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Measurement of Reliability in Grip Strength

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Abstract: **Research techniques are a form of collecting and Interpreting data depending on the nature of the research. It is a planned Procedure, not a spontaneous one. It is focused and limited to a specific Scope [(7)]. This study explains and discusses the procedure and Technique used to check the reliability of grip strength instrument (T.K.K. 5710, Grip-D Takei, Tokyo, Japan [Takei Scientific Instruments Co. Ltd]). Experimental design of single-Group repeated measurements. For the purpose of study, a total of 27 participants took part in the grip strength test. All of them are students of a university. The test was held during class hours. To perform the hand grip strength test a digital Dynamometer (T.K.K. 5101, grip-D Takei, Tokyo, Japan [Takei Scientific Instruments Co., Ltd]) is used.**
The data of week 1 and 2 is analyzed using SSPS. Descriptive Statistics was used for exploring the data along with normality test. It can be concluded that validity is more important than Reliability because if an instrument does not accurately measure what it is Supposed to, there is no reason to use it even if it measures consistently.

Keywords: **Grip strength, reliability, validity and instrument.**

I. INTRODUCTION

Research techniques are a form of collecting and interpreting data depending on the nature of the research. It is a planned procedure, not a spontaneous one. It is focused and limited to a specific scope [(7)].There are certain
Procedures in the research process which are always done in order to get the
Most accurate results. Reliability and Validity are the two important concepts in the field of research analysis. Reliability can be defined as, the extent to which the same result is achieved when a measure is repeatedly applied to the same group [(7)].Validity refers to the degree to which a study accurately reflects or assesses the specific concept that the researcher is attempting to measure [(4).] Reliability is concerned with the accuracy of the actual measuring instrument or procedure while as validity is concerned with the study's success at measurement [(2)].All the measurements that are made during the research technique should be reliable and valid. Reliability and validity both form a continuum. Validity forms mainly of two parts: internal and external validity. Reliability and validity are relevant research concepts, particularly from a quantitative point of view; have to be redefined in order to reflect the multiple ways of establishing truth. This study explains and discusses the procedure and technique used to check the reliability of grip strength instrument (T.K.K. 5710, Grip-D Takei, Tokyo, Japan [Takei Scientific Instruments Co., Ltd]). Various tests used during the study are, coefficient of variation (CV), paired t-test and limits of agreement.

II. METHOD

For the purpose of study, a total of 27 participants took part in the grip strength test. All of them are students of a university. The test was held during class hours. The participants are fully informed of the purpose and possible risks and benefits of the study before giving their written consent. A brief presentation of the test was demonstrated to the students before starting the actual one.

III. INSTRUMENT

To perform the hand grip strength test a digital Dynamometer (T.K.K. 5710, grip-D Takei, Tokyo, Japan [Takei Scientific Instruments Co., Ltd]) is used. Unit of measuring strength is kilogram (kg).

Specifications:

1. Measuring range: 0 kg to 100 kg
2. Dimensions: Approx. 154(W) × 240(D) × 60(H) mm
3. Weight: Approx. 0.65 kg

IV. PROTOCOL

The test was performed at the University laboratories. Test and retest ware held exactly after an interval of one week. Mathiowetz et al found no significant differences in grip measures when using 15, 30 and 60 second rest periods between measurements [6].Hence there was no standard resting period between the trials. Each participant repeated the test three times. The test was performed with both the hands. Each participant was asked to stand straight with their head up and arms resting in the neutral position. The participant holds the digital dynamometer in their hand and grips the bar with his fingers. The participant was told to raise his/her arm above the head sideways without putting any pressure on the dynamometer. The participant then brings the arm down with elbows fully extended in sideways position and simultaneously exerts maximum force on the dynamometer. Once the arm is inline with the body the pressure is released. The readings are noted. After each participant has given three trials the highest among them is taken. It has been found that circadian rhythm has a significant affect on the isometric strength of an individual. Hence the retest was followed at exactly the same time as the first one. The tests are done randomly. Correlation among the test-retest values is also done. In this procedure of test-retest, reliability is administered with the same test being carried out to the same people on two different occasions. There being no substantial change in the construct between the two occasions.

V. STATISTICAL ANALYSIS

The data of week 1 and 2 is analyzed using SSPS. Descriptive statistics was used for exploring the data along with normality test. Difference variable can be obtained by using transform and compute options. Absolute variance can be obtained by removal of all the negatives from the difference. Using transform and compute the mean value of week 1 and 2 was obtained. In order to check for any significant difference between the measurements of week 1 and 2 taken by the handgrip dynamometer a paired sample t-test was done. Paired t-test gave the systematic difference between tests of week 1 and 2.

Coefficient of Variation (CV), paired t-test and limits of agreement are used in the statistical analysis. Coefficient of variation was calculated where the Standard deviation of the data in paired t-test is divided by the grand mean and multiplied by 100 [(1)]. The CV of 10% might be considered an indicator of acceptable agreement [(1)].

Table 1. Mean Values

	Week 1	Week 2	Difference
Mean Value	37.9389	38.0759	-.1370

In table1, the mean values of week1, week 2, difference and frequency is shown.

VI. RESULTS

Table 2. Descriptive Statistics of week 1 and 2

			Statistic	Std. Error
Week 1	Mean		37.9389	1.29309
	95% Confidence Interval for Mean	Lower Bound	35.3453	
		Upper Bound	40.5325	
	5% Trimmed Mean		37.9272	
	Std. Deviation		9.50222	
Week 2	Mean		38.0759	1.26009
	95% Confidence Interval for Mean	Lower Bound	35.5485	
		Upper Bound	40.6033	
	5% Trimmed Mean		38.3364	
	Std. Deviation		9.25971	

Table 2 shows descriptive statistics of week 1 and 2, giving mean value, 95% confidence interval for mean (lower and upper bound), 5% trimmed mean value and standard deviation.

By looking at the histogram it can be seen that the data is normally distributed. The histograms do not show any major lateral deviation.

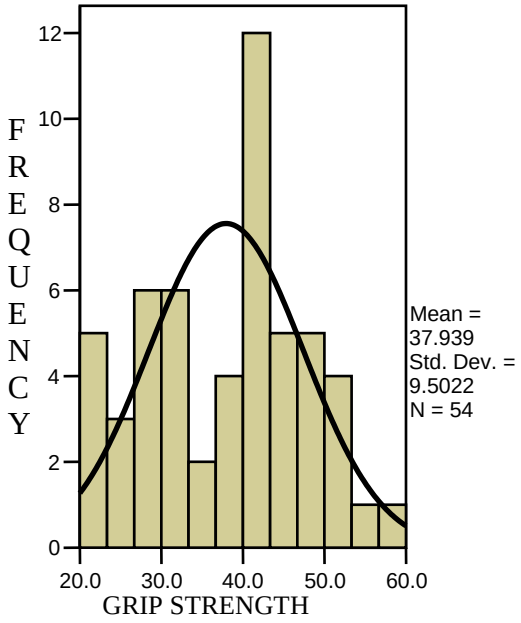

Figure 1.1, Week 1 histogram with Normal curve.

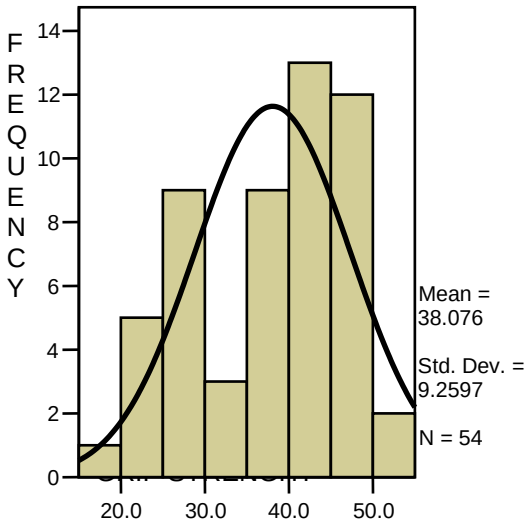

Figure 1.2, Week 2 histogram with normal curve

Table 3, Test of Normality

	Kolmogorov-Smirnov		
	Statistic	df	Significance
Week 1	.129	54	.025
Week 2	.150	54	.004

In order to get the confirmation of results, further Normality Test (Kolmogorov-Smirnov statistic) was done. The value of significance should be greater than .05 for the data to be normally distributed. In case of week 1 and 2 the values are .025 and .004 respectively, hence confirming that the data is not normally distributed.

Table 4. Paired Samples Test

	Paired Differences					t	df	Sig (2-tailed)	Paired Correlation	
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference						
	m	sd		Lower	Upper				Correlation	significance
Week 1-Week2	-.137	3.00988	.40959	-.95858	.68450	-.33	53	.739	.949	.000

Table 4 represents the paired sample test. The table includes values of paired differences in mean, standard deviation, standard error mean, lower and upper values of 95% confidence interval of the difference of freedom and probability value (significance 2 tailed). The value of probability being .793 which is greater than .05, representing that there is no significant difference between the readings of week 1 and 2. The table also gives values of paired differences in mean (m), standard deviation(sd), standard error mean, upper and lower values of 95% confidence interval of the difference, t-value, degree of freedom (df), probability value -2 tailed and paired correlation (correlation and significance). Perfect positive correlation can be seen as the value of correlation is .949, which is significantly close to 1.0[(3)].Hence confirming a strong correlation between the two variables.

Co- EFFICIENT OF VARIATION (CV):

The values for co-efficient of variation (CV) can be obtained by using the following formulae:

$$CV = \frac{\text{standard deviation of difference}}{\text{Grand Mean}} \times 100$$

Substituting the values,

$$= \frac{3.00988}{38.0074} \times 100 = 7.91\%.$$

LIMITS OF AGREEMENT:

In order to calculate limits of agreement, significant difference between the test and retest was calculated. The value comes out to be 3.00988. This is then multiplied by 1.96 to obtain the 95% random error component. Value comes out to be 5.899. The mean value of difference is -0.137. Limits of error can be formed by adding or subtracting random error from significant difference.

Mean $\pm$ 5.899

So, limits of agreement have the following 2 values.

-.137 – 5.899 = -6.036

-.137 + 5.899 = + 5.762,

Hence, it can be stated that the limits of agreement are -6.036 to +5.762.

VII. DISCUSSION

Results of the present study provide test–retest reliability estimates for commonly used grip strength measures for a group of university participants. In determining the reliability and validity of research, reducing error is of prime concern [(4)].The test-retest estimator is especially feasible in most experimental designs that use a no-treatment control group. These designs always have a control group that is measured on two occasions (test and retest). Test-retest reliability is an index of score consistency over a brief time period. By keeping the participants and test–retest intervals constant across test variables, this study provides information about the comparative reliabilities of the various measures. The study also provides an estimate of the error variability and standard deviation of the change. Errors of any kind need to be decreased which consequently will lead to an increase in accuracy and consistency of the instrument and the test scores on the whole. A perfect correlation (r = 1.0) would indicate that the instrument is entirely consistent across the two occasions [(5)]. The coefficient of variation is cited as a measure of reliability, since the reliability of different tools can be compared [(4)]. Reliability is expressed by the correlation coefficient which ranges from 0 to 1. For scores of correlation coefficient nearer to 1, it depicts the data being more reliable. After doing the paired t-test, the data appears to be reliable as the value of correlation is 0.949 being nearer to 1. Therefore, after seeing the results it can be stated that the instrument, digital dynamometer (T.K.K. 5101) is reliable. The results collected from correlation value (.949), coefficient of variation (7.91%) and limits of agreement values signify that the instrument is reliable. Any kind of score change could be caused by day to day fluctuation in the performance, or the participant's recollection of the administration. One of the drawbacks with this approach is that it does not have any information about reliability until the retest is done and, if the reliability estimate is low, the test is pretty much of a failure. It can be concluded

that validity is more important than reliability because if an instrument does not accurately measure what it is supposed to, there is no reason to use it even if it measures consistently.

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Conflict of intrest:

It requires further more Research and emphasis on the measurement of reliability as many instruments are available from many companies.

So measuring with good reliable instrument is required for accurate data.

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Ethical clearance:

Ethical committee, University of Wolverhampton, Walsal campus, Walsal, Wolverhampton, United Kingdom.

REFERENCES

1. Greg Atkinson and Alan M. Nevill, Oct 1998. *Statistical Methods For Assessing Measurement Error (Reliability) in Variables Relevant to Sports Medicine.Sports Medicine*; 26 (4): 217-238
2. Golafshani, N. (2003). *Understanding Reliability and Validity in Quantitative Research.*
3. Pallant, J. (2001) SPSS survival manual: *A Step By Step Guide to Data Analysis using SPSS for Windows* (version 10).
4. Sureyya S. Dikmen, Robert K. Heaton, Igor Grant and Nancy R. (1999), Timkien, *Journal of the International Neuropsychological Society*, (5), 346–356.
5. Thomas J R and Nelson J K (2001). Research Methods in Physical Activity. 4th edition. Human Kinetics.
6. Trossman, P. B., & Li, P. W. (1989). The effect of the duration of intertrial rest periods on isometric grip strength performance in young adults. *Occupational Therapy Journal of Research*, (9), 362-378.
7. Vincent, W.J. (1999) *Statistics in kinesiology.* 2nd edition, Champaign, ILL: Human Kinetics.
8. http://ags.pearsonassessments.com/assessments/retest.asp