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Prevalence of Work - Related Musculoskeletal Disorders & its Associated Postural Factors among Professional Kitchen Workers: A Cross-Sectional Study

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Abstract: ***Background: The restaurant industry is growing tremendously in India having range of cuisines and diverse cooking technique to meet the ever - increasing demand of the people. The kitchen workers are susceptible to develop WRMSDs as it imposes dynamic and static loading on the whole musculoskeletal system. A chef is in charge of the kitchen in restaurants and their work is characterized by long standing hours, constant forward leaning, repetitive upper body movement, lifting heavy objects and awkward postures. Moreover, the work of kitchen worker includes grasping of cooking utensil, tossing a wok, cutting vegetables etc. all of which require the forceful exertion of entire body. Therefore, the main aim of the study is to find the prevalence of WRMSDs in restaurant worker and to assess the postural risks. Methodology: the study was conducted on 101 kitchen worker from Bharuch and Surat city. The data was collected using structured questionnaire and videography. Result: out of 101 kitchen worker, 69% of them reported WRMSDS within the past 12 month. The most affected joint is shoulder (23.8%) followed by neck (21.8%) and wrist (21.8%). Furthermore, it is observed that 50% of worker works at medium risk. Conclusion: the study concludes that the prevalence of WRMSDS is 69% and the most affected joints are shoulder (23.8%), neck (21.8%) and wrist (21.8%). Moreover, 50% of worker falls under medium risk and if they continue, they may fall into high risk category in future.***

Keywords: Work related Musculoskeletal disorders (WRMSDS), kitchen workers, postural risks, prevalence

1. Introduction

The restaurant industry is growing tremendously in India having range of cuisines and diverse cooking technique to meet the ever - increasing demand of the people[1]. As per the report of National Restaurant Association of India (NRAI), the food service market is estimated to be more than 5, 00, 000 crores in 2022 and it is growing at an annual rate of 7% [2], providing employment to a vast number of people. Restaurant ranges from local diner to hotel restaurant and consist of two main area: the kitchen, where the preparation and cooking of meals take place; the dine - in area where the customer gets to eat their food.3

Musculoskeletal disorders (MSDs) are the conditions primarily affecting muscles, bones, joints and associated tissues responsible for major cause of occupational disability[4.] Work related musculoskeletal disorders (WRMSDs) are the condition caused specifically by work due to repetitive or static position for long time[4, 5]. The kitchen workers are susceptible to develop WRMSDs as it imposes dynamic and static loading on the whole musculoskeletal system[6]. Kitchens are hot and uncomfortable and the restaurants worker have to work a variety of hours such as early morning, late evenings and even on holidays and weekends. A chef is in charge of the kitchen in restaurants and their work is characterized by long standing hours, constant forward leaning, repetitive upper body movement, lifting heavy objects and awkward postures. Moreover, the work of kitchen worker includes grasping of cooking utensil, tossing a wok, cutting vegetables etc. all of which require the forceful exertion of entire body[7].

The study conducted by abeer abdelsalam et al 2023 in Cairo Egypt revealed that the majority of kitchen workers (90.6%) at the student's hostel reported WRMSDs within the past 12 months[8]. Studies done in various other countries among kitchen and restaurants workers shown similar results in finland[9] (87%), Taiwan[10] (85.2%), Ethiopia[11] (81.5%), and Bangladesh[12] (78%). The study in south India done by S. Shankar et al 2015 revealed that 65.5% of the male kitchen workers experienced WRMSDs during the past 12 months[13]. Variations are found in the results of prevalence of WRMSDs in various joints. Globally, the study conducted in Kathmandu by Shakya NR et al in 2018 revealed back pain (35%) most commonly reported disorder followed by neck (27.5%) and ankle pain (27.5%) [14]. The results in the study of S. Shankar et al in south India (2015) showed prevalence of lower back (65.8%), Shoulder (62.3%) [13]. Whereas, the highest prevalence was found in ankle (26%) followed by lower back (23%) and wrist (21%) in the study conducted by Ms. Aarti Memkiya in Gujarat, 2015[15].

