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ORIGINAL ARTICLE

Comparison of Isometric Hand Grip Strength among Computer Operators and Non-Computer Operator -, A Cross Sectional Study

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ABSTRACT

Background: Most frequently self-reported work-related illness are due to musculoskeletal disorders. Highly repetitive tasks with grasping of the hands, repetitive flexing of the wrist, vibrations and localized mechanical pressure play a role in development of repeated stress injury. Many computer users complain about wrist fatigue, discomfort or pain after typing.
Aim: To assess and compare isometric grip strength of computer operators and non-computer operators.
Methods: This study was conducted at the Shalimar Institute of Health Sciences. A sample of 30 computer operators and 30 controls (non-computer operators) were recruited after screening hand ultrasonography. Purposive sampling was used. Isometric grip is measured with a hand-held dynamometer. Subjects were asked to hold the dynamometer with full exertion. Each reading is from a maximum contraction period of three seconds with a 30-second pause.
Results: Average Hand Grip Strength of computer operators was 27.71±11.19kg and non-computer users was 37.05±11.09kg. The results were statistically significant with the p-value of 0.002.
Practical Implications: Continuous computer use reduces hand grip strength therefore those who are having long term use of computers must go for hand grip strength exercises to maintain normal hand grip strength.
Conclusion: Computer operators have less isometric hand grip strength than non-computer operators as it was concluded in this study.
MeSH words: Isometric hand grip strength, computer operators, non-computer operator

INTRODUCTION

Maximal force can be measured through isometric grip strength that the one's arm muscle can produce. Isometric hand grip strength can be used as a tool to determine the upper body strength and general fitness. According to a study, grip strength in middle age can predict about the physiological illness of old age and it can also be used to assess overall health status of a patient[1]**.** According to one study, the peak of grip strength is between the ages of 35 and 39, after which HGS decreases in both sexes. Height, BMI and weight were correlated with hand grip strength. The low HGS cutoff values were <28.9 and <16.8 kg in men and women respectively[2].

Grip measurements mostly vary, including average or maximum readings of any of three attempts with any hand or with the dominant one only.[3] Computer operators generally work between thirty five and forty hours per week. According to a study fatigue occur in computer operators who work straight for 4 hours. Fatigue can be known by muscular contraction ability of the forearm through the handgrip before and after work. There are differences in l contraction ability of the fingers and arms before and after working in front of the computer for 4 hours[4]. According to a study, musculoskeletal disorders that are caused by typing are associated with many factors[5].

Long-term computer use can be a risk factor for musculoskeletal relate health problems in computer operators. Most frequently reported disorders were ocular (27.3%), Musculoskeletal (55.8%), and mental disorders (7.1%). There are many health problems in male and female and risk factors for that were age, negative working atmosphere, overtime work, the presence of vibrations, awkward posture at work, noise, chemical and dust in environment. Preventive measures are most affective and necessary for the health of computer operators[6]. In recent studies, significantly stronger hand is dominant hand than the other one, but the dominant hand also fatigues fast so hand grip of dominant hand should be measured for research[7]. Relative endurance and grip strength can contribute to musculoskeletal and occupational injury's cumulative risk. Ergonomists should think about the most important and relevant aspect so that their research and design goals are not related to the strength and endurance of hand only[8].

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MATERIALS &METHODS

A cross-sectional study was conducted at Shalimar Institute of Health Sciences. Participants were recruited according to inclusion and exclusion criteria including computer operators from the institute and other medical staff. This study was conducted from June 2022 to December 2022 after obtaining ethical letter from institutional review board of Shalimar Institute of Health Sciences and as per guidelines of declaration of Helsinki, prior written informed consent was obtained from all the study participants. Female and male between the ages of 18 and 50 were recruited after undergoing detailed ultrasonography of hands to rule out any evidence of myositis, muscle atrophy and fluid collection in hand muscles and those who had any aforementioned pathology were excluded. Conditions of the study were communicated to the subjects prior to giving their formal consent to the research methodology and methods.

A questionnaire was provided to get sociodemographic information, like age, height and weight. Next, the strength of the isometric grip is measured with a hand-held dynamometer, an electrical instrument that measures the strength of the handle. Participants were asked to stand in an anatomical position at the time of measurement. Feet should be upright and kept flat on the ground. The shoulders of the subjects were adducting and the test arms were close to their bodies. Subject was instructed to grip the dynamometer with maximum force. Subjects were encouraged to use maximum grip force by verbal command. Hold the handle for three seconds. Each reading was defined as a maximum contraction period of three seconds with a break of 30 seconds.[9]

Maximum grip strength of 2 readings mean were recorded and was used for sake of statistical analysis.

Statistical Analysis: Data was entered into SPSS version 26 and was dully checked for errors and omissions. Descriptive data including age, gender and qualitative data was assessed in terms of frequencies and percentages and were depicted in pie charts and graphs. Normality of data was checked by employing Shapiro Wilk test and as per of normality Independent Sample t test was used. A p-value less than 0.05 was taken as significant cut off.

