

ORIGINAL RESEARCH

# Electrocardiographic Responses to Deer Hunting in Men and Women



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**Objective.**—Deer hunting includes various stimuli resulting in augmented sympathetic activity, increased heart rate (HR) response, and rhythm changes. Collectively, these superimposed stresses may increase an individual's risk for cardiovascular events. We undertook this study to evaluate HR and rhythm responses in multiple phases of deer hunting in men and women with and without cardiovascular disease (CVD).

**Methods.**—Nineteen participants age  $38.3 \pm 13.8$  years (mean  $\pm$  SD) with body mass index  $29.2 \pm 6.9$  kg/m<sup>2</sup> followed their normal hunting routine. HR and rhythm were recorded continuously during the hunt using a small leadless electrocardiogram (ECG) patch monitor.

**Results.**—Data were collected on 13 of 19 hunters while hiking. Three hunters recorded HR  $\geq 85\%$  of their age-predicted heart rate maximum (HRmax) for 1 to 2 minutes. Arrhythmias were detected in both participants with CVD and in 8 without CVD. Recorded rhythms included premature atrial, junctional, and ventricular complexes. Six hunters climbed a tree stand; 3 of them recorded HR  $\geq 85\%$  HRmax with sustained elevated HR response for 2 to 3 minutes with premature junctional contractions. Four of 19 participants dragged deer carcasses. During the drag, 1 male hunter recorded an HR of 91% HRmax, and another male hunter without CVD recorded an exercise-induced ischemic ECG. Fifteen of 19 hunters experienced “buck fever” (acute extreme excitation), with 7 reaching  $\geq 85\%$  HRmax for up to 1 minute. Ventricular bigeminy and trigeminy and ventricular couplets were observed in 1 subject during buck fever.

**Conclusions.**—Men and women with and without CVD recorded substantial increases in HR and clinically relevant arrhythmias while deer hunting.

*Key words:* deer, electrocardiogram, physical activity

## Introduction

According to the US Fish and Wildlife Service, approximately 14.6 million Americans engage in hunting each year, with a large majority of hunters pursuing deer. During the past decade, the number of women who hunt has risen dramatically, and now accounts for approximately 10% of all hunters.<sup>1</sup> Various physical hazards are associated with hunting activities, including falls from tree stands<sup>2–4</sup> and gunshot wounds.<sup>5–7</sup> However, acute cardiovascular events are often overlooked as a serious danger

while hunting. Each year, hunting-related fatalities occur as the result of sudden cardiac events. During a 9-year span, Reishus<sup>6</sup> reported 229 hunters with nontraumatic medical emergency department visits, half of which were cardiac related. It was also reported that 7 hunters died as the result of a cardiac event, accounting for 78% of the fatalities. Specifically, 4 died in the emergency department and 3 while hunting in the field.<sup>6</sup>

It is understood that deer hunting involves both strenuous physical activities<sup>3,6,8–10</sup> and psychological stimuli.<sup>11</sup> Haapaniemi et al<sup>8</sup> provided evidence that the high-intensity nature of deer hunting results in dangerous cardiac stresses and suggested fitness may influence a person's relative risk. Stedman and Heberlein<sup>11</sup> examined a well-known phenomenon referred to as “buck fever,” wherein the psychological response of spotting the prey prompts an adrenaline release and subsequent increase in heart rate (HR) and cardiac stress.<sup>11</sup> Such external physical and psychological stimuli, either alone or in combination, may increase the likelihood

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**Table 1.** Participant demographics

Variable	All (n = 19)	Male (n = 13)	Female (n = 6)
Age (y)	38.3 ± 13.8	43.7 ± 12.1	26.7 ± 9.8
HRmax (beats/min)	181.7 ± 13.8	176.3 ± 12.1	193.3 ± 9.8
85% HRmax (beats/min)	154.0 ± 11.7	149.9 ± 10.3	164.3 ± 8.3
Height (cm)	176.2 ± 11.8	182.5 ± 8.3	162.6 ± 2.8
Weight (kg)	91.2 ± 25.3	101.4 ± 23.2	69.2 ± 12.8
BMI (kg/m <sup>2</sup> )	29.2 ± 6.9	30.6 ± 7.4	26.2 ± 4.7
Hunting experience (y)	23.0 ± 14.4	29.8 ± 15.5	8.5 ± 2.9

All participant demographic data reported as mean ± SD.