Kitchen personal face four main physical risk factor which include posture, force, repetition, duration. Abnormal Posture includes Neck flexion while cooking food, overreaching while preparing food, reaching for supplies, poorly designed kitchens, small working space. Worker has to use Force while carrying bulk food packages, moving pots and pans.

Repetition of tasks occurs in chopping and dicing while preparing the food. Duration of long working hours and sometimes even without breaks can contribute to be a major risk factor of WRMSDs[16].

Numerous studies have been reported regarding the prevalence of WRMSDs in restaurant workers but very few studies were done on postural analysis of restaurant worker specifically in India. Therefore, the main aim of the study is to find the prevalence of WRMSDs in restaurant worker and to assess the postural risks.

2. Methodology

A cross sectional Study was carried out from July 2023 to march 2024 on 101 kitchen workers from various restaurants in Bharuch and Surat city. Both male and female subjects whose age is between 21 to 50 years, who is a full time worker and has at least one year of experience, works for at least 6h/day and 5 days/week were included in the study, Whereas workers who are diagnosed with msk pathologies of non - occupational origin and infectious disease, have any previous history of surgeries and trauma of musculoskeletal system were excluded from this study.

3. Data collection Procedure

The study protocol was submitted to PPSU ethical review committee via school of physiotherapy, P. P. SAVANI UNIVERSITY. Upon approval, permission was sought from various hotel managers from Surat and Bharuch city. Those who were willing to participate in the study recruited for the same after signing a return consent form. All the subjects of the study were selected based on inclusion and exclusion criteria and those who qualified for participation were evaluated using outcome measure. Nordic musculoskeletal scale (NMQ) was taken by interview method, Rapid Entire Body Assessment (REBA) was taken via observation method for which videography was done by camera kept at predefine angles which we took from right and left side and camera distance from the worker was 2.5 to 3m for data collection. The video was 3 to 5 minutes long depending on the specific task of the worker. The collected video of right and left side was analysed using Kinovea software. If videography was not allowed then data were collected through observation method.

Outcome: Pain & Postural risk

Outcome Tools

NMQ is a worldwide instrument used to assess musculoskeletal disorders. It is use to detect and analyze musculoskeletal symptom in different individual in different parts of the body. To answer this questionnaire, the subjects were asked to answer "yes" or "no". REBA was developed by the Hignett and MCAttamney in 2000. It is used to systematically assess the whole body postural and musculoskeletal disorders and risks associated with the job tasks. In the REBA worksheet, the evaluator will assign a scores for each of the following body region: Wrist, Forearm, Elbows, Shoulder, Neck, Trunk, Back, Legs and Knees. The score for each region is compiled to form a single score that represents the level of WRMSDs risk[7]. Another tool which is used in the study is Kinovea software which is a valid and reliable video analysis software used for 2D motion and postural analysis[17 - 18]. It can measure ROM of the joints of the body. Line and arrows can be drawn on the video using drawing tool. Video can be analyzed in slow motion[18]. It allows feature of observations, measurements and comparison of videos[19]. The advantages of this software are it is easily accessible, free of cost, easy to use and does not require any physical sensor[20.]

Statistical Analysis

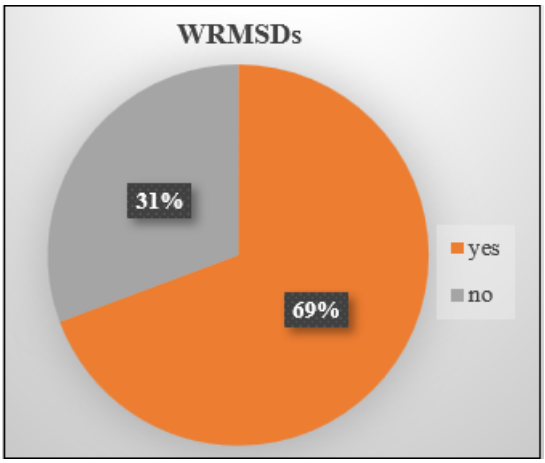
Data Analysis was done using latest version of SPSS software. Prevalence and joint wise distribution was done using descriptive analysis. While, the association between WRMSDs and its postural and worksite risk factors with WRMSDs were done using chi square method where $P < 0.05$ was considered as statistically significant.

