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Comparison Of Isometric Hand Grip Strength Among Computer Users and Non- Computer Users and Its Relation with The Incidence of Neck Pain. A Correlational Study

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ABSTRACT
This study explores the comparison of isometric hand grip strength among computer and non- computer users and its relation with the incidence of neck pain.
Background: The use of computers in modern world has made digital environment more accessible. As a result, a large portion of the global population devotes extended periods of time to using computers daily. However, while this widespread adoption of computer technology facilitates various tasks, it has also led to diverse health concerns, especially musculoskeletal disorders. Prolonged and repetitive use of computers, often involving prolonged periods of typing, mouse manipulation, and other fine motor tasks, has raised questions about its potential impact on hand grip strength—a key indicator of upper extremity musculature function Individuals with higher hand grip strength may have relatively better muscle strength and muscle endurance than people with lower higher hand grip strength, which may lower the chances of getting musculoskeletal disorders, including neck pain.
Study Design: A Correlational study
Aim: To identify the comparison of isometric hand grip strength in relation to neck pain among computer and non-computer users.
Objective: To evaluate isometric hand grip strength in relation to neck pain among computer and non- computer users.
Participants: The participants were recruited based on exclusion and inclusion criteria. A total of 70 participants were included in the study.
Method: A correlational study design was conducted on 70 patients from housing societies, like Parsvanatha regalia, Ghaziabad, Vidyamandir classes Delhi. The total sample was randomly divided into two groups, Camry hand dynamometer and neck disability index were used.
Result: In this study both the groups exhibited a negative correlation with each other, when grip strength decreases the neck pain increases, and vice versa. The standard error, which shows how much the sample mean might differ from the true average, was 1.61 for the dynamometer and 0.916 for the NDI. The standard deviation, which measures how spread out the data is, was 9.55 for the dynamometer and 5.417 for the NDI, meaning the dynamometer results were more spread out than the NDI scores. Lastly, the sample variance, another measure of data spread, was 91.26 for the dynamometer and 29.341 for the NDI, supporting the observation that the dynamometer data had greater variability.
Conclusion: This research substantiates the profound connection linking grip strength with neck disability in a manner where individuals with greater grip strength are more likely to have lower neck disability and pain. The statistical negative relationship seen in participants who engaged in computer usage as well as those who did not, reflects the possibility of using hand strength as a non-invasive indicator of skeleton health across diverse groups. There is good evidence in this study to suggest that grip strength may be a viable measure in clinical or preventative applications.

Keywords: NDI, MSD, HAND GRIP STRENGTH, CAMRY HAND DYNAMOMETER

INTRODUCTION:

Work-related musculoskeletal disorders (WRMSDs), also known as occupational musculoskeletal disorders or ergonomic injuries, refer to a group of painful conditions that affect the muscles, tendons, ligaments, and other soft tissues. (1) These disorders are typically caused or exacerbated by repetitive movements, awkward postures, forceful exertions, vibration, or other ergonomic factors associated with the workplace. WRMSDs are a significant occupational health concern as they can result in pain, discomfort, reduced productivity, and long-term disabilities for affected workers. (1)
The use of computers in modern world has made digital environment. As a result, a large portion of the global population devotes extended periods of time to using computers daily. However, while this widespread adoption of computer technology facilitates various tasks, it has also led to diverse health concerns, especially musculoskeletal disorders (MSDs). The most common MSD is neck pain which affects many computer users. Musculoskeletal conditions consist of a wide range of disorders affecting the body's muscles, bones, tendons, ligaments, and other related structures. Prolonged and repetitive use of computers, often involving prolonged periods of typing, mouse manipulation, and other fine motor tasks, has raised questions about its potential impact on hand grip strength—a key indicator of upper extremity musculature function. While some studies suggest that prolonged computer usage might lead to a decrease in grip strength

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due to muscle fatigue and repetitive strain, others postulate that regular engagement with computers could potentially lead to adaptation and enhanced grip strength, as these tasks might serve as low-resistance exercises for the hand muscles.[(2)]Isometric hand grip strength Hand grip strength (HG) has been established as among the most used anthropometric indicators of muscle strength; it shows the maximum force exerted on an object by hand muscles during contraction. HGS is commonly employed as an index for muscle strength and performance and is related with numerous health aspects, such as physical fitness, nutritional state as well as the prevalence of chronic diseases. [(3)] This research topic of integrating HGS and neck pain is quite emerging in the literature. Based on this theory, it could be assumed that individuals with higher HGS may have relatively better muscle strength and muscle endurance than people with lower HGS, which may lower the chances of getting MSP, including neck pain. On the other hand, lower HGS means people may be more susceptible to muscle fatigue and strain which is likely to cause neck pains [(4)]. The justification for comparison of isometric hand grip strength between the population that uses computer and that does not use computer draws its premised from the necessity to establish the prospective impacts of factors associated with the occipital region pain in the distinct categories of employment. [(5)]

