

ORIGINAL ARTICLE**INVESTIGATION OF MUSCULOSKELETAL DISORDERS AMONG WORKERS IN FOOD SERVICES (CAFETERIA)**Seri Rahayu KAMAT¹, Eezsafauzia Azalin NORDIN¹, Kalthom HUSAIN², Sharifah Aznee SYED ALI³¹ Department of Management Engineering, Faculty of Manufacturing Engineering, Universiti Teknikal Malaysia Melaka, Hang Tuah Jaya, 76100 Durian Tunggal, Melaka, Malaysia.² Department of Methodology, Kolej Universiti Islam Antarabangsa (KUIS) Selangor, Malaysia³ Department of Mechanical Engineering, Polytechnic Port Dickson, Negeri Sembilan, Malaysia.**ABSTRACT**

In commercial food services, the workers are exposed to various risks factors such as awkward postures, repetition of the body movement, heat stress, prolonged standing, poor lighting and vigorous vibration that are led to work-related musculoskeletal disorders (WMSDs). The aim of this paper is to investigate the impact of ergonomics risk factors on worker's postures while performing kitchen daily activities. The method adopts qualitative method on the physical experience discomfort through the interview session, workplace observation and questionnaires survey to all workers. This project started with determining the physical discomfort which influenced worker working posture while performing daily kitchen activities. The result concluded that most of the respondents faced severe pain in their upper back and lower back. This is due to kitchen daily activities usually involving repetitive and forceful task where workers are required to perform the task in prolonged working hours hence lead to the development of muscle fatigue. The effect of risk factors on the working posture of UTeM's Cafeteria workers while performing daily kitchen activities is determined by analysing the worker posture using RULA Analysis. Based on the result obtained, the total score for all working posture for current cooking area involving male and female workers are high and required immediate improvement.

Keywords: Work-Related Musculoskeletal Disorders (WMSDs), Rapid Upper Limb Assessment (RULA), Food Service Industry, Workstation

INTRODUCTION

The food service industry in Malaysia is generally divided into two major subsectors which are the commercial food services and non-commercial food services. The commercial food services are those whose primary business is food and beverage services. Meanwhile, the non-commercial food is a self-operated food service such as hospitals, and hotels (Chandran et al., 2010). In commercial food services, the workers are exposed to various risks factors. The most common risk factors are awkward postures, repetition of the body movement, heat stress, prolonged standing, poor lighting and vigorous vibration. These risk factors may lead to work-related musculoskeletal disorders (WMSDs). Currently, there are many work-related-injuries that have been reported involved the commercial kitchen worker which resulting both direct and indirect losses. Generally, the injuries might be the consequent result of repetitive lifting daily routine and working environment. Based on the statistical analysis, 12285 cases are reported to SOCSO from the year 2009 until 2014 (Social Security Organisation; 2009-2014). There are 8910 accident cases reported in male compare the female which is 3375 cases. Whereby, the

number of accidents occurs involves the commercial kitchen worker had increased uniformly from the year 2009 to 2014, according to the Accommodation and Food Services as depicted in Figure 1.

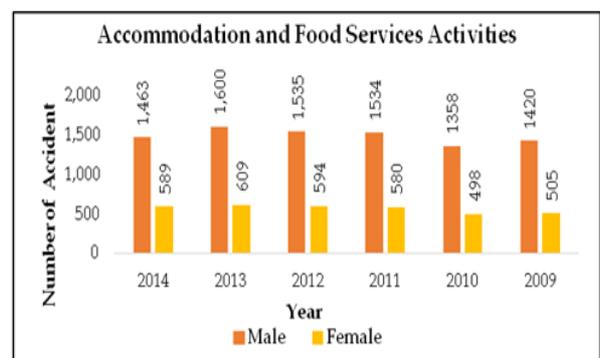


Figure 1 Number of Accidents According to Accommodation and Food Services Activities Source (Annual report from SOCSO)

Manual handling is widely applied in the commercial kitchen since most of the equipment in the kitchen is not automated. According to Wu, (2000), lifting equation is developed to estimate the recommended weight limit for a worker in performing manual lifting tasks. However, the number of work-related injuries associated with manual lifting is continuously increased, even though the

guidelines for safe weight limits for manual handling is provided. The kitchen worker is an explicit job that requires the workers to focus throughout the operation because the workers require repeating the similar procedures in countless time. Therefore, the aim of this paper is to determine physical discomfort experienced and analyse working posture of UTeM Cafeteria workers while performing daily kitchen activities.

