

COMPARISON OF CHANGES IN AUTONOMIC AND RESPIRATORY PARAMETERS OF GIRLS AFTER YOGA AND GAMES AT A COMMUNITY HOME

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Summary: The heart rate, breathing rate, and skin resistance were recorded for 20 community home girls (Home group) and for 20 age-matched girls from a regular school (School group). The former group had a significantly higher rate of breathing and a more irregular breath pattern, known to correlate with high fear and anxiety, than the School group. Skin resistance was significantly lower in the School group, which may suggest greater arousal. 28 girls of the Home group formed 14 pairs, matched for age and duration of stay in the home. Subjects of a pair were randomly assigned to either yoga or games groups. For the former, emphasis was on relaxation and awareness, whereas for the latter increasing physical activity was emphasized. At the end of an hour daily for six months both groups showed a significant decrease in the resting heart rate relative to initial values (Wilcoxon paired-sample test), and the yoga group showed a significant decrease in breath rate, which appeared more regular but no significant increase in the skin resistance. These results suggest that a yoga program which includes relaxation, awareness, and graded physical activity is a useful addition to the routine of community home children.

From Finland, reports are available on the psychophysiological status of children with problems at home, in school, or in society, who are admitted to community homes, governed by special legislation (Ahvenainen, Lindholm, & Nikkanen, 1984). These children were described as physically normally developed but were socially and emotionally traumatized. They were also reported to describe more anxiety and fears than is usual and to be extra aggressive. A report on physiological measures showed that the resting electrical activity of selected facial and back muscles (EMG) was significantly higher in Community Home boys than in a Control group of the same age in an ordinary school (Rauhala, Alho, Hanninen, & Helin, 1990). This was considered likely increased by stress. After four months of relaxation training combined with increased physical activity, the EMG measures of the Community Home group decreased compared to their baseline values as well as compared to the initial values of the Control group.

The present study was conducted with girls in a community home in South India, who (like the children in Finland described above) were admitted due to problems in adjusting at home or in society. The aim was to examine whether there would be differences in standard psychophysiological measures (heart rate, skin resistance, and breath rate and pattern) of these girls compared to girls of the same age who were staying at home and attending a regular school. This was the first part of the study.

In the second part of the study, a comparison was made of the effects of two interventions (yoga and games) on the same measures recorded for Community Home girls. The routine of the community home included education, work, and psychotherapy. Yoga or games were introduced for the first time. Yoga emphasizes relaxation with awareness, whereas playing games was intended to increase the physical activity. The reason for selecting these interventions can be understood from previous reports. Increased physical activity has been shown to reduce autonomic reactivity to mental stressors (Steptoe, Kearsley, & Walters, 1993). Also, the practice of yoga reduces autonomic arousal (Wallace, Benson, & Wilson, 1971; Joseph, Sridharan, Patil, Kumaria, Selvamurthy, Joseph, & Nayar, 1981). The study allowed comparison of the effects of relaxation with those of increased physical activity, which had been combined in the previous study of children in a community home (Rauhala, et al., 1990)

METHOD

Subjects

In Part one, 40 girls between 12 and 16 years of age were selected at random from a total of 120 girls in a community home. All had a history of difficulty in adjusting at home or in society. Fifteen were from broken homes (one or both parents were dead or their parents were separated). For comparison, another 40 girls of the same age group were selected at random from students who were attending a regular school and living at home. Both groups were from similar socioeconomic backgrounds. A routine medical examination verified that the girls had normal health, and none was receiving medication. For both groups the informed consent of the subjects and their guardians was obtained.

The second part was carried out on 28 girls of the 40 from the community home. They were randomly assigned to either the yoga or the games group. The group's average age \pm SD was 15.1 \pm 0.6 yr. (games group) and 14.9 \pm 0.6 yr. (yoga group). The duration for which they had lived in the home ranged from 6 to 36 mo. (average for the games group was 12.8 mo. and for the yoga group 12.0 mo.).

Design of the Study

In Part one 40 girls aged between 12 and 16 yrs., were selected at random from the residents of a community home. Forty girls from a regular school who were of the same age group and socioeconomic status were selected for comparison. The two groups were matched for age (\pm 6 mo). Of the 80 girls 20 age-matched pairs could be formed for comparison. Their data were analyzed. Both groups were assessed polygraphically under similar conditions.

