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ASSESSING THE IMPACT OF ADIPOSITY ON VELOCITY OF NERVE CONDUCTION

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ABSTRACT

Nerve conduction studies (NCS) are tests to evaluate the nerve function and electrical activity. They are frequently used to assess progression of ailments related to the Nervous System. Physiological factors such as age, height, gender and temperature, are also known to modulate the velocity of nerve conduction. Previous studies indicate that nerve conduction velocity (NCV) decreases with increasing BMI, but the relationship between degree of obesity and NCV or which nerves are most involved remains unclear. Other studies report that nerve conduction velocity (NCV) increases with increasing BMI in underweight category. Effect of obesity in Nerve-Conduction-Studies is of paramount clinical-importance to a Clinical-Neurophysiologist in establishing tighter control data. Thus, this study aimed to analyze the effect of varying adiposity on NCV and to determine the BMI group at which there are significant changes in the values and also to provide electro-physiological data for median nerve in carefully screened healthy adults.

KEYWORDS – *BMI, SNCV, Obesity, MNCV, Neuro-Physiology*

INTRODUCTION

Nerve conduction studies (NCS) are tests to evaluate the nerve function and electrical activity. They are frequently used to assess progression of ailments related to the Nervous System.[1] Physiological factors such as age, height, gender and temperature, are also known to modulate the velocity of nerve conduction.[2,3,4] Previous studies have reported different results with

regard to these physiological factors affecting NCS. Previous studies indicate that nerve conduction velocity (NCV) decreases with increasing BMI, but the relationship between degree of obesity and NCV or which nerves are most involved remains unclear. Other studies report that nerve conduction velocity (NCV) increases with increasing BMI in underweight category. There is little agreement on value ranges for body mass index, and data from older studies are contradictory. The impact of varying adiposity in adult NCS is of importance to the neuro-physiologist in creating rigorous control data. There is an erroneous inclination, however, to use a single reference range of normal values.[5] The impact of obesity on nerve conduction values has seldom been the main focus of a study with a non-uniform sampling of subjects with respect to BMI. Effect of obesity in Nerve-Conduction-Studies is of paramount clinical-importance to a Clinical-Neurophysiologist in establishing tighter control data.

Thus, this study aimed to analyze the effect of varying adiposity on NCV and to determine the BMI group at which there are significant changes in the values and also to provide electro-physiological data for median nerve in carefully screened healthy adults.

MATERIAL AND METHOD

The study undertaken was cross sectional type of observational study planned to record Nerve Conduction Velocity in apparently healthy individuals and to Assess and Compare the Impact of varying adiposity on Nerve Conduction Velocities.

The present study was conducted in the Clinical Physiology and Clinical Pharmacology Lab, Department of Physiology, S.M.S. Medical College, Jaipur (Rajasthan). 105 consenting individuals aged 18-60 yrs were enrolled in the study; provided, they did not suffer from any chronic disease, neurological disorders or peripheral nerve injury. The 105 individuals were divided in 4 groups based on their BMI as follows: GROUP 1 = (Underweight) n = 2 GROUP 2 = (Normal) n = 53 GROUP 3 = (Overweight) n = 43 GROUP 4 = (Obese) n = 7.

TOOL & PROCEDURE – A standard 2-channel physiograph, RMS EMG 2-Channel [SALUS Software] was used for data collection. Stimulation technique was as per institutional criteria with supra maximal current (mA) technique for nerve conduction studies. Wrist-to-elbow distances were measured by a standard measure tape. Sensory nerve conduction velocity (SNCV) and motor nerve conduction velocity (MNCV) of median nerves of both hands for individuals of either handedness. The nerve conduction velocity (NCV) was calculated by dividing the distance between two stimuli with their latency difference.

STATISTICAL ANALYSIS - Results were presented in terms of [Mean +/− SD] m/sec. Unpaired-t Test was used for comparison of conduction velocity between two groups. Statistical significance was set at a P value < 0.05.

RESULTS + TABLES + CHARTS

Mean age of our subjects was 37.11 ± 13.44 years. The mean height of our subjects was 1.69 ± 0.08 meters. The mean weight of our subjects was 71.2 ± 11.30 kg. The mean BMI of our subjects was 24.9 ± 3.65 kg/m2. The Average Motor Nerve Conduction was 59.27 ± 3.25 m/sec. The Average Sensory Nerve Conduction was 59.67 ± 2.71 m/sec.

