

Original Research Article

Impact of driving duration on hand muscle strength in people who commute for work

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ABSTRACT

Background: Urbanization has brought a lot of health issues in the citizens. Commuting for work has become more common. People around the world use different means of commute like public transport or driving a car to work. The increase in time of commute may be associated with many health hazards. In this study we try to study the impact of driving duration on hand muscle power.

Methods: A prospective cross sectional study was conducted in a tertiary care hospital. About 32 persons who drive car for their work participated in this study after giving their consent. Subjects grouped in to two categories long commuters, who drive for greater or equal to one hour and short commuters less than one hour. Muscle power tested on two occasions immediately after driving and four hour after driving with a help of hand grip dynamometer. Demographic details were collected. The two groups compared for muscle power and body mass index (BMI).

Results: The long commuters had less muscle power in comparison with short commuters and it was significant. The average BMI of long commuters was in obesity range were as the average BMI of short commuter is less and it was statistically significant.

Conclusions: Driving for greater than one hour is associated with obesity and reduced muscle power immediately after driving.

Keywords: Muscle power, Hand grip dynamometer, Isometric tension, Commute, BMI, Car drive

INTRODUCTION

The society needs a large work force which has to commute for work a long distance everyday. Fatigue and commute stress are integral part of travel. Commute to work by driving a car had a large association with stress than commuting through a public transport, because it involved self-driving.¹ Commute for work is associated with positive and negative health outcomes.² Active means of commute like bicycle and walking are associated with positive health outcomes. The health outcomes of commute in a negative manner is due to many factors of commute such as traffic congestions and decrease in time spent in exercise and relaxation.¹ Long hours of commute is associated with many non-

communicable disease such as diabetes and hypertension. Workers who travel for work for a time greater than ninety minutes exhibited decrease of vagal activity and at the same time an increase in sympathetic activity.³ In a study done to assess the stress level of commute by means of detecting cortisol in saliva it was found that people who had an elevated level of cortisol showed a decrease in the persistence of a task assigned to them.⁴ The ergonomics of commute is not studied in Indian population. Many studies done across the globe to study the effects of commute in their citizens. While studies addressed the commuters body mass index (BMI) and cardio metabolic risk, very few studies addressed the muscle power of hands in people who commute a long distance for work. The impact of driving duration on

muscular strength of hand is not well studied. The fatigue caused as a result of driving may influence the work efficiency of workers particularly works which involve fine movements like surgeons and industrial employers.

METHODS

This prospective cross sectional study was conducted in a Chettinad Hospital and Research Institute a tertiary care hospital in a group of doctors. The data was collected from 2017 June to 2018 February. Study started after getting approval from the institutional ethics committee. Informed consent was taken from the study subjects. The subject's demographic data like height, weight, age, sex, address, profession and time of commute were collected the day before assessment of muscle power along with informed consent. Inclusion criteria included subjects who drove car for at least 5 days a week for greater or equal to one hour or less than one hour. Exclusion criteria included subjects who had muscular disorders, upper limb injuries or under any muscle relaxant or neuromuscular blocking drugs. Height and weight of the subjects was measured using electronic stadiometer and weighing machine with bare foot. BMI calculated with the formulae ht/wt^2 . Subject's hand muscle strength was measured with handgrip dynamometer. The subject was instructed to hold the dynamometer in dominant hand and to compress the handles with maximum effort. The tension developed was measured in kgs. After one minute the whole procedure was repeated and second reading was taken.⁵ The mean of the two readings was called maximal isometric tension. It was measured twice, immediately after commuting in the morning and 4 hours later. The muscle power measured immediately after commute gave idea of fatigue of the muscles and after 4 hours there would be recovery from a fatigue. The subjects were divided into two groups, group one who

commuted for greater than one hour and are called long commuters and group 2 who commuted less than one hour and are called short commuters. T-test was used to compare muscle power of the hand muscles in the two groups at the two occasions. Statistically analysis was done with SPSS version 21. Muscle power, age and BMI were expressed as mean \pm SD or median. Student t-test or Mann-Whitney test was used to compare variables between two, long commuters and short commuters. To study the effect of duration of commute with BMI and muscle power, person's correlation was used and level of significance was set as $p < 0.005$.

RESULTS

32 people participated in the study out of 182 people approached, they met the inclusion criteria. 26 adults were male and only 8 were female. 56% of them were long commuters and 44% of them were short commuters. The long commuters had 14 male and 4 female subjects' short commuters had 12 male and 2 females, we observed a higher male population in long commuters. The average age in long commuters was comparatively high than short commuters. The muscle power in long commuters immediately after commute was 24.82 ± 3.991 and 4 hours after commute was (36.93 ± 5.291) . The muscle power in short commuters immediately after commute was (27.45 ± 3.661) and (31.09 ± 3.741) four hours after commute. BMI average of long commuters was (32.07 ± 2.521) and short commuters it was (24.77 ± 2.759) . Muscle strength of hands immediately after commuting was less than muscle strength four hour after commuting in the group which commuted for more than one hour this indicated the fatigue of muscles. The BMI of long commuters was comparatively more than short commuters.

