Measurement of Ankle Muscles Strength among Professional Drivers; A Cross Sectional Study

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Highlights:

- Measurements of ankle muscle strength was done
- Dynamometer was used to measure muscle strength
- Ankle planter flexors and dorsi flexors of both right and left sides were found to be stronger in professional drivers as compared to the normal persons.

Abstract:

Measurement of muscle strength in the lower extremities is an essential element of physical therapy evaluation because weak muscles may significantly impact a number of activities involving walking ability and is also important for the prevention of sports injuries and musculoskeletal deformities.

Objective:

The objective of this study is to measure the strength of ankle muscles in professional drivers using dynamometer.

Methodology:

The sample size of this cross sectional study was 80. Minimum age was 19 years and maximum was 31 years. Participants were divided into two groups' i.e.: professional drivers and non-professional drivers. Dynamometer was used to measure muscle strength. The strength of ankle dorsi flexors and plantar flexors was measured through handheld dynamometer by using convenient sampling technique. Data were analyzed using SPSS 21 software.

Results:

Mean strength of right sided ankle planter flexors in professional drivers was 42.69±6.19lbs and among non-professional drivers was 27.97±3.60lbs (p value <0.001).Mean strength of left sided ankle planter flexor in professional drivers was 42.49±5.48lbs and among non-professional drivers was 27.63±4.11lbs. Mean strength of left sided ankle dorsi flexor in professional drivers was 43.14±7.16lbs and among non-professional driverswas 23.96±4.40lbs.

Conclusion:

Ankle planter flexors and dorsi flexors of both right and left side were found to be stronger in professional drivers as compared to non-professional drivers.

Keywords:

Ankle, Drivers, Dynamometer, Muscle strength.

Introduction:

Force or a torque that a muscle or group of muscles produce is defined as muscle strength[1.] Muscle strength within the lower extremities is a necessary component of physical therapy evaluation and has substantial effect on various activities including walking capability and sports injuries prevention. Measurement of muscle strength is a fundamental part of assessment procedure frequently conducted in clinics and rehabilitation centers[2]. This method empowers the estimation of joint integrity including the good health of ligaments, tendons and joint stability[3,4.] Additionally, strength assessment helps to diagnose existing weak muscles as an outcome of muscular diseases and enables quantitative evaluation of functional restoration in rehabilitation frameworks[5,6]. Ankle pain exists in many professional drivers[7]. There

is a difference between ankle muscle strength of professional drivers (including bus, truck, taxi drivers etc.) and persons related to other professions. A professional driver such as taxi driver must drive a vehicle for more than 8 to 10 hours a day, on the other hand a person who is not driver professionally would not drive the vehicle in routine for as long hours[8]. Proficient drivers are those who drive an engine vehicle for example truck, cable car, trolley, taxi and rescue vehicles. The health of such drivers is essential, as it is an important factor in guaranteeing the wellbeing of travelers utilizing the services and also for the wellbeing of the drivers themselves[9,10]. Recently, the programmed transmission has turned out to be more famous than the manual transmission because of the basic and agreeable task of the program, for example, the way that it requires just a single foot to control the throttle and brake cushions. For increasing and decreasing the speed, the driver controls the throttle or brake pedal in a conscious way, with dorsal arch and a plantar flexion in the lower leg. In discontinuous rush hour, the drivers exchange between the quickening agent pedal and the brake pedal by pivoting the lower leg at the foot rear area[11], between the malleoli to the second metatarsal[12]. According to a study conducted by Patter et al (2013) in Nigeria, ankle pain is mostly seen in professional drivers as compare to non-professional driver[8]. Intrinsic foot muscles play an important role in supporting the medial longitudinal curve in static position. Upsetting the capacity of these muscles brought an expansion in pronation as evaluated by navicular drop[13]. In 2014, Kang et al examined ankle active range of motion, dorsi flexors strength and pressure pain threshold of tibialis anterior muscle in taxi drivers and concluded that dorsi flexors strength was significantly less in the professional drivers than in the control group[14]. There is a possibility to have musculoskeletal problems on ankle joint due to repetitive pedaling operation; therefore this study was conducted to determine the strength of dorsi flexors and plantar flexors of ankle. It was hypothesized that ankle muscles of professional drivers were stronger than those who are not drivers by profession (non-professional drivers).

Methodology:

The total sample size was 80, calculated by using formula $N = \frac{Z^2}{(P1-P2)^2}$ Convenient sampling technique was used. 80 male participants were enrolled in this study. 40 were drivers by profession who usually drive a vehicle for more than 8 to 10 hours and 40 were not drivers by profession but they know driving and drive any vehicle in normal routine. Minimum age of participants was 19 years and maximum was 31 years. Study design was cross-sectional. After getting approval from the university ethical committee and IRB UOL, professional drivers from different transport terminals of Lahore were approached and their ankle muscle strength was measured using the handheld dynamometer. Then 40 age and sex matched participants who were not drivers by profession were selected and their ankle muscle strength was measured and compared with the professional drivers. All measurements were taken three times and then the mean was calculated. Data were analyzed by using SPSS 21 software.

