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Association of BMI with Neurodynamics in Healthy Adults: Review

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Abstract: ***Neurodynamics is the science of relationships between mechanics and physiology of nervous system. It is the assessement and treatment of physical health of nervous system. Differentiating the body tissues involved in musculoskeletal pain disorders is a key component of the clinical evaluation. There is association between obesity and increased nerve size which suggests endoneurial oedema as a metabolic mechanism that causes intrafascicular swelling. To review the literature available on Association of BMI with neurodynamics. The reviewed literature was searched using different search engines and different keywords. The Source of the data has been electronic sources (Google Scholar, PubMed, and journals). All the articles were screened for title and inclusion-exclusion criteria. A total of 8 articles with a good level of evidence were included and tabulated revealing their important factors like a year, author, title, method and conclusion. The article published in the English language was included in the study. There is significant correlation of BMI with neurodynamic tests performed clinically for diagnostic as well as therapeutic purpose.***

Keywords: neurodynamic tests, BMI, weight, ULTT.

I. INTRODUCTION

Neurodynamics is the science of relationships between mechanics and physiology of nervous system. It is the assessment and treatment of physical health of nervous system. Differentiating the body tissues involved in musculoskeletal pain disorders is a key component of the clinical evaluation. Neural tissue involvement can be evaluated through tests that assess its physiological and mechanical capabilities. Those tests, known as neurodynamic tests. Neurodynamic tests are considered to be able to detect increased nerve mechanosensitivity.[3] Thus Physical therapists and other healthcare providers use neural tension tests (neurodynamic tests) as part of the clinical examination to help differentiate the underlying pathoanatomic structures. The most common neural tension tests include the straight leg raise test (SLR), the seated slump test (SST), and the upper limb neural tension test (ULNTT).[5]

Nerve conduction study (NCS) results are affected by factors such as gender, age, height, and weight[1]. There is potential for increased measurement error due to greater soft tissue excursion relative to underlying bony landmarks in older people, and excessive adipose tissue relative to underlying bony landmarks in those with a high Body Mass Index (BMI).[5] A nerve may have reduced elasticity and mobility without producing any symptoms. This reduction can be caused by adhesions in the neural tissues or surrounding tissue, which can reduce the mobility of the nerve in its bed. Also, increased volume of interface in overweight individuals may result in decreased sliding of nerves and flexibility is reduced in increased body mass index individuals. There is association between obesity and increased nerve size which suggests endoneurial oedema as a metabolic mechanism that causes intrafascicular swelling.[7]

II. AIMS AND OBJECTIVE

1) *Aim:* To review the literature available on association of BMI with neurodynamics.
2) *Objectives:* To Search the articles using search engines like Google Scholar, ovoid, SAGE, PUBMED, Springer Link, Cochrane, Science Direct, EBSCO Discovery Service, and Web of Science database.

III. MATERIAL AND METHODOLOGY

This narrative review of literature pertaining role in association of BMI with neurodynamics in healthy adults. Keywords were finalized i.e. neurodynamic tests, BMI, weight, ULTT.

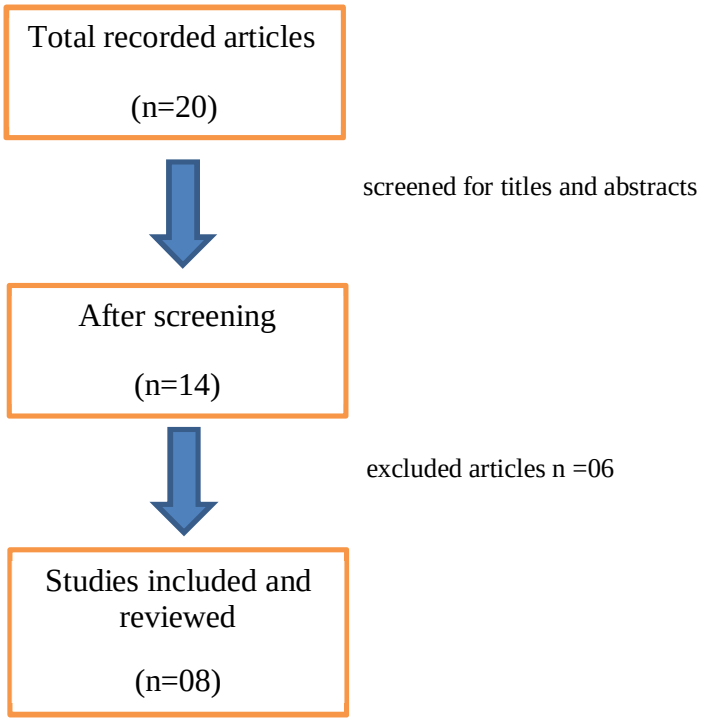
After finalizing the keywords, the literature search was done using various search engines such as Google Scholar, PubMed, ovoid, SAGE, springer link, EBSCO, Discovery service, and web of science database, etc. whenever possible hand search of articles was done in University library and research centre.

