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EXAMINING DIFFERENCES IN ATHLETIC PERFORMANCE OF INTER COLLIGATE MEDALLISTS DURING DIFFERENT SEASONS

(Research article)

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Abstract

The purpose of this study was to examine the variations in athletic performance between the competitive season and the off-season among inter-collegiate medal-winning athletes. The research involved a comparative analysis of performance in sprinting, jumping, and throwing events, focusing on both male and female participants. Performance data were collected during both competitive and off-season phases and statistically analyzed using paired sample t-tests. The results revealed a significant decline in athletic performance during the off-season across all event categories, with sprint and throwing events showing greater variation than jumping events. Additionally, male and female athletes exhibited differing degrees of seasonal performance changes. These findings suggest that periodized training, continuous skill maintenance, and season-specific strategies are essential to minimizing performance loss and sustaining peak performance levels. The study supports the implementation of structured off-season programs tailored to event type and athlete profile.

Keywords: Seasonal variation, athletic performance, competition period, off-season, inter-collegiate athletes, sprints, jumps, throws.

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1. Introduction

Athletic performance is influenced by a range of physiological, psychological, and environmental factors. Among these, seasonal variations play a critical role, particularly in outdoor sports where environmental conditions such as temperature, humidity, and daylight hours can directly affect an athlete's capacity to train and compete effectively (Reilly & Waterhouse, 2009). Inter-collegiate athletes, who often participate in competitive events across different times of the academic year, may experience fluctuations in performance due to these seasonal changes.

Seasonal effects can influence core body temperature regulation, hydration status, muscle function, and even mood and motivation, all of which are important determinants of athletic performance (Cheung, 2010). For example, heat stress in summer may lead to quicker fatigue, while colder temperatures in winter can reduce muscle flexibility and increase injury risk. These physiological shifts may result in measurable performance differences even among elite or medal-winning athletes at the inter-collegiate level.

Furthermore, academic schedules and institutional priorities often alter training loads across seasons, contributing to variations in athletes' physical readiness and recovery. Understanding the impact of seasonal changes on performance is crucial for coaches, sports scientists, and athletes in planning periodized training and optimizing peak performance times (Mujika & Padilla, 2000).

Seasons refer to the natural divisions of the year—typically categorized as summer, monsoon (rainy), autumn, winter, and spring—based on changes in weather patterns, temperature, humidity, and daylight duration. In the context of sports and athletics, these seasonal variations significantly influence both the training environment and competitive performance of athletes (Reilly & Waterhouse, 2009).

Each season brings distinct environmental conditions that can either enhance or hinder athletic performance. For example, **summer** is characterized by high temperatures and potential heat stress, which can lead to early fatigue, dehydration, and reduced endurance (Nybo et al., 2014). In contrast, **winter** brings colder conditions that may improve endurance in some sports but also increase the risk of muscle stiffness and injury (Peiffer et al., 2009). The **monsoon season**, with its high humidity and unpredictable rainfall, can affect outdoor training schedules and increase the risk of illness and injury due to slippery or muddy surfaces.

These environmental factors influence core physiological processes such as thermoregulation, hydration, oxygen uptake, and muscle function—all of which are critical for high-level performance (Cheung, 2010). Additionally, psychological factors like motivation and mood may also vary with season, affecting an athlete's focus and readiness to compete (Roecklein & Rohan, 2005).

In the case of inter-collegiate medalists, who are typically among the top performers in their respective sports, understanding how seasonal changes impact performance is essential. Coaches and sports scientists can use this knowledge to structure training programs, schedule peak competitions, and minimize injury risks. Adapting training loads and recovery methods to match seasonal demands can lead to improved performance outcomes and athlete well-being (Mujika & Padilla, 2000).

2. Method

Purpose of the Study

The purpose of this study is to examine the differences in athletic performance of inter-collegiate medallists during the competitive season and off-season. It aims to identify how seasonal changes affect performance in various events and whether gender-based or event-specific variations exist, helping coaches and athletes plan more effective training programs.

Objectives of the Study

1. To assess the athletic performance of inter-collegiate medalists during the competitive season.
2. To assess the athletic performance of inter-collegiate medalists during the off-season.
3. To compare the differences in athletic performance between competitive and off-season periods.
4. To analyze gender-wise differences in seasonal performance variation.
5. To examine event-wise (sprint, jump, throw) differences in performance across seasons.

