ACADEMIA International Journal for Social Sciences
Volume 4, Issue 3, 2025 ISSN-L (Online): 3006-6638

Prevalence of Ergonomic Related Health Concerns among Culinary Professionals in Restaurants of Karachi, Pakistan. A Cross- Sectional Study

Alizeh Rehman
alizehladhani999@gmail.com
DPT, Indus University, Department of Allied Health Sciences, Pakistan

Dr. Maira Muneer
maira.muneer00@gmail.com
Lecturer/Academic Coordinator Department of Allied health Sciences, Indus University, Karachi, Pakistan

Dr. Okasha Anjum
drokashaanjumpt@gmail.com
Head of Department/Assistant Professor, Department of Health Sciences, Indus University Karachi, Pakistan
Corresponding Author: * Alizeh Rehman alizehladhani999@gmail.com

Received: 09-04-2025 **Revised:** 10-05-2025 **Accepted:** 15-06-2025 **Published:** 05-07-2025

ABSTRACT

Work-related musculoskeletal disorders (WMSDs) are among the top occupational health problems around the world. The culinary profession has similar demands as other occupations. Culinary professionals, working quickly and efficiently in kitchens, often encounter repeated movements, prolonged standing, frequent heavy lifting, and required postures in order to complete physically demanding jobs. All of these factors contribute to an increased risk for an ergonomic-related health concern. Even though the importance of workplace risks is recognized internationally, there has been limited research on the prevalence of ergonomic-related health concerns in the restaurant industry in Pakistan, especially in urban areas such as Karachi. Moreover, a chef performs more than simply food preparation; they must also routinely work long and physically demanding hours and frequently perform repetitive tasks that result in fatigue and musculoskeletal strain. When you consider poor ergonomics along with long hours and poor workplace planning, these jobs are vulnerable to health-related risks. It is important to address these health-related risks to not only ensure worker safety but also to improve quality of work and quality of life among employees in the hospitality sector. Having an understanding of the type and extent of health risks present among culinary professionals is important for the development of suitable ergonomics interventions and preventative occupational health procedures To assess the prevalence of ergonomic-related health concerns, specifically musculoskeletal disorders and fatigue, among culinary professionals working in restaurants in Karachi, Pakistan. A cross-sectional study was carried out over six months that recruited 169 culinary professionals using non-probability convenience sampling from different restaurants at small and large scales in central and southern districts of Karachi. Participants in the study were aged between 20-40 years and had at least six months of kitchen experience. Data was collected using to validated tools i.e., the Nordic Musculoskeletal Questionnaire (NMQ) and the Fatigue Assessment Scale (FAS). The questionnaire also captured demographic information such as age, gender, years of experience, job level, and daily working hours. Data were analyzed using SPSS version 29. Descriptive statistics, correlation analysis, and chi-square tests were applied. Diagnostic tests including reliability, normality, homogeneity, and multicollinearity assessments were also conducted. Among respondents, lower back pain (54.4%), shoulder pain (53.8%), and neck pain (52.7%) were the most reported musculoskeletal issues over the past 12 months. In the past 7 days, ankle/foot pain (40.2%) and lower back pain (39.1%) remained prevalent. Regarding fatigue, 38.3% of participants reported moderate to high levels. Significant associations were found between musculoskeletal symptoms and variables such as gender (p = 0.000),

working hours (p = 0.021). Correlation analysis revealed strong positive relationships between reported symptoms and workplace physical demands, with the highest correlations observed in ankle/foot pain (r = 0.51) and difficulty starting tasks (FAS item 6, r = 0.63). Reliability analysis showed Cronbach's alpha of 0.87 for the NMQ and 0.67 for FAS, with an overall reliability of 0.81. Normality and homogeneity assumptions were met for most variables. Several null hypotheses were rejected, particularly those related to gender and working hours, confirming statistically significant ergonomic health impacts among culinary professionals. Culinary professionals in Karachi face a high burden of ergonomic-related health issues. Ergonomic awareness programs, improved kitchen designs, and preventive strategies are urgently needed to safeguard their health and enhance workplace productivity.

Keywords: *Ergonomics, Musculoskeletal Disorders, Occupational Health, Posture, Food Service, Fatigue.*

INTRODUCTION

Culinary industry significantly boosts the demand for highly skilled and professionally trained chefs, administrators, and managers across various sectors such as hotel management, food service, restaurant operations, food production, catering, and the broader hospitality industry. This demand aims to ensure outstanding food and service experiences for both guests and consumers. The professional development of chefs plays a crucial role in driving national economic growth. As culinary standards continue to rise, culinary professionals face growing pressure to deliver exceptional and customer centered dining experiences, especially in high end hotel environments. Chefs are more than traditional employees; they function as practitioners, artists, and innovators. Their roles require a wide ranging set of expertise that reflect multiple professional identities. Although food preparation is central to their responsibilities, the chef's role goes far beyond simply cooking. The fields of professional culinary arts and commercial kitchen operations demand a workforce that is not only highly skilled but also dynamic, passionate, and deeply committed to the culinary profession as a lifetime vocation. [1]

A chef is basically an expert cook aware of every aspect of cooking. [4] Chef takes as knowledge a group of objectives concerning various flavors, textures, ingredients, and dish types, creating a single recipe that meets all these purposes. Its result is a distinctive plan, structured like a recipe that meets all of the user's objectives. [25]

Chefs participate in numerous tasks and activities in the kitchen such as preparing meals, cutting, garnishing, arranging, baking, and transporting heavy appliances and tools within the kitchen. The chefs receive tasks according to their respective departments in the kitchens of hotels and restaurants. [3] Chefs are prone to various injuries or accidents, experiencing pain and discomfort that can arise from slips, trips, falls, or several other mishaps. Many kitchen workers and chefs unintentionally adopt uncomfortable positions during their daily tasks. The prevention of injuries and the safety of chefs are connected to ergonomic and safety considerations. [4] Restaurants are widely known for their discipline as focus on specifics in creating and consistently providing high- quality food is crucial. [5]

Ergonomics is the study of human-system interactions aimed at enhancing well-being and overall system performance. It involves the examination of creating and organizing tasks or, more accurately, shaping the work to match the worker's physique and skills. This will help the worker relax and lessen physical strain, effectively preventing numerous potential work-related musculoskeletal issues and injuries. Ergonomics involves analyzing the competencies related to the tasks individuals undertake, the

methods in which those tasks can be executed, and the tools and devices employed for those specific tasks. [2]

Ergonomics is a technical field focused on human factors concerning the interaction between people and various system elements, as well as professions that apply theories, principles, data, and methods to enhance human well-being and the comprehensive performance framework. [24]

For chefs and other culinary professionals, extended working hours and prolonged standing are typical aspects of daily kitchen routines. These individuals usually perform most of their tasks while standing or frequently moving around. Remaining in the same posture for several consecutive hours often exceeding 10 hours a day can significantly increase the risk of developing back pain, as well as injuries in the shoulders and lower limbs. [6]

Physically demanding tasks and repetitive movements in the kitchen environment are known contributors to musculoskeletal pain. There is a strong correlation between repetitive work activities and the development of neck and shoulder disorders. Similarly, there is a well-established association between lower back pain (LBP) and the adoption of awkward postures in the workplace. [6]

Musculoskeletal disorders (MSDs) are among the most common occupational health problems affecting workers worldwide. They are the second leading cause of disability globally. The prevalence of MSDs differs by country, with rates as high as 74% in the United Kingdom, 90% in Taiwan, and 56% in Norway. MSDs are also a major contributor to absenteeism and disability when compared to other health conditions. These disorders can affect various parts of the body, including the neck, upper limbs, back, and lower extremities. Neck-related issues are the most prevalent (95.1%), followed by problems in the lower back (82.4%), shoulders (84.1%), wrists (81.0%), upper back (78.1%), and elbows (77.1%). Activities such as maintaining static postures for extended periods, performing repetitive movements, and lifting heavy objects are key contributors to the development of MSDs. [7]

