International Journal of Science and Healthcare Research
Vol.7; Issue: 3; July-Sept. 2022
Website: ijshr.com
ISSN: 2455-7587
Original Research Article

Nerve Conduction and Surface Electromyography of Physically Active Healthy Medical Undergraduates of Nepal

Dr. Siddhartha Kr Shah[1], Dr. Priza Subedi[2], Dr. Rupak Dhakal[1], Dr. Sabin Ghale[1], Dr. Pramit Khatiwada[1]

[1]B.P. Koirala Institute of Health Sciences, Dharan, Nepal
[2]Department of Basic and Clinical Physiology, B.P. Koirala Institute of Health Sciences, Dharan, Nepal

Corresponding Author: Dr. Siddhartha Kr Shah

DOI: https://doi.org/10.52403/ijshr.20220735

ABSTRACT

Introduction: Physical activity is defined as any bodily movement produced by skeletal muscles that requires energy expenditure. Nerve conduction studies and surface EMG provides a comprehensive evaluation of nerve, muscle or neuromuscular impairment. However, such studies are mostly done on professional athletes.
Methods: Healthy physically active (n=17) and non-active (n=17) medical undergraduate students from B.P. Koirala Institute of Health Sciences (BPKIHS), Nepal were enrolled in the study using convenient sampling technique. Anthropometric and motor nerve conduction parameters of common peroneal nerves and surface EMG of gastrocnemius muscle were recorded using standard technique in Neurophysiology Lab II, BPKIHS. Descriptive analysis was done. Unpaired t-test was applied for comparing the nerve conduction and surface EMG variables between the groups. Pearson's correlation was applied between anthropometric and nerve conduction & surface EMG variables.
Objectives: To compare nerve conduction parameters of common peroneal nerve and surface EMG of Gastrocnemius muscle between active and non-active individuals.
Results: The distal and proximal amplitudes of left common peroneal nerve were significantly higher in physically active compared to non-active individuals (LCPDA-p value: 0.026, LCPPA-p value: 0.009). Anthropometric parameters showed significant correlation with nerve conduction parameters.
Conclusion: Nerve conduction parameters are affected in the physically active individuals. Anthropometric variables showed significant relation with the nerve conduction parameters.

Keywords: Nerve Conduction Velocity, Surface Electromyography, Peroneal Nerve, Gastrocnemius.

INTRODUCTION

Nerve conduction studies (NCS) are the most sensitive and reproducible measure of peripheral nerve functions.[1] These tests examine the state of rapidly conducting myelinated fibers in a peripheral nerve.[2] NCS are conventionally performed with electromyography (EMG). If the NCS is done along with EMG, it yields better diagnostic value.[3,4] Nerve conduction study includes assessment of motor (compound muscle action potential: CMAP) of accessible peripheral nerves in lower limbs including common peroneal and tibial nerves. Commonly measured parameters of CMAP include latency, amplitude, duration, and conduction velocity. These parameters are known to vary with demographic profile, anthropometric measurements of the population studied, and laboratory conditions of the test.[3,4] Colak et al. found that sural nerve distal latencies were prolonged in runners compared to the control subjects whereas no significant delay was found in common peroneal nerve.[5] According to

Ross et al. Nerve conduction velocity (NCV) has been shown to increase in response to a period of sprint training.[6]

The primary objectives were to compare nerve conduction parameters of the common peroneal nerve and surface electromyography parameters of gastrocnemius muscles in active and non-active individuals.

The effect of physical activity on nerve conduction and surface EMG parameters were mostly done on the professional athletes. Very few studies could be found on the effect of such activities on individuals who are doing it for short duration. Our study aimed to find the effect of shorter duration physical activities on the nerve conduction and surface EMG parameters among those individuals who do physical exercises for short duration.

METHODS

Sample size calculation

As per the reference article by Didehdar et al. "Decreased Nerve Conduction Velocity in Football Players", we have taken the distal onset latency of deep peroneal nerve on the non-dominant leg for nerve conduction study on 35 male college students (20 football players and 15 actives).[7] In this study, data were expressed as the data in mean and SD.