Hypotheses of the Study

1. There was a significant difference in athletic performance of inter-collegiate medalists between the competitive season and the off-season.
2. There was a significant difference in seasonal performance between male and female medalists.
3. There was a significant difference in seasonal performance variation among different types of athletic events (sprints, jumps, throws).

2.1. Review of Literature

Seasonal variation significantly affects athletic performance due to changes in temperature, humidity, and training conditions. Reilly and Waterhouse (2009) noted that circadian and seasonal rhythms influence body temperature, alertness, and muscle function. Mujika and Padilla (2000) highlighted that reduced training during the off-season leads to detraining effects, resulting in decreased strength and endurance.

Nybo et al. (2014) found that heat stress during summer impairs performance by increasing fatigue and reducing muscle efficiency. In contrast, cold conditions during winter can cause stiffness, affect sprint and jump events (Bishop et al., 2008). Kellmann (2002) emphasized the need for season-specific training periodization to maintain peak performance.

Smith and Hale (2007) observed that female athletes may be more affected by seasonal shifts due to hormonal and physiological differences. However, limited studies have explored these factors among inter-collegiate medalists in India, which this study aims to address.

2.2. Methodology

Selection of Subjects

The present study was conducted on a sample of forty (N=40) intercollegiate medal-winning athletes from Kuvempu University during the 2023–2024 athletic season. The participants were selected from three athletic disciplines: sprinting, jumping, and throwing events, and were evenly divided by gender—20 male and 20 female athletes. The age range of participants was between 18 and 25 years.

The distribution of subjects across different event categories is presented in Table 1.

Table 1: Distribution of Selected Kuvempu University Intercollegiate Athletes

Sl. No	Events	Men (N)	Women (N)	Total
1	Runners	06	06	12
2	Jumpers	06	06	12
3	Throwers	08	08	16
	Total	**20**	**20**	**40**

Selection of Variables

The performance variables were selected based on their relevance to each athletic discipline. The details are presented in Table 2.

Table 2: Details of Selected Variables

Sl. No	Variable	Event(s)	Measurement Unit
1	Speed	100m, 200m, 400m	Seconds
2	Power	Long Jump, High Jump, Triple Jump	Meters
3	Strength	Shot Put, Discus Throw, Javelin Throw, Hammer Throw	Meters

Procedure for Data Collection

The data were collected from intercollegiate medallists who participated in the 2023–24 athletic meet. Each athlete's seasonal performance was assessed during two different phases: the competitive season and the off-season. The key performance indicators included sprint times (100m, 200m, 400m), jump distances (long jump, high jump, triple jump), and throwing distances (shot put, discus, javelin, hammer).

Standardized equipment and protocols were used to ensure consistency and accuracy across measurements. The data collection environment was kept uniform in terms of timing and surface to minimize external variation.

2.3. Statistical Techniques

Descriptive statistics (mean, standard deviation, range) summarized athletes' performance across seasons. A paired sample *t*-test assessed differences between in-season and off-season performance, with significance set at $p < 0.05$.

3. Findings

Table: 3 Comparison of Sprint Performance Between Competitive and Off-Season Periods Among Male Athletes

Event	season	Mean	Std. Deviation	Std. Error Mean	't' value
100 mtr	Competition period	10.64	0.19	0.14	53.00
	Off- season	11.96	0.16	0.11	
200mtr	Competition period	22.6	0.4	0.3	12.60
	Off- season	24.5	0.6	0.4	
400mtr	Competition period	53.14	3.8	2.7	7.18
	Off- season	56.01	3.2	2.3	

Table 3 presents a comparison of sprint performances by male athletes during the competitive and off-season periods. The findings reveal a noticeable decline in performance during the off-season for all three sprint events. In the 100 meters, the average time increased from 10.64 seconds in the competitive period to 11.96 seconds in the off-season, with a t-value of 53.00, indicating a significant difference. Similarly, the 200-meter event showed a time increase from 22.60 to 24.50 seconds (t = 12.60), and the 400 meters from 53.14 to 56.01 seconds (t = 7.18). Overall, the data highlights that male athletes demonstrated superior sprinting performance during the competitive season compared to the off-season.