A study in Bahir Dar City, Ethiopia, found that 76% of kitchen workers in the hospitality industry reported work-related musculoskeletal disorders, indicating a high prevalence of MSDs in commercial kitchen environments. As well, a study conducted in Gondar City highlighted the level of self-reported musculoskeletal disorders among restaurant workers was extremely high in terms of circumstances specific to the role, especially the physical task and postural aspect. [10] [11] A study of pastry chefs located in Malacca, Malaysia reported a whopping 70.5% of the pastry chefs interviewed indicated they had musculoskeletal disorders, and it can also demonstrate a considerable global prevalence of MSD's among chefs in this specific area of the world. [7] A study that studied the prevalence of musculoskeletal disorders in chefs working in restaurants in twin cities of Pakistan (Islamabad and Rawalpindi), were 71.4 % of respondents reported an MSD question, where back and shoulder pain were most commonly cited.[8] In another study located in Sialkot, Pakistan, the restaurant chefs also reported high levels of musculoskeletal pain, where 68.3% of chefs reported discomfort specifically related to work with repetitive tasks and poor posture. [9] Several studies conducted in Lahore, Pakistan, showed high rates of musculoskeletal pain among chefs. In one study, lateral epicondylitis (tennis elbow) was specifically highlighted, with a significant correlation between work-related risk factors (such as posture and repetitive movements) and the incidence of pain.[16][21]

To sum up, Musculoskeletal disorders among chefs can arise from various factors, including the nature of kitchen work such as extended shifts, physically demanding tasks, and heavy workloads that involve awkward postures, repetitive arm movements, or strain on supportive body regions like the lower back. [6]

METHODOLOGY

Study Design

This study followed a cross-sectional design to estimate the prevalence of ergonomic-related health concerns among culinary professionals in Karachi.

Sampling Techniques

Non-probability convenience sampling was used to recruit participants from small and large scale restaurants located in the central and southern districts of Karachi.

Outcome Measures

The two outcome measures used for this study included the Nordic Musculoskeletal Questionnaire (NMQ) and the Fatigue Assessment Scale (FAS). The NMQ was used to assess the occurrence and distribution of musculoskeletal symptoms across a number of body regions, such as the neck, shoulders, lower back, and wrists, in the past 12 months and past 7 days. The FAS was used to determine the degree to which they experienced physical and mental fatigue, which included a 10-item Likert scale that was self-reported. Both measures are valid and reliable measures that are commonly used in research involving occupational health, and overall can provide a greater understanding of an individual's health specific to ergonomic concerns.

Data Analysis Procedure

Data management and analysis were done with the use of SPSS version 29. The data were presented descriptively including summary statistics such as means, frequencies, and percentages for demographic characteristics and ergonomic concerns. Chi-square and correlation analyses were used for inferential statistics for the associations of the variables. The reliability and validity of the study included diagnostic tests for normality and homogeneity while identifying any possible multicollinearity.

Ethical Consideration

Prior to data collection, ethical approval was obtained from the Institutional Review Board of Indus University. Participation was voluntary and all precautions were made to ensure confidentiality. Written informed consent was received from all respondents prior to be asked to participate.

.Reliability

The dependability of the instruments used for data collection in this study was evaluated through Cronbach's alpha, which measures internal consistency. The Nordic Musculoskeletal Questionnaire (NMQ) scored a Cronbach's alpha of 0.87, which reflects good internal consistency. The Fatigue Assessment Scale (FAS) scored a Cronbach's alpha of 0.67, reflecting acceptable internal consistency. The overall reliability of the combined scales was 0.81, confirming that the instruments used in this research were reliable for assessing ergonomic-related health concerns and fatigue among culinary professionals in restaurant settings.

RESULTS

Introduction

This chapter discusses the results of statistical applications on dependent variables, independent variables, and their mutual relations. It reviews two aspects of data analysis i.e. (i) Data dissection and

its visualization aiming to provide research glimpse briefly to general audience and (ii) Statistical descriptions including descriptive statistics, correlation & chi-square analysis, and diagnostic analysis.

Chart 1: Age-wise population: Showing break-up of population w.r.t. age brackets of respondents.

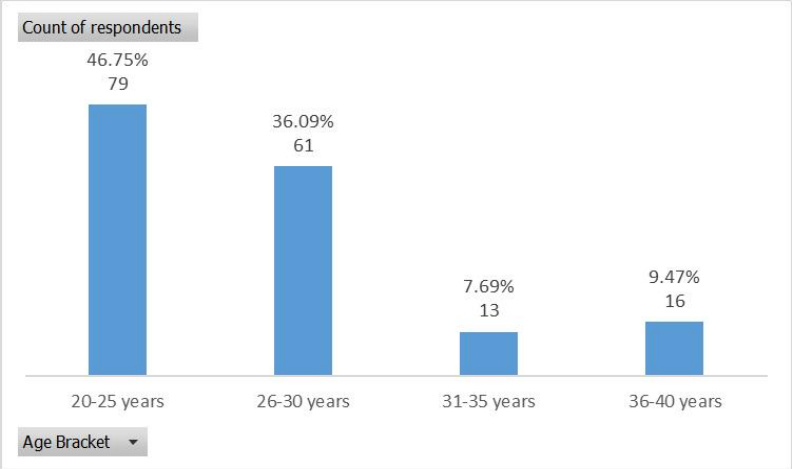

Chart 1 showing that one-hundred and sixty-nine respondents have examine for research consist with four (04) age-brackets i.e., 79 respondents (46.75% of population) having age bracket of 20- 25 years old, 61 respondents (36.09% of population) having age bracket of 26-30 years old, 13 respondents (7.69% of population) having age bracket of 31-35 years old and 16 respondents (9.47% of population) having age bracket of above 36-40 years old.

Chart 2: Count of gender-wise Population: Showing break-up of population of respondents w.r.t. gender-wise population.

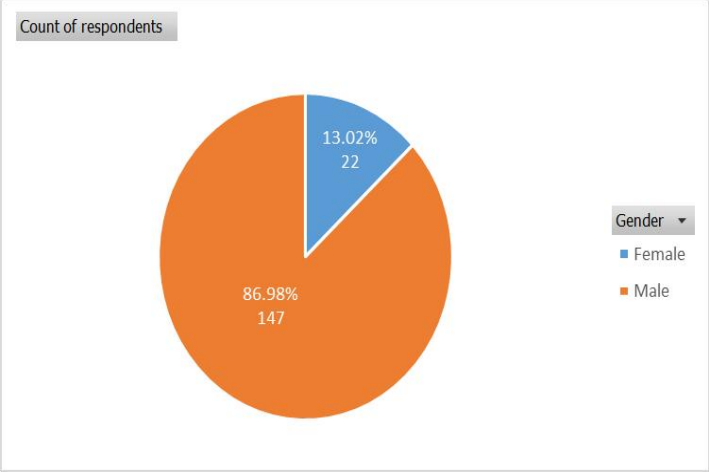

Chart 2 showing that One-hundred and sixty-nine respondents have examine for research consist with two (02) genders i.e., 147 respondents (86.98% of population) are male, and 22 respondents (13.02% of population) are female.

Chart 3: Count of experience-wise Population: Showing break-up of population of respondents w.r.t. experience -wise population.