In the second part, the community home girls alone were assessed. Out of the 40, 28 girls were matched for age (\pm 6 mo.) and duration of stay in the community home (\pm 2 mo.). Subjects of a pair were then assigned to a random order of the two groups, viz., games or yoga. The baseline assessments of these groups were made in a similar manner before the programs commenced. After this the Yoga group received training in yoga, while the Games group played games for an hour, at the same time of the day, five days a week. The programs were not part of the earlier routine. The staff members of the home supervised the programs. Also, staff were asked to alternate between supervising yoga and games on different days. After six months of practice, both groups were assessed once more, under conditions like those of the baseline assessment. The subjects were also asked to give a report of their experience of the program in which they had participated.

Yoga training

Staff members of the community home who were first trained in yoga were involved in teaching and supervising the subjects. A trained yoga teacher visited the class every fortnight to check the practice. Yoga techniques included simple yogasanas, postures which are maintained for as long as possible while relaxed for, 50 minutes. As subjects had more experience in yogasanas the time for which the posture was maintained was gradually increased. Also, brief (10-min.) relaxation in shavasana (corpse posture) was included. Throughout both practices, the emphasis was on relaxation and awareness of physical and other sensations.

Games

The session included jogging in place, rapid bending forwards and backwards, twisting, and bending sideways (40 minutes) as well as games such as relay races in which all the girls had to take an active part for about 20 minutes.

Measurements

Measurements for Part 1 (Community Home girls versus those from an ordinary school) as well as for Part 2 (Yoga versus Games groups of Community Home girls) were made under identical conditions. A moderately lit, sound-attenuated cabin was used for recording. After an initial period of 15 min. while sitting at ease, assessments were made for 10 min., also in the same Posture.

A 10-channel polygraph (Polyrite Recorders and Medicare, Chandigarh, India) was used to record the electrocardiogram (EKG), respiration, and the skin resistance. The EKG was recorded using standard limb lead 1 configuration. Skin resistance was recorded using silver chloride disc electrodes filled with electrode paste, and placed in contact with the volar surfaces of the distal phalanges of the index and middle fingers of the left hand. A constant current of 10 microamperes was passed between the electrodes. Respiration was recorded using a volumetric pressure transducer. Subjects were asked to stand erect and the transducer was fixed around the trunk, approximately 5 cm below the lower costal margin.

Data extraction and analysis

Data extraction was carried out similarly for both parts of the study. Polygraphic data were scored "blind" as follows. The heart rate (in beats per minute), was obtained by counting the number of QRS complexes in successive 60-sec. epochs continuously. The skin resistance (in kilo ohms) was sampled at 20-sec. intervals continuously. The breath rate (in breath cycles per minute) was obtained by counting the breath cycles in 60-sec. epochs continuously. For each subject the average of the values obtained during the 10-min. recording session were analysed.

The data of girls from the community home were compared with those of regular school girls of the same age using the Mann-Whitney U test. The data of both groups obtained at the end of six months were compared with their respective baseline data using the Wilcoxon paired-sample test.

RESULTS

Part

I

The breath rate of the Community Home group was significantly higher than that of the group from a regular school using the Mann-Whitney U test [U value obtained is 348. for $n_1=n_2$ =number in each group=20, $U=319$ at .001 (two-tailed) probability level, hence $p<.001$]. Also, skin resistance of the Community Home group was significantly lower than that of the regular school group [U value obtained is 272. For $n_1 = n_2 = 20$, $U= 262$ at the .05 (one-tailed) probability level, and $U=273$ at the .05 (two-tailed) probability level, hence $p < .05$]. The group mean values \pm SD are presented in Table 1.

TABLE 1: Means and standard deviations for Heart rate, Respiratory rate, and Skin resistance values in Community Home Girls and those from a Regular Schools

| Group | n | Heart Rate (bpm) | | Respiratory Rate (breaths/min.) | | Skin Resistance Kilo ohms | |
|----------------|----|------------------|------|---------------------------------|-------|---------------------------|-------|
| | | M | SD | M | SD | M | SD |
| Community home | 20 | 81.9 | 12.2 | 22.5 | 4.2** | 105.7 | 72.2* |
| Regular | 20 | 80.0 | 11.7 | 18.3 | 2.4 | 117.9 | 162.0 |

* $p<.05$, One tailed. ** $<.001$, two-tailed Mann-Whitney U test

Part II

There was a significant decrease in the heart rates of both Yoga and Games groups of Community Home girls at the end of six months compared with their respective baseline values, using the Wilcoxon paired-sample test [T= 1 for the Yoga group and T= 2 for the Games group. For n