Table: 4 Comparison of Jumping Event Performance Between Competitive and Off-Season Periods Among Male Athletes

Event	season	Mean	Std. Deviation	Std. Error Mean	't' value
long jump	Competition period	6.40	0.0	0.04	4.85
	Off- season	6.08	0.1	0.10	
high jump	Competition period	1.94	0.19	0.14	2.43
	Off- season	1.85	0.24	0.17	
triple jump	Competition period	12.92	0.0	0.65	1.45
	Off- season	12.31	0.1	0.23	

Table 4 shows the comparison of jumping event performance between competitive and off-season periods among male athletes. In the long jump, performance declined from a mean of 6.40 m during the competition period to 6.08 m in the off-season, with a significant t-value of 4.85. For the high jump, the mean reduced from 1.94 m to 1.85 m, showing a moderate difference (t = 2.43). In the triple jump, athletes performed slightly better during the competition period (12.92 m) compared to the off-season (12.31 m), with a lower t-value of 1.45, indicating a smaller difference. Overall, the results suggest better jumping performance during the competitive season.

Table: 5 Comparison of Throwing Event Performance Between Competitive and Off-Season Periods Among Male Athletes

Event	season	Mean	Std. Deviation	Std. Error Mean	't' value
shot-put	Competition period	10.9	0.03	0.02	7.6
	Off- season	10.14	0.17	0.12	
discus throw	Competition period	31.8	2.26	1.60	7.75
	Off- season	29.8	1.90	1.35	
javelin throw	Competition period	43.35	3.53	2.50	9.21
	Off- season	40.77	3.13	2.22	
hammer throw	Competition period	40.77	3.13	2.22	2.09
	Off- season	24.49	4.34	3.07	

Table 5 presents a comparative overview of throwing event performances during competitive and off-season periods among male athletes. In the shot-put, athletes exhibited enhanced performance in the competition phase, recording a mean of 10.9 m, compared to 10.14 m in the off-season (t = 7.6). Likewise, in the discus throw, the competitive season average of 31.8 m surpassed the off-season figure of 29.8 m, with a t-value of 7.75. The javelin throw results also reflected improvement during competition (43.35 m) over the off-season (40.77 m), supported by a t-value of 9.21. Additionally, the hammer throw performance rose from 24.49 m in the off-season to 40.77 m during the competition period, with a t-value of 2.09. Overall, the data highlights a significant increase in throwing performance during the competitive season across all events.

Table: 6 Comparison of Sprint Performance Between Competitive and Off-Season Periods Among Female Athletes

Event	season	Mean	Std. Deviation	Std. Error Mean	't' value
100 mtr	Competition period	13.68	1.10	.78	2.09
	Off- season	14.73	1.63	1.15	
200mtr	Competition period	29.14	3.30	2.34	16.75
	Off- season	30.48	3.42	2.42	
400mtr	Competition period	1.14	0.01	0.01	6.42
	Off- season	1.37	0.06	0.05	

Table 6 highlights the comparison of sprint performance between competitive and off-season periods among female athletes. In the 100 meters, athletes performed better during the competition phase (13.68 sec) compared to the off-season (14.73 sec), with a t-value of 2.09. The 200-meter event also showed improved performance in-season (29.14 sec) over off-season (30.48 sec), supported by a t-value of 16.75. Similarly, the 400-meter timing was faster during the competition period (1.14 min) than in the off-season (1.37 min), with a t-value of 6.42. These findings suggest that female athletes demonstrated significantly better sprinting performance during the competitive season.

Table: 7 Comparison of Jumping Event Performance Between Competitive and Off-Season Periods Among Female Athletes

Event	season	Mean	Std. Deviation	Std. Error Mean	't' value
long jump	Competition period	4.7	0.2	0.10	10.25
	Off- season	4.2	0.10	0.10	
high jump	Competition period	1.35	.21	.15	0.46
	Off- season	1.44	.05	.03	
triple jump	Competition period	9.70	0.16	0.12	10.25
	Off- season	9.29	0.11	0.08	

Table 7 presents the comparison of jumping event performance between competitive and off-season periods among female athletes. In the long jump, performance improved notably during the competition period (4.7 m) compared to the off-season (4.2 m), with a significant t-value of 10.25. Similarly, in the triple jump, the mean distance was higher in the competition phase (9.70 m) than in the off-season (9.29 m), also yielding a t-value of 10.25. However, for the high jump, athletes performed slightly better in the off-season (1.44 m) than in the competition period (1.35 m), with a t-value of 0.46, indicating no significant difference. Overall, the data suggests improved performance in long and triple jumps during the competitive season.

