

Determination of cardiovascular variables associated with athletic function in draft pulling horses

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Introduction

Draft pulling horses perform high-intensity work that places significant strain on their cardiovascular system, yet their cardiovascular health during competition has not been studied. Although exercise-induced cardiovascular changes have been documented in equine athletes, primarily Thoroughbred racehorses, this subject remains unexplored in draft horses. Identifying cardiovascular variables associated with draft horse performance could reveal risk factors, including cardiac arrhythmias or biochemical imbalances, that predispose these horses to cardiac injury.

Methods

Twelve draft horses were evaluated during a local draft horse pulling competition. Each horse underwent the following assessments before competition:

- Cardiac auscultation
- Serum biochemistry panel
- Cardiac troponin analysis
- Five-minute standing electrocardiogram (ECG)

All assessments were repeated immediately following the competition.

Objectives

- Evaluate cardiovascular status before and after competition using diagnostic tests proven to detect signs of cardiac injury or stress.
- Identify potential risk factors that may predispose cardiac injury or stress during training or competition.
- Explore potential associations between cardiovascular risk factors and performance outcomes.

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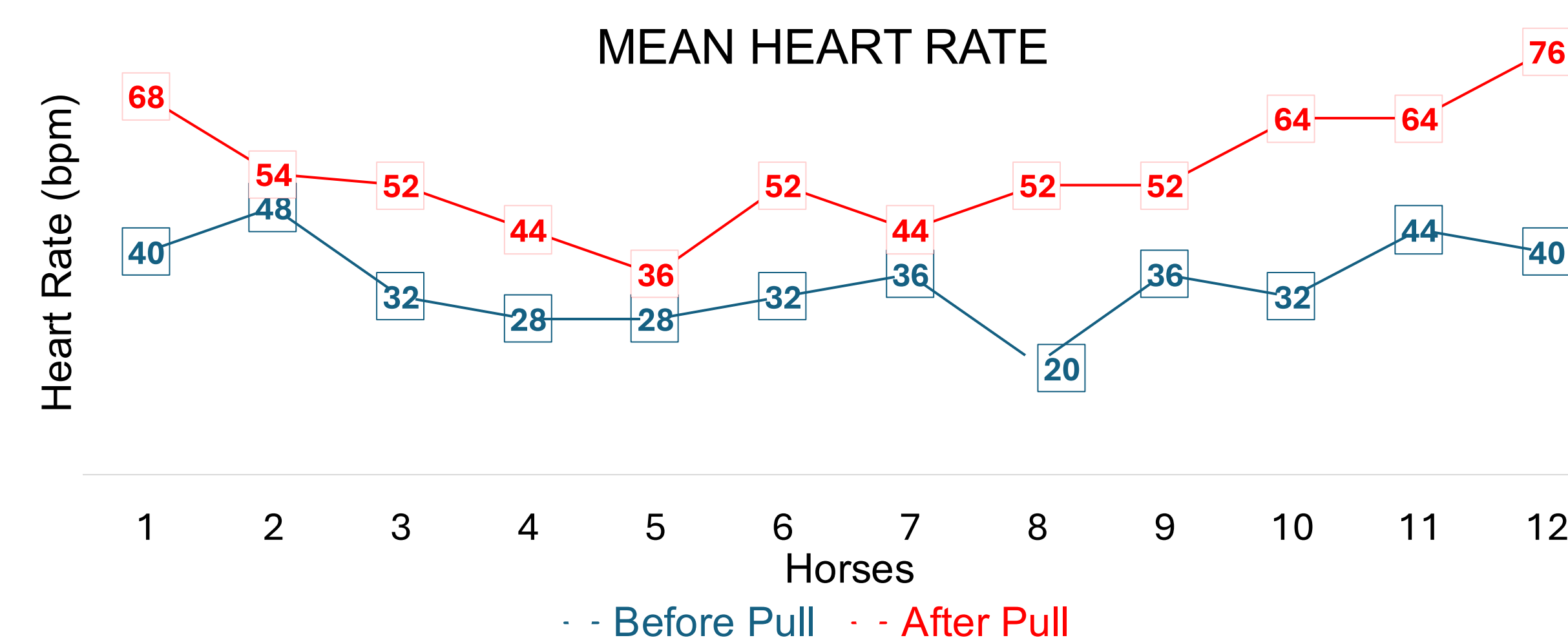


