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ORIGINAL ARTICLE

The effect of exercise on salivary IgA levels and the incidence of upper respiratory tract infections in postmenopausal women

Menopoz sonrası dönemde kadınlarda üst solunum yolu enfeksiyonları sıklığı ve egzersizin tükürük IgA sekresyonuna etkisi

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Objectives: To examine the patterns of upper respiratory tract infections (URTI) in postmenopausal Turkish women and the relationship of moderate aerobic exercise with secretion of salivary IgA and episodes of URTI.

Materials and Methods: Ninety healthy, sedentary women at ages 45 to 65 years volunteered to participate in a 12-week prospective study. They were randomized to three groups equal in number: indoor exercise, outdoor exercise, and no exercise. The exercising women were supervised during 30 min indoor treadmill walk or outdoor track walking sessions during 5 days/week at 60% of their calculated maximal heart rate. During a 12-week exercise program, episodes suggestive of URTI were recorded. Non-exercising women were followed with weekly telephone calls. The salivary IgA levels were measured in all the subjects before and at the end of the study.

Results: There were significant differences between the exercising and non-exercising women with respect to the number of URTI episodes and the length of URTI symptomatology per episode in favor of exercise. No significant difference was found between the indoor and outdoor exercising groups. The salivary IgA levels showed no significant differences between the three groups and within each group.

Conclusion: Moderate intensity aerobic exercise is associated with fewer episodes of URTI and fewer days of URTI symptomatology per episode in healthy postmenopausal Turkish women, but this does not seem to be related to salivary IgA concentrations.

Key Words: Exercise/physiology; female; immunoglobulin a, secretory; oxygen consumption; postmenopause; respiratory tract infections; saliva/immunology.

Amaç: Menopoz sonrası dönemdeki Türk kadınlarında üst solunum yolu enfeksiyonu (ÜSYE) tiplerini araştırmak ve orta düzeydeki aerobik egzersiz ile tükürük IgA sekresyonu ve ÜSYE arasındaki ilişkiyi incelemek.

Olgular ve Yöntemler: On iki haftalık bu prospektif çalışmaya, gönüllü olarak katılmayı kabul eden, 45-65 yaşlarında, sağlıklı, sedanter yaşayan 90 kadın alındı. Kadınlar, ev içi veya dışında egzersiz yapan veya egzersiz yapmayan olmak üzere sayıca eşit üç gruba ayrıldı. Egzersiz yapan kadınlara, haftada beş gün, günde 30 dakika süreli ev içi yürüme bandında veya dışarda, maksimal kalp hızının %60'ını geçmeyecek şekilde yürüme egzersizleri verildi. On iki haftalık sürede ÜSYE düşündüren semptomlar kaydedildi. Egzersiz yapmayan kadınlar haftalık telefon konuşmalarıyla izlendi. Tüm katılanların çalışma öncesi ve bitiminde tükürük IgA düzeyleri ölçüldü.

Bulgular: Egzersiz yapan ve yapmayan kadınlar arasında, ÜSYE epizodlarının sayısı ve epizod başına ÜSYE semptomatolojisinin süresi açısından, egzersiz grupları lehine anlamlı farklılık görüldü. Ev içinde ve dışında egzersiz yapanlar arasında bu açıdan farklılık yoktu. Tükürük IgA düzeyleri gruplar arasında ve her bir grupta çalışma öncesi ve sonrasında farklılık göstermedi.

Sonuç: Orta ağırlıkta aerobik egzersiz yapan sağlıklı postmenopozal Türk kadınlarında daha az sayıda ÜSYE epizodu ve epizod başına daha kısa süren ÜSYE semptomatolojisi görüldüğü ve egzersizin tükürük IgA konsantrasyonuyla ilişkisi olmadığı sonucuna varıldı.

Anahtar Sözcükler: Egzersiz/fizyoloji; kadın; immünglobulin A, sekretuvar; oksijen tüketimi; menopoz sonrası; solunum yolu enfeksiyonu; tükürük/immünoloji.

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Upper respiratory tract infection (URTI) is a common cause for morbidity throughout the world and this is especially true for the older individuals.[1,2] It seems that the aging process significantly impairs the competence of the immune system, which leads to an increased incidence of infectious diseases, autoimmune disorders and malignancy.[3]

Exercise has potent stimulatory effects on phagocytosis, antitumor activity, reactive oxygen and nitrogen metabolism, and chemotaxis.[4] Some studies have shown that physical activity and regular exercise training improves resistance to URTI and increases salivary IgA levels (sIgA).[5-9]

Taking all these factors into consideration we have decided to study the relationship between moderate physical activity and the risk of acquiring URTI in healthy, postmenopausal, previously sedentary Turkish women during a 12 week prospective study and to see if this is related to the secretion of salivary IgA.

