



DO CARDIOVASCULAR DISEASE RISK INDICES DIFFER BASED ON BODY MASS INDEX CLASSIFICATION AMONG FIRST RESPONDERS

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Abstract

PURPOSE: To assess differences in cardiovascular disease (CVD) risk indices among first responders' body mass index (BMI) classifications.

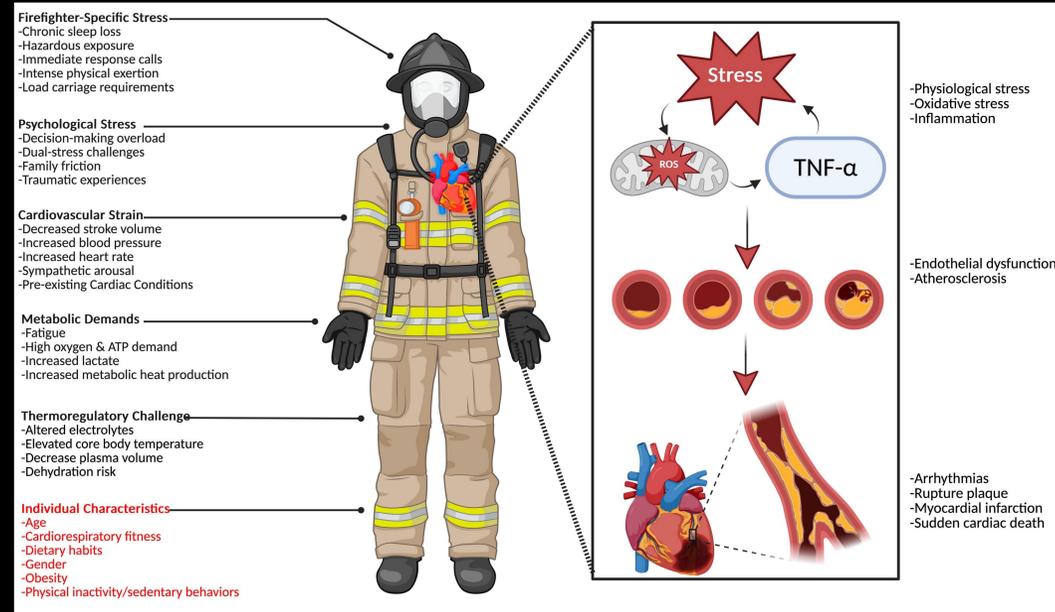
METHODS: One hundred and seventy-one male ($n=171$) first responders were analyzed. Fasted blood and saliva samples were collected to assess CVD risk biomarkers. Body composition metrics were taken. A cardiopulmonary exercise test (CPXT) was completed. One-minute push-ups, sit-ups, and a hand-grip strength assessment were completed. Resting hemodynamics were used to calculate estimated pulse wave velocity (ePWV), while waist circumference and height were used to calculate body roundness index (BRI). The first responders were stratified into three BMI groups, including "healthy" ($18.5 - 24.9 \text{ kg/m}^2$), "overweight" ($25.0 - 29.9 \text{ kg/m}^2$), and "obese" ($\geq 30.0 \text{ kg/m}^2$). Shapiro-Wilk Test assessed for normality. One-way analysis of variance (ANOVA) or a non-parametric Kruskal-Wallis H test (if normality was violated) with Fishers Least Significant Difference or Bonferroni post hoc corrections (respectively) evaluated for differences in CVD risk, fitness, and body composition metrics between BMI groups, where in effect sizes were calculated as partial eta squared. For comparisons between groups (i.e., healthy versus obese), effect sizes were calculated using Cohen's d .

RESULTS: Significant differences were noted across BMI classification groups for CPXT time ($H=19.486, p<0.001, \eta^2=0.124$), VO_2max values ($H=18.527, p<0.001, \eta^2=0.126$), push-ups ($F(2,154)=5.033, p=0.008, \eta^2=0.062$), hand grip strength ($H=6.613, p=0.037, \eta^2=0.025$), waist-to-hip ratios (WHR; $F(2,156)=4.156, p=0.017, \eta^2=0.051$), BRI ($H=80.100, p<0.001, \eta^2=0.193$), body fat percentage (BF%; $H=47.290, p<0.001, \eta^2=0.276$), fat mass ($H=84.981, p<0.001, \eta^2=0.454$), lean mass ($H=65.660, p<0.001, \eta^2=0.358$), android ($F(2,162)=34.724, p<0.001, \eta^2=0.300$) and gynoid ($H=28.122, p<0.001, \eta^2=0.138$) fat percentages, low-density lipoprotein cholesterol (LDL-c; $F(2,161)=3.714, p=0.026, \eta^2=0.044$), high-density lipoprotein cholesterol (HDL-c; $H=14.409, p<0.001, \eta^2=0.116$), triglycerides (TAG; $H=11.448, p=0.003, \eta^2=0.052$), and blood glucose ($F(2,162)=5.498, p=0.005, \eta^2=0.064$). In particular, the obese BMI group displayed lower CPXT times ($p<0.001, d=0.932$), VO_2max values ($p<0.001, d=1.062$), push-ups ($p=0.020, d=0.510$), and HDL-c ($p=0.001, d=0.869$), and higher hand grip strength ($p=0.047, d=0.295$), WHR ($p=0.012, d=0.640$), BRI ($p<0.001, d=1.007$), BF% ($p<0.001, d=1.454$), fat mass ($p<0.001, d=1.882$), lean mass ($p<0.001, d=1.769$), android ($p<0.001, d=1.639$) and gynoid ($p<0.001, d=0.966$) fat percentage, LDL-c ($p=0.011, d=0.502$), TAG ($p=0.003, d=0.625$), and blood glucose ($p=0.001, d=0.667$) than the healthy BMI group. When comparing the healthy to overweight BMI groups, the overweight BMI group displayed higher hand grip strength ($p=0.047$), WHR ($p=0.007$), BRI ($p<0.001$), fat mass ($p=0.002$), lean mass ($p<0.001$), android fat percentage ($p<0.001$), LDL-c ($p=0.017$), and TAG ($p=0.019$), and lower HDL-c ($p=0.003$) than the healthy BMI group.

