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A study of relationship between performance and selected fitness components of state and national level weight lifters

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Abstract
The aim of present study was to study the relationship between selected physical fitness components and weight lifting skill performance of 17 to 20 year old males those who have at least state level participation in weight lifting in the last 3 years (i.e. 2015, 2016 and 2017). The study was conducted on 15 subjects (N=15) who had appeared in the skill and fitness testing for admission to a renowned central university of India. Pearson's coefficient correlation and partial correlation was being used to analyse the data. A separate analysis of state and national level was also done using the Pearson's coefficient correlation method. Overall significant correlation (r>.01 and r>.05) was observed for all the lifters on weight lifted in snatch, weight lifted in clean and jerk, number of valid push ups in 1 minute and for number of valid sit ups in 1 minute with one or more variables. No correlation was being observed on competition body weight, total weight lifted. However the partial correlation between SBJ and 1 minute push ups dropped drastically (r= .279) after controlling for 1 minute sit ups, therefore the correlation as observed was not real. Similarly the correlation between Standing broad jump and 1 minute sit –ups also dropped drastically (r=.366) after controlling for 1 minute push ups, therefore the correlation was not real.

Keywords: Bodyweight, weight lifting, clean and jerk, snatch, Person's correlation

1. Introduction
Weight and power lifting has been a popular sport that requires immense focus and concentration and very hard training over the period of many years. The events like snatch, clean and jerk not only displays power and strength but also they are highly technical skills by nature. It is only after having developed a minimum of functional strength and endurance that one should go for specialization in this sport progressively. There is an effort by the weight lifters to lose body weight using various means without compromising on their maximum power and strength during competition. It is the competition body weight that matters a lot on the day of weigh in and how do the player utilises his/her subsequent window period in maintaining or to improve upon the performance. For ''explosive'' sports such as sprinting, jumping, and weightlifting, power production during the activity is typically the most important variable associated with success. Basic physical fitness plays an important role in conditioning and preparatory phases. It is not necessary that a good lifter will also have a great standing broad jump or he would be able to better perform on a one minute sit up or on a 1 minute push up test. Many long jumpers use weights to improve their jumping performances but it is seldom heard about a weight lifter using standing broad jump as a training method to improve his/her clean and jerk or snatch performance. Although the dynamics appears to be somewhat similar to a layman but both involve different intensity and volume of training for success. A sprinter might use certain callisthenic with or without weight exercises to improve upon his/her ballistic strength at the take off but it would be in moderation without peaking at any point of time so that he/she does not start to gain body weight and compromising on the range of movement with heavy training load. It was being hypothesized that there will not be significant difference between the skill (snatch, clean and jerk) and the fitness variables namely: number of push ups in one minute, number of sit-ups in one minute and standing broad jump performances.

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2. Methodology

a) Present study is a cross sectional study of 15 subjects (all boys), 17 to 20 years old, examined during the admission trials at New Delhi. Each one of them had previously participated in at least one state championship to the maximum of SGFI school national championship in the last 3 years.

After a brief explanation about the study and signing an informed consent form, each participant was measured by one surveyor for Body weight (in kg). They were then asked to warm up for the subsequent skill tests and fitness training tests as listed below:

Test name	Remarks
Wt. lifted in snatch	Best of 3 trails was recorded
Wt. lifted in clean & Jerk	Best of 3 trails was recorded
Total wt lifted in KG	Not applicable
No. of valid push ups in 1 min.	Best of 2 trails was recorded
No. of valid sit ups in 1 min.	Best of 2 trails was recorded
Standing Broad Jump in meters	Best of 3 trails was recorded

Subjects filled in the Periodic Examination Health Survey questionnaire, comprising information on: age, sex, smoking habits (by current smokers and non smokers), and routine sports related physical activity habits (number, duration, and type of physical activity training per week of the last minimum six months), and nutritional information (adherence to a certain diet, body weight changes over the previous year, and receiving of nutritional consulting). This information was reviewed for accuracy together with the examinee during a short joint session conducted immediately before or after the measurements were taken.

b) Statistical analysis

SPSS (versions 20) was used to calculate Pearson's correlation coefficients to assess the relationship between weight lifted in snatch, Wt. lifted in clean & Jerk, Total wt lifted in KG, no. of valid push ups in 1 min., no. of valid sit ups in 1 min., Standing Broad Jump (measured in meters) for the study sample as a whole and then according to the level of participation.

