Original Article

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Physiology Section

Comparison of Motor Nerve Conduction Velocity between Football Players and Sedentary Individuals: A Cross-sectional Study

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ABSTRACT

Introduction: Athletic training improves the cardiovascular, pulmonary and musculoskeletal performance. A number of studies have also suggested an improvement in neural capabilities. Nerve Conduction Study (NCS) helps in learning about various electrophysiological parameters of the nerve such as Nerve Conduction Velocity (NCV), latency, amplitude, duration, etc. They influence co-ordination and speed of voluntary activity.

Aim: To study the Motor Nerve Conduction Velocities (MNCV) of trained athletes and compare their values with untrained individuals.

Materials and Methods: A cross-sectional study was conducted in the Department of Physiology, Government Medical College, Trissur, Kerala, India, from January 2016 to January 2017. The sample consisted of 60 male subjects who included 30 athletes and 30 non athletes between ages 18 to 25. MNCV, latency, amplitude and duration of median, ulnar, and tibial nerves of both sides of the subjects were measured. These were compared using independent t-test, and p-value <0.05 was taken as significant.

Results: The MNCV in athletes were found to be faster than non athletes. The mean MNCV of left and right median nerves were 61.5±2.60 m/s and 61.45±2.52 m/s in athletes, and 56.48±2.70 m/s and 56.73±2.51 m/s in non athletes, respectively. The mean MNCV of the left and right ulnar nerves were 61.28±2.64 m/s and 61.58±3.15 m/s in athletes, and 57.87±3.42 m/s and 58.05±3.94 m/s in non athletes. The mean MNCV of the left and right tibial nerves were 46.34±3.44 m/s and 46.37±3.60 m/s in athletes, and 44.74±3.46 m/s and 44.86±3.58 m/s in non athletes. In both tibial nerves, the proximal and distal amplitude was higher, and the proximal and distal duration was lower in athletes.

Conclusion: The results indicated MNCV of athletes were higher which could be beneficial in their sports performance.

Keywords: Athletic training, Neural adaptation, Neural conduction

INTRODUCTION

Professional athletes undergo a well-scheduled training regime that aims at improving their performance in the practicing sport by increasing not just the cardiovascular and muscular capacities, but also the neural capabilities [1,2]. Studies have shown that the nervous system, if properly trained, can recruit motor units much better, thus improving an athlete's sporting activity [1,3]. The optimum amount of force applied at the right time can often be the difference between victory and loss in a professional sporting career. For example, in a penalty shootout, the nervous system of the football player has to deal with the daunting task of recruiting just the right set of muscles that would allow him to make a shot from where he stands, so that the ball would land inside the goal post but at the same time, evade the goal keeper [4]. Various levels of the nervous system co-ordinate together to accomplish such motor activity [5].

The NCS is a type of electro-diagnostic procedure for studying the conduction of an impulse across a nerve. For motor nerves, it is carried out by stimulating the nerve electrically at two or more different sites and recording the response from the innervated muscle [6]. The MNCV, a parameter derived from NCS which denotes the speed at which electrical potentials travel along the motor nerve fiber, has an influence on the effectiveness of motor activity [7,8]. MNCV along with cognitive ability and cerebellar learning can affect reaction time, an important element of well-coordinated motor activity [9,10]. Faster impulses reduce reaction time, which in turn increases athletic performance [10]. MNCV is influenced by factors like age, temperature and height [6]. Generally, conduction velocities tend to increase with age as the extent of myelination increases [11]. However, after 30-40 years of age, conduction velocities tend to decline [12]. Nerve impulses are found to conduct faster with an increase in temperature, as is seen after physical activity [1], and slower when there is a drop in temperature [13]. Height was found to have an inverse correlation with nerve conduction velocities [14]. Women in general were found to have higher conduction velocities than men [15].

