# CURRENT SCIENTIFIC RESEARCH IN SPORTS MANAGEMENT AND ATHLETE HEALTH


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# PREFACE

Dear Readers,

Sport stands as the most natural and effective defense mechanism of the body against the greatest health risks of our era: physical inactivity and chronic diseases. Regular physical activity, which is universally accepted as the undisputed foundation of a healthy life, not only boosts an individual's physical resilience but also constitutes one of the primary and indispensable strategies in modern medicine for the prevention and treatment of many common chronic illnesses, ranging from cardiovascular disorders and obesity to Type 2 diabetes. Furthermore, beyond merely increasing physical strength and endurance, the ability of sport to strengthen our mental health by reducing levels of anxiety and depression proves that it is an essential need for both our physical and spiritual well-being. However, while the universal language of sport and the unique passion for competition it instills in the human spirit have always drawn immense interest, the transformation of this passion into professional and sustainable success today is not merely possible through the presence of innately talented athletes. Instead, it relies on the integration of three fundamental, science-based elements. These elements, which have become the focal point in the modern sports science literature, constitute the intersection of data-driven management strategies, health approaches that determine the long-term career and quality of life of athletes, and managerial decisions that directly impact on-field performance. Prepared with the mission to illuminate this complex equation, this work aims to build an interdisciplinary bridge by compiling the most up-to-date scientific research in the fields of sports management and athlete health from a holistic perspective.

In this book, we present a new compilation titled "Current Scientific Research İn Sports Management And Athlete Health," featuring research explored in separate chapters under the following headings: Metabolic Syndrome Risk Management Within The Framework Of Sports Policies: Effectiveness Of Athlete Nutrition Education And Preventive Intervention Programs, Organizational Challenges And Resilience Development Policies Due To Anxiety Disorder İn Sports Management Leadership, The Physiological Role Of Intermittent Fasting, Autophagy, And Mitochondrial Function İn Athlete Nutrition And Performance, Integratıon Of Hıgh-Rısk Athlete Health Condıtıons (Thyroıd Dıseases Example) Into Event

Management And Competıtıon Organızatıon, Social Physıcal Activity Policies İn Neurodegenerative Diseases And The Case Of Parkınson's Disease, and The Effects Of Endocrine Disorders (Hyperthyroidism) On Athlete Performance And The Integration Of Medical Nutrition Therapy Practices İnto Team And Health Management Protocols.

We extend our sincere thanks to the esteemed authors who contributed to the preparation of this book: Prof. Dr. Mutlu TÜRKMEN, Asst. Prof. Ali Ozan ERKILIÇ, Asst. Prof. Tuğçe ORKUN ERKILIÇ, Lecturer Dr. Mehmet YÖNAL, Lecturer Dr. Seda ÇELİKEL TAŞCİ, and Dietitian Rabia İPEK. We also offer our gratitude to Mr. Sefa Salih BİLDİRİCİ and İbrahim KAYA for their invaluable help and unwavering support during the book's preparation phase, and to the staff of IKSAD Publishing House for their dedicated support and effort during the publication process.

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Prof. Dr. Mutlu TÜRKMEN was born in 1973 in Arıtaş Village, which is connected to the Şiran district of Gümüşhane. He started his primary education at Arıtaş Village Primary School and completed it at Ankara Karşıyaka Primary School; he finished his high school education by graduating sequentially from the Middle School section of Private Yükseliş High School and Yenimahalle Mustafa Kemal High School. His academic journey began with a Bachelor’s degree obtained from the Department of English Language and Literature, Faculty of Letters, Hacettepe University, between 1992 and 1997. Possessing a multidisciplinary educational background, TÜRKMEN completed postgraduate education in four different fields: Traffic Planning and Application at Gazi University, Institute of Science (Master's Degree, 1999–2001); Physical Education and Sports Education at Sakarya University, Institute of Social Sciences (Master's Degree, 2004–2006); Tafsir (Exegesis) at Ankara University, Institute of Social Sciences (Doctoral Degree, 2003–2007); and finally, Physical Education and Sports Education at Gazi University, Institute of Educational Sciences (Doctoral Degree, 2009–2012). Mutlu TÜRKMEN started his career as a Lecturer at Kırıkkale University Rectorate between 1997 and 2010, and continued his duty as a Lecturer in the Recreation Department of Bartın University BESYO (School of Physical Education and Sports) between 2010 and 2012. He served as an Assistant Professor in the Recreation Department of the same university during the 2015–2022 period, and continued his academic studies as an Associate Professor between 2015 and 2019. TÜRKMEN served as an Associate Professor in the Sports Management Department of Bayburt University BESYO in the years 2019–2020, and in 2020, he received the title of Professor at Bayburt University. He currently continues his duty as the Rector of Bayburt University. In addition to supervising 22 Master's theses and 5 Doctoral dissertations, he has 75 articles published in both international peer-reviewed journals (within the SCI-SCI-Expanded scope) and national peer-reviewed journals. He has participated in many scientific meetings and congresses both domestically and abroad. Along with congress participation, he has numerous international/national papers. There are many successfully completed scientific research projects in which he took part as a project manager and researcher, notably those supported by TUBITAK. He holds original scientific book editorships and has contributed book chapters published by recognized international publishing houses, as well as serving as a reviewer for international journals. Prof. Dr. Mutlu TÜRKMEN's main research field is the Sport Sciences basic area, and his specialization topics, in which he has taught courses and carries out many studies, are Sports Management, Sports Management and Policy, Sports Business Management, Event Management, and Organization.

**Areas of Research:** Sports Management, Sports Management and Policy, Sports Business Management, Event Management, and Organization.

