Quantifying the Relationship between Testosterone and Aerobic Capacity in Career Firefighters

Kornkanok Sophonsakulrat[1], Michael J. Conner[2], Alex Jesko[2], Kealey J. Wohlgemuth[1], Jacob A. Mota[1]

[1]Neuromuscular and Occupational Performance Laboratory, Department of Kinesiology and Sport Management Texas Tech University, TX, USA; [2]Front Line Mobile Health, TX, USA

FRONT LINE MOBILE HEALTH

NEUROMUSCULAR & OCCUPATIONAL PERFORMANCE LAB

TEXAS TECH
College of Arts & Sciences
Department of Kinesiology & Sport Management

BACKGROUND

- Career firefighters rely on their aerobic capacity to perform their critical and essential occupational tasks[1]
- It is well-documented that testosterone levels decreases throughout the lifespan of males[2]
- A previous study reported that firefighters with higher aerobic performance (i.e., longer running time) displayed decreased odds of having low testosterone[3]

PURPOSE: The purpose of this study was to determine the relationship between testosterone and VO_{2PEAK} in career firefighters.

METHODS

PARTICIPANTS

- Data from 1151 career firefighters (age = 39 ± 9 years, BF% = 30.2 ± 1.5%) were examined from an annual routine health screening
  - Firefighters were from local fire departments across the United States

BODY COMPOSITION

- Body composition was assessed through a multi-frequency bioelectrical impedance analysis (MF-BIA) device (InBody 570, InBody USA, Cerritos, CA, USA)

CARDIOPULMONARY EXERCISE TESTING

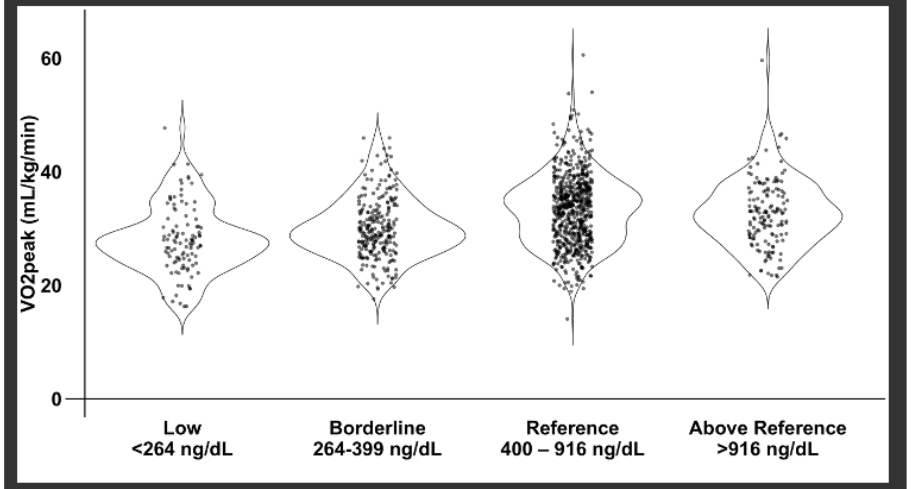
- Participants performed grades testing exercise on a cycle ergometer to determine maximal oxygen consumption (VO_{2PEAK})

SERUM TESTOSTERONE

- In the morning, following a 9-hour fast, participants visited a local lab in order to acquire blood samples via venipuncture
- Testosterone levels can be categorized as low range (<264 ng/dL), borderline range (264-399 ng/dL), reference range (400 – 916 ng/dL), and above reference range (>916 ng/dL)[3]

STATISTICAL ANALYSIS

- Linear mixed effect models were employed to use VO_{2PEAK} as the dependent variable %BF and testosterone category as independent variables



Firefighters in the low testosterone category displayed lower VO_{2PEAK}.

RESULTS

- The linear mixed-effect models indicated that participants' VO_{2PEAK} was higher for those within testosterone categories below:

Testosterone Category	VO_{2PEAK}	t-value	p-value
Borderline	1.66 ml/kg/min	2.58	0.01
Reference	4.23 ml/kg/min	7.35	<0.001
Above Reference	4.52 ml/kg/min	6.51	<0.001

CONCLUSIONS

- Firefighters with testosterone levels in the borderline range have lower VO_{2PEAK}, indicating reduced aerobic capacity
- VO_{2PEAK} increases with higher testosterone levels, with those in the **reference** and **above reference** ranges exhibiting significantly higher VO_{2PEAK} compared to those in the **borderline range**.
- **Future studies** could explore more refined categorizations of testosterone to better understand its relationship with VO_{2PEAK}.

REFERENCES

1.Hare, M. M., Wohlgemuth, K. J., Jesko, A., Conner, M. J., Frost-Piedrahita, V., & Mota, J. A. (2024). Climbing the Ranks: A Study of Firefighter Health Disparities. Healthcare, 12(2), 227.

2.Bhasin, S., Brito, J. P., Cunningham, G. R., Hayes, F. J., Hodis, H. N., Matsumoto, A. M., Snyder, P. J., Swerdloff, R. S., Wu, F. C., & Yialamas, M. A. (2018). Testosterone Therapy in Men With Hypogonadism: An Endocrine Society* Clinical Practice Guideline. The Journal of Clinical Endocrinology & Metabolism, 103(5), 1715–1744.

3.Porto, L. G. G., Soares, E. M., Ranadive, S. M., Lofrano-Porto, A., & Smith, D. L. (2024). Association of endogenous testosterone with physical fitness measures during firefighter occupational health evaluations. *International Journal of Environmental Research and Public Health*, *21*(3), 274.

4.Oskui, P. M., French, W. J., Herring, M. J., Mayeda, G. S., Burstein, S., & Kloner, R. A. Testosterone and the Cardiovascular System: A Comprehensive Review of the Clinical Literature. Journal of the American Heart Association, 2(6), e000272.