MATERIALS AND METHODS

Subjects, who participated in this study, were 90 postmenopausal women between the ages 45-65 who were recruited after coming to our laboratory for routine check up purposes. They had shown a desire to start regular exercise but had not started prior to the study. They were divided into three groups of 30 women each with each group having similar characteristics and randomly assigned to be in either outdoor exercise group (G1), indoor exercise group (G2) or asked to hold of on exercising (G3) for 12 weeks (months of September, October and November). They were excluded for chronic disease, any medications including vitamins, having received the flue shot and having smoked cigarettes within the last two years.

The subjects had anthropometrical measurements in the fasting state. Body weight and height were measured on standard scale with an attached ruler wearing light clothes and no shoes. Body mass index (BMI) was calculated as weight in kilograms (kg) divided by the square of the height in meters (m). Waist circumference was measured using a flexible measuring tape at the umbilicus level with the participants standing straight, arms at their sides and feet together. Body fat mass and fat free mass were determined by bioelectric impedance.

Both the indoor and outdoor exercise groups underwent supervised exercise sessions five days a week for 30 min each time walking on a treadmill or an outdoor tract respectively at 60% of their maximal heart rate as determined by the simple formula of Maximal Heart Rate=220-age. Heart rate measurements were done with Polar Heart Rate Monitor.

During the supervised sessions, subjects were noted for and asked about upper respiratory infection symptoms of runny stuffy nose, sore throat, coughing, sneezing colored discharge and fever. Those who were in the non-exercise group were phoned weekly for the same data collection. Number of URTI episodes and the number of URTI days per episode were recorded for each subject. An episode of URTI was defined as having the symptoms for more than 2 days and separated by at least 5 days from the previous episode.

The saliva samples were collected prior to starting the study and at the end of the 12 weeks each time after the mouth had been rinsed thoroughly with distilled water. The saliva samples were frozen at -20°C and stored until the end of the study period. Salivary IgA concentrations were measured by enzyme linked immunosorbent assay (ELISA) method (Immulon II; Dynex Technologies, Chantilly, Virginia, USA).

The investigation conformed to the principles outlined in the Declaration of Helsinki and was approved by the Local Research Ethics Committee. Signed informed consent was obtained from all subjects prior to participation.

RESULTS

The results of this study show that women who performed moderate aerobic exercise either outdoors or indoors had lower incidence of URTI ($p=0.020$, $p=0.038$ respectively) and fewer days of URTI symptomatology per episode ($p=0.049$, $p=0.047$ respectively) as compared to their sedentary counterparts during a 12-week prospective study. There was no statistically significant difference in the incidence of URTI ($p=0.8$) and the days of URTI symptomatology per episode ($p=0.7$) between the groups who exercised outdoors and indoors. The demographic and anthropometric characteristics as well as the number of URTI episodes and the days of URTI symptomatology per episode can be seen in Table I.

TABLE I

THE DEMOGRAPHIC AND ANTHROPOMETRIC CHARACTERISTICS OF THE SUBJECTS

	Group 1	Group 2	Group 3
n	30	30	30
Age (years)	55.0±3.5	54.6±2.1	54.9±3.8
Weight (kg)	79.3±3.1	79.9±3.5	80.7±2.8
Body Mass Index (kg/m^2)	29.9±2.7	30.6±1.7	31.2±2.9
Waist circumference (cm)	81.8±3.1	82.9±1.9	83.1±2.5
Fat mass (kg)	32.9±2.5	32.2±1.3	33.4±3.3
Fat Free Mass (kg)	44.8±1.8	45.7±1.0	45.5±1.9
No of URTI episodes/12 weeks	1.2±0.52	1.3±0.53	1.6±0.56*
No of URTI days per episode	5.1±1.8	5.2±1.3	6.1±1.0#

G1: outdoor exercise group, G2: indoor exercise group, G3: sedentary group; URTI: Upper respiratory tract infections; Data are means ± SD; *: p=0.020 compared to group 1, p=0.038 compared to group 2; #: p=0.049 compared to group 1, p=0.047 compared to group 2.

There was also no statistically significant difference seen in the amount of salivary IgA between the three groups or within a group at the beginning or the end of the study. The results of the sIgA measurements can be seen in Table II.