Studies across the globe have found that physical training can have an effect on MNCV. In a 2005 study in China, where femoral and tibial NCVs of athletes trained in soccer and Sanshou (a Chinese martial art), were compared with untrained individuals, it was seen that the MNCV of athletes were significantly better than untrained individuals [16]. In 2012, an Indian study concluded that a positive relationship of MNCV of radial and ulnar nerve in athletes may be the result of their long-term training that leads to neurophysiological adaptations [17]. In 2013, a similar study in Brazil aimed at measuring the MNCV of the median and common fibular nerves in three groups of athletic activities -middle distance runners, sprinter runners and handball players [18]. The MNCV of those practicing a sport were found to be significantly better than the control group, who were not participating in any. These studies raise a question on whether physical training undergone by athletes play a role in increasing their MNCV. Only few Indian studies were available in literature in this regard [17,19]. Thus, the aim of the present study was to evaluate this hypothesis by comparing MNCV of trained football players with sedentary subjects.

MATERIALS AND METHODS

This cross-sectional study was conducted in the Department of Physiology, Government Medical College, Thrissur, Kerala, India. Clearance from the Hospital Ethical Committee was obtained, after which, recruitment and data collection was conducted between January 2016 to January 2017.

Sample size calculation:

Sample size was calculated using the formula [20]

$$\frac{(z\alpha+z\beta)^2\times 2\times (SD)^2}{d^2}$$

where $z\alpha$=z value for α error (the probability of falsely rejecting a true null hypothesis)

$z\beta$=z value for β error (the probability of failing to reject a false null hypothesis)

SD=mean standard deviation between two groups

d=difference between the mean of two groups

The values for calculation were obtained from the study 'Measurement of motor nerve conduction velocity in three different sports' by Luís Paulo Nogueira Cabra (LPNC) Borges [18].

The values used were

$(z\alpha+z\beta)^2$=7.84 SD=6.25 d=6

It was calculated to be 16.98. However, a total of 30 athletes, who were trained football players, and 30 sedentary individuals were included in this study. They were selected by simple random sampling methods and based on the inclusion and exclusion criteria.

Inclusion criteria: Athletes included healthy male football players between the ages of 18-25 from various institutions in Thrissur. Their exercise regime lasted approximately two hours each in the morning and evening for five days a week, for a minimum of one year. Their workout regimes included stretching, running, and football practice sessions.

Exclusion criteria: Individuals with history of neurological disease, trauma accompanied by nerve damage or any other medical illness, and those taking medications were excluded. Those with history of smoking or tobacco abuse were also excluded from the study.

The non athlete group included age and sex matched students of Government Medical College, Thrissur, with physical activity such as engaging in sports and/or regular exercise regimes less than a minimum of 30 minutes, three days a week.

Study Procedure

After obtaining a written consent from the study subjects, detailed history was taken and physical examination was performed. Height (cm) and weight (kg) were measured using standard protocol and Body Mass Index (BMI) was calculated (kg/m^2). Pulse rate (beats per minute) was obtained by counting the radial artery for one minute in sitting position. Systolic and diastolic blood pressure (mm of Hg) was recorded in the sitting position from the right upper limb, using standard mercury sphygmomanometer by palpatory and auscultatory methods.

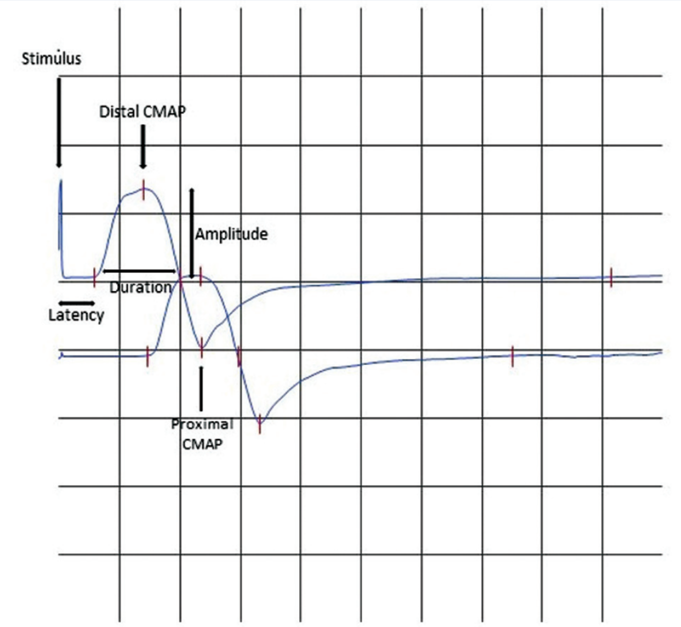
On the basis of expert opinion, available laboratory facilities at the institute, and the ease of evaluation, MNCV of median, ulnar, and tibial nerves were selected for pursuing the present study. MNCV was measured using 'Natus Dantac Keypoint' by employing standard technique of supramaximal percutaneous stimulation with a constant current stimulator [21]. After placing the three electrodes-G1 (active/anode), G2 (reference/cathode) and G0 (ground), the respective nerve was stimulated at a proximal and a distal point along its course through the limb [22]. The placement of electrodes and sites of stimulation for each of the tested nerves are outlined below [Table/Fig-1] [6].

