ORIGINAL ARTICLE

Effect of the Psychophysical Approach in Slipping Incident Among Workers at The Commercial Kitchen Activity

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ABSTRACT

Introduction: The occurrence of slips can be disruptive in workers' life, causing various types of injuries. Working with prolonged standing and walking postures in a commercial kitchen contributes to worker fatigue. A psychophysical approach can be used in identifying the extent to which workers' fatigue contributes to the occurrence of slipping. **Method:** Electromyography (EMG) was used to record and analyze the data of three values of muscle activity obtained from the study. Twelve participants aged 23 to 60 years old with a Body Mass Index (BMI) mean of 27.82 ± 4.01 kg/m2. The participants were selected based on the experience of at least three years and above in commercial kitchen activity. The testing procedures were explained in detail upon agreement. They had to walk with four different types of walking speeds with water and oil as the contaminants on the floors. **Results:** The slip occurred high frequency for obese participants compared to overweight participants when increasing their speeds of walking on oily floor surfaces. Female participants experience slips more than male participants. The muscle Soleus and Tibialis frequently produce higher muscle activity during slip occurrence compared to muscle Peroneus. **Conclusion:** The results of the study show that the psychophysical approach is significant in the occurrence of slipping during work activities in commercial kitchens when the muscle of Soleus and Tibialis produces higher muscle activity during slip occurrence. There was no significant factor of age during the slip occurrence.

Keywords: Slip, Psychophysical, Overweight, Obesity, Muscle activity

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INTRODUCTION

Activities carried out at the workplace will produce muscle activity because it relates to the physical activity and their subjective correlations. Physical activity that is work-related, in terms of peak loads and continued and/or repetitive contractions, gives risk factors for the development of muscular pain and disorders. Muscle activity is related to the strength for each muscle. In the working environment, working postures and tasks are the main activities that could contribute to potential musculoskeletal disorders. Workers who work in a commercial kitchen maybe exposed to potential hazards due to usage of cooking equipment, raw material, environment. During working hours, workers need to perform a variety of cooking activities utilizing food products such as preparing material and dishes, cooking, lifting plates and servicing and delivering the food. Workers keep using a dynamic posture and standing is the most posture used during their working day (1). Therefore, the workers in hotels and restaurants are often reported as having a different symptom of a disease that needs ongoing treatment due to exposed static and dynamic posture (1-3). Working in a commercial kitchen requires prolonged working hours in a limited space and different workloads. There was a total of 10,691 cases of accidents that the Accommodation and Food Services Activities in Malaysia (AFSAM) reported to SOCSO from the year 2013 until 2018. The accident rate among male employees is 72% which is higher than the female employees which was 28% with a mean 1781.83 ± 517.22 (Table I). However, the number of Benefit Paid according to AFSAM shows that 79% of the benefits paid was for Temporary Disablement, while 19% was for Permanent Disablement and 1% was for Dependent Benefit (Table I). Therefore, the statistics shows that the AFSAM identified hazardous workplace (10-11) as the third-largest factor contributing to workplace injuries due to the environment contributing mostly to slips and falls (12). Slips and falls are serious injuries, because that can lead to potentially fatal incidents and other life altering incidents when working under prolonged standing position for almost 6 to 8 hours and above every day. The workers would need to walk on slippery floors with potential floor contaminants and utilizing awkward postures possibly causing injuries to the themselves. Standing positions were classified as the posture with

Table I: Number of Accidents and Benefit Paid at Accommodation and Food Services Activities (4-9)

Year	Accidents at Accommodation and Food Services Activities		Number of Benefit Paid		
	Male	Female	Temporary Disablement	Permanent Disablement	Dependant Benefit
2018	1,271	465	1,588	403	22
2017	1344	534	1791	462	36
2016	544	235	774	219	18
2015	1456	581	1,962	434	32
2014	1,463	589	1,895	441	27
2013	1,600	609	1,987	447	46
Total	7678	3013	9,997	2406	181

the highest contribution to fatigue (13). The muscles Soleus (SOL), Tibialis anterior (TIB), Peroneus longus (PL) were studied most during walking activity (14-15).

The aim of this study is to investigate the muscle activity of the calf lower leg with four different speeds of walking and to justify the potential of slip occurring during the activity and correlate the walking speed with the slip incident.

MATERIALS AND METHODS

Three muscle activity values during four types of walking speeds (16-17) from 84 steps/minute, 100 steps/minute, 116 steps/minute, and 132 steps/minute were determined among the participants walking on a wet and oily floor surface while lifting three different types of load. Twelve healthy adults were recruited to participate in this study with 3 years of commercial kitchen activity experience with a mean age 32 ± 11 years (range 23 years-57 years), and BMI of 27.82 ± 4.01 kg/m2. The procedure and purpose of the study are explained to the subject clearly and participants needed to sign a letter of consent to participate. This study was given ethical clearance by the Ethics Committee of University Technical Malaysia Melaka (UTeM.24.01/600-1/1/3/2 Jld.22(84) and the participants information would be kept secret by.