CONCLUSIONS: These data demonstrate that a higher BMI is associated with more adverse health and poorer fitness profiles than a "healthy" BMI among first responders. This study highlights the importance of maintaining a healthy BMI to support underlying health and fitness.

PRACTICAL APPLICATION: Practitioners and coaches within first responder departments, agencies, and tactical strength and conditioning specialists should encourage and prioritize programs designed to help improve BMI.

Disease Risk



Background

First responders, such as firefighters (FFs) and law enforcement officers (LEOs), face a higher risk of cardiovascular disease (CVD). Data shows that about 45% of on-duty FF fatalities are linked to CVD, and LEOs have a 1.7 times higher prevalence of CVD compared to the general public. While it makes sense that individuals with a higher body mass index (BMI) are at greater risk of CVD than those with lower BMI, it is unclear how much their risk changes with BMI. Identifying this difference could help TSAC-F professionals working with first responders better customize training programs to improve BMI classifications and lower their CVD risk.

Methods

- 171 first responders (73 LEOS; 98 FFs) were included.
- Fasted ($\geq 12\text{h}$) blood and saliva bio-samples were collected.
- Dual-energy x-ray absorptiometry and waist and hip circumferences metrics were taken.
- A symptom-limited maximal cardiopulmonary exercise test (CPXT) was completed and VO_2max was estimated via the Foster equation.
- The first responders were stratified into three BMI groups, including "healthy" ($18.5 - 24.9 \text{ kg/m}^2$), "overweight" ($25.0 - 29.9 \text{ kg/m}^2$), and "obese" ($\geq 30.0 \text{ kg/m}^2$).

Statistical Analysis

The Shapiro-Wilk Test was used to assess normality. One-way analysis of variance (ANOVA) or a non-parametric Kruskal-Wallis H test (if normality was violated) with Fishers Least Significant Difference or Bonferroni post hoc corrections (respectively) evaluated for differences in CVD risk, fitness, and body composition metrics between BMI groups, where in effect sizes were calculated as partial eta squared. For comparisons between groups (i.e., healthy versus obese), effect sizes were calculated using Cohen's d .

Results

- Significant differences were noted across BMI classification groups for CPXT time, VO_2max values, push-ups, hand grip strength, waist-to-hip ratios, BRI, body fat percentage, fat mass, lean mass, android and gynoid fat percentages, low-density lipoprotein cholesterol, high-density lipoprotein cholesterol, triglycerides, and blood glucose.
- The obese BMI group displayed lower CPXT times, VO_2max values, push-ups, and HDL-c levels, and higher hand grip strength, WHR, BRI, BF%, fat mass, lean mass, android and gynoid fat percentages, LDL-c, TAG, and blood glucose levels than the healthy BMI group.
- When comparing the healthy to overweight BMI groups, the overweight BMI group displayed higher hand grip strength, WHR, BRI, fat mass, lean mass, android fat percentage, LDL-c, and TAG ($p=0.019$), and lower HDL-c than the healthy BMI group.

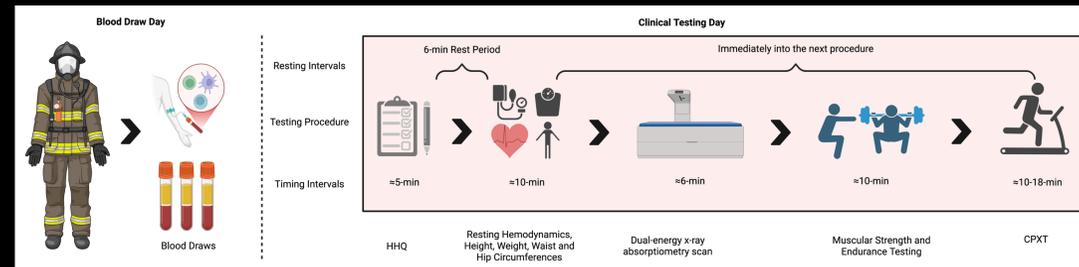
Conclusions

These data show that a higher BMI is linked to worse health and lower fitness levels than a "healthy" BMI among first responders. This study emphasizes the importance of maintaining a healthy BMI to support overall health and fitness. Practitioners, coaches within first responder departments, agencies, and tactical strength and conditioning specialists should promote and prioritize programs aimed at improving BMI.

Acknowledgements

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Experimental Design



Figures

