



GYMNASTIC PERFORMANCE AND MOTOR FITNESS AND ITS COMPONENTS

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To identify the motor fitness and its components (Arm & shoulder strength power, flexibility, agility, speed and endurance) which differentiate the high gymnasts performance from low performance gymnasts. The investigator used motor fitness tests, step up test, zig zag Run, Putting the shot, Standing Broad jump, Trunk Extension and Trunk Flexion to measure endurance, agility and speed, arm and shoulder strength, power, flexibility respectively, scores on the various tests through its events referred to above were obtained, of 250 inter District female gymnasts selected from Haryana and Punjab states. Quantified data have been recorded in tables. The data were statistically analyzed as per objectives of the investigation. Analysed data pertaining to motor fitness and its components are discussed as follows:

To find out the relationship between performance in gymnastics and components of motor fitness used in the project, the co-efficient of correlation between scores of all the components and gymnastic performance were calculated separately for each component. To work out co-efficient of correlation "Pearson's moment" method was used. The value of 'r' for each component has been recorded in Table 1.

Table -1

Co-efficient of correlation between gymnastic performance and motor fitness components scores of 250 female gymnasts:

Performance	Endurance	Agily & speed (zig-zag) run	Arm & shoulder strength (putting the shot)	Power (standing Broad Jump)	Flexibility (through Extension)	Flexibility (through Flexion)
Gymnastics of female gymnasts	+0.00	-0.28**	+0.69**	+0.53**	+0.57**	+0.63**

❖ Significance at .01 level of confidence

r * 0.165 df * 248

❖ Significance at .05 level of confidence

r * 0.126, df * 248

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The results in Table 1 show that certain motor fitness components have positive and others have negative co-efficient of correlation with performance in gymnastics. The co-efficient of correlation between the components - endurance, arms and shoulder strength power and flexibility performance are +0.11, +0.69, +0.53, +0.57 & +0.63 respectively which are positive and components agility and speed has negative co-efficient of correlation which is 0.28 (agility and speed test scores were against time, that is more the scores, less the agility and speed and less the scores, more the agility and speed).

The co-efficient of correlation between performance scores and motor fitness components- Arm and Shoulder strength power and flexibility are positive and highly significant whereas with zig zag run it negative and significant whereas. In the case of step up test positive and insignificant. it is revealed that performance in gymnastics is significantly related to all the components of motor fitness studied here- like agility and speed, arm and shoulder strength, power and flexibility , except endurance.

For further analysis the relationship of performance in gymnastics with components of motor fitness, the group of female gymnasts was divided into high and low performance group. The number of subjects (gymnastic) falling below first quartile (Q1) and above third quartile (Q3) on the performance scores of the group were sorted out. Thus, the following groups of gymnast were formed:

- i) High performance female gymnasts
- ii) Low performance female gymnasts

The subjects which fall below Q1, were regarded as low performance group, while those falling above Q3 were considered high performance group of gymnasts. The values of Q1 and Q3 were computed which came out to be 8.89 and 18.98 respectively. Therefore, gymnasts scoring 09 or less and 19 or more are grouped in the category of low performance and high performer gymnasts. In this way as pointed out earlier the female gymnasts in high performance group remained 64 and that of low performance group 68. The scores of motor fitness components alongwith their performance scores in gymnastics were noted in tabular form under their respective group for statistical operations. The means, Standard deviations and standard errors of each component for both the group separately were calculated and are recorded in table 2. The significance of means difference of each components was tested against 't' ratio. Thus t-ratio s were worked out and also noted in the



table 2. The result in table 2 for all the components of motor fitness were discussed one by one for both the group of gymnasts- high and low performance as follows:-

Table 2

The means, standard deviations and standard errors of components of motor fitness scores alongwith t-ratios.

