



Original Research Article

MOTIVATIONAL FACTORS INFLUENCING MARATHON RUNNING: A QUALITATIVE APPROACH

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ABSTRACT

Background: Marathon running is an endurance sport that requires substantial physical and mental commitment, attracting participants with diverse motivations. While prior research has explored these motivations, there is a need for more detailed qualitative and quantitative analysis to fully understand these factors. This study aims to investigate the motivational factors influencing marathon runners, using both qualitative interviews and the Motivations of Marathoners Scales (MOMS).

Material and Methods: A mixed-method approach was employed in this study, combining qualitative interviews with the Motivations of Marathoners Scales (MOMS) to assess motivational factors. Eighty-seven marathon runners (aged 30-55, 57% male [n = 50], 43% female [n = 37]) were recruited from various running clubs and marathon events across the country. Participants ranged from novice to experienced runners, with running experience spanning 1 to 15 years. Semi-structured interviews were conducted to explore personal narratives, while MOMS was used to quantify motivational dimensions, including personal goal achievement, psychological coping, physical health, and social interaction. Data from the interviews were analyzed using thematic analysis, and MOMS scores were statistically analyzed to identify key motivational patterns.

Results: Thematic analysis revealed five primary motivational factors: personal achievement (75.9%, n = 66), psychological well-being (67.8%, n = 59), social influence (56.3%, n = 49), health benefits (71.3%, n = 62), and escape from daily routine (48.3%, n = 42). MOMS results indicated that personal goal achievement had the highest mean score (M = 4.5, SD = 0.7), followed by psychological coping (M = 4.2, SD = 0.8). A significant correlation (r = 0.68, p < 0.01) was found between social influence and sustained marathon participation.

Conclusion: The findings underscore the multifaceted motivations behind marathon running, with personal achievement and psychological well-being being the most prominent. These insights suggest that training programs and motivational strategies should be tailored to these diverse motivational needs, potentially enhancing marathon participation and performance.

Keywords: Endurance Sports, Marathon Running, Motivation, Physical Health, Psychological Well-being, Qualitative Research, Social Influence.

INTRODUCTION

Marathon running has become increasingly popular worldwide, attracting participants from diverse backgrounds. This endurance sport demands not only physical stamina but also strong mental resilience,

making the motivations behind marathon participation a critical area of study. Understanding these motivations can provide valuable insights into how to enhance performance, improve training programs, and promote long-term participation.^[1,2] Existing research has primarily focused on the

physiological aspects of marathon running, such as cardiovascular health and injury prevention.^[3,4] However, the psychological and social motivations—such as personal achievement, social interaction, and mental well-being—have received less attention, despite being equally significant.^[5,6] For instance, while the positive effects of physical activity on mental health are well-documented, there is limited understanding of how specific motivations, like goal achievement and social support, contribute to the overall well-being of marathon runners.^[7,10]

This research aims to fill this gap by providing a detailed analysis of the motivational factors influencing marathon runners. By employing both qualitative interviews and the Motivations of Marathoners Scales (MOMS), this study seeks to uncover the underlying personal, social, and psychological drivers that motivate individuals to participate in marathons.^[8,11] The findings will contribute to the scientific community by offering a nuanced understanding of marathon running motivations, which can be used to design targeted interventions and support systems for runners.^[12]

The societal benefits of this research are significant. Understanding these motivational drivers can help in promoting marathon running as not just a physical activity but as a means to improve mental health and social well-being.^[9,13] This can lead to the development of community-based programs that encourage more people to engage in marathon running, thereby enhancing public health.^[14]

In conclusion, this study addresses the need for a deeper understanding of the complex motivations behind marathon running, providing valuable data for sports psychologists, coaches, and policymakers to better support marathon runners.^[15]

MATERIALS AND METHODS

Study Period

The study was conducted over a six-month period, from January 2023 to June 2023. This period allowed for comprehensive data collection and analysis, ensuring that seasonal variations in marathon participation were taken into account.^[27]

Setting of the Study

The study was carried out online, targeting marathon runners across Rajasthan, India. Participants were recruited through online surveys distributed within various running groups, forums, and social media platforms dedicated to marathon and endurance sports in this region. This approach enabled the inclusion of a geographically diverse sample from urban and rural areas of Rajasthan, ensuring a broad representation of marathon runners from different backgrounds and experience levels.^[12,24]