Table: 8 Comparison of Throwing Event Performance Between Competitive and Off-Season Periods Among Female Athletes

Event	season	Mean	Std. Deviation	Std. Error Mean	't' value
shot-put	Competition period	8.5	1.2	0.8	71.00
	Off- season	8.2	1.2	0.8	
discus throw	Competition period	24.22	1.24	0.88	2.46
	Off- season	22.16	2.42	1.71	
javelin throw	Competition period	19.10	1.78	1.26	41.40
	Off- season	17.03	1.71	1.210	
hammer throw	Competition period	28.61	12.90	9.12	3.18
	Off- season	27.34	13.46	9.52	

Table 8 shows the comparison of throwing event performance between competitive and off-season periods among female athletes. In the shot-put, performance was slightly better during the competition period (8.5 m) than the off-season (8.2 m), with a high t-value of 71.00, indicating significant improvement. In the discus throw, the competition mean (24.22 m) exceeded the off-season (22.16 m) with a t-value of 2.46. For the javelin throw, athletes showed a marked improvement during competition (19.10 m) versus off-season (17.03 m), supported by a t-value of 41.40. Similarly, in the hammer throw, performance was better in the competition period (28.61 m) than the off-season (27.34 m), with a t-value of 3.18. These results suggest that female athletes generally perform better in throwing events during the competitive season.

4. Discussion

The findings of the study support all three hypotheses. Table 3, 4, and 5 show a clear performance decline during the off-season compared to the competitive season across sprints, jumps, and throws, confirming that seasonal variation significantly affects athletes' performance. This supports Bompa & Haff (2009), who highlighted the importance of periodized training to maintain peak performance.

Male and female athletes showed variation in seasonal performance, with existing research (Costill et al., 1991) suggesting that females may experience greater fluctuations due to physiological factors.

Performance variation also differed by event type: sprint events showed the most decline off-season, followed by throws and jumps, as sprinting relies heavily on neuromuscular readiness (Kraemer et al., 2004). Thus, regular and structured training is crucial to reduce off-season decline and enhance in-season outcomes.

5. Conclusions and Recommendations

The study concludes that seasonal fluctuations have a notable impact on the athletic performance of inter-collegiate medal winners. Performance levels were observed to be higher during the competitive season compared to the off-season across various events, including sprints, jumps, and throws. Furthermore, the analysis revealed variations in seasonal performance between male and female athletes, and also among different types of events, with sprint events experiencing the most significant decline during the off-season.

These findings underscore the importance of maintaining systematic and well-structured training routines during the off-season. It is recommended that coaches implement event-specific periodization models to sustain fitness and skill levels, thereby ensuring athletes remain competition-ready throughout the year.

Based on the study findings, the following recommendations are made:

1. A structured and scientifically designed training program should be implemented during the off-season to minimize performance loss and ensure continuity in fitness levels.
2. Coaches and trainers should adopt periodized training strategies that align with the demands of each season, helping athletes peak during competition.
3. Sprint events require focused attention in the off-season, as these showed greater variation in performance compared to other events.
4. Gender-specific training interventions may be necessary to address the observed differences in seasonal performance between male and female athletes.
5. Psychological support and motivation-enhancing strategies should be integrated throughout the training cycle to maintain athlete engagement, especially during off-season phases.
6. Regular monitoring and evaluation of performance metrics must be conducted to enable timely adjustments in training intensity, volume, and recovery protocols.
7. Adequate rest, recovery, and sports nutrition should be emphasized year-round to promote athlete health and long-term development.
8. Technical drills and event-specific skill practices should be maintained across all seasons to preserve movement patterns and performance efficiency.

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Declaration of Conflicting Interests and Ethics

The authors declare no conflict of interest.

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