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acute Half Marathon running
among Male Recreational Runners**

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Status of Upper Respiratory Tract Infection and Lung Function due to Acute Half Marathon running among Male Recreational Runners

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Abstract

Background: High intensity long duration aerobic exercise can cause suppression of mucosal immunity factors leading to Upper Respiratory Tract Infections (URTIs). This could cause obstruction in the lungs leading to loss of lung function. This study examined the effect of acute half marathon running on the status of URTI and Forced Expiratory Volume of first second (FEV₁) among the recreational runners, who ran their first ever half marathon. **Methods:** Seventy five first time recreational half marathoners in four age groups were analysed on their URTI and FEV₁. Wisconsin Upper Respiratory Symptom Survey (WURSS-21) score was used to analyse the URTI and Digital spirometer was used to record the FEV₁. Fifteen volunteers for each age group were analysed and results compared. Age groups studied were 20-25yrs, 25-30, 30-35 and 35 above. Pre run and post run URTI and FEV₁ were analysed with Analysis of Covariance (ANCOVA). Highest scores of the URTI and FEV₁ within the first seven days of post run were included. **Results:** Covariance analysis (P<.05) indicated, for both URTI and FEV₁ the four groups showed significant difference among themselves on their post run status. Adjusted post run URTI means were 71.93(20-25 yrs), 59.65(25-30), 83.67(30-35) and 86.12(35 above). Tukey HSD post hoc comparison indicated that 35⁺ group experienced significant increases (P<.05) in their URTI symptoms, though the 30-35 group also experienced considerable increase in URTI symptoms. Adjusted post run FEV₁ were 80.16, 82.28, 78.17 and 76.84 for the four groups and the Tukey post hoc analysis (P<.05) indicated that there were significant decrements in the FEV₁ of both 30-35 and 35⁺ groups. **Conclusions:** Recreational runners of plus 35 years are vulnerable group with respect to the upper respiratory tract infections and loss of lung function considerably due to acute half marathon running.

Keywords: aerobic exercise, mucosal immunity, upper respiratory tract infections, recreational runners, half marathon.

Background

Exercise has been recognised as an effective intervention to prevent many degenerative diseases like hypertension, atherosclerosis etc. Regular physical activity has been postulated as one of the essential dimensions of wellness management for optimum health (Peters EM. 1997). It is now a global phenomenon that many individuals are attracted towards running and participation in marathon and half marathon events. These recreational runners sometimes participate in marathon events without proper scientific training exposure and with insufficient training status. Though, exercise in general is viewed as effective tool in improving general health and immunity of individuals (Matthews CE, Ockene IS, et.al. 2002), excessive involvement in high intensity and prolonged aerobic exercises like marathon running and even half marathon running could bring negative effects on immune status of individuals (Malm C. 2006). This concept of temporary loss of immunity was explained through the open window theory of immune system (Kakanis MW, Peake J, Brenu EW, et.al. 2010), wherein, soon after the high intensity prolonged endurance activities could cause for loss or suppression of immune proteins like salivary immunoglobulins, lisozyme, leading to exposure to bacterial and viral attack on the endothelium of the respiratory tract and consequent infections of respiratory tract. Upper respiratory tract infections seems to be more common infections among even elite athletes causing worry of loss of form during the competitive season (Gunzer W et.al. 2012), though high level adaptations through, high intensity training for sufficiently long periods could bring certain changes (Gleeson M. 2006). Immune compromise due to excessive exercise like acute high intensity marathon running is not only due to mucosal immune factor suppression but may also due to tissue trauma sustained during high intensity, sustained aerobic exercise, producing antigen challenge leading to excessive production of cytokines, causing production of T (H) 2 lymphocyte profile resulting in suppression of cell mediated immunity too. It may also happen, intense exercise stimulate changes in airway cellular profiles, involving bronchial epithelium cells to inflammatory state leading to bronchial spasm too. This is the result of hyperventilatory increase of air way osmolarity. Hence, immune suppression of both mucosal and/or cell mediated immunity and/or hyperventilation mediated cytokine challenge on the mucosal epithelium could cause both respiratory infections and loss of lung function (Walsh NP, Gleeson M, Shephard RJ, Gleeson M, et.al. 2011). Clinical manifestation of lung function is verified by FEV₁ capacity of individuals and lung health is predicted. Recreational running, manifesting with sporadic attempts of running suddenly, exposing to acute and high intensity aerobic running like half marathon could jeopardise the health status, causing loss of training and loss of performance too, which could cause loss in motivation. Very limited studies examined the effect of first time marathon running effect on the respiratory tract health status and lung function of these recreational runners.

