

# Effect of exercise on upper respiratory tract infection in sedentary subjects

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**Objective:** To determine if exercise training affects the severity and duration of a naturally acquired upper respiratory tract infection (URTI) in sedentary subjects.

**Methods:** Subjects were sedentary volunteers (two or fewer days a week of exercise for less than 30 minutes a day for the previous three months), 18–29 years of age, with a naturally acquired URTI (three to four days of onset). All subjects were screened—for example, asthma, hay fever—by a doctor and were afebrile. Volunteers were alternately assigned to an exercise (EX) group (four men, seven women) or a non-exercise (NEX) group (three men, eight women). Subjects in the EX group completed 30 minutes of supervised exercise at 70% of target heart rate range for five days of a seven day period. For the initial screening, and every 12 hours, all subjects completed a 13 item symptom severity checklist and a physical activity log. Cold symptom scores were obtained until the subjects were asymptomatic. Significance was set at  $p \leq 0.05$ .

**Results:** There were no significant differences between EX and NEX group mean symptom scores for the morning and evening reporting periods. There were also no differences between the groups for the mean number of days from the baseline symptom score to when the subjects were asymptomatic. There were no differences between physical activity levels, other than what was assigned in the EX group.

**Conclusion:** Moderate exercise in sedentary subjects with naturally acquired URTI probably does not alter the overall severity and duration of the illness. Previously sedentary people who have acquired a URTI and have just initiated an exercise programme may continue to exercise.

The average adult has from one to six colds each year,<sup>1</sup> with rhinoviruses accounting for about 40% of these infections.<sup>2</sup> Colds are associated with major socioeconomic expense in the United States, costing five billion dollars annually because of truancy from work and school, doctor's expenses, and over the counter medications.<sup>3</sup>

Moderate exercise may decrease the risk of acquiring an upper respiratory tract infection (URTI), but too little or too much may increase the risk.<sup>4</sup> Research has shown that exercise in moderately fit and active people with a URTI does not prolong or intensify the illness.<sup>5</sup> This finding is important for fitness enthusiasts who are interested in enjoying exercise and maintaining their fitness levels during a URTI. However, is there a dose-response phenomenon with respect to the severity and duration of a URTI and the extent of physical activity in sedentary people with a URTI? The effect of exercise on the course of a URTI in sedentary people has not been determined. It would be worth knowing if a sedentary person who has begun an exercise programme can continue without worsening the illness. If exercise is not detrimental to the URTI, a person could continue a fitness programme so as not to risk health benefits being further allayed. The purpose of this study was to investigate the chronic (seven day period) effects of exercise training on the symptom severity and duration of a naturally acquired URTI in sedentary subjects. We expected that moderate exercise during a URTI would not increase the severity and duration of the illness. This study focused on each subject's responses to naturally acquired URTI relative to physical activity level rather than to fitness level. Although fitness level would be an interesting variable to study in relation to URTI, the literature indicates that activity level is the more important consideration.<sup>5</sup> People who exceed their optimum exercise level may be fostering infection. Although triathlons may not be too much for some, even moderate exercise may be detrimental for sedentary people.

## METHODS

Students at Ball State University (ages 19–29) who had acquired a URTI within the preceding three to four days (typical peak of illness) were solicited through newspaper advertisements. Volunteers were interviewed about their physical activity levels and completed a 13 item symptom severity checklist as part of the initial screening process. A physical examination by a doctor and screening included a health history questionnaire about acute and chronic diseases, asthma, bronchitis, chronic colds, allergies, pregnancy, immune deficiency, medications, smoking, and physical activity level. Volunteers were sedentary (two or fewer days a week of recreational exercise for less than 30 minutes a day for the preceding three months). Subjects had no symptoms of lower respiratory tract illness, were afebrile ( $<100^{\circ}\text{F}$ ), and apparently healthy according to the criteria of the American College of Sports Medicine.<sup>6</sup> All subjects agreed to refrain from self treating their colds with over the counter medicines. Each subject signed an informed consent form approved by the institutional review board. Subjects who completed the study received some remuneration.