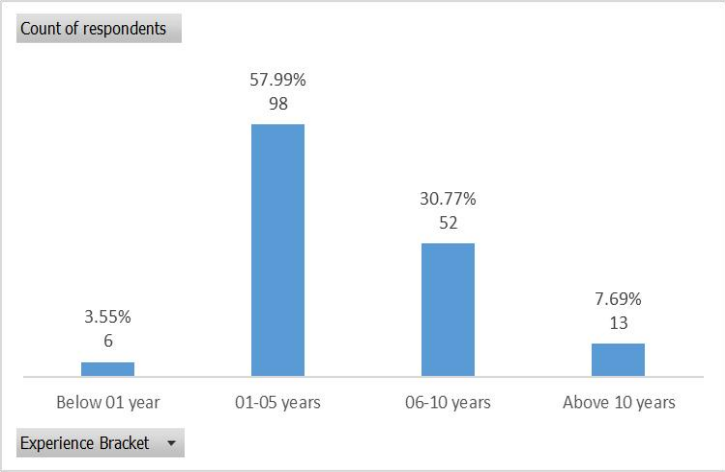

Chart 3 showing that One-hundred and sixty-nine respondents have examine for research consist with four (04) categories i.e., 06 respondents (3.55% of population) have experience of below 01- year, 98 respondents (57.99% of population) have experience of 01-05 years, 52 respondents (30.77% of population) have experience of 06-10 years and 13 respondents (7.69% of population) have experience of above-10 years.

Chart 4: Working hour-wise population: Showing break-up of population w.r.t. Working hour brackets of respondents.

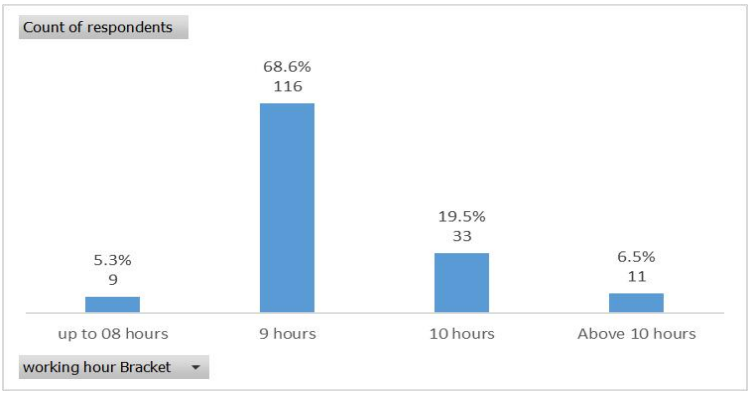

Chart 4 showing that one-hundred and sixty-nine respondents have examine for research consist with four (04) working-hours brackets i.e., 09 respondents (5.3% of population) having working-hours bracket of up to 08-hours, 116 respondents (68.6% of population) having working-hours bracket of 09-hours, 33 respondents (19.5% of population) having working-hours bracket of 10-hours and 11 respondents (6.5% of population) having working-hours bracket of above 10-hours.

Chart 5: Job-level-wise population: Showing break-up of population w.r.t. job-level of respondents.

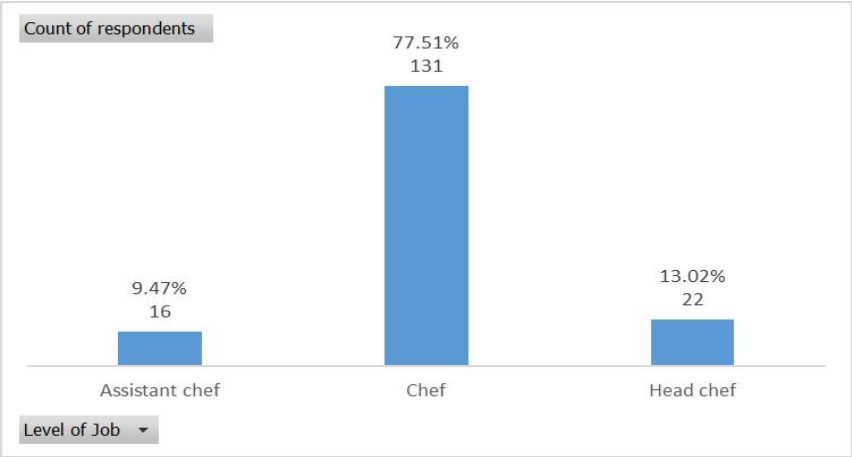

Chart 5 showing that one-hundred and sixty-nine respondents have examine for research consist with three (03) job-levels i.e., 16 respondents (9.47% of population) are assistant chef, 131 respondents (77.51% of population) are chef and 22 respondents (13.02% of population) are head chef.

DESCRIPTIVE STATISTICS

Table 1: Descriptive Analysis of Dependent-variables Scale:

DV Elements	N	Min.	Max.	Mean	SD	Variance	%
Age	169	20	40	30	.942	.888	75.0%
Gender	169	1	2	1	.337	.114	56.5%
Experience Bracket	169	1	4	2	.687	.472	60.7%
Working year Bracket	169	1	4	2	.661	.437	56.8%
Level of Job	169	1	3	2.0	.474	.225	65.5%

Table 1 showing descriptive analysis of dependent variables related to Prevalence of ergonomic related health concerns among culinary professionals in restaurants of Karachi showing that each element showing how frequently respondents made assertive answers against these questions; results showing that respondents have highest age is 40, lowest age is 20 within average of 30.

Table 2: Descriptive Analysis of NMQ 12 Months Pain-Organs Scale:

NMQ-12 Months Pain-Organs	N	Min.	Max.	Mean	SD	Variance	%
Neck [12M]	169	0	1	0.53	.501	.251	52.7%
Shoulder [12M]	169	0	1	0.54	.500	.250	53.8%
Elbows [12M]	169	0	1	0.25	.433	.188	24.9%
Wrists/Hands [12M]	169	0	1	0.35	.478	.229	34.9%

Upper back [12M]	169	0	1	0.30	.460	.212	30.2%
Lower back [12M]	169	0	1	0.54	.500	.250	54.4%
Hips/Thighs [12M]	169	0	1	0.30	.460	.212	30.2%
Knees [12M]	169	0	1	0.34	.474	.225	33.7%
Ankles/Feets [12M]	169	0	1	0.48	.501	.251	47.9%
Work prevention	169	0	1	0.47	.501	.251	47.3%

Table 2 shows descriptive analysis of NMQ related to Prevalence of ergonomic related health concerns among culinary professionals in restaurants of Karachi; study of each element showing how frequently respondents made assertive answers against these questions. NMQ is the parameters to show the overall involvement of respondents in response to assess the Prevalence of ergonomic related health concerns among culinary professionals in restaurants of Karachi here and in the rest of documents as well; showing that 54.4% respondents have highest response for item "Lower back [12M]" and 24.9% respondents have lowest response for item "Elbows [12M]".

Table 3: Descriptive Analysis of NMQ 07 Days Pain-Organs Scale:

NMQ-07 Days Pain-Organs	N	Min.	Max.	Mean	SD	Variance	%
Neck [7D]	169	0	1	0.46	.500	.250	46.2%
Shoulder [7D]	169	0	1	0.37	.485	.235	37.3%
Elbows [7D]	168	0	1	0.18	.384	.148	17.9%

Table 3 shows descriptive analysis of NMQ related to Prevalence of ergonomic related health concerns among culinary professionals in restaurants of Karachi; study of each element showing how frequently respondents made assertive answers against these questions. NMQ is the parameters to show the overall involvement of respondents in response to assess the Prevalence of ergonomic related health concerns among culinary professionals in restaurants of Karachi here and in the rest of documents as well; showing that 55.4% respondents have highest response for item "1. Do you believe your work has contributed to any of the musculoskeletal issues reported above? Sec-03-Q1" and 6.5% respondents have lowest response for item "4. Have you made modifications to your work to reduce discomfort? (e.g., ergonomic adjustments, breaks, physical therapy) Sec- 03-Q4".