Specifically, this study seeks to unravel the contribution of muscle function to neck pain incidence by assessing HGS as one of the attributes of muscle strength and endurances.[(5)] Furthermore, the comparison between these two groups could assist in defining factors associated with particular jobs and determine the causes of neck pain due to computer use and design the ergonomic and therapeutic approach to this problem The scope of this study includes a detailed examination of isometric hand grip strength and its association with neck pain among two distinct groups: and more important the students who do and those who do not have access to computers.[(6)] The measures collected in each study will include HGS using standard procedures in addition to the occurrence of neck pain via questionnaires. Demographic and occupational variables including age, gender duration on the computer and on physical activity level will be considered in the analysis in order to get a full picture of the factors affecting HGS and neck pain. [(2)]

The Camry hand dynamometer is a device that is used as a professional device in training for handgrip strengths which can be used by any physician, physical therapy clinic, occupational therapist engineering lab, or gym. The Camry hand dynamometer is a dynamometer which works on a spring mechanism and is ten times cheaper than the Jamar dynamometer. Camry digital dynamometer is a reliable tool to assess handgrip strength. The Camry handheld dynamometer is a handheld device designed to assess grip strength [(3)]. It is commonly used in various settings, including clinical, research, and fitness environments, to assess the strength of an individual's hand and forearm muscles. The dynamometer typically consists of a sturdy frame with a grip handle and a built-in force gauge that records the amount of force applied by an individual while squeezing the grip handle. [(4)]

The Camry hand dynamometer is often utilized to evaluate changes in grip strength over time, monitor progress during rehabilitation or strength training programs, and gather data for research purposes. It is a convenient and portable tool that provides quantitative measurements of grip strength, which can be useful for assessing overall muscular function and monitoring the effects of interventions on hand and forearm strength. [(3)]

To ensure the achievement of the purpose/goal of this study, a correlational research design was used. The study population consist of individuals categorized into two groups based on their primary occupational activities: computer users and non- computer users. The isometric hand grip strength will be determined with hand dynamometer while the rate of incidence of neck pain will be determined by self-reported questionnaires. Work-related musculoskeletal disorders (WRMSDs) that are being studied are neck pain. Therefore, the target of this research topic is to find connection between isometric grip strength of the hand and incidence of neck pain between computer and non -computer workers

METHODOLOGY:

The total 70 participants included in the study by using the convenient sampling as per inclusion criteria with age 25-50 years, gender both Male and Female, Individuals who are computer and non-computer users, individuals who are willing to participate in the study English/Hindi and exclusion criteria are, those who are pregnant, those who are unwilling to participate and have incomplete data. After the complete purpose, procedure, benefits and consequences of this study was explained to the participants in details. A consent was obtained from each participant. The outcome measures were Neck disability index and Camry hand dynamometer.

Outcome measures:

Camry Handheld Dynamometer

The Camry handheld dynamometer is a portable tool that is used for assess grip strength. It is used in a range of areas: clinical practice, research and fitness in order to estimate the strength of muscles of hand and forearm. Such a device is most often employed in practice as a resistance with a measuring stick which displays the force exerted by the participant holding the handle of grip. [(3)]

NDI

The Neck assessment for Disability (NDI) is a self-reported objective assessment format that measures self-recorded incapacity due to neck pain. It has ten items that inquire about difficulties affecting day to day activities namely personal hygiene, twisting, reading, doing work, driving, sleeping, and recreation. Each response is recorded using a 6-point scale

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ranging from 0 to 5 with 5 being most disability. [5]

Data collection:
The total 70 participants included in the study by using the convenient sampling. The data was collected from housing societies Parsvanatha Regalia, Ghaziabad and Vidyamandir classes, Delhi. Isometric hand grip strength among participants and neck pain was assessed based on participant's history, and using standardized scale i.e., Neck Disability Index (NDI) and Camry hand dynamometer and score were calculated.

DATA ANALYSIS
After completion of all evaluation, results were collected and data were put in the master chart using Microsoft excel and analyzed using the IBM SPSS Software Version 26.0.0. After the data collection, the results of outcome measures Neck Disability Index (NDI) and Camry hand dynamometer were analyzed through IBM SPSS Software Version 26.0.0. for statistical significance result.

RESULT:
Most of the participants, totaling 34 individuals, fall within the 28–37 age group. The next largest segment comprises 27 individuals aged 38–47. Lastly, the smallest representation is seen in the 48–57 age group, with only 9 participants. This distribution highlights a decreasing trend in the number of samples as the age range increases. The metrics help assess and compare the consistency and reliability of the two measurement systems.

Table 1.0 Descriptive Stats of Camry Dynamometer (kg) and NDI of Computer Users:

Stats	***Camry dynamometer(kg)***	***NDI***
Mean	30.177	34.343
Standard Error	1.135	0.714
Standard Deviation	6.716	4.221
Sample Variance	45.109	17.820

Table 2.0 Pearson Correlation of Camry Dynamometer (kg) and NDI of Computer Users:

Pearson Correlations			
		Camry dynamometer (kg)	NDI
Camry dynamometer(kg)	Pearson Correlation	1	-.413*
	Sig. (2-tailed)		.014
	N	35	35
NDI	Pearson Correlation	-.413*	1
	Sig. (2-tailed)	.014	
	N	35	35
*. Correlation is significant at the 0.05 level (2-tailed).			

