Dialogue Social Science Review (DSSR)
www.thedssr.com

ISSN Online: 3007-3154
ISSN Print: 3007-3146

DIALOGUE SOCIAL SCIENCE REVIEW

Vol. 3 No. 12 (December) (2025)

# Perception Of Athletes About Use And Accuracy Of Wearable Technology For Tracking Physiological Variables

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## ABSTRACT

Wearable technology refers to those devices which used for monitoring different physiological variables such as heart rate, sleep patterns, and energy expenditure. It is considered an integral element of sports. This research study aimed to assess the perception of athletes about the use and awareness of athletes regarding Wearable Technology for real-time tracking of Physiological Variables. The population of the study was comprised of competitive athletes of various sports activities from different universities in the Punjab, Pakistan. Four hundred fifty (450) athletes were taken as a sample of the study by using available sampling technique. A structured Likert-scale questionnaire was developed by adapting validated items from the IPAQ, and the WHO-5 was used for data collection. The collected data were processed through statistical package for social sciences (SPSS, version 26), and thus, suitable statistical tools were applied. On the basis of data analysis and findings, the researcher arrived at the conclusion that the majority of respondents used different Wearable technologies for real-time tracking of physiological variables such as heart rate, sleep patterns, and energy expenditure. In addition, all of the respondents were satisfied with the accuracy of wearable technologies used in sports.

**Keywords:** Wearables, Tacking Accuracy, Athletes, Physiological Variables.

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## INTRODUCTION

In recent years, with the advancement of information and communication technology (ICT), wearable devices have become one of the most prevalent technologies (Markets and Markets, 2017). Wearable technology is considered a vital element of sports, used by almost of athletes for tracking real-time physiological activities such as recording heart rate, variability, sleep, blood oxygen saturation, caloric expenditure, and movement dynamics. It helps the player as well as the coach with immediate feedback to optimize training, reduce injury risk, and guide recovery (Taylor et al., 2022).

Sports wearables contain features and accompanying apps that provide training schedules, help track fitness activities, gather and process fitness and health-related data, and give users performance feedback (Gee et al., 2015; Lee et al., 2016; Swan, 2012; Ometov et al., 2021).

Wearable technology is primarily used in sports for the following purposes: (1) performance monitoring and optimization, which gives coaches and athletes actionable metrics (velocity, power proxies, workload indices) for session planning and technique feedback; (2) workload management and injury risk reduction, which tracks acute: chronic workload ratios and movement patterns associated with injury risk; (3) rehabilitation and return-to-play, which objectively monitors recovery progress and functional benchmarks; (4) talent identification and tactical/technical analysis, which provides fine-grained movement profiling across players; and (5) health surveillance and athlete wellbeing (Li et al., 2016; Seçkin et al., 2023; Gartner, 2016).

For optimal performance in sports, tracking and monitoring of various physiological variables such as heart rate and body composition are considered important (Nawaz et al., 2022). Wearables are increasingly integrating psychophysiological indicators (e.g., HRV-based stress scores), yet athletes' trust in such metrics differs widely. In addition, studies addressing performance-related biochemical indicators, such as uric acid, oxidative stress, and recovery markers (Butt et al., 2024; Tabassum et al., 2021).Hormonal and biochemical responses, such as cortisol, testosterone, and liver enzyme fluctuations, are important to consider in the context of athletes' performance (Khan et al., 2022; Mohy ud Din et al., 2023). Psychological states, including anxiety and stress hormones, interact closely with physiological monitoring (Sattar et al., 2021; Husein et al., 2024).

## METHODOLOGY

The procedures below are adopted by the researcher to reach certain findings and conclusions.

### Study Design

The current study was carried out for the assessment of the perception of athletes about the use and awareness of athletes regarding wearable technology for real-time tracking of Physiological Variables; therefore, a cross-sectional survey design was applied.

### Study Population

The population of the study was comprised of competitive athletes of various sports activities from different universities in the Punjab, Pakistan.

### Sample and Sample Size

Four hundred fifty (450) athletes were taken as a sample of the study by using an available sampling technique.

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**Tools for Data Collection**
A structured Likert-scale questionnaire was developed by adapting validated items from the IPAQ, and the WHO-5 was used for data collection.

**Mode for Data Collection**
The developed questionnaire was personally distributed by the researcher among the respondents and collected after being filled out by the respondents. Four hundred and fifty (450) questionnaires were distributed among the respondents, and thus four hundred twelve (412) questionnaires were collected

**Ethical Consideration**
Ethical approval was obtained from the Department of Sports Sciences and Physical Education, University of the Punjab, Lahore, Pakistan. Informed consent was taken from all the subjects before participation in the study. All the respondents were informed about the confidentiality of data.

**Data Analysis**
The collected data were processed through the statistical package for the social sciences (SPSS, version 26), and thus, suitable statistical tools were applied.

