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The impact of high-intensity exertion on hemoglobin levels in weightlifters: A pre-test post-test study

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Abstract
This study investigates the effect of high-intensity exertion on hemoglobin levels in weightlifters using a pre-test post-test design. Hemoglobin is vital for oxygen transport, influencing performance in weightlifting. The study focuses solely on the AVSN group, which underwent high-intensity training protocols involving Ashtang Vinyas Surya Namaskar (AVSN), a dynamic sequence of yoga postures developed by K. Pattabhi Jois. The results show a statistically significant increase in hemoglobin levels post-training, emphasizing the role of high-intensity exertion in enhancing physiological adaptations related to oxygen delivery.

Keywords: High-intensity exertion, hemoglobin levels, weightlifting performance. ashtang vinyas, surya namaskar (AVSN), physiological adaptations

Introduction
Hemoglobin plays a critical role in athletic performance by transporting oxygen from the lungs to the muscles. In weightlifting, the exertion level during training may impact hemoglobin levels, which can affect an athlete's endurance, performance, and recovery. This study explores how high-intensity exertion influences hemoglobin levels in weightlifters, specifically focusing on Ashtang Vinyas Surya Namaskar (AVSN), developed by K. Pattabhi Jois. AVSN is a dynamic series of yoga postures that combine strength, flexibility, and cardiovascular conditioning, designed to maximize physical exertion.
Studies have shown that intense physical training can stimulate erythropoiesis, the process of red blood cell production, leading to elevated hemoglobin levels (Sawka *et al*., 2000) [4]. Additionally, research on various forms of yoga, including high-intensity sequences like Surya Namaskar, has demonstrated benefits in improving cardiovascular fitness and enhancing overall aerobic capacity (Mody, 2011) [2].
The hypothesis is that increased exertion through AVSN will lead to higher hemoglobin levels due to increased physiological demands and adaptation. The study aims to provide evidence on the impact of high-intensity exertion on hemoglobin levels, helping weightlifters and coaches optimize training regimens.

Methodology
Participants
The study included 20 male weightlifters aged 20-35 years, with at least two years of consistent training experience. All participants were assigned to the AVSN group, which was subjected to high-intensity training protocols involving Ashtang Vinyas Surya Namaskar.

Experimental Design
AVSN Group
Participants underwent high-intensity training through Ashtang Vinyas Surya Namaskar, characterized by rapid transitions between yoga postures, increased load on the body, reduced rest intervals, and a focus on maximum exertion.
Hemoglobin levels were measured using blood tests before the intervention (pre-test) and after four weeks of training (post-test).

Data Analysis

Paired t-tests were conducted to compare pre-test and post-test hemoglobin levels within the AVSN group. Descriptive statistics, including mean, standard error, and variance, were also calculated to provide a detailed analysis of the changes observed.

Results

Table 1: AVSN Group (High Intensity)

Hemoglobin Levels (g/dL)	Pre-Test Mean	Post-Test Mean	Change	t-value	p-value
AVSN Group	14.62	15.02	0.4	4.57	< 0.05

The AVSN group showed a significant increase in hemoglobin levels after four weeks of high-intensity exertion, with the mean rising from 14.62 g/dL to 15.02 g/dL. The paired t-test results indicated that this increase was statistically significant ($p < 0.05$), supporting the hypothesis that high-intensity training through AVSN positively affects hemoglobin levels.

Discussion

The significant increase in hemoglobin levels observed in the AVSN group suggests that high-intensity exertion, such as that provided by Ashtang Vinyas Surya Namaskar, stimulates physiological adaptations that enhance oxygen transport capabilities. These adaptations likely include increased red blood cell production and improved hemoglobin concentration, which are crucial for delivering oxygen to muscles during intense exercise.

Studies have shown that high-intensity exercise, including dynamic yoga sequences like Surya Namaskar, can lead to significant cardiovascular improvements, including increased VO2 max and enhanced aerobic capacity (Bhutkar *et al*., 2011) [1]. These physiological benefits are closely linked to improved hemoglobin levels, as the body adapts to higher oxygen demands during intense physical exertion (Montero *et al*., 2015) [3].

AVSN's combination of strength, flexibility, and cardiovascular demand uniquely positions it as an effective high-intensity training modality. This increase in hemoglobin can improve endurance, performance, and recovery in weightlifters, making high-intensity training like AVSN a valuable component of athletic conditioning.

Conclusion

The study confirms that high-intensity exertion through Ashtang Vinyas Surya Namaskar significantly increases hemoglobin levels in weightlifters, highlighting the importance of training intensity in optimizing physiological adaptations. Weightlifters and coaches should consider integrating high-intensity protocols like AVSN to maximize performance benefits related to improved oxygen delivery. Future research should explore the long-term effects of sustained high-intensity exertion through AVSN and investigate other physiological variables influenced by such training.

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