3. Results and discussion

Table 1: Descriptive statistics for all 15 lifters

Variable	Mean	Std. Deviation	N
Body weight in KG	79.78	16.02	15
Competition Body weight in KG	82.93	15.18	15
Wt. lifted in snatch	56.66	19.05	15
Wt. lifted in clean & Jerk	72.33	24.84	15
Total wt lifted in KG	129.00	43.59	15
no. of valid push ups in 1 min.	28.46	10.97	15
no. of valid sit ups in 1 min.	33.53	6.47	15
Standing Broad Jump in meters	2.05	.301	15

Table-1 shows the mean and standard deviation values of all 15 male weight lifters

Table 2: Correlation matrix (2 tailed) using Pearson's correlation (product moment correlation) for all 15 lifters

Variable	Body weight in KG	Competition Body weight in KG	Wt. lifted in snatch	Wt. lifted in clean & Jerk	Total wt lifted in KG	no. of valid push ups in 1 min.	no. of valid sit ups in 1 min.	Standing Broad Jump in meters
Body weight in KG	1	.982**	0.285	0.257	0.271	-0.251	-0.297	-0.426
Competition Body weight in KG		1	0.362	0.337	0.351	-0.223	-0.231	-0.385
Wt. lifted in snatch			1	.972**	.991**	0.15	0.232	0.222
Wt. lifted in clean & Jerk				1	.995**	0.272	0.311	0.31
Total wt lifted in KG					1	0.22	0.279	0.274
no. of valid push ups in 1 min.						1	.734**	.622*
no. of valid sit ups in 1 min.							1	.652**
Standing Broad Jump in meters								1

**correlation is significant at the .01 level (2-tailed)
*correlation is significant at the .05 level (2-tailed)

Table -2 shows highly significant positive correlation between weight lifted in snatch and clean and jerk (r=.972, $p<.01$)). Significant positive correlation (at .01 level) between weight lifted in snatch and total weight lifted (r=.991). Significant positive correlation (at .01 level) between weight lifted in clean and jerk and total weight lifted (r=.995). Significant positive correlation (at .01 level) between 1 minute push ups and 1 minute sit ups (r=.734). Significant positive correlation (at .05 level) between 1 minute push ups and standing broad jump (r=.622). Significant positive correlation (at .01 level) between 1 minute sit ups and standing broad jump (r=.652).

Table 3: Descriptive statistics for standing broad jump, one minute push-ups and one minute sit ups

Variables	Mean	Std. Deviation	N
Standing Broad Jump in meters	2.05	.30	15
no. of valid push ups in 1 min.	28.46	10.97	15
no. of valid sit ups in 1 min.	33.53	6.47	15

Table-3 shows the mean and standard deviation of standing broad jump, 1 minute push-ups and 1 minute sit ups values of all 15 male weight lifters. The partial correlation was being computed because of the highly significant results obtained above in table-2.

Table 4: Partial correlation between SBJ and one minute push-ups after controlling for 1 minute sit ups variable for all 15 lifters

Control Variable			Standing Broad Jump in meters	no. of valid push ups in 1 min.
no. of valid sit ups in 1 min.	Standing Broad Jump in meters	Correlation	1.000	.279
		Significance (2-tailed)	.	.333
		df	0	12
	no. of valid push ups in 1 min.	Correlation	.279	1.000
		Significance (2-tailed)	.333	.
		df	12	0

Above table shows that the partial correlation between SBJ and 1 minute push ups dropped drastically (r= .279) after controlling for 1 minute sit ups, therefore the correlation as observed in table-2 was not real.

Table 5: Descriptive statistics for standing broad jump, one minutes push-ups and one minute sit ups

Variables	Mean	Std. Deviation	N
Standing Broad Jump in meters	2.05	.301	15
no. of valid sit ups in 1 min.	33.53	6.47	15
no. of valid push ups in 1 min.	28.46	10.97	15

Table-5 shows the mean and standard deviation of standing broad jump, 1 minute sit -ups and 1 minute push ups values of all 15 male weight lifters. The partial correlation was being computed because of the highly significant results obtained above in table-2.

Table 6: Partial correlation between SBJ and one minute sit-ups after controlling for 1 minute push ups variable for all 15 lifters

Control Variable			Standing Broad Jump in meters	no. of valid sit ups in 1 min.
no. of valid push ups in 1 min.	Standing Broad Jump in meters	Correlation	1.000	.366
		Significance (2-tailed)	.	.198
		df	0	12
	no. of valid sit ups in 1 min.	Correlation	.366	1.000
		Significance (2-tailed)	.198	.
		df	12	0

Above table shows that the correlation between SBJ and 1 minute sit –ups dropped drastically (r=.366) after controlling for 1 minute push ups, therefore the correlation as seen in table-2 was not real.