BMI, body mass index; HRmax, age predicted maximal heart rate (220 – age).

of sudden cardiac death in the presence of structural or functional cardiovascular abnormalities.<sup>12</sup>

The conclusions drawn from these studies suggest that there is a relationship and possible causal relationship between physical and emotional stimuli associated with the various hunting-related activities and cardiovascular risks and events. Given the popularity of deer hunting and the record of cardiovascular events, it would be valuable to have a better understanding of the cardiovascular demands associated with both the physiological and psychological responses of deer hunting-related activities. To date, no investigations have addressed the aforementioned aspects in combination. Accordingly, the purpose of this investigation is to evaluate the HR and rhythm response involved in multiple phases of deer hunting in both men and women with and without known heart disease.

## Methods

Nineteen hunters (12 men, 7 women) participated in this study. All 19 participants purchased valid deer hunting licenses and planned to hunt during the rifle deer hunting season. A summary of participant demographics is displayed in Table 1, whereas individual participant information can be found in Table 2. Hunting experience (mean ± SD) was 23 ± 14 years. Six participants were considered overweight (defined as a body mass index of ≥ 25 kg/m<sup>2</sup>), and 7 were considered obese (defined as a body mass index of ≥ 30 kg/m<sup>2</sup>). Two men had a history of atrial fibrillation although they had neither been diagnosed with nor shown major signs and symptoms of cardiovascular disease (CVD). One underwent surgery to replace both the mitral and aortic valves, and the other had a pacemaker implanted. Four other participants were not diagnosed with disease, but presented with 1 or more CVD risk factors, such as cigarette smoking, hypertension, hypercholesterolemia, and family history (Table 2). Medications for cardiac conditions remained unchanged during data collection, and included β-blockers (in 1 subject), anticoagulants, aspirin, angiotensin-converting

enzyme inhibitors, diuretics, and statins. Consumption of caffeinated coffee in the morning was reported, which was consistent with normal morning routines. Only 4 of 19 participants (2 men, 2 women) met the American College of Sports Medicine (ACSM) recommendation for moderate-intensity aerobic exercise per week (at least 5 days per week; 150 minutes total).<sup>13</sup> Before data collection, approval for the study was secured from the university's institutional review board, and written informed consent was obtained from all participants.

Typical hunting weather included average daily high temperatures of -5°C with bouts of snow flurries. Participants were instructed to follow their normal hunting routine and were provided a diary to document the phases of the hunt, which included hiking, climbing a tree stand, buck fever (collectively defined as sighting, sighting but not shooting, shooting and missing, shooting and hitting), and dragging a shot deer. In addition, HR and rhythm were recorded via a ZIO XT Patch (iRhythm, San Francisco, CA), a small, leadless electrocardiograph patch monitor affixed to the upper left quadrant of the chest (Figure). Participants were instructed to wear the patch continuously for up to 14 days (timeline of rifle hunting season and battery life of monitor) and press the event button on the patch for the above phases. Once hunting ended, by either a successful hunt or completion of the season, the ZIO XT Patch was sent to the iRhythm Clinical Centers (iCC) for processing and analysis. The data were then reviewed by a certified cardiographic technician, specialized in advanced arrhythmia detection, to help ensure high accuracy and quality of the report. Reports were provided to the investigators for further analysis with preliminary findings. Final report interpretation was performed by an exercise physiologist with expertise in ECG interpretation.

## Results

Observations recorded via ZIO XT Patch monitoring throughout the various hunting-associated activities are

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