Upon stimulation, the generated nerve action potential transmits through the nerve, crosses the neuromuscular junction and stimulates the muscle, the response of which is recorded as the Compound Muscle Action Potential (CMAP). It is a biphasic potential from which parameters like conduction velocity, amplitude, latency and duration

	Median nerve	Ulnar nerve	Tibial nerve
G1	Centre of abductor pollicis brevis	Centre of abductor digiti minimi	Centre of abductor hallucis muscle.
G2	Proximal phalanx of thumb 3-4 cm distal to active electrode	Distally over fifth digit	Medial surface of the great toe.
G0	Dorsum of the hand between active electrode and the stimulator	Dorsum of the hand, between active electrode and the stimulator	Between active electrode and the stimulator.
Distal stimulation	Between tendons of flexor carpi radialis and palmaris longus, 3 cm proximal to distal wrist crease	3 cm proximal to distal wrist crease just medial to the flexor carpi ulnaris tendon	Proximal to medial malleolus.
Proximal stimulation	At elbow, lateral to the brachial pulsation	At posterior aspect of the elbow 5 cm distal to the medial epicondyle	Popliteal fossa slightly lateral to the midline.

[Table/Fig-1]: Placement of electrodes and sites of stimulation for the tested nerves [6].
G1: Anode; G2: Cathode; G0: Ground electrode

are derived [Table/Fig-2] [22]. The time from stimulus to the initial negative deflection is called latency expressed in milliseconds (ms). Amplitude expressed in millivolts (mV) of the potential is commonly measured from baseline to negative peak. Duration (ms) is measured from initial deflection from baseline to first baseline crossing. Each nerve is stimulated at a proximal and distal site. The respective latencies at proximal (Lp) and distal (Ld) sites were recorded. Length of the nerve segment (D) between the points of proximal and distal stimulation was measured in millimeters (mm). Conduction Velocity (CV) was derived by dividing the distance between the stimulus points by the corresponding latency difference [22].



[Table/Fig-2]: Compound Muscle Action Potential (CMAP) [22].

CV=D/Lp-Ld

It is expressed in 'metres per second'.

The reported normal MNCVs of a few nerves are as follows.

Median MNCV: 58.52±3.76 m/s [21]

Ulnar MNCV (below elbow): 58.7±5.1 m/s [6]

(above elbow): 61.0±5.5 m/s [23]

Common Peroneal MNCV (below knee): 48.3±3.9 m/s [24]

(above knee): 52.0±6.2 m/s [24]

Posterior Tibial MNCV: 48.3±4.5 m/s [25]

Latency, amplitude and duration of the CMAP were also analysed in this study.

The variables measured were age, height, weight, BMI, pulse rate, blood pressure, MNCV, proximal and distal latencies, proximal and distal amplitudes, proximal and distal CMAP durations of right and left median, ulnar and tibial nerves.

STATISTICAL ANALYSIS

Data was entered in Microsoft Excel 13 and analysed using Epi Info software version 7. Statistical analysis was done using independent t-test, and p-value <0.05 was taken as significant.

RESULTS

The mean age of football players was 21.17±2.07 years and that of sedentary individuals was 20.83±1.82 years respectively, which was comparable (p-value=0.510). Mean values of quantitative variables such as height, weight, BMI, pulse rate, systolic and diastolic blood pressure for both categories is shown in [Table/Fig-3]. Pulse rate and systolic blood pressure were found to be significantly lower in football players (p-value <0.05). Other parameters were found to be comparable between the two groups (p-value >0.05).

Variable	Study group	Mean±Std. Deviation	p-value
Height (cm)	Athletes	169.27±2.92	0.164
	Non athletes	168.13±3.30	
Weight (kg)	Athletes	62.33±3.21	0.244
	Non athletes	61.40±2.92	
BMI (kg/m^2)	Athletes	21.74±0.62	0.817
	Non athletes	21.71±0.48	
Pulse rate (beats per minute)	Athletes	69.07±2.45	0.010
	Non athletes	70.60±1.98	
Systolic blood pressure (mm of Hg)	Athletes	111.27±2.90	0.042
	Non athletes	112.80±2.81	
Diastolic blood pressure (mm of Hg)	Athletes	70.60±2.63	1.000
	Non athletes	70.60±1.75	

[Table/Fig-3]: Descriptive statistics of variables of athletes and non athletes.
Test of significance; Independent t-test

The MNCV of right and left median, ulnar and tibial nerves of both groups were compared and they were found to be higher in athletes [Table/Fig-4], which was statistically significant (p-value <0.05). As height was known to be a confounding factor for MNCV [14], their correlation was checked using Pearson correlation coefficient [Table/Fig-5]. Significant correlation was found only with right ulnar nerve (p=0.046).

Variable (m/s)	Study group	Minimum	Maximum	Mean±Std. Deviation	p-value
Left Median MNCV	Athletes	55.60	66	61.50±2.60	<0.001
	Non athletes	51.80	60.60	56.48±2.70	
Right Median MNCV	Athletes	54.70	64.60	61.45±2.52	<0.001
	Non athletes	53.30	63	56.73±2.51	
Left Ulnar MNCV	Athletes	57.60	66.70	61.28±2.64	<0.001
	Non athletes	49.40	62.20	57.87±3.42	
Right Ulnar MNCV	Athletes	56.70	67.80	61.58±3.15	<0.001
	Non athletes	51.20	63.10	58.05±3.94	
Left Tibial MNCV	Athletes	42.10	57.50	46.34±3.44	0.007
	Non athletes	40.10	52.30	44.74±3.46	
Right Tibial MNCV	Athletes	38.40	52.10	46.37±3.60	0.011
	Non athletes	40.40	51.60	44.86±3.58	

[Table/Fig-4]: Descriptive Statistics- MNCV of athletes and non athletes (m/s).
Test of significance=independent t test; A p-value <0.05 is considered to be statistically significant

	MNCV	MML	MMR	UML	UMR	TML	TMR
Height	Pearson Correlation	0.166	0.033	0.207	0.259*	0.115	0.119
	Sig. (2-tailed)	0.206	0.801	0.112	0.046	0.383	0.365
	N	60	60	60	60	60	60

[Table/Fig-5]: Correlation between height and MNCV.
MML: Median motor left; MMR: Median motor right; UML: Ulnar motor left; UMR: Ulnar motor right; TML: Tibial motor left; TMR: Tibial motor right; A p-value <0.05 is considered to be statistically significant

The proximal and distal amplitudes between the two groups were compared [Table/Fig-6], revealing higher values for both tibial nerves and right ulnar nerve in athletes, which was statistically significant (p-value <0.05). The proximal and distal latencies of the two groups were also compared [Table/Fig-7], revealing lower values in both median nerves of athletes (proximal latency), which was statistically significant (p-value <0.05).

