher rates of MSDs among academic staff compared to institutions in more developed settings. Cultural norms and limited awareness of ergonomic practices may also play a role in increasing vulnerability to MSDs.[11]

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This study seeks to address this gap by investigating the extent to which job stress and job demand are associated with MSDs among academic staff in universities in Benue State. To this end, this study aims to analyze the relationship between Job Stress, job demand, and Musculoskeletal Disorder among academic staff of Universities in Benue State.

Method

Study Area

The geographical scope of study included the four universities in Benue state namely; Benue state university Makurdi, Joseph Sarwuan Tarka University Makurdi, University of Mkar and Federal University of Health Sciences Otukpo.

Benue State University is a state-owned university in Makurdi, Benue State, Nigeria. The university has a total enrollment of 29,459 students (27,712 undergraduates and 1,347 graduates). BSU runs 59 accredited undergraduate programs and more than a dozen postgraduate programs across the 9 faculties of the university.

Joseph Sarwuan Tarka University Makurdi (JOSTUM), which was formerly known as University of Agriculture, Makurdi (UAM) has over 30 departments in ten colleges. In 2017, the academic staff strength was 756 .[12]
University of Mkar, Mkar is a private faith-based university established by the Universal Reformed Christian Church (URCC). As at 2019, the total student enrollment was 1,052. The academic staff strength in 2019 was 219.

Federal University of Health Sciences Otukpo is a young institution which started operation in February, 2020. The academic staff strength of the institution as at 2023 was 134.

Study Design and Sampling Technique

The study employed a cross-sectional design among academic staff in the four universities in Benue State. A multi -staged sampling was done to proportionately allocate participants based on number of staff in the universities. Subsequently purposive sampling was done to recruit respondents in their various departments. Data was collected from 1stOctober, 2023 to 31st January, 2024.

Study Population

The study population consisted of academic staff of the four universities in Benue state from Graduate assistants to professors.

Sampling Methodology

Purposive sampling was employed to recruit all the respondents from their departments in the various universities until the desired number was obtained.

Inclusion criteria

All consenting academic staff in the four universities in Benue state.

Exclusion criteria

All non- academic staff and students in the universities in Benue state were excluded. Academic staff from other tertiary institutions like polytechnics and colleges of education in the state were also excluded. Respondents with major musculoskeletal injuries like fractures and dislocations or who have undergone major surgery were excluded.

Sample Size Determination

Sample Size $n = N * [Z^2 * p * (1-p)/e^2] / [N – 1 + (Z^2 * p * (1-p)/e^2]$
Where[13]
N = Population size (1881)
Z = Critical value of the normal distribution at the required confidence level (at 95% confidence level is 1.96)
p = Sample proportion (unsure so we will use 0.5 as a conservative approach)
e = Margin of error (5%)
Sample size n=320 + 10% attrition (32) = 352

Instrumentation

The instrument used in this study was a questionnaire that was adapted by modifying four previously validated questionnaires from similar studies. The Musculoskeletal Health Questionnaire (MSK-HQ) was used to measure the dependent variable which was musculoskeletal pain, ache or discomfort in the various body regions namely; neck, shoulders, upper back, elbows, wrists/hand, lower back, one or both hips and thighs, one or both knees and one or both ankles.[14] This questionnaire was for research screening purposes and not for diagnostic purposes. It was a rated Likert -scale of 14 questions with options ranging from 'Not at all=4, Slightly =3, Moderately=2, Very severe=1' depending on how healthy the respondents were in terms of musculoskeletal health.

Worker's job stress was assessed using Marlin Company and the American Institute of Stress scale calculation (The Marlin Company by Harris Interactive, 2001).[15] It contains four options (Strongly Disagree-1, Disagree-2, Agree-3 and Strongly Agree-4) with ten items. The range of interpreting the Likert scale mean score was given as follows: 1.0-1.75 (strongly disagree), 1.76-2.50 (disagree),

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and 2.51-3.25 (Agree), 3.26-4.00(strongly agree). Where the mean scores were above 2.50 in this 4-point Likert scale, the respondents were considered to have perceived their jobs as stressful.