Given the number of selection criteria—for example, number of days of illness, upper v lower respiratory tract illness, sedentary—and subject responsibilities, it was a difficult and lengthy task to recruit volunteers for this study. Therefore, to ensure equal group sizes, subjects meeting all of the selection criteria were alternately assigned to the exercise (EX) group or the non-exercise (NEX) group. Eleven subjects (four men, seven women) were assigned to the EX (experimental) group, and 11 (three men, eight women) to the NEX (control) group.

The EX group was assigned to supervised exercise training sessions for any five of the seven days of the study, and the NEX group was instructed to be sedentary throughout the study. Obvious exceptions for activity were granted for both subject groups—for example, walking to class, working

part-time jobs. Repeated verbal encouragement was given to persuade the NEX group to remain sedentary and the EX group to refrain from any additional physical activity other than what was assigned. All subjects reported to the laboratory every 12 hours (0700 and 1900) for seven consecutive days, beginning on the evening of the day on which they were selected into the study. All completed the 13 item symptom severity checklist at each reporting period. They all also completed an activity log during each evening reporting period to monitor their physical activity levels. After the seventh day of the study, subjects reported to the laboratory once a day until they were asymptomatic.

### Clinical evaluation of URTIs

Subjects completed a previously validated symptom checklist.<sup>7-9</sup> They rated the severity of 13 common cold symptoms (0 = not present, 1 = mild, 2 = moderate, 3 = severe). A cold with a total score of less than 7 was considered mild, one with a total score of 7–11 was moderate, and one with a total score of 12 or greater was severe. The rise and fall of clinical symptoms and signs using this checklist are clearly associated with virus shedding and served as a valid determination of a URTI.<sup>8</sup> Oral temperatures were taken to ensure that the subjects remained afebrile. These activities continued until the subjects were asymptomatic. The screening and monitoring processes used in this study safeguarded the likelihood that the subject continued to have a URTI and did not develop symptoms indicative of other illnesses—for example, flu, lower respiratory tract illness, allergies, bacterial infection.

### Physical activity profile

All subjects were required to complete a physical activity log at each evening reporting period (1900) beginning on the first day of the study. The activity log was simply intended to recognise if or when a subject engaged in activity beyond what was assigned or absolutely necessary. The quantity of the subjects' physical activity was determined through self report and included total minutes of walking and cycling (transportation), hours of work, and participation in recreational activity. This log was also used in our previous research,<sup>10</sup> as none of the previously validated physical activity measurement instruments<sup>11</sup> required daily physical activity reports.

### Exercise training

By the second day of the study, subjects in the EX group began the supervised exercise training sessions. They were scheduled for either a morning or an evening exercise session, and were expected to exercise at the same time for all five days of the study. Exercise sessions lasted 30 minutes at 70% of target heart rate with the mode of exercise chosen by the subject from the following list of choices: the Air-Dyne bicycle (Schwinn Bicycle Co, Chicago, Illinois, USA); the Cybex MET 100 cycle (Cybex Metabolic Systems, Ronkonkoma, New York, USA); walking or jogging on a treadmill (Trotter, Millis, Massachusetts) or on an indoor track; or stair climbing on the Stepmill (StairMaster Sports and Medical Products, Kirkland, Washington, USA). All subjects performed the same mode for each training session. Heart rate was monitored continuously via Polar heart rate telemetry units.

### Statistical analysis

Symptom severity scores from the cold symptom checklist were summed. Two statistical analyses were performed. A two group (EX and NEX) by two factor repeated measures analysis of variance was used to compare the mean symptom questionnaire values of study subjects for mornings and evenings (AM/PM) of six time periods (DAY) after collection of the baseline symptom data ( $2 \times 2 \times 6$ ). The analyses included data obtained for only days 2–7 of the study because some study subjects were unable to participate on the first day after

collection of the baseline data. An independent groups *t* test was used to compare the number of days from baseline until the study subjects were symptom free. The analysis of variance was performed on scores obtained by: (a) subtracting baseline symptom values from values obtained during the study; (b) ranking the resulting difference values; and (c) obtaining normalised *z* scores for the ranks.<sup>12-14</sup> A set of polynomial contrasts was specified in the SPSS MANOVA program (SPSS, Inc, Chicago, Illinois, USA) for the day factor. Statistical tests were conducted for the linear relation component of elapsed time from baseline scores and for the relations of the other components combined with the scores. The latter statistical test identified if systematic variation among the score means existed beyond that identified by the linear component—that is, deviation from linearity. The statistical power for evaluating the relation of the day factor with the scores and for the difference between the EX and NEX groups over the days ( $p \leq 0.05$ ) was 0.89 for Cohen's<sup>15</sup> large effect size and 0.45 for his medium effect size ( $x$ ). A one way analysis of variance for differences between the measures on the physical activity logs for the EX and NEX groups was also completed. An  $\alpha$  level of  $p \leq 0.05$  was considered significant in this investigation.