Results:

Applicable descriptive statistics were analyzed and framed depending upon the variables under the vision of this study. Less than 0.05 p-value was appraised as significance. 40subjects were professional drivers and 40 were not professional drivers. Mean age of participants was 27.60±5.60 years. Comparison of mean ankle muscle's strength among professional drivers and non-professional drivers was done. Mean strength of ankle planter flexors of right side in professional drivers was 42.6965±6.19018lbs and non-Professional drivers was 27.97±3.60 lbs. There is statistically significant difference between strength of right ankle planter flexors in professional drivers vs. non-Professional drivers (p value <0.001). Similarly, mean strength of

ankle planter flexors of left side in professional drivers was 42.49±5.48 lbs and non-professional drivers were 27.63±4.11 lbs. There is statistically significant difference strength of left ankle planter flexors of professional drivers and non-Professional drivers (p-value 0.035). Mean strength of ankle dorsi flexor of right side in professional drivers was 43.94±7.60lbs and in non-Professional drivers was 24.54±3.20 lb. There is statistically significant difference between strength of ankle dorsi flexors of right side in professional drivers and non-Professional drivers (p value <0.001).Mean strength of ankle dorsi flexor of left side in professional drivers was 43.14±7.16 lbs and in non-Professional drivers was23.96±4.40 lbs. There is statistically significant difference between strength of ankle dorsi flexors of left side in professional drivers vs. non-Professional drivers (p value <0.001) **(Table-I).** In pair 1 the difference between ankle planter flexors of right and left side was not statistically different in professional drivers and non-professional persons (p-value 0.41). In pair 2 the difference between ankle dorsi flexors of right and left side was not statistically different in professional drivers and non-professional persons (p-value0.08) **(Table-II).**

Ankle Muscles	Drivers	Mean	Std. Deviation	P value
Ankle planter flexors (Right side)	Professional driver	42.69±6.19		<0.001
	Non-Professional drivers	27.97±3.60		
Ankle planter flexors (Left side)	Professional driver	42.49±5.48		0.035
	Non-Professional drivers	27.63±4.11		
Ankle dorsi flexors (Right side)	Professional driver	43.94±7.60		<0.001
	Non-Professional drivers	24.54±3.20		
Ankle dorsi flexors (Left side)	Professional driver	43.14±7.16		<0.001
	Non-Professional drivers	23.96±4.40		

Table-I: Comparison of ankle muscle strength among professional and non-professional drivers

Ankle Muscles	Mean±SD	T-value	P value
Ankle planter flexors (Right side)	35.33±8.95	0.828	0.410
Ankle planter flexors (Left side)	35.064±8.89		
Ankle dorsi flexors (Right side)	34.24±11.35	1.760	0.082
Ankle dorsi flexors (Left side)	33.55±11.31		

Table II: Mean strength of ankle muscles through Paired sample t test

Discussion:

In this study, the measurement of ankle muscle strength in professional drivers was done and then it was compared with ankle muscle strength of persons who are not drivers by profession i.e. non-professional drivers. A study conducted in 2016 by Angelica et al, concluded that postural balance, muscle strength as well as level of cognition may affect the driving performance and safety level of a driver. All these factors are related to braking time and may assist to advise precise interventions that could reserve the driving performance[16]. On the other hand, In 2015, Chougala *et al*, described that ankle pain did not impact driving but only 5.6% subjects had negative effect on driving and 9.3% had not any affect on other activities. They found that prevalence of ankle pain was 13.4%. Whereas in recent study 16% professional drivers felt ankle pain and had difficulty in sports activities, while 41% subjects of professional drivers felt difficulty in some activities. 31 of total felt difficulty in walking and only 15 felt difficulty in daily living. 71 subjects did not felt difficulty in standing and 10 felt difficulty in standing[17.] In 2016, Bertani *et al.* concluded that just 21% participants confronted lower leg irritation in Nigeria. However, in recent study it is revealed that 26.3% respondents' confronted lower leg irritation. This factor may effect ROM of Ankle dorsiflexion and plantar flexion[18]. In 2017, Aenumulapalli et.al found that prevalence of ankle pain in general population was 13.5%.Data was collected from 950 participants[19,] whereas in

recent study it was concluded that 16% nonprofessional drivers had ankle pain while 41% professional drivers felt ankle pain. In 2012, Magawa et. al collected data from 2500 participants and in 2015, Taylor et al, collected data from 2000 subjects and found that 58.4% subjects had normal ROM of plantar flexion and flat foot prevalence was 18.4%, whereas in recent study data comprised of 80 respondents from Lahore and it was estimated that 26.3% respondents faced ankle pain[20,21]. Professional drivers usually focus less on their foot and ankle. There is a possibility to have musculoskeletal problems on ankle joint due to repetitive pedaling operation of brake and accelerator pedal in professional drivers.

Conclusion:

This study concluded that the strength of both right and left sided ankle planter flexors and ankle dorsi flexors was greater in persons who were drivers by profession as compared to those who were not drivers by profession. This indicates that the repetitive motion associated with pedaling action alters the ankle muscle strength. It is recommended that professional drivers must undergo adequate rest intervals and proper exercise. Preventive measures must be taken by them.

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