Job demand was assessed using the Job Demand-Control-Support section of the questionnaire. It had a 4-point Likert scale ranging from 1-Strongly agree,2-agree,3-disagree to 4-strongly disagree (Karasek et al.,1998).[16] Where the mean scores were above 2.50 in this 4-point likert scale, the respondents were considered to have perceived their jobs as demanding.

The questionnaire was categorized into two parts. The first part included socio-demographic characteristics such as age, sex and rank. The second part comprised psychosocial factors that is job stress and job demand.

Validation of Instrument

The validity of the questionnaires was done by five experts. Three of them were from department of human kinetics and health education and two from department of science education of Benue state university Makurdi.

Reliability

The reliability for the questionnaire was tested among 50 academic staff at Federal University Wukari. The Cronbach alfa for musculoskeletal health assessment was (α=.724). The Work Stress Scale had a Cronbach alfa (α =.786), while that of job demand was (α=.747).

Data Collection

The questionnaires were self -administered to all the selected academic staff (graduate assistants to professors in the four universities in Benue state) by multi- staged sampling by five research assistants. The respondents were proportionately distributed according to the population of the universities as follows; Benue State University Makurdi 726 (136 respondents), Joseph Sarwuan Tarka University Makurdi 802(150 respondents), University of Mkar 219(41 respondents) and Federal University of Health Sciences 134(25 respondents) making a total of 1881(352 respondents).However, 400 questionnaires were distributed ,359 were retrieved and 355 representing 88.75% were adequately filled and were used for analysis.

The purpose of the research was explained to each participant by the trained research assistants. Collecting, filling and returning the questionnaire was regarded as evidence of consent. No names, or any other means of identification traceable to the respondents was on the questionnaire.

Method of Data Analysis

Descriptive statistics was computed using frequencies with percentages for categorical variables. Spearman Rank correlation was employed to show the relationship between dependent and independent variable with P-value of <.05 considered to be statistically significant. To answer the research questions, the correlation coefficient which is a statistical measure of the strength of a linear relationship between two variables was used. Its values can range from -1 to 1. A correlation coefficient of -1 described a perfect negative, or inverse, correlation, with values in one series rising as those in the other decline, and vice versa. A coefficient of 1 shows a perfect positive correlation, or a direct relationship. A correlation coefficient of 0 meant there was no linear relationship. The correlation coefficient of 0.0 to < 0.1 was no correlation, 0.1 to < 0.3 low correlation, 0.3 to <0.5 moderate correlation,0.5 to <0.7 high correlation ,0.7 to 1.0 very high correlation. The hypothesis was tested using the t-test and a p-value of <0.05 was regarded as significant.

Worker's job stress was assessed using the American Institute of Stress scale (The Marlin Company by Harris Interactive, 2001). The means of the scores of each respondent was calculated and correlated with the scores of the dependent variable which was obtained from musculoskeletal health assessment questionnaire.
The scores for Job demand were also correlated with musculoskeletal conditions. The strength and direction of the correlation was determined using Spearman Rank Correlation.

Results

The results showed that the prevalence of MSD among academic staff of universities in Benue State was 84.4%. The commonest symptoms were joints pains (89.0%), Muscle pain (87.3%) and Neck Pain (76.9%). Most of them were senior lecturer 112(31.5%), were males 230(64.8%) and within the 51 and above age bracket 146 (41.1%) (Table 1).

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Table 1. Showing Socio-Demographic Characteristics of Academic Staff of Universities in Benue State

Variable	Frequency	Percentage (%)
Age		
21-30yrs	5	1.4
31-40yrs	136	38.3
41-50yrs	68	19.2
51yrs & above	146	41.1
Sex		
Male	230	64.8
Female	125	35.2
Rank		
Graduate assistant /Assistant Lecturer	53	14.9
Lecturer 11/Lecturer 1	110	31.0
Senior Lecturer	112	31.5
Associate Professor/Professor	80	22.5
Total	355	100

Table 2: ***Mean Analysis on Job Stress among Academic Staff of Universities in Benue State (n = 355)***

