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Preventive influence of regular physical exercise on the incidence of common cold - a literature review

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ABSTRACT:

Introduction and purpose:

The common cold is a collection of illnesses caused by various pathogens. It has no definite treatment, therefore common cold prevention should be of utmost importance. Regular, moderate physical activity has been linked with lower incidence of common colds. The aim of this review is to summarize all available knowledge on the influence of regular exercise on the incidence of common cold in human adults.

State of knowledge:

Randomized controlled trials and epidemiological studies suggest that individuals adhering to WHO's guidelines for physical activity (MVPA), show significantly reduced susceptibility to common cold infection, and possibly, lower number of sick days compared to sedentary counterparts. There is insufficient data to determine a cause of this phenomenon, however prevailing theories include: increased mucosal immunity, increased NK-cells activity, and hormonal adaptations. High intensity and frequency of the exercise may cause transient suppression of the immune system and leaving an "open window" for opportunistic pathogens. Recent studies suggest that for optimal reduction of common cold infections, low intensity activity for over 358 min/week or moderate intensity activity for over 120 min/ week are recommended. This finding however requires reproduction and validation on more diverse populations.

Conclusions:

Exercise following the WHO MVPA guidelines reduces incidence of common cold and may reduce the number of sick days. High intensity exercise regimes may lead to temporary

suppression of the immune system and increase risk of infection. The relationship between exercise duration, intensity and frequency on occurrence of common cold in adults is significant but requires further study to establish clear recommendations.

Keywords: Common Cold / prevention & control; Physical Activity; Exercise / immunology; Respiratory Tract Infections / prevention & control; Immunity, Mucosal / physiology; Physical Fitness

1. Introduction

Upper respiratory tract infection, also known as common cold, is a term used to describe not a single defined disease, but rather a group of diseases caused by many unrelated pathogens.
Although common, it can have serious complications for individuals as well as for the healthcare system, especially during high risk seasons, like during autumn and winter[1] [7]. Symptoms usually include: sore throat, rhinitis, rhinorrhea, cough and malaise, and last 7 to 10 days[8]. A variety of viruses may be responsible for the symptoms with rhinoviruses being most prominent in all age groups, with an estimated 30–50% proportion of cases. No pathogen is determined in 30-50% of cases[1] [8]. Other pathogens responsible are corona and influenza viruses. Unfortunately there is no available causal treatment for a common cold, therefore prevention is key to limiting its burden on individual and public health. [20] Physical activity has been proven to not only lengthen lifespan for individuals but also prevent or delay the onset of 40 different chronic conditions. Inadequate physical activity was labelled as the fourth leading risk factor for global public health. [12]Additionally, regular exercise is reported to boost the immune system [4,11], it promotes metabolic health and helps to maintain healthy body mass and composition [5].
Reports have been made on the preventive effects of exercise on other upper respiratory tract infections, such as influenza virus infection, although there is little high quality evidence to draw a definite conclusion[6]. Preventive effect of exercise on contracting common colds has been suggested before by some authors [1]. Most recent review targeting issues in question were conducted in 2014 and 2021, and are devoid of new findings published in recent years.

2. Aim of the study

The aim of this study is to summarise all available knowledge on the influence of performing regular physical exercise on the incidence of common cold in human adults.

3. Materials and methods of research

We undertook a systematic literature search on 03.11.2024 with various search terms such as "(("prevention and control" [Subheading]) AND "Common Cold"[Mesh]) AND "Exercise"[Mesh]; ("Common Cold"[Mesh]) AND ("Exercise"[Mesh]); "Common cold prevention" AND "exercise"; "common cold" AND "physical activity" ", hand searched online journals and scanned reference lists of identified citations. Our research is restricted to PubMed and Google Scholar databases and to studies published between Jan 1, 1990, and Dec 31, 2024. Original studies, meta analyses and previous reviews are included. Inclusion criteria being: Studies conducted on human adults, studies published between Jan 1, 1990, and Dec 31, 2024, original studies implementing regular exercise as the only intervention. Exclusion criteria being: other intervention apart from exercise being implemented in original papers, studies on professional athletes. We only took into consideration articles and studies written in English. Two authors (AC and ŁF) independently did the literature search and extracted data. Any disagreements were resolved after discussion.

4. Results

After primary search, 10 articles were extracted from Google Scholar and 42 were retrieved from PubMed. 52 articles were screened for eligibility. After abstract examination, 11 were excluded because of inclusion of professional athletes and 5 works were excluded because of combining exercise with additional intervention. Finally, 34 articles met the requirements for this review.