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**Assoc**. Prof. Dr. Bülent BAYRAKTAR was born on March 6, 1980, in Gölcük. He completed his primary and secondary education in Kocaeli, and finished his high school education in 1997 at İstanbul Selimiye Veterinary Health Vocational High School. Following his high school education, he worked as a Veterinary Health Technician at Kocaeli Medical Veterinary Clinic between 1997 and 1998. He graduated from Uludağ University, Yenişehir İbrahim Orhan Vocational School, Department of Animal Health and Husbandry in 2000, and from Atatürk University, Faculty of Veterinary Medicine in 2006. Between 30.11.1998 and 25.07.2017, he served as a District Director and Deputy Provincial Director in Gümüşhane (Köse), Düzce (Akçakoca), Çorum (Boğazkale), and Bayburt Provinces, under the Ministry of Agriculture and Forestry.

He completed his doctoral education in the Department of Physiology (Veterinary) at Kırıkkale University, Institute of Health Sciences, in 2017, thus receiving the title of Doctor. In 2017, he was appointed as an Assistant Professor Dr. (Dr. Öğr. Üyesi) to the Department of Physiotherapy and Rehabilitation, Faculty of Health Sciences, Bayburt University. He became an Associate Professor in 2022. Furthermore, he graduated from Anadolu University, Open Education Faculty, Department of Justice in 2012, followed by the Faculty of Law at Iliria Royal University (Collegi Iliria) in Kosovo, and the Department of Zootechnics at Kahramanmaraş Sütçü İmam University, Faculty of Agriculture. He is currently continuing his master's education in the Department of Artificial Intelligence and Intelligent Systems at Gümüşhane University, Graduate Education Institute.He currently serves as the Vice Dean of the Faculty of Health Sciences at Bayburt University, in addition to his role as the Head of the Department of Physiotherapy and Rehabilitation. In addition to supervising 11 Master's theses and 2 Doctoral dissertations, he has 62 articles published in both international peer-reviewed journals (within the SCI-SCI-

Expanded scope) and national peer-reviewed journals. He has participated in many meetings and congresses both domestically and abroad. He has articles in both SCI-SCI-Expanded scope and national and international peer-reviewed journals. He has congress proceedings, scientific research projects, and international journal reviewership duties. He has taught courses in numerous fields such as Molecular Endocrinology, Endocrine System Physiology, Animal Genetics and Reproductive Physiology, Physiology, and Neurophysiology. Additionally, he has conducted many multidisciplinary studies in the areas of Circadian Rhythm, Psychophysiology, Neuro-leadership, Pediatric Physiology, Nutritional Physiology, Neurophysiology of Learning, Neuromarketing, and Neurotheology.

**Areas of Research:** Endocrinology, Neurophysiology, Circadian Rhythm, Stress Physiology, Exercise Physiology in Horses, Avian Physiology, Reproductive Endocrinology.

# CHAPTER 1

## METABOLIC SYNDROME RISK MANAGEMENT WITHIN THE FRAMEWORK OF SPORTS POLICIES: EFFECTIVENESS OF ATHLETE NUTRITION EDUCATION AND PREVENTIVE INTERVENTION PROGRAMS

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## INTRODUCTION

Metabolic Syndrome (MS) is one of the most complex and rapidly spreading epidemiological crises facing society today. It is not simply the sum of a series of clinical findings, but rather a homeostatic dysregulation characterized by insulin resistance and the synchronized operation of cardiometabolic risk factors (Alberti et al., 2009). The alarming increase in the global prevalence of obesity directly impacts the prevalence of MS and creates an inevitable risk cluster for high-morbidity chronic diseases such as type 2 diabetes and coronary artery disease.

From a nutritional sciences perspective, diet has a critical, bidirectional impact on the pathogenesis and regression of MS. Dietary models based on high glycemic load, refined fructose, and trans fatty acids increase visceral adipose tissue accumulation, inducing the release of pro-inflammatory adipokines, which leads to disruption of insulin signaling pathways at the cellular level (Mozaffarian, 2016; Hotamisligil, 2006). In contrast, dietary approaches characterized by anti-inflammatory and antioxidant contents have been proven to optimize endothelial function and support metabolic flexibility (Salas-Salvadó et al., 2011). These scientific facts highlight the necessity for sports organizations and governing bodies to incorporate high-quality nutritional standards for athletes and the sports-related population into their policies. Stress is a state of perceived imbalance or threat resulting from a mismatch between demands (stressors) from an individual's internal or external environment and the perceived or actual resources available to respond to these demands (Tekce et al., 2020; Kirbaş et al., 2024a; Kirbaş et al., 2024b; Kaya, 2023; Bayraktar et al., 2023). In addition to these biological factors, chronic stress and the resulting activation of the Hypothalamic-Pituitary-Adrenal (HPA) axis are known to accelerate the development of insulin resistance by increasing cortisol release (Epel et al., 2004). Regular physical activity and sports are a unique and powerful intervention tool that combines physiological benefits (increased GLUT4 translocation and glucose uptake) and psychological benefits (balancing cortisol levels) in the prevention of MS (Pedersen & Saltin, 2015); because, exercise not only triggers the release of BDNF (Brain-Derived Neurotrophic Factor), a basic neurotrophic protein that supports neuroplasticity (Bayraktar, 2019; Okur and Bayraktar, 2025a; Kirbaş et al., 2025), but also reinforces its positive effect on cognitive functions and mood by increasing the activation of CREB (cAMP response-sensitive element-binding protein), a key regulator of learning and memory in the hippocampus (Okur and Bayraktar, 2025b), and this neurocognitive improvement has been scientifically proven to provide bidirectional protection against the pathophysiology of Metabolic Syndrome by indirectly supporting insulin sensitivity in the peripheral nervous system; However, dysfunctional attitudes developed by athletes as a result of institutional or personal pressures, such as competitive pressure and performance perfectionism, lead to maladaptive patterns in nutritional behaviors such as binge eating or overly restrictive diets, thus posing a fundamental behavioral risk factor that threatens the long-term effectiveness of healthy lifestyle interventions. These dysfunctional attitudes (Kirbaş et al., 2024c) can even be considered, in a Heideggerian context, as a physical and metabolic reflection of the human tendency to declare oneself master of the earth (Köse, 2025), and constitute a high-priority organizational behavioral risk for organizations. In light of all this comprehensive physiological and psychosocial data, Metabolic Syndrome Risk Management has moved beyond being merely a public health issue and has become a direct area of interest and responsibility for the fields of Sports Policy and Sports Management. The threat that sedentary lifestyles and poor nutritional habits pose to athlete performance and career sustainability necessitates the development of proactive corporate strategies for organizations. Accordingly, this study focuses on the integration of effective nutrition and physical activity interventions into organizational strategies for the prevention of Metabolic Syndrome. The primary objective of the study is to evaluate the effectiveness of such preventive intervention programs (nutrition education and healthy lifestyle policies) within the framework of Sports Management and to translate this knowledge into practical policies that can be transferred to corporate risk management processes. This aims to ensure that sports policies provide a sustainable framework not only for performance but also for the long-term preservation of athletes' metabolic health.