Item	M	SD	Remark
Job Stress			
I feel that my job is affecting my emotional wellbeing	2.88	0.83	
I often feel overwhelmed by my workload	2.99	0.95	
I frequently feel muscle tension due to work	2.92	0.97	
I often feel pressured to meet unrealistic expectations from my supervisors	2.69	0.99	
I often experience conflict with my co-workers	2.36	0.96	
I find it difficult to disconnect from work during non-working hours	2.69	0.61	
I frequently experience anxiety related to work task	2.52	0.72	
I feel that job pressure is affecting my family life	2.61	0.83	
I do not have adequate control over my work duties	2.61	0.69	
I frequently experience headache related to work task	2.57	0.85	
Cluster M (SD)	**2.68**	**0.84**	**Stressful**

M = Mean, SD = Standard Deviation

Table 2 presents mean (M) and standard deviation (SD) analysis on job stress among academic staff of universities in Benue State. The results show that academic staff of universities in Benue State were experiencing job stress (cluster M = 2.68 > 2.50, SD = 0.87). The findings indicate that academic staff in Benue State experience moderate levels of job stress, with workload, emotional impact, and physical strain being the most common sources of stress.

Table 3: ***Mean Analysis on Job Demand among Academic Staff of Universities in Benue State (n = 355)***

Item	M	SD	Remark
Job demands working hard	3.23	0.58	
Job demands working fast	3.10	0.67	
Job demands working excessively	2.96	0.67	
I do not have enough time to get the job done	2.96	0.77	
Job brings conflicting demands	3.15	0.61	
Job frequently requires intense concentration	2.68	0.73	
I often experience tight deadlines for completing tasks	2.95	0.53	
Job requires critical thinking	2.87	0.68	
Job requires multi-tasking	3.08	0.77	
Job requires solving complex problems	2.95	0.54	
Cluster M (SD)	**2.99**	**0.66**	**Demanding**

M = Mean, SD = Standard Deviation

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Table 3 presents mean (M) and standard deviation (SD) analysis on job demand among academic staff of universities in Benue State. The results show that academic staff of universities in Benue State were experiencing high job demand (cluster M = 2.99 > 2.50, SD = 0.66). The findings reveal that academic staff experience significant job demands, particularly in terms of workload intensity, conflicting responsibilities, and the need for fast-paced work.

Table 4: Spearman's Correlation between Job Stress and Musculoskeletal Disorders among Academic Staff of Universities in Benue State.

Variable	Job Stress	Musculoskeletal Disorders	DF	*P*-value
Job Stress		.80	353	.000
Musculoskeletal Disorders	.80			

Table 4 shows Spearman's correlation between job stress and musculoskeletal disorders among academic staff of universities in Benue State. There was a positive significant relationship between job stress and musculoskeletal disorders among academic staff of universities in Benue State, r_s (353) = .80, p<.001. The null hypothesis was, therefore, rejected. The result implies that the higher the job stress, the higher the chances of developing musculoskeletal disorders, and vice-versa.

Table 5: *Spearman's Correlation between Job Demand and Musculoskeletal Disorders among Academic Staff of Universities in Benue State.*

Variable	Job Demand	Musculoskeletal Disorders	DF	*P*-value
Job Demand		.308	353	.052
Musculoskeletal Disorders	.308			

Table 5 shows Spearman's correlation between Job Demand and musculoskeletal disorders among academic staff of universities in Benue State. There was a positive but not significant relationship between Workload and musculoskeletal disorders among academic staff of universities in Benue State, r_s (353) = .328, p>.05. The null hypothesis was therefore, not rejected.

Discussion

This study investigated the prevalence of musculoskeletal disorders (MSDs) and their relationships with job stress and job demand among academic staff in universities in Benue State, Nigeria. The findings highlight the high prevalence of MSDs and underscore the significant role of job stress in contributing to these conditions. The overall prevalence of MSDs among academic staff was 84.4%, with the most common symptoms being joint pain (89.0%), muscle pain (87.3%), and neck pain (76.9%). These results reveal a concerningly high burden of MSDs in this population, likely resulting from prolonged sitting, repetitive tasks, and psychological stress associated with their academic roles. A study among secondary school teachers in Saudi Arabia reported a MSD prevalence of 87.4% while Meaza et al. reported a 12months prevalence of 65% among staff of Makelle university in Ethiopia.[17,18] These findings align with global trends, where teaching professionals are considered at high risk for MSDs due to prolonged hours of desk work and inadequate ergonomic practices. The implications of this high prevalence are profound, as MSDs can impair productivity, increase absenteeism, and reduce overall quality of life. These findings call for immediate interventions, including ergonomic improvements, awareness campaigns, and preventive measures.