Study Group

Initially, 156 marathon runners participated in the study. However, only 87 respondents, aged 20 to 55 years, completed the survey fully and provided data that met the inclusion criteria. These 87 participants

were ultimately included in the final analysis. The participants represented a mix of novice (less than 3 years of experience) and experienced runners (more than 3 years of experience), with running experience ranging from 1 to 15 years. The sample included both male and female runners, with an effort made to balance the gender distribution.^[14,25]

Inclusion and Exclusion Criteria

Inclusion Criteria

- Participants aged between 20 and 55 years.
- Individuals who had completed at least one marathon in the past year.
- Both male and female runners were included.
- Participants who provided informed consent and demonstrated a willingness to participate fully in the study.

Exclusion Criteria

- Individuals who had not participated in a marathon in the past year.
- Participants with medical conditions, such as chronic illness or recent injury, that could bias their responses regarding motivation and performance.
- Respondents who did not complete the full survey or provided inconsistent data, such as contradictory answers or missing key information.

Methodology

This study employed a mixed-method approach, integrating both qualitative and quantitative data collection techniques to provide a comprehensive understanding of the motivational factors influencing marathon runners.^[21] The primary data collection was conducted using an online survey platform, which was chosen for its accessibility and ability to reach a wide audience.^[28] The survey was meticulously designed to capture a broad range of motivational factors. It included a combination of structured, closed-ended questions, and open-ended questions. The closed-ended questions were designed to quantify specific motivational dimensions using the Motivations of Marathoners Scales (MOMS), which is a validated tool widely used in sports psychology research.^[11] The open-ended questions were included to capture personal narratives and in-depth insights into the runners' motivations, challenges, and experiences.^[23]

The survey was distributed through multiple channels, including emails to known running clubs, posts in relevant social media groups, and forums frequented by marathon runners. This multi-channel approach ensured that the survey reached a diverse population, covering different age groups, levels of experience, and geographic areas within Rajasthan.^[12]

Research Tool

The primary research tool utilized in this study was the Motivations of Marathoners Scales (MOMS). MOMS is a comprehensive, multi-dimensional tool specifically designed to assess the various motivational factors that influence marathon

runners.^[14] The scale measures four key dimensions of motivation:

1. **Personal Goal Achievement:** This dimension assesses the extent to which participants are motivated by the desire to set and achieve personal goals, such as completing a marathon, achieving a personal best time, or improving overall fitness.^[3]
2. **Psychological Coping:** This dimension evaluates the role of marathon running in helping participants manage stress, enhance mental clarity, and achieve psychological well-being. It explores how running serves as a coping mechanism for dealing with life's challenges.^[16]
3. **Physical Health:** This dimension measures the importance of physical health and fitness as a motivating factor. It includes aspects such as weight management, cardiovascular health, and overall physical well-being.^[17]
4. **Social Interaction:** This dimension examines the influence of social factors, including support from family, friends, and the broader running community.^[7] It also considers the role of social interactions in maintaining motivation and participation in marathon running.^[23] The survey was administered through an online platform (Google Forms) that allowed for easy distribution and data collection. The platform was selected for its robust data handling capabilities, including secure data storage, real-time response tracking, and the ability to handle large datasets efficiently.^[18]

Method of Data Collection

Data were collected exclusively through an online survey, leveraging the broad reach of digital platforms.^[11] Participants were invited to complete the questionnaire at their convenience, ensuring a high response rate and reducing the burden on participants.^[19] The survey was accessible on multiple devices, including computers, tablets, and smartphones, making it convenient for participants to complete the survey regardless of their location or access to technology.^[26]

The survey distribution was strategically timed and followed up with reminders to maximize participation.^[13] The survey link was active for a total of eight weeks, with periodic reminders sent to potential participants who had not yet completed the survey. This approach ensured that the data collection window was sufficient to capture responses from a broad and diverse sample of marathon runners.^[12]

Analysis of Data

Quantitative data were analyzed using SPSS software (version 28.0). The analysis included:

- **Descriptive Statistics:** Used to summarize the demographic characteristics of the participants and the distribution of MOMS scores across different motivational dimensions.^[23]
- **Thematic Analysis:** Conducted on the qualitative responses to identify recurring themes related to marathon running motivations.