## Metabolıc Syndrome: Defınıtıon, Epıdemıology, And Rısk Factors

Metabolic Syndrome (MS) was first conceptualized by Reaven in 1988 as "syndrome X" and was considered a cluster of metabolic disorders with insulin resistance at their core (Reaven, 1988). Today, organizations such as the World Health Organization (WHO), the American Heart Association (AHA), and the International Diabetes Federation (IDF) use similar, though slightly different, criteria to define the syndrome. According to the criteria published by the IDF in 2005, abdominal obesity is an essential prerequisite, and the presence of at least two other metabolic abnormalities (high triglycerides, low HDL cholesterol, hypertension, and high fasting glucose) is also required (Alberti et al., 2005). From a sports management perspective, these pathophysiological components of MS should be considered as a cluster of risk factors that directly threaten not only general health risks but also athletes' performance continuity, training adaptation, and long-term career well-being.

## Epidemiology

The prevalence of metabolic syndrome is increasing alarmingly worldwide, with an estimated 20-25% of adults worldwide experiencing it (Grundy, 2008). Intensive urbanization, the adoption of Western-style eating habits, and a lack of physical activity in the general population, particularly in developing countries, are dramatically increasing this prevalence rate. Field studies in Turkey have shown that the prevalence of metabolic syndrome can reach up to 40% in women and 28% in men (Onat et al., 2006), highlighting the urgency of this issue from a public health perspective. These general public health data provide critical data for institutional risk management in the field of sport sciences. They demonstrate that individuals who have retired from professional sports may experience a more rapid and unpredictable increase in their risk of developing Metabolic Syndrome compared to sedentary populations due to a combination of factors such as the continuation of high-energy intake habits and a sudden decrease in training volume. This situation highlights the need for sports organizations to develop and implement post-career health monitoring programs. Furthermore, athletes competing in sports requiring extreme weight control and rapid weight gain/loss cycles, such as wrestling and boxing, are at high risk for Metabolic Syndrome in the short term due to acute and chronic fluctuations in their metabolic parameters. This reinforces the need to integrate sport-specific specialized nutrition and health monitoring policies into organizational strategies. Finally, governing bodies organizing amateur sporting events (marathons, public runs) have a responsibility to maximize their institutional impact on public health by implementing proactive intervention and awareness programs targeting the general population, where Metabolic Syndrome is highly prevalent, and to ensure the sustainability of such programs through the integration of sports policies.

## Risk Factors, Controllable Risks, and Areas for Managerial Intervention

Beyond non-modifiable factors such as family history, ethnicity, and age, behavioral and environmental factors that directly trigger the pathophysiology of the syndrome are of critical importance in the development of Metabolic Syndrome. Among these factors, unhealthy diet, sedentary lifestyle, alcohol consumption, and especially chronic stress (Saklayen, 2018) stand out as significant metabolic risks that activate the Hypothalamic-Pituitary-Adrenal (HPA) axis and elevate cortisol levels, triggering central obesity and insulin resistance. This situation, coupled with the fact that high-glycemic load diets and excessive consumption of saturated fat and fructose-containing foods (Tchernof & Després, 2013) induce visceral adiposity and systemic inflammation, necessitates risk management in sports organizations. On the other hand, the MS risk-reducing effects of anti-inflammatory dietary patterns, such as the Mediterranean diet, rich in olive oil, whole grains, vegetables, fruits and omega-3 fatty acids (Esposito et al., 2004), constitute the strongest scientific basis for the mandating of Sports Nutrition Education and psychosocial support programs within the framework of Sports Policies, so that dietary style should be considered as an intervenable area of institutional health, in addition to being a key factor determining the emergence of MS.

## The Effect of Nutrition on Metabolic Syndrome and Essential Risk Parameters for Sports Organizations

Diet is one of the most important environmental factors that plays a decisive role in the emergence and progression of metabolic syndrome. Dietary patterns high in energy density, low in fiber, and rich in simple carbohydrates and saturated fats disrupt metabolic balance, contributing to the development of syndrome components such as abdominal obesity, insulin resistance, and dyslipidemia (Schulze et al., 2016). The increasingly widespread consumption of processed foods and fast food is considered one of the primary causes of the global rise in metabolic syndrome, and this consumption trend, even in the young athlete population, carries a risk of premature metabolic deterioration. Excessive consumption of foods with a high glycemic index and glycemic load leads to postprandial (after-meal) hyperglycemia, leading to insulin ineffectiveness and, over time, the development of insulin resistance (Liu et al., 2000). High-fructose sweeteners, particularly corn syrup, increase lipogenesis, trigger hepatic steatosis, and exacerbate systemic inflammation associated with obesity (Stanhope, 2016). Chronic low-level inflammation plays a central role in the pathophysiology of Metabolic Syndrome and contributes to the maintenance of cardiometabolic risk factors. From a sports management perspective, this inflammatory burden reduces athletes' recovery capacity, increases their risk of injury, and hinders performance optimization.