The criteria for the inclusion of articles were studied and reports that provide data on association of BMI with neurodynamics in healthy adults. All types of studies like systematic review, meta- analysis, randomized control trials, case series were included. The article published in the English language and having good level of evidence was included in the study.

IV. RESULTS

After finalizing various keywords, and with the help of the search strategy 20 studies were identified from multiple databases. Following the removal of duplicates and the screening of titles and abstracts, a total of 14 potentially relevant studies remained. These studies were reviewed according to inclusion criteria to determine if they should be reviewed, 8 studies remained other 6 studies were excluded from the studies because of their lack of explanation of neurodynamics and BMI.

Searching key words database identification



V. TABLE

SR. NO.	AUTHOR NAME (YEAR)	NAME OF STUDY	METHODOLOGY	CONCLUSION
1.	Azizfatema Munawer Khan and et al (2015)	Comparison of effect of different sensitizing manoeuvres on Slump test in patients with low back pain having normal and overweight Body Mass Index	30 patients having low back pain with or without radiculopathy were divided in two groups, one group (A) had patients with underweight and normal BMI and other group (B) had overweight and obese subjects. Patients with conditions like tumour, osteoporosis, infection, spinal surgery and pregnancy were	The neural tissue mobility was found to be decreased in overweight and obese patients with back pain as compared to patients having underweight and normal BMI.

			excluded. The outcome measure used was the popliteal angle. The readings were taken in four positions with cervical spine neutral with ankle neutral, cervical spine neutral with ankle dorsiflexion, cervical spine flexion with ankle neutral, and cervical spine flexion with ankle dorsiflexion and were compared on both the sides. Thoracic and lumbar spine was maintained in flexion in all positions. Level of significance was kept at 5%.	
2.	Meenakshi Venkateswaran and et al (2014)	Comparison of effect of Different Sensitizing Manoeuvres on Slump test between Normal and Overweight Young Adults	200 young healthy adults within the age group of 20-40 years were randomly selected for the study, of which 100 had a normal B.M.I. i.e. 18.5-24.9 and 100 had overweight B.M.I. i.e. 25-29.9. The outcome measure used was the goniometric active knee extension deficit angle. The readings were taken in four positions namely cervical spine neutral with ankle neutral, cervical spine neutral with ankle dorsiflexion, cervical spine flexion with ankle neutral, cervical spine flexion with ankle dorsiflexion and compared on both sides.	From the study it can be concluded that the neural tissue extensibility was reduced in Overweight young adults as compared to age matched normal young adults. However, in both the groups the active knee extension deficit angle was below 30 degrees which is considered clinically normal.
3.	Chi-Ren Huang et al (2009)	Effects of Age, Gender, Height, and Weight on Late Responses and Nerve Conduction Study Parameters	NCS from the neurological screening tests of 101 individuals without spinal cord, root, nerve, neuromuscular junction, muscular, or systemic diseases were collected and analysed.	the sensitivity and specificity of NCS will decrease when using the same reference data in individuals with different gender, age, height, and weight.