To study the effect of Body Mass Index on the velocity of Nerve Conduction, we divided the subjects into 4 groups based on their BMI. Out of 105 subjects, 2 were Underweight (Motor NCV - 56.46 ± 8.45, Sensory NCV - 58.54 ± 2.16), 53 were Normal (Motor NCV - 60.11 ± 2.55, Sensory NCV - 60.55 ± 2.17), 43 were Overweight (Motor NCV - 58.57 ± 3.56, Sensory NCV - 58.94 ± 2.93) and 7 were Obese (Motor NCV - 57.92 ± 3.33, Sensory NCV - 57.82 ± 3.3).

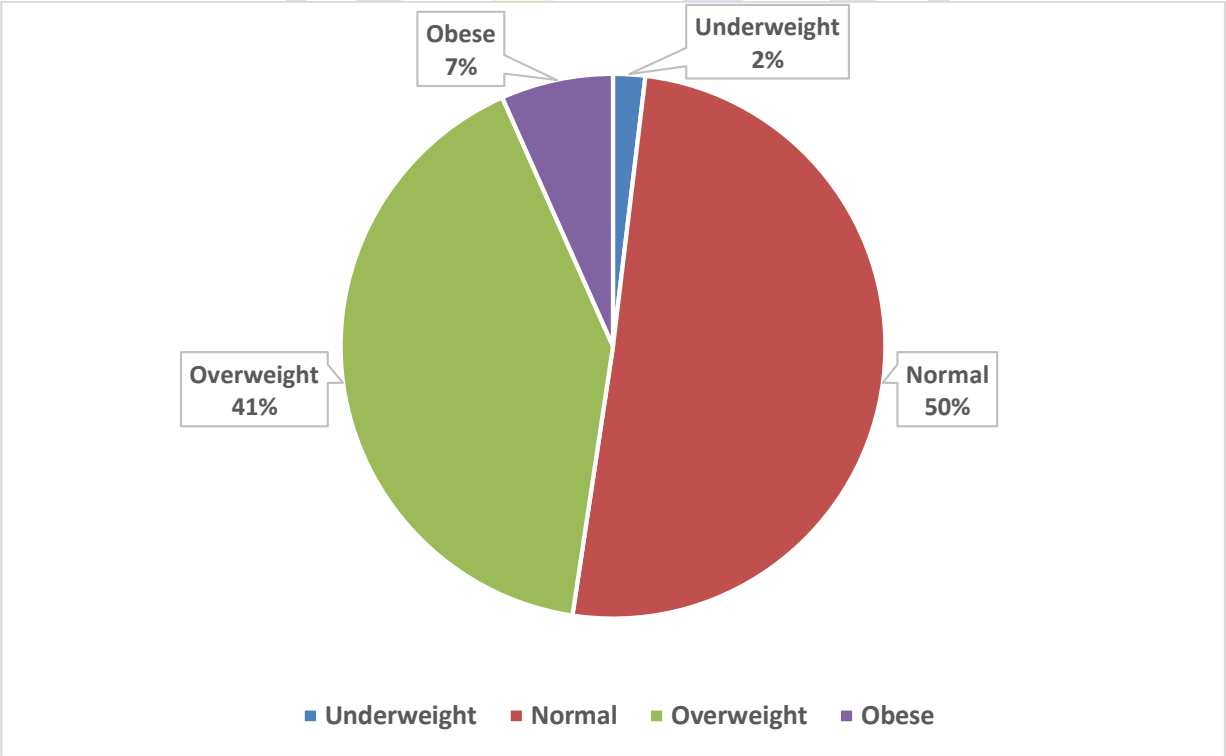

Chart 1 *Distribution of individuals based on their BMI status.*

TABLE 1. Shows Data pertaining to the Average Sensory NCV along with Standard Deviations for BMI segregated groups. Underweight - 2, Normal - 53, Overweight - 43, Obese - 7.

GROUP	N	MEAN	SD	SEM
Underweight	2	58.54	2.16	1.52
Normal	53	60.55	2.17	0.29
Overweight	43	58.94	2.93	0.44
Obese	7	57.82	3.3	1.24

Table 1 *Data pertaining to the Average Sensory NCV along with Standard Deviations for BMI segregated groups.*

TABLE 2. Shows Statistical Analysis for association between Average Sensory NCV and BMI of individual.