METHODS

Interview, Observation and Questionnaire Survey

The observation and measurement were used to identify the potential factors influencing the physical discomfort experienced by kitchen workers. Inputs from the kitchen workers and observation were considered in the questionnaire. At the same time, the potential factors for physical discomfort experienced are also determined through previous research. The observation was made based on the activities involved in the daily routine of kitchen workers which included repetitive lifting, carrying of weights in front of the body, and leaning forward. The current workstations were observed in term of working posture, equipment placing, and material handling. All these concerns were recorded and captured by using a camera for further analysis. The dimensions of the existing kitchen and dishwashing area were measured by using a measuring tape and this data was used in layout modelling construction in DELMIA V5.

Draft of the questionnaire was constructed based on the information gathered through observation in UTeM's Cafeteria kitchen. In addition, inputs from kitchen workers were considered in the designing the questionnaire. The draft questionnaire was tested with the workers' participation, in order to determine whether the questionnaire was understandable.

Section A highlighted the demographic information of the respondents which consist of gender, age, health status, height, weight, and job assignment. All this information is vital in this study especially height, and job assignment is the possible factors that may lead to an unsafe working posture. Section B emphasised on the risk factors associated with kitchen daily activities. The respondents were given a list of possible risk factors and rate the agreement based on what they had experienced while performing the task. Section C focused on the discomfort level of the body part while performing the kitchen daily activities in

current workstation based on the Nordic questionnaire. This data was applied to the proposed design of the workstation as part of the improvement to reduce discomfort level among the kitchen workers. The figure refers to the Nordic questionnaire of the human body was provided to help the respondents clearly respond to the discomfort level of their body part. Section D captured the design requirements of the workstation and the respondents rate the agreement as listed in the table and the respondents were allowed to fill up the spaces provided if they have an additional suggestions. The listed design requirements were adjustable height, extra walking space, and equipment placing for specific activities.

RESULTS

Demographic Information of the UTeM's Cafeteria Workers

The demographic information of the respondents is highlighted in section A which consist of gender, age, health status, height, weight, job assignment, working hours and working experience. The result shows, the male workers are 55.7% and female 44.3% involve on the café activity. The workers age range between 22 to 39year old for male are 48.5% and female are 37.2%. About 25.7% male job as dishwasher and kitchen helper and 27.1% female job as chief assistant and kitchen helper. All this information are vital in this study especially height, working hours, job assignment and working experience are the possible factors to cause unsafe working posture. The questionnaire was distributed to all UTeM's cafeteria worker includes Cafe 1, Cafe 2, Industrial Campus Cafe, and Lestari Cafe. There were 70 workers participated in this survey 38 males and 32 females. The Job assignment in UTeM's Cafeteria basically consists of a chef, chef assistant, kitchen helper, drinks crew, cashier and dishwasher as shown in Figure 2.

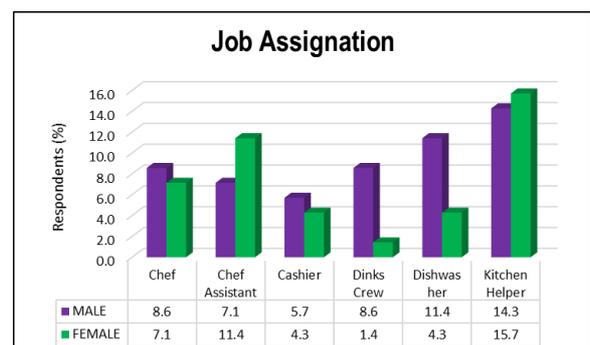


Figure 2 UTeM's Cafeteria Workers Gender and Job Assignment

The workers age who participated in this survey, most of them are 22-25 years old as illustrated in Figure 3 depicts the number of workers in numerous age group. The worker's current health status for both female and male workers is illustrated as shown in Figure 4. The common health issues are back pain, coronary heart disease, hypertension, and diabetes. The graph shows, the higher health issues is back pain which, male has 43.3% and female has 34.4%.