4.	RALPH M. BUSCHBACHER (1998)	Body mass index effect on Common nerve conduction Study measurements.	Two hundred fifty-three subjects had the following NCS tests performed on them: median, ulnar, peroneal, and tibial motor studies; median, ulnar, radial, and sural sensory studies; median and ulnar mixed nerve studies; and H-reflex studies. BMI was calculated as weight (kg) divided by height (m) squared.	The correlation between increased BMI and lower sensory/mixed nerve amplitudes was derived.
5.	Carol Ann Flavell and et al (2017)	Intra-examiner reliability of lumbar spine and neuro-dynamic flexibility measurements in an older and overweight healthy asymptomatic population	Nineteen volunteers (56.00 ± 7.62 years) performed sets of eight lumbar spine examination tests. Five repetitions of each set of tests were conducted with rest periods between sets. One examiner measured lumbar flexion, extension, right and left lateral flexion and rotation using a tape measure. A goniometer was used to measure Slump and Passive Straight Leg Raise (PSLR) test.	This study was conducted on an asymptomatic older, overweight population and the ICC results support the suitability of these methods and tools for measurement in a clinical setting for this population demographic.
6.	ROBERT A. WERNER and et al (2004)	Influence of body mass index on median Nerve function, carpal canal pressure, and Cross-sectional area of the median nerve	27 obese subjects and 16 thin subjects was taken. All subjects were asymptomatic for hand symptoms, and had measurements of median and ulnar sensory nerve conduction in the nondominant hand, ultrasound measurement of the median nerve cross-sectional area proximal to the carpal canal, and carpal canal pressure measurement. There was no difference in age or gender ratio between the obese and thin groups.	Obesity does not influence carpal canal pressure or the size of the median nerve at the wrist. However, there is a strong association between slowed median nerve conduction and increased nerve size which suggests endoneurial edema as a metabolic mechanism; the conduction slowing does not appear to be related to mechanical stress.

7.	Marinko Rade and et al (2015)	Correlation analysis of demographic and anthropometric factors, hip flexion angle and conus medullaris displacement with unilateral and bilateral straight leg raise	Using the same methods as in our previous MRI studies, we further investigated whether any correlations existed between age, height, weight, BMI or hip flexion angle and magnitude of conus medullaris displacement with the unilateral and bilateral SLR.	the degree of hip flexion may have strong predictive values for magnitude of neural displacement. Magnitude of conus medullaris displacement in response to unilateral and bilateral SLRs is not likely to be predicted from easily clinically collectable measures such as age, height, weight and BMI. This study offers information relevant to investigation of prediction of neuromechanical responses in neurodynamic tests.
8.	MARK E. LANDAU et al (2005)	Effect of body mass index on ulnar nerve Conduction velocity, ulnar neuropathy At the elbow, and carpal tunnel syndrome	Retrospectively analysed the electro diagnostic records of control patients, UNE patients, and CTS patients. The BMI was calculated for 50 patients with a sole diagnosis of UNE and compared to the BMI of 50 patients with CTS and 50 control subjects.	Across-elbow (AE) ulnar motor NCV may be falsely increased in patients with a high BMI, relatively slender individuals have comparatively slower AE ulnar NCVs

VI. DISCUSSION

From the review of 2 articles neural tissue extensibility was reduced in over weight and obese patients (back pain) as compared to patients(back pain) having normal and underweight BMI and neural tissue extensibility was affected in overweight young adults as compared to age matched normal young adults.

Same studies stated increased volume of interface in overweight individuals result in decreased sliding of the nerves and flexibility is reduced in individuals with increased body mass index.

Review from other 6 articles stated the correlation of nerve conduction with BMI. These studies found correlation of nerve conduction with gender, age, height, and weight. But Weight shows a substantial correlation with latencies of F-wave and H reflex, where individuals with higher body weights have longer latencies of the median, peroneal, tibial F-wave, and H reflex studies compared to those with lower body weights. There is correlation between increased BMI and lower sensory/mixed nerve amplitudes should be taken into account in clinical practice.

Thus, there is influence of adipose tissue in the epineurium is related to some extent to the amount of body fat, it is conceivable that the amount of such fat affect the conduction of the nerves.