TABLE II : Heart Rate, Respiratory Rate, Skin Resistance Values in Yoga and Games Groups of Community Home Girls at the Beginning (1) and End (2) of Six Months

| Group | n | Time | Heart Rate | | Respiratory Rate | | Skin Resistance | |
|-------|----|------|------------|-------|------------------|------|-----------------|------|
| | | | M | SD | M | SD | M | SD |
| Yoga | 20 | 1 | 81.0 | 8.3 | 22.5 | 2.1 | 105.0 | 79.2 |
| | 20 | 2 | 67.2 | 8.6+ | 21.3 | 2.3* | 121.5 | 72.4 |
| Games | 20 | 1 | 80.3 | 14.5 | 22.5 | 4.9 | 125.3 | 68.5 |
| | 20 | 2 | 69.4 | 10.3+ | 21.2 | 3.9 | 100.2 | 81.6 |

* $p < .02$ + $p < .001$ Wilcoxon paired sample - test

(number of pairs)=14, T=4 at the .001] two-tailed probability level, hence $P < .001$. The Yoga group alone showed a significant reduction in the breath rate [T value obtained is 14. For n = 14, T= 15 at the .02 (two-tailed) probability level, hence $p < .02$]. The group mean values + SD are presented in Table 2.

DISCUSSION

Part 1 showed that the Community Home girls had significantly higher breath rates and lower skin resistance values than the girls of the same age and economic status, who were attending a regular school and living at home. Visual inspection of the records of the Community Home group also showed more irregular breath patterns. Fear and anxiety were likely bases for irregular breathing with a characteristic pattern, i.e., very rapid and jerky (Ax, 1953; Bloch, Lemeignan & Aguilera-T, 1991). Such signs of arousal are in keeping with the higher electromyography tone reported for boys in a community home in Finland (Rauhala, et al., 1990). Inspection of the data of the Community Home girls indicated no differences between girls who were from broken homes and whose families visited them in the home. Also, the polygraphic data of the girls who had been in the home for less than six months were not different from those of girls whose stay was longer, e.g., 36 months. A previous study (Garraida, Connel, & Taylor, 1991) showed differences in autonomic reactivity (based on skin conductance and heart rate) for children with emotional and conduct disorders. Children with emotional disorders were more reactive to aversive events, whereas conduct-disordered subjects showed increased reactivity to pleasant situations. It was also mentioned that the baseline heart rates were significantly higher in the more severely affected of the emotionally disordered group, compared with those with lower scores.

The present Community Home girls did not have significantly higher heart rates than the other group. However, if the rapid and irregular breathing and lower skin resistance values are interpreted as signs of high psychophysiological arousal, the Community Home girls could be speculated to have emotional disturbances.

After six months of practice of the yoga or games significantly reduced the Community Home girls' heart rates. The yoga group only showed a significant reduction in the rate of respiration after 6 mo. The spiogram also showed that breathing was more regular in this group after 6 mo. The skin resistance did not change significantly for either group, although the Yoga group showed

a nonsignificant increase however, that of the Yoga group was lower initially. Most children of both groups reported subjective feelings of well being at the end of 6 mo.

The heart-rate reduction for both groups could be anticipated from previous reports which indicated that a decrease in heart rate can occur with the practice of both yoga (Wallace, et al., 1971; Joseph, et al., 1981) and games (Williams & Sperry, 1962). The effects of yoga and games in reducing the rate of breathing have also been reported. The practice of yoga reduced the breath rate, both as an immediate effect (Wallace, et al., 1971) and over 3 mo. (Joseph, et al., 1981). Similarly, athletes have lower breathing rates than those who do not have regular exercise (Shephard, 1966). In the present study six months of yoga practice reduced the breathing rate and irregularity of breathing, while increased physical activity for the same period did not have the same effect. In trying to explain this, two factors may be considered. The significantly more rapid (and more irregular) breathing of the Community Home group suggests that observations, e.g., increased physical activity reducing breath rate (Shephard, 1966) based on studies conducted on normal volunteers may not be applicable. Also, the two programs emphasized different factors (physical activity or relaxation). An earlier study (Rauhala, et al., 1990) had shown the efficacy of a carefully designed training program in reducing signs of stress in boys of a community home. This program consisted of increased physical activity through various aerobic exercises (jogging and swimming) as well as a form of relaxation which involved alternately contracting and relaxing different groups of muscles. Subjects were unable to relax with conventional relaxation exercises.

In the present study, given the yoga program's emphasis on relaxation and awareness, the subjects reported being able to relax perhaps because the yogasanas did involve at least minimal physical activity with instructions to relax throughout. In this way, subjects may have been better prepared for the 10-min. relaxation ("shavasana" or corpse posture) at the end of each session. The duration for which subjects had to remain in a particular posture was gradually increased as relaxation was maintained. These results suggest that a program which includes relaxation, awareness, and graded physical activity may be a useful addition to the routine of children resident in a community home.

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