Results

Biochemistry Results and Reference Intervals	All Horses	
	Pre	Post
N=	12	12
Sodium (135-148 mmol/L)	138.3±3.39	136.5 ±2.15
Potassium (3.0-5.0 mmol/L)	*3.9 (2.9-4.2)	*4.25 ±0.19
Na:K Ratio	*36.9 ± 4.58	*32.2 ± 1.71
Chloride (98-110 mmol/L)	100.1 ±3.40	97.7 ±2.49
Calcium (2.8-3.44 mmol/L)	3.0 ± 1.6	3.06 ± 0.1
Magnesium (0.74-1.02 mmol/L)	*0.79 ± 0.06	*0.67 ± 0.06
Phosphate(1.0-1.8 mmol/L)	*1 ± 0.12	*0.94 ± 0.12
Urea (3.5-7.0 mmol/L)	5.6 ±0.67	5.4 ±0.52
Creat. (78-143 umol/L)	122.9 ± 16.47	128.9 ± 20.44
Glucose (3.6-5.6 mmol/L)	*3.3 ± 0.68	*4.6 ± 0.29
T. Billi (4-102 umol/L)	*22.5±7.47	*17.1 ± 4.68
ALP (95-233 U/L)	*124(110-167)	*117.5(111-164)
GGT (0-25 U/L)	*17.2 ± 6.09	*16 ± 5.29
AST (197-429 U/L)	*416.5(277-932)	*385.5(261-870)
CK (0-500 U/L)	*455.7 ±130.11	*366.7 ± 100.24
T. Prot (60-77 g/L)	*66.7 ± 3.76	*63.4 ± 3.77
Albumin (28-42 g/L)	*34.5 ±2.06	*33.1 ± 1.58
Globulin	*32.2 ±3.59	*30.2 ± 3.67
A:G. Ratio (0.6-1.5)	1.0 ± 0.15	1.1 ± 0.16
Troponin-R (ng/mL)	0.003(0.003-0.0042)	0.003(0.003-0.0145)

Figure 1: Serum Biochemistry and Cardiac Troponin Analysis. Values are presented as mean ± standard deviation for normally distributed variables and median (range) for non-normally distributed variables. Asterisks indicate a statistically significant difference between pre-pull and post-pull samples ($p < 0.05$).

Figure 2: Comparative heart rates before and after pulling. The mean heart rates significantly increased across all post-pull measurements ($p < 0.001$). The mean heart rate increased from 34 ± 7.7 bpm pre-competition to 54 ± 11.3 bpm post-competition.



