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COMPARATIVE STUDY OF HANDGRIP STRENGTH WITH BODY MASS INDEX (BMI) AMONG STUDENTS IN THE FACULTY OF SCIENCE FEDERAL UNIVERSITY DUTSE

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Abstract

The study was conducted at Faculty of science, Federal University Dutse, Dutse LGA, Jigawa State Nigeria. Using random sampling, a total of 500 Students of Federal University Dutse, faculty of Science were assessed. These were categorized into male and female. A cross-sectional descriptive study of 500 adolescents attending Federal University Dutse, Faculty of Science, in Northwestern Nigeria was carried out to examine the association of HGS with the BMI. It was observed that the hand grip strength in both males and females are significant as the value of p is <0.05 . The estimation of right handgrip strength with age, and it has shown that it have no significance because $p=0.058$. The estimation of left handgrip strength with age, and it has shown that it has significance because the value of $p=0.0174$. The right handgrip strength was higher in males than females. The handgrip strength was not always higher with respect to age. Having higher BMI does not determine higher grip strength and vice versa.

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Introduction:-

Recently, it has been used as an indicator of nutritional status, especially for hospitalized patients. Bohannon summarized the literature addressing the value of grip strength as a predictor of important outcomes [1]. For example, the HGS of cirrhotic patients was found to be significantly low compared to predicted values based on age. Many studies have correlated grip strength to various other physical variables including nutritional status, rotator cuff weakness, fatigue, and overall physical function

Also found a correlation between grip strength and performance in American men's junior weightlifting [2]. Reduced grip strength was independently associated with dementia in an older Korean population. Recently, HGS has also received attention from the industrial sector. Although economic and industrial development has increased

the use of automated systems, operations requiring manual skills cannot be completely avoided. Therefore, workers are continually required to learn how to operate various types of hand tools and equipment.

The hand exerts three main types of force: grip, pinch, and torque. Of these, grip, with relevant control-of-force applications, is the most frequently used? HGS is a critical source of power for work-related operations. Ergonomics and patient diagnostic research on HGS have focused particularly on the grip's maximum volitional contraction (MVC). For example, Liao demonstrated that MVC is relevant to the performance of tasks involving hand-eye coordination [3], which is a crucial skill that allows humans to grasp, grip, and manipulate. A stronger HGS indicates a firmer grasp or grip. Research has also focused on the mechanisms of HGS in relation to industrial safety and tool design. Kong et al. showed HGS to be related to the distance between an individual's fingers, the length of the fingers, and their interaction [4].

Grant et al.[5] indicated that a tool handle's diameter affects force application. Carey and Gallwey showed that the level of HGS varies significantly according to factors such as age, sex, physique, posture, and duration [6]. Hallbeck and McMullin [7] showed that the HGS of females is weaker (approximately 74% in their study) than that of males.

Abu-Ali et al.[4] demonstrated that carpal tunnel syndrome (CTS) and other cumulative trauma disorders (CTDs) are affected by HGS. Lu et al. argued that the pipette task is affected by hand strength [8]. HGS, therefore, has significant implications in rehabilitation outcomes and is a predictor of work capacity. Results of studies on HGS can provide useful information for patient filtering, selection of personnel, and work designs.

Materials and Method:-

Area of Study

The study was conducted at Faculty of science, Federal University Dutse, Dutse LGA. Jigawa State Nigeria

Population of the Study

Using random sampling, a total of 500 Students of Federal University Dutse, faculty of Science were assessed. These were categorized into male and female

Research design

A cross-sectional descriptive study of 500 adolescents attending Federal University Dutse, Faculty of Science, in Northwestern Nigeria was carried out to examine the association of HGS with the BMI.

Sample size determination

The sample size of this study was obtained using the formula

$$N = Z^2pq/d[9]$$

The minimum sample size for the categorical data was established using the Cochran's sample size formula, at an alpha level of 0.05 and power of 95% ($n = z^2pq/d^2$, where; n = the sample size, z = standard normal deviate, p = proportion in the target population expected to have the required characteristics, $q = 1-p$) (proportion in the target population not having their required characteristics, d = degree of accuracy required, which was set at 0.05 level) (35,36). The sample size values were achieved based on per 1000 determination

$$N = 1000$$

Inclusion criteria

The inclusion criteria for the study were

1. Age between 17 and 25 years old and
2. healthy and free of illness (i.e., hand pain, osteoarthritis, and rheumatoid arthritis).

Exclusion criteria

The exclusive criteria were

1. Age below 17 and those above 25 years old
2. physical deformity or having ailments.

Ethical Considerations

The study protocol was reviewed and approved by the Department of Human Anatomy, Yusuf Maitama Sule University, Kano and from the Federal University Dutse, from Faculty of science FUD. Before data collection, the nature and scope of the study were explained to the Subjects, who gave written informed consent.

Anthropometric measures

Body mass and height measurement follow the standard procedures as prescribed by Marfell-Jones et al., Body mass was measured to the nearest 0.5 kg, while on a Frankfort position using Seca mass-height Scale, Hamburg, Germany. Height was measured barefooted to the nearest 1.0 cm. BMI was calculated using the formula weight (kg)/height (m²).

Statistical Analysis

The data were cross-checked for normality by means of the Shapiro-Wilk test. For significant disparities in HGS between the LHGS and the RHGS, a paired sample t-test was used. Subsequently, two-way ANOVA was computed to ascertain if age and gender have significant effect or interaction on HGS of the participants. Similarly, the Tukey's Honest Significant Difference (HSD) test, is a post-hoc test based on the studentized range distribution, was computed to analyze specifically where the differences lie and the groups' means (compared with each other) are different.

A sequence of independent sample t-test was also computed to ascertain the disparities between the genders' based on the age group to determine age and gender difference HGS. Similarly, percentiles based on a class interval of five were computed to establish the values for RHGS and LHGS based on the age-group analysis. In addition, the Pearson product-moment correlation (PPMC) was computed to ascertain the correlation between HGS and BMI. All statistical analyses were computed using the IBM-SPSS (version 24) software for Windows.

Results:-

Table 1 shows the Descriptive Statistics of comparative study of Handgrip strength with body mass index (BMI) among Students of faculty of science, Federal university, Dutse Jigawa State. The mean AGE was found to be 21.15±2.40 while the minimum and maximum values for AGE were 17 and 25 respectively. The mean arm length was found to be 28.52±3.74 while the minimum and maximum values for arm length were 20 and 37 respectively. The mean FAL was 28.43±2.90 while the minimum and maximum values for forearm length were 22 and 35 respectively. The mean BMI was 20.40±3.70 while the minimum and maximum values for BMI were 12.90 and 39.76 respectively. The mean RHGS was 30.90±9.99 while the minimum and maximum values for LHGS were 13.10 and 57.60 respectively. The mean RHGS was 30.29±9.99 while the minimum and maximum values for LHGS were 13.30 and 60.40 respectively.

Table 2: shows the sexual dimorphisms of comparative study of Handgrip strength with body mass index (BMI) among Students of faculty of science, Federal university, Dutse Jigawa State. It was observed that the hand grip strength in both males and females are significant as the value of p is <0.05

Table 3 Shows the estimation of right handgrip strength with age, and it has shown that it have no significance because p=0.0581

Table 4 Shows the estimation of left handgrip strength with age, and it has shown that it has significance because the value of p=0.0174

Table 1:- Descriptive Statistics of comparative study of Handgrip strength with body mass index (BMI) among Students of faculty of science, Federal university, Dutse Jigawa State.

Variables	N	Minimum	Maximum	Mean± SD
AGE	200	17	17	21.15±2.40
AL	200	20	37	28.52±3.74
FAL cm	200	22	35	28.43±2.90
BMI	200	12.90	39.76	20.40±3.70
RHGS	200	13.10	57.60	30.90±9.99
LHGS	200	13.30	60.40	30.29±9.99

NOTE: Arm length (AL), forearm length (FAL), Body mass index (BMI), Right hand grip strength (RHGS) and Left hand grip strength (LHGS)

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Table 2:- Result of sexual dimorphisms of comparative study of Handgrip strength with body mass index (BMI) among Students of faculty of science, Federal university, Dutse Jigawa State.

Variables	SEX	NO.	Mean	SD	t-value	p-value
RHGS	FEMALE	102.00	29.44	10.22	-2.06	0.04
	MALE	98.00	32.33	9.57	-2.06	0.04
LHGS	FEMALE	102.00	28.62	10.41	-2.44	0.02
	MALE	98.00	32.03	9.28	-2.45	0.02