SOURCE OF VARIATION	SS	DF	Variance Est (MS)
Between Groups	90.47	3	30.16
Within Groups	675.4	101	6.68
Total	765.9	104	

Table 2 *Statistical Analysis for association between Average Sensory NCV and BMI of individual.*

TABLE 3. Shows Statistical Analysis for association between Average Sensory NCV and BMI of individual. (p=0.005) – There is a statistically significant association of BMI with Average Sensory NCV.

$F = MS_{\text{Between Groups}} / MS_{\text{Within Groups}} = 30.16 / 6.68 = 4.51$
$p = 0.005$

Table 3 *Statistical Analysis for association between Average Sensory NCV and BMI of individual.*

TABLE 4. Shows Data pertaining to the Average Motor NCV along with Standard Deviations for BMI segregated groups. Underweight - 2, Normal - 53, Overweight - 43, Obese - 7.

GROUP	N	MEAN	SD	SEM
Underweight	2	56.46	8.45	5.97
Normal	53	60.11	2.55	0.35
Overweight	43	58.57	3.56	0.54
Obese	7	57.92	3.33	1.25

Table 4 *Data pertaining to the Average Motor NCV along with Standard Deviations for BMI segregated groups.*

TABLE 5. Shows Statistical Analysis for association between Average Motor NCV and BMI of individual.

SOURCE OF VARIATION	SS	DF	Variance Est (MS)
Between Groups	87.01	3	29
Within Groups	1008	101	9.98
Total	1095	104	

Table 5 *Statistical Analysis for association between Average Motor NCV and BMI of individual.*

TABLE 6. Shows Statistical Analysis for association between Average Motor NCV and BMI of individual. (p=0.038) – There is a statistically significant association of BMI with Average Motor NCV.

$F = MS_{\text{Between Groups}} / MS_{\text{Within Groups}} = 29 / 9.98 = 2.91$
$p = 0.038$

Table 6 *Statistical Analysis for association between Average Motor NCV and BMI of individual.*

DISCUSSION

Our observations for association of conduction velocities with BMI: For motor nerve conduction velocity (MNCV), following were the results of ANOVA test – *p*-value = 0.038 (*SS). For sensory nerve conduction velocity (SNCV), following were the results of ANOVA test – *p*-value = 0.005 (*SS). *Kumar Avinash et al (2018)* studied 27 individuals belonging to different BMI categories to assess association of Ulnar and Median nerve motor conduction velocity with BMI of individuals. Their data elucidated a positive correlation between Body Mass Index and ulnar MNCV (p value = 0.027* statistically significant, r = 0.43). Ulnar and

median NCV were also associated (p value = 0.021* statistically significant, r = 0.45), showing the relation of Median MNCV with increasing BMI.[6] Findings in our study are consistent with their study. There is a decrease in both Motor Nerve conduction velocity (*p*-value = 0.038) and Sensory Nerve Conduction velocity (*p*-value = 0.005) with increasing BMI. *Subhabrata Majumdar et al (2017)* 100 subjects aged 18-60 yrs to assess effect of obesity on nerve conduction studies in India. Their data showed a significant difference of MNCV of the right and left median nerve in the obese vs nonobese group (p value < 0.001* Statistically significant), with obese subjects having lower values of velocities of nerve conduction.[7] The findings of their study are consistent with ours, but in contrast to their study, we studied both MNCV and SNCV of left median nerve and right median nerve. In our study, both motor nerve conduction (*p*-value = 0.038) & sensory nerve conduction (*p*-value = 0.005) showed a statistically significant decline with increasing BMI.

CONCLUSION

Our observations showed a statistically significant reduction in both median average Sensory Nerve Conduction Velocity and median average Motor Nerve Conduction Velocity with both increasing and decreasing Body mass index. Comparing the conduction velocities between the four BMI groups, the decreasing trend was well observed in the underweight and obese category individuals. This may be explained in underweight individuals as a possible effect of inadequate myelination of the Peripheral Nervous System due to decreased total body fat stores. The decrease in Nerve Conduction Velocity in obese individuals may be a result of possible free radical induced injuries due to excessive total body fat percentage. Tendency of using single reference range for normal values should be discouraged & there should be different reference range of values for Sensory-NCV & Motor-NCV for different BMI groups so as to provide the clinician a better canvas for patient treatment.

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CONFLICT OF INTEREST: No conflict of Interest.

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