Distal Latency of deep peroneal nerve of a football player (mean ±SD): 3.77 ± 0.64 (millisecond). Distal Latency of deep peroneal nerve of control (mean ±SD): 3.03 ± 0.8 (millisecond)

Now, to calculate sample size by comparing means of two normally distributed samples of equal size using a two-sided test with significance level α and power 1- β.

The sample size (n) = $$\frac{(\delta_1^2 + \delta_2^2)\,(Z_{1-\alpha/2} + Z_{1-\beta})^2}{\Delta^2}$$

Here,

n = Sample Size

δ_1 = Standard deviation of distal latency of deep peroneal nerve on non-dominant leg among football players

δ_2 = standard deviation of distal latency of deep peroneal nerve on non-dominant leg among controls

$Z_{1-\alpha/2} = 1.96$

$Z_{1-\beta} = 0.842$

Δ = mean of *football player* – mean of control

Total sample size = $(0.64^2 + 0.8^2) \times (1.96 + 0.842)^2 / (3.77-3.03)^2$

= 1.0496* 7.84/0.5476 = 15.02

So, after the calculation done by the above formula, the total sample size becomes 15.02. Now adding 10% to reduce various types of biases, the total sample size becomes 17. So, this study was conducted on 17 active and 17 non-active medical undergraduate students.

Inclusion criteria

a. An objective cross-sectional study was done on 17 active and 17 non-active individuals in the Neurophysiology Lab II (NCS, EMG, VEP, BERA), BPKIHS, Dharan for 1 month during April, 2019 after receiving ethical clearance from Department Review committee. Convenience sampling was done Male medical undergraduates of BPKIHS with age group of 18 to 25 years
b. No history of symptoms such as tingling sensation, burning sensation, fasciculation or muscle weakness.
c. Active life: Individuals running 10 kilometers per week or individuals playing football for 5 hours per week.
d. Sedentary life: individuals not doing any sort of physical exercise or gym exercise.
e. No history of drugs that causes neuropathy.

Exclusion criteria

a. Females
b. Age < 18 years and > 25 years
c. History of regular smoking or alcohol intake

Statistical Analysis

The data collected was entered in Microsoft Excel 2010 and converted into SPSS 11.5 for statistical analysis. Since our data was normally distributed, for descriptive statistics, mean & SD were calculated and a tabular presentation was made. Regarding inferential statistics, as our data were normally distributed unpaired t-test was applied. Similarly, Pearson's correlation was applied to find out the association between the Nerve conduction variables, surface EMG variables, and anthropometric variables.

RESULTS

Table 1: Comparison of anthropometric values between active and non-active undergraduate males

Variables	Active males(n=17) Mean ± S.D.	Non - active males(n=17) Mean ± S.D.	P value
Age (years)	21.71 ± 1.40	21.94 ± 1.25	0.609
Height (in cm)	172.24± 6.29	168.76 ± 5.86	0.106
Weight (in Kg)	65.12 ±8.96	64.79 ±7.30	0.909
BMI (Kg/m^2)	21.89 ±2.36	22.77 ±2.61	0.312
Lower limb length (in cm)	101.65 ±3.16	98.24 ±5.88	0.043

Note: P-value considered significant at ≤ 0.05

According to Table 1, on comparing anthropometric variables between active and non-active undergraduate males, age was similar, whereas height, weight, lower limb length mean was slightly higher of that of active males and BMI was found to be slightly lower.

Table 2: Comparison of nerve conduction variables between active and non-active undergraduate males

Variables	Active males(n=17) Mean ± S.D.	Non - active males(n=17) Mean ± S.D.	P value
RCPDL (milliseconds)	3.29± 0.69	3.24± 0.68	0.823
RCPPL (milliseconds)	10.95 ±1.77	10.66± 1.47	0.602
RCPDA (millivolt)	7.01± 2.34	6.01 ±2.15	0.205
RCPPA (millivolt)	6.70 ±2.05	5.41 ±1.85	0.062
D (millimeter)	397.06 ±36.53	385.88 ±34.11	0.363
RCPNCV (m/s)	52.87 ±8.61	52.86 ±7.95	0.995
LCPDL (milliseconds)	3.38 ±0.73	3.21 ±0.60	0.449
LCPPL (milliseconds)	10.76 ±1.13	10.57 ±1.13	0.620
LCPDA (millivolt)	7.24 ±2.15	5.72± 1.61	0.026
LCPPA (millivolt)	6.76 ±2.04	5.06 ±1.47	0.009
LCPNCV (m/s)	54.02 ±4.60	52.92 ±6.90	0.589