4. Result

The Demographic data of the total 101professional kitchen workers are mentioned below in table 1.

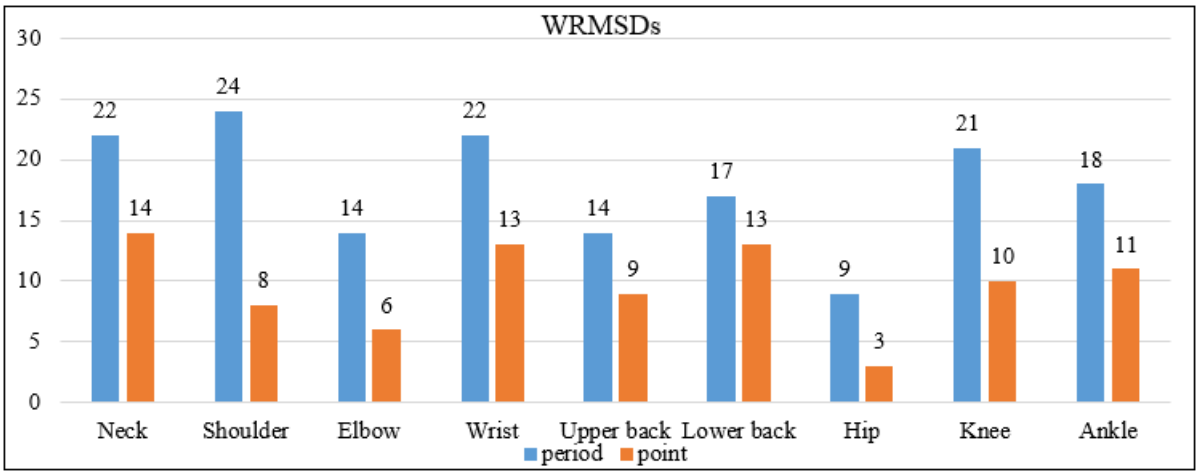
Table 1: Descriptive statistics for demographic variables

Variables	Min	Max	Mean ± SD
BMI Value	14.40	38.70	24.19 ± 4.62
Age	21.00	65.00	33.79 ± 8.69



Graph 1: Distribution of WRMSDs among workers

Out of 100% it has been found that 69% of workers suffered from Work related musculoskeletal disorder. The twelve month and point prevalence of work related musculoskeletal disorder is shown in graph 2 below. The period prevalence of Work related musculoskeletal disorders was maximum in the shoulder (23.8%) followed by neck (21.8%), wrist (21.8%), knee (20.8%), ankle (17.8%), lower back (16.8%), upper back (13.9%), elbow (13.9%), hip (8.9%). Whereas the point prevalence of Work related musculoskeletal disorders was highest in neck (13.9%), wrist (12.9%), lower back (12.9%), ankle (10.9%), knee (9.9%), upper back (8.9%), shoulder (7.9%), elbow (5.9%) and hip (3%).



Graph 2: Distribution of point and period prevalence of WRMSDs at different regions of the body

Table 2: Distribution of workers characteristics as individual factors

Individual factors	Descriptive data	N [Participants]	% [Percentage]
BMI	Underweight	10	9.9
	Normal	51	50.5
	Overweight	25	24.8
	Obese 1	13	12.9
	Obese 2	2	2
Gender	Male	90	89.1
	Female	11	10.9
Dominance	Right	91	90.1
	Left	10	9.9
Education	Illiterate	8	7.9
	Primary	27	26.7
	10^{th}	27	26.7
	12^{th}	33	32.7
	Graduation	6	5.9
Marital Status	Single	34	33.7
	Married	67	66.3
Addiction	None	72	71.3
	Smoking	10	9.9
	Tobacco	17	16.8
	Alcohol	2	2
Work Experience	1 - 5 yrs	51	50.5
	6 - 10 yrs	29	28.7
	11 - 15 yrs	9	8.9
	16 - 20 yrs	4	4
	>20 yrs	8	7.9
Working Days	3 - 5 days	6	5.9
	6 - 7 days	95	94.1
Work Duration	4 - 6 hrs	4	4
	6 - 8 hrs	44	43.6
	>8 hrs	53	52.5
Rest Time	<30 min	1	1
	30 - 40 min	28	27.7
	>45 min	69	68.3
	No break	3	3
Working Difficulty	No	72	71.3
	Yes	29	28.7