The results of Spearman's correlation analysis demonstrated a strong positive and statistically significant relationship between job stress and MSDs, rs (353) =0.80, p<0.001. This indicates that as job stress increases, the likelihood of experiencing musculoskeletal disorders also rises. Academic staff reported moderate levels of stress (cluster M=2.5<2.68, SD=0.84), with key contributors being workload intensity, emotional strain, and physical symptoms such as muscle tension and headaches. These findings suggest that academic staff face challenges balancing the demands of teaching, research, and administrative responsibilities, which can exacerbate physical strain and stress-related disorders. Stress contributes to MSDs through physiological mechanisms, including increased muscle tension, poor posture, and the release of stress hormones like cortisol, which can exacerbate inflammation and pain perception. These factors likely explain the strong correlation observed in this study. This report is similar to the findings of Meaza et al. in their study among academic

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staff in Makelle university in Ethiopia in which female gender, body mass index, working hours per day, and physical inactivity, were the independent factors positively associated with musculoskeletal pain.[18] In a study by Akah et al. in two Nigerian universities, it was concluded that occupational stress significantly influences the job performance of lecturers in universities.[19]

In contrast, the correlation between job demand and MSDs, $r_s(353) = 0.308, p > 0.05$ was positive but not statistically significant. The study revealed that academic staff experience high job demands (cluster $M = 2.5 < 2.99$, $SD = 0.84$), particularly in areas such as excessive workload, tight deadlines, and multitasking. However, the lack of statistical significance suggests that job demands alone may not directly result in musculoskeletal disorders but could interact with other factors, such as individual coping strategies, job resources, or workplace ergonomics. Cantley et al. in a similar study among a cohort of aluminium manufacturing workers reported that compared with workers in jobs rated as having low psychological demand, workers in jobs with high psychological demand had 49% greater risk of serious injury and serious MSD requiring medical treatment, work restrictions or lost work time.[20]The non-significant relationship in the index study may reflect the multifactorial nature of MSDs. While high job demands contribute to fatigue and stress, they may not independently account for the onset or severity of musculoskeletal conditions without additional moderating factors like stress or physical activity levels.

Strength and limitation of this study

One key strength of this study is its focus on a pertinent public health issue, highlighting the relationship between job stress, job demand, and musculoskeletal disorders (MSDs) among academic staff, a group often underrepresented in occupational health research. By identifying an 84.4% prevalence of MSDs among respondents and a significant positive correlation between job stress and MSDs, the study contributes valuable insights into workplace health challenges faced by this demographic.

The methodology employed is another strength. The use of a cross-sectional survey design with a multi-stage sampling technique ensured a diverse and representative sample from four universities in Benue State, enhancing the study's relevance and applicability within the region. Additionally, the use of validated scales to measure job stress and job demand lends credibility to the data collection process, ensuring that findings are based on reliable and standardized assessments.

Furthermore, the study's statistical analysis, including descriptive and Spearman Rank correlation, provides robust evidence to support its conclusions. By identifying specific stressors such as workload, emotional strain, and physical demands, the research offers actionable recommendations for intervention, such as implementing stress management programs and optimizing workload distribution

Despite its strengths, the study has several limitations. The cross-sectional design precludes establishing causality, leaving open questions about the directionality and long-term impact of job stress and demands on MSDs. While correlations are informative, they do not confirm whether job stress directly causes MSDs or whether other factors might mediate or influence this relationship.

Another limitation lies in the reliance on self-reported data, which can introduce bias. Participants may underreport or overreport their experiences of stress, job demand, or MSD symptoms due to recall inaccuracies or social desirability. This subjectivity may affect the reliability of the findings.