Methodology

Seventy five recreational runners who started training recently (maximum of six months duration) and trained for half marathon or long distance running for health on self conceived training program basing on the internet sources or any other sources were included into this study. They were explained about the concept of the study and acknowledgements from the participants were obtained. Out of the seventy five runners, fifteen each belonged to different age groups of the study. The age groups for the study were 20-25 yrs, 25-30 yrs, 30-35 yrs and +35 yrs. Also all the seventy five runners of the study participated in their first ever half marathon run. These runners ran in different half marathon events organised in Hyderabad city of India. Upper respiratory tract infection symptoms were assessed through the Wisconsin Upper Respiratory Symptom Survey (WURSS-21). FEV₁ capacity of the participants was measured with the computerised digital spirometer. Pre run and post run URTI and FEV₁ were analysed with Analysis of Covariance (ANCOVA). Highest scores of the URTI and FEV₁ within the first seven days of post run were included. Tukey's HSD post hoc comparison was used to find out the significantly affected group on their URTI score and on their FEV₁ capacity due to the acute half marathon running competition for the first time.

Results

Analysis of Covariance for URTI symptom scores (table I) indicates that there was significant difference in the post run URTI symptom scores of the individuals when compared to their pre run URTI symptom scores (α 0.05, $F=2.97$, $p = 0.0036$). Adjusted post run URTI symptom score mean values (table II) were 62.92 (pre run = 15.40), 55.03(18.67), 79.56(22.80) and 84.63(24.21) for 20-25 yrs, 25-30 yrs, 30-35 yrs and +35 yrs groups respectively. All the four groups of recreational first time half marathon runners of the study experienced significantly high increase in their URTI symptom score after their first time half marathon participation.

Table I. Analysis of Covariance for URTI Symptom Scores

Source	SS	df	MS	F	P
Adjusted means	7642.86	3	2547.62	2.97	0.0036
Adjusted error	47173.29	55	857.70		
Adjusted total	54816.15	58			

Table II. Mean Values for URTI SYMPTOM SCORES

Groups/Mean	Pre run	Post run	Adjusted post run
20-25 yrs	15.40	54.40	62.92
25-30 yrs	18.67	52.67	55.03
30-35 yrs	22.80	85.00	79.56
+35 yrs	24.21	90.07	84.63

Figure I.

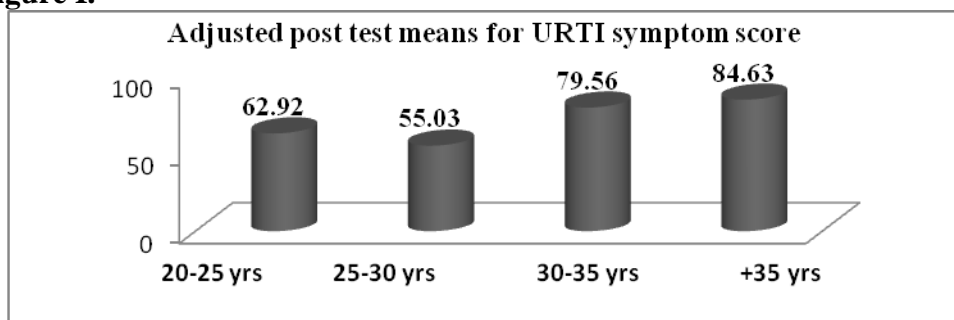


Table III. Tukey HSD Post Hoc Test for URTI Score (CD at 0.05 = 27.5)