In table 2, distribution of kitchen workers as individual factor is shown.89.1% were male participants and 50.5% comes under normal BMI category.90.1% were right handed.32.7% have completed their education till 12^{th}. Married people were 66.3%. Workers with no addiction were 71.3%.50.5% workers have 1 - 5 years of work experience.52.5% workers works for more than 8 hours.68.3% takes rest break of more than 45 mins.71.3% doesn't experience any kind of work difficulty.

Table 3: Association between individual factors and WRMSDs among workers, $p < 0.05$

Individual factors	Data	Frequency	WRMSDs	No WRMSDs	p - Value
BMI	Underweight	10	8	2	0.591
	Normal	51	35	16	
	Overweight	25	15	10	
	Obese 1	13	10	3	
	Obese 2	2	2	0	
Gender	Male	90	60	30	0.091
	Female	11	10	1	
Dominance	Right	91	61	30	0.126
	Left	10	9	1	
Education	Illiterate	8	5	3	0.377
	Primary	27	15	12	
	10^{th}	27	21	6	
	12^{th}	33	24	9	
	Graduation	6	5	1	
Marital Status	Single	34	21	13	0.173
	Married	67	49	18	
Addiction	None	72	46	26	0.01
	Smoking	10	10	0	
	Tobacco	17	14	3	
	Alcohol	2	0	2	
Work Experience	1 - 5 yrs	51	33	18	0.081
	6 - 10 yrs	29	22	7	
	11 - 15 yrs	9	8	1	
	16 - 20 yrs	4	4	0	
	>20 yrs	8	3	5	
Working Days	3 - 5 days	6	5	1	0.4
	6 - 7 days	95	65	30	
Work Duration	4 - 6 hrs	4	4	0	0.262
	6 - 8 hrs	44	32	12	
	>8 hrs	53	34	19	
Rest Time	<30 min	1	0	1	0.433
	30 - 40 min	28	21	7	
	>45 min	69	47	22	
	No break	3	2	1	

Table 3 describe the association of individual factors with Work related musculoskeletal disorders. It shows that addiction is significantly related with work related musculoskeletal disorders in workers. Whereas other factors like BMI, Age, Gender, Dominance, Education, Marital Status, Addiction, Work experience, Working days, Working

duration and Rest time were not found to be associated significantly.

Table 4: Distribution of kitchen workers as postural risk factors

Level of Risk	REBA (R)	REBA (L)
Low Risk	32	38
Medium Risk	50	52
High Risk	19	10
Very High Risk	0	1

Table 4 gives information about the evaluation of REBA in kitchen workers while doing REBA of right side it is found that 49.5% of workers have medium postural risk whereas on the left side 51.5% workers works at a medium risk.

Table 5: Association of REBA & WRMSDs among workers, $p < 0.05$

Individual factors	Data	Frequency	WRMSDs	No WRMSDs	p - Value
REBA (R)	Low Risk	32	21	11	0.105
	Medium Risk	50	32	18	
	High Risk	19	17	2	
	Very High Risk	0	0	0	
REBA (L)	Low Risk	38	23	15	0.271
	Medium Risk	52	37	15	
	High Risk	10	9	1	
	Very High Risk	1	1	0	

Table 5 shows association of REBA with Work related musculoskeletal disorder. It is evident that REBA is not significantly associated with work related musculoskeletal disorders.

5. Discussion

The study was conducted to find out the prevalence of WRMSDS among kitchen workers in two cities of the South Gujarat region and its association with postural risk factors. The permission was sought from the restaurant managers to recruit the subjects. They were selected considering the inclusion and exclusion criteria. The prevalence of WRMSDS was assessed by Nordic musculoskeletal scale via interview method and videography was taken while the workers were working to examine postural risk via REBA. The videos were then analyzed in Kinovea software. Where there was the restriction of taking videography, REBA was taken by direct observation method.

