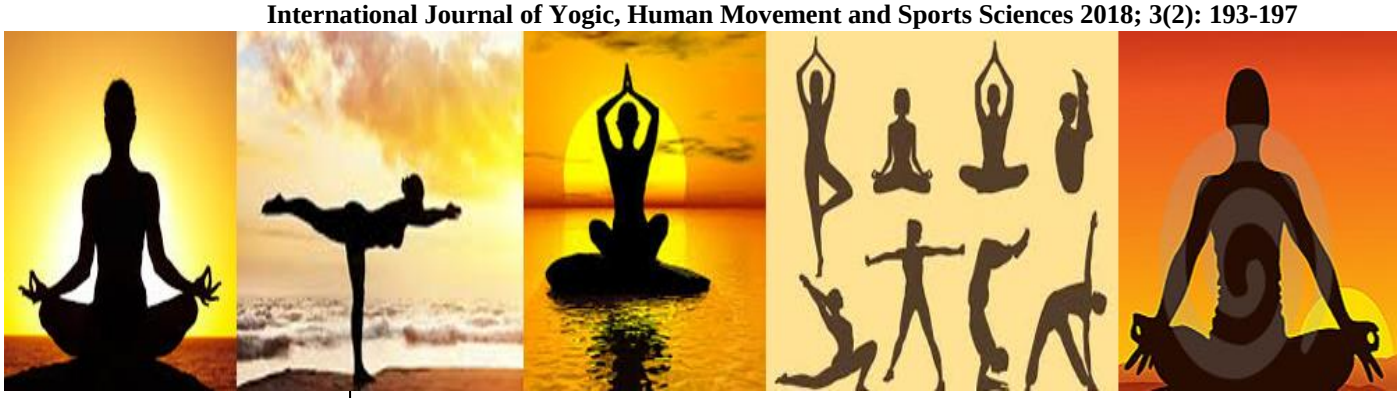
International Journal of Yogic, Human Movement and Sports Sciences 2018; 3(2): 193-197



ISSN: 2456-4419
Impact Factor: (RJIF): 5.18
Yoga 2018; 3(2): 193-197

www.theyogicjournal.com
Received: 27-05-2018
Accepted: 28-06-2018

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Comparative effect of two variations of circuit training on explosive strength, strength endurance and speed of movement of judokas

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Abstract
The main purpose of the study was to compare the effect of two variations of circuit training on explosive strength, strength endurance and speed of movement of Judokas. Thirty Judokas belonging to the age group 18-24 year from LNIPE Gwalior, were selected randomly as subjects for this study. On the basis of pre test performance the subjects were equated and divided in to three equal groups. The training programme of group A and B consisted of circuit training with use of weights, but there was a variation in intensity, repetition, density & frequency. All groups were tested in the explosive strength, strength endurance &speed of movement before & after the training. During the experimental period group A and group B were trained with progressive program of circuit training, but C not involve in any type of circuit training programmes. Analysis of variance was used for finding the mean difference for each group and t-ratio (paired-t) was used to see the significant difference of mean in between pre and post performance of group. The analysis of data showed that both circuit training is best to improve legs explosive strength, legs strength endurance and hands speed of movement.

Keywords: Circuit training, explosive strength, strength endurance, speed of movement

Introduction
Circuit training is considered to be one of the best form of training program for achieving top performance in judo. Since the dominating conditional abilities required to perform better in Judo are explosive strength, strength endurance, quick reaction to a stimulus, speed of movement etc**.** all these conditional abilities can be developed through a method or program called circuit training Judo is a sport for few minutes and similarly circuit training consists of few minutes (4-8 minutes) so this method of training seems to be the best method to improve the performance of Judoka.

Statement of the Problem
The purpose of this study was to compare the effect of two variations of circuit training on explosive strength, strength endurance and speed of movement of Judokas.

Hypothesis
On the basis of expert opinion and researchers own understanding it is hypothesised that there will be significant difference between the effects of two variation of circuit training on explosive strength, strength endurance and speed of movement of Judokas. It is also hypothesised that both intensive and extensive circuit training program will significantly improve strength endurance, explosive strength and speed of movement of Judokas.

Significance of the Study
1. The result of this study will be great help to physical education teachers.
2. It will help physical education teachers and coaches to select the circuit training programme.
3. The findings of study may throw light on formulating circuit training program.

Experimental Design

Thirty male judokas belonging to the age group 18-24 years from LNIPE Gwalior were selected randomly as subjects for this study. On the basis of pre tests the subjects were equated and divided into three equal groups. The equated group design was used to divide the group. The training programme of group A and B consisted of circuit training with use of weights, but there was a variation in intensity, repetition, density and frequency. Both the groups were tested in the explosive strength, strength endurance, speed of movement of arms and legs. Analysis of variance was used for finding the mean difference for each group. The level of significance was chosen at .05 level of confidence.