The study also does not include clinical or ergonomic assessments to confirm MSD diagnoses or evaluate physical workplace factors contributing to strain. Such assessments could have provided a more comprehensive understanding of the interplay between occupational conditions and health outcomes.

Furthermore, the research's focus on universities in Benue State limits the generalizability of findings to other regions or countries with different cultural and institutional contexts. Finally, while the study highlights job stress and job demand, it does not account for other potentially influential variables such as social support, job control, or workplace ergonomics, which could also impact MSD prevalence.

Implications of the findings

Policy Implications

Universities should prioritize the integration of occupational health policies aimed at preventing and managing musculoskeletal disorders (MSDs) among academic staff. Implementing workplace health policies will help mitigate the risks associated with prolonged sitting, repetitive strain, and other job-related stressors that contribute to MSDs. Additionally, institutions

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should adopt stress reduction policies that include flexible work schedules, mentorship programs, and workload redistribution, ensuring that faculty members do not experience excessive job strain.

Furthermore, ergonomic standards should be established within universities, incorporating appropriate office setups, lecture halls, and research spaces designed to minimize physical strain. Providing faculty members with ergonomically optimized workspaces can help prevent the development of MSDs. In addition to physical health considerations, policymakers should mandate stress management interventions, such as mental health support programs and resilience training. These initiatives will enhance the psychological well-being of academic staff and reduce stress-related health complications.

Practical Implications

To address the impact of workload on MSDs, universities should implement workload optimization strategies, such as hiring additional faculty members to distribute teaching and administrative responsibilities more evenly. This would reduce excessive job strain and enhance staff efficiency. Physical health interventions should also be encouraged, including structured exercise programs, posture correction training, and the provision of physiotherapy services within university health centers. These measures would help alleviate MSD-related symptoms and prevent their occurrence.

Additionally, regular workshops on stress management, mindfulness, and coping strategies should be conducted to equip academic staff with effective tools for managing job-related stress. Training sessions focused on stress reduction techniques will contribute to improved well-being and job satisfaction. Another critical consideration is job redesign, which involves structuring tasks to minimize prolonged sitting, repetitive motions, and excessive administrative burdens. By making these adjustments, universities can improve the overall work environment and protect faculty members from MSDs.

Research Implications

Future research should explore the long-term effects of job stress and MSDs among academic staff through longitudinal studies. Such research would provide deeper insights into causal relationships and help develop effective interventions. Additionally, intervention-based studies are needed to assess the effectiveness of ergonomic improvements, stress management programs, and flexible work arrangements in reducing MSD prevalence among university faculty.

Comparative studies that examine MSD prevalence and stress levels across different academic disciplines and regions would offer valuable perspectives on how institutional and environmental factors influence these health issues. Moreover, further research should investigate the role of gender and age in moderating the relationship between job stress, job demands, and MSDs. Understanding these dynamics would allow for more targeted and effective interventions tailored to different demographic groups within the academic workforce.

Conclusion

In conclusion, this study highlights the significant correlation between job stress and musculoskeletal disorders (MSDs) among academic staff in universities in Benue State, emphasizing the need for proactive interventions. The findings reveal that while job stress is a major predictor of MSDs, job demand, though positively related, does not show a statistically significant association. With an MSD prevalence of 84.4%, it is evident that academic staff face considerable occupational health risks due to stress and workload-related factors. Therefore, universities should prioritize stress management initiatives, workload optimization, and ergonomic interventions to mitigate the impact of job-related strain on musculoskeletal health, ultimately enhancing staff well-being and institutional productivity.
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Declarations

Authors contributions: Williams Terhemen Yongu: conceived and designed the study, coordinated and supervised data collection.
Targema Iorvaa: Approved the design, reviewed and revised the draft. ***Sarah Ngukuran Burbwa***: Approved the design and implementation and critically reviewed and revised the draft. ***Orfega Zwawua***: Approved the design, critically reviewed the draft and did data analysis ***Michael Enokela Efu*** : Critically reviewed the draft and coordinated data collection.

Conflict of interest: The authors declare no conflict of interest

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