Table 7: Descriptive statistics for only 8 school national level lifters

Variables	Mean	Std. Deviation	N
Body weight in KG	79.15	16.32	8
Competition Body weight in KG	83.37	16.64	8
Wt. lifted in snatch	71.87	9.97	8
Wt. lifted in clean & Jerk	92.50	11.95	8
Total wt lifted in KG	164.37	21.45	8
no. of valid push ups in 1 min.	31.62	7.20	8
no. of valid sit ups in 1 min.	36.00	4.27	8
Standing Broad Jump in meters	2.181	.31	8

Table-7 shows the mean and standard deviation values of 8 school national level lifters

Table 8: Correlation matrix using Pearson's correlation (product moment correlation) for only 8 school national level lifters

Variables	Body weight in KG	Competition Body weight in KG	Wt. lifted in snatch	Wt. lifted in clean & Jerk	Total wt lifted in KG	no. of valid push ups in 1 min.	no. of valid sit ups in 1 min.	Standing Broad Jump in meters
Body weight in KG	1	.988**	0.691	.723*	.724*	-0.576	-0.249	-0.467
Competition Body weight in KG		1	.778*	.799*	.807*	-0.65	-0.263	-0.477
Wt. lifted in snatch			1	.913**	.974**	-0.614	-0.352	-0.466
Wt. lifted in clean & Jerk				1	.982**	-0.551	-0.587	-0.481
Total wt lifted in KG					1	-0.593	-0.491	-0.485
no. of valid push ups in 1 min.						1	0.153	0.372
no. of valid sit ups in 1 min.							1	0.314
Standing Broad Jump in meters								1

**correlation is significant at the .01 level (2-tailed)
*correlation is signifcant at the .05 level (2-tailed)

Table -8 shows that for the school national level lifters, there was a significant positive correlation (at .05 level) between competition weight lifted in snatch(r=.778), clean and jerk (r=.799), total weight lifted (r=.807). Significant correlation (at .01 level) between weight lifted in snatch and weight lifted in clean and jerk (r=.913). Significant correlation (at .01 level)

between weight lifted in snatch and total weight lifted (r=.974). Significant correlation (at .01 level) between weight lifted in clean and jerk and total weight lifted (r=.982). Unlike overall observation in table-2, there was no significant correlation between any other variables for 8 school national level lifters in table-8.

Table 9: Descriptive statistics for only 7 state level lifters

Variables	Mean	Std. Deviation	N
Body weight in KG	80.50	16.95	7
Competition Body weight in KG	82.42	14.62	7
Wt. lifted in snatch	39.28	8.38	7
Wt. lifted in clean & Jerk	49.28	10.57	7
Total wt lifted in KG	88.57	17.96	7
no. of valid push ups in 1 min.	24.85	13.86	7
no. of valid sit ups in 1 min.	30.71	7.69	7
Standing Broad Jump in meters	1.914	.22	7

Table-9 shows the mean and standard deviation values of 7 state level lifters

Table 10: Correlation matrix using Pearson's correlation (product moment correlation) for only 7 state level lifters

Variables	Body wt. in KG	Competition body wt.	wt. lifted in snatch	wt. lifted in clean & jerk	Total wt. lifted in KG	No. of valid push ups in 1 min	No. of valid sit ups in 1 min	Standing broad jump in meters
Body wt. in KG	1	.987**	.698	.614	.687	-.078	-.362	-.459
Competition body wt.		1	.608	.557	.612	.002	-.305	-.406
wt. lifted in snatch			1	.792*	.933**	-.109	-.353	-.385
wt. lifted in clean & jerk				1	.959**	.317	.120	.143
Total wt. lifted in KG					1	.136	-.094	-.096
No. of valid push ups in 1 min						1	.882**	.850*
No. of valid sit ups in 1 min							1	.907**
Standing broad jump in meters								1

**correlation is significant at the .01 level (2-tailed)
*correlation is significant at the .05 level (2-tailed)

Table -10 shows that for the state level lifters, there was a significant positive correlation (at .05 level) between weight lifted in snatch and weight lifted in clean and jerk (r=.792), significant at .01 level with total weight lifted (r=.933), total weight lifted (r=.807). Significant correlation (at .01 level) between weight lifted in snatch and weight lifted in clean and jerk (r=.913). Significant correlation (at .01 level) between weight lifted in snatch and total weight lifted (r=.974). Significant correlation (at .01 level) between weight lifted in clean and jerk and total weight lifted (r=.982). Unlike overall observation in table-2, there was no significant correlation between any other variables for 8 school national level lifters in table-8.

Contrary to the observation sof the present study, Schmidtbleicher (1992) [6] indicated that maximum strength is the basic quality affecting power output; Stone *et al.* (1992, 2002, 2003) [7, 8] also determined that maximum strength has large effects upon explosive-power–oriented sports performance.

4. Conclusion
It was observed that the performances of the national level weight lifters were superior as compared to the state level weight lifters. There were significant positive Pearson's correlations observed between weight lifted in snatch and weight lifted in clean and jerk, between no. Of valid push ups in 1 minute and no. Of valid sit ups in 1 minute. Between no. of valid push ups in 1 minute and standing broad jump, between no. of valid sit ups and standing broad jump performances of all the lifters but real relationship was not found after controlling for the confounding variables as seen after computing partial correlation. Neither of the two clean and jerk or snatch performance had any correlation with the standing broad jump performance. As also there was no correlation between the sit up and push ups with the clean and jerk or snatch performance. Overall, higher the number of push ups, better was the site ups performance and also the standing broad jump performance. More the number of sit ups, better was the standing broad jump performance.

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