Groups / Means	25-30 yrs	30-35 yrs	+ 35 yrs
20-25 yrs 62.92	7.89 N. Sig	16.64 N. Sig	21.71 N. Sig
25-30 yrs 55.03		24.53 N. Sig	29.6 Sig
30-35 yrs 79.56			5.07 N.Sig

The tukey’s HSD post hoc comparison (α 0.05, CD = 27.5) for between the group differences indicate, that +35 yrs group recreational runners experienced significant increases in their URTI symptom score when compared to the 25-30 yrs group of runners (29.6). There was no significant difference between any other two groups of runners of the study.

Analysis of Covariance for FEV₁ scores (table IV) indicates that there was significant difference in the post run FEV₁ scores of the individuals when compared to their pre run FEV₁ scores (α 0.05, F= 4.41, p = 0.0075). Adjusted post run FEV₁ score mean values (table V) were 79.63 (pre run = 84.84), 81.51(86.17), 78.39(83.09) and 78.00(82.14) for 20-25 yrs, 25-30 yrs, 30-35 yrs and +35 yrs groups respectively. All the four groups of recreational first time half marathon.

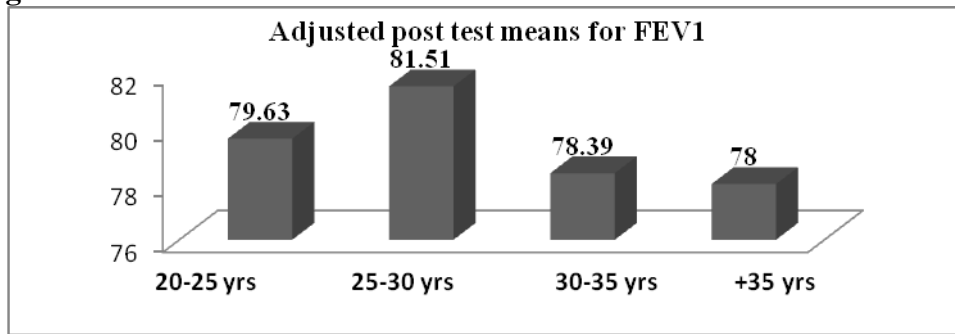
Table IV. Analysis of Covariance for FEV₁ Score

Source	SS	df	MS	F	P
Adjusted means	98.43	3	32.81	4.41	0.0075
Adjusted error	409.14	55	7.44		
Adjusted total	507.57	58			

Table V. Mean Values for FEV₁ Score

Groups/Mean	Pre run	Post run	Adjusted post run
20-25 yrs	84.84	80.21	79.63
25-30 yrs	86.17	83.08	81.51
30-35 yrs	83.09	77.67	78.39
+35 yrs	82.14	76.57	78.00

Figure II.



Runners of the study experienced significantly high increase in their FEV₁ score after their first time half marathon participation. The tukey's HSD post hoc comparison (α 0.05, CD = 2.58) for

Table VI. Tukey HSD Post Hoc Test for FEV₁ Score (CD at 0.05 = 2.58)

Groups / Means	25-30 yrs	30-35 yrs	+ 35 yrs
20-25 yrs 79.63	1.88 N. Sig	1.24 N. Sig	1.63 N. Sig
25-30 yrs 81.51		3.12 Sig	3.51 Sig
30-35 yrs 78.39			0.39 N.Sig

Between the group differences indicate that both 30-35 yrs (3.12) and +35 yrs (3.51) groups of recreational runners experienced significant decrements in their FEV₁ mean values when compared to 25-30 years group of recreational runners post their first half marathon participation. The decrement differences in FEV₁ mean of other groups (20-25 yrs, 25-30, 30-35 yrs to +35 yrs) were not significant.