Physical exercise and the risk of incidence of common cold

Trails investigating the effect of exercise on the incidence of common cold date as far back as 1990. Many randomised controlled trials and epidemiological studies over the years have repeatedly reported a lower incidence rate, relative risk and illness severity of common

cold [7,9, 18, 30,31,32,33,34,35,36,37,38]. Extent of the reduction varied between the studies due to different approaches, design, population and length, but all authors deemed the reduction significant. Especially noteworthy are randomised controlled trials looking in which exercise complies with WHO MVPA guidelines including 150–300 min of moderate-to-vigorous physical activity per week.[41]

Lee et al's meta-analysis from 2014 reports the relative risk of the common cold in the exercising group being 0.73. Unfortunately many of the studies published after 2014 containing high quality data were not included in the analysis[12,15]. Additionally authors highlighted another potentially beneficial effect of exercise: reduction of symptomatic days. The amount of sick days of active and sedentary individuals in 3 studies were compared, with the length of illness being shorter In the group that performed exercise by 3.5 days. This corresponds to data gathered by Nieman et al. [36], who analysed 1002 male and female subjects with the validated Wisconsin Upper Respiratory Symptom Survey [52], and found 43-46% reduction in the number of days with illness symptoms in more physically active individuals, compering to more sedentary group. Those findings point to potential influence of exercise on the severity and symptomatology of common cold that should be further studied. Other authors suggested that attending exercise classes may increase exposure to pathogens and therefore the decrease in exercising groups may be even more prevalent [9].

Only available study taking into account seasonality, and variability of common cold was Chubak et al. in a 1 year long study on exercising and non exercising postmenopausal women. It randomly allocated 112 postmenopausal women in one of two groups: exercising moderately 45 min per day 5 days a week and stretching 45 min 5 days a week throughout 12 months. Authors showed that 18.2% more women that were not exercising got at least one common cold in 12 months. In the last 3 months of the study the risk of incidence in non exercising group rose three-fold[9]. Many authors pointed out flaws in design and the proceedings of the study, deeming it insufficient to draw any conclusions and highlighted the need its reproduction[13,14] .

Reduction of the risk of infection caused by exercise, described above, would correlate with conclusions obtained in a more general epidemiological study on nearly 98000 adults that reported a risk reduction by 48% for all viral disease in patients following MVPA guidelines[40]. This suggests that the protective effect of physical activity is a nonspecific anti-viral adaptation . That adaptation in the body caused by physical activity may not be

specific to a common cold, but may have preventive effects against other more severe viral infections.

Most authors believe that unique changes in immunology of the body exposed to chronic physical activity are responsible for this effect [11, 16,17, 18,19,25,26,27,28]. Substantial research linked moderate intensity chronic exercise with higher numbers and increased activation of NK-cells in the blood [7,11,18], but evidence seems inconsistent [28]. Some authors claim that exercise increases number CD4+ helper cells and level of IgA salivary immunoglobulin [12] [16] [17] [18] [21] [24], however it has been shown that IgA level in the saliva of a single individual is not constant but varies highly in within a single day or day by day measurements [24].

Exercise additionally seems to have a profound influence on leukocyte activity, decreasing population of senescent T cells and increasing naive T cell population capable of responding to new pathogens, which might be beneficial in generating a strong immune response to new community acquired seasonal pathogens, responsible for the common cold[17] .Additional appropriate physical activity stimulates the continuous exchange of vital leukocytes between the circulation and tissues[12, 16,17] .The function of other cells of the immune system such as lymphocytes B and T, neutrophils seem to be unaffected. Moreover exercise has been shown to alter cellularity of respiratory tract fluids boosting local mucosal immunity and and increasing resistance to respiratory viruses[3] [28] .Some authors linked the changes in the immune system stimulated by exercise with heightened steroid hormone production or adrenaline exposure during exercise, however the evidence is still insufficient [16].

Duration, frequency and intensity of exercise and its preventive effect

As shown above, multiple studies described a beneficial effect of exercise on the incidence of common cold. However the duration, frequency and intensity of exercise implemented as An intervention varied throughout the studies, giving inconsistent results[7,9,18, 30,31,32,33,34,35,36,37,38]. It has been shown that exercise may have numerous beneficial effects for many illnesses at certain intensities and durations of the activity and not at others[44] . Some differences in the outcomes are unavoidable due to different population, location of the study and present epidemiological situation, but a need of identifying optimal duration, frequency and intensity of physical activity for lowering the risk of upper respiratory tract infection became apparent. This “dose response” way of thinking about exercise, as a

medicine that should be prescribed and taken in precise doses, is not in any way new to sports science. As Gonzales et al put it “There is a demonstrable quantitative relationship between exercise intensity and its health and fitness benefits, with exercise intensity being crucial for regulating physiological stress and maximising the health benefits of daily physical activity.” [43].

Nieman et al. [45] was the author laying groundwork in the analysis of this issue and proposing a “J” shape model to describe the relationship between workload, as a description of intensity and volume and upper respiratory tract incidence. Meaning that to a certain workload exercise has a beneficial effect, but with increasing amount of intensity and duration it becomes less and less beneficial.

