

The Prevalence of Heart Rate Variability Monitoring Among a Sample of Habitual Runners

Direct Original Research

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Submitted:
March 2, 2026
Accepted:
March 23, 2026
Published:
March 27, 2026



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Journal of Exercise and Nutrition: 2026, Volume 9 (Issue 1): 11

ISSN: 2640-2572

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Abstract

Introduction: The measurement of heart rate variability (HRV) draws widespread attention among athletes and researchers, but few data are available on the use and application of HRV in runners. The purpose of this study was to examine the prevalence of HRV monitoring and the adjustment of training based on HRV among a sample of habitual runners.

Methods: Runners (18-65 yr) who reported running ≥ 3 d·wk⁻¹ for ≥ 6 months and competing in ≥ 2 races annually completed a 13-item survey on training habits and the use of wearable devices. Chi-square analysis was used to detect differences in the prevalence of HRV monitoring between genders, age groups, and competitive levels. Unpaired t-tests were used to compare training frequency (d·wk⁻¹), volume (hr·wk⁻¹), and experience (years running) between HRV trackers and nontrackers and between competitive and noncompetitive runners. Statistical significance was accepted at $p \leq 0.05$.

Results: Out of $N=210$ respondents (17.7 ± 8.81 yr experience, 3.78 ± 0.98 d·wk⁻¹ frequency), 47% ($n=99$) reported regularly monitoring HRV. More HRV users ($\chi^2=4.89$, $p=0.027$) were male (57.6%, $n=57$) than female (42.4%, $n=42$). HRV monitoring was similar between “competitive” vs. “recreational” runners ($\chi^2=0.486$, $p=0.49$). 71% of HRV trackers used Garmin® devices while only 20% reported adjusting training based on HRV.

Conclusions: HRV measurement is prevalent among runners, but is not frequently used to alter training.

Key Words: wearables; running; heart rate variability

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Introduction

The rapid advancement of wearable technology has a profound and continuing impact on the exercise, fitness, and sport landscape¹⁻³. This is especially true in running, as more than 90% of runners report using a GPS device to track speed, distance, and/or heart rate⁴. Many current running wearables are equipped to measure heart rate variability (HRV), a topic of growing attention among athletes and researchers⁵. HRV has been recognized as a marker of recovery status and adaptation to training, and it is increasingly used by coaches and practitioners to individualize training prescription^{6,7}. While evidence exists to support the utility of HRV monitoring and training adjustment in endurance athletes^{8,9}, several wearable manufacturers integrate predictive metrics based on HRV and exercise data to estimate recovery, readiness, and fitness^{5,10}. However, none of these proprietary metrics have been validated^{2,3}, and emerging evidence suggests that wearables’ predictive messaging can have perceptual effects in endurance athletes¹¹. While GPS tracking is prevalent among runners, few data are available on the use and application of HRV monitoring in this population. Characterizing the current prevalence of HRV monitoring and HRV-based training adjustment can provide coaches and practitioners with

actionable insight on how runners use and interact with HRV and related predictive metrics. Such information could enable a more informed decision-making process in the adoption of HRV measurement and is crucial for researchers to determine the need for future interventions utilizing HRV. Therefore, the purpose of this study was to assess the prevalence of the use of wearable devices to monitor HRV and the adjustment of training based on HRV or derived metrics among a sample of habitual runners.

Methods

Participants

Habitual male and female adult distance runners ($N = 210$, $n=107$ female, 18-65 years of age) were recruited using social media and paper flyers distributed at local races, running groups, and run specialty stores in the Louisville, Kentucky (USA) metropolitan and surrounding area. Although recruitment efforts were focused on this region, runners residing outside the state of Kentucky were also welcome to participate. Participants were eligible if they reported running ≥ 3 d·wk⁻¹ for the last six months and competing in ≥ 2 organized races ≥ 5 km (3.1 mi) annually. All study procedures were approved by the Bellarmine University Institutional Review Board, and all participants electronically provided informed consent prior to participation.

Protocol

The current study used a cross-sectional survey design. All participants were invited to respond anonymously to a 13-item online survey including questions concerning demographics, training habits, self-reported performance level, and the use of wearable devices related to running.