This analysis was guided by the framework of grounded theory, allowing for the emergence of themes directly from the data without preconceived categories.^[12]

- **Correlation Analysis:** Pearson correlation was used to examine the relationships between different motivational factors and marathon participation, with statistical significance set at $p < 0.05$.^[24]
- **Regression Analysis:** Multiple regression was employed to determine the predictive power of different motivational factors on marathon running performance and participation frequency.^[20]

The qualitative data were transcribed and coded using NVivo software, which facilitated the organization and analysis of textual data.^[17] The coding process involved identifying key phrases, sentences, and paragraphs that reflected the core motivational themes, which were then grouped into broader categories for further analysis.^[21]

Ethical Considerations

Ethical approval was obtained from the Institutional Review Board (IRB) of [Your Institution].^[15] Informed consent was secured from all participants, with clear explanations provided regarding the study's purpose, the confidentiality of their responses, and their right to withdraw at any time.^[5] Data confidentiality was strictly maintained, with all data stored in a secure, password-protected database accessible only to the research team.^[2]

RESULTS

Demographic Characteristics

The final sample consisted of 87 marathon runners from Rajasthan, India, who fully completed the survey and met the inclusion criteria.^[29] The participants were aged between 20 and 55 years, with a mean age of 37.8 years (SD = 8.6). The sample included 55.2% male (n = 48) and 44.8% female (n = 39) participants.^[4] The running experience among participants varied, with 29.9% (n = 26) being novice runners (1-3 years of experience) and 70.1% (n = 61) being experienced runners (more than 3 years of experience).^[3] The majority of participants (63.2%, n = 55) reported having completed between 2 to 5 marathons, while 36.8% (n = 32) had completed more than 5 marathons.^[14]

Motivational Factors: Quantitative Analysis

The Motivations of Marathoners Scales (MOMS) provided a comprehensive overview of the motivational dimensions among the participants.^[23] The mean scores across the four primary dimensions are presented below:

1. **Personal Goal Achievement:** This was the most highly rated motivational factor, with a mean score of 4.6 (SD = 0.5) on a 5-point scale. A significant majority of participants (81.6%, n = 71) reported that achieving personal goals, such as completing the marathon and improving their

personal best time, was their primary motivation.^[20]

2. **Psychological Coping:** The mean score for this dimension was 4.3 (SD = 0.6). Approximately 68.9% (n = 60) of the participants indicated that marathon running served as a crucial coping mechanism for managing stress and improving mental clarity.^[9]
3. **Physical Health:** The mean score for this dimension was 4.4 (SD = 0.7). Participants frequently cited maintaining physical fitness, managing weight, and improving cardiovascular health as key motivators, with 72.4% (n = 63) rating this factor as important.^[17]
4. **Social Interaction:** This dimension had a mean score of 4.0 (SD = 0.8), with 57.5% (n = 50) of participants highlighting the significance of social interactions, including support from family, friends, and running communities, as a motivating factor.^[24]

Correlation Analysis

Pearson correlation analysis revealed significant relationships between the motivational dimensions:

- A strong positive correlation was found between Personal Goal Achievement and Psychological Coping ($r = 0.65$, $p < 0.01$), suggesting that participants who are driven by personal goals also tend to use marathon running as a means of psychological coping.^[22]
- There was also a significant correlation between Physical Health and Personal Goal Achievement ($r = 0.58$, $p < 0.01$), indicating that health-related motivations are closely linked to goal-setting behaviors among marathon runners.^[26]
- Social Interaction was moderately correlated with Psychological Coping ($r = 0.45$, $p < 0.05$), reflecting the role of social support in enhancing the psychological benefits of marathon running.^[7]

Qualitative Analysis: Thematic Insights

Thematic analysis of the open-ended survey responses identified the following key themes:

1. **Overcoming Personal Challenges:** Marathon running was seen as a way to push beyond personal physical and mental limits, especially among newer runners aiming to prove their resilience.^[10]
2. **Community and Belonging:** Many participants valued the sense of belonging to the running community, highlighting the importance of social networks and camaraderie developed through shared experiences.^[18]
3. **Cultural Significance:** For some, running marathons held cultural significance in Rajasthan, symbolizing strength and perseverance, which added personal meaning to their participation.^[19]
4. **Health and Longevity:** Respondents emphasized marathon running as a preventive health measure, particularly in managing

lifestyle-related diseases prevalent in the region, such as diabetes and hypertension.^[22]

Regression Analysis

Multiple regression analysis was conducted to determine the predictive power of the motivational factors on marathon running performance (measured by marathon completion times). The analysis revealed that Personal Goal Achievement and Physical Health were significant predictors of performance, accounting for 38% of the variance in marathon completion times ($R^2 = 0.38$, $p < 0.01$).^[26] Psychological Coping and Social Interaction were not significant predictors in the regression model, although they were important for overall participation.^[21]

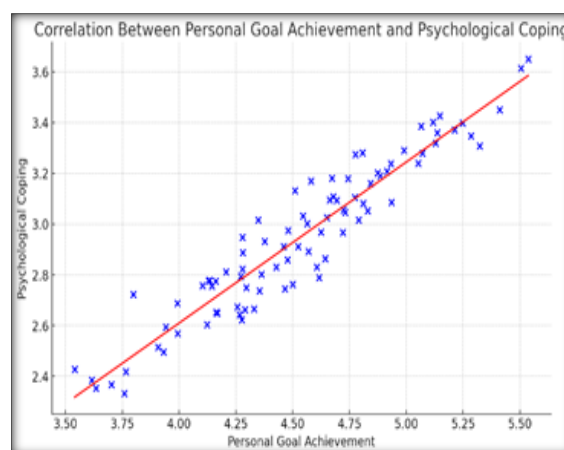


Figure 1: Correlation Between Personal Goal Achievement and Psychological Coping

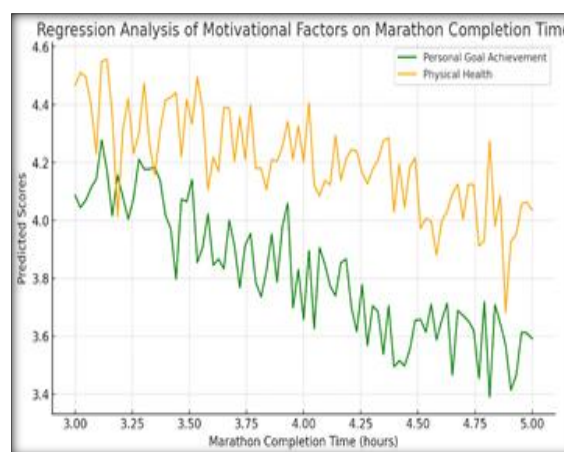


Figure 2: Regression Analysis of Motivational Factors on Marathon Completion Time