## RESULTS

### Symptom severity/duration

There was no overall difference (days 2–7 combined) between the cold symptom score mean values in the NEX and EX groups. The combined EX and NEX group cold symptom score means decreased linearly for the combined AM and PM times of days 2–7. The average AM symptom mean was higher than the average PM for both the EX and NEX groups, which is consistent with the general trend of the symptom means decreasing during the study. However, the average decrease in the means from AM to PM for the days was larger for the EX group than for the NEX group. There was no difference between the EX and NEX groups in the mean number of days from baseline before the subjects were asymptomatic (8.36 and 8.45 respectively).

### Physical activity

Log measures of total minutes of walking and cycling (transportation purposes), hours of work, and participation in recreational activity were determined from reviewing physical activity logs completed by the subjects at each evening reporting period. There was no significant difference in physical activity levels between groups with respect to minutes of transportation or hours of work. In addition, none of the subjects reported participation in recreational fitness activity, other than what was assigned for the EX group.

## DISCUSSION

This study attempted to evaluate the impact of exercise on symptom severity and duration in sedentary subjects with a URTI. The results appear to support our expectation that moderate exercise would not increase the severity and duration of a URTI in this population. Although all subjects had severe colds indicated by a total symptom score of greater than 12, there was no significant difference ( $p \leq 0.05$ ) in the symptom scores for the EX and NEX group from baseline to the second reporting period on day 7. EX and NEX group subjects were also asymptomatic at approximately the same point (by day 9). Although a higher exercise training intensity may also play a role in severity and duration of URTI,<sup>16-18</sup> it would not be prudent or practical for the sedentary person to begin an intense exercise programme regardless of a URTI. Initiating an exercise programme under the conditions of this study for sedentary people with a URTI may not be common; however, it seems reasonable that continuing in an exercise programme that has already been initiated will also not affect URTI symptom severity/duration. This still may be conjecture, but it

### Take home message

This study affirms the recommendation that people can exercise moderately during a naturally acquired URTI.

seems plausible that, as the hormonal and psychological stress of initiating an exercise programme during a URTI did not increase symptom severity and duration, then continuing in an exercise programme that has already begun may be permissible. This warrants further research.

Significant findings with respect to time (AM/PM) were observed in symptom severity among and between groups. Illness severity was higher in the morning for both the EX and NEX groups. This is considered normal for people with colds.<sup>10</sup> Interestingly, the difference in the AM and PM symptom severity scores in the EX group was less than that reported by the NEX group. Perhaps exercise induced psychological and/or hormonal responses account for this decline. Weidner *et al*<sup>10</sup> found that symptom severity scores (acute response) had not changed significantly after exercise. This study may indicate that there is a more chronic effect of exercise on symptoms that is beneficial in decreasing their severity over the course of a day. However, the overall symptom severity and duration of the URTI is not altered.

This study is the first attempt to examine the influence of exercise training on the symptom severity and duration of a naturally acquired URTI in sedentary subjects. Alternative forms of exercise such as weight training, particularly that resembling heavy physical labour, would help to determine if, and to what extent, these patterns influence symptom severity and duration. The course of cold symptom severity and duration during exercise among an older (>50 years) and younger (<18 years) population also warrants further investigation. In addition, there is a need to investigate this response in highly fit athletes with a URTI.

The results from this investigation suggest that moderate exercise training in sedentary people during a naturally acquired URTI will not affect illness symptom severity or duration. This finding adds to a trend that moderate exercise during a URTI does not affect symptom severity or duration.<sup>10</sup> Further, moderate exercise during a URTI does not affect pulmonary function test and exercise responses,<sup>19</sup> running gait,<sup>20</sup> or physical performance.<sup>21</sup> Similar studies with other forms of exercise (for example, weight training), other populations (for example, young and old, labourers), and fitness levels (for example, highly fit) warrant further investigation.

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