Survey Details

Survey responses were collected over a period of 60 days from October – November 2022. Participants accessed the survey by following a hyperlink/QR code, then completed the survey on the online portal Explorance[®]. Two demographic questions asked participants to select their gender (female, male, nonbinary) and age category (18-29, each decade thereafter). Five questions on training habits inquired about the length of running experience, typical frequency and duration of running, training intensity distribution, and methods used to plan training. To characterize performance level, one question asked runners to select the most appropriate descriptor from the following: recreational, competitive age group/masters athlete, interscholastic athlete (high school or college team), sub-elite (Olympic Trials qualifier or hopeful), elite/professional. “Recreational” status was described as running for health and/or enjoyment without focusing on finish times or competitive placing. The categorization of “competitive age group/masters athlete” was described as training specifically to enhance individual performance and/or competing for placement in one’s age group or the overall “masters” (age ≥ 40 yr) category. Five questions regarding wearable device use sought to identify the type(s) of wearable device(s) used and the specific brand of wearable(s) (Apple[®], Coros[®], Fitbit[®], Garmin[®], Oura[®], Polar[®], Whoop[®], other, none), characterize the preferred sophistication of features, and determine the use of HRV monitoring and extent to which HRV informed training decisions.

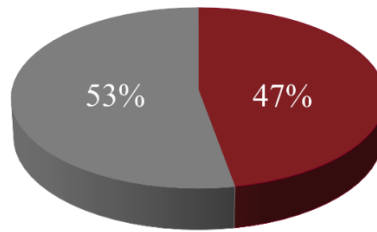
Statistical Analysis

All statistical analyses were performed using SPSS (version 28, IBM SPSS Inc., Illinois, USA) with an α level of $p \leq 0.05$. Descriptive statistics of the study sample (age, gender, running frequency and volume) and the prevalence (%) of HRV monitoring were calculated. Survey respondents were classified by gender, age, and self-reported performance level. Chi-square analysis was used to detect differences in the prevalence of HRV monitoring between genders, age groups, and self-reported performance categories. Independent t-tests were used to compare self-reported training frequency (d·wk⁻¹), volume (hr·wk⁻¹), and experience (years running) between HRV trackers and nontrackers and between competitive and noncompetitive runners.

Results

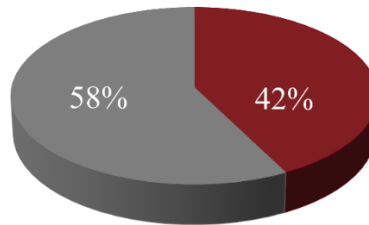
The survey received $N=210$ unique respondents, of which 51% ($n=107$) were female and 49% ($n=103$) were male. Overall, participants reported 17.7 ± 8.81 years of running experience and a running frequency of 3.78 ± 0.98 d·wk⁻¹. 56% ($n=117$) of the sample self identified as “recreational” whereas 44% ($n=93$) selected one of the competitive categories and were collectively designated as “competitive”. Because the vast majority of competitive respondents identified as age group/masters athletes ($n=85$), the competitive subcategories were grouped together for analysis. Those who identified as “competitive” reported greater frequency of running (4.9 ± 0.66 vs. 3.5 ± 0.81 d·wk⁻¹, $p=0.002$) and longer experience (17.7 ± 7.49 vs. 13.1 ± 10.1 yr, $p=0.001$).

Of all respondents, 98% ($n=206$) reported regularly using GPS to monitor speed and/or distance and 47% ($n=99$) reported regularly monitoring HRV, as shown in Figure 1. More HRV users ($\chi^2=4.89, p=0.027$) were male (58%, $n=57$) than females (42%, $n=42$), but HRV use did not differ between those who identified as “competitive” vs. “recreational” ($\chi^2=0.486, p=0.49$), as shown in Figure 2. HRV users had not been running as long (13.8 ± 9.31 vs. 16.5 ± 10.9 yr, $p=0.04$), but reported greater weekly volume (6.6 ± 2.69 vs. 4.9 ± 3.01 hr·wk⁻¹, $p=0.02$). Among all HRV trackers ($n=99$), 71% ($n=70$) used Garmin® devices, a significantly greater proportion ($\chi^2=17.0, p<.001$) than those using other brands. As shown in Figure 3, 20% ($n=20$) of HRV trackers (10% of $N=210$) reported regularly adjusting training based on HRV, which was significantly fewer than those who did not ($\chi^2=36.0, p<0.001$).



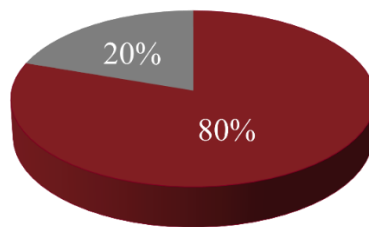
■ Monitor HRV
 ■ Do Not Monitor HRV

Figure 1. Overall HRV monitoring. Out of all survey respondents ($N= 210$), 47% ($n = 99$) reported regularly monitoring HRV.



■ Competitive ■ Recreational

Figure 2. HRV monitoring and competitive level. Among all HRV users ($n= 99$), the proportion identifying as “competitive” did not differ from “recreational” ($\chi^2=0.486, p=0.49$).



■ Do Not Adjust Training
 ■ Adjust Training

Figure 3. Training adjustment based on HRV. Among all HRV users ($n= 99$), only 20% reported adjusting training based on HRV ($\chi^2=36.0, p<0.001$).

Discussion

The present survey data affirms the widely reported expansion of wearable technology use in sport and exercise^{1,2}, while yielding novel insights into the prevalence of HRV measurement in habitual distance runners. Notably, in concert with previously available data⁴, most of our sample reported tracking their running time, speed, and distance using a GPS device. While HRV measurement is an increasingly standard feature of running wearables and growing research has investigated the potential for greater performance enhancement using HRV guided training^{8,9}, few data on the prevalence of HRV monitoring amongst the running population are available. The results of our survey suggest that HRV monitoring is prevalent among runners (47% of $N=210$), though not approaching the near ubiquitous rate of GPS tracking of speed/distance (98% of $N=210$) with or without HRV monitoring. Among this sample, HRV monitoring was more common in males but did not differ between self-identified competitive vs. recreational runners. Interestingly, despite numerous brands offering HRV equipped wearables targeted at runners, the majority of HRV trackers in our sample used Garmin[®] devices. Additionally, despite the considerable proportion of our sample that reported monitoring their HRV, relatively few (20% of HRV trackers) reported adjusting their training based on these measurements or HRV derived metrics such as recovery or readiness scores or ratings of training status (e.g., “productive”, “unproductive”).

As wearable technology assumes an increasingly fixed role in multiple exercise and sport activities¹⁻³, including distance running, our results suggest that endurance athletes’ use of predictive features (particularly HRV and derived metrics) to alter training plans likely does not match the increasing availability of such features on current wearables. Although several studies have shown greater performance enhancement following an individualized HRV-guided training schedule^{8,9}, others have shown that even falsified predictive feedback from a wearable can impact expectations, perceived effort, and pacing¹¹. As such, an individualized approach to integrating HRV measurement throughout a training cycle may be warranted.

Several limitations should be noted when interpreting the results of this study. While the sample of $N=210$ provides insight into wearable use and HRV tracking among runners, it is inadequately sized to be fully representative of the adult running population. Also, despite 44% of the sample identifying as “competitive”, the majority of these were age group/masters competitors. Therefore, these data do not indicate the prevalence of HRV tracking among highly competitive or elite runners. Additionally, the online format of the survey may have biased the responses toward those respondents who were more likely to embrace electronic technologies, mirroring the predictive features of running/fitness wearables. Furthermore, because most of the sample was geographically limited to Kentucky, the results may not be directly generalizable to the running population at large.

Conclusions

These survey data indicate that HRV monitoring is prevalent among runners, though not at the rate of GPS tracking of speed/distance *per se*. HRV monitoring was similar between recreational and competitive runners, but is currently not used widely to adjust training by runners in either category. Running coaches can utilize these findings by understanding that most recreational and competitive runners do not currently arrange or adjust their training schedule based on HRV measurements or HRV-derived metrics. However, should a data driven approach be preferred, such as the HRV-guided scheduling of intense sessions described elsewhere^{8,9}, many runners already possess capable technology and are accustomed to regularly monitoring HRV. For the purposes of data sharing via online platforms, a majority of runners who track HRV do so with Garmin devices.

Conflict of Interest. The authors declare no conflicts of interest.

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