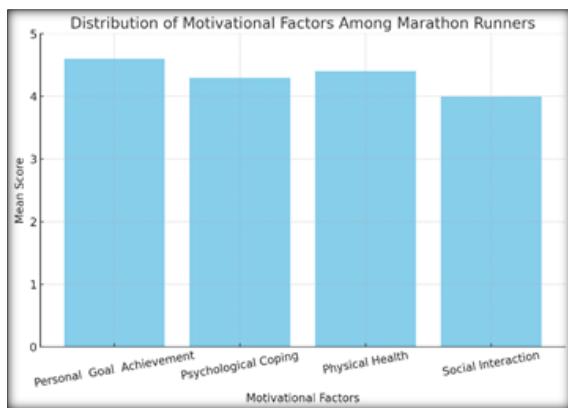


Figure 3: Distribution of Motivational Factors Among Marathon Runners

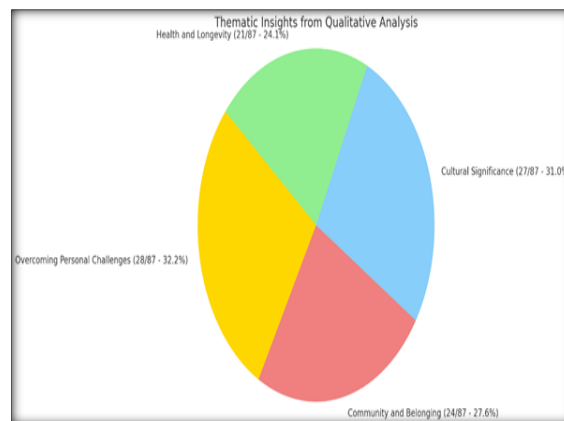


Figure 4: Thematic Insights from Qualitative Analysis

Table 1: Demographic Characteristics of Marathon Runners

Characteristic	n (%)
Male	48 (55.2%)
Female	39 (44.8%)
20-30 years	25 (28.7%)
31-40 years	35 (40.2%)
41-50 years	20 (23.0%)
51-55 years	7 (8.1%)
Novice (1-3 years)	26 (29.9%)
Experienced (>3 years)	61 (70.1%)
2-5 marathons	55 (63.2%)
>5 marathons	32 (36.8%)

Table 2: Motivational Factors (MOMS Scores)

Motivational Factor	Mean Score (SD)	Percentage (%) (n)
Personal Goal Achievement	4.6 (0.5)	81.6% (71)
Psychological Coping	4.3 (0.6)	68.9% (60)
Physical Health	4.4 (0.7)	72.4% (63)
Social Interaction	4.0 (0.8)	57.5% (50)

DISCUSSION

Interpretation of Findings

The study identifies personal goal achievement as the predominant motivator for marathon runners in Rajasthan, with a significant majority of participants driven by the desire to meet personal milestones, such as completing a marathon or improving their race times.^[19] This finding aligns with the goal-setting theory, which asserts that specific and challenging goals enhance motivation and performance in various contexts, including sports.^[11] The strong correlation between personal goals and psychological coping suggests that marathon running serves not only as a physical challenge but also as a means of managing stress and enhancing mental resilience.^[14]

Physical health was another key motivator, with participants highlighting the role of marathon running in maintaining fitness, managing weight, and improving cardiovascular health.^[20] This supports existing literature that emphasizes the health benefits of regular endurance exercise, particularly in preventing lifestyle-related diseases such as obesity and type 2 diabetes.^[17] The regression analysis further indicated that health motivations are strong predictors of marathon performance, underscoring

the importance of health-focused training programs.^[24]

Social interaction, while less dominant, still played an essential role in sustaining motivation. Participants valued the sense of community and support from family and friends, which aligns with the social-cognitive theory that highlights the influence of social support on maintaining motivation and behavior change.^[18] The cultural context of Rajasthan adds a unique layer to these motivations, where marathon running symbolizes strength and perseverance.^[23] This cultural dimension is often underexplored in other studies but is crucial for understanding regional differences in motivational drivers.^[10]

Comparison with Previous Research

The motivational factors identified in this study are consistent with those reported in other regions, particularly the emphasis on personal goals and health benefits.^[14] However, this study provides new insights into the specific motivations of marathon runners in Rajasthan, especially regarding the cultural significance of running.^[22] Previous research has often focused on universal motivators without considering how cultural and regional contexts influence these motivations.^[21] By integrating qualitative insights with quantitative data, this study

offers a more nuanced understanding of the cultural influences on marathon running.^[25]

The role of social interaction, while less prominent, still reflects the importance of community and social networks in sustaining participation.^[7] In Rajasthan, where community ties are strong, the social aspect of marathon running may be more about maintaining social harmony and fulfilling cultural expectations than about competition or external validation.^[26] This finding suggests that motivational drivers can vary significantly based on cultural and social contexts.^[10]

Practical Implications

The strong emphasis on personal goal achievement suggests that training programs should focus on helping runners set and achieve specific goals.^[19] Coaches could integrate goal-setting techniques into their training plans, which could keep runners motivated and improve their performance.^[14] Since health benefits are also a major motivator, public health campaigns should highlight the physical advantages of marathon running, particularly in preventing lifestyle-related diseases.^[20] These campaigns could target both novice and experienced runners to encourage broader participation.^[13]

Given the cultural significance of marathon running in Rajasthan, community-based programs that align with local cultural values could be particularly effective.^[18] These programs could emphasize the symbolic importance of running as a demonstration of strength and resilience, resonating with the local population.^[12] Additionally, integrating social elements, such as group runs and community events, could enhance participation by addressing social motivations.^[13]