Table 4: Descriptive Analysis of FAS Scale:

FAS	N	Min.	Max.	Mean	SD	Variance	%
1. I am bothered by fatigue.	169	1	5	1.85	.740	.548	36.9%
2. I get tired very quickly.	169	1	5	1.78	.885	.782	35.5%
3. I don't do much during the day.	169	1	5	1.62	.739	.546	32.4%
4. I have enough energy for everyday life.	169	1	5	2.44	1.610	2.594	48.9%
5. Physically, I feel exhausted.	169	1	5	1.91	.899	.808	38.2%
6. I have problems starting things.	169	1	5	1.64	.862	.742	32.9%
7. I have problems thinking clearly.	169	1	5	1.69	.964	.929	33.8%
Wrists/Hands [7D]	169	1	5	1.81	1.052	1.107	36.2%

Upper back [7D]							
Lower Back [7D]							
Hips/Thighs [7D]							
Knees [7D]							
Ankles/Feets [7D]							
1. Do you believe your work has contribute of the musculoskeletal issues reported abov 03- Q1							
2. Have you taken sick leave musculoskeletal problems in the past 12 Sec-03-Q2							
3. Have you sought medical treatment musculoskeletal problems? Sec-03-Q3							
4. Have you made modifications to your reduce discomfort? (e.g., ergonomic adju breaks, physical therapy) Sec-03-Q4							
Musculoskeletal pain prevalence							
8. I feel no desire to do anything.							
9. Mentally, I feel exhausted.	169	1	5	2.02	1.123	1.261	40.5%
10. When I am doing something, I can concentrate quite well.	169	1	5	2.17	1.596	2.548	43.4%
Fatigue severity	169	1	3	1.15	.372	.139	38.3%

Table 4 shows descriptive analysis of NMQ related to Prevalence of ergonomic related health concerns among culinary professionals in restaurants of Karachi; study of each element showing how frequently respondents made assertive answers against these questions. NMQ is the parameters to show the overall involvement of respondents in response to assess the Prevalence of ergonomic related health concerns among culinary professionals in restaurants of Karachi here and in the rest of documents as well; showing that 48.9% respondents have highest response for item “4. I have enough energy for everyday life.” and 32.4% respondents have lowest response for item “3. I don’t do much during the day”.

CORRELATION MATRIXC

Table 5: Correlation Analysis of NMQ prevalence-work prevention:

NMQ-12 Months-work prevention	Item -1	Item -2	Item -3	Item -4	Item -5	Item -6	Item -7	Item -8	Item -9	Work prevention
Neck [12M]	1.00	0.55	0.38	0.25	0.26	0.18	0.21	0.07	0.17	0.28
Shoulder [12M]	0.55	1.00	0.31	0.25	0.27	0.13	0.12	-0.02	0.08	0.24
Elbows [12M]	0.38	0.31	1.00	0.47	0.31	0.06	0.28	0.17	0.13	0.14
Wrists/Hands [12M]	0.25	0.25	0.47	1.00	0.33	0.27	0.30	0.37	0.24	0.30
Upper back [12M]	0.26	0.27	0.31	0.33	1.00	0.37	0.38	0.27	0.25	0.31
Lower back [12M]	0.18	0.13	0.06	0.27	0.37	1.00	0.37	0.25	0.26	0.30

Hips/Thighs [12M]	0.21	0.12	0.28	0.30	0.38	0.37	1.00	0.57	0.45	0.36
Knees [12M]	0.07	-0.02	0.17	0.37	0.27	0.25	0.57	1.00	0.54	0.45
Ankles/Feets [12M]	0.17	0.08	0.13	0.24	0.25	0.26	0.45	0.54	1.00	0.51
Work prevention	0.28	0.24	0.14	0.30	0.31	0.30	0.36	0.45	0.51	1.00

Table 5 is Correlation Analysis of NMQ assessment of prevalence of symptom and fatigue severity shows the correlation between items of NMQ prevalence of our research data. Directions of relations among has positive and negative impact for Prevalence of ergonomic related health concerns among culinary professionals in restaurants of Karachi. Results showing that "Ankles/Feets [12M]" have highest positive relationship to i.e. 51.0%, and the least relationship has found positive impact of item "elbows [12M]" i.e. 14.0% is correlated positively with pain risk prevalence.

Table 6: Correlation Analysis of NMQ prevalence:

NMQ-Musculoskeletal pain prevalence	Item-1	Item-2	Item-3	Item-4	Item-5	Item-6	Item-7	Item-8	Item-9
Neck [7D]	1.00	0.66	0.41	0.36	0.31	0.28	0.29	0.10	0.21
Shoulder [7D]	0.66	1.00	0.51	0.45	0.34	0.21	0.26	0.16	0.27
Elbows [7D]	0.41	0.51	1.00	0.48	0.41	0.17	0.33	0.24	0.26
Wrists/Hands [7D]	0.36	0.45	0.48	1.00	0.47	0.34	0.41	0.38	0.43
Upper back [7D]	0.31	0.34	0.41	0.47	1.00	0.41	0.36	0.42	0.31
Lower back [7D]	0.28	0.21	0.17	0.34	0.41	1.00	0.47	0.36	0.43
Hips/Thighs [7D]	0.29	0.26	0.33	0.41	0.36	0.47	1.00	0.50	0.45
Knees [7D]	0.10	0.16	0.24	0.38	0.42	0.36	0.50	1.00	0.61
Ankles/Feets [7D]	0.21	0.27	0.26	0.43	0.31	0.43	0.45	0.61	1.00
1. Do you believe your work has contributed to any of the musculoskeletal issues reported above?	0.19	0.13	0.15	0.28	0.18	0.35	0.27	0.38	0.34
2. Do you believe your work has contributed to any of the musculoskeletal issues reported above?	-0.01	0.14	0.06	0.07	0.15	0.06	0.19	0.16	0.10

3. Have you sought medical treatment for any musculoskeletal problems?	0.17	0.20	0.26	0.07	0.11	0.12	0.19	0.15	0.05
4. Have you made modifications to your work to reduce discomfort? (e.g., ergonomic adjustments, breaks, physical therapy)	0.14	0.19	-0.06	0.01	0.08	0.03	0.02	0.00	0.08
Musculoskeletal pain Prevalence	0.39	0.47	0.38	0.46	0.41	0.48	0.54	0.48	0.55

NMQ-Musculoskeletal pain prevalence	Item-10	Item-11	Item-12	Item-13	Musculoskeletal pain prevalence
Neck [7D]	0.19	-0.01	0.17	0.14	0.39
Shoulder [7D]	0.13	0.14	0.20	0.19	0.47
Elbows [7D]	0.15	0.06	0.26	-0.06	0.38
Wrists/Hands [7D]	0.28	0.07	0.07	0.01	0.46
Upper back [7D]	0.18	0.15	0.11	0.08	0.41
Lower back [7D]	0.35	0.06	0.12	0.03	0.48
Hips/Thighs [7D]	0.27	0.19	0.19	0.02	0.54
Knees [7D]	0.38	0.16	0.15	0.00	0.48
Ankles/Feets [7D]	0.34	0.10	0.05	0.08	0.55
1. Do you believe your work has contributed to any of the Musculoskeletal issues reported above?	1.00	0.23	0.13	-0.13	0.55
2. Do you believe your work has contributed to any of the musculoskeletal issues reported above?	0.23	1.00	0.19	0.03	0.43
3. Have you sought medical treatment for any musculoskeletal problems?	0.13	0.19	1.00	0.17	0.33
4. Have you made modifications to your work to reduce discomfort? (e.g., ergonomic adjustments, breaks, physical therapy)	-0.03	0.03	0.17	1.00	0.16
Musculoskeletal pain prevalence	0.55	0.43	0.33	0.16	1.00

Table 6 (6.1 and 6.2) is Correlation Analysis of prevalence of symptom and fatigue severity shows the correlation between dependent variables of NMQ prevalence of our research data. Directions of relations among has positive and negative impact for Prevalence of ergonomic related health concerns among culinary professionals in restaurants of Karachi. Results show that "1. Do you believe your work has contributed to any of the musculoskeletal issues reported above? Sec-03- Q1" have highest positive relationship to i.e. 51.0%, and the least relationship has found positive impact of item "4. Have you made modifications to your work to reduce discomfort? (e.g. ergonomic adjustments, breaks, physical therapy) Sec-03-Q4" i.e. 16.0% is correlated positively with pain risk prevalence.