Discussion

It is clearly evident in this study, that there was significant increase in the URTI symptoms of all the four groups of recreational runners post their first time participation in competitive half marathon. There was variation in the URTI symptom change among the four different age groups, younger age groups of the study (20-25 yrs and 25-30 yrs) reporting less aggressive increments when compared to the older age groups (30-35 yrs and + 35 yrs) of the study. There are increasing evidences to support that the high intensity aerobic efforts of sustained durations could lead to temporary suppression of innate immunity (Moreira A, Delgado L, et.al. 2009) leading to respiratory tract infections even among the well trained and elite athletes (Gleeson M. 2000). Suppression of mucosal immune proteins like Salivary

immunoglobulins (sIgA1 and sIgA2) been observed in several studies (Nakamura D, Akimoto T, et.al. 2006) and this could lead to temporary immune suppression state, failure of first line of defence on mucosal linings of the bronchial pathways, increasing the chances of infection rate of upper respiratory tract infections among athletes after their high intensity aerobic efforts of extended durations like half marathon and marathon running. Though there are no conclusive evidences in exercise immunology, that both the mucosal and cell mediated immune functions are affected due to high intensity acute half marathon running or marathon running, the idea of immune suppression due to very high intensity sustained endurance efforts may be correlated to the increased symptoms of infections especially of upper respiratory tract (Gleeson M, Williams C. 2013), thereby causing possible performance reduction. This latent effect of the performance reduction seems to be much to affect the further competition of the runners. Aging might also has influence in causing differential effects due to acute half marathon running on the immune physiology leading to much aggressive symptoms of URTI among the elderly marathon runners when compared to the younger runners. The study observed increased susceptibility to intensified URTI symptoms for 30-35 yrs and +35 years age groups of recreational runners of the study. It may be the recreational runners are more prone to infectious status to respiratory tract infections showing more aggressive increments, and training adaptations need to be understood in this respect (Konig D, Grathwohl D, et.al. 2000). Loss of lung function as indicated by the decrements in FEV₁ capacity of the individuals (Fabio. C, Giuseppina. C, Vincenzo. B, et.al. 2002) may be very much in importance in the training of runners and especially during the competition period, which could impede the performances of the runners. The cause of this apparent depression in acquired immunity appears to be related to elevated circulating stress hormones, and alterations in the pro/anti-inflammatory cytokine balance in response to exercise (Bermon S. 2007). The clinical significance of these changes in acquired immunity with acute exercise and training remains unknown. The relationship between URTI and exercise is affected by poorly known individual determinants such genetic susceptibility, neurogenic mediated immune inflammation and epithelial barrier dysfunction could be the reasons for this temporary state of immune suppression, inflammatory challenge of cytokines (Couto M, Silva D, et.al. 2013) leading to lung function decrease and consequent decrease in aerobic capacity temporarily, though training is continued. Sometimes, though the URTI symptoms are not manifested, or with no infection status observed, the decrements in lung function could be manifested and this bronchial inflammation without significant infection, could be the reason for lung function decrease. The study observed that all the four groups of recreational runners of the study experienced significant decreases in FEV₁ capacities post their acute half marathon competitive running, more prominently for aged groups like 30-35 yrs and + 35 years. Recreational runners are more prone to the combination of both immune suppression and aggravated pathogen mediated bronchial inflammation. This could have resulted in appearance of

aggravated URTI symptoms coupled with loss in FEV₁ capacity among them due to the acute half marathon competitive running for the first time.

Conclusions

Recreational runners participating for the first time in half marathon competitive running were prone for susceptibility to aggravated URTI symptoms across all ages, more prominently the above thirty years age recreational runners affected much more significantly. Also, the recreational runners of all the age groups of the study experienced significant loss in the FEV₁ capacities post their first competitive half marathon running due to possible loss of lung function, and this was more pronounced among the above thirty years runners. This signifies that aged individuals who are not well trained are at more significant threat to upper respiratory infections and also loss in the FEV₁ capacities, which could impair training protocols and loss in performances.

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