The "excessive energy intake but insufficient nutrients" situation, frequently observed in dietary behaviors, along with micronutrient deficiencies, paves the way for metabolic disorders. Inadequate intake of magnesium, potassium, vitamin D, and omega-3 fatty acids, in particular, has been linked to Metabolic Syndrome, leading to decreased insulin sensitivity, increased blood pressure, and altered lipid profiles (Mirmiran et al., 2015). This suggests that adequate intake of not only macronutrients but also critical micronutrients should be considered an institutional imperative in sports nutrition education. Conversely, dietary models based on high-fiber, antioxidant-rich, and unprocessed foods balance insulin response and support metabolic health (Salas-Salvadó et al., 2011). Behavioral factors such as meal duration and timing are also associated with Metabolic Syndrome. Late-night eating, irregular meal patterns, and late-night snacking can disrupt the circadian rhythm, negatively affecting glucose regulation and lipid metabolism (Garaulet & Gómez-Abellán, 2014). From a sports management perspective, meal timing should be planned programmatically as a performance strategy that protects metabolic health, especially for athletes with busy training and travel schedules. In conclusion, unhealthy eating behaviors and the consumption of foods with low nutritional value are the primary triggers of Metabolic Syndrome; Conversely, adopting balanced, diverse, and functional diets has both preventive and therapeutic effects. Therefore, increasing individual nutritional awareness and disseminating nutrition education in the prevention and management of Metabolic Syndrome, and developing sustainable nutrition policies at the community level (from school cafeterias to athlete menus) are of paramount importance as a matter of institutional responsibility.

## Effect of Diet Quality and Eating Behaviors on Metabolic Syndrome and Behavioral Assessment for Risk Management

In the development of Metabolic Syndrome, individuals' diet quality and eating behavior patterns, as well as the quantity and type of food consumed, play a vital role. While it has been proven that high diet quality, as determined by objective measures such as the Healthy Eating Index (HEI) (Kim et al., 2019), contributes to the normalization of metabolic parameters by reducing inflammatory biomarkers (Rossi et al., 2015), it is a scientific fact that poor diet quality, characterized by excessive energy density and low fiber and micronutrient intake, predisposes to insulin resistance and abdominal obesity. However, since disordered eating behaviors, especially emotional eating, binge eating, and night eating syndrome (NES) (Geliebter et al., 2014), increase the risk of Metabolic Syndrome by disrupting the circadian rhythm (Nedeltcheva & Scheer, 2014) and causing excessive calorie intake due to delayed satiety signals (Ohkuma et al., 2015), integrating mindful eating techniques and psychosocial support programs, along with healthy nutrition education, into institutional strategies to manage these behavioral risks within the framework of Sports Policies offers a holistic approach to the prevention and management of Metabolic Syndrome.

## Preventive Approaches and Nutrition-Based Interventions in Sports Policies and Institutional Integration

Metabolic Syndrome represents a clinical condition that develops as a result of the complex interaction of environmental and lifestyle factors along with genetic predispositions. However, it is largely preventable with early and proactive management interventions. Therefore, prevention strategies play a critical institutional role not only in protecting the health of individual athletes but also in reducing the risk costs and long-term healthcare expenditures of sports organizations. Nutrition-based interventions stand out among these strategies due to their high applicability and proven effectiveness in glucose metabolism, lipid profile, and inflammatory markers.

### Nutritional Impact on Metabolic Syndrome and Key Risk Parameters for Sports Organizations

Personalized nutritional counseling and education, centered on the athlete's performance and metabolic health, form the basis of individual-level interventions in preventing Metabolic Syndrome. In this context, evidence-based nutrition plans such as Mediterranean, DASH or low glycemic index diets, which are meticulously designed according to the athlete's age, gender, training intensity and metabolic profile (Tuso et al., 2013), aim to gain sustainable and balanced nutritional habits in the long term by avoiding short-term popular diets, which in turn reduce basic risk factors such as abdominal obesity and insulin resistance with awareness-based approaches (Mason et al., 2018) and provide permanent improvements on the components of metabolic syndrome.

### Corporate and Societal Interventions in Policy Making and Environmental Regulation

Preventing Metabolic Syndrome within the framework of sports policies is possible through institutional regulations that ensure individuals have easy access to healthy foods and disseminate accurate information. In this context, mandating healthy menu planning in sports facilities and club canteens, setting nutritional quality standards in mass catering services, and making food labels understandable (Story et al., 2008) are effective tools that improve the environment for athletes and sports participants to make healthy choices. Furthermore, regulation of the food industry, and particularly limiting advertising of products high in sugar, salt, and saturated fat during sports events and broadcasts, has been identified by the World Health Organization (WHO) (World Health Organization, 2016) as a priority target for preventing obesity and metabolic diseases. This constitutes an important preventive strategy in terms of public health and the ethical responsibility of sports organizations.

### Multidisciplinary Interventions, Behavioral and Psychological Support Integration

Nutrition interventions provide more lasting results when integrated holistically with behavioral and psychological support. Psychosocial interventions such as Cognitive Behavioral Therapy (CBT), motivational interviewing techniques, and group support programs contribute to sustainable changes in eating habits, particularly in athletes with comorbid emotional eating, binge eating, and eating disorder behaviors (Forman et al., 2013). This highlights the need for Sports Governing Bodies to make psychosocial support specialists an integral component of the healthcare team within the scope of Metabolic Syndrome Risk Management.

### Technology-Assisted Interventions: Digital Risk Monitoring and Feedback

Digital health tools such as mobile health (mHealth) apps, wearable technologies, and online nutrition tracking systems provide modern support in the prevention of Metabolic Syndrome and the real-time monitoring of athletes' metabolic parameters. These applications allow the individual to track daily energy intake, physical activity level and health indicators, while also providing personalized nutrition recommendations supported by artificial intelligence, making the intervention continuous (Wang et al., 2020). However, in order to increase effectiveness, it is a critical necessity for Sports Policies that these applications be supported with scientifically based content and include components that support behavioral change.