Note: P value considered significant at ≤ 0.05

RCPDL: Right Common Peroneal Distal Latency
RCPPL: Right Common Peroneal Proximal Latency
RCPDA: Right Common Peroneal Distal Amplitude
RCPPA: Right Common Peroneal Proximal Amplitude
D: Distance between stimulation sites
RCPNCV: Right Common Peroneal Nerve Conduction Velocity
LCPDL: Left Common Peroneal Distal Latency
LCPPL: Left Common Peroneal Proximal Latency
LCPDA: Left Common Peroneal Distal Amplitude
LCPPA: Left Common Peroneal Proximal Amplitude
LCPNCV: Left Common Peroneal Nerve Conduction Velocity

According to Table 2, Left Common Peroneal Distal amplitude and left common peroneal proximal amplitude were found to be significantly higher in active males than that of non-active males.

Table 3: Comparison of Surface EMG variables between active and non-active undergraduate males

Variables	Active males(n=17) Mean ± S.D.	Non - active males(n=17) Mean ± S.D.	P value
RGA (microvolt)	457.65 ±153.89	481.18 ±132.38	0.636
LGA (microvolt)	447.65 ±150.81	473.53 ±141.55	0.609

Note: P value considered significant at ≤ 0.05

RGA: Right Gastrocnemius-muscle Amplitude
LGA: Left Gastrocnemius-muscle Amplitude

According to Table 3, Right and left Gastrocnemius-muscle amplitude were found to be non-significant between active and non-active individuals.

Table 4: Correlation of anthropometric and nerve conduction variables

Nerve Conduction Variables	Anthropometric variables	Pearson's correlation (r-value)	P value
RCPDL (milliseconds)	Age (years)	.342*	**0.047**
RCPPL (milliseconds)	Age (years)	0.284	0.103
RCPDA (millivolt)	Age (years)	-0.344*	**0.046**
RCPPA (millivolt)	Age (years)	-0.250	0.154
D (millimeter)	Age (years)	0.137	0.441
RCPNCV (m/s)	Age (years)	-0.055	0.756
LCPDL (milliseconds)	Age (years)	0.265	0.130
LCPPL (milliseconds)	Age (years)	0.077	0.667
LCPDA (millivolt)	Age (years)	-0.186	0.293
LCPPA (millivolt)	Age (years)	-0.156	0.380
LCPNCV (m/ms)	Age (years)	0.248	0.157
RCPDL (milliseconds)	Height (cm)	0.174	0.325
RCPPL (milliseconds)	Height (cm)	.407*	**0.017**
RCPDA (millivolt)	Height (cm)	0.059	0.741
RCPPA (millivolt)	Height (cm)	0.050	0.779
D (millimeter)	Height (cm)	0.630**	**<0.05**
RCPNCV (m/s)	Height (cm)	-0.122	0.493
LCPDL (milliseconds)	Height (cm)	0.037	0.835
LCPPL (milliseconds)	Height (cm)	0.428*	**0.012**
LCPDA (millivolt)	Height (cm)	0.268	0.126
LCPPA (millivolt)	Height (cm)	0.282	0.106
LCPNCV (m/s)	Height (cm)	-0.067	0.706
RCPDL (milliseconds)	Weight (kg)	0.312	0.072
RCPPL (milliseconds)	Weight (kg)	0.272	0.120
RCPDA (millivolt)	Weight (kg)	-0.328	0.059
RCPPA (millivolt)	Weight (kg)	-0.270	0.122
D (millimeter)	Weight (kg)	0.349*	**0.043**
RCPNCV (m/s)	Weight (kg)	0.012	0.944
LCPDL (milliseconds)	Weight (kg)	-0.016	0.928
LCPPL (milliseconds)	Weight (kg)	0.086	0.629
LCPDA (millivolt)	Weight (kg)	0.154	0.384
LCPPA (millivolt)	Weight (kg)	0.161	0.364
LCPNCV (m/s)	Weight (kg)	0.159	0.369
RCPDL (milliseconds)	BMI (kg/m^2)	0.234	0.184
RCPPL (milliseconds)	BMI (kg/m^2)	0.025	0.886
RCPDA (millivolt)	BMI (kg/m^2)	-.406*	**0.017**
RCPPA (millivolt)	BMI (kg/m^2)	-0.336	0.052
D (millimeter)	BMI (kg/m^2)	-0.023	0.896
RCPNCV (m/s)	BMI (kg/m^2)	0.114	0.520
LCPDL (milliseconds)	BMI (kg/m^2)	-0.071	0.692
LCPPL (milliseconds)	BMI (kg/m^2)	-0.206	0.241
LCPDA (millivolt)	BMI (kg/m^2)	-0.015	0.933
LCPPA (millivolt)	BMI (kg/m^2)	-0.017	0.924
LCPNCV (m/s)	BMI (kg/m^2)	0.235	0.181
RCPDL (milliseconds)	LLL (cm)	0.304	0.081
RCPPL (milliseconds)	LLL (cm)	.514**	**0.002**
RCPDA (millivolt)	LLL (cm)	0.101	0.570
RCPPA (millivolt)	LLL (cm)	0.062	0.728
D (millimeter)	LLL (cm)	.470**	**0.005**
RCPNCV (m/s)	LLL (cm)	-0.272	0.119
LCPDL (milliseconds)	LLL (cm)	0.284	0.104
LCPPL (milliseconds)	LLL (cm)	.542**	**0.001**
LCPDA (millivolt)	LLL (cm)	0.204	0.247
LCPPA (millivolt)	LLL (cm)	0.208	0.238
LCPNCV (m/s)	LLL (cm)	-0.148	0.404

Note:
***. Correlation is significant at the 0.05 level (2-tailed).**
****. Correlation is significant at the 0.01 level (2-tailed).**

RCPDL: Right Common Peroneal Distal Latency
RCPPL: Right Common Peroneal Proximal Latency
RCPDA: Right Common Peroneal Distal Amplitude
RCPPA: Right Common Peroneal Proximal Amplitude

D: Distance
RCPNCV: Right Common Peroneal Nerve Conduction Velocity
LCPDL: Left Common Peroneal Distal Latency
LCPPL: Left Common Peroneal Proximal Latency
LCPDA: Left Common Peroneal Distal Amplitude
LCPPA: Left Common Peroneal Proximal Amplitude
LCPNCV: Left Common Peroneal Nerve Conduction Velocity
BMI: Body Mass Index
LLL: Lower Limb Length

According to Table 4, RCPDL significantly increased with age, RCPDA significantly decreased with age, RCPPL, D and LCPPL significantly increased with height, RCPDA significantly decreased with BMI, RCPPL, D, LCPPL significantly increased with LLL.

Table 5: Correlation of anthropometric and surface EMG variables

Surface EMG Variables	Anthropometric variables	Pearson's correlation (r-value)	P value
LGA (microvolt)	Age (years)	-0.172	0.332
RGA (microvolt)	Age (years)	0.245	0.163
LGA (microvolt)	Height (cm)	-0.111	0.533
RGA (microvolt)	Height (cm)	-0.077	0.665
LGA (microvolt)	Weight (kg)	-0.224	0.203
RGA (microvolt)	Weight (kg)	0.136	0.443
LGA (microvolt)	BMI (kg/m^2)	-0.171	0.334
RGA (microvolt)	BMI (kg/m^2)	0.194	0.273
LGA (microvolt)	LLL (cm)	-0.093	0.600
RGA (microvolt)	LLL (cm)	-0.050	0.777

Note:
***. Correlation is significant at the 0.05 level (2-tailed).**
****. Correlation is significant at the 0.01 level (2-tailed).**

RGA: Right Gastrocnemius-muscle Amplitude
LGA: Left Gastrocnemius-muscle Amplitude
BMI: Body Mass Index
LLL: Lower Limb Length

According to Table 5, surface EMG variables correlation with anthropometric variables were found to be insignificant.

DISCUSSION

This study was conducted to compare the nerve conduction and surface EMG parameters of lower limbs in physically active and non-active medical undergraduate students. Our study demonstrated that the mean amplitude of left common peroneal nerve CMAP was significantly higher in physically active than non-active individuals (LCPDA in millivolts 7.24 ± 2.15 vs. 5.72 ± 1.61, p-value = 0.026 and LCPPA in millivolts 6.76 ± 2.04 vs. 5.06±1.47, p-value = 0.009). Rest all the nerve conduction parameters were comparable between the groups. Similarly, the mean amplitude of MUAP of gastrocnemius muscles was comparable on both sides between the two groups. Also, the recruitment pattern of MUAPs was comparable between the groups.

Sharma et al. did a study of tibial motor and sural sensory nerves in twenty-seven elite male football players with a mean age of 22.74±2.52 years and twenty-nine non-athletic males with a mean age of 23.42±2.95 years. Tibial CMAP amplitude was higher and the duration of CMAP was shorter in football players than that of controls. Sural nerve action potential duration was significantly lower in non-dominant limbs compared to controls.[8] In our study, common peroneal motor CMAP amplitude is significantly higher in active than non-active individuals.

Borges et al. studied common peroneal motor nerve conduction velocity in 15 healthy male individuals involved in three different sports viz, middle distance runners, sprint runners, and handball players. They found that motor NCV was significantly higher in different athletes' groups as compared to controls. They found that regular physical exercise has a beneficial influence on motor NCV in the lower extremity.[9] However, these findings are not in agreement with several other similar studies that observed a reduction in amplitude of motor nerves of upper limbs in different sports.[10,11]

Colak et al. conducted a study on tennis players and reported that the sensory and motor conduction velocities of the radial nerve and the sensory conduction velocity of the ulnar nerve were significantly delayed in the dominant arms of tennis players compared with their non-dominant arms and normal subjects. There were no statistical differences in the latencies, conduction velocities, or amplitudes of the median motor and sensory nerves between controls and tennis players in either the dominant or non-dominant arms.[12]

Waghmare et al. did a study on 30 young adult males in the age group of 20 to 30 years practicing table tennis for at least 1 hour daily for at least 4 days a week for more than six months. They studied motor and sensory nerve conduction velocities of median and ulnar nerves. The study showed that motor and sensory nerve conduction velocities were lower in the dominant hands as compared with the controls.[13]

Soodan et al. did a motor nerve conduction study of the ulnar nerve in the upper extremity and common peroneal nerve in the lower extremity on 60 male athletes comprised of 30 sprinters and 30 distance runners in the age range of 18-25 years. The study showed motor NCV of the ulnar nerve was higher in sprinters than distance runners and motor NCV of common peroneal nerves was higher in runners as compared to the sprinters.[14]

In our study, no statistically significant differences were observed in distal latency and conduction velocities of the common peroneal nerve in active males. However, a study done by Didehdar et al. showed delayed distal latency and conduction velocity of the deep peroneal nerve in football players. The study also showed delayed latency and conduction velocity of the tibial motor nerve.[7]

Our study showed no significant differences in surface EMG variables between the physically active and non-active males. Wu et al. did a study to investigate the effect of prolonged running on lower limb muscle activity and found that average maximum amplitude rectus femoris, tibialis anterior, and gastrocnemius were significantly increased during running as compared to before running.[15]

The decrease in nerve conduction velocity and sensory amplitude associated with increasing age has been well documented by Buchthal et al.[16] Subjects with older age had longer latencies, smaller amplitudes, and slower velocities compared with those in the younger age group.[17] In our study there was a significant positive correlation between the age with the distal latency of the right common peroneal nerve while a significant negative correlation for right distal amplitude.

Stetson et al. found a positive correlation of median, ulnar and sural nerve distal latencies with height and a significant negative correlation between height with amplitudes of the same nerves.[18] And in our study we found right and left common peroneal nerve proximal latency showed a significant positive correlation with height.