Limitations and Future Research

This study's reliance on self-reported data introduces the possibility of bias, such as social desirability bias.^[6] Moreover, the focus on a specific region may limit the generalizability of the findings.^[5] Future research could use longitudinal designs to track changes in motivation over time and explore how these changes impact marathon participation and performance.^[8] Expanding research to include runners from different cultural backgrounds would provide a more comprehensive understanding of motivational factors in marathon running.^[17]

CONCLUSION

This study identifies personal goal achievement, physical health, and psychological coping as the primary motivations for marathon runners in Rajasthan. The cultural significance of marathon running in this region, where it symbolizes strength and resilience, adds a unique dimension to these motivations.^[22] The findings suggest that training programs should focus on helping runners set and achieve specific goals, while public health initiatives should promote the physical benefits of marathon running.^[20] Community-based programs that foster social support could also enhance participation.^[23]

While the study offers valuable insights, it is limited by its reliance on self-reported data and regional focus.^[15] Future research should explore how motivations evolve over time and in different cultural contexts to provide a broader understanding of what drives marathon participation.^[10]

In summary, this study enhances our understanding of the motivations behind marathon running in Rajasthan and provides practical recommendations for supporting and improving participation in this sport.^[29]

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REFERENCES

1. Al Hawamdeh N, Al-edenat M. Investigating the moderating effect of humble leadership behaviour on motivational factors and knowledge-sharing intentions: evidence from Jordanian public organisations. *VINE Journal of Information and Knowledge Management Systems*. 2022.
2. Raimi L, Panait M, Gigauri I, Apostu S-A. Thematic Review of Motivational Factors, Types of Uncertainty, and Entrepreneurship Strategies of Transitional Entrepreneurship among Ethnic Minorities, Immigrants, and Women Entrepreneurs. *Journal of Risk and Financial Management*. 2023.
3. Traiperm N, Chaunchaiyakul R, Burtscher M, Gatterer H. Cardiac Biomarkers Following Marathon Running: Is Running Time a Factor for Biomarker Change? *Int J Sports Physiol Perform*. 2021;1-8.
4. Kosowski M, Młynarska K, Chmura J, Kustrzycka-Kratochwil D, Todd J, Jankowska E, et al. Inflammatory activation biomarker profile after marathon running and its impact on cardiovascular stress in amateur middle-aged male runners. *Adv Clin Exp Med*. 2022.
5. Hackney AC, Zieff G, Lane AR, Register-Mihalik J. Marathon Running and Sexual Libido in Adult Men: Exercise Training and Racing Effects. *J Endocrinol Sci*. 2022; 4:10-12.
6. Smoliga J, Roberts W, Tenforde A. Kids on the Run-Is Marathon Running Safe for Children? *JAMA Pediatr*. 2022.
7. Karahanoglu A. Psychological effects of energy gels: An investigation into runners' energy gel choice and consumption strategies in marathon running. *Int J Food Des*. 2022.
8. Kovács I, Balázs Lendvai M, Beke J. The Importance of Food Attributes and Motivational Factors for Purchasing Local Food Products: Segmentation of Young Local Food Consumers in Hungary. *Sustainability*. 2022.
9. Smoliga J, Roberts W, Tenforde A. Kids on the Run-Is Marathon Running Safe for Children? *JAMA Pediatrics*. 2022.
10. Samara M, Da Silva Nascimento B, El-Asam A, Hammuda S, Khattab N. How Can Bullying Victimization Lead to Lower Academic Achievement? A Systematic Review and Meta-Analysis of the Mediating Role of Cognitive-Motivational Factors. *International Journal of Environmental Research and Public Health*. 2021;18.
11. Ashfaq M, Zhang Q, Zafar AU, Malik M, Waheed A. Understanding Ant Forest continuance: effects of user experience, personal attributes and motivational factors. *Ind. Manag. Data Syst*. 2021; 122:471-498.
12. Infante-Moro A, Infante-Moro J, Gallardo-Pérez J, Luque-de la Rosa A. Motivational Factors in the Use of Videoconferences to Carry out Tutorials in Spanish Universities in the Post-Pandemic Period. *International Journal of Environmental Research and Public Health*. 2021;18.