RESULTS

A total of 60 participants (27 women and 33 men) with the age range of 18 to 50 years with mean age of 32.47±6.41 (Group 1: computer Operators) v/s 32.53±9.23 (Group 2: Non-computer operators) with no significant age difference. Among computer operators 16(53.3%) were male and 14(46.7%) were female and among non-computer operators 17(56.7) were male and 13(43.3) were females. The results showed that computer operators had hand grip strength of average 27.71±11.19 while non-computer isometric hand grip strength average was 37.05±11.09 as shown in table 1. Males average hand grip strength was 33.2438±12.05 and females average hand grip strength was 21.3750±5.54 suggestive of higher hang grip strength in males.

Table 1. Gender based Comparison of study variables within Study Groups.

Population	Gender	N	Mean	Std. Error Mean
Computer operators				
Age (Year)	Male	16	33.3750±6.51	1.62756
	Female	14	31.4286±6.37	1.70234
BMI (kg/m2)	Male	16	24.8657±2.98	.74471
	Female	14	23.0916±2.49	.66487
Hand Grip Strength	Male	16	33.2438±12.05	3.01241
	Female	14	21.3750±5.54	1.48107
Non-computer operators				
Age (Year)	Male	17	32.2941±9.18	2.22744
	Female	13	32.8462±9.65	2.67669
BMI (kg/m2)	Male	17	24.9094±2.68	.65122
	Female	13	22.8452±1.85	.50634
Hand Grip Strength	Male	17	44.7000±7.10	1.72240
	Female	13	27.0392±6.19	1.71721

Among them males average was 44.7000±7.10 and of females was 27.0392±6.19. The difference between the two groups calculated by applying independent t test and p value obtained was 0.002 (table 2).Average Hand Grip Strength of computer operators was 27.71±11.19kg and non-computer users was 37.05±11.09.The difference was statistically significant (p-value 0.002) as explained in table 2.

Table 2: Comparison of study Parameters in Computer and Non-Computer Operators based on Independent Sample T test.

Parameters	Computer operators	Non-computer operators	p-value
Age (Year)	32.47±6.41	32.53±9.23	0.974
BMI (kg/m2)	24.04±2.86	24.01±2.54	0.974
Reading1	28.53±11.87	36.00±10.73	0.013*
Reading2	26.88±10.82	38.09±11.67	0.001*
Hand Grip Strength	27.71±11.19	37.05±11.09	0.002*

DISCUSSION

This study compared isometric grip of computer operators and non-computer users among workers at Shalamar Institute of Health Sciences. The study recruited 60 participants of age 18 -50 years computer operators **(**32.47±6.41) and non-computer operators (32.53±9.23). This study concluded that computer operators have less isometric hand grip strength than non-computer operators. So, computer operators are more prone to developing MSKs disorders in later stages of life as mentioned earlier hand grip strength in middle age is predictive of physical disability and strength in old age. In a recent review by Cronin et al reported that subjects normally achieved higher maximal isometric handgrip strength values in their dominant hand (mean difference of 0.1% to 16.5%) compared to their nondominant hand. Previous research stated that Muscle strength is found to track over the life span, those who had higher grip strength during midlife remained stronger than others in old age[8].

Grip strength may be proven as marker of physical activity, which itself preserves function and prevents disability. Previous studies reported that low grip strength may indicate subclinical disease, which later developed into clinical disease and disability. Finally, good grip strength may mark some general intrinsic midlife vitality or motivation that tracks into good functional ability in old age[9]. Previous research stated that grip strength in middle age can tell us about the physical disability in old age and also help to evaluate overall health of patient as explained by Hogrel et al. which is in accordance to our study.

In previous studies effects of different posture was seen on hand grip i.e. sitting, lying and standing[10]. This study showed that standing is best position for measuring hand grip strength[11] which we opted for our study as well. As Li et al. demonstrated that position of the elbow that was extended or flexed at 90° did not affect the MGS estimate, these normative values were recorded when the elbow were extended. According to the physiotherapists involved in the clinical study at our center, the straightened elbow gives less compensatory motion. However, not all patients are able to achieve an extended elbow position, for example those with contractures such as those associated with DMD[12].

According to Decostore et al, estimating absolute strength is meaningless without taking into account individual stature. Strength is negatively correlated with muscle mass and, more specifically, the number of muscle fibers working in tandem. A stature index can be useful in determining what should be achieved in relation to the subject's stature in the absence of valid measurements of the biomechanical profile[13].Therefore, the data are obtained in the most optimal position. According to a recent study, due to many risk factors typing is associated with many musculoskeletal disorders[14]. The current study compared isometric hand grip strength among computer operators and non-computer operators which was not done in past.

According to our study computer operators are more prone to developing MSKs disorders as they have less hand grip strength than control group. This study showed significant difference of isometric grip strength of both groups. Hence proved that repetitive work like typing in computer operators can influence hand grip strength more rapidly. As they have decrease strength than non-computer operators of same ages and BMI. But our findings were limited and cannot be generalized due to small sample size and limited resources as other confounding factors were not taken in account.

CONCLUSIONS

The study concluded that computer operators have less isometric hand grip strength than non-computer operators. So, computer operators are more prone to developing MSKs disorders in later stages of life as mentioned earlier hand grip strength in middle age is predictive of physical disability and strength in old age.

Conflict of interest: Nothing to declare

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