### Applications to the Effectiveness of Preventive Interventions

Numerous randomized controlled trials on the prevention of Metabolic Syndrome have demonstrated that nutrition-based lifestyle interventions lead to significant improvements in components of the syndrome, such as glucose metabolism, lipid profile, blood pressure, and waist circumference. For example, the Diabetes Prevention Program (DPP) study conducted in the United States demonstrated that lifestyle changes can reduce the development of type 2 diabetes and metabolic syndrome by 58% (Knowler et al., 2002), and the Finnish Diabetes Prevention Study (DPS) in Europe demonstrated that improving dietary habits and increasing physical activity led to long-term improvements in metabolic parameters (Tuomilehto et al., 2001). These findings reinforce the need for sports policies to adopt evidence-based, structured lifestyle intervention programs as the primary risk management tool.

## General Evaluation and Conclusion on Sports Policies and Sustainable Metabolic Risk Management

Metabolic Syndrome, due to its increasing prevalence and the risk of cardiovascular morbidity, type 2 diabetes, and mortality it poses, is a strategic imperative that sports organizations and corporate governance structures must prioritize, beyond traditional public health problems. This syndrome is characterized by a cluster of interconnected metabolic disorders, such as abdominal obesity, hypertension, dyslipidemia, and insulin resistance, and is closely associated with modifiable lifestyle factors such as poor eating habits, sedentary behavior, and chronic stress. Within this framework, nutritional behaviors and diet quality play a central role in both the development and prevention of MS. The scientific evidence detailed in this study clearly demonstrates the decisive and physiological impact of diet quality on the fundamental components of MS: Concretely, dietary models, such as the Mediterranean and DASH diets, which prioritize plant-based and anti-inflammatory foods, have been demonstrated to support cardiometabolic balance by reducing visceral fat, improving glucose tolerance, and suppressing systemic inflammation (Sofi et al., 2010; Siervo et al., 2015). Conversely, numerous studies have confirmed that the Western diet (due to its high content of processed foods, sugar, and saturated fat) increases the risk of MS (Cordain et al., 2005). From a sports policy perspective, nutrition-based interventions should no longer be limited to individual dietary recommendations; they should be addressed holistically, incorporating societal policies, environmental regulations, and psychosocial support systems. The effectiveness of lifestyle changes, demonstrated by important randomized controlled trials such as the Diabetes Prevention Program (DPP) (Knowler et al., 2002; Tuomilehto et al., 2001), clarifies the need for sports governing bodies to adopt early screening, mandatory nutrition education, mobile health applications, and behavioral change-focused support programs as primary risk management tools (Forman et al., 2013).

In conclusion, the prevention and management of Metabolic Syndrome is possible not only through medical treatment but also through the promotion of healthy eating habits at the individual and institutional levels. In this context, nutrition should be viewed not only as a lifestyle choice but as a fundamental preventive medicine and institutional risk management tool that protects athlete performance and career health. Future studies should develop more comprehensive and applicable intervention models that consider factors affecting managerial decision-making processes, such as cultural differences, socioeconomic factors, and individual psychological makeup. This should be a fundamental strategy to increase the success of Metabolic Syndrome Risk Management within the Framework of Sports Policies.

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# CHAPTER 2

## ORGANIZATIONAL CHALLENGES AND RESILIENCE DEVELOPMENT POLICIES DUE TO ANXIETY DISORDER IN SPORTS MANAGEMENT LEADERSHIP

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## INTRODUCTION

Today's sports organizations are characterized by the intensity of global competition, the anxiety of mega-events' return on investment, and constant media scrutiny. With the industrialization of professional sports, success is measured not only by on-field athletic performance but also by effective management, sustainable financial structures, and a solid corporate reputation (Chen et al., 2025). As sports management experts such as Westerbeek et al. (2006) have noted, this complex and emotionally charged environment makes the strategic and operational burden on sports executive leaders even more critical than in other sectors. This intense pressure, particularly when combined with factors such as uncertainty avoidance, significant financial risks, and the fear of making public mistakes, can trigger the development of clinical or subclinical anxiety disorders in individuals in leadership positions (Malekpour, 2025).

Anxiety is a mental health problem that significantly impacts an individual's quality of life and professional performance (Saxena and Rathore, 2025). However, in the context of sports management, anxiety transcends a mere personal health problem and carries the potential to transform into a systemic organizational challenge that can disrupt the functioning of the entire organization. Dysfunctional Attitudes are rigid, negative, and irrational core beliefs an individual holds about themselves, their environment, and their future (Kirbaş et al., 2024c). Exposure to these high organizational stressors can overwhelm individual coping mechanisms, leading leaders to replace functional management behaviors (e.g., delegation, risk analysis, vision-setting) with dysfunctional attitudes (e.g., micromanagement, procrastination, and irrational risk aversion) (Gavin and Porter, 2025). Because an athletic career inherently involves high expectations, an intensely competitive environment, and the necessity of being constantly evaluated, it stands out as a significant and unavoidable source of stress for athletes. Stress is the totality of the organism's natural emotional, mental, and physical responses to an internal or external situation that an individual encounters and requires adaptation or response, and is perceived as challenging, threatening, or oppressive (Tekce et al., 2020; Kaya, 2023; Bayraktar et al., 2023; Kirbaş et al., 2024a; Kirbaş et al., 2024b). Anxiety is a reaction to stress. Anxiety is an emotional and mental response that manifests as excessive and persistent worry about the uncertainty and outcome of stressful situations (a match or competition perceived as threatening) (Selvakumar et al., 2025). Anxiety is the mental and physical outcome of stress. This state of anxiety that develops under pressure is generally examined in two basic dimensions: transient State Anxiety, which is associated with a specific situation perceived as an immediate threat, such as a critical shot or before a competition, and Trait Anxiety, which is part of an individual's general personality structure and reflects the tendency to exhibit anxious reactions at different times. This state of anxiety manifests itself in two components: mental and physical. In the mental dimension, called Cognitive Anxiety, athletes experience internal tensions such as fear of failure, self-doubt, negative self-evaluations, and difficulty concentrating. Somatic Anxiety manifests itself through involuntary physiological reactions such as increased heart rate (palpitations), muscle tension and tremors, rapid breathing, and gastrointestinal problems (Daniel et al., 2025; Krempel et al., 2025). The impact of anxiety on performance is not unidirectional. While moderate levels of anxiety and arousal are expected to have a beneficial effect, such as optimizing performance by increasing attention and boosting energy levels, excessive anxiety, particularly at a cognitive level, can also have detrimental effects, such as reducing rational decision-making skills, impairing focus, and over-tensioning muscles, increasing the risk of injury. The primary factors that trigger this anxiety in athletes include high performance expectations from coaches, family, or the public, as well as the athlete's own goals; the uncertainty of the outcome of the competition; the fear of making mistakes at critical moments; and injury anxiety, which can lead to the fear of losing one's career or place on the team. To manage this challenging situation, athletes often employ various strategies, including relaxation and breathing exercises, mental visualization techniques, and professional psychological support. Chronic anxiety in a leader can lead to multifaceted problems, such as the disruption of rational decision-making processes, the erosion of trust within the team, and dysfunctional responses in times of crisis. This situation can make it difficult for an organization to achieve its goals, leading to a loss of competitive advantage in the long term and a tarnished corporate reputation. Therefore, examining the mental well-being of sports managers and its impact on organizational performance is not only an ethical responsibility but also a strategic imperative. This study aims to identify the organizational challenges

