OBJECTIVE

The purpose of this study was to investigate the effect of varied combinations of resistance training, aerobic training and yogic practices on percent body fat and aerobic capacity of obese adolescent children. A total of forty five (45) male obese subjects having BMI 30.0 – 39.9 were selected for the study. Their age ranged between 10 to 14 years. These subjects were randomly distributed in three groups namely resistance aerobic training group (RATG), resistance and yoga training group (RYTG) and control group (CG) each group consisting of 15 subjects each. All subjects undergo serious health checkup prior to the study to avoid death during training or testing. Each subject reported to the Department of Physical Education, E. R. Higher Secondary School, Trichy and they were tested aerobic capacity before and after training. Aerobic capacity was measured by one mile run and walk test. Triceps, biceps, subscapular and suprailliac skinfold measurement was taken to measure percent body fat using skinfold caliper. Prior to the formal study sessions, a pilot study was conducted to validate research procedure and the initial capacity of the participants to design the training programme. The RATG and RYTG group underwent 8 weeks of training. The result showed that adjusted post test of percent body fat and aerobic capacity found to be significant. The covariate is significant, indicating that aerobic capacity before training had a significant improvement after 8 weeks of training. RATG is better than RYTG in reducing percent body fat and improving aerobic capacity of obese children.

INTRODUCTION

Obesity is recognized as a major global burden to health (Wearing, et al., 2006). In India when the child reaches adolescence their level of physical activity declines. There is evidence (Wang, et al., 2002) that children and adolescents of urban families are more overweight than rural, possibly because of decreased physical activities, sedentary lifestyle, altered eating patterns and increased fat content of the diet. Increase in sedentary activities, such as television viewing and computer games, is suspected to be responsible for the decline in physical activity levels.

Poor cardiorespiratory fitness (CRF) and muscle strength and abnormalities in the autonomic nervous system (ANS) are important predictive factors of morbidity and mortality associated with obesity (Miyatake, et al., 2004; Wei, et al., 1999; Hulens, et al., 2001; Grassi, et al., 2004; Piccirillo, et al., 1998). Physical exercise is a key strategy in the management of obesity. Numerous health-related benefits have been observed in overweight and obese people who participate in exercise training programs, even in those without significant weight loss (ACSM, 2009; Ciolac and Guimaraes, 2004). For example, CRF improves in overweight and obese subjects following exercise training programs (Church, et al., 2007; Irving, et al., 2008; Menshikova, et al., 2005). Similarly, in players aerobic training of high intensity nature tends to improves aerobic fitness (Chittibabu 2013).

In order to eradicate obesity it is therefore important to encourage sustainable physical activity habits in children, and further reinforcing these habits in adolescents, which will help establish desirable healthy lifestyle patterns that continue into adulthood. The purpose of this study was to investigate the effect of varied combinations of resistance training, aerobic training and yogic practices on percent body fat and aerobic capacity of obese adolescent children.

METHODS

SUBJECTS AND VARIABLE

A total of forty five (45) male obese subjects having BMI 30.0 – 39.9 were selected for the study. Their age ranged between 10 to 14 years. These subjects were randomly distributed in three groups namely RATG (15), RYTG (15) and CG (15). All subjects undergo serious health checkup prior to the study to avoid death during training or testing. Each subject reported to the Department of Physical Education, E. R. Higher Secondary School, Trichy and they were tested aerobic capacity before and after training. Aerobic capacity was measured by one mile run and walk test.

Rajarathi, R and Pitchaiappa, T
Department of Physical Education, Karpagam University, Coimbatore

M.R. College of Physical Education, Thathanur, Udayarpalayam, Ariyalur

Available Online at http://www.recentscientific.com
Skinfold measurement was obtained from the obese subjects. There are many common sites at which the skinfold pinch can be taken. The four sites proposed by Durnin and Womersley (1974) is applied in this study. The sites recommended by Durnin and Womersley (1974) are Triceps, Biceps, Subscapular and Suprailliac (waist) measurements are obtained using skinfold caliper and Siri (1961) equation is used to estimate percent body fat.

**Pilot Study**

Prior to the formal study sessions, a pilot study was conducted to validate research procedure and the initial capacity of the participants to design the training programme. For the purpose, twelve participants (n=10) were selected at random, who had BMI 30.0 – 39.9 were selected (ACSM, guidelines, 2000). These subjects were classified into two groups as RATG (n=6) and RYTG (n=6). This group underwent 5 session of training under the watchful eyes of the investigator. The initial loads of the participants were fixed and the training programme for both groups were designed separately based on the performance in the pilot study.

**Resistance training Programme schedule**

Resistance training was administered to obese subject for 90 min/workout. The equipments used are free weights and exercise machines available in E.R. Higher Secondary School, Trichy. The load designed for these subjects as intensity between 60-85% 1RM, 6-12 repetitions, 3-4 sets and 1 min rest between tri-sets. The training load was increased by 5% every week. These subjects performed resistance training 3days/week (Monday, Wednesday & Friday) for eight weeks.

**Aerobic training Programme schedule**

Aerobic training was given for 2 days per week (Tuesday and Thursday). We used the formula proposed by Gerbeaux et al., (1991) to calculate Maximal aerobic speed (MAS). The MAS was used as a criterion velocity to set running paces for high-intensity short intermittent exercises.

**RESULTS**

It is clear from the table 1 that the pre test (F = 0.044, p > 0.05) showed no significant difference in percent body fat. However, post (F = 3.511, p < 0.05) and adjusted post test mean (F = 9.515, p < 0.05) value showed significant difference. The covariate is significant, indicating that percent body fat before training had a significant altered after 8 weeks of training. Since, adjusted post test mean is significant Scheffé S post hoc was applied and presented in table 2. It is clear from the table 1 that the pre test (F = 0.032, p > 0.05) and post test (F = 3.082, p > 0.05) showed no significant difference in aerobic capacity. However, adjusted post test mean value showed significant difference $F = 9.515, p < 0.05$. The covariate is significant, indicating that

**Table 1** Summary of ANCOVA on Percent body fat and Aerobic capacity

<table>
<thead>
<tr>
<th>Variable</th>
<th>Groups</th>
<th>Tests</th>
<th>F value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent body fat</td>
<td></td>
<td>Pre</td>
<td>Post</td>
</tr>
<tr>
<td>RATG</td>
<td>36.54 ±3.67</td>
<td>32.79 ±3.75</td>
<td>32.79</td>
</tr>
<tr>
<td>RYTG</td>
<td>36.33 ±4.10</td>
<td>35.65 ±4.33</td>
<td>34.83</td>
</tr>
<tr>
<td>CG</td>
<td>36.75±3.87</td>
<td>37.05 ±5.05</td>
<td>36.88</td>
</tr>
<tr>
<td>Aerobic capacity</td>
<td></td>
<td>Pre</td>
<td>Post</td>
</tr>
<tr>
<td>RATG</td>
<td>32.30±7.95</td>
<td>38.10 ±7.42</td>
<td>37.79</td>
</tr>
<tr>
<td>RYTG</td>
<td>31.90±7.90</td>
<td>32.41 ±8.02</td>
<td>32.43</td>
</tr>
<tr>
<td>CG</td>
<td>31.58±7.73</td>
<td>31.79 ±7.58</td>
<td>32.08</td>
</tr>
</tbody>
</table>

The tabulated $F$ ratio for: 0.05 level (df 2 & 42 = 3.220; df 2 & 41 = 3.226)

**Table 2** Scheffé S test for difference between paired means on percent body fat and aerobic capacity among RATG, RYTG and CG

<table>
<thead>
<tr>
<th>Variables</th>
<th>RATG</th>
<th>RYTG</th>
<th>CG</th>
<th>MD</th>
<th>CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent body fat</td>
<td>32.79</td>
<td>34.83</td>
<td>2.04*</td>
<td>1.42</td>
<td></td>
</tr>
<tr>
<td></td>
<td>32.79</td>
<td>34.83</td>
<td>4.09*</td>
<td>1.42</td>
<td></td>
</tr>
<tr>
<td>Aerobic capacity</td>
<td>37.79</td>
<td>32.43</td>
<td>5.36*</td>
<td>2.326</td>
<td></td>
</tr>
<tr>
<td></td>
<td>37.79</td>
<td>32.43</td>
<td>5.71*</td>
<td>2.326</td>
<td></td>
</tr>
</tbody>
</table>

*Significant at 0.05 level.

The MAS of the obese subjects are 2.70 m/s and intensities are fixed from 100 to 130%. Each session was preceded by a standardized warm-up: 1× (10×10s), (7× 15s), (5× 20s) at 100% of MAS (one set of 10 repetitions of 10 s or 7 repetitions of 15s or 5 repetitions of 20 s of running at 100% of MAS, punctuated by 10s, 15s, 20s of recovery). Between each set, the recovery was of 3 min. Exercise time was 30min for each session. The training schedule followed for eight weeks.

**Yoga training**

The yoga group practiced a mixed set of yoga techniques daily, in the form of asana. They performed two asanas every week and keep on adding two asanas for six week and last two week they performed sixth week schedule. The asanas are Ekpada Uttan Asana, Uttanpada Asana, Bhujanga Asana, Shalabha Asana, Santulan Asana, Pawanmuktasana Asana, Suryanamaskar Asana, Dhanur Asana, Ardha Vakra Asana, Paschimottan Asana, Supta Vajra Asana, Matsyendra Asana. After practicing asana they rest is shava Asana for the sipulated period. They practice yoga daily.

**Statistical analysis**

For this study Analysis of Covariance (ANCOVA) was used. The proposed hypothesis was tested at 0.05 level of confidence. Beside this mean and standard deviation were also calculated. SPSS statistic software package (SPSS Company, America, version 17.0) was used.

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aerobic capacity before training had a significant improvement after 8 weeks of training. Since, adjusted post test mean is significant Scheffé S post hoc was applied and presented in table 2.

From Table 2, the Scheffé S post hoc test showed significant difference between the groups on percent body fat and aerobic capacity at 0.05 level of confidence. Thus, it is concluded that 8 weeks of RATG found to be better than RYTG in reducing percent body fat and improving aerobic capacity among adolescent male obese children.

DISCUSSION FINDINGS

It is evident in this study that significant improvement in cardiorespiratory fitness noticed in combined training effect of resistance and aerobic training. These results were also in line with the previous literature that endurance training improves both aerobic capacity (Rognmo, et al., 2004; Wisloff, et al., 2007) and endothelial function (Wisloff, et al., 2007; Meyer, et al., 2006), and is now increasingly recommended in the prevention and treatment of overweight and obesity (Haskell, et al., 2007). Scientific evidence and clinical observations support the contention that participation in strength-building activities gives obese children and adolescents a chance to experience success and gain confidence in their abilities to be physically active (Shabi, et al., 2006; Sothern, 2001; Sothern, et al., 2000).

In addition to enhancing muscular strength and local muscular endurance, appropriately prescribed and competently supervised resistance training programs may also positively influence bone mineral density, cardiorespiratory fitness, blood lipids, and psychosocial well-being (Faigenbaum, 2007).

CONCLUSION

RATG for 8 weeks is better than RYTG in significantly altering percent body fat and improving aerobic capacity of obese children.

References


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