DISCUSSION

Immune dysfunction is associated with increased mortality risk in elderly people. An important part of human ageing is characterized by a decline in the ability of individuals to adapt to environmental stress.[10] It is known that various types of psychological and physiological stressors, including physical activity, influence the immune system. Physical activity can influence neuropeptide levels both in the central nervous system as well as in peripheral blood.[11] The reported changes of immune function in response to exercise have been suggested to be partly regulated by the activation of different neuropeptides and neuroendocrinological factors including catecholamines, growth hormone, cortisol, beta-endorphin, and sex steroids.[11,12] Exercise has also been suggested as a prototype for studying the effects of stress factors on the cellular immune system.[10,13]

Epidemiological evidence suggests that heavy acute or chronic exercise is related to an increased incidence of upper respiratory tract infections in athletes.[14-19] Nieman et al's data suggest that endurance athletes are at increased risk for upper respiratory tract infections during periods of heavy training and the 1-2 week period following a marathon or a similar event.[18,20,21] Many components of the immune system exhibit adverse change after prolonged, heavy exertion. These immune changes occur in several compartments of the immune system and body such as the skin, upper respiratory tract mucosal tissue, lung, blood and muscle, with elevation of the stress hormones, epinephrine, and cortisol.[17,22] Gleeson and Pyne[23] have shown that with moderate

TABLE II

THE CONCENTRATION OF SIGA BEFORE AND AFTER 12 WEEKS OF MODERATE EXERCISE TRAINING

	Group 1	Group 2	Group 3
Baseline sIgA values (mg/ml)	24.7±14.4	23.7±14.2	25.3±14.5
sIgA value after 12 weeks (mg/ml)	27.8±11.2	25.2±12.9	27.4±12.4

sIgA: Salivary secretory immunoglobulin A; G1: outdoor exercise group, G2: indoor exercise group, G3: sedentary group; p>0.05 in intergroup or intragroup analysis.

exercise salivary IgA and IgM concentrations decline immediately after a bout of intense exercise but usually recover within 24 h. Training at an intense level over many years can result in a chronic suppression of salivary immunoglobulin levels. The degree of immune suppression and the recovery rates after exercise are associated with the intensity of exercise and the duration or volume of the training. Low levels of salivary IgM and IgA, particularly the IgA1 subclass is associated with an increased risk of respiratory illness in athletes.

Even though heavy exercise is not favorable to the immune system, moderate exercise is believed to be protective.[24,14,15,17,18] A study by Nieman et al.[27] has shown that moderate exercise is associated with elevated natural killer (NK) cell activity after six weeks and reduced URI symptomatology in comparison to a randomized, sedentary control group Few other studies have supported this view.[25,26,28] This is also the case in the present study. Akimoto et al.[5] have shown that the salivary IgA levels have increased in elderly subjects after 12 months of moderate exercise. This contradicts the study done by MacKinnon and Jenkins[29] who have reported that resting salivary IgA levels in athletes had not changed after eight weeks of interval training. The present study also showed that there was some increase in the sIgA levels after 12 weeks of moderate exercise but this was not statistically significant. It may be the case that if the length of exercise training were increased, perhaps the increase in the sIgA levels of the exercising groups may have reached a level of statistical significance in the present study.

Only a few studies have investigated whether moderate exercise is beneficial in reducing URTI symptomatology. In one randomized, controlled study of 36 women walking 45 min. 5 days·/wk, subjects experienced 5.1±1.2 days with URTI symptoms during the 15-wk study period compared with 10.8±2.3 days in the sedentary group.[27] The number of URTI episodes did not vary between groups, but the number of URTI days per episodes was lower in exercising group. In a study done on older subjects during a 12-wk follow-up the incidence of the common cold was 8% in highly conditioned elderly women who exercised moderately, 21% in previously sedentary elderly women walking 40 min 5 times a week and 50% in the sedentary control group.[6] A study done by Kostka et al.[30] on 33 elderly men and 28 elderly women, URTI symptomatology was found to be inversely related to energy expenditure utilized during moderately intensive physical exercise. The present study agrees with the previous studies that moderate exercise may reduce URTI symptomatology in older population.

In summary, we conclude that in healthy, active, postmenopausal Turkish women, the episodes and days of symptomatology of URTI are shorter in those performing moderate physical exercise as compared to the sedentary controls during a 12 week prospective study but this does not seem to be related to a change in the sIgA levels.

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