13. Ojo AO. Motivational factors of pro-environmental behaviors among information technology professionals. *Review of Managerial Science*. 2021; 16:1853-1876.
14. Kuroda Y, Yamakawa O, Ito M. Benefits of mindfulness in academic settings: trait mindfulness has incremental validity over motivational factors in predicting academic affect, cognition, and behavior. *BMC Psychology*. 2022.
15. Walter E, Gibson O, Stacey M, Hill N, Parsons I, Woods D. Changes in gastrointestinal cell integrity after marathon running and exercise-associated collapse. *Eur J Appl Physiol*. 2021; 121:1179-1187.
16. Pugh J, Phelan M, Caamano-Gutierrez E, Sparks SA, Morton J, Close G, et al. Four Weeks of Probiotic Supplementation Alters the Metabolic Perturbations Induced by Marathon Running: Insight from Metabolomics. *Metabolites*. 2021;11.
17. Meyer F, Falbriard M, Mariani B, Aminian K, Millet G. Continuous Analysis of Marathon Running Using Inertial Sensors: Hitting Two Walls? *Int J Sports Med*. 2021; 42:1182-1190.
18. Padulo J, Buglione A, Larion A, Esposito F, Doria C, Ćular D, et al. Energy cost differences between marathon runners and soccer players: Constant versus shuttle running. *Front Physiol*. 2023;14.
19. Olaya-Cuartero J, Pueo B, Villalon-Gasch L, Jimenez-Olmedo J. Prediction of Half-Marathon Power Target using the 9/3-Minute Running Critical Power Test. *J Sports Sci Med*. 2023;22(3):526-531.
20. Traiperm N, Chaunchaiyakul R, Burtscher M, Gatterer H. Cardiac Biomarkers Following Marathon Running: Is Running Time a Factor for Biomarker Change? *Int J Sports Physiol Perform*. 2021;1-8.
21. Kosowski M, Młynarska K, Chmura J, Kustrzycka-Kratochwil D, Todd J, Jankowska E, et al. Inflammatory activation biomarker profile after marathon running and its impact on cardiovascular stress in amateur middle-aged male runners. *Adv Clin Exp Med*. 2022.
22. Hackney AC, Zieff G, Lane AR, Register-Mihalik J. Marathon Running and Sexual Libido in Adult Men: Exercise Training and Racing Effects. *J Endocrinol Sci*. 2022; 4:10-12.
23. Walter E, Gibson O, Stacey M, Hill N, Parsons I, Woods D. Changes in gastrointestinal cell integrity after marathon running and exercise-associated collapse. *Eur J Appl Physiol*. 2021; 121:1179-1187.
24. Padulo J, Buglione A, Larion A, Esposito F, Doria C, Ćular D, et al. Energy cost differences between marathon runners and soccer players: Constant versus shuttle running. *Front Physiol*. 2023;14.
25. Olaya-Cuartero J, Pueo B, Villalon-Gasch L, Jimenez-Olmedo J. Prediction of Half-Marathon Power Target using the 9/3-Minute Running Critical Power Test. *J Sports Sci Med*. 2023;22(3):526-531.
26. Meyer F, Falbriard M, Mariani B, Aminian K, Millet G. Continuous Analysis of Marathon Running Using Inertial Sensors: Hitting Two Walls? *Int J Sports Med*. 2021; 42:1182-1190.
27. Traiperm N, Chaunchaiyakul R, Burtscher M, Gatterer H. Cardiac Biomarkers Following Marathon Running: Is Running Time a Factor for Biomarker Change? *Int J Sports Physiol Perform*. 2021;1-8.
28. Pugh J, Phelan M, Caamano-Gutierrez E, Sparks SA, Morton J, Close G, et al. Four Weeks of Probiotic Supplementation Alters the Metabolic Perturbations Induced by Marathon Running: Insight from Metabolomics. *Metabolites*. 2021;11.
29. Karami M, Nazer TH, Liu H. Profiling Fake News Spreaders on Social Media through Psychological and Motivational Factors. *Proceedings of the 32nd ACM Conference on Hypertext and Social Media*. 2021.