Exercise as a Means to Reduce Stereotypic Behaviors Among Children and Adolescents with Autism

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Stereotypic Behaviors

Self-stimulation
- Rocking
- Hand/finger flapping
- Object tapping
- Mouthing
- Head-nodding
- Inappropriate vocalizations
- Repetitive movements
- Off-task behavior

Maladaptive Behaviors
- Aggression
- Self-injury
- Property destruction
Methods to Correct Behaviors

- Punishment
- Physical restraint
- Electric Shock
- Social disapproval
- Time-out
- Sensory extinction
- Exercise
Previous Studies

Watters and Watters (1980)
- 5 adolescent males with autism
- 8-10 min of “jogging” vs. TV control
- 32.7% reduction in behaviors w/ exercise

Elliott et al. (1994)
- 3 treatment groups: no-exercise, motor training/"light exercise”, “vigorous exercise”
  - 2 adults w/ autism or mental retardation per group
  - 20 min sessions
- Measured pre & post HR (not during)
- Only the “vigorous exercise” group showed improvement
Previous Studies

Bachman and Fuqua (1983)

- 4 mentally impaired children
- Heart rate fell within moderate to vigorous ranges; taken at intervals (every 3rd lap) during workout
- 20.8% decrease with vigorous vs. moderate exercise

Levinson and Reid (1993)

- 3 preadolescent subjects with autism
- Took pre and post-exercise heart rates
- 17.5% reduction in jogging vs. walking conditions

Intensity interaction with exercise duration??
Participants

- 7 male autistic children and adolescents ($M_{age} = 13.0$, $SD = 1.43$)
- Behaviors were specific to the participant and were recorded on an individual basis
  - Must have had observable stereotypic behaviors and able to tolerate intense exercise
- All participants were enrolled in a developmental program for children with autism
Procedures

- Within-subjects design
- 4 randomly ordered exercise conditions varying exercise duration (10 vs. 20 min) and exercise intensity (low [L] = 50-65% $HR_{max}$ vs. high [H] = 70-85% $HR_{max}$) and a no-exercise control
  - 10L; 10H; 20L; 20H; C
- Both pre and post-exercise observations took place in a classroom familiar to the participants during normal instruction hours
  - A video camera was set up in the classroom to record behaviors
- Participants were observed and recorded for 15 min before exercise and 60 min after exercise
Monitoring Intensity

- HR monitored using Polar S810 HR monitors

- OMNI Rating of Perceived Exertion (RPE)
  - Validated for cycling (Robertson et al., 2000), running, and walking (Utter et al., 2002) in male and female children and adolescents
  - Pictorial representation of RPE
  - Used in conjunction with HR monitoring
  - L = 0-3; H = 4-7
Measures

- **Stereotypic Behaviors**
  - The number of stereotypic behaviors performed by each participant were recorded
    - 15 min intervals
  - Coders were blind to which treatment the participants received
A 5x5 (Condition x Time) repeated measures ANOVA was used to examine the effects of the conditions on stereotypic behaviors. Interaction effects were followed-up by examining simple effects of Condition w/in Time. Pairwise comparisons were then used to determine significant differences in behaviors for each condition at each time point. 

\[ \alpha = .10 \]
Analysis: Overall Effects

- Significant Condition Main Effect \( (p<.01) \) and Condition \( \times \) Time Interaction \( (p<.10) \)

- Simple Effects of Condition \( \text{w/in Time} \) were used as follow-ups
  - No significant difference in pre-exercise behaviors across conditions \( (p>.45) \)
  - Simple effects were significant at all other time points \( (p<.08) \)
Results: 15 min Post

- 20H produced significantly worse behaviors ($p<.10$) than all other conditions except the control.
Results: 30 min Post

• 10 L was significantly better than either 20-minute condition (p<.10)
Results: 45 & 60 min Post

- 45 minutes following exercise, 10L produced significantly fewer behaviors than all other conditions \((p<.10)\)

- 60 minutes post-exercise:
  - Behaviors were worse following 20H compared to 10L, 10H, & 20L \((p<.10)\)
  - 10L was better than C and 20H \((p<.05)\)
Results: Low 10 vs. High 20

![Graph showing the number of behaviors over time for two groups, Low 10 and High 20. The graph indicates a decrease in behaviors from the Pre to the post assessments, with the High 20 group consistently showing more behaviors than the Low 10 group.](image-url)
Effect sizes were calculated to determine the magnitude of behavior changes compared to pretest for each condition.
Results

[Bar graph showing behavioral change (ES) over time for different conditions: C, 10L, 10H, 20L, 20H. The x-axis represents time in post intervals (15 post, 30 post, 45 post, 60 post), and the y-axis represents behavioral change (ES) ranging from -1.4 to 1.0.]
Rationale for the Observed Dose-Response Effect

- Apparent dose-response relationship between exercise workload and behaviors
- High intensity exercise may increase physiologic arousal to a point that “overstress” the system
- More moderate exercise doses may provide a more optimal challenge to the system and decrease anxiety (Arent et al., 2005; Landers & Arent, in press)
Implications

- Practical application
  - "Short" bouts of exercise may alleviate behavior problems
    - Control for intensity and volume
  - Frequency of exercise may also impact responses throughout the day
  - Dose-response effects for "fitness" vs. "behavior" appear to be different
  - ADHD effects?

- The duration of the response is consistent with recent findings for the duration of reductions in stress reactivity following an acute bout of exercise (Alderman, Arent, et al. In Press. Psychophys)
Acknowledgements

- Joanne Monaco & the staff and students at the Eden Institute