SUMMARY CONCLUSION AND RECOMMENDATIONS

Summary

Exercises to improve maximal muscle strength and maximal aerobic endurance capacity are essential elements for enhancing handball playing performance. A combined intervention of strength and endurance training is common practice in handball training, but the scientific evidence is scarce. The influences between strength and endurance training have been investigated in other sports but the findings are scattered. Some state the interventions are negative to each other, some state there is no negative relationship and some find bisected and supplementary benefits from the combination when training is applied appropriately. The purpose of the study was to examine the alterations on selected motor fitness and physiological variables of male handball players due to combined high intensity intermittent training and weight training for eight weeks.

To achieve the purpose of the study twenty four (24) male handball players with right hand and left leg as dominant were considered. These players were selected from Sports Authority of India, Sports Training Centre (STC), Sarurnagar, Hyderabad, Andhra Pradesh. Their mean age, height and weight of the selected subjects are 22.55 ± 3.24 years, 171.24±5.65 cm and 64.39±4.37 Kg respectively. The selected subjects were randomly distributed into two groups
namely combined training group (N=12) and control group (N=12). All subjects were subjected to medical examination by a general medical practitioner before participation in the study to ensure that they were capable of taking part in fitness testing and training.

The investigator referred to various relevant literatures, consulted with experienced experts in sports to identify ideal variables. In addition to this by using the investigator’s personal knowledge and professional experience the following most appropriate variables were selected in the present investigation. The dependent variables selected in this study were Motor fitness variables (balance, speed, power, agility) and physiological variables (percent body fat, lean body mass, aerobic capacity, anaerobic capacity, fatigue index, resting heart rate). The independent variable selected in the present study was combined training (combination of high intensity intermittent training and weight training), with two session of high intensity intermittent training and two session of weight training, totally four session per week for eight weeks.

All the subjects reported to the Sports Authority of India, Sports Training Centre (STC), Sarurnagar, Hyderabad, Andhra Pradesh, who were tested on motor fitness and physiological variables prior to training and after eight weeks of training. The testing session consists of warm-up and test interspersed with rest. All tests were explained and demonstrated. Before testing, subjects were given practice trials to become familiar with the testing procedures. All tests were counterbalanced during pre and post testing to ensure that testing effects
were minimized. Subjects performed each test according to test procedure and the scores of best trials were taken for this study.

In the morning of the first day of testing measurements like height, weight, heart rate, body composition, balance on dominant foot, balance on non dominant foot, speed, power and agility were measured, however in the evening anaerobic capacity were evaluated. On the evening of the second day of testing the subjects were tested for their aerobic capacity.

The subjects in the combined endurance and strength training group performed endurance training twice a week and strength training twice a week, performing a total of four training sessions per week on alternate days. The high intensity intermittent training was formulated based on Gerbeaux et al. (1991) proposed method of calculating Maximal aerobic speed (MAS). The MAS of 4 m/s was used as a criterion velocity to set running paces for high-intensity short intermittent exercises. They performed series of sprints lasting 15 and 20 second for given distance. The training group performed training at 1:1 work rest ratio. The recovery adopted in the present study was passive recovery. During alternate days they performed weight training at different intensities. During first four weeks were 60 to 70% and last four weeks 70 to 80% of the one repetition maximum 2-4 sets, 8-12 repetitions per set with 3 minutes rest between sets. They performed lat pull-down, leg press, bench press, shoulder press, seated row, leg extension, leg curl, biceps curl, triceps push-down and standing heel raise that were performed with the multi gym machine.
The CTG and CG were assessed on selected motor fitness and physiological variables before and after eight weeks of combined training. The data collected from the combined training group and control group on selected motor fitness and physiological variables were statistically analysed to examine the effectiveness of combined training. The statistical technique used for the present investigation was Analysis of Covariance (ANCOVA). Since only two groups are involved post hoc test was not applied to determine the significant paired mean differences. The level of confidence was fixed at 0.05 to test the significance. The data was analysed in computer system by using statistical package for social science (SPSS) version 17.

**Conclusions**

The present study showed that combined training is ineffective in improving the motor fitness components in male handball players. However, it significantly altered physiological variables. The dependent variables, percent body fat decreased significantly \((p < 0.05)\) by 28.44\%, fatigue index \((p < 0.05)\) by 40.20\% and resting heart rate \((p < 0.05)\) by 6.13\%. On the other hand, increases in lean body mass \((p < 0.05)\) by 5.13\%, aerobic capacity \((p < 0.05)\) by 13.79\% and anaerobic capacity \((p < 0.05)\) by 29.80\% in male handball players.

In the present study male handball players performing both endurance and strength training in parallel leads to significantly improve cardio respiratory endurance but it fails to impact motor fitness components. Although, eight weeks of combined training have obvious contributions to team sport players, who
require both a high aerobic capacity and anaerobic power to reproduce multiple high-energy outputs. This study suggests that improvements in aerobic and anaerobic performance may provide an advantage for the players to effectively and continuously perform their technical skills and motor abilities under competitive conditions.

**Recommendations**

Based on the results of the study the following recommendations have been made.

1. In the present study motor fitness performances are impaired which require detailed investigation on training load and procedures.

2. In the present investigation strength alterations was not analysed. However, strength which forms the base for motor fitness. Impairment in motor fitness along with strength require in depth analysis.

3. Combined training effects on cardiovascular changes have to be measured during exercise and recovery.

4. Alterations in haematological parameters due to combined training have to be studied.

5. Impact of combined training on coordinative ability of handball players has to be studied.
Based on the limitations of the study the following recommendations have been made.

1. The technical skills need to be investigated, as it has not been tested in this study.

2. Studies can be extended to women players, as they were not considered in this study.

3. The studies can extended in comparing dominant and non dominant foot dominance of players and the effectiveness of combined training thereof.