



Plasma erythropoietin concentration following normobaric hyperoxia

McGuire, A., Querido, J.S., Fedoruk, M., Wang, P., Rupert, J.L., McKenzie, D.C.

School of Human Kinetics, University of British Columbia, Vancouver, Canada



Abstract

There is ample evidence to demonstrate that plasma erythropoietin concentration (p[EPO]) is increased in response to a renal hypoxic insult; however, there is recent evidence of an increase in serum [EPO] 24 hours after exposure to two hours of 100% normobaric oxygen. The purpose of this investigation was to confirm this previous observation and to examine the effect of breathing 100% normobaric oxygen on p[EPO] over a 56 hour period. Six healthy, non-smoking, active females volunteered for this study. A blood sample was taken immediately before hyperoxia to represent baseline p[EPO]. Subjects were then exposed to two hours of 100% normobaric oxygen. Subsequent blood samples were taken 22, 34, 46 and 56 hours after the hyperoxia exposure. p[EPO] was measured in duplicate by ELISA and the data was normalized to a percent change from baseline values. Although there was a 19% increase in EPO at 34 hours, a repeated measures ANOVA showed no significant differences in p[EPO] over the 56 hour period (p=0.33). Furthermore, there was no general trend for the p[EPO] response across individuals. These results suggest that breathing 100% normobaric oxygen for two hours does not appear to trigger a significant increase in p[EPO]. Further investigation into the effects of prolonged or repeated exposures to hyperoxia could prove useful.

Introduction

•Erythropoietin (EPO) induces red blood cell production by activating red bone marrow progenitor cells¹, which is regulated by the systemic availability of oxygen⁴.

•In conditions of reduced oxygen supply to the kidney, such as anemia, hypobaric or normobaric hypoxia or hypoxemia¹, the rate of EPO secretion increases and enhances the production of new erythrocytes⁴.

•Conversely, preliminary experiments suggested that hyperoxia or hyperbaric hyperoxia results in a suppression of erythropoiesis^{2,3}.

•In 2004, an investigation found that 100% normobaric oxygen for 2 hours resulted in a significant increase in serum [EPO] at 24-36 hours post-exposure.

•It was suggested that a sudden decrease in tissue-oxygen tension from hyperoxia back to normoxia may act as a stimulus for EPO release¹.

Purpose

• The purpose of this investigation was to confirm the recent observation that exposure to a hyperoxic condition causes an increase in plasma [EPO] and to examine the effect of breathing 100% normobaric oxygen on p[EPO] over a 56 hour period

Methodology

•6 healthy, non-smoking, active females volunteered from the University of British Columbia

•A blood sample was taken immediately before exposure to represent baseline p[EPO]

•Subjects were then exposed to 2 hours of 100% normobaric oxygen

•Subsequent blood samples were taken 22, 34,46, and 56 hours after the hyperoxia exposure

•Blood samples were immediately centrifuged (10 minutes at 3000rpm) and the separated plasma was frozen immediately to -80 °C

•p[EPO] was measured in duplicate by ELISA (enzyme-linked immunosorbent assay)

Results

•There was a 19% increase in p[EPO] at 34 hours

•A repeated measures ANOVA showed no significant differences in p[EPO] over the 56 hour period (p=0.33)

•There was no general trend in the p[EPO] response across individuals

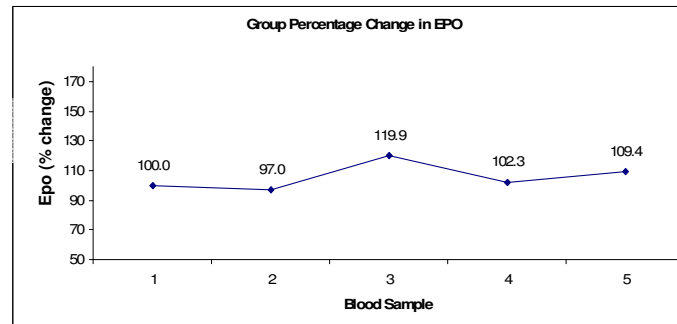


Fig.1. Percentage change in p[EPO] for each blood sample drawn (entire cohort)

Individual Percentage Change in EPO

	Blood Sample				
	1	2	3	4	5
A	100.0	81.8	123.6	94.8	98.9
B	100.0	130.6	118.8	79.1	88.1
C	100.0	96.6	93.9	97.6	93.7
D	100.0	108.3	101.4	103.4	99.7
E	100.0	56.8	110.2	86.1	139.9
F	100.0	107.8	171.4	152.6	135.9
Total	100.0	97.0	119.9	102.3	109.4

Fig.2. Percentage change in p[EPO] for each blood sample for each subject

Discussion/Conclusions

•Although researchers of the previous investigation saw an increase in p[EPO] after exposure to 100% normobaric oxygen,¹ no significant increase in p[EPO] was measured in this investigation.

•Therefore results of the previous investigation¹ were not replicated.

•Results of an earlier experiment in 1972² demonstrated an increase in reticulocytosis without an increase in EPO.

•This suggests that further investigation into the effects of prolonged or repeated exposures to hyperoxia on blood parameters could prove useful.

References

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