Table 7: Correlation Analysis of FAS prevalence:

FAS-Fatigue severity	Item-1	Item-2	Item-3	Item-4	Item-5	Item-6	Item-7	Item-8	Item-9	Item-10	Fatigue
1. I am bothered by fatigue.	1.00	0.40	0.34	-0.06	0.31	0.22	0.18	0.41	0.23	-0.13	0.32
2. I get tired very quickly.	0.40	1.00	0.41	0.02	0.31	0.49	0.44	0.45	0.36	0.00	0.54
3. I don't do much during the day.	0.34	0.41	1.00	-0.05	0.02	0.30	0.32	0.31	0.26	0.00	0.40
4. I have enough energy for everyday life.	-0.06	0.02	-0.05	1.00	-0.16	0.09	0.02	-0.12	-0.08	0.70	0.22
5. Physically I feel exhausted.	0.31	0.31	0.20	-0.16	1.00	0.36	0.26	0.28	0.44	-0.16	0.29

6. I have problem s with starting things.	0.22	0.49	0.30	0.09	0.36	1.00	0.57	0.48	0.51	0.03	0.63
7. I have problem s thinking clearly.	0.18	0.44	0.32	0.02	0.26	0.57	1.00	0.36	0.38	0.01	0.54
8. I feel no desire to do anythin g.	0.41	0.45	0.31	-0.12	0.28	0.48	0.36	1.00	0.35	-0.06	0.47
9. Mentall y, I feel exhaust ed.	0.23	0.36	0.26	-0.08	0.44	0.51	0.38	0.35	1.00	-0.05	0.58
10. When I am doing somethi ng, I can concentr ate quite well.	-0.13	0.00	0.00	0.70	-0.16	0.03	0.01	-0.06	-0.05	1.00	0.21
Fatigue Severity	0.32	0.54	0.40	0.22	0.29	0.63	0.54	0.47	0.58	0.21	1.00

Table 7 is Correlation Analysis of prevalence of symptom and fatigue severity shows the correlation between dependent variables of FAS prevalence of our research data. Directions of relations among has positive and negative impact for Prevalence of ergonomic related health concerns among culinary professionals in restaurants of Karachi. Results show that "6. I have problems starting things." have highest positive relationship to i.e. 63.0%, and the least relationship has found positive impact of item "10. When I am doing something, I can concentrate quite well." i.e. 21.0% is correlated positively with fatigue prevalence.

Table 8: Correlation Analysis of FAS prevalence:

DV-Correlation	Work prevention	Musculoskelel pain prevalence	Fatigue severity
Work prevention	1.00	0.57	0.23

Musculoskeletal pain prevalence	0.57	1.00	0.20
Fatigue severity	0.23	0.20	1.00

Table 8 is Correlation Analysis of prevalence of symptom and fatigue severity shows the correlation between dependent variables of our research data. Directions of relations among has positive and negative impact for Prevalence of ergonomic related health concerns among culinary professionals in restaurants of Karachi. Results show that work prevention has 57% pain risk and 23% on fatigue severity. Similarly, musculoskeletal pain has 20% on fatigue.

CHI-SQUARE

Chi-Square is a statistical measure which compares the actual and expected results leading to accept or reject null hypothesis. We reject the null hypothesis if the chi-square value is greater than the critical value. If you reject the null hypothesis, you can conclude that your data are significantly different from what you expected. Here we assume five (05) null hypotheses are as under to assess:

HO1: There is no significant relationship between age groups and Prevalence of ergonomic related health concerns among culinary professionals in restaurants of Karachi.

HA1: There is significant relationship between age groups and Prevalence of ergonomic related health concerns among culinary professionals in restaurants of Karachi.

HO2: There is no significant relationship between gender and Prevalence of ergonomic related health concerns among culinary professionals in restaurants of Karachi.

HA2: There is significant relationship between gender and Prevalence of ergonomic related health concerns among culinary professionals in restaurants of Karachi.

HO3: There is no significant relationship between experience bracket and Prevalence of ergonomic related health concerns among culinary professionals in restaurants of Karachi.

HA3: There is significant relationship between experience bracket and Prevalence of ergonomic related health concerns among culinary professionals in restaurants of Karachi.

HO4: There is no significant relationship between working hour's bracket and Prevalence of ergonomic related health concerns among culinary professionals in restaurants of Karachi.

HA4: There is significant relationship between working hour's bracket and Prevalence of ergonomic related health concerns among culinary professionals in restaurants of Karachi.

HO5: There is no significant relationship between level of job and Prevalence of ergonomic related health concerns among culinary professionals in restaurants of Karachi.

HA5: There is significant relationship between level of job and Prevalence of ergonomic related health concerns among culinary professionals in restaurants of Karachi.

Table 9: Case Processing Summary

	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Age * Musculoskeletal pain prevalence	169	100%	0	0%	169	100%
Age * Fatigue severity	169	100%	0	0%	169	100%

Gender * Musculoskeletal pain prevalence	169	100%	0	0%	169	100%
Gender * Fatigue severity	169	100%	0	0%	169	100%
Experience Bracket * Musculoskeletal pain prevalence	169	100%	0	0%	169	100%
Experience Bracket * Fatigue severity	169	100%	0	0%	169	100%
Working year Bracket * Musculoskeletal pain prevalence	169	100%	0	0%	169	100%
Working year Bracket * Fatigue severity	169	100%	0	0%	169	100%
Level of Job * Musculoskeletal pain prevalence	169	100%	0	0%	169	100%
Level of Job * Fatigue severity	169	100%	0	0%	169	100%

Table 9 shows that each element has no exclusion, and each element has assessed with filled parameters.

Table 10: Chi-Square Tests

Test Element	Pearson Chi-Square	p-value	Result
Age * Musculoskeletal pain prevalence	2.285	0.892	Null hypothesis rejected
Age * Fatigue severity	4.760	0.575	Null hypothesis rejected
Gender * Musculoskeletal pain prevalence	20.424	0.000	Null hypothesis rejected
Gender * Fatigue severity	11.066	0.004	Null hypothesis rejected
Experience Bracket * Musculoskeletal pain prevalence	4.839	0.565	Null hypothesis rejected
Experience Bracket * Fatigue severity	6.431	0.377	Null hypothesis rejected
Working year Bracket * Musculoskeletal pain prevalence	2.412	0.878	Null hypothesis rejected
Working year Bracket * Fatigue severity	14.904	0.021	Null hypothesis rejected
Level of Job * Musculoskeletal pain prevalence	3.024	0.554	Null hypothesis rejected
Level of Job * Fatigue severity	3.317	0.506	Null hypothesis rejected

Table 10 showing that each element has greater chi-square value than of p-value; resulting that each HO has rejected hence concluded the assertiveness of all alternative hypothesis and stated that have significant impact on Prevalence of ergonomic related health concerns among culinary professionals in restaurants of Karachi.

DIAGNOSTIC ANALYSIS

Diagnostic analyses in research are to be performed to check that all conditions for application of statistical analysis have verified or not with a substantial degree of accuracy. In this research we have checked (i) reliability and (ii) multicollinearity of all independent variables.