Table 1: Comparison between long commuters and short commuters.

	Driving 1hour>	Driving <1 hour	P<0.001
Average age (in years)	41.7 \pm 8.6	34.2 \pm 8.8	0.000**
Average BMI	32.07 \pm 2.521	24.72 \pm 2.759	0.000**
MPI in kgs	24.0 \pm 3.991	27.45 \pm 3.661	0.019
MPA4 in kgs	36.93 \pm 5.291	31.09 \pm 3.741	0.000**

MPI: Muscle power immediately after driving; MPA4: Muscle power after four hours of driving. All the data given are mean \pm SD. All the comparison were made with ANOVA and Turkey's multiple comparison with level of significance ($p < 0.05$). *: denotes significant difference.

Table 2: Correlation of duration of driving with clinical characteristics.

Variables	R	P	Significance
Average age (in years)	0.399	0.004	**
Average BMI	0.815	0.000	**
MPI in kgs	-0.327	0.020	NS
MPA4 in kgs	-0.535	0.000	**

MPI: Muscle power immediately after driving; MPA4: Muscle power after four hours of driving; **: Significant two tailed; NS: Not significant.

The duration of commute showed negative correlation with muscle power which proved with increase in

duration of driving there is a decrease in muscle power and increase in BMI.

DISCUSSION

Long driving time was associated with increased tendency for smoking, lack of exercise, obesity, sleep disorders and impaired physical and mental health.⁶ Our study proved that driving was associated with muscle fatigue and decrease in muscle power as the power of the muscle measured immediately after driving was less compared with power of the muscle measured four hours after driving this had been proved in a study where continuous motor activity resulted in fatigue and decreased the endurance of muscle, lack of proper rest and increased liability to fatigue was found to be the risk factors.⁷ Muscle fatigue affect coordination.⁸ In a study which tested successful trial of movement involving the upper limb it had been proved that, without fatigue of muscles the velocity of hand movements was better in comparison with the velocity of fatigued muscles.⁸ Muscle fatigue of shoulder rotators caused a decrease in proprioception but there was no change in neuromuscular control. The decrease in muscle power following continuous motor activity may change the pattern of movement of that limb, influence coordination, reflex time and was an important cause of low back pain in drivers.^{5,9} Long hours of driving was associated with many muscular injuries.¹⁰ The disability of pain as a result of muscular fatigue had reduced the working abilities of workers muscle fatigue affected the kinetics of movements of the concerned limb.^{7,11} Long driving time was associated with increased body weight the risk factors found to be lack of time for exercise. Studies have proved that long hours of driving were associated with increase in waist circumference.¹² The increased weight of long commuters was an important factor for prevalence of non-communicable disease in many countries. High BMI have been found in workers who drove more time per week compared with physically active individual who drove less time.¹³ The average age in long commuters was higher compared to short commuters. High BMI in long commuter was due to absence of time for physical activity and stress associated with commute.¹³ BMI had been cited as a risk factor in studies which proved that long hours of driving was associated with increased incidence of diabetes and hypertension.¹⁴ Compared to people who spend fifteen minutes in car driving the BMI, circumference of waist, plasma glucose in fasting state and metabolic risk factors were more in people who spend more than one hour in driving a car per day.¹⁵ Each hour of driving was associated with higher chance of having insufficient time for physical activity. In a study which compared the weight gain for an average four years in three different types of commuters like non-car commuters, occasionally car commuters and daily car commuters the overall weight gain was high in daily car commuters than the other two groups after adjusting for leisure time physical activity.¹⁶ Physical activity in commuters was an important factor in preventing weight gain and high BMI. Nakano et al compared the walking activity of train commuters with car commuters and found that train

commuters walked more steps per day than car commuters and how this had contributed to the weight gain in the two groups.¹⁷ As a preventive measure to improve health status of the citizens active modes of transport like walking, cycling and use of public transports should be promoted. This was an active mode of obesity prevention various studies done across the world to improve health ergonomics of workers.¹² In a study done with people who did typing it was found that wrist support and hand rest decreased the muscle fatigue of hand muscles.¹⁸ More studies have to be initiated to prevent muscle fatigue in drivers who drive continuously for more than one hour to prevent fatigue and muscle related morbidity. The Government should subsidize active commute to work like public transport and should provide free cycles in order to promote healthy weight gain of adult population. Workers should avoid long driving and can car pool which may decrease the number of vehicles use, which is a means of preventing pollution and saving economy. The employer should provide quarters for employees to prevent long hours of commute which caused muscular fatigue as it had been proved in this study. The above suggested measures may reduce the prevalence of non-communicable disease.

CONCLUSION

Driving a car for greater than one hour is associated with decrease in muscle strength of the hand. Long driving time of greater than one hour is associated with increased BMI. In the general population, the male population tends to commute a long distance for work when compared with female population. Thus health care policy should be planned to reduce the commuting time of the general population so that the nation is free from non-communicable disease such as diabetes and hypertension which are caused due to increased BMI.

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