Chaurasia et al. found the median motor nerve conduction had an inverse association with BMI.[19] Buschbacher conducted a study on 253 subjects to determine the effect of body mass index in nerve conduction study and found that the sensory and mixed nerve amplitudes decreased by 20-40% in obese subjects when compared to thin subjects. No correlation was noted between BMI and latency and conduction velocity.[20] In our study, we found a significant negative correlation between right common peroneal nerve distal amplitude and body mass index (BMI).

Falco et al. also found the conduction velocities and distal latencies slowed significantly in deep peroneal, sural and medial dorsal cutaneous nerves with increasing leg length except for tibial distal latency.[21] While in our study we did not find any significant correlation of anthropometric variables with the conduction velocity. Right common peroneal nerve proximal latency was also found to have a positive correlation with lower limb length. Most of the anthropometric variables showed a correlation with latency and amplitude among nerve conduction parameters.

CONCLUSION

It can be concluded from our study that nerve conduction study parameters are affected in physically active individuals. There was a significant increase in left common peroneal nerve distal and proximal amplitudes in case of physically active subjects. Rest all the nerve conduction parameters are comparable between the groups. Similarly, the mean amplitude of MUAP of gastrocnemius muscles was comparable on both sides between the two groups. Also, the recruitment pattern of MUAPs was comparable between the groups. Nerve conduction study parameters also showed a significant correlation with various anthropometric variables. An increase in distal latency and decrease in right distal amplitude of the right common peroneal nerve was seen with an increase in age. Right and left common peroneal nerve proximal latency showed a significant positive correlation with height. Right common peroneal nerve proximal latency was also found to have a positive correlation with lower limb length. There was a significant negative correlation between right common peroneal nerve distal amplitude and body mass index (BMI). We did not find any significant correlation of anthropometric variables with the conduction velocity. There was no correlation between the anthropometric variables and surface EMG. The findings would have been more conclusive if the NCV and surface EMG parameters could be performed just after the completion of activity which was taken as our limitations.

Conflict of Interest: None
Source of Funding: None
Ethical Approval: Approved

REFERENCES

1. Jagga M, Lehri A, Verma SK. Effect of aging and anthropometric measurements on nerve conduction properties-A review. Journal of exercise science and physiotherapy. 2011 Jun;7(1):1-10. https://doi.org/10.18376//2011/v7i1/67617.
2. Hendriksen PH, Oey PL, Wieneke GH, Bravenboer B, Van Huffelen AC. Subclinical diabetic polyneuropathy: early detection of involvement of different nerve fibre types. Journal of Neurology, Neurosurgery & Psychiatry. 1993 May 1;56(5):509-14. https://doi.org/10.1136/jnnp.56.5.509.
3. Preston DC, Shapiro BE. Basic nerve conduction studies. Electromyography and Neuromuscular Disorders”. Boston: Butterworth-Heinemann. 1998:26-56. https://doi.org/10.1016/b978-1-4557-2672-1.00003-9.
4. Misulis KE, Head TC. Nerve conduction study and electromyography. In “Essentials of Clinical Neurophysiology” 3rd Ed. Pioli SF (eds). Butterworth- Heinemann, 2003; 987.
5. Colak T, Bamaç B, Gönener A, Özbek A, Budak F. Comparison of nerve conduction velocities of lower extremities between runners and controls. Journal of Science and Medicine in Sport. 2005 Dec 1;8(4):403-10. https://doi.org/10.1016/s1440-2440(05)80055-6.
6. Ross A, Leveritt M, Riek S. Neural influences on sprint running. Sports medicine. 2001 May;31(6):409-25. https://doi.org/10.2165/00007256-200131060-00002.
7. Didehdar D, Jazayeri-Shoshtari SM, Taghizade S, Ghaem H. Decreased nerve conduction velocity in football players. Zahedan Journal of Research in Medical Sciences. 2014 Jun 1;16(6):85-8.
8. Sharma D, Paudel BH, Khadka R, Thakur D, Shah DK, Sapkota NK, Yadav RL, Yadav PK. Nerve conduction studies in lower limb of elite Nepalese football players: an insight into neural adaptations. The Journal of Sports Medicine and Physical Fitness. 2016 Feb 3;57(3):313-8. https://doi.org/10.23736/s0022-4707.16.05941-7.
9. Borges LP, Leitão WC, Ferreira JO, Carvalho LC. Measurement of motor nerve conduction velocity in three different sports. Revista Brasileira de Medicina do Esporte.