Reliability: Reliability of a questionnaire as a survey instrument ensures the accuracy of measures by assessing its internal consistency. There are different methods available to evaluate the internal consistency of the questionnaire. As we used SPSS, Cronbach alpha was used to assess reliability. Cronbach's alpha is a measure of internal consistency, which describes how closely related a set of items are as a group. It is a measure of scale reliability having a statistical standard that Cronbach's alpha of 0.70 and up 0.79 has acceptable internal consistency, 0.80 and up to 0.89 is good and 0.90 and above considered as excellent internal consistency.

Table 11: Case Processing Summary

		N	%
Cases	Valid	169	100
	Excluded a	0	0
	Total	169	100

Table 11 shows that each element has no exclusion, and each element has assessed with filled parameters.

Table 12: Reliability Statistics:

Cronbach's Alpha	Cronbach's Alpha	N of sub-scales
NMQ	0.87	23
FAS	0.67	10
Overall (NMQ + FAS)	0.81	33

Table 12 shows that Cronbach's Alpha of two (02) scales; NMQ questionnaire is 0.87 with nineteen

(23) items which good reliability of NMQ questionnaire, FAS questionnaire has 0.67 with ten (10) items which poor reliability of NMQ questionnaire. Overall chronbache is 0.81 showing good reliability.

(i) Multicollinearity: In statistical research, Multicollinearity is known as a situation in which two or more explanatory variables in a model are highly linearly related. Multicollinearity is denoted by variance inflation factor (VIF). If VIF is greater than ten, there is severe collinearity in that specific variable and research results would perturb. In contrast If VIF is less than 10, there is no collinearity, and data is acceptable for performing the statistical analyses.

Table-13: Multicollinearity Values:

Model: Dependent Variable:
Age
Gender
Experience Bracket
Working year Bracket

Level of Job
a. Dependent Variable: NMQ-Musculoskeletal Pain risk prevalence and Fatigue Severity

Table 13 shows that VIF of all five (05) components are <10 which shows there is no collinearity and data is acceptable for performing the statistical analyses.

Normality Test: Normality Test determines whether sample data has been drawn from a normally distributed population. Here we are using the Shapiro-Wilk Test to assess the normality; where value of the Shapiro-Wilk test is greater than 0.05, it assumes the data is normal.

Table-14: Normality tests of prevalence of symptoms and fatigue severity prevalence:

		Shapiro-Wilk	
Musculoskeletal-pain risk prevalence		Statistic	Sig.
Age	20-25 years	0.793	0.000
	26-30 years	0.802	0.000
	31-35 years	0.825	0.014
	36-40 years	0.796	0.002
Gender	Male	0.785	0.000
	Female	0.738	0.000
Experience Bracket	Below 01 year	0.822	0.091
	01-05 years	0.801	0.000
	06-10 years	0.778	0.000
	Above 10 years	0.812	0.010

Working year Bracket	up to 08 hours	0.838	0.055
	09 hours	0.801	0.000
	10 hours	0.788	0.000
	Above 10 hours	0.785	0.006
Level of Job	Head chef	0.794	0.000
	Chef	0.802	0.000
	Assistant Chef	0.757	0.001

Table 14 shows that each dimension of prevalence of pain risk prevalence has derived from a normal distributed population for assessment of all factors have significant impact on Prevalence of ergonomic related health concerns among culinary professionals in restaurants of Karachi as value of the Shapiro-Wilk test is greater than 0.05 for all elements for all assessments.

		Shapiro-Wilk	
Fatigue severity		Statistic	Sig.
Age	20-25 years	0.423	0.000
	26-30 years	0.467	0.000
	31-35 years	0.446	0.000
Gender	Male	0.371	0.000
	Female	0.645	0.000
Experience Bracket	01-05 years	0.500	0.000
	06-10 years	0.336	0.000
Working year Bracket	up to 08 hours	0.655	0.000
	09 hours	0.405	0.000
	10 hours	0.328	0.000
	Above 10 hours	0.345	0.000
Level of Job	Head chef	0.474	0.000
	Chef	0.442	0.000

Table 14 shows that each dimension of prevalence of fatigue severity prevalence has derived from a normal distributed population for assessment of all factors have significant impact on Prevalence of ergonomic related health concerns among culinary professionals in restaurants of Karachi as value of the Shapiro-Wilk test is greater than 0.05 for all elements for all assessments except age bracket of 36-40, experience bracket of below 01 year and above 10 years having only one response.

Homogeneity Test In the test of homogeneity, we select random samples from each subgroup or population separately and collect data on a single categorical variable.

Table 15: Homogeneity Test

		Levene	
		Statistic	Sig.
Musculoskeletal pain	Age	0.39	0.76
	Gender	0.02	0.90
	Experience Bracket	1.58	0.20
	Working year Bracket	0.79	0.50
	Level of Job	1.12	0.33
Fatigue severity	Age	5.56	0.00
	Gender	25.67	0.00
	Experience Bracket	11.24	0.00
	Working year Bracket	3.90	0.01
	Level of Job	8.17	0.00

Table 15 shows that population of all elements for assessment of all factors have significant impact on Prevalence of ergonomic related health concerns among culinary professionals in restaurants of Karachi Here for; p-value is more than 0.05 in prevalence of risk of pain in sub group of age , gender, experience bracket, working year bracket and level of job hence homogeneity assumption of the variance is met; have a mean that spread of data within each combination of factors should be roughly the same. Whereas in fatigue severity, all p-values are below 0.05 hence data is fit for analysis.

DISCUSSION

The culinary industry has experienced rapid growth, intensifying the demand for highly trained chefs and hospitality professionals. Today's chefs are not just food preparers; they are artists, designers, and leaders who operate in stressful kitchen environments. Chefs are constantly evolving and are now required to be multitaskers and problem solvers, exercising creativity, and working in fast-paced situations whether in hotels, restaurants, or catering. But this evolution comes at a cost; chefs are experiencing increased reports of work-related musculoskeletal disorders (MSDs); in fact, MSDs are quickly becoming one of the most common occupational health problems in the world, resulting in a global impact that is both physical and economic. Chefs often work shifts that go well over 10 hours long, while standing for lengthy periods of time, while lifting pots and heavy kitchen equipment, while participating in repetitive tasks like chopping and garnishing. All of these demands can lead to injuries in the back, neck, shoulders, and wrist. The poor ergonomics and the absence of workstation design do not help alleviate the situation. Studies from around the world in Industial kitchen facilities have shown alarming statistics, 76% and 70% of other hospitality kitchen workers in Ethiopia and 70.5% of pastry

chefs in Malaysia have reported working with at least one MSD and 70% of chefs employed in different cities in Pakistan have reported working with at least one MSD. The common complaints in hospitality kitchens are lower back pain, shoulder stiffness, or repetitive strain injuries. All of these should focus on poor posture, repetitive motion, and physical stress. Ergonomics is a science that aims to match work tasks with the human body, abilities, and limitations. By adapting kitchen workstations and techniques to reduce physical strain such as introducing ergonomic tools and improving task flow chefs' health can be preserved without compromising productivity. In conclusion, while the culinary profession is critical to the hospitality industry and national economy, its workforce is increasingly burdened by physical strain. Addressing MSDs through ergonomic interventions and improved safety practices is essential to safeguard the well-being of culinary professionals and sustain the industry's growth.

LIMITATION

Despite the valuable insights provided by this study on ergonomic-related health concerns among culinary professionals in Karachi, several limitations must be acknowledged. These limitations may influence the generalizability, accuracy, and interpretability of the findings.