(Decision-Making Paralysis, Weakened LMX, and Decreased Crisis Management Effectiveness) posed by anxiety disorders observed in sports managers, drawing on international literature. Based on the findings, the study aims to develop organizational resilience by introducing evidence-based management policies (Leadership Training, Structured Decision Making, and Transparent Communication) that will increase organizational resilience against these challenges. Given that these policies must address both cognitive and emotional components, Okur and Bayraktar's (2025a) examination of the relationship between Brain-Derived Neurotrophic Factor (BDNF) and Multiple Intelligence Profiles highlights the potential for leaders to develop resilience by leveraging their diverse cognitive strengths. Similarly, Okur and Bayraktar's (2025b) investigation of salivary cAMP Response Element Binding Protein (CREB) and cortisol hormone responses to metacognitive skills will be useful in understanding the neurobiological effects of developing metacognitive skills in leadership training on stress and anxiety management. Finally, Köse's (2025) examination of the Transformation of the Self-Proclaimed Master of the Earth into a Resource in Heidegger's Thought offers a theoretical contribution to understanding the philosophical/existential roots of the excessive control and pressure for success seen in modern sports management.

## Organizational Difficulties Caused by Anxiety Disorder

Anxiety disorders are common mental health problems affecting an estimated 4% to 5% of the global population and can seriously disrupt an individual's daily life, social relationships, and work/school life (WHO, 2025). In the organizational context, anxiety disorders cause significant challenges, affecting not only individual performance but also organizational productivity, costs, and overall workplace culture. The World Health Organization (WHO) estimates that an estimated 12 billion workdays are lost each year due to depression and anxiety, costing the global economy $1 trillion annually (WHO, 2024).

## Individual-Level Organizational Impacts of Anxiety Disorder

The cognitive and physiological symptoms of anxiety disorders directly impact employees' abilities and performance at work. Scientific studies detail these impacts as follows:

## 1. Cognitive Dysfunctions

Contemporary psychology and cognitive science studies widely support the notion that anxiety disorders, particularly Generalized Anxiety Disorder (GAD), fundamentally impair cognitive functions in the brain through a cycle of persistent and excessive worry, dramatically negatively impacting organizational performance. This directly depletes working memory capacity (Baddeley & Hitch, 1974), the cognitive system's most valuable resource, leading to repetitive, task-irrelevant negative thoughts that occupy memory resources, thereby reducing information processing capacity (Eysenck & Calvo, 1992). This cognitive cost, as detailed by Processing Efficiency Theory, is characterized by anxiety not impairing performance but rather by requiring significantly greater cognitive effort (processing cost) from the individual to achieve the same level of success (Eysenck et al., 2007), increasing the risk of burnout. On the other hand, the attentional bias mechanism in anxious individuals creates an automatic and selective vigilance against threat signals in their environment (e.g., criticism or indicators of failure), forcibly diverting attentional resources from the current task, thus leading to the prevalence of high tension and fear of making mistakes in the workplace (Bar-Haim et al., 2007). Furthermore, the cognitive load created by anxiety severely impairs individuals' cognitive flexibility, especially in situations involving uncertainty and requiring complex organizational decisions, leading to problem-solving rigidity (adherence to fixed and inefficient strategies) combined with a tendency to catastrophize (APA Dictionary of Psychology, 2025); and finally, this condition results in constant mind-wandering, which causes the individual to drift off task and engage in negative, future-oriented thoughts (Smallwood & Schooler, 2015). This significantly shortens concentration time in tasks requiring sustained attention (such as data analysis and long meetings), leading to a significantly increased error rate. Difficulty Concentrating and Decision-Making: Individuals with anxiety may have difficulty focusing on anything other than worry and may feel their minds "go blank" (Mayo Clinic, 2025; Cleveland Clinic, 2025). This increases the error rate, especially in complex or attention-demanding tasks, and slows or inhibits decision-making processes (StatPearls, 2025). Inability to Cope with Role Ambiguity and Conflict: Employees experiencing anxiety may be more vulnerable to organizational stressors such as role ambiguity (unclear work duties) and role conflict (conflicting demands) (Medicana, 2024; DergiPark, 2013). Due to hypervigilance and fear of negative evaluation, these uncertainties create excessive stress and reduce performance.

### 2. Physical and Behavioral Challenges

Physiological symptoms also reduce workforce engagement and productivity:

• Absenteeism and Loss of Productivity (Presenteeism): Anxiety can lead to physical symptoms such as sleep disturbances, muscle tension, headaches, and gastrointestinal discomfort, leading to absenteeism (Mayo Clinic, 2025; WHO, 2025). More commonly, it results in presenteeism, a state in which an individual arrives at work but fails to perform at full capacity, leading to overall loss of productivity (WHO, 2024).