This model has been tested further in the Tu et al.[15] web based survey study on 1920 subjects older than 18 years old, self reporting physical activity habits and frequency of self diagnosed common colds. Authors analysed incidents of common colds according to frequency, intensity and duration of exercise. It was found that both frequency and duration have an inverse dose response to common colds occurrence, meaning that the more frequent and longer exercises are the lower is the number of colds reported. On the other hand, the intensity has a “U” shaped response to a number of common colds reported. Amidst physically active individuals, the group experiencing the highest number of colds were the ones who exercised with high intensity and frequency, and the number of infections were significantly lower than in sedentary individuals.

This shows that moderate intensity exercise can enhance the immune system whereas repeated bouts of long-lasting, arduous intensity exercise can suppress it.

The higher risk of contracting common cold in those performing high frequency and high intensity training could be explained by transient depression of the immune system, leaving an “open window” for opportunistic infections or latent virus reactivation for as long as 72 hours[17][16] . This effect can be lengthened by repeating the strenuous exercise without proper rest, causing chronic state of impaired immunity, caused by reduced T cell proliferation, lower neutrophil respiratory burst and decline in NK-cells activity[16,17] . There is substantial evidence out of a single blind, placebo controlled study from Copenhagen suggesting that supplementation VitaminC and E can reduce this immunosuppressive effect of strenuous exercise[18] .

Another survey study proposed a model determining minimal weekly volume of exercise that reduces the risk of contracting common cold. Tang et al. gathered self-diagnosed cold

frequency, frequency of exercise and exercise intensity by questionnaire, during a web based survey study on 1683 Chinese individuals older than 40 years old[12]. The intensity has been assessed by CR-10 scale [46],mirroring previous similar research, then an amount of metabolic equivalents (METs) corresponding to the intensity have been assigned[47]. Tang et al. found that subjects in this study by increasing physical activity level to one exceeding 538 MET-min/wk could significantly reduce the risk of getting a cold. This corresponds to approximately 359 minutes of low intensity exercise per week or 120 min of moderate intensity physical activity, which is 30 minutes less than the amount of physical activity recommended in WHO's guidelines. The results suggest that the beneficial effect of exercise on the incidence of exercise could begin with the "dose" of exercise being smaller than previously thought.

It is worth pointing out that [12][15] studies concerning exercise intensity, frequency and duration are survey studies requiring self diagnosis. Due to lack of medical confirmation of the results some authors reported that only about 30% of self reported common cold cases had an identifiable pathogen, pointing to similar clinical presentation of common cold to non-infectious ailments such as: exposure to irritants or air pollutants or local inflammation associated with higher respiration rate[17]. Additionally, both of the trials are conducted on the Chinese population, and should be reproduced in other ethnicities. Due to these limitations further studies need to be conducted concerning exercise intensity, frequency and duration and common cold incidence to draw definite conclusions. Such could facilitate other research concerning common cold and exercise, study similar adaptations in other infections and make clear and helpful recommendations to patients.

5.Conclusion

There seems to be a consensus among authors that exercise following WHO MVPA guidelines reduces the incidence of common cold in adults, but exercises shorter than recommended may also have beneficial effects. The extent of the reduction of common cold occurrence in physically active individuals, varies between sources, hence it is difficult to determine. Reports have been made on additional reduction of severity and changes in symptomatology in active adults compared to sedentary individuals. There are many potential theories on the cause of this phenomenon, with the most prevalent one being the immune adaptation to chronic exercise. Frequency, duration and intensity of the exercise significantly

influence its benefits on the incidents of upper respiratory tract infections. High intensity and frequency training may cause transient suppression of the immune system and increase incidence of common cold compared to other exercise regimes. Most beneficial training regime seems to be low intensity training performed more than 358 minutes per week or moderate exercise regimen performed more than 130 minutes per week. Due to lack of high quality reproducible research the relationship between intensity, frequency and duration of exercise and occurrence of common cold needs further study.

All authors have read and agreed with the published version of the manuscript.

Disclosure:

Author's contribution:

Conceptualization: Adam Czarnecki
Methodology: Adam Czarnecki, Łukasz Fijałkowski
Software: Piotr Zając, Artur Pastuszka
Formal analysis: Aleksandra Nosal; Łukasz Fijałkowski
Investigation: Adam Czarnecki, Jan Węgrzyn
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Data curation: Aleksandra Galanty-Ochyra, Karolina Serwońska
Writing rough preparation: Jan Węgrzyn
Writing- review and editing: Karolina Serwońska, Olga Jabłońska
Visualization:Artur Pastuszka
Supervision: Aleksandra Galanty-Ochyra
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