Firstly, the use of a cross-sectional study design restricts the ability to establish causal relationships between ergonomic factors and musculoskeletal disorders. Since data were collected at a single point in time, it is not possible to determine whether the identified health issues are a result of long-term exposure or pre-existing conditions. Secondly, the sampling technique employed non-probability convenience sampling introduces potential selection bias. Participants were recruited based on ease of access rather than random selection, which may not fully represent the broader population of culinary professionals in Karachi. As a result, findings may reflect the experiences of a specific subgroup, possibly skewing results and limiting the generalizability of the study. Additionally, the sample size, though calculated with statistical software, was drawn from a relatively small finite population of 300 individuals.While there was an attempt to include a wide variety of restaurant types and locations, the limited population base may have led to some limitations in variability of the data as well as diminished the strength of statistical associations. One limitation is the use of self-reported data. Data obtained from questionnaires, such as the Nordic Musculoskeletal Questionnaire (NMQ) and Fatigue Assessment Scale (FAS) rely heavily on the memory and subjective judgement of the participants. This vulnerability creates an opportunity for recall bias or potentially inaccurate data reporting, particularly regarding pain severity or duration. Additionally, exclusion criteria such as not including individuals with pre-existing conditions may have ignored those subjects who were indeed at higher risk thereby underestimating the true burden of ergonomic-related issues in this workforce. Furthermore, the study only continues to focus on the ages of 20-40 years which could have overlooked the larger impacts ergonomically that older workers may have experienced. These limitations indicate some caution should be taken in interpreting results and a desire for more longitudinal and randomized studies in this area.

RECOMMENDATION

To overcome the limitations highlighted in this research on the ergonomic-related issues among culinary professionals in Karachi, some practical and methodological changes could be recommended for future research. A longitudinal study design, on the other hand, could be used to either supplement or replace the current cross-sectional design; longitudinal designs would allow the researcher to track changes over time, establish the causation between ergonomic exposure and musculoskeletal disorders, and ultimately provide stronger evidence regarding the development and risk factors involved with health issues in culinary environments. As far as

sampling technique, although convenience sampling limits ability to extrapolate, future studies should employ a probability factor sampling techniques such as stratified sampling or cluster random sampling so they can improve on representativeness providing a more reliable and generalizable result for various types of restaurants and geographical locations in Karachi. Also, in regard to the limited sample size and limited sample from one population, researchers should try and recruit more participants, and a more diverse population possibly including studying participants from neighbouring cities or regions.

This would increase the external validity of the results, and provide a more holistic view of ergonomic risks experienced by culinary professionals throughout Pakistan. Ultimately, to minimize self-reporting bias, next steps could include the use of more objective assessments of ergonomics (e.g. observational checklists, physical assessments, wearable technology with motion sensors), which would assist not only in verifying self-reported data, but also allow a clearer understanding of posture, repeated movement, and physical load. We would recommend a revision to the exclusion of individuals with pre-existing conditions to following documentation and subgroup analysis. Modifying the exclusion criteria would help researchers discover differential impacts, and develop targeted prevention initiatives. Finally, expanding the age range for participants would capture the ergonomic risks experienced throughout an entire culinary career and all combined risks, transferable to older workers, who are often more at risk for chronic musculoskeletal conditions. All aforementioned potential adjustments would significantly strengthen future research and subsequently help improve policy and workplace interventions within the hospitality industry.

CONCLUSION

This study presents a timely and significant contribution to the understanding of ergonomic-related health concerns among culinary professionals in Karachi. As the hospitality industry expands rapidly, the physical demands on chefs and kitchen staff have intensified, resulting in a high prevalence of musculoskeletal disorders (MSDs) and fatigue. Through the use of validated tools such as the Nordic Musculoskeletal Questionnaire (NMQ) and the Fatigue Assessment Scale (FAS), the research reveals critical insights into how factors like age, gender, job designation, experience, and working hours correlate with ergonomic health risks. Particularly vulnerable were younger chefs with moderate experience and longer shifts highlighting an urgent need for occupational health interventions. The study also underscores a significant gap in Pakistan's academic literature on workplace ergonomics in the culinary sector. By providing local evidence, it strengthens the case for immediate workplace reforms and informs public health stakeholders, restaurant managers, and policymakers about the growing burden of physical strain in kitchens.

Despite methodological limitations such as non-probability sampling, cross-sectional design, and reliance on self-reported data, the findings remain valuable for initiating dialogue and action toward safer work environments. To sustain industry growth while protecting its workforce, ergonomic improvements, such as redesigned workstations, staff rotation, and awareness training, must be prioritized. Moreover, expanding future studies through longitudinal designs, randomized sampling, and broader inclusion criteria will enhance the accuracy and applicability of findings. Ultimately, this research not only raises awareness but also lays a foundation for improving health standards and job satisfaction among culinary professionals in Pakistan.

REFERENCES

Aali MA, Iftikhar S, Raza A, Islam F. Exploring Calf and Hamstring Tightness among Chefs (Culinary Professionals). Pak-Euro Journal of Medical and Life Sciences. 2024 Jun 30;7(2):283-8.

Aali MA, Iftikhar S, Raza A, Islam F. Exploring Calf and Hamstring Tightness among Chefs (Culinary Professionals). Pak-Euro Journal of Medical and Life Sciences. 2024 Jun 30;7(2):283-8.

Abdelsalam A, Wassif GO, Eldin WS, Abdel-Hamid MA, Damaty SI. Frequency and risk factors of musculoskeletal disorders among kitchen workers. Journal of the Egyptian Public Health Association. 2023 Feb 20;98(1):3.

Abdelsalam A, Wassif GO, Eldin WS, Abdel-Hamid MA, Damaty SI. Frequency and risk factors of musculoskeletal disorders among kitchen workers. Journal of the Egyptian Public Health Association. 2023 Feb 20;98(1):3.

Abdul Aziz F, Rohizad MA. Evaluation of the Relationship Between Body Discomfort and Personal Background Among Restaurant Cooks. InHuman Factors and Ergonomics Malaysia Biennial Conference 2023 Aug 13 (pp. 316-329). Cham: Springer Nature Switzerland.

Abdul Aziz F, Rohizad MA. Evaluation of the Relationship Between Body Discomfort and Personal Background Among Restaurant Cooks. InHuman Factors and Ergonomics Malaysia Biennial Conference 2023 Aug 13 (pp. 316-329). Cham: Springer Nature Switzerland.

Abebaw T, Destaw B, Yenealem DG, Tesfaye AH, Melaku C, Mamaye Y, Bezie AE, Abere G. Work-related musculoskeletal disorders: prevalence, associated factors, and impact on quality of life among kitchen workers in hospitality industry, Bahir Dar City, Northwest Ethiopia, 2023. Frontiers in Public Health. 2024 May 14;12:1358867.

Abebaw T, Destaw B, Yenealem DG, Tesfaye AH, Melaku C, Mamaye Y, Bezie AE, Abere G. Work-related musculoskeletal disorders: prevalence, associated factors, and impact on quality of life among kitchen workers in hospitality industry, Bahir Dar City, Northwest Ethiopia, 2023. Frontiers in Public Health. 2024 May 14;12:1358867.

Amjad F, Matloob M, Javed NU, Hashim A, Chaudhry A, Zafar B, Khan K. Work-related risk factors for lateral epicondylitis in chef in Lahore. Pakistan Journal of Medical & Health Sciences. 2023 Feb 21;17(01):241-.

Amjad F, Matloob M, Javed NU, Hashim A, Chaudhry A, Zafar B, Khan K. Work-related risk factors for lateral epicondylitis in chef in Lahore. Pakistan Journal of Medical & Health Sciences. 2023 Feb 21;17(01):241-.

Cerasa A, Fabbricatore C, Ferraro G, Pozzulo R, Martino I, Liuzza MT. Work-related stress among chefs: A predictive model of health complaints. Frontiers in Public Health. 2020 Mar 10;8:68.

Cerasa A, Fabbricatore C, Ferraro G, Pozzulo R, Martino I, Liuzza MT. Work-related stress among chefs: A predictive model of health complaints. Frontiers in Public Health. 2020 Mar 10;8:68.