• **Social Isolation and Teamwork Issues:** People with Social Anxiety Disorder, in particular, may avoid social situations, meetings, presentations, and team interactions due to fear of negative evaluation (WHO, 2025). This hinders effective communication and teamwork and reduces organizational synergy.

### Organizational Challenges and Costs

The prevalence and impact of anxiety disorders lead to significant organizational costs and cultural problems.

### Economic Burden

• Direct and Indirect Costs: Anxiety disorders lead to increased healthcare utilization (medical claims and treatment costs) and increased indirect costs due to the productivity losses mentioned above (absenteeism, presenteeism) (ResearchGate, 2010). There is evidence that costs can be reduced with effective treatment in managed healthcare systems (ResearchGate, 2010).

### The Cycle of Organizational Stress

The relationship between anxiety and stress can create a vicious cycle. Organizational stressors (strict rules, wage inequalities, a competitive environment, excessive workload, and limited advancement opportunities) can trigger anxiety, while the poor performance and tension of an anxious employee can negatively impact the workplace environment and cause stress in other employees (Medicana, 2024; DergiPark, 2013).

### 3. Human Resources Management Challenges

• **Turnover and Employee Turnover:** Chronic stress and anxiety reduce employee job satisfaction and increase their intention to leave. This increases the costs of hiring and training new employees, disrupting organizational stability.

• **Motivation and Amotivation:** Other mental health problems, such as depression, which often coexist with anxiety (comorbidity rate exceeds 50%) (KPD, 2013; ResearchGate, 2011), lead to psychological symptoms such as irritability, pessimism, discouragement, and apathy in employees (Medicana, 2024). This, in turn, reduces overall motivation and organizational commitment.

### Solutions and Organizational Support

Scientific evidence demonstrates that psychological interventions such as Cognitive Behavioral Therapy (CBT) and pharmacological treatments such as selective serotonin reuptake inhibitors (SSRIs) are effective in treating anxiety disorders (WHO, 2025; Our World in Data, 2025). Organizations should adopt the following strategies to address these challenges and support the mental health of their employees:

**1. Creating a Safe and Healthy Work Environment:** An environment that respects employees' rights to safety and health minimizes tensions and conflicts, increases employee retention, job performance, and productivity (WHO, 2024).

**2. Access to Mental Health Programs:** Providing easy access to professional support services through workplace-based CBT-based interventions (cognitive-behavioral therapy) and employee assistance programs (EAPs) is important (ResearchGate, 2011).

**3. Workload and Role Clarity:** Managing key organizational stressors such as workload overload and role ambiguity, and providing advancement/development opportunities, are critical for reducing overall workplace stress and, consequently, anxiety (Medicana, 2024; DergiPark, 2013).

The organizational challenges of anxiety disorders should not be addressed solely as an individual problem but rather as a significant public and occupational health issue. Organizations implementing proactive, evidence-based support strategies will both enhance employee well-being and help reduce global productivity loss.

## CONCLUSION

Under sports management leadership, the organizational challenges stemming from anxiety disorders, which are an inevitable part of the modern sports industry, such as the high-performance culture and results-oriented pressure that create chronic stress and high-expectation anxiety on athletes and supporting administrative/technical staff, thus disrupting the basic functioning of the organization (increased error rates especially in complex negotiations during critical game moments or transfer periods due to cognitive dysfunctions, decline in strategic planning ability due to long-term working memory depletion, exaggeration of risks and missed opportunities due to attentional bias, increased absenteeism or presenteeism rates associated with psychosomatic complaints) should be addressed within a comprehensive and scientific framework; In order to support not only the achievement of sporting goals in the short term, but also the mission of protecting institutional sustainability and the long-term career health of the personnel, managers should integrate cognitive skills training (CBT-based) that restructures threat perception, mindfulness practices that encourage self-compassion and emotional regulation, and reliable and confidential employee assistance programs (EAP) in accordance with the Social Support Theory into the organizational structure; and combining all these interventions with a transparent Human Resources Management (HR) strategy that eliminates role ambiguity and workload imbalance, creating a multidimensional welfare policy that systematically, continuously and measurably increases the psychological resilience of the individual and the team has become the most urgent and strategic human capital management issue for international sports management.

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# CHAPTER 3

## THE PHYSIOLOGICAL ROLE OF INTERMITTENT FASTING, AUTOPHAGY, AND MITOCHONDRIAL FUNCTION IN ATHLETE NUTRITION AND PERFORMANCE

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## INTRODUCTION

Autophagy is a cellular degradation and recycling mechanism that is activated to ensure cellular survival and energy homeostasis under metabolic stress conditions (nutrient deprivation, hypoxia) (Yang et al., 2019; Liu and Zhang, 2025; Xu et al., 2025). Autophagy is an evolutionarily conserved cellular recycling and cleansing process that involves the cell digesting itself (Cadwell et al., 2025). The autophagy process breaks down unnecessary, dysfunctional or damaged components of the cell (organelles, proteins and macromolecules) by transporting them to the organelle called lysosome, where these parts are reused to build new cellular structures (Alhowyan and Harisa, 2025).

The basic mechanism steps of Mitophagy (Mitochondrial Autophagy), which is a process used by the cell to eliminate damaged or dysfunctional mitochondria, are as follows:

1. **Induction (Stimulation/Initiation):** The cell receives a signal to initiate autophagy due to conditions such as nutrient deprivation, stress, or damage (Voros et al., 2025).
2. **Phagophore Formation (Nucleation):** A flat, double-layered membrane structure called the phagophore begins to form around the damaged organelle (e.g., a mitochondrion) or other intracellular components that are to be degraded (Zarro et al., 2025).
3. **Elongation and Autophagosome Formation:** The phagophore membrane expands, fully enveloping the target cargo and isolating it from the rest of the cell. This double-membraned vesicle is called the autophagosome (Juliani et al., 2025).
4. **Fusion:** The resulting autophagosome fuses with the lysosome, which is the cell's digestive center. The structure formed as a result of this fusion is called the autolysosome (Radulovic et al., 2025).
5. **Degradation and Recycling:** Powerful digestive enzymes (hydrolases) inside the lysosome break down the cargo (damaged components) within the autolysosome into smaller parts (amino acids, fatty acids,

nucleotides). These simple molecules are then released back into the cytoplasm for the cell's reuse (Liu and Zhang, 2025).