VII. CONCLUSION

There is significant correlation of BMI with neurodynamic tests (slump test and nerve conduction studies)

VIII. FUTURE IMPLICATION

Further studies can be carried out to establish direct correlation of BMI with ULTT and SLR.

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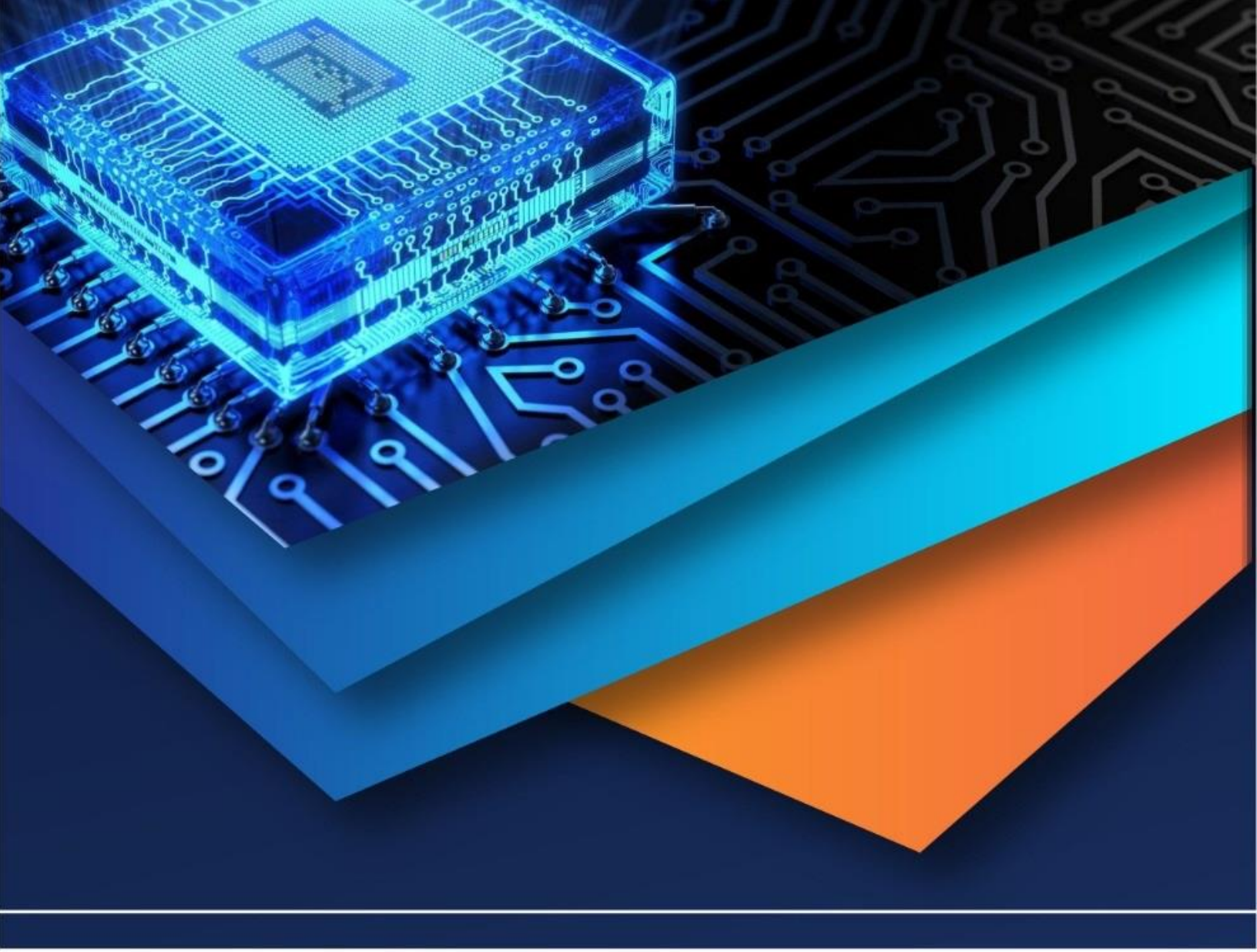

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