**PRESENTATION OF DATA**
**Table no. 1 showing the Demographic Characteristics of Respondents (N = 412).**

| Variable | Categories | Frequency (n) | Percentage (%) |
|---|---|---|---|
| **Gender** | Male | 278 | 67.5 |
| | Female | 134 | 32.5 |
| **Age (years)** | 18–20 | 156 | 37.9 |
| | 21–23 | 174 | 42.2 |
| | 24 & above | 82 | 19.9 |
| **Sports Experience** | 1–3 years | 168 | 40.8 |
| | 4–6 years | 149 | 36.2 |
| | 7 years & above | 95 | 23.1 |

Table no. 1 presents the demographic distribution of the 412 competitive university athletes who participated in the study. The majority were male (67.5%), and most belonged to the middle age bracket of 21–23 years (42.2%). A substantial proportion had 1–3 years of sports experience (40.8%), indicating that wearable technology adoption is widespread even among comparatively early-stage athletes

**Table no.2 Shows the Descriptive Statistics of Wearable Usage (N = 412)**

| Variable | Mean | SD | % Using Feature |
|---|---|---|---|
| Heart-rate tracking | 4.08 | 0.71 | 92% |
| Sleep | 3.21 | 0.84 | 77% |

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| Variable | Mean | SD | % Using Feature |
|---|---|---|---|
| monitoring | | | |
| GPS distance | 3.89 | 0.79 | 64% |
| Training load estimation | 3.76 | 0.82 | 69% |

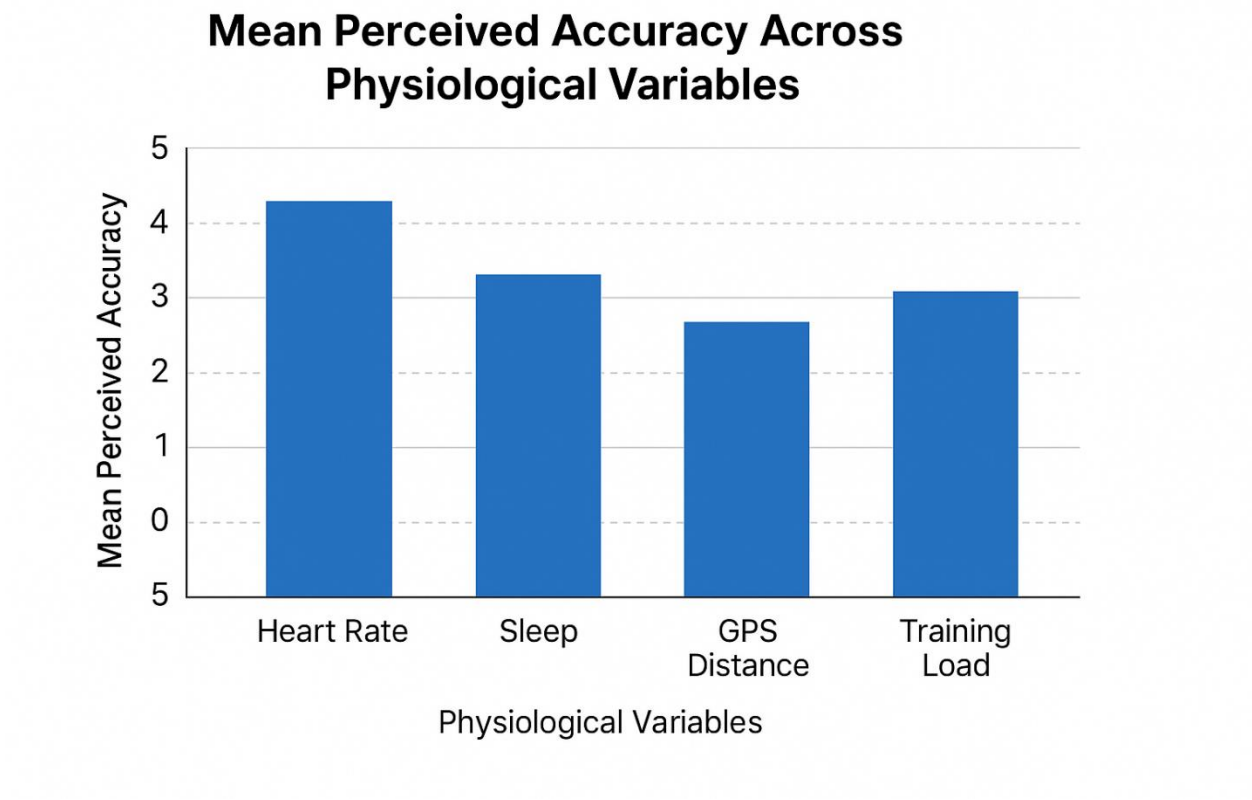


**Figure 1.** Mean Perceived Accuracy Across Physiological Variables

Table no.2 **demonstrates** that heart-rate tracking had the highest perceived usage and accuracy (M = 4.08, 92%), followed by GPS distance (M = 3.89) and training load estimation (M = 3.76). Sleep monitoring showed comparatively lower perception scores (M = 3.21, 77%). Figure no.1 further visualizes how athletes trust real-time cardiovascular and movement-based measures more than algorithm-dependent sleep metrics.

