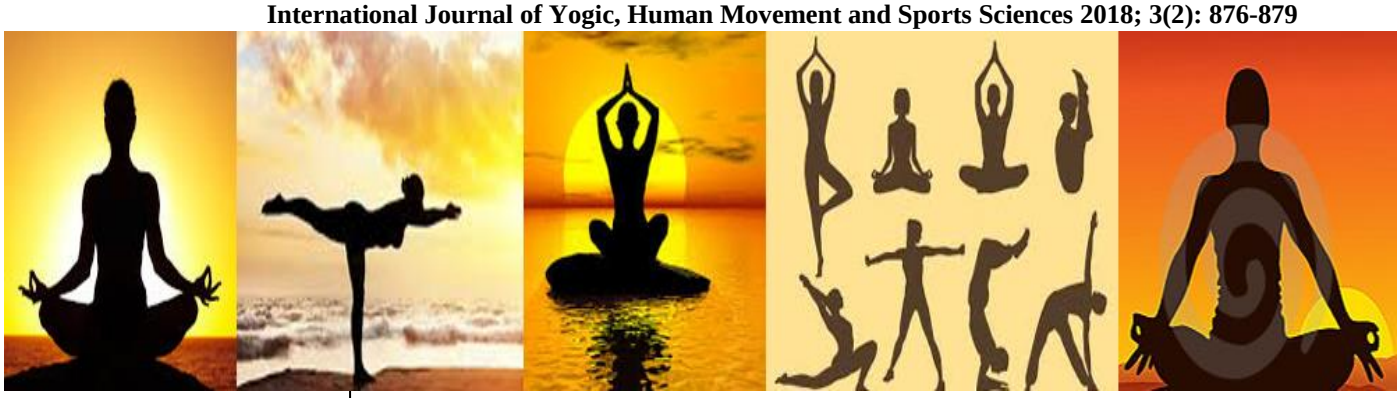
International Journal of Yogic, Human Movement and Sports Sciences 2018; 3(2): 876-879



ISSN: 2456-4419
Impact Factor: (RJIF): 5.18
Yoga 2018; 3(2): 876-879

www.theyogicjournal.com
Received: 21-05-2018
Accepted: 22-06-2018

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Impact of plyometric and SAQ training on physical fitness indices of handball players

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Abstract
Handball is very fascinating modern game with fast and excitement action. Successful performance in Handball requires the good motor abilities and physiological and precise skill to accomplish desired result. This study aimed to find out the impact of plyometric and SAQ training on physical fitness indices of handball players. For this purpose the researcher selected 90 male handball players (30 each from plyometric, SAQ & control group), age ranges between 18-25 years. Samples were selected at different playing levels i.e. AIU, SGFI, HFI and PHA from Punjab state. Random sampling technique was applied to select the sample. Physical variable i.e. agility was selected for this study. To find out the difference among various groups (Plyometric, SAQ & Control group) of Agility variable 'ANCOVA' test was applied at 0.05 level of significance. The results showed that experimental groups (Plyometric & SAQ) of handball players enhance the performance of agility as compare to control group.

Keywords: Agility, physical fitness, plyometric group, SAQ group, control group, ANCOVA

Introduction
The human body is an amazing machine. All human movements, from the blinking of an eye to the running of a marathon, depend on the proper functioning of skeletal muscles. Whether it is the strained effort of a sumo wrestler or the graceful pirouette of a ballet dancer, physical activity can be accomplished only through muscle force. Speed, agility, and quickness (S.A.Q) training is too often associated with sports and other physically demanding activities. Upon closer observation, we realize we have missed the everyday events and activities that can greatly benefit from S.A.Q training. You never know when you're going to run after your kids, play a pickup game of basketball, or cut through the trees during your next ski trip. This method of training can help with the previously mentioned scenarios, but will also enhance workouts for anyone who is involved in recreational sports, exercises on a regular basis, or simply enjoys activities such as walking with dog or playing with their child (Clark et. al., 2014) [1]. Gill and Deol (2017) [3] analysed the effect of 12 week plyometric training on physical fitness variables of handball players and they showed that there is a significant difference found between all the physical fitness variables. Emeish (2015) [2] find that speed, agility, quickness is a system of training that enhances performance levels in all sports. The results revealed significant differences between pre- and post- measurements (speed-agility and reactive agility tests). Our suggestion is that young athletes can benefit by reinforcing muscles and improving the speed, agility, flexibility and jump shoot performance through S.A.Q exercises. Nageswaran (2013) [6] conducted a study to find out the effect of S.A.Q (Speed Agility Quickness) training on Speed, Agility and Balance among Inter Collegiate Athletes. He found that there was a significant improvement and significant different exist due to the effect of S.A.Q training on speed, agility and balance among inter collegiate athletes when compared to control group.

Material and methods
The purpose of the study was to find out the effect of 12 week plyometric and SAQ training on physical fitness variable (agility) of handball players. Total 90 male handball players were selected; (30 each from plyometric, SAQ & control group) age ranges between 18-25 years. The data was obtained from Punjab.

Variable
Physical Fitness Variable
Agility

Statistical Consideration
For interpretation of the data statistical techniques of 'ANOVA' and 'ANCOVA' test was applied to find out mean differences.

Results
A different type of descriptive statistic such as mean was computed to describe variable statistically. The level of significance was set at .05. Its results have been depicted in the following tables.

Table 1: Analysis of variance (ANOVA) of pre test of agility among plyometric, SAQ and control groups

Source of variation	Sum of Squares	Df	Mean Square	F-Value	P- value (Sig.)
Between Groups	11.19	2	5.59	139.84*	.000
Within Groups	3.48	87	.04		
Total	14.67	89			

Tabulated 'F' value (2.29) at .05 level of significance

An examination of table 1 revealed that there is significant difference found with respect to pre agility test among control, plyometric and SAQ groups, because P-value (sig) .000 is less than 0.05 (P<0.05) level of significance. Since the acquired F-ratio 139.84 is found significant.

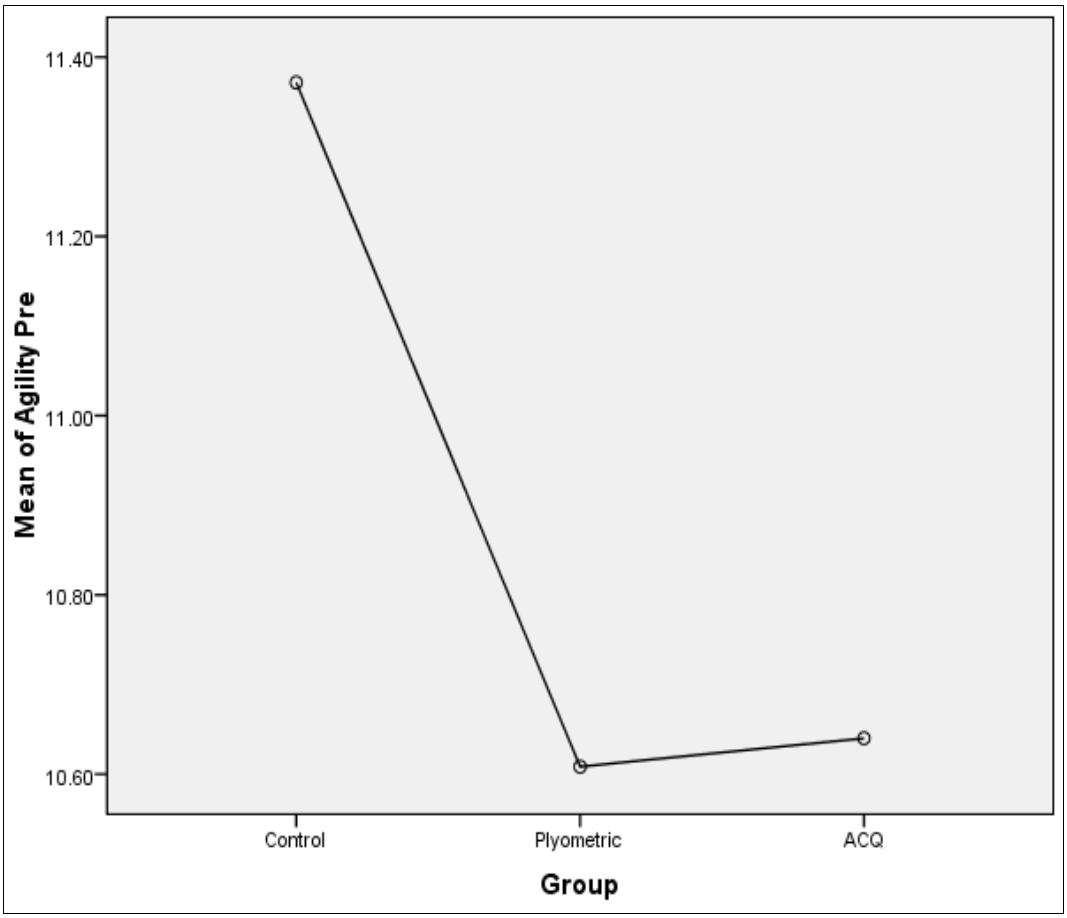

Fig 1: Mean scores of pre test of agility among plyometric, SAQ and control groups

Table 2: Analysis of variance (ANOVA) of post test of agility among, plyometric, SAQ and control groups

Source of variation	Sum of Squares	df	Mean Square	F-Value	P- value (Sig.)
Between Groups	31.99	2	15.99	390.22*	.00
Within Groups	3.56	87	.04		
Total	35.56	89			

Tabulated 'F' value (2.29) at .05 level of significance

It can be seen from table-2 that significant difference is found with regard to the post agility test among control, plyometric and SAQ groups as the p-value (sig.) .000 is found lower than 0.05 level of significance (p>0.05). The acquired F-ratio 390.22 is found significant.

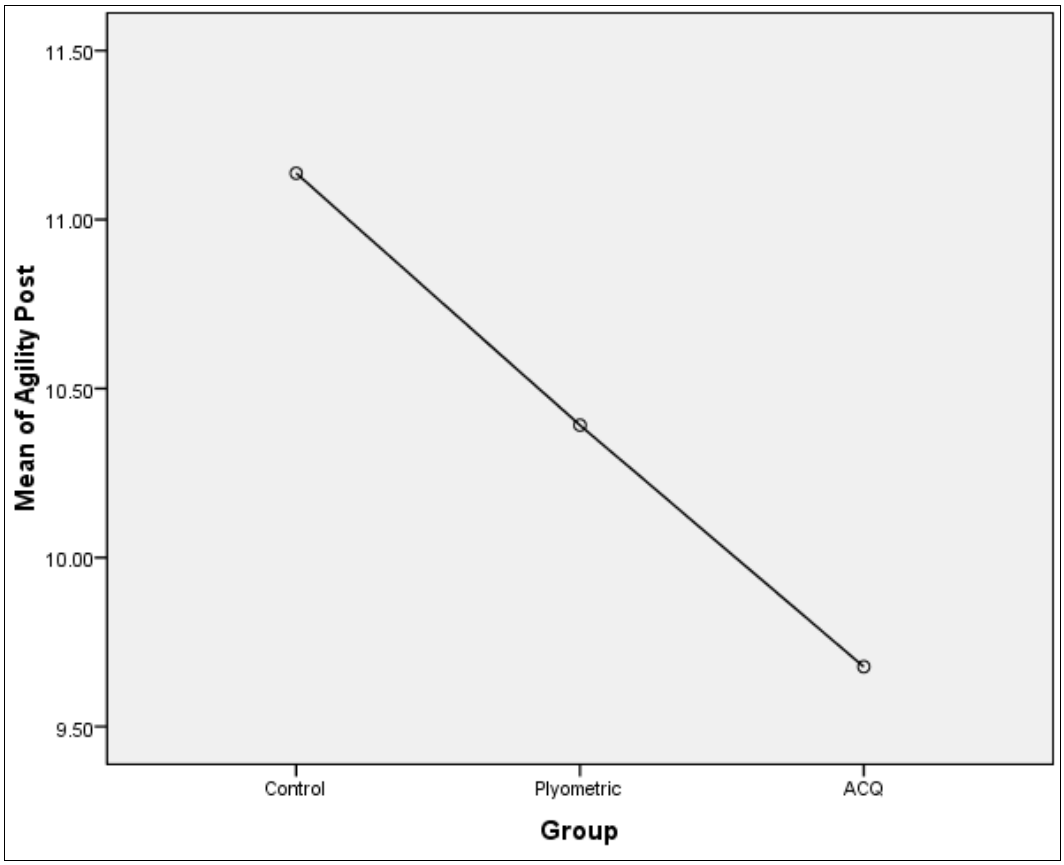

Fig 2: Mean scores of post test of agility among plyometric, SAQ and control groups

Table 3: Analysis of co-variance (ANCOVA) of agility test among plyometric, SAQ and control groups

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	34.20[a]	3	11.40	724.93	.000
Intercept	.08	1	.08	5.60	.020
AGILITY	2.21	1	2.21	140.74	.000
Groups	9.79	2	4.89	311.25	.000
Error	1.35	86	.01		
Total	9773.70	90			
Corrected Total	35.56	89			

R Squared = .962 (Adjusted R Squared = .961)
Computed using alpha = .05

Table 3 represents the F value for comparing agility among control, plyometric and SAQ groups, since p-value for the F-statistics is .000, which is less than 0.05, it is significant. Thus the alternative hypothesis is accepted. Since the F-value is significant, to find out the critical differences, post hoc test has been made, which is shown in the next table.

Table 4: Pairwise comparisons of agility test among plyometric, SAQ and control groups

Group (Mean)		Mean Diff	Std. Error	P-Value (Sig.)
Control Group N= 30 (10.74[a])	**Plyometric Group** N= 30 (10.60[a])	.13	.06	.080
Plyometric Group N= 30 (10.60[a])	**Saq Group** N= 30 (9.86[a])	.74*	.03	.000
Saq Training Goup N= 30 (9.86[a])	**Control Group** N= 30 (10.74[a])	-.87*	.05	.000

The mean difference is significant at the 0.05 level.
From table-4 the following conclusions were drawn:

Table 4 demonstrated that mean difference of agility between control group and plyometric group was found to be insignificant .13. Plyometric group (10.60) had exhibited significantly higher agility than their across control group (10.74). Mean difference of plyometric group and SAQ group was found to be significant .74*. SAQ group (9.86) had exhibited significantly supreme in agility than plyometric group (10.60). Mean difference of agility between SAQ group and control group was found to be significant -.87*. SAQ group had exhibited significantly higher agility than control group.

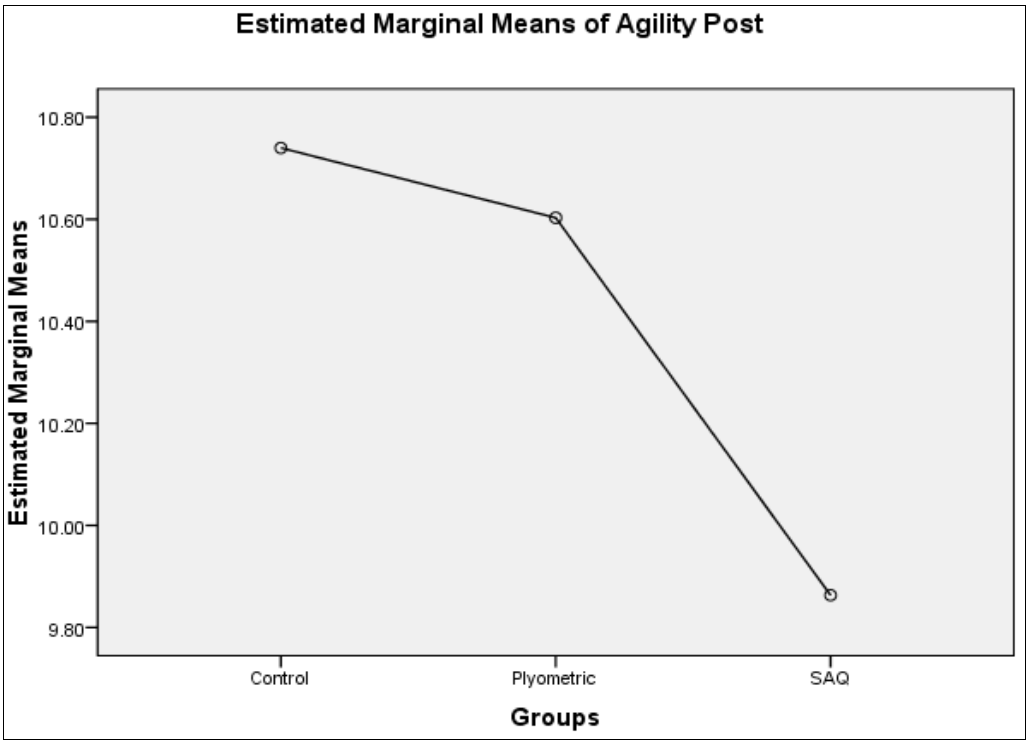

Fig 3: Mean scores of agility test among plyometric, SAQ and control groups

Discussion

The results showed the statistically significant difference was found between pre and post-test values of agility among the all groups eg. Plyometric, SAQ and control. The experimental groups (Plyometric & SAQ) were exhibited significantly higher agility compared to control group thereby, results proved that after the 12 weeks of training handball players improves the rate of agility. Control group also improve the agility of players because they are under practice. The result might be based upon the fact that experimental group was under twelve week SAQ training in which the agility component of handball players was increased by following training drills; T drills, zig-zag jump, jump turn 90 degree, snake run & lateral agility ladder etc. Agility is helpful for handball player in various aspects in a game situation during one to one faint, group tactics, dodging, scoring the goal & it is also helpful for pivot player. The results of the study conducted by Singh & Deol (2016) [7] on "effect of 12 weeks of SAQ drills training programme on selected physical, physiological variables and hockey skills'' also found that after giving the SAQ drill training there is significant effect on the agility variable. These findings are similar with Emeish (2015) [2] who found that SAQ drill training enhances the performance level in all sports. Zoran *et al*., (2013) [8] examined to find out the effects of a 12 week conditioning programme involving speed, agility and quickness (SAQ) training and its effect on agility performance in young soccer players and suggests that SAQ training is an effective way of improving agility, with and without the ball, for young soccer players and can be included in physical conditioning programmes. Miller *et al*. (2006) [5] undertook a study on "to determine the six weeks of plyometric training can improve an athlete'sagility" had found that plyometric training can be an effective training technique to improve an athlete's agility. The findings of this sub variable confirm the findings of Kultu *et al*., (2012) [4].

Conclusion

Taking into account the results of this study, the accompanying conclusion were drawn:

It was observed that the experimental group were having higher rate of improvement in the performance of agility as comparison to their counterparts of handball players.

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