Criterion Measure

The individual scores were obtained by administering six different test items for explosive strength, strength endurance and speed of movement and these variables were used as criterion measures for the study because these are essential physical fitness components for a good Judoka. There are three variables, each consists of two tests are as following for arms and legs:

S. no.	Variables	Tests	Criterion Measures
1.	Explosive strength:		
	Legs-	Vertical jump test	Centimeters
	Arms-	Two-hand Medicine Ball put	Inches
2.	Strength Endurance:		
	Legs-	Half squat jump Test	In number
	Arms-	Chin-ups Test	In number
3.	Speed of movement:		
	Legs-	The Nelson Foot Reaction Time Test	In Mile sec.
	Arms-	The Nelson speed of movement Test	In Mile sec.

Procedure for Administering Tests

Before the actual administration of the tests all selected subjects for the study were assembled in Dojo Hall and briefed about the purpose of the study and the tests to be administered. The data were collected with the help of fellow scholars who had experience in conducting tests, and taking measurements under the direct supervision of the scholar.

Selection of Exercises

The researcher went through the available literature related to the training of Judo players using circuit training with weight and also discussed with experts in this field, and then selected the following exercise:-

Name of exercise

1. Horizontal press
2. Half Squats
3. Biceps Curls
4. Leg press
5. Triceps Curls
6. Step ups
7. Military press
8. Sit ups

The explanation of two variation of circuit training is given below:

S.no.	Group A	Group B
1.	Number of exercise-8	Number of exercise-8
2.	Intensity- 30-40%	Intensity- 50-65%
3.	Speed of Movement-Not less than that of competition	Speed of Movement-Not less than that of competition
4.	Repetition- 30-40/60 sec	Repetition- 20-40/60 sec
5.	Recovery- 40 sec in between station and 3 minutes in between one circuit or one round	Recovery- 60 sec in between station and 4 minutes in between one circuit or one round
6.	Number of sets- 4	Number of sets- 3

Procedure of Experiment

The experiment was conducted for a period of six weeks. The performance tests were taken at the beginning and at the end of the experimental period. During the experimental period of six weeks the two groups A and B were assigned circuit training with a variation. Group C i.e. control group did not participate in any form of training. Both the groups A and B were reported during the match practice period on alternate days thrice a week i.e. (Monday, Wednesday, Friday).

Statistical Procedure

To determine the significant difference of mean in between pre and post performance of groups t-ratio (paired-t) was used and analysis of variance was used for finding the mean difference for each group.

Results and Discussion

Table 1: significance of mean difference of post and pre test of group A

S. No.	Variable	Test	Dm	Calculated 't'	Tabulated 't' (.05)
1.	Explosive Strength	(i) Vertical jump test	2.9	2.82*	1.83
		(ii) Two hand medicine Ball put	7.7	3.09*	1.83
2.	Strength Endurance	(i) Half squat jump test	7.1	2.87*	1.83
		(ii) Chin ups	2.2	2.82*	1.83
3.	Speed of movement	(i) Nelson foot reaction time test (left leg)	0.0010	2.80*	1.83
		(ii) The Nelson foot reaction time test (right leg)	.00064	2.41*	1.83
		(iii) The Nelson Speed of movement test (hands)	0.118	1.708	1.83

Results

The above table reveals that there is a significant improvement in all the variables except hands speed of movement. In all the tests calculated 't' is greater than tabulated 't' except hands speed of movement. In this case calculated 't' (1.078) is less than the tabulated 't' (1.83) with the degree of freedom 2,27 at.05 level of significance. The above variables (2.82,3.09,2.87,2.82,2.80,2.41), have got the significant difference than tabulated 't' (1.83) at .05 level of significance with the degree of freedom 2,27. Due to this it is evident that extensive interval method of training had improved the Explosive strength of arms and legs, strength endurance of arms and legs, speed of movement of legs.

Table 2: Significance of mean difference of post and pre test of group B

S. No.	Variable	Test	Dm	Calculated 't'	Tabulated 't' (.05)
1.	Explosive Strength	(i) Vertical jump test	1.9	2.79*	1.83
		(ii) Two hand medicine Ball put	4.1	2.84*	1.83
2.	Strength Endurance	(i) Half squat jump test	4.0	3.03*	1.83
		(ii) Chin ups	0.6	2.14*	1.83
3.	Speed of movement	(i) Nelson foot reaction time test (left leg)	.00423	1.45	1.83
		(ii) The Nelson foot reaction time test (right leg)	0.00037	3.7*	1.83
		(iii) The Nelson Speed of movement test (hands)	0.00133	0.39	1.83

Results

The above table reveals that there is a significant improvement in explosive strength and strength endurance. In case of hands speed of movement and leg speed of movement the calculated 't' (0.39 and 1.45) is lesser than the tabulated 't' (1.83) with the degree of freedom at.05 level of significance. The above variables (2.79, 2.84, 3.03, 2.14, 3.7) have got the significant difference than tabulated 't' (1.83) at .05 level of significance with the degree of freedom 2,27. Due to this it is evident that intensive interval method of training had improved the Explosive strength of arms and legs, strength endurance of arms and legs.

Table 3: Significance of mean difference of post and pre test of group C

S. No.	Variable	Test	Dm	Calculated 't'	Tabulated 't' (.05)
1.	Explosive Strength	(i) Vertical jump test	0.3	0.57	1.83
		(ii) Two hand medicine Ball put	0.5	0.12	1.83
2.	Strength Endurance	(i) Half squat jump test	0.5	0.64	1.83
		(ii) Chin ups	0.2	0.39	1.83
3.	Speed of movement	(i) Nelson foot reaction time test (left leg)	.00015	0.36	1.83
		(ii) The Nelson foot reaction time test (right leg)	0.003451	1.5	1.83
		(iii) The Nelson Speed of movement test (hands)	.00022	0.73	1.83

Results

The above table reveals that there is no significant improvement in variable i.e. explosive, strength endurance and speed of movement of arms and legs. The above variables or calculated 't'(0.57,0.12,0.64,0.39,0.36,1.5,0.73) are lesser than the tabulated 't' (1.83) with the degree of freedom 2,27 at.05 level of significance. Due to this it is evident that group 'C' has not improved their performance significantly in any of the selected variable, because they did not participated in any type of circuit training. They were doing their routine practice and daily task

Table 4: Analysis of variance on vertical jump performance of two experimantal and one control group

S. No.	Source of Variance	Df	SS	MSS	Obatained F-Ratio	Required F-Ratio At .05 Level
1.	SS_b	r-1			4.89*	(2,27) 3.35
		3-1=2	398.6	199.3		
2.	SS_w	N-r				
		30-3=27	1098.1	40.68		

The required 'F' value for significant at .05 level of confidence with 2,27 df 3.35.

Table 4 reveals that there is significant difference among the two experimental and control froups as the 'F' value obtained (4.89) was more than the table value (3.35) at .05 level of confidence with 2,27 degrees of freedom.

Post hoc test of mean differences in vertical jump performance

A	B	C	CD at 5% Level
38.2	31.2	29.9	5.84

"_____/" Indicate no difference between means.

Findings

Comparing the pair wise difference of means with critical difference it is evident that there is no difference between means of second and third group. Whereas mean of the first group is significantly higher than that of the second and third both. Thus it may be concluded that first circuit training is the best in improving the explosive strength of legs.

Table 5: Analysis of variance of two hands medicine ball put performances of two experimental group and control group

S. No.	Source of Variance	Df	SS	MSS	Obtained F-ratio	Required F-ratio at .05 level
1.	SS_b	r-1			0.036	(2,27) 3.35
		3-1=2	275.5	137.75		
2.	SS_w	N-r				
		30-3=27	10276.3	380.6		

The required 'F' value for significant at .05 level of confidence is 3.35.

Findings

Table 5 reveals that there is no significant difference among the two experimental group and control group as the 'F' value obtained (0.36) was less than the table value (3.35) at .05 level of confidence with 2,27 degrees of freedom.

Table 6: Analysis of variance of half squat jump performance of two experimantal and control group

S. No.	Source of Variance	Df	SS	MSS	Obatained F-Ratio	Required F-Ratio At .05 Level
1.	SS_b	r-1			42.00*	(2,27) 3.35
		3-1=2	12345	617.5		
2.	SS_w	N-r				
		30-3=27	397.7	14.7		

The required 'F' value for significant at .05 level of confidence with 2,27 df is 3.35.

Table 6 reveals that there is significant difference among the two experimental and control groups as the 'F' value obtained (42.00) was more than the table value (3.35) at .05 level of confidence with 2,27 degrees of freedom.

Post hoc test of mean differences in half squat jump performance

A	B	C	CD at 5% Level
80.1	67.6	65.6	3.51

"_____/" Indicate no difference between means.

Findings

Comparing the pair wise difference of means with critical difference it is evident that there is no difference between means of second and third group. Whereas mean of the first group is significantly higher than that of the second and third both. Thus it may be concluded that first circuit training is the best in improving the strength endurance of legs.

Table 7: Analysis of variance of chin ups performance of two experimental group and control groups

S. No.	Source of Variance	df	Ss	Mss	Obtained F-ratio	Required F-ratio at .05 level
1.	SS_b	r-1			2.051	(2,27) 3.35
		3-1=2	42.5	21.25		
2.	SS_w	N-r				
		30-3=27	279.7	10.36		

The required 'F' value for significant at .05 level of confidence is 3.35.

Findings

Table 7 reveals that there is no significant difference among the two experimental and control groups as the 'F' value obtained (2.051) was less than the table value (3.35) at .05 level of confidence with 2,27 degrees of freedom.

Table 8: Analysis of variance of left foot reaction time performance of two experimantal and control groups

S. No.	Source of Variance	Df	SS	MSS	Obatained F-Ratio	Required F-Ratio At .05 Level
1.	SS_b	r-1			0.9583	(2,27) 3.35
		3-1=2	0.002915	0.0014575		
2.	SS_w	N-r				
		30-3=27	0.0410635	0.0015208		

The required 'F' value for significant at .05 level of confidence with 2,27 df is 3.35.

Table 8 reveals that there is no significant difference among the two experimental and control groups as the 'F' value obtained (0.9583) was less than the table value (3.35) at .05 level of confidence with 2,27 degrees of freedom.

Table 9: Analysis of variance of right foot reaction time performance of two experimantal and control groups

S. No.	Source of Variance	Df	SS	MSS	Obatained F-Ratio	Required F-Ratio At .05 Level
1.	SS_b	r-1			1.0869656	(2,27) 3.35
		3-1=2	0.002515	0.0012575		
2.	SS_w	N-r				
		30-3=27	0.031237	0.0011569		

The required 'F' value for significant at .05 level of confidence with 2,27 df is 3.35.

Table 9 reveals that there is no significant difference among the two experimental and control groups as the 'F' value obtained (1.0869656) was less than the table value (3.35) at .05 level of confidence with 2,27 degrees of freedom.

Table 10: Analysis of variance of hands speed of movement performance of two experimantal and control groups

S. No.	Source of Variance	Df	SS	MSS	Obatained F-Ratio	Required F-Ratio At .05 Level
1.	SS_b	r-1			5.100738*	(2,27) 3.35
		3-1=2	0.0051141	0.002557		
2.	SS_w	N-r				
		30-3=27	0.0135377	0.0005013		

The required 'F' value for significant at .05 level of confidence with 2,27 df is 3.35.

Table 10 reveals that there is a significant difference among the two experimental and control groups as the 'F' value obtained (5.100738) was more than the table value (3.35) at .05 level of confidence with 2,27 degrees of freedom.

Post hoc test of mean differences in hands speed of movement

A	B	C	CD at 5% Level
0.28541	0.25923	0.26581	0.0205202

"_____/**"** Indicate no difference between means.

Findings

Comparing the pair wise difference of means with critical difference it is evident that there is no difference between means of second and third group. Whereas mean of the first group is significantly higher than that of the second and third both. Thus it may be concluded that first circuit training is the best in improving the speed of movements of arms.

Discussion of Findings

The findings of study showed that six week intensive and extensive circuit training program effected significant improvement in explosive strength, strength endurance and speed of movement of Judo player. Circuit training is considered to be best form of training for player of competitive sports, specially Judo, The conditional or physical qualities considered to be most essential for Judo player are explosive strength, strength endurance and speed of movement. In circuit training the related weight training exercise and their loading procedure are so arranged that every trainee uder went series of exercise with incomplete recovery, there by sufficient stress was given on related conditional ability. The two forms of circuit training intensive and extensive resulted in significant improvement of explosive strength, strength endurance and speed of movement. This findings may be attributed to the fact that six week duration of training was sufficient enough to bring about the physiological adaptation to cause significant improvement in related parameters, further may be the intensive and extensive loading system followed in the circuit training was most appropriate to cause optimum effect and resulted in improvement of strength endurance, explosive strength and speed of movement. When the two training program was compared it was observed that extensive circuit training proved to more effective than intensive circuit training for development of hand speed, muscular endurance and strength of leg. This finding may be attributed to the reason that extensive circuit training program had longer duration of rest period in between station and series, compared to that of intensive training program. This provision of better rest might have better effected. Further may be high intensity circuit training creates lesser conducive situation to course improvement then intensive training. On the light of finding study the hypothesis that there will be significant effect of six weeks intensive and extensive circuit training program in explosive strength, strength endurance and speed of movement is accepted. Further the hypothesis that the two forms of training will effect significantly different is accepted for variables. Hand speed, leg muscular endurance and explosive strength of leg. And the hypothesis rejected for the variables two hand medicine ball put, Chin ups.

Conclusions

In the light of study findings of study following conclusion were drawn:

1) Circuit training is best form of training to develop explosive strength, strength endurance and speed of movement for Judokas.
2) Extensive circuit training is better than intensive circuit training for developing hand speed, leg muscular endurance and leg speed of movement of Judo players.
3) Circuit training should be of minimum six week duration.
4) Weight training exercises are best form of exercise on which circuit training should be planned.

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