Autophagy is a fundamental catabolic and regenerative process that is induced through signaling mechanisms such as inhibition of the mTOR (Mammalian Target of Rapamycin) signaling pathway and activation of AMPK (AMP-Activated Protein Kinase); targets damaged organelles (especially mitochondria), misfolded protein aggregates, and invading pathogens, encapsulating them with double-membrane autophagosomes, followed by fusion of these vesicles with lysosomes, degrading the contents with hydrolytic enzymes and recycling the macromolecular building blocks to the cytoplasm; thus, it plays a protective role against various pathophysiological processes such as neurodegenerative disorders, cardiovascular diseases, and neoplasms by demonstrating cellular homeostasis, quality control, and anti-aging effects (Moazed, 2025;Lee et al., 2025;Jia et al., 2025).

Nutrition is a vital process that underpins humankind's ability to grow, develop, meet energy needs, and maintain health by developing resistance to disease. Adequate and balanced nutrition directly impacts not only physical health but also cognitive performance and quality of life (Orkun Erkılıç et al., 2024).

Based on this fundamental physiological necessity, modern nutrition strategies have focused not only on "what we eat" but also on "when we eat." Intermittent Fasting is a contemporary nutritional approach that triggers cellular adaptation through periods of food restriction, specifically by activating autophagy, aiming to support the body's self-cleansing and repair mechanisms (Reytor-González et al., 2025; Patel and Cheung, 2025).The most critical molecular regulators in the induction of autophagy by intermittent fasting are the AMP-Activated Protein Kinase (AMPK) and Mechanistic Target of Rapamycin (mTOR) pathways, two key energy sensors with inverse signaling relationships (Vergara et al., 2025; Purnomo et al., 2025).

- **AMPK Activation:** During fasting, cellular energy status is disrupted; adenosine monophosphate (AMP) levels rise and the ATP/AMP ratio falls. This triggers phosphorylation and potent activation of AMPK. AMPK essentially initiates a "fuel-saving" mechanism, promoting catabolic processes (fatty acid oxidation) while suppressing energy-consuming anabolic processes (protein and lipid synthesis) (Ray, 2025; Zhang et al., 2025).

- **mTOR Inhibition:** mTOR Complex 1 (mTORC1) is a kinase that senses the presence of amino acids and growth factors and is a master regulator of cell growth, proliferation, and protein synthesis. Under nutrient depletion, activated AMPK inhibits mTORC1 directly or indirectly (e.g., through the TSC complex). mTORC1 is the primary negative regulator of autophagy. Thus, IF-induced mTORC1 inhibition leads to the activation of Atg (Autophagy-related genes) proteins, which initiate the autophagy process (specifically, macroautophagy) and the initiation of autophagosome formation (Moazed, 2025; Wang et al., 2025).

By inducing autophagy through these signaling pathways, intermittent fasting orchestrates two fundamental processes that are key to cellular regeneration:

- **Mitophagy and Its Role in Mitochondrial Function:** Mitochondria are organelles known as the "power plants" of the cell, located in the cytoplasm of eukaryotic cells, with a double membrane and their own DNA (mtDNA). They produce Adenosine Triphosphate (ATP), the basic energy unit required for all vital activities, by burning nutrients in an oxygenated environment through oxidative phosphorylation (Bayraktar et al., 2024). Mitophagy, a mitochondria-specific form of autophagy, facilitates the clearance of damaged or dysfunctional mitochondria (Zhao et al., 2025).

These damaged mitochondria, which accumulate with aging, increase the production of reactive oxygen species (ROS), leading to cellular damage and aging (Xu et al., 2025; Jia et al., 2025). IF-induced autophagy enhances mitophagy, maintaining the quality of the mitochondrial network, optimizing cellular respiration and ultimately delaying cell aging (Speranza, 2025).

**Improvement of Stem Cell Function:** Stem cells are undifferentiated, basic cells found in the body that have the ability for long-term self-renewal and differentiation into certain specialized cell types.Studies in animal models indicate that intermittent fasting facilitates the transition of stem cells from a quiescent state to an active regeneration phase in various tissues (hematopoietic system, muscles) by suppressing mTORC1 and increasing autophagy during the fasting period (DiNicolantonio and McCarty, 2019; Sundareswaran  et al., 2021). This has the potential to reverse the age-related decline in tissue regeneration capacity (Barberi et al., 2013).

**Geroprotective Regulation:** The effects of chronic psychological stress (especially those reinforced by negative cognitive schemas such as dysfunctional attitudes) to which the organism (Kirbaş et al., 2024c;Köse, 2025) is exposed are reflected at the cellular level via neuroendocrine (HPA axis) pathways, increasing mitochondrial dysfunction and oxidative stress. This situation impairs autophagic flux in the long term, reducing the self-cleaning capacity of the cell and paving the way for the progression of neurodegenerative processes.Longevity Genes and Stress Response: By mimicking metabolic stress conditions, intermittent fasting activates a family of "geroprotective" (anti-aging) genes and proteins that have been conserved throughout evolution and are activated in the presence of low nutrient/energy levels. These mechanisms offer the potential to slow the rate of aging by preventing the accumulation of cellular damage and enhancing repair capacity.

**Sirtuins (SIRTs): Metabolic Energy Sensors and Epigenetic Regulators:** Sirtuins function as NAD+-dependent lysine deacetylases (class III HDACs) that link cellular energy status to adaptive transcriptional responses and play a key role in metabolic regