# Effects of Varied Combinations of Aerobic Training followed by Strength Training on Speed, Flexibility, Aerobic Capacity and Dribbling Performance of Male Basketball Players 

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#### Abstract

To study the effects of varied combinations of aerobic training followed by strength training on speed, flexibility, aerobic capacity and dribbling performance of male basketball players eighty male basketball players ( $18-25$ yrs) were selected from various colleges. The subjects were divided as the Experimental group:-1 ( $\mathrm{n}=20$, ASAD group) performed the aerobic and strength program on alternate days, Experimental group:-2 ( $\mathrm{n}=20$; ASSD group) performed the aerobic and strength training program on the same day, Experimental group:-3 ( $\mathrm{n}=20$, ASSTS group) performed the aerobic and strength training program at the same training session and the fourth group ( $\mathrm{n}=20$; CONTROL group) underwent skill practice alone. Pre-test values of speed, flexibility, aerobic capacity and dribbling were $8.725 \pm 0.34,26.35 \pm 1.2,40.7315 \pm 1.7,22.878 \pm 1.1$ for ASAD, $8.7685 \pm 0.35,26.6 \pm 1.1,40.8445 \pm 1.5,22.839 \pm 1.2$ for ASSD $8.8935 \pm .37,26.8 \pm 0.83,40.687 \pm 1.3,22.8370 \pm 0.3$ for ASSTS and $8.8935 \pm .46,26.8 \pm 1.96,40.687 \pm 1.73,22.8575 \pm 0.82$ for CONTROL group respectively; After 12 week of training programme the physical variables and skill performance variables were significantly improved at ( $\mathrm{P}<=0.05$ level) the post test values were $7.8065 \pm .23,28.55 \pm .68,43.745 \pm 1.5,20.8175 \pm 0.96$ for ASAD , $7.9015 \pm 0.43,28.25 \pm .71,42.8375 \pm 1.3,20.8670 \pm 0.85$ for ASSD, $8.393 \pm 0.6,28.2 \pm 0.95,42.077 \pm 0.7,20.9015 \pm 0.7$ for ASSTS and $8.911 \pm 0.33,26.95 \pm 1.73,40.766 \pm 1.41,21.847 \pm 0.87$ for CONTROL group respectively. The study shows that aerobic training followed by strength training yields a positive influence on speed, flexibility, aerobic capacity and dribbling performance of male basketball players.


Keywords: Basketball, Flexibility, Aerobic Capacity, Dribbling and ANOCOVA.

## INTRODUCTION

Basketball is one of today's fastest team sports and is epitomized by grandiose manoeures such as slam dunk and blocked shot. These show cases of athletic ability clearly demonstrate the nature of the sports in that speed. Strength and power are all major determinants of successful basketball performances (Nick stone., 2007). Basketball has gained worldwide popularity and fascinated players and spectators with its dynamic characteristics as a team sport (Hoffman \& Maresh, 2000). In this sport, players cover about $4500-5000 \mathrm{~m}$ during a $40-\mathrm{min}$ game with a variety of multidirectional movements such as running, dribbling, and shuffling at variable velocities (Crisafulli et al., 2002). In order to execute running, dribbling and shuffling like movements during performance, both aerobic and anaerobic metabolic systems appear to be involved throughout a game (Ciuti et al., 1996).Therefore the objectives of this study was to examine the effects of varied combinations of concurrent aerobic and strength training programme on selected skill performance and fitness related parameters of male basket ball players.

## METHODS

## Subjects

Randomly Eighty male basketball players from various colleges representing inter collegiate level tournaments were selected as subjects for this study.

## Protocol

Four groups participated in various training programmes. The Experimental group:-1 ( $\mathrm{n}=20$, ASAD group) performed the aerobic and strength program on alternate days, Experimental group:-2 ( $\mathrm{n}=20$; ASSD group) performed the aerobic and strength training program on the same day, Experimental group:-3 ( $\mathrm{n}=20$, ASSTS group) performed a aerobic and strength training program at the same training session and the fourth group ( $\mathrm{n}=20$; CONTROL group) underwent skill practice alone.

## Testing

The test items selected were highly standardized, appropriate and ideal for the selected variables. Speed, flexibility and aerobic capacity were tested with 50 mtr dash, Sit and Reach test and Queens college three minute step tests respectively. Dribbling was measured with dribble test (KNOX basket ball test), testing occurred before and after the 12 weeks of training regimen.

## Training programme

TABLE - 1: Training Programme for ASAD (1,3, 5,7, 9 and $11^{\text {th }}$ week's schedule, Strength training 3 sets of $10-12$ reps with 60 $\%-75 \% 1 R M$.

| Mon | Tue | Wed | Thu | Fri | Sat |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Warm-up <br> 10 min | Warm-up 10min | Warm-up <br> 10 min | Warm-up 10min | Warm-up <br> 10 min | Warm-up 10min |
| $\begin{aligned} & \text { Jogging: } \\ & 30 \mathrm{~min} . \\ & 75 \%- \\ & 85 \% \mathrm{MHR} \end{aligned}$ | - Bench press, <br> - Shoulder press <br> - Lat pull down <br> - Biceps barbell curl <br> - Triceps dip <br> - Leg extension <br> - Leg curl <br> - Calf raise with barbell | Jogging : <br> 30-45 min. <br> 75\% - <br> 85\%MHR | - Bench press, <br> - Shoulder press <br> - Lat pull down <br> - Biceps barbell curl <br> - Triceps dip <br> - Leg extension <br> - Leg curl <br> - Calf raise with barbel | Jogging : <br> $30-45 \mathrm{~min}$. <br> $75 \%$ - <br> 85\%MHR | - Bench press, <br> - Shoulder press <br> - Lat pull down <br> - Biceps barbell curl <br> - Triceps dip <br> - Leg extension <br> - Leg curl <br> - Calf raise with barbel |
| Warm-down 10 min |  | Warm-down 10 min |  | Warm-down 10 min |  |

TABLE - 2 : Training programme for ASAD (2, 4, 6, 8, 10 and $12^{\text {th }}$ week's schedule, Strength training 3 sets of $10-12$ reps with $60 \%-75 \% 1 R M)$

| Mon | Tue | Wed | Thu | Fri | Sat |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Warm-up 10min | Warm-up 10 min | Warm-up 10 min | Warm-up 10 min | Warm-up 10min | Warm-up 10 min |
| $\begin{gathered} \text { Jogging : } \\ 30 \mathrm{~min} . \\ 75 \% \text { - } \\ 85 \% \mathrm{MHR} \end{gathered}$ | - Bench flyes <br> - Dumbells Lateral raise <br> - Dumbell one arm row <br> - Biceps dumbell curl <br> - Lying Triceps extension <br> - Lunges <br> - Squats <br> - Calf raise with dumbells | $\begin{gathered} \text { Jogging : } \\ 30 \mathrm{~min} . \\ 75 \% \text { - } \\ 85 \% \mathrm{MHR} \end{gathered}$ | - Bench flyes <br> - Dumbells Lateral raise <br> - Dumbell one arm row <br> - Biceps dumbell curl <br> - Lying Triceps extension <br> - Lunges <br> - Squats <br> - Calf raise with dumbells | $\begin{gathered} \text { Jogging : } \\ 30 \mathrm{~min} . \\ 75 \% \text { - } \\ 85 \% \mathrm{MHR} \end{gathered}$ | - Bench flyes <br> - Dumbells Lateral raise <br> - Dumbell one arm |
| Warm-down 10 min |  | Warm-down 10 min |  | Warm-down 10 min | row <br> - Biceps dumbell curl <br> -Lying Triceps extension <br> - Lunges <br> - Squats <br> - Calf raise with dumbells |

TABLE - 3 Training Programme for ASSD (1,3,5,7, 9 and $11^{\text {th }}$ week's schedule, Strength training 3 sets of $10-12$ reps with $60 \%$ $-75 \% 1$ RM.

| Mon / Morning | Mon / Evening | Wed / <br> Morning | Wed / <br> Evening | Fri/ <br> Morning | Fri/ Evening |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Warm-up 10min | Warm-up 10min | Warm-up 10min | Warm-up 10min | Warm-up 10 min | Warm-up 10min |
| $\begin{gathered} \text { Jogging : } \\ 30 \mathrm{~min} . \\ 75 \% \text { - } \\ 85 \% \mathrm{MHR} \\ \hline \end{gathered}$ | - Bench press, <br> - Shoulder press <br> - Lat pull down <br> - Biceps barbell curl <br> - Triceps dip <br> - Leg extension <br> - Leg curl <br> - Calf raise with barbel | $\begin{gathered} \text { Jogging: } \\ 30-45 \mathrm{~min} \text {. } \\ 75 \% \text { - } \\ 85 \% \mathrm{MHR} \end{gathered}$ | - Bench press, <br> - Shoulder press <br> - Lat pull down <br> - Biceps barbell curl <br> - Triceps dip <br> - Leg extension <br> - Leg curl <br> - Calf raise with barbel | $\begin{gathered} \text { Jogging: } \\ 30-45 \mathrm{~min} . \\ 75 \% \text { - } \\ 85 \% \mathrm{MHR} \end{gathered}$ | - Bench press, <br> - Shoulder press <br> - Lat pull down <br> - Biceps barbell curl |
| Warm-down 10 min |  | Warm-down 10 min |  | Warmdown 10 min | - Triceps dip <br> - Leg extension <br> - Leg curl <br> - Calf raise with barbel |

TABLE - 4: Training programme for $\operatorname{ASSD}\left(2,4,6,8,10\right.$ and $12^{\text {th }}$ week's schedule, Strength training 3 sets of $10-12$ reps with $60 \%-75 \% 1 R M)$

| Mon / <br> Morning | Mon / <br> Evening | Wed/ <br> Morning | Wed / <br> Evening | Fri/ <br> Morning | Fri/ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Evening |  |  |  |  |  |


| Warm-up 10 min | Warm-up 10 min | Warm-up 10min | Warm-up 10 min | Warm-up 10min | Warm-up 10 min |
| :---: | :---: | :---: | :---: | :---: | :---: |
| $\begin{gathered} \text { Jogging : } \\ 30 \mathrm{~min} . \\ 75 \%- \\ 85 \% \mathrm{MHR} \\ \hline \end{gathered}$ | - Bench flyes <br> - Dumbells Lateral raise <br> - Dumbell one arm row <br> - Biceps dumbell curl <br> -Lying Triceps extension <br> - Lunges <br> - Squats <br> - Calf raise with dumbells | $\begin{gathered} \text { Jogging: } \\ 30 \mathrm{~min} . \\ 75 \% \text { - } \\ 85 \% \mathrm{MHR} \\ \hline \end{gathered}$ | - Bench flyes <br> - Dumbells Lateral raise <br> - Dumbell one arm row <br> - Biceps dumbell curl <br> - Lying Triceps extension <br> - Lunges <br> - Squats <br> - Calf raise with dumbells | $\begin{gathered} \text { Jogging : } \\ 30 \mathrm{~min} . \\ 75 \% \text { - } \\ 85 \% \mathrm{MHR} \\ \hline \end{gathered}$ | - Bench flyes <br> - Dumbells Lateral raise <br> - Dumbell one arm row <br> - Biceps dumbell curl |
| Warmdown 10min |  | Warm-down 10 min |  | $\begin{aligned} & \text { Warm-down } \\ & 10 \mathrm{~min} \end{aligned}$ | - Lying Triceps extension <br> - Lunges <br> - Squats <br> - Calf raise with dumbells |

TABLE -5: Training programme for ASSTS (1, 3, 5, 7, 9 and $11^{\text {th }}$ week's schedule, Strength training 3 sets of $10-12$ reps with 60 $\%-75 \% 1 \mathrm{RM}$ and 10 minutes gap before Strength works)

| Monday |  | Wednesday |  | Friday |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Aerobic | Strength | Aerobic | Strength | Aerobic | Strength |
| Warm-up 10 min | Strength related Warm-up 10 min | Warm-up 10 min | Strength related Warm-up 10 min | Warm-up 10 min | Strength related Warm-up 10 min |
| $\begin{gathered} \hline \text { Jogging: } \\ 30 \mathrm{~min} . \\ 75 \% \text { - } \\ 85 \% \mathrm{MHR} \\ \hline \end{gathered}$ | - Bench press, <br> - Shoulder press <br> - Lat pull down <br> - Biceps barbell curl | $\begin{gathered} \hline \text { Jogging : } \\ 30 \mathrm{~min} . \\ 75 \%- \\ 85 \% \mathrm{MHR} \\ \hline \end{gathered}$ | - Bench press, <br> - Shoulder press <br> - Lat pull down <br> - Biceps barbell curl | $\begin{gathered} \hline \text { Jogging : } \\ 30 \mathrm{~min} . \\ 75 \% \text { - } \\ 85 \% \mathrm{MHR} \\ \hline \end{gathered}$ | - Bench press, <br> - Shoulder press <br> - Lat pull down <br> - Biceps barbell curl |
| Warmdown 10 min | - Triceps dip <br> - Leg extension <br> - Leg curl <br> - Calf raise with barbel | Warmdown 10 min | - Triceps dip <br> - Leg extension <br> - Leg curl <br> - Calf raise with barbel | Warmdown 10 min | - Triceps dip <br> - Leg extension <br> - Leg curl <br> - Calf raise with barbel |

TABLE -6: Training programme for ASSTS ( $2,4,6,8,10$ and $12^{\text {th }}$ week's schedule, Strength training 3 sets of $10-12$ reps with $60 \%-75 \% 1 \mathrm{RM}$ and 10 minutes gap before Strength works)

| Monday |  | Wednesday |  | Friday |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Aerobic | Strength | Aerobic | Strength | Aerobic | Strength |
| Warm-up 10min | Strength related Warm-up 10 min | Warm-up 10 min | Strength related Warm-up 10 min | Warm-up 10 min | Strength related Warm-up 10 min |
| $\begin{gathered} \text { Jogging : } \\ 30 \mathrm{~min} . \\ 75 \%- \\ 85 \% \mathrm{MHR} \end{gathered}$ | - Bench flyes <br> - Dumbells Lateral raise <br> - Dumbell one arm row <br> - Biceps dumbell curl <br> - Lying Triceps extension <br> - Lunges <br> - Squats <br> -Calf raise with dumbbells | $\begin{gathered} \text { Jogging : } \\ 30 \mathrm{~min} . \\ 75 \% \text { - } \\ 85 \% \mathrm{MHR} \end{gathered}$ | - Bench flyes <br> -Dumbells Lateral raise <br> - Dumbell one arm row <br> - Biceps dumbell curl <br> - Lying Triceps extension <br> - Lunges <br> - Squats <br> - Calf raise with dumbells | $\begin{gathered} \text { Jogging : } \\ 30 \mathrm{~min} . \\ 75 \% \text { - } \\ 85 \% \mathrm{MHR} \end{gathered}$ | - Bench flyes <br> - Dumbells Lateral raise <br> - Dumbell one arm row <br> - Biceps dumbell curl |
| Warm-down 10 min |  | Warm-down 10 min |  | Warm-down 10 min | - Lying Triceps extension <br> -Lunges <br> - Squats <br> - Calf raise with dumbells |

## Statistical Analysis

A paired sample of student's t-test was used to determine the significance of the mean differences between the pretest to posttest values of a variable in the same group. Analysis of covariance (ANOCOVA) was used with the pretest values as the covariate for each
group to adjust the posttest values to determine the significance of mean difference among the groups. Statistical significance was accepted as $p \leq 0.05$ level of confidence.

## Results and Discussion

The results of the study showed significant differences in dribbling (Table-7)
TABLE - 7:- T- Test

| Variable | ASAD | ASSD | ASSTS | CONTROL |
| :--- | :---: | :---: | :---: | :---: |
| Speed | $9.587^{*}$ | $6.64^{*}$ | $2.738^{*}$ | 1.371 |
| Flexibility | $6.242^{*}$ | $5.180^{*}$ | $4.381^{*}$ | 0.238 |
| Aerobic <br> Capacity | $21.208^{*}$ | $24.508^{*}$ | $4.465^{*}$ | .325 |
| Dribbling | $9.060^{*}$ | $8.541^{*}$ | $10.312^{*}$ | $3.826^{*}$ |

*Table value $=2.093$
The scheduling of aerobic and strength training performed on alternate days, on the same day and during the same session produced greater development on dribbling performance and fitness variables of speed, flexibility and aerobic capacity significantly (Table -8).

TABLE - 8:- Analysis of Variance and Covariance

| Variable | ANOVA <br> Pre | ANOVA Post | ANACOVA <br> Adj.Post test |
| :--- | :---: | :---: | :---: |
| Speed | 0.993 | $8.22^{*}$ | $27.092^{*}$ |
| Flexibility | 0.489 | $28.512^{*}$ | $9.935^{*}$ |
| Aerobic <br> Capacity | 0.008 | $6.578^{*}$ | $49.321^{*}$ |
| Dribbling | 0.043 | $18.595^{*}$ | $7.225^{*}$ |

*Critical value $=2.73$
The Speed, flexibility, aerobic capacity and dribbling performance had improved significantly after 12 weeks of training. The improvements in speed were as follows: Group ASAD $=10.5 \%$; group ASSD $=9.88 \%$; group ASSTS $=5.62 \%$; and group CONTROL $=0.19 \%$. The improvements in flexibility were as follows: Group ASAD $=8.34 \%$; group ASSD $=6.2 \%$; group ASSTS $=$ $5.2 \%$; and group CONTROL $=0.55 \%$. The improvements in aerobic capacity were as follows: Group ASAD $=7.4 \%$; group ASSD $=$ $4.9 \%$; group ASSTS $=3.4 \%$; and group CONTROL $=0.194 \%$. The improvements in dribbling were as follows: Group ASAD $=9 \%$; group ASSD $=8.63 \%$; group ASSTS $=8.47 \%$; and group CONTROL $=4.4 \%$.The study is in line with previous studies of Davis.W Jackson. (2008) who reported a significant increase in lower body flexibility by $8.4 \%$. Further the present study are in line with previous studies [J.McCarthy (1993), Christos Balabins (2003) and Collins (1993)] who reported a significant increase in aerobic capacity by $16 \%$ due to combined strength and aerobic endurance training during the same session, $12.9 \%$ due to combined aerobic endurance and strength training for male basket ball players and $6.2 \%$ (endurance /strength) concurrent training performed in males and females performed during the same session respectively.

## CONCLUSION

The coaches and physical education personnel should plan the training schedule for basketball players in such a way that at least 24 hours of rest is given between the strength training and aerobic endurance training programme so that the basketball players can improve their performance at the highest level or at least 8 hours of rest is given between the strength training and aerobic endurance training programme so that the basketball players can improve their performance but not as like 24 hours of rest between strength and aerobic trainings.

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