The Electromyographic (EMG) readings was obtained from 3 muscles of the ankle muscles Soleus (SOL), Tibialis anterior (TIB), Peroneus longus (PL). Figure 1 shows the position of muscles activity of the participants. The EMG (in μV) will be recorded based on the testing procedures and the slip occurrence will be identified during testing.

RESULTS

The result represent that slips frequently occur when oil is the contaminant especially among overweight and obese participants. Figure 2 shows the slip occurrence among male participants aged below 30 years old during the lifting process. When lifting a load of 1kg, the slip occurs at 116 steps/minute of walking

Figure 1: Muscle marker position

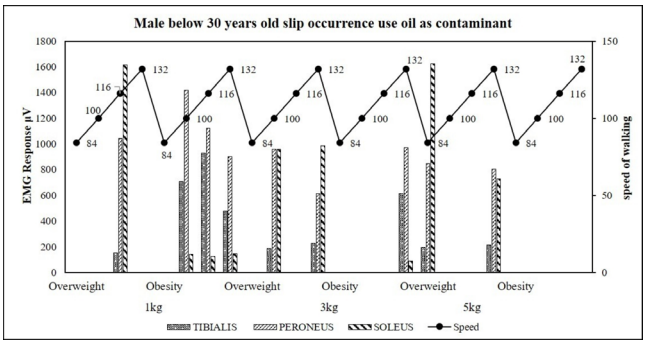

Figure 2: Slip occurrence among Male aged below 30 years old during lifting

for the overweight participants where the muscle of Soleus produces higher muscle activity. Among obese participants, the slip occurs for speed of walking at 100, 116 and 132 steps/minute respectively and produces higher muscle activity of muscle Peroneus. When lifting loads of 3kg, the slip frequently occurs among overweight participants for speed of walking at 100 and 132 steps/minute respectively with the muscle of Peroneus and Soleus producing higher muscle activity. Among obese participants, the slip occurs when the speed of walking at 132 steps/minute and produces higher muscle activity of the muscle Peroneus. For lifting loads of 5kg, the slip frequently occurs among overweight participants for speed of walking at 84 and 132 steps/minute respectively. During the slip, the Soleus muscle produces higher muscle activity followed by the Peroneus muscle. Therefore, the slip frequently occurs among 56% of the overweight participants and among 44% of the obese participants where the muscle Soleus produces higher muscle activity.

Figure 3 shows the slip occurrence among the male participants aged above 30 years old during the lifting process. When lifting a load of 1kg, the slip frequently occurs among overweight participants for speed of walking at 84 and 132 steps/minute where the muscle of Tibialis and Soleus produces higher muscle activity respectively. Among obese participants, the slip occurs for speed of walking at 84 and 132 steps/minute where the muscle of Tibialis produces higher activity, respectively. When lifting loads of 3kg, the slip frequently occurs among obese participants for speed of walking at 84 and 132 steps/minute with the muscle of Tibialis produces higher muscle activity. When lifting loads of 5kg, the slip frequently occurs among obese participants for speed of walking at 84 and 132 steps/minute with the higher muscle activity of Tibialis. Therefore, slip occurs among 75% of obese and 25% of overweight male participants aged above 30 years old for speeds of walking at 84 and 132 steps/minute respectively with the muscle Tibialis producing higher muscle activity.

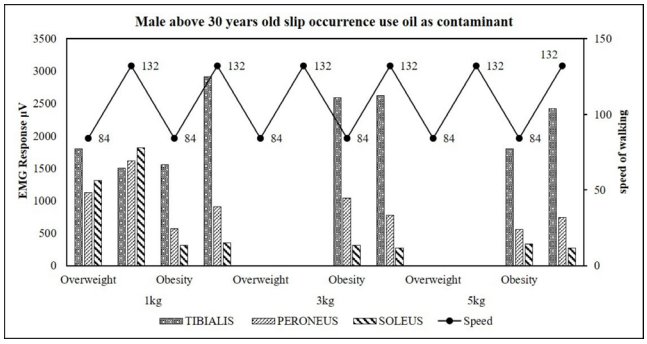

Figure 3: Slip occurrence among Male aged above 30 years old during lifting

Figure 4 shows the slip occurrence among female participants aged below 30 years old during the lifting process. When lifting a load of 1kg, the slip frequently occurs among overweight participants for speed of walking at 132 steps/minute and the muscle of Tibialis produces higher muscle activity. Among obese participants, the slip occurs for speed of walking at 84, 100, 116 and 132 steps/minute respectively where the muscle of Tibialis produces higher muscle activity followed by the muscle of Soleus. When lifting loads of 3kg, the slip frequently occurs among obese participants for speed of walking at 84, 100, 116 and 132 steps/minute respectively where the muscle of Tibialis produces higher muscle activity followed by muscle Soleus. When lifting loads of 5kg, the slip occurs among overweight participants for speed of walking at 84 steps/minute and the muscle of Soleus produces higher muscle activity. Among obese participants, the slip occurs for speed of walking at 84, 100, 116 and 132 steps/minute where the muscle of Tibialis produces higher muscle activity followed by the muscle of Soleus. The slip experienced among 86% of obese participants followed by 14% of the overweight participants where the muscle Tibialis and Soleus produces higher muscle activities during slip occurrence.

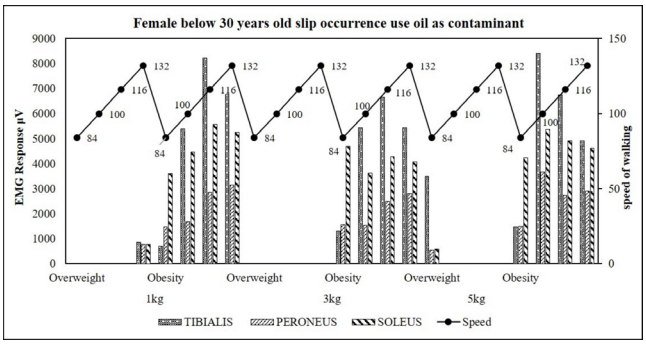

Figure 4: Slip occurrence among Female aged below 30 years old during lifting

Figure 5 shows the slip occurrence among female participants aged above 30 years old during the lifting process. When lifting loads of 1kg and 3kg respectively, the slip occurs among overweight participants for speed of walking at 100 steps/minute where the muscle of Soleus produces higher muscle activity. Among obese participants, the slip occurs for speed of walking at 84, 100, 116 and 132 steps/minute respectively when lifting loads of 1kg and 3kg where the muscle of Tibialis produces higher muscle activity. When lifting loads of 5kg, the slip frequently occurs among overweight participants for speeds of walking at 84 and 132 steps/minute respectively where the muscle of Soleus produces higher muscle activity. Among obese participants, the slip occurs for speed of walking at 84, 100, 116 and 132 steps/minute where the muscle of Tibialis produces higher muscle activity followed by the muscle of Peroneus. Therefore, the slip experienced among 75% of obese participants followed by among 25% of overweight participants where the muscle Soleus produces higher muscle activity during slip occurrence.

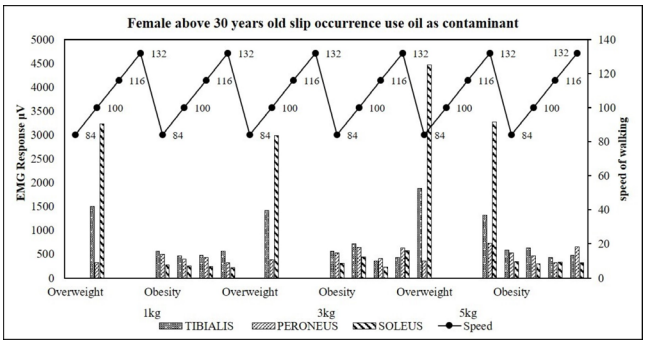

Figure 5: Slip occurrence among Female aged above 30 years old during lifting

DISCUSSION

From this study, the first finding is that most of the slip occurs frequently when walking on oily floor, and this reveals that walking on the oily surface was significant towards the slip incidents. Previous research highlighted that the interaction of oil on the vinyl floor at the commercial kitchen will result in a lower coefficient of friction (18). Therefore, immediate cleaning process was encouraged to control the floor contaminants at the

restaurant (19). Another study mentions that the sole of the footwear also results in three times more likely of slip to occur when there is any pollution (20). The second finding is that the speed of walking is significant in slip occurrence. The increase of the speed of walking will produce higher frequency of slip occurrences similar to previous studies where the speed of walking influences slip accidents when rushing on a contaminated floor (21-22). Thirdly, obesity is significant in slip occurrence where an obese person often reported to have a high risk of workplace accident especially if it is related to slips, trips and falls (23-25). Fourth is that the muscle activity is significant with the slip occurrence where the muscle Soleus and muscle Tibialis produces higher muscle activity during slip occurrence. Our findings are similar to previous research that highlighted the muscles Tibialis anterior, Soleus, Peroneus longus and Vastus medialis produce higher muscle fatigue which are similar to walking on a treadmill (26) or walking on flat-arched feet (27). Another finding was that working with prolonged awkward postures will create fatigue and this will affect a person's stability especially when doing activities such as walking and lifting heavy items (28).

CONCLUSION

In summary, our study shows that the psychophysical approache are significant with the occurrence of slipping during work activities in commercial kitchens. The findings show that the muscle activity of Soleus and muscle Tibialis produce higher muscle activity during slip. The speed of walking is a significant factor with slip frequency, the faster the speed of walking, the higher occurrence of slip. There was no significant factor of age during the slip occurrence. Therefore, the findings show that psychophysical approache are affected in producing muscle fatigue among workers during work in the commercial kitchen. Further investigations into more significant factors relating to slip occurrence can be carried out to predict the level for each interaction.

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