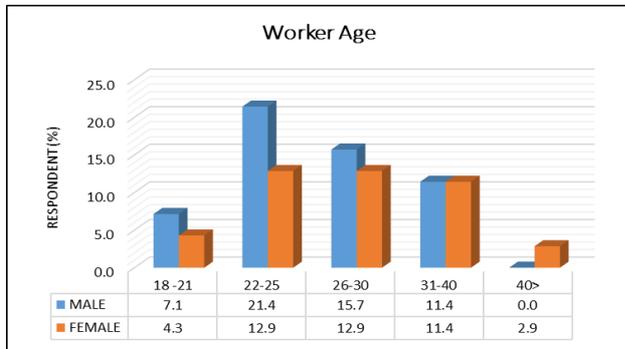


Figure 3 UTeM's Cafeteria Workers' Age

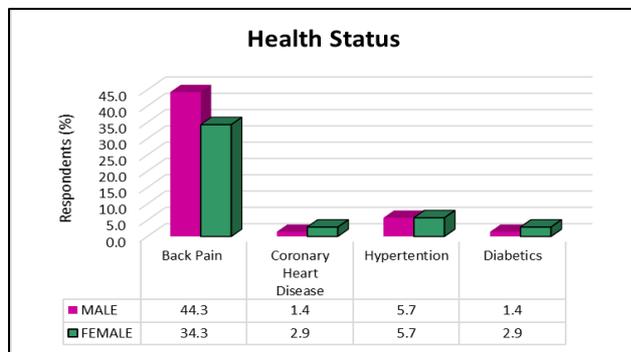


Figure 4 UTeM's Cafeteria Workers Health Status

Based on the data gathered through the questionnaire, the main risk factors that influence the posture in kitchen daily activities are human factors, the design of a workstation, and workstation layout. The risks factors contribute to unsafe working posture is determined accordingly through a questionnaire survey. Figure 5 shows the feedbacks from kitchen workers regarding the risk factors associated kitchen worker daily task.

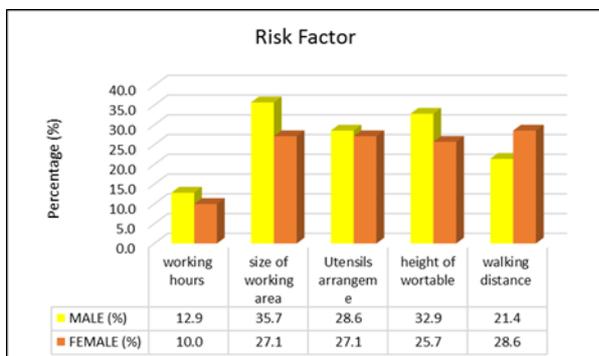


Figure 5 Risk Factors Associated with kitchen workers daily activities

Among all of the respondents, there is 32.9% male and 25.7% female workers strongly agreed that with the height is one of the critical risk factors to provoke unsafe posture. The height of the operator corresponding to the height of the machine is critical where inadequate height will promote muscular stress and poor postural angle and torso angle (Seghers. J. et al., 2010). Fewer workers agreed that working hours as the risk factor associated with kitchen daily activities since most of the workers work not more than 8 hours daily. Basically, from the survey concluded that the risk factors of awkward posture in kitchen daily activities are constituted of four main categories. The risk factors will contribute to unsafe working posture, hence it should be further analysed in order to reduce postural risk among workers.

Observation in UTeM's Cafeteria

The observation and measurement are used to identify the potential factors for physical discomfort experienced by UTeM Cafeteria kitchen workers. Inputs from kitchen observation are considered in the questionnaire.



Figure 6 The Workers Performing Kitchen Task (Café UTeM)

As illustrated in Figure 6, the kitchen workers practice non-neutral working posture where the worker has to bend and lean forward their body in order to perform the task. Moreover, the kitchen workers required to repeat the same procedure for several times in prolonged working hours. The aisles width of the working area is too narrow since the equipment is not properly arranged according to the specific task. Hence, it is difficult for a worker to move around to perform a task this will indirectly increase the postural risk among workers. According to Sally (2008), poor working environment leads to unsafe, low productivity and discomfort situations to the workers and also to the public health and safety.