Table 3.0 Descriptive Statistics of Camry Dynamometer (kg) and NDI of Non- Computer Users:

Stats	***Camry dynamometer(kg)***	***NDI***
Mean	37.63	10.2
Standard Error	1.61	0.916
Standard Deviation	9.55	5.417
Sample Variance	91.26	29.341

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Table 4.0 Pearson Correlation of Camry Dynamometer (kg) and NDI of Non-Computer Users:

Pearson Correlations			
		Camry dynamometer(kg)	**NDI**
Camry dynamometer(kg)	**Pearson Correlation**	**1**	**-.419***
	Sig. (2-tailed)		**.012**
	N	**35**	**35**
NDI	**Pearson Correlation**	**-.419***	**1**
	Sig. (2-tailed)	**.012**	
	N	**35**	**35**
***. Correlation is significant at the 0.05 level (2-tailed).**			

Table 5.0 Comparison of Computer User and Non-Computer User to Check Isometric Hand Grip Strength in Relation to Neck Pain

Pearson Correlations					
Computer User				**Non-Computer User**	
		Camry dynamometer(kg)	**NDI**	**Camry dynamometer (kg)**	**NDI**
Camry dynamometer (kg)	Pearson Correlation	1	-.413	**1**	**-.419***
	Sig. (2-tailed)		0.014		**0.012**
	N	35	35	**35**	**35**
NDI	Pearson Correlation	-.413*	1	**-.419***	**1**
	Sig. (2-tailed)	0.014		**0.012**	
	N	35	35	**35**	**35**
*. Correlation is significant at the 0.05 level (2-tailed).					

These results indicate that stronger hand gripping strength is associated with lower NDI scores, suggesting reduced neck pain or disability. The null hypothesis, which posits no significant relationship between gripping strength and neck pain, is therefore rejected in favor of the alternative hypothesis, which asserts a significant association between these variables in both groups.

DISCUSSION:

The analysis of hand grip strength and neck disability metrics provided valuable insights into the central tendencies, variability, and interrelationships of these measures. The mean gripping strength (30.177 kg) and NDI score (34.343) represent the average performance and disability level, respectively. However, the higher variability observed in gripping strength measurements, as evidenced by its greater standard deviation (6.716) and variance (45.109) compared to NDI (4.221 and 17.820), suggests more heterogeneous hand strength capabilities among participants than their perceived neck disability levels.

A notable result is the weak and negative correlation of gripping strength with NDI scores in both users and non-users of computer with Pearson correlation coefficient values equal to

-0.413 and -0.419 respectively. The negative correlation shows that as one increases their gripping strength, the level of neck pain or disability is mild regardless of whether the individual is a computer user or not. We base our discussion on the statistical values which returned $p < 0.05$ hence allowing for the null hypothesis to be rejected for there exists a positive correlation between these variables.

These findings corroborate the previously existing evidence establishing a solid connection between musculoskeletal and functional outcomes. Several lines of research have established a connection between gripping strength and overall musculoskeletal health. Stronger Gripping strength may also be a physical characteristic of good body conditioning or one with low levels of inflammation in the body which may all help in the maintenance of neck. These findings lead to the conclusion that gripping strength assessment has a potential of being an easy, fast and non-invasive screening method for people who are at an advanced risk of neck disability.

In addition, the strength of the correlation between neck strength and computer users is also equivalent to those who barely use computers which means gripping strength is valuable as a measure neck of health in the general population.

The consistence in different population also ensures that the use of gaged gripping strength measurement is useful in both clinical and non-clinical settings, making it a valuable metric for early intervention and preventive strategies.
As per the previous studies Comparison of hand gripping strength among computer and non-computer users Hiba Sultan Et. al. suggested that computer operators are diagnosed with MSK disorders more often due to weaker hand gripping strength compared to the non- computer operators. (3)
In previous studies results of the Neck Disability Index in patients with mechanical neck disorder Brian. A. Young PT Et. al. said that NDI is very responsive and accurate in measure during disability due to neck pain (4).

CONCLUSION:
In conclusion, this research substantiates the profound connection linking grip strength with neck disability in a manner where individuals with greater grip strength are more likely to have lower neck disability and pain. Since there was a higher variation in grip strength compared to neck disability, that means that participants possessed a wider range of hand strength capabilities. The statistical negative relationship seen in participants who engaged in computer usage as well as those who did not, reflects the possibility of using hand strength as a non-invasive indicator of skeleton health across diverse groups. There is good evidence in this study to suggest that grip strength may be a viable measure in clinical or preventative applications.

LIMITATION OF THE STUDY:
The study was limited to only neck pain, other musculoskeletal conditions were not considered.
Gender specific correlational study was not done.
Other working professionals were not considered for the study.

FUTURE RECOMMENDATION:
Study should be done on other musculoskeletal conditions in relation to hand grip strength.
In future studies intervention protocol can be used instead of cross-sectional protocol.
Other factors may be considered with neck pain like incidence of stress, headache, functional mobility can be included in further studies
Grip strength with incidence of neck pain is not limited to computer users therefore in future studies other professionals should also be considered.

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