GROUP	HIGH PERFORMERS				LOW PERFORMANCE				t-ratio df = 130
	Mean	S.D.	S.E.	N	Mean	S.D.	S.E.	N	
Components	2	3	4	5	6	7	8	9	10
Endurance (Step up Test)	84.67	12.83	1.60	64	80.96	12.52	1.52	68	1.68
Agility & Speed (Zig-zag run)	26.87	4.76	0.59	64	27.91	5.70	0.69	68	1.14
Arm & Shoulder Strength (Putting the shot)	424.18	74.96	9.37	64	341.71	68.48	8.30	68	**6.587
Power (Standing Broad Jump)	165.28	33.72	4.22	64	110.25	16.24	1.97	68	**11.834
Flexibility (Trunk Extension)	34.69	7.79	.973	64	27.94	7.17	.869	68	**4.208
Flexibility (Trunk Flexion)	17.58	4.13	.516	64	13.46	3.29	.398	68	**6.319

** Significant at .01 level of confidence, t = 2.63 df = 130

* Significant at .05 level of confidence, t = 1.98 df = 130

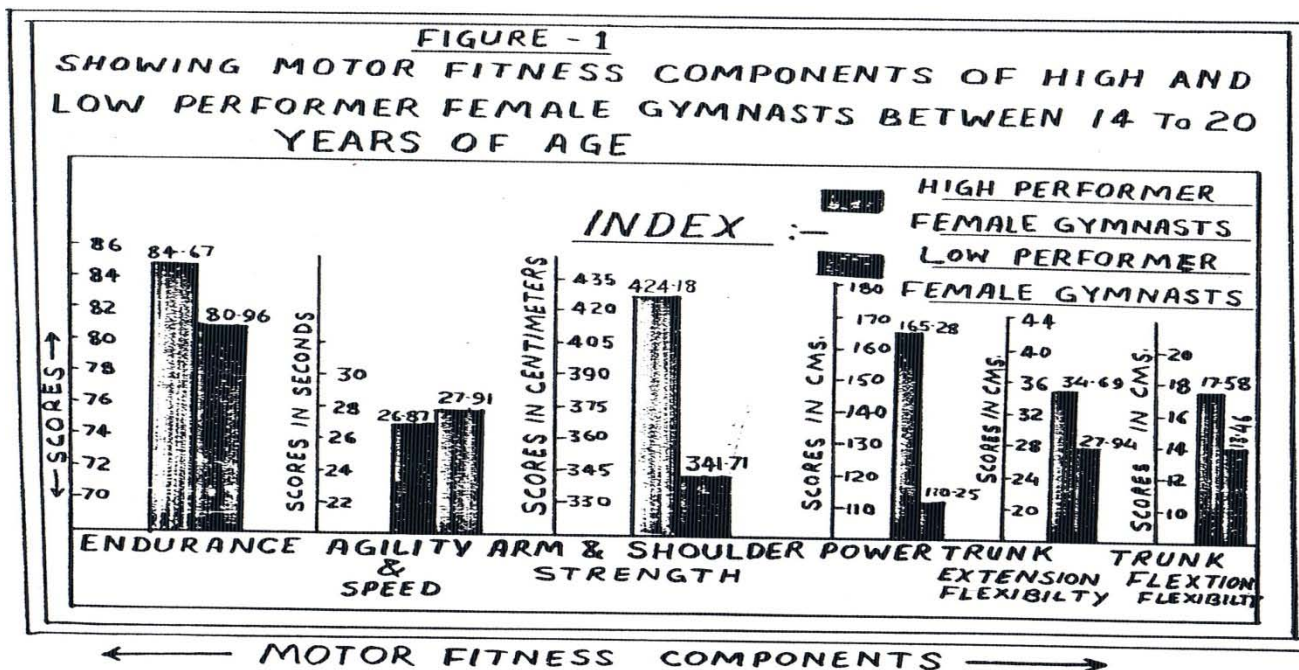


Fig. 4.1

The results in table 2, indicate that female high performer gymnasts and low performers do not differ significantly at any accepted level of confidence, that is at $<.5$ and $<.01$ levels, on the below given motor fitness components :

- i. Endurance as measured by step up test.
- ii. Agility and speed measured by zig-zag run.

