ORIGINAL ARTICLE

HIGH-POWERED POLICE MOTORCYCLE: MUSCLE DISCOMFORT AMONG MALAYSIAN TRAFFIC POLICE RIDERS

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ABSTRACT

Discomfort due to riding a motorcycle is an issue that need to be addressed as it has long-term effects of musculoskeletal disorders on motorcyclists especially among occupational motorcyclist. Thus, this study was conducted to analyse the rating of muscle discomfort and correlation with the risk factors among traffic police riders. A cross-sectional study was carried out among 137 male traffic police riders (high-powered motorcycle) with the age between 20 to 39 years old. The 100-mm visual analogue scale questionnaire included ratings of perceived discomfort scales for 20 specific body regions was used in the study. The results indicate that the lower back (left and right) were the highest mean of discomfort which were 56.6 mm and 55.9 mm respectively. This followed with right (48.5±36.2 mm) and left (48.4±30.3 mm) upper back, and right hand (47.0±33.0 mm). The mean of overall discomfort ratings for all regions were more than 20 mm. Besides, there is a strong positive significant correlation between duration of ridings (hours) and overall discomfort ratings ($p<0.01$, $r=0.785$) and moderate positive correlation between year of traffic police motorcycle riding experience and overall discomfort ratings ($p<0.01$, $r=0.410$). As a conclusion, cumulative riding hours, riding experience and no support of the back area of the body in motorcycle seat, are the most concern in this study as this are the contributing factors to the muscle discomfort among traffic police riders while riding high-powered motorcycle. Thus, this study suggested an additional feature is needed in current motorcycle design in order to enhance comforts of traffic police riders. Also, it will improve the condition of traffic police riders' discomfort and indirectly also improve their work and health performance as well as productivity.

Keywords: *Body region; musculoskeletal disorders; riding; posture; Visual Analogue Scale*

INTRODUCTION

Discomfort is associated with tiredness, numbness and pain feelings[1]. Meanwhile, according to Bernard et al. (1997), body discomfort is the first indicator for many types of musculoskeletal disorders (MSD)[2]. Discomfort and comfort level are commonly measured by using subjective rating scales. The respondents will be asked to evaluate their pain intensity and discomfort by using body map [3].

Motorcycle riding provides unnatural workstation as there are lacks of adjustment to fulfil the riders need[3]. According to Porter and Gyi (2002), regularity of exposure to driving which leads to the development of musculoskeletal symptoms among the drivers and the study also found that the discomfort frequency also increased along with the total distance of driving [4]. It shows that the frequency and duration of driving influenced the level of discomfort. Besides, a study by Balasubramanian and Jaannath (2014) concluded that the longer duration of riding causes more fatigue among motorcycle riders[5]. An erector spinae and latissimus dorsi medial are among posture muscles that show fatigue development due to motorcycling activity.

Biomechanical factors also linked with the development of bodily discomfort. For examples, muscular contractions, postures, joint angles, stresses and distribution of pressure while sitting [6]. Riding activity for a prolonged time can lead to musculoskeletal disorders problem. A previous study by Ramasamy et al. (2017) showed that shoulder and back parts have high number of incidences for driving related musculoskeletal disorders [7]. Static position of sitting also influence the level of discomfort during riding. The action of sitting for an extended time with the same position and limited space lead to discomfort and fatigue.

In addition, prevalence of low back pain and discomfort was more significant among occupational motorcyclist compared to non-occupational motorcyclist [8]. In Malaysia, traffic police are responsible for controlling traffic congestion, escorting VIP, and coordinating traffic. Traffic police use various types of vehicles including motorcycles for carrying out their daily duties. They may ride for many hours while on

duty which can lead to muscle discomfort, a decrease in their productivity and work performance, and even health risk. Thus, this study was conducted to analyse the rating of muscle discomfort and correlation with the risk factors among traffic police riders.

METHODS

A cross-sectional study was carried out among one-hundred-and-thirty-seven male police riders who are riding a high-powered motorcycle (Honda CBX 750) were recruited volunteers for this experiment. The respondents were selected based on criteria of males, aged between 20 to 39 years old with experienced at least more than one-year ride, Honda CBX 750 motorcycle. None subjects had a previous history of MSD before qualifying as police riders. The mean age of the respondents was 31.8 years old. The mean year of traffic police motorcycle riding experience was 5.5 years. The mean duration of daily riding among the respondents was 5.64 hours.

Questionnaire

The questionnaire included ratings of perceived discomfort scales for 20 specific body regions to obtain information on the body regions that most experienced discomfort during riding high-powered motorcycle. The 100-mm (millimetre) visual analogue scale (VAS) was used in this questionnaire, with 0 mm representing no discomfort and 100 mm representing extreme discomfort. This questionnaire was adapted from Donnelly et al. (2009) and Mergl et al. (2005) [9,10]. This questionnaire was distributed to the respondents during their break in a meeting room, Police Station. Each of the respondents were explained briefly about the questionnaire and written consent form was obtained from respondent to participate in this study. The questionnaire session lasted approximately 10 minutes.

Statistical Analysis

All the data gathered from questionnaire and measurement will be analysed by using IBM SPSS (Statistical Package for the Social Science) version 22. The data collected was analysed by using univariate and bivariate analysis. This study was conducted using 95% confident level, 80% of power and the results of $p \leq 0.05$ was considered significant.

RESULTS

The mean rating of body parts discomfort symptoms rating experienced by the traffic police riders are shown in Fig.1. A rating of perceived discomfort level from 5 mm to 44 mm was considered mild, 45-74 mm was moderate and 75-100 mm was considered extremely discomfort [11]. The lower back (left and right) were the highest mean of discomfort which were 56.6 mm and 55.9 mm respectively. This followed with right (48.5±36.2 mm) and left (48.4±30.3 mm) upper back, and right hand (47.0±33.0 mm). The mean of overall discomfort ratings for all regions were more than 20 mm.

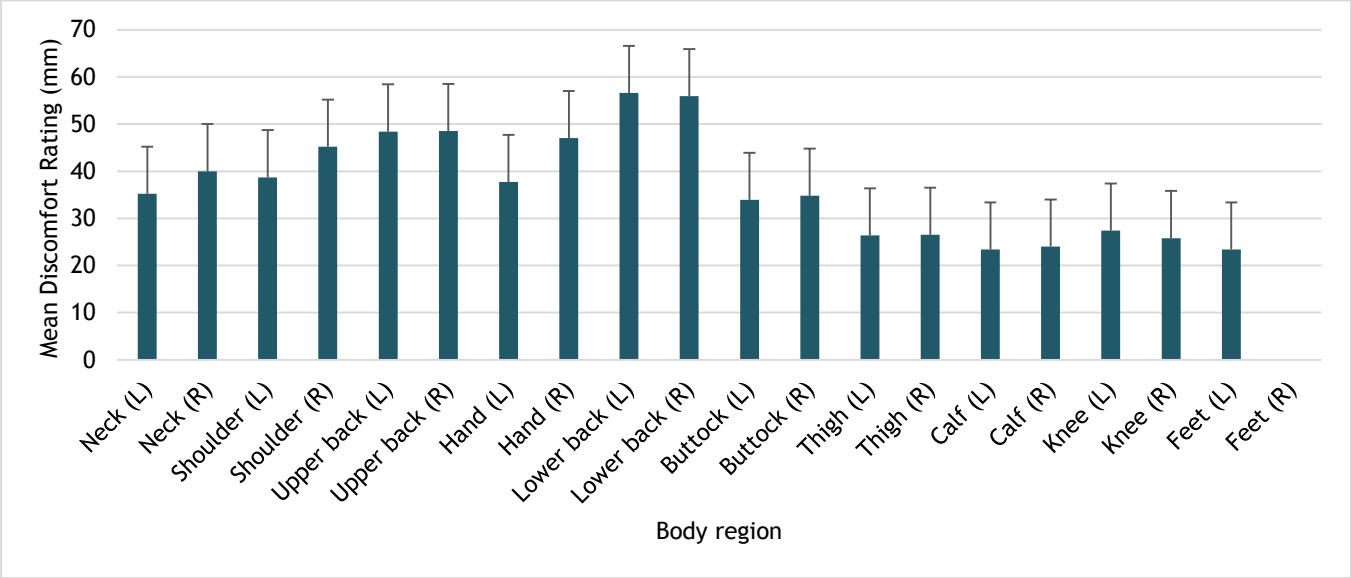

Figure 1. Mean (SD) discomfort ratings of 20 specific body regions (n=137).

The results of the correlation between overall discomfort ratings with age, duration of ridings, and year of traffic police motorcycle riding experience was shown in Table 1. There is a strong positive significant correlation between duration of ridings (hours) and overall discomfort ratings ($p<0.01$, $r=0.785$) and moderate positive correlation between year of traffic police motorcycle riding experience and overall discomfort ratings ($p<0.01$, $r=0.410$). However, in

this study we found that there is no significant correlation between age and overall discomfort ratings.

Table 1. Correlation between overall discomfort ratings with age, duration of ridings, and year of traffic police motorcycle riding experience (n=137).

	Duration of riding (hours)	Riding experience (year)	Age	Overall discomfort ratings (cm)
Duration of riding		0.373*	0.164	0.785*
Riding experience	0.373*		0.464*	0.410*
Age	0.164	0.464*		0.053
Overall discomfort ratings	0.785*	0.410*	0.053	

** p-value is significant at p<0.01*

DISCUSSION

The discomfort ratings result in this study was supported by previous studies that traffic police officers were exposed to prolonged riding routinely which cause high tendency in developing muscle discomfort and MSD compared to workers not exposed to this condition [12,13]. This study discovered that several body parts of the traffic police riders experienced discomfort symptoms due to riding. This study is in agreement with the previous study on seating comfort among police officers found that lower back experienced greater discomfort compared to other body parts [9].

There are several factors that may promote the development of body parts discomfort. First of all, the duration of riding. This study revealed that police riders spent more than 5 hours daily on riding. Therefore, this prolonged duration of riding may have contributed to body parts discomfort among the riders. The results of this study are also similar to the previous study that showed police officer experienced low back discomfort after exposure to prolonged driving experience [9,14].

Besides, the motorcycle itself also considered as unergonomic for the police riders' usage. The rider has to maintain the static posture for a long period during riding in order to ride safely. Larsen et. al (2018) explained that prolonged static posture can cause rider fatigue and seat discomfort [15]. This is because static posture by the rider may cause interruption of muscular blood supply due to high intramuscular pressure. Lack of oxygen to muscles will lead to discomfort and fatigue to the rider. Diyana et. al (2019) also demonstrated that vibration exposure, prolonged static sitting during riding contributed to MSD especially in neck, shoulder and lower back [13]. The motorcycle also only provides limited space for adjustment which may be different among the riders need [3]. Moreover, carriage of police appointment including a firearm, handcuff and walkie-talkie also may lead to discomfort in the lower part of the body as this equipment are attached to the police's belt [15]. They also revealed that carriage of appointments with normal belt resulted in greater overall discomfort among police officers compared to load-bearing vest/belt combination.

The hand and shoulder were also among the highest discomfort ratings in this study with 47.0±33.0 mm and 45.2±27.9 mm. Interestingly, both of them were from the right side of the body. This finding was parallel with several studies where hand and shoulder were the most common body discomfort reported among motorcycle riders [16,17,18]. Local vibration from the handlebars and static position of the hand-arm during riding motorcycle may contribute to the cause of this discomfort [12, 19]. Based on Roseiro et al. (2016), the most affected body part among motorcyclist were forearm, arm, and shoulder due to high level of hand-arm vibration from the handlebars [12].

The present study found there was strong significant correlation between overall discomfort and duration of riding motorcycle (hours). The results of this study were supported by Jagannath and Balasubramaniam (2014) where they found that at the end of 60 minutes riding, the riders reported physically discomfort in back, shoulder and buttock muscle [5]. Karmegam et al. (2011) also found that there is a significant correlation between riding duration and buttock and upper body part discomfort among male riders with average 11 hours riding duration in a week [21]. Riding for an hour while yields dominant pressure distribution with peak pressure at the ischium region. These observed uneven pressure distribution over motorcycle seat have substantial contribution to cause rider discomfort [22]. Prolonged and monotonous riding position and activity have been found induce the muscle discomfort and fatigue. The retention of the rider's posture and exposure to whole body vibration along riding duration causes low level muscle contraction that produce muscle discomfort [13].

Riding experience was also found had a significant relationship with overall muscle discomfort ratings. This result agreed with Karmegam et al.

(2011) where they found that riding experience had positive correlation with upper back, lower back, hand and buttock [21]. In this present study, this trend may cause by body posture adapted while riding motorcycle. Since, CBX 750 motorcycle applied standard posture while riding motorcycle, the awkward posture can lead to muscle injuries and discomfort issues. Besides, the present study found that muscle discomfort was also likely caused by lifting the heavy motorcycle repeatedly during the duration of work to on and off the motorcycle stand for parking.

CONCLUSION

In a conclusion, lower and upper back area are the most affected body part with discomfort among traffic police riders is not surprising giving the constrained work space (motorcycle). However, it is still a cause of concern for the high level of discomfort which can lead to MSD in future. Cumulative riding hours, riding experience and no support of the back area of the body in motorcycle seat with the many equipment attached to the police's belt that must be worn along the work shift, are the most concern in this study. Thus, this study suggested the development of an ergonomic motorcycle seat design and fits with traffic police rider's needs. It will improve the condition of traffic police riders' discomfort and indirectly also improve their work and health performance as well as productivity.

ABBREVIATIONS

MSD-Musculoskeletal disorders, VAS-Visual Analogue Scale.

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COMPETING INTERESTS

There is no conflict of interest.

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