Interview at UTeM's Cafeteria

The interview was conducted via visiting UTeM's cafeteria owners includes Cafe 1, Cafe 2, Industrial Campus Cafe, and Lestari Cafe. The outlined outcomes obtained from the affinity diagram will be utilised as the establishment to develop questionnaire survey. Table 1 shows the respond from the owner and worker on the risk factors. Therefore, attitude and behaviour of the kitchen workers and working stress are omitted. According to Willis, G.B. (2004), the cognitive interview is able to construct trustable questionnaire surveys since it will capture the direct opinions according to the respective people and it minimises the scopes of developing the questionnaires and hence the internal accuracy of the survey is reliable.

Table 1: The Affinity Diagram Obtained from Interview

AFFINITY DIAGRAM			
Information of Interview	Risk Factors	Expectation in the project	Additional Suggestion on new workstation design
(Café Lestari) Owner	-Long Working hours -Prolonged standing -Behaviour of the work -Stress	Effective solution	Improve comfortability of the workstation
(Café 2 A) Owner	-Attitude and behaviour of the worker -Long Working Hours -Prolonged standing -Poor piping system Small cooking and dishwashing area	Relevant solution	Improve overall workstation design especially for cooking and dishwashing area
(Café 2 B) Owner	- Dishwashing area narrow -Small walking space -Poor piping system -Small cooking area	Relevant solution	Enhance the workstation design and the piping system
(Café 1A)	-Poor	Effective	Improve

Owner	piping system -Small cooking area -Long Working hours -Prolonged standing	solution	workstation design especially for cooking area.
(Café 1B) Worker	-Cooking area is too narrow -Long working hours -Prolonged Standing	Relevant solution	Improve workstation comfortability for cooking area.
(Café 1A) Worker	-Poor kitchen stove design -Stove far from cooking material preparation area -Stress -Food preparation area narrow -Small walking space	Effective solution	Improve overall cooking area design
(Café Industry) Workers	-Poor dishwashing workstation design -Rack far from dishwashing area	Relevant solution	Improve workstation for dishwashing area
(Café 2 A) Worker	-Poor kitchen stove design -Stove far from cooking material preparation area -Food preparation area narrow	Effective solution	Enhance layout for cooking area
SUMMARY	-Long Working hours -Poor working posture -Poor Piping System -Poor kitchen	Sustainable Solution	Improve comfortability of the workstation Improve overall cooking and dishwashing area design Enhance the piping

	and dishwashing workstation design -No proper equipment arrangement -Attitude and behaviour -Working Pressure		system
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The Effects of Risk Factors on Working Posture

This section discusses the results and discussion on the effect of the risk factors associated with the kitchen daily activities which obtained from the questionnaire survey. First sections portray the comfort level of workers while performing daily kitchen activities at the current workstation and followed by discussing the results obtained through Rapid Upper Limb Assessment (RULA) to evaluate the critical level of the working posture.

Physical Discomfort Level (Current Workstation in UTeM’s Cafeteria)

The data gathered through questionnaire survey in order to determine the comfort level of kitchen workers comfort level while performing daily kitchen activities at the existing workstation. As illustrated in Table 2 the majority of the respondents experienced discomfort in their body parts occasionally. Furthermore, most of the respondents always faced severe pain in their upper back, lower back and wrist. This is due to kitchen daily activities usually involving repetitive and forceful task where workers are required to perform the task in prolonged working hours hence lead to the development of muscle fatigue (Wickens et al., 2004). The further analysis of the effects on the working postures will be discussed in next section. In contrast, there are only a few respondents commented that they feel comfortable working at the current workstation.

Table 2: Physical Discomfort Level among Workers

	Level of Pain	Frequency	Level of Pain	Level of Pain
	MEAN		STANDARD DEVIATION	MODE
LOWER BACK	3.41	3.26	1.14	4
Shoulder	2.99	2.98	1.52	1
Neck	2.96	2.73	1.2	3
Elbow	2.59	3	1.06	2
Waist	2.69	2.97	1.09	2
UPPER BACK	4.03	3.34	1.21	5
Waist	3.04	2.93	1.19	4
Knee	3.19	2.69	1.14	3
Leg	2.6	2.63	1.27	2

Level of Pain Frequency Level of Pain Level of Pain

Highly Potential Risk Workstations

Based on the data gathered through questionnaire, the existing workstation is listed according to the contribution to postural risk. The most critical workstation is determined and will be further analysed in order to reduce the postural risk among workers. The existing workstation includes cooking, drinks, dishwashing, and counter area. The critical workstation area that required to be redesign based on workers’ opinion is as illustrated in Figure 7. The data gathered based on male and female workers’ opinion is shown in Figure 8.

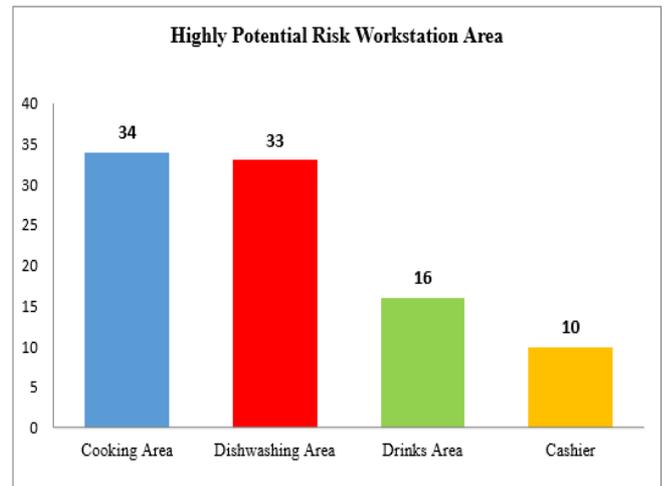


Figure 7 UTeM’s Cafeteria Critical Workstation design

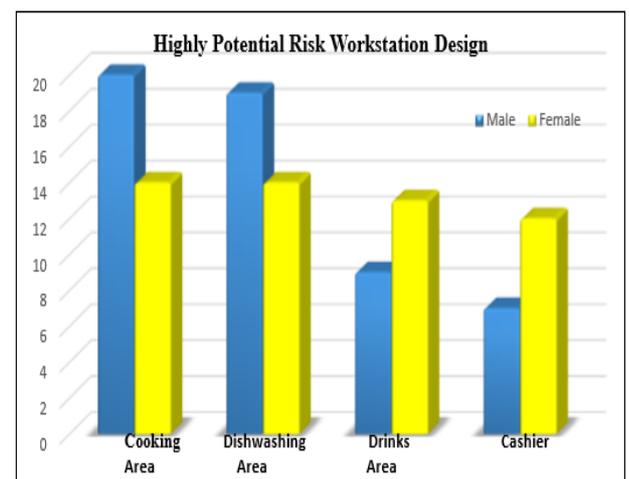


Figure 8 UTeM’s Cafeteria Workers Based on Gender

Moreover, there are 20 male and 14 female respondents have strongly agreed that cooking area is necessary to be redesigned in order to reduce physical discomfort among workers. There are 19 male and 14 female respondents have strongly agreed that current dishwashing area is another crucial workstation area that requires further analysis. For drinks and cashier workstation most of the female workers agreed that the existing workstation design needs to be redesigned. The questionnaire data is gathered and most critical workstation design that is necessary to be redesigned are cooking and dishwashing area. In order to ensure working performance is maintained since both of the workstation is used by most of the workers.

The second higher physical discomfort is on the wrist because of the hand motion while the workers doing the cooking and dishwashing activity. The utensils arrangement is proper systematic. The workers need to reach the object in the higher distance and some of the cooking equipment position not good arrangement

Working Posture using Rapid Upper Limb Assessment on DELMIA Software

The working postures of the kitchen workers while performing daily task with current workstation design were analysed using Rapid Upper Limb Assessment (RULA) on DELMIA Software. According to Mc Atamney et al., (1993) Rapid Upper Limb Assessment (RULA) is a type of survey method used to determine the loads sustained by the musculoskeletal system based on working posture, force, and movement of the people. It is a type of quick assessment of exposure risk by calculating from score 1(low) to 7 (high) in a numerical scoring worksheet. The final score is used as a guide to the priority for subsequent investigations as shown in Table 3.

Table 3: Rapid Upper Limb Assessment (RULA) levels and indications (Middlesworth,2007)

SCORE	LEVEL OF MSD RISK
1-2	Negligible risk, no action required
3-4	Low risk, change may be needed
5-6	Medium risk, further investigation, change soon
6+	Very high risk, implement change now

Figure 4.11 shown the workers working postures, and RULA scores for left and right side respectively for a current cooking

workstation. Based on Figure 9 the total RULA score for all working posture in the cooking area involving male and female workers are 7. The right side of the body is in dynamic position and required immediate improvement. The trunk obtained high RULA score because the workers need to bend their body to perform the task. This work practice leads to musculoskeletal injuries. Figure 10 shows the analysis working postures, and RULA scores for left and right side respectively for current dishwashing workstation. The total score for all working posture for both gender in dishwashing area are 7. The RULA score indicated that trunk, neck, leg and wrist required immediate improvement. The workers required to use both of their arms to reach and handle the soiled plates. According to Kilroy N. et al. (2000), musculoskeletal injuries have a strong relationship with the RULA score hence more precautions should be taken especially workplace design.

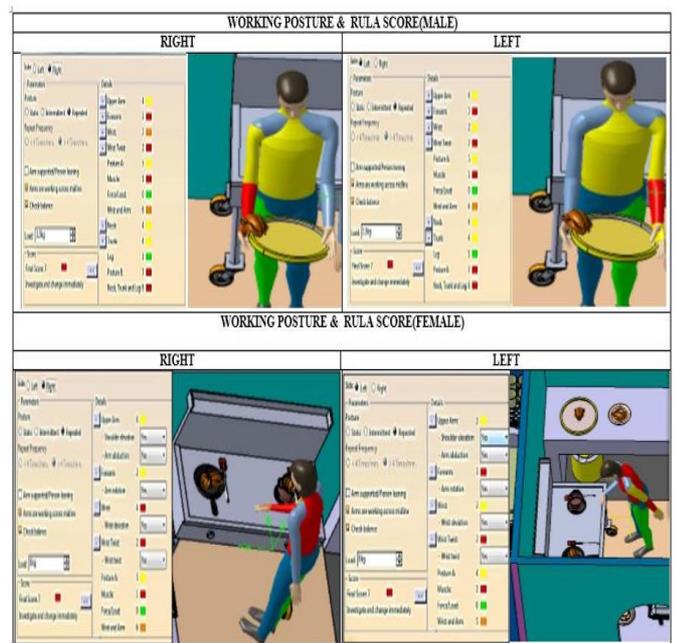


Figure 9 RULA Analysis On Kitchen Worker (Current Cooking Workstation)

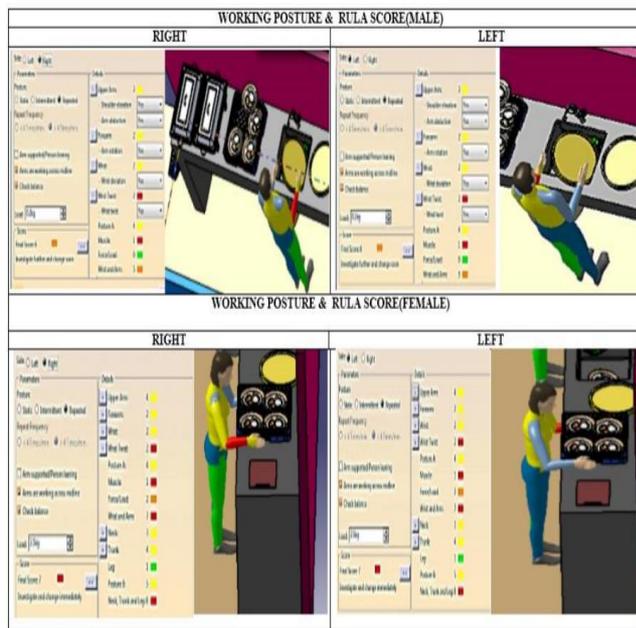


Figure 10 RULA Analysis On Kitchen Worker (Current Dishwashing Workstation)

CONCLUSION

The psychophysical study concluded that most of the respondents always faced severe pain in their upper back, lower back and wrist. This is due to kitchen daily activities usually involving repetitive and forceful task where workers are required to perform the task in prolonged working hours hence lead to the development of muscle fatigue. In contrast, there are only a few respondents commented that they feel comfortable working at the current workstation. The RULA Analysis, the total score for all working posture for current cooking and dishwashing area involving male and female workers are 7. The right side of the body is in dynamic position and required immediate improvement. The trunk obtained high RULA score because the workers need to bend their body to perform the task. This work practice leads to musculoskeletal injuries. For the future study, improved design of the cooking and dishwashing workstation should be need and the design is based on the preferred design requirements obtained through the questionnaires survey, house of quality (HOQ), and the concept screening method.

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COMPETING INTERESTS

There is no conflict of interest.

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