Journal of Advances and Scholarly Researches in Allied Education
Vol. 20, Issue No. 2, April-2023, ISSN 2230-7540

Analysis of Rate of Change of Strength in Elite Class Indian Judokas with Respect to Anthropometric Variables

Shubham Pal[1*], Dr. Vinita Bajpai Mishra[2]

[1] Research Scholar, L.N.I.P.E. Gwalior

[2] Associate Professor, L.N.I.P.E. Gwalior

Abstract - The present study was conducted in an attempt to quantify the rate of change of muscular strength with respect to 1 unit change in circumference of that particular group of muscle. To achieve the objectives of the study 52 Judokas were recruited to the study of age 22±3.21y. Judokas with training age ≥5 years, had experience of playing at national level tournaments and above took part in the study voluntarily. Subjects performance was tested on 2 strength variables (bench press and leg strength), and 3 anthropometric variables (chest circumference, thigh circumference, and calf circumference). Regression analysis was used as statistical tool for computation the data. Level of significance was set at 0.05 for whole analysis. Results of the analysis suggests that predictor variable chest circumference alone is capable of explaining 71% change in performance of bench press. In another multiple regression analysis it was noted that 89% change in performance of leg strength can be claimed by two anthropometric variables namely thigh circumference, and calf circumference.

Keywords - Anthropometry, Strength variable, Regression analysis, Judokas

----------X----------

INTRODUCTION

Achieving sports excellence is the top most priority of all the allied disciplines closely associated with sports. Working with one coach with all traditional diet and reaching to the top, attaining grand victory at international level of tournaments has now become a thought of past. A team of expert use to assist an athlete who is preparing for such international level tournament. The world of sports has now been completely changed from equipment(s) to coaching styles, from athlete preparation to level of administration, we have observed so many changes. To coup with demands of international level our government is also taking worthwhile steps. They are funding athletes through various schemes. They are also working on empowering good administrative and training staff for the same.

"Coming events cast their shadows before" This line fits better in case of anthropometric measurements and level of muscular strength. If rest of factors assured constant muscular strength improves as with its circumferential growth. In most of the combat sports where contest are decided according to body weight and age, anthropometric variables act as whistle blower of muscular strength. As it is described in so many Physiology texts that 1 square centimeter cross sectional area of muscle can exert approximately 30 – 40 newtons of force. The present study provides answer to how much change is observed in level of muscular strength by increasing/ decreasing one unit change in circumference of one particular group of muscle.

METHODOLOGY

52 Male Judokas of 6 weight categories were selected purposively from 2 Judo training centers of Bhopal. They were asked to perform 2 strength related tests (bench press, and leg strength test) and 3 anthropometric tests (chest circumference, thigh circumference, calf circumference). Bench press test was performed using flat bench, and IWF (International Weightlifting Federation) approved weight plates and barbell. Leg strength test was conducted using Takei Leg strength dynamometer. For both strength tests 1RM was measured. All anthropometric measurements were taken using Gulick tape.

ANALYSIS OF DATA

To reach statistically valid and meaningful conclusions Descriptive statistics, correlations, list of variables entered/ removed, model summary, ANOVA table for testing significance of developed models, coefficients like outputs were computed.

Table-1: Descriptive Statistics

	Mean	Std. Deviation	N
BENCH PRESS	106.44	13.11	52
CHEST CIRCUMFERENCE	95.75	6.96	52

Table-1 provides idea regarding measure of central tendency and measure of dispersion of Bench press and chest circumference variables. The mean score for bench press was noted as 106.44 Kg with standard deviation 13.11. The mean score for chest circumference was noted as 95.75 Kg with standard deviation 6.96.

Table-2: Correlations

		BENCH PRESS	CHEST CIRCUMFERENCE
Pearson Correlation	BENCH PRESS	1.000	.843
	CHEST CIRCUMFERENCE	.843	1.000
Sig. (1-tailed)	BENCH PRESS	.	.000
	CHEST CIRCUMFERENCE	.000	.
N	BENCH PRESS	52	52
	CHEST CIRCUMFERENCE	52	52

The value of Pearson's as observed in table-2 r= .843 indicates bench press and chest have linear relationship upto 84.3%. This correlation value was found significant even as on 0.01 level of significance as observed p-value .000≤.0.05.

Table-3: Variables Entered/Removed from the analysis

Model	Variables Entered	Variables Removed	Method
1	CHEST CIRCUMFERENCE[b]	.	Enter

a. Dependent Variable: BENCH PRESS

b. All requested variables entered.

Table-3 tells about name and number of predictor variables feeded to regression analysis in SPSS using which method. It also provides list of removed variable(s) if any.

Table-4: Model Summary of developed model

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.843[a]	.710	.704	13.65734	.710	122.455	1	50	.000

a. Predictors: (Constant), CHEST CIRCUMFERENCE

b. Dependent Variable: BENCH PRESS

Table-4 provides insight about number of models developed on the basis of present dataset. For present analysis the study have developed one model which include one predictor variable (Chest circumference). This predictor variable alone can explain 71% change in bench press performance R square= .710.

Table-5: ANOVA Table for testing significance of the developed model

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	22840.675	1	22840.675	122.455	.000[b]
	Residual	9326.152	50	186.523		
	Total	32166.827	51			

a. Dependent Variable: BENCH PRESS

b. Predictors: (Constant), CHEST CIRCUMFERENCE

ble-5 Justifies the worth of table 4, it confirms whether developed model is significant or not. For present case the developed model was found significant as the observed p-value .000≤0.05.

Table-6: Standardized and unstandardized Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-184.623	26.371		-7.001	.000
	CHEST CIRCUMFERENCE	3.040	.275	.843	11.066	.000

a. Dependent Variable: BENCH PRESS

Unstandardized and standardized coefficients have been presented in table 6. Unstandardized coefficients are used for developing regression equation while standardized coefficient(s) tells about relative contribution of individual predictor variable for causing change in dependent variable.

Table-7: Descriptive Statistics

	Mean	Std. Deviation	N
LEG STRENGTH	153.05	12.62	52
CALF CIRCUMFERENCE	36.42	2.86	52
THIGH CIRCUMFERENCE	53.38	4.35	52

Table-7 provides idea regarding measure of central tendency and measure of dispersion of Leg strength and calf circumference, & thigh circumference variables. The mean score for leg strength was noted as 153.05 Kg with standard deviation 12.62. The mean score for calf circumference was noted as 36.42 cm. with standard deviation 2.86. The mean score for thigh circumference was noted as 53.38 cm. with standard deviation 4.35.

Table-8: Correlations

		LEG STRENGTH	CALF CIRCUMFERENCE	THIGH CIRCUMFERENCE
Pearson Correlation	LEG STRENGTH	1.000	.872	.937
	CALF CIRCUMFERENCE	.872	1.000	.860
	THIGH CIRCUMFERENCE	.937	.860	1.000
Sig. (1-tailed)	LEG STRENGTH	.	.000	.000
	CALF CIRCUMFERENCE	.000	.	.000
	THIGH CIRCUMFERENCE	.000	.000	.
N	LEG STRENGTH	52	52	52
	CALF CIRCUMFERENCE	52	52	52
	THIGH CIRCUMFERENCE	52	52	52

The value of Pearson's as observed in table-8 r= .872, .937 indicates performance of leg strength and calf circumference have linear relationship upto 87.2%. This correlation value was found significant even as on 0.01 level of significance as observed p-value .000≤.0.05. The performance of leg strength and thigh circumference have linear relationship upto 93.7%. This correlation value was found significant even as on 0.01 level of significance as observed p-value .000≤.0.05.

Table-9: Variables Entered/Removed from the analysis

Model	Variables Entered	Variables Removed	Method
1	THIGH CIRCUMFERENCE, CALF CIRCUMFERENCE[b]	.	Enter
a. Dependent Variable: LEG STRENGTH			
b. All requested variables entered.			

Table-9 tells about name and number of predictor variables feeded to regression analysis in SPSS using which method. It also provides list of removed variable(s) if any. For instance variables were entered using Enter method while no variables were dropped during the process of analysis.

Table-10: Model Summary of developed model

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.946[a]	.896	.891	4.16076	.896	210.391	2	49	.000
a. Predictors: (Constant), THIGH CIRCUMFERENCE, CALF CIRCUMFERENCE									
b. Dependent Variable: LEG STRENGTH									

Table-10 provides insight about number of models developed on the basis of present dataset. For present analysis the study have developed one model which include two predictor variables (Calf circumference, and thigh circumference). These predictor variable together can explain 89.6% change in leg strength performance R square= .710.

Table-11: ANOVA table for testing significance of the developed models

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	7284.545	2	3642.272	210.391	.000[b]
	Residual	848.282	49	17.312		
	Total	8132.827	51			
a. Dependent Variable: LEG STRENGTH						
b. Predictors: (Constant), THIGH CIRCUMFERENCE, CALF CIRCUMFERENCE						

Table-11 Justifies the worth of table 10, it confirms whether developed model is significant or not. For present case the developed model was found significant as the observed p-value .000≤0.05.

Table-12: Standardized & unstandardized Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.034	7.580		.136	.892
	CALF CIRCUMFERENCE	1.119	.398	.254	2.810	.007
	THIGH CIRCUMFERENCE	2.084	.262	.719	7.956	.000
a. Dependent Variable: LEG STRENGTH						

Unstandardized and standardized coefficients have been presented in table 12. Unstandardized coefficients are used for developing regression equation while standardized coefficient(s) tells about relative contribution of individual predictor variable for causing change in dependent variable.

RESULTS/ CONCLUSIONS

By going through whole statistical analysis the study have produced two regression equations which can quantify the performance of bench press and leg strength.

Bench press performance = -184.62 + 3.04 (measurement of chest circumference in centimeters)

Example- If a Judokas whose body weight is 66kg and his chest circumference is 92 centimeters, then according to the regression equation provided in research study he is suppose to lift the barbell loaded with weight plates in bench press would be equal to:

Bench press performance =-184.62 + 3.04 **(92)**

Bench press performance = 95.06 kg

To measure the leg strength of the subject the observed equation reads:

Leg strength performance = 1.03 + 1.12 (calf circumference in cm) + 2.08 (thigh circumference in cm).

Example- If a Judokas whose body weight is 73kg and his calf circumference is 37 centimeters, and thigh circumference is 56 centimeters. Then according to the regression equation provided in research study he is suppose to overcome resistance 158.95 kg≥ on leg strength dynamometer. Let us compute this with derived equation and tentative example:

Leg strength performance = 1.03 + 1.12 **(37)** + 2.08 **(56)**

Leg strength performance = 1.03+ 41.44 + 116.48

Leg strength performance= 158.95 Kg

REFERENCES

1. Cristina Casals, Jesus R Huertas, Emerson Franchini, Katarzyna Sterkowicz-Przybycien, Stanislaw Sterkowicz, Carlos Gutierrez-Garcia, Raquel Escobar-Molina, Special Judo Fitness Test level and anthropometric profile of elite Spanish Judo athletes *Journal of strength and conditioning DOI 10.1519/jsc.0000000000001216*.
2. Sterkowicz-Przybycien, K, and Fukuda, D.H. (2014) Establishing normative data for the Special Judo fitness test in Female Athletes using systematic review and meta-analysis. *Journal of Strength and Conditioning* 28:3585-3593.
3. Franchini E, Takito MY, Kiss M, and Sterkowicz. S. (2005) Physical Fitness and Anthropometrical differences between elite and non-elite Judo players. *Biomechanics of Sports* 22: 315-328.
4. Georgios Zaggelidis, Savvas Lazaridis. (2013) Muscle activation profiles of lower extremities in different throwing techniques and in jumping performance in elite and novice Greek Judo athlete. *Journal of Human kinetics volume 37/2013, 63-70 DOI: 10.2478/hukin-2013-0026.*
5. Harter, R.A. and Bates, B.T. (1985) "Kinetic and temporal Characteristics of Judo hip throw," Biomechanics in Sports 2nd edition. *California publishers* 2nd edition. p.150.
6. Uchida George S. (1968) The External Mechanics of Eight Judo Throws. *Complete research in Health, Physical Education and research.* 10. p.78.

Corresponding Author

Shubham Pal *

Research Scholar, L.N.I.P.E. Gwalior