Both the high and low performance female gymnasts do differ significantly at less than level of confidence with regard to the other components given below:

- iii. Arm & Shoulder Strength : as measured by putting the shot test.
- iv. Power : as measured by Standing Broad Jump.
- v. Flexibility : as measured through trunk extension by event on table.
- vi. Flexibility : as measured through trunk flexion by event on table.

The differences on the motor fitness components of high and low performers female gymnasts may be interpreted and concluded as follows:

i. ENDURANCE

The continuum of the test scores extends from "more" endurance at the upper end to "less endurance" at the lower end. The mean of the high performer female gymnasts on this component endurance, is 84.67 and those of low performer group is 80.96. The difference between the means of the groups did not come out significant at any level of confidence, thus depicting that the high performer female gymnasts seem to on an average have more



endurance than those of low performer. But the findings could not be established as the difference between means of the groups did not emerge significant at any level of confidence.

The results here substantiate that findings of Kumari (1982) and also some theoretical literature available who feel that endurance is not much important motor fitness component in gymnastic performance. But the results contradict the findings as reflected in the studies of Kjeldsen (1961), cumming (1967), Kaur (1977) Fukashina (1981) and Debnath (1983) that endurance contributes to the better performance in gymnastics.

It may be clouded from the results discussed and interpreted that the attribute under the "endurance" component of motor fitness appears to be insignificantly related to performance in gymnastics though there is positive relation. To clarify the relationship issue of endurance with gymnastic performance, further studies are suggested.

In the light of the above discussion of results from the table No. 1, it appears that the second hypothesis (women performance in gymnastics would be significantly related to cardio - vascular - endurance) of this investigation could not be verified and hence rejected.

ii. AGLILITY AND SPEED

The scores of this component run from low "Agility and speed at the upper end to more "agility and speed" at the lower end. The means of high performer gymnastic female group on this component (Agility and speed) is 26.87 seconds and that of low performer is 27.91 seconds. The differences between the group means did not come significant at any level of confidence. It appears from the results that the high performer female gymnasts seem to, on an average, have more agility and speed as compared to their counter-parts low performer, but difference is insignificant. While scanning the literature related to the above components no study could be found on the relationship of agility and speed with the performance of the gymnasts.

Thus, it may be inferred form the results of this study, that agility and speed relation with gymnastic performance can not be ascertained with confidence; it can be there by change.

On the basis of the results dicussed, interpreted concluded and represented in table - 1, the fourth hypothesis (there would be positive and significant relationship between agility, speed and performance of women gymnasts in gymnastics) of the study could not be verified, therefore not accepted.



iii. ARM AND SHOULDER STRENGTH

In this component "Strength" is higher at the upper end to lesser at the lower end of the scores. The mean of the high performance gymnasts on this component of strength is 424.18, where as that of low performance group is 341.71. The difference between the means of both groups found to be significant at .01 level of confidence. This indicates that the high performance group of female gymnasts seems to, on an average, have significantly more arm and shoulder strength than the less performance group. It shows that performance in gymnastics significantly depends on arm and shoulder strength. The results of this investigation more or less, substantiate the findings of Cureton, (1955); Kjeldsen (1961); Cumming (1967); Walia (1981); Fukashina (1981); Harre (1982); Walia (1985); and Singh and Kalpana, (1989) they have that round strength either of arm or shoulder or leg or back plays most important role in the better performance in gymnastic skills. It is also added that the performance in simple and complicated movement in various events of gymnastics depends largely on level of conditional and coordinative abilities. Out of all conditional and coordinative abilities. Strength plays a dominant role in competitive performance in gymnastics. Therefore, it can be concluded that arm and shoulder strength of gymnasts appears to be the important attribute of high performance in gymnastics.

In the light of the results discussed, interpreted, concluded and represented in table - 1, the fifth hypothesis (shoulder girdle strength of women gymnasts would significantly and positively be related to their performance in gymnastics) of the project was verified and hence accepted.

iv. POWER

The component extends from "more power at the upper end of the scores to "less power" at the lower end. The mean of the high performance female gymnasts on this component of motor fitness (power is 165.28 and those of low performer group is 110.25. The mean difference of high and low performance groups of female gymnasts came out significant at .01 level of confidence, thus depicting that the high performance gymnasts have on an average more scores on the factor than those of low performance group, showing more power requirement for high performance. It shows that power is required for high performance in gymnastics.



The results of this investigation support the findings as reflected from the studies of Logan, (1961), Kaur (1972); Bose, (1973); Rani, (1978); that power component of motor fitness contributes towards high performance in gymnastics.

Therefore it may be concluded that the attribute under the "power component of motor fitness appears to be helpful in high performance in gymnastics.

From the results concluded from this study, the seventh hypothesis (power components of motor fitness would positively and significantly be related to performance in gymnastics) of the study stands the test of verification and hence accepted.

FLEXIBILITY

The scores run from high flexibility of the upper end of the scores to less flexibility at the lower end (it is measured through extension and flexion of Trunk) The means of the high performance female gymnasts on this component (flexibility) for Trunk Extension and Flexion re 34.69 and 17.58 and those of less performer female gymnasts are 27.94 and 13.46 respectively. The differences between mean came out significant at <.01 level of confidence in both the method. This shows that the high performer female gymnasts on an average need more flexibility as compared to their counterparts.

In the studies by Cureton, 1955' Robert 1970, sinning and Lindberg, 1972; the iportance of flexibility as the ability to execute movements with large amplitude was felt because of the nature of the sport. It is worth mentioning that the findings of the studies conducted by Bose, (1973); Bose (1975) Chaudhary, (1975); Kaur, (1977); falls and Humphrey, (1978); Harse (1979) pointed out that flexibility is a prime pre-requisite of a qualitatively and quantitatively good execution of movement. It is also added that lack of flexibility leads to injuries and various faults in execution. Salmela, (1980); Harre, (1982); Walia, (1985); observed that the performance of simple and complicated movement on various events depends largely on level of flexibility.

Thus, it may be concluded that the flexibility component of motor fitness is an attribute of a female gymnast who is a high performer in gymnastics. In short flexibility is needed for high performance in gymnastics. The results in table 2, are presented diagrammatically in figure 1, depicts the same findings, as discussed and interpreted regarding the motor fitness components- Endurance; Agility and speed; Arm and shoulder strength; power and flexibility differences between high and low performer female gymnasts.



The conclusions showed that sixth hypothesis (flexibility of women gymnasts would have significant relation to their performance in gymnastics) of the investigation is prove and hence retained.

In general, it can be concluded from the results of this study discussed and interpreted, regarding the motor fitness components of a high performer female gymnast.

- i. That there are differences in motor fitness components between high and low performer female gymnasts as established by the various tests used to measure them i.e. step up for endurance; zig-zag run for agility and speed; putting the shot for arm and shoulder strength; standing Broad jump for power; and Trunk Extension and Flexion for Flexibility.
- ii. That there are highly significant differences between the mean of high and less performer of female gymnasts on the arm and shoulder strength, power and flexibility as measured through above mentioned tests. Thus, it indicates that a good performer in gymnastics require much of strength, power and flexibility or in other words strength power flexibility components of motor fitness are the significant predictor of performance in gymnastics. The other two motor fitness components- endurance and agility and speed are also significantly and positively related to performance of gymnasts but it cannot be said with confidence. In brief it can be concluded that motor fitness is significant predictor of performance in gymnasts.

From the combined results discussed and interpreted, it appears that first hypothesis (there would be significant and positive relationship of motor fitness with performance in gymnastics of female gymnasts) stands the test of verification and hence accepted.

To summarise the results of this study, it can be inferred that arm and shoulder strength, power and flexibility components of motor fitness as measured by putting the shot, standing broad jump and trunk extension and flexion play important role to determine the performance in gymnastic events.

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