Choudhary YQ, Idress MQ. Frequency of Musculoskeletal Pain Among Chefs Working in Restaurants of Lahore: JRCRS. 2020; 8 (2): 69-73. Journal Riphah College of

Choudhary YQ, Idress MQ. Frequency of Musculoskeletal Pain Among Chefs Working in Restaurants of Lahore: JRCRS. 2020; 8 (2): 69-73. Journal Riphah College of

Hammond KJ. CHEF: A Model of Case-based Planning. InAAAI 1986 Aug 11 (Vol. 86, pp. 267-271).

Hammond KJ. CHEF: A Model of Case-based Planning. InAAAI 1986 Aug 11 (Vol. 86, pp. 267-271)

Hinterstoisser TM. An investigation into the relationship between conscientiousness, self- awareness, and occupational stress outcomes in culinary chefs.

Hinterstoisser TM. An investigation into the relationship between conscientiousness, self- awareness, and occupational stress outcomes in culinary chefs.

Huynh T. Health risks of being a chef and its effects on chefs and the restaurant business.

Huynh T. Health risks of being a chef and its effects on chefs and the restaurant business.

Iqbal MU, Ahmad N, Khan ZS, Awan M, Zafar I, Safdar G, Altaf S, Sajjad AG, Kiyani

Iqbal MU, Ahmad N, Khan ZS, Awan M, Zafar I, Safdar G, Altaf S, Sajjad AG, Kiyani

Ismail FH, Osman S, Rahman FB. Ergonomics kitchen: a better place to work. International Journal of Academic Research in Business and Social Sciences. 2021;11(13):43-53.

Ismail FH, Osman S, Rahman FB. Ergonomics kitchen: a better place to work. International Journal of Academic Research in Business and Social Sciences. 2021;11(13):43-53.

Karelia BJ, Rathod D, Kumar A. Assessment of posture related musculoskeletal risk levels in restaurant chefs using rapid entire body assessment (REBA). International Journal of Health Sciences and Research. 2021 May;11(5):333-9.

Karelia BJ, Rathod D, Kumar A. Assessment of posture related musculoskeletal risk levels in restaurant chefs using rapid entire body assessment (REBA). International Journal of Health Sciences and Research. 2021 May;11(5):333-9

Karthik L, Rao R. Ergonomic assessment of musculoskeletal discomfort among chefs in commercial kitchens. International Journal for Innovative Research in Multidisciplinary Field (IJIRMF). 2020 May;6:371-9.

Karthik L, Rao R. Ergonomic assessment of musculoskeletal discomfort among chefs in commercial kitchens. International Journal for Innovative Research in Multidisciplinary Field (IJIRMF). 2020 May;6:371-9.

Kini RS, Dinesh TK, Shetty A, K A. Exploring the Risks Faced by Hotel Kitchen Professionals: From Stovetop to Safety Net. Cogent Social Sciences. 2025 Dec 31;11(1):2460700.

Kini RS, Dinesh TK, Shetty A, K A. Exploring the Risks Faced by Hotel Kitchen Professionals: From Stovetop to Safety Net. Cogent Social Sciences. 2025 Dec 31;11(1):2460700.

Kohli N, Mehta M. Occupational stress: A case study among chefs and kitchen workers. International Journal of Advances in Engineering and Management. 2022 Mar;4(3):970-7.

Kohli N, Mehta M. Occupational stress: A case study among chefs and kitchen workers. International Journal of Advances in Engineering and Management. 2022 Mar;4(3):970-7.

Matloob M, Fatima T, Baig N, Khalid S, Irfan H, Hashim A, Tabassum MS. Association of Work-Related Risk Factors and Lateral Epicondylitis among Chefs in Lahore. Pakistan Journal of Medical & Health Sciences. 2022 Sep 16;16(08):220-.

Matloob M, Fatima T, Baig N, Khalid S, Irfan H, Hashim A, Tabassum MS. Association of Work-Related Risk Factors and Lateral Epicondylitis among Chefs in Lahore. Pakistan Journal of Medical & Health Sciences. 2022 Sep 16;16(08):220-.

McFadden T. An exploratory analysis of occupational stress amongst Chefs in Ireland: The adverse consequences for their personal life (Doctoral dissertation, Dublin, National College of Ireland).

McFadden T. An exploratory analysis of occupational stress amongst Chefs in Ireland: The adverse consequences for their personal life (Doctoral dissertation, Dublin, National College of Ireland).

MM. Prevalence of musculoskeletal disorders among chefs working in restaurants of twins cities of Pakistan. Work. 2023 Apr 18;74(4):1507-13.

MM. Prevalence of musculoskeletal disorders among chefs working in restaurants of twins cities of Pakistan. Work. 2023 Apr 18;74(4):1507-13.

Murray-Gibbons R, Gibbons C. Occupational stress in the chef profession. International Journal of Contemporary Hospitality Management. 2007 Feb 13;19(1):32-42.

Murray-Gibbons R, Gibbons C. Occupational stress in the chef profession. International Journal of Contemporary Hospitality Management. 2007 Feb 13;19(1):32-42.

Nazar Z, Shakeel S, Naseer A, Razzaq R. Prevalence of Musculoskeletal Pain among Chefs Working in Restaurants of Sialkot: Prevalence of Musculoskeletal Pain. Pakistan Journal of Health Sciences. 2023 Dec 31:134-9.

Nazar Z, Shakeel S, Naseer A, Razzaq R. Prevalence of Musculoskeletal Pain among Chefs Working in Restaurants of Sialkot: Prevalence of Musculoskeletal Pain. Pakistan Journal of Health Sciences. 2023 Dec 31:134-9.

Ovias Z, Rao R. An Ergonomic Study to Evaluate Specific Work-Related Tasks of Chefs in Commercial Kitchens. International Journal of Innovative Science, Engineering & Technology (IJISET). 2020;7:195-203.

Ovias Z, Rao R. An Ergonomic Study to Evaluate Specific Work-Related Tasks of Chefs in Commercial Kitchens. International Journal of Innovative Science, Engineering & Technology (IJISET). 2020;7:195-203.

Rehabilitation Sciences. 2020 Dec 12;8(2):69-73.

Rehabilitation Sciences. 2020 Dec 12;8(2):69-73.

Suhairom N, Musta'amal AH, Amin NF, Kamin Y, Wahid NH. Quality culinary workforce competencies for sustainable career development among culinary professionals. International Journal of Hospitality Management. 2019 Aug 1;81:205-20.

Suhairom N, Musta'amal AH, Amin NF, Kamin Y, Wahid NH. Quality culinary workforce competencies for sustainable career development among culinary professionals. International Journal of Hospitality Management. 2019 Aug 1;81:205-20.

Tan D, Balaraman T. Working posture and musculoskeletal pain among restaurant chef. Website: www. ijpot. com. 2020 Jun;14(02):2254.

Tan D, Balaraman T. Working posture and musculoskeletal pain among restaurant chef. Website: www. ijpot. com. 2020 Jun;14(02):2254.

Tan S, Muniandy Y, Vasanthi RK. Prevalence of musculoskeletal disorders and associated work-related risk factors among pastry chefs in malacca, malaysia. International Journal of Aging Health and Movement. 2021 Jun 24;3(2):20-30.

Tan S, Muniandy Y, Vasanthi RK. Prevalence of musculoskeletal disorders and associated work-related risk factors among pastry chefs in malacca, malaysia. International Journal of Aging Health and Movement. 2021 Jun 24;3(2):20-30.

Tegenu H, Gebrehiwot M, Azanaw J, Akalu TY. Research Article Self-Reported Work- Related Musculoskeletal Disorders and Associated Factors among Restaurant Workers in Gondar City, Northwest Ethiopia, 2020.

Tegenu H, Gebrehiwot M, Azanaw J, Akalu TY. Research Article Self-Reported Work- Related Musculoskeletal Disorders and Associated Factors among Restaurant Workers in Gondar City, Northwest Ethiopia, 2020.