Highlights

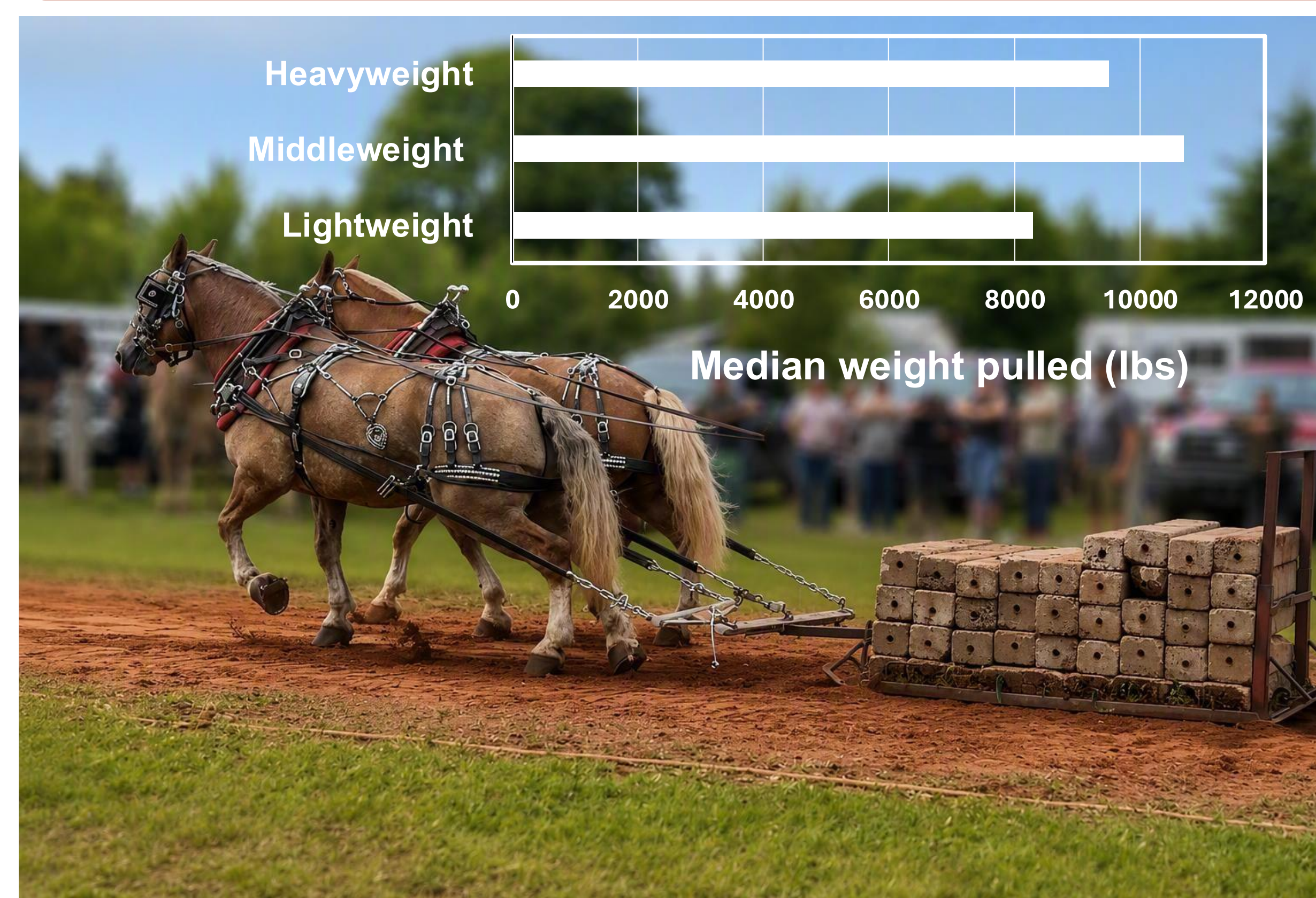


Figure 3: The median weight pulled for each weight class. Lightweight and heavyweight categories had 8 pulls each, while the middleweight category had 11.

Out of twelve horses evaluated, eight of those horses were Belgian draft horses, three participants were Percheron, and one horse was a Belgian/Percheron cross. Three of these horses were mares; the rest were geldings, with ages ranging from 7 to 11 years.

Conclusion and Discussion

- Cardiac arrhythmias were detected in two horses before the competition which included atrial premature complexes (APCs) and a type I second-degree atrioventricular (AV) block. No cardiac arrhythmias were detected following the competition.
- There was no significant difference in cardiac troponin concentrations before and after the pull, although three horses demonstrated post-pull increases.
 - Two horses had cardiac troponin levels that increased to 114% of their pre-pull values, while one horse exhibited an increase to 345% of its pre-pull concentration.
- Across all post-pull measurements, heart rates were significantly elevated ($p < 0.001$), and serum potassium concentrations were significantly higher following the pull ($p = 0.003$).
- AST and CK activities were significantly lower after the competition in 92% of horses ($p = 0.003$ and $p = 0.007$).
- Overall, this draft pulling competition elicited expected cardiovascular responses without evidence of acute myocardial injury. However, further investigation is warranted to better understand the biochemical changes that occur during high-intensity exercise.

Limitations

- Only one post-pull blood sample was collected at a time point selected to prioritize cardiac troponin measurements, which may have limited the interpretation of CK and AST concentrations.
- Data from a single horse show has a limited sample size.

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