**Table no 3. Shows the Regression Predicting Perceived Accuracy**

| Testing Variables | β | p-value |
|---|---|---|
| Training experience | .24 | <.001 |
| Wearable type | .18 | .004 |
| Weekly load | .13 | .032 |
| Sport type | .06 | .118 |

Model $R^2$ = .31

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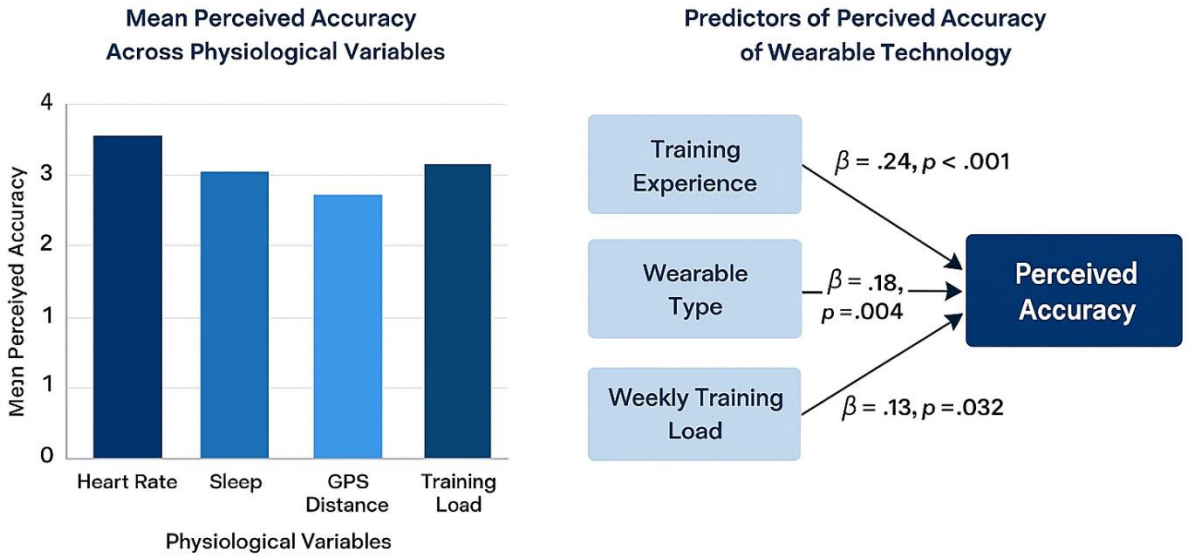


**Figure 2.** Regression Model Predicting Perceived Accuracy of Wearable Technology

**Table no.3** indicates that training experience (β = .24, p < .001), wearable type (β = .18, p = .004), and weekly training load (β = .13, p = .032) significantly predict athletes' perceived accuracy of wearable devices. Sport type had no significant effect (p = .118). Figure no.2 depicts this predictive model, showing that familiarity with technology and higher physiological demands enhance user trust in wearable outputs. The overall model explained 31% variance in perceived accuracy ($R^2$ = .31), demonstrating a moderate level of explanatory power

## RESULT & DISCUSSION

The current study was carried out for the assessment of the perception of athletes about the use and awareness of athletes regarding wearable technology for real-time tracking of Physiological Variables. The study found that the majority of respondents used different Wearable technologies for real-time tracking of physiological variables such as heart rate, sleep patterns, and energy expenditure. In addition, all of the respondents were satisfied with the accuracy of wearable technologies used in sports. In line with these findings, the study conducted by Fullagar et al (2021) and Nawaz et al (2022) showed that currently, sports rely on digital monitoring devices and similarly, athletes trust in heart-rate data, aligning with biochemical and physiological research validating HR as a reliable performance marker.

Findings of the study also highlight that athletes expressed lower trust in sleep tracking, reflecting concerns previously raised about algorithmic inaccuracies in consumer-grade devices. Training load and device type significantly predicted the perceived accuracy link between perceived usefulness and intention to adopt technology. This aligns with physiological evidence showing how hormonal, metabolic, and stress indicators shift with training load (Khan et al., 2022; Mohy ud Din et al., 2023)

Psychological monitoring findings are also relevant: studies reporting on the interaction

ISSN Online: 3007-3154
ISSN Print: 3007-3146

DIALOGUE SOCIAL SCIENCE REVIEW

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between anxiety, stress hormones, and training environments (Sattar et al., 2021; Husein et al., 2024). Highlight the need for multidimensional monitoring. Many wearables now provide HRV-based stress indices, which require athlete trust to be effective.

The lower perceived accuracy for recovery and biochemical estimates reflects what performance-related studies indicate: biomarkers such as uric acid, inflammation, and hormonal fluctuations require controlled laboratory assessments (Butt et al., 2024; Tabassum et al., 2021). Wearables currently cannot fully replace these gold-standard assessments.

## CONCLUSION

On the basis of data analysis and findings, the researcher arrived at the conclusion that wearable technology is widely adopted across competitive sports, but athletes distinguish sharply between metrics they trust and those they do not. Heart-rate and movement-based indicators receive the highest confidence, while sleep and recovery estimates remain questionable.

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ISSN Print: 3007-3146



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