Variable (mV)	Study group	Mean±Std. Deviation	p-value
Left Median Ad	Athletes	16.18±2.79	0.066
	Non athletes	18.36±5.66	
Left Median Ap	Athletes	15.51±2.87	0.118
	Non athletes	17.22±5.16	
Right Median Ad	Athletes	16.95±3.78	0.31
	Non athletes	18.07±4.65	
Right Median Ap	Athletes	15.94±3.75	0.269
	Non athletes	17.16±4.64	
Left Ulnar Ad	Athletes	17.31±2.40	0.438
	Non athletes	16.72±3.42	
Left Ulnar Ap	Athletes	16.32±1.73	0.208
	Non athletes	15.46±3.23	
Right Ulnar Ad	Athletes	18.44±2.51	0.003
	Non athletes	16.22±2.98	
Right Ulnar Ap	Athletes	17.12±2.86	0.014
	Non athletes	15.18±3.05	
Left Tibial Ad	Athletes	28.70±5.91	<0.001
	Non athletes	20.52±5.94	
Left Tibial Ap	Athletes	25.45±5.17	<0.001
	Non athletes	18.55±4.87	
Right Tibial Ad	Athletes	29.26±6.39	<0.001
	Non athletes	21.36±4.47	
Right Tibial Ap	Athletes	24.83±4.77	<0.001
	Non athletes	18.18±4.18	

[Table/Fig-6]: Descriptive statistics-distal and proximal amplitudes of athletes and non athletes.
Test of significance=independent t test; A p-value <0.05 is considered to be statistically significant; Ad: Distal Amplitude; Ap: Proximal Amplitude

Variable (ms)	Study group	Mean±Std. Deviation	p-value
Left Median Ld	Athletes	3.09±0.26	0.474
	Non athletes	3.05±0.24	
Left Median Lp	Athletes	7.00±0.28	<0.001
	Non athletes	7.41±0.36	
Right Median Ld	Athletes	3.02±0.28	0.686
	Non athletes	3.05±0.28	
Right Median Lp	Athletes	7.01±0.36	<0.001
	Non athletes	7.53±0.44	
Left Ulnar Ld	Athletes	2.58±0.23	0.065
	Non athletes	2.47±0.22	
Left Ulnar Lp	Athletes	6.87±0.29	0.211
	Non athletes	6.97±0.34	

Right Ulnar Ld	Athletes	2.53±0.27	0.063
	Non athletes	2.39±0.33	
Right Ulnar Lp	Athletes	6.93±0.34	0.136
	Non athletes	7.08±0.41	
Left Tibial Ld	Athletes	4.43±0.71	0.593
	Non athletes	4.54±0.92	
Left Tibial Lp	Athletes	13.23±1.09	0.723
	Non athletes	13.35±1.59	
Right Tibial Ld	Athletes	4.40±0.56	0.41
	Non athletes	4.25±0.86	
Right Tibial Lp	Athletes	13.12±1.02	0.284
	Non athletes	13.51±1.70	

[Table/Fig-7]: Descriptive statistics -distal and proximal latencies of athletes and non athletes (ms).
Test of significance=independent t test; A p-value <0.05 is considered to be statistically significant; Ld: Distal latency; Lp: Proximal latency

The proximal and distal CMAP durations between the two groups were compared [Table/Fig-8] revealing lower values in both tibial nerves of athletes, which was statistically significant (p-value <0.05).

Variable (ms)	Study group	Mean±Std. Deviation	p-value
Left Median Dd	Athletes	38.0±2.7	0.969
	Non athletes	38.1±2.1	
Left Median Dp	Athletes	34.7±3.1	0.913
	Non athletes	34.7±3.2	
Right Median Dd	Athletes	33.7±4.9	0.513
	Non athletes	34.3±4.5	
Right Median Dp	Athletes	31.8±4.4	0.521
	Non athletes	32.4±4.2	
Left Ulnar Dd	Athletes	35.0±5.1	0.779
	Non athletes	35.3±4.7	
Left Ulnar Dp	Athletes	35.2±3.9	0.564
	Non athletes	34.8±3.6	
Right Ulnar Dd	Athletes	32.9±2.1	0.458
	Non athletes	33.8±1.9	
Right Ulnar Dp	Athletes	30.9±2.3	0.643
	Non athletes	31.5±1.5	
Left Tibial Dd	Athletes	27.3±3.6	<0.001
	Non athletes	32.1±2.8	
Left Tibial Dp	Athletes	28.1±2.8	0.021
	Non athletes	29.9±3.2	
Right Tibial Dd	Athletes	29.5±3.5	<0.001
	Non athletes	34.6±2.9	
Right Tibial Dp	Athletes	26.9±3.2	0.006
	Non athletes	29.3±2.7	