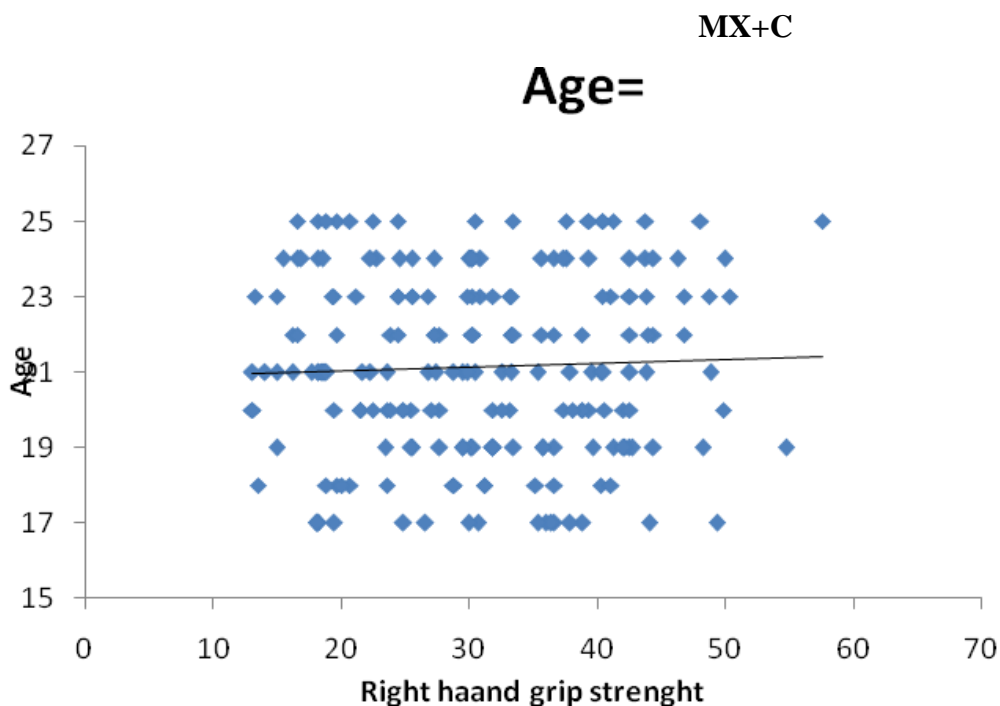
RHGS=Right hand grip strength and LHGS=Left hand grip strength

Table 3:- Estimation of RHGS with age using linear regression analysis, of comparative study of Handgrip strength with body mass index (BMI) among Students of faculty of science, Federal university, Dutse Jigawa State.

STEP	Y=MX+C	R	R ²	SEE	t	P
1	RHGS=0.009AGE+20.859	0.039	0.002	2.408	0.553	0.581

Table 4:- Estimation of LHGS with age using linear regression analysis of comparative study of Handgrip strength with body mass index (BMI) among Students of faculty of science, Federal university, Dutse Jigawa State.

STEP	Y=MX+C	R	R ²	SEE	t	P
1	LHGS=0.023AGE+20.448	0.096	0.009	2.398	1.363	0.174





Discussion:-

Most prior studies have attempted to associate HGS with anthropometric variables to predict the outcome of the former [6]. Several factors affect HGS performance, including sex, age, height, weight, and handedness (Liao, 2014). Body weight and stature (body height) are primary indicators of human growth, particularly for children. There are highly significant relationships between maximal HGS of the dominant hand and general anthropometric variables in all age groups [10]. The adolescent growth curve peaks at 15 years of age for both males and females in Taiwan.

The present study shows that the sexual dimorphism was observed that the hand grip strength in both males and females are significant as the value of p is <0.05 and the estimation of right handgrip strength with age, and it has shown that it has no significance because $p=0.0581$ and the estimation of left handgrip strength with age, and it has shown that it has significance because the value of $p=0.0174$. Shih et al. also indicated that grip strength was related to the heights of hand elbows. Luna-Heredia et al found that grip strength in healthy people correlated positively with stature [11], while Liao reported that HGS corresponded effectively to stature and weight [6]. However, only a few studies have focused on the correlation between the ratio of weight and stature squared (meter^2), or between BMI and HGS. Since understanding the relationship between BMI and HGS can benefit hospitalized patients and industrial operators [12], this study statistically analyzes the relationship between these two variables. The Descriptive Statistics of comparative study of Handgrip strength with body mass index (BMI) shows the mean AGE was 21.15 ± 2.40 while the minimum and maximum values for AGE were 17 and 17 respectively. The mean arm length was 28.52 ± 3.74 while the minimum and maximum values for arm length were 20 and 37 respectively. The mean forearm length was 28.43 ± 2.90 while the minimum and maximum values for forearm length were 22 and 35 respectively. The mean BMI was 20.40 ± 3.70 while the minimum and maximum values for BMI were 12.90 and 39.76 respectively. The mean RHGS was 30.90 ± 9.99 while the minimum and maximum values for LHGS were 13.10 and 57.60 respectively. The mean RHGS was 30.29 ± 9.99 while the minimum and maximum values for LHGS were 13.30 and 60.40 respectively.

Conclusion:-

The right handgrip strength was higher in males than females. The handgrip strength was not always higher with respect to age. Having higher BMI does not determine higher grip strength and vice versa.

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