The results reveal the prevalence of WRMSDS in kitchen workers within the past 12 months is 69%. The findings were similar to a study done by Shankar et al (2015) in South India, in which 67.5% of male kitchen workers reported MSDs during the past 12 months[13]. Likewise, a 73% prevalence of MSDS of the upper limb was reported in a study done on catering workers by Concetto Giorgianni et al (2023) [21]. However, different results were reported in a study done by Serena Tan et al (2021) on pastry chefs in Malaysia, where a higher prevalence of 92.3% was noted[22]. Similarly, another study done in northwest Ethiopia by Habtamu Tegenu et al in (2020) shows a prevalence of 81.5%[11]. The etiological factors like the repetitive use of an upper limb, lifting heavy weight, and standing in static postures may be considered to be the main factors in developing WRMSDs[23].

The study results show the joint prevalence of WRMSDS of kitchen workers was highest in the shoulder (23.8%) followed by the neck (21.8%), wrist (21.8%), knee (20.8%), ankle (17.8%), lower back (16.8%), upper back (13.9%), elbow (13.9%), hip (8.9%). The results matched with the study conducted by Chyuan et al (2004) in Taiwan, in which the prevalence rate among restaurant workers was found more for the shoulder (58%), followed by the neck (54%) and lower back/waist (53%) [10]. In addition, a study done by Wen Liu et al (2011) among cooks in Taiwan also had results with high prevalence in the shoulder (63.5%), neck, (59.9%), and lower back (56.9%) [24]. However, different findings were found in research done by Serena Tan (2021) on pastry chefs in Malaysia, with more prevalence in ankles, (76.9%), followed by upper back (60.6%) and shoulder[22]. (58.7%). In the same way, a study on restaurant chefs done by Dominic Tan et al in (2020) analyzed that ankle and foot (59.5%), lower back (52.4%), and shoulder (48.5%) were the most prevalent[4]. It was found that shoulder muscles have to work maximum when the arm is not supported while stirring food, chopping, and plating which leads to pain and abnormal postures. Moreover, WRMSDs in the neck may develop due to bad postures while tossing a wok, carrying heavy utensils, standing, and chopping for extended periods. Prolonged periods of flexed neck and spine activity may result in a forward head posture, which would change the neck biomechanics[7].

From this study, it was concluded that 50% of kitchen workers work at medium risk and if they continue, they may fall into the high - risk category in the future. To prevent these, necessary precautions and corrective postures should be recommended. The association between WRMSDs and different factors like BMI, age, gender, dominance, education, addiction, marital status, work experience, working days, working duration, and rest time were examined. The present study shows a significant association of addiction with WRMSDs. According to the result, 10 kitchen workers are smokers and 17 workers consume tobacco. Out of which, all smokers have WRMSDs whereas 14 tobacco eaters from a total of 17 subjects reported WRMSDs. According to research done by Abate et al in (2013), it had been found that cigarette smoking is highly associated with musculoskeletal disorders[31]. Another study done by Ankit Sheth et al, in (2022) found that tobacco usage is a significant predictor of WRMSDs[32]. Smoking has deleterious effects on the musculoskeletal system, there is

evidence that it has negative effects on muscle metabolism and tendons[31].

6. Limitations

- Only the postural risk factors of WRMSDs among professional kitchen workers are the subject of this investigation.
- The south Gujarat region has only been covered in two cities. We may have covered multi - region centers.
- There are differences in the sample sizes that were calculated and obtained. The study's obtained sample size was smaller.
- The study's male to female ratios varied significantly.

7. Conclusion

The aim of the study was to find out prevalence of WRMSDs among kitchen workers of 2 cities of South Gujarat region and its association with the postural risk factors. The research concludes that the period prevalence of WRMSDs among kitchen workers was 69%. The discomfort regions were identified with higher prevalence ratio of discomfort level at the shoulder region, followed by neck, wrist, knee, ankle, lower back, upper back, elbow and hip. Ergonomic factors were analysed using REBA and they show that restaurant workers tasks are categorized in medium level risk tasks. Association of WRMSDs with various factors revealed that addiction is significantly associated with WRMSDs. The study findings shows need for awareness about WRMSDs and postural risks among restaurant workers.

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