[Table/Fig-8]: Descriptive statistics -distal and proximal duration of athletes and non athletes.
Test of significance=independent t test; A p-value <0.05 is considered to be statistically significant; Dd: Distal duration; Dp: Proximal duration

DISCUSSION

It was found that the MNCV of football players were higher than sedentary individuals in the median, ulnar and tibial motor nerves. The proximal and distal amplitudes of tibial motor nerves were higher, and the proximal latencies of median motor nerves were lower in athletes. Proximal and distal CMAP duration of tibial nerves, resting pulse rate and systolic blood pressure were also lower in athletes.

Evidence suggests that physical activity has some influence on nerve conduction velocity. In 1982, Sale DG et al., had shown that subjects who underwent limb immobilisation when subjected to a period of exercise training, showed faster median nerve conduction velocity [26]. In 1985, Halar EM et al., also showed that the nerve conduction velocity of the sural nerve increased during 30 minutes of walking [1]. A study was conducted by Van Meeteren NL et al., in 1997, observed the effects of exercise training on improving nerve function recovery after a sciatic nerve crush lesion in rats [27]. The sensorimotor recovery was better with exercise training. Conduction velocity, especially in the late phase of recovery was significantly better in the trained group. These studies point to the fact that exercise training can improve MNCV. Athletes practice regular physical activity for improving their overall performance in the practicing sport. The effect of athletic training on skeletal muscle, cardiovascular and pulmonary physiology has received considerable attention [28]. In present study also, the resting pulse rate and systolic blood pressure in athletes were found to be lower, possibly due to their higher vagal tone. The neural mechanisms leading to improvement in performance are equally important [1,29,30]. Studies were conducted to find the change in MNCV in athletes is shown in [Table/Fig-9] [16-18]. These studies were similar to present study where the MNCV of athletes were found to be higher. Two possible mechanisms explain this increase in MNCV in athletes. First, athletes usually have a lower body fat percentage which seems to improve their MNCV by better facilitation of neural transmission [31]. Second, strict training regimes of athletes lead to functional overload which may increase the diameter of the nerve fibers and myelin sheath, causing higher velocity of nerve conduction [32]. Higher MNCV causes shorter refractory period, which increases frequency of impulses to the muscle, thereby increasing muscular activation and athletic ability [30].

The present study also shows the proximal and distal amplitudes of tibial nerves to be significantly higher in athletes. The right ulnar nerve also presented higher proximal and distal amplitude in the case of athletes. This was similar to a study conducted in Nepal, where the tibial CMAP amplitudes were found to be higher in football players in comparison to untrained individuals [33]. This could be due to an increase in muscle fiber size. The amplitude difference was pronounced in the tibial nerves of football players probably because of higher involvement of lower limbs in the sport, which could have led to regional muscle hypertrophy [34,35]. The present study also revealed that the proximal and distal durations of both tibial nerve CMAPs were lower in athletes. This could be due to higher synchronicity of muscle fibre discharge in the trained individuals [33].

The proximal latencies of both median motor nerves were found to be significantly lower in athletes in present study, which could probably be due to dendrite restructuring and increased neuro-muscular transmission dynamics [29,36]. The results of some studies been outlined in [Table/Fig-10] [37-40]. These studies show that it is also possible to get a reduced MNCV in athletes. This depends on the type of sporting activity pursued, and the associated injuries. Vibrations or shock produced by a hit, as in contact sports, which occur repeatedly can lead to neuropathy that reduces MNCV [37-40]. This is supported by Chang KY et al., who observed that repeated exposure to vibration and shocks, causes degeneration of par anodal myelin and vasoconstriction, apart from their direct detrimental effects [41]. Adoption of abnormal postures during the course of a sport, like abduction, external rotation of the shoulder, and wrist extension in hockey players, can stretch the nerves and reduces MNCV [42].

Not many studies evaluating NCV are available in Kerala, India and this adds to the future scope in this field. Athletes from various sports could be recruited and their nerve conduction must be evaluated to see if MNCV varies according to the sport practiced. MNCV could also be used to diagnose subclinical neuropathies in athletes. They are also important in providing objective analysis of skill and co-ordination in sports training. Athletes in present study were trained regularly under supervision and selection was not based

S. No.	Author's name and year	Place	Number of subjects	Groups compared	Parameters assessed	Conclusion
1	Huang YM et al., (2005) [16]	China	38	- Soccer players - Sanshou practitioners - Untrained individuals	NCV of femoral and tibial nerves	Higher NCV in soccer players and sanshou practitioners
2	Soodan JS and Kumar A (2012) [17]	India	200	- Aerobic group of athletes - Anaerobic group of athletes - Mixed group of athletes - Non athletes	NCV of radial, ulnar, common peroneal and sural nerves	NCV higher in athletes, especially anaerobic group
3	Borges LPNC and Vasconcelos WC (2013) [18]	Brazil	24	- Sprint runners - Middle distance runners - Handball players - Non athletes	MNCV of median and common fibular nerves	MNCV higher in athletes
4	Present study, 2022	India	60	- Football players - Sedentary individuals	MNCV of median, ulnar and tibial nerves	MNCV higher in athletes

[Table/Fig-9]: Comparison of present study with similar studies [16-18].
NCV: Nerve conduction velocity; MNCV: Motor nerve conduction velocity

S. No.	Author's name and year	Place	Number of subjects	Groups compared	Parameters assessed	Conclusion
1	Pawlak M and Kaczmarek D (2010) [37]	Polland	59	- Field hockey players - Soccer players - Tennis players - Non-active men	NCV of ulnar and tibial nerves	- Lower ulnar MNCV in hockey players - Lower tibial MNCV in athletes with longer duration of practicing the sport
2	Didehdar D et al., (2014) [38]	Iran	35	- Football players - Non active men	NCV of tibial and common peroneal nerves	- Lower tibial and common peroneal NCV in football players
3	Singh S and Kaur S (2015) [39]	India	10	- Drawing and bow arm of female archers	NCV of median and ulnar nerves	- MNCV of drawing arm lower than bow arm
4	Waghmare VS et al., (2015) [40]	India	60	- Table tennis players - Non active men	NCV of median and ulnar nerves	- Lower median and ulnar NCV in table tennis players
5	Present study, 2022	India	60	- Football players - Sedentary individuals	MNCV of median, ulnar and tibial nerves	MNCV higher in athletes

[Table/Fig-10]: Comparison of present study with studies showing different results [37-40].
NCV: Nerve conduction velocity; MNCV: Motor nerve conduction velocity

on self-reported physical activity. All parameters including MNCV were measured by a single observer using non invasive method of surface electrode stimulation. The results are relevant from a clinical and public health perspective.

Limitation(s)

Sample size was small with 30 subjects in each group. The subjects were all males due to lack of sufficient number of trained female football players who adhere to the inclusion criteria. Handedness of the subject and variation between dominant and non dominant side was not evaluated in this study. Variation in MNCV according to gender could not be documented. The effect of different types of sports on MNCV could not be documented as all athletes were football players. The variation of MNCV based on the type of player (goal keeper, defender, forward etc), and the skill level of player could not be documented. Only a single MNCV reading could be documented per subject due to time and cost limitations. So the change in MNCV, if any, as the athlete trains further could not be documented.

CONCLUSION(S)

The study highlights an increase in MNCV of football players when compared to sedentary individuals. Proper, efficient and effective physical training can improve not only the cardiopulmonary parameters, but also the neuro-muscular parameters, which directly relates with skill and co-ordination required for increasing athletic performance. It would be enlightening to analyse the potential variation in MNCV of athletes practicing different sports, and study the possible neural adaptation mechanisms so that further scientific support can be extended to athletic training programs.

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