2013;19:328-31. https://doi.org/10.1590/S1517-86922013000500005.
10. Paladini D, Dellantonio R, Cinti A, Angeleri F. Axillary neuropathy in volleyball players: report of two cases and literature review. Journal of Neurology, Neurosurgery & Psychiatry. 1996 Mar 1;60(3):345-7. https://doi.org/10.1136/jnnp.60.3.345.
11. Capitani D, Beer S. Handlebar palsy–a compression syndrome of the deep terminal (motor) branch of the ulnar nerve in biking. Journal of neurology. 2002 Oct;249(10):1441-5. https://doi.org/10.1007/s00415-002-0864-4.
12. Colak T, Bamac B, Özbek A, Budak F, Bamaç YS. Nerve conduction studies of upper extremities in tennis players. British journal of sports medicine. 2004 Oct 1;38(5):632-5. https://doi.org/10.1136/bjsm.2003.008029.
13. Waghmare VS, Shesha S, Jiwane R, Sadawarte SK, Rahule AS. Effect of table tennis as recreational sport on upper limb nerve conduction velocity. J ContMed A Dent. 2015;3(1):29-32. https://doi.org/10.18049/jcmad/315.
14. Soodan JS, Kumar A. Motor nerve conduction velocity of sprinters and long distance runners of selected nerves of both upper and lower limbs. Journal of Exercise Science and Physiotherapy. 2011 Dec;7(2):95-8. https://doi.org/10.18376//2011/v7i2/67613.
15. Wu WL, Chang JJ, Wu JH, Guo LY, Lin HT. EMG and plantar pressure patterns after prolonged running. Biomedical Engineering: Applications, Basis and Communications. 2007 Dec;19(06):383-8. https://doi.org/10.4015/s1016237207000483
16. Buchthal F, Rosenfalck A. Sensory conduction from digit to palm and from palm to wrist in the carpal tunnel syndrome. Journal of Neurology, Neurosurgery & Psychiatry. 1971 Jun 1;34(3):243-52. https://doi.org/10.1136/jnnp.34.3.243.
17. Huang CR, Chang WN, Chang HW, Tsai NW, Lu CH. Effects of age, gender, height, and weight on late responses and nerve conduction study parameters. Acta Neurol Taiwan. 2009 Dec 1;18(4):242-9. https://doi.org/10.1002/mus.880151007.
18. Stetson DS, Albers JW, Silverstein BA, Wolfe RA. Effects of age, sex, and anthropometric factors on nerve conduction measures. Muscle & Nerve: Official Journal of the American Association of Electrodiagnostic Medicine. 1992 Oct;15(10):1095-104. https://doi.org/10.5455/njppp.2019.9.0203302022019.
19. Chaurasia H, Kumar A, Prasad A, Taywade O. Influence of age and body mass index on nerve conduction velocity in median nerve and relation among them in the healthy population of Indore region. National Journal of Physiology, Pharmacy and Pharmacology. 2019 Feb 6;9(6):485-. https://doi.org/10.5455/njppp.2019.9.0203302022019.
20. Buschbacher RM. Body mass index effect on common nerve conduction study measurements. Muscle & Nerve: Official Journal of the American Association of Electrodiagnostic Medicine. 1998 Nov;21(11):1398-404. https://doi.org/10.1002/(SICI)1097-4598(199811)21:11%3C1398::AID-MUS6%3E3.0.CO;2-4.
21. Falco FJ, Hennessey WJ, Goldberg G, Braddom RL. Standardized nerve conduction studies in the lower limb of the healthy elderly. American journal of physical medicine & rehabilitation. 1994 Jun 1;73(3):168-74. https://doi.org/10.1097/00002060-199404000-00037

How to cite this article: Siddhartha Kr Shah, Priza Subedi, Rupak Dhakal et.al. Nerve conduction and surface electromyography of physically active healthy medical undergraduates of Nepal. *International Journal of Science & Healthcare Research.* 2022; 7(3): 242-249. DOI: *https://doi.org/10.52403/ ijshr.20220735*

******