THE IMPACT OF AN EIGHT WEEK APNEA TRAINING PROGRAM ON SPLEEN VOLUME AND HAEMATOLOGICAL VALUES

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Abstract

Aims. Apnea training has recently been proposed as a simple and cheap method to stimulate erythropoietin (EPO) production and increase hemoglobin (Hb) concentration and hematocrit (Hct). This study aimed to investigate both acute and chronic effects of apnea on spleen volume and hematological values through an 8-week apnea training program.

Methods. Thirteen subjects daily performed five static apneas. Before, halfway through and after the apnea training period, subjects performed five maximal breathholds at the laboratory. Baseline values for and changes in splenic volume, Ht, Hct, reticulocyte count (RETQ) and EPO were assessed.

Results. A strong spleen contraction in response to acute apnea was observed with volume reductions of 50 ±10% (p <0.001). An acute increase in [Hb] from 156 ±1 g L-1 to 159 ±9 g L-1 (+2%, p <0.005) was seen immediately after the last apnea. Training did not improve acute effects for neither spleen volume (p=0.868), [Hb] (p=0.358) nor Hct (p=0.423). Although no differences in baseline Hct, RETQ and EPO were found (p>0.05), the apnea training program did increase baseline spleen volume by 24 ±7% (p<0.05) and baseline [Hb] by 3.3 ±5% (p<0.05).

Conclusion. Our results show an apnea-specific training effect, as it was demonstrated that both baseline spleen volume and [Hb] had increased after eight weeks of apnea training. These increases suggest improved oxygen storage and transport capacity which might be beneficial for both elite athletes and anaemic patients. In contrast, acute spleen contraction and temporarily increases in [Hb] remained unaltered after training.

INTRODUCTION

Spleen contraction → Acute ↑[Hb] → More pronounced in trained divers

EPO production → Chronic ↑[Hb] → Higher [Hb] in trained divers

AIMS

1. To determine the magnitude of the acute response
2. To determine the impact of an 8 week apnea training program on the acute response
3. To determine the impact of an 8 week apnea training program on baseline spleen volume and [Hb]

METHODS

8 WEEK TRAINING STUDY
- Daily training
- Series of 5 static apneas: 4x 80s + 1x max

15 MALE PE STUDENT
- Age: 22.5±6.4y
- Height: 179±0.25m
- Weight: 71±0.74kg
- VOD max: 55.5±5.6Ls min⁻¹ kg⁻¹

STATISTICAL ANALYSES
- RM ANOVA
- Acceptance at α <0.05

RESULTS

Acute response and training adaptation

1. Acute apnea evokes a spleen contraction of 34 ±12% after one (v1) and 50 ±10% (v4 on left panel) after 4 apneas, increasing circulating [Hb] from 156 ±11 at baseline (BL) to 159 ±9 g L⁻¹ (right panel) immediately post apnea (time point 0).
2. This response was not altered by the training program.

Training adaptation to baseline values

3. Apnea training did increase baseline spleen volume by 24% from 241±55mL PRE training to 299±53mL POST training (left panel). Baseline [Hb] was increased by 3.3% from 153±10 to 159±9 g L⁻¹ (right panel).

CONCLUSION

1. This study confirms the acute spleen contraction and concomitant ↑ in [Hb] following a series of maximal static apneas.
2. No training adaptations were observed for the acute response
3. This study was the first to observe ↑ in baseline spleen volume and [Hb] following an apnea training program

This is in agreement with larger spleen volumes and higher [Hb] found in divers vs non-divers[0].

The magnitude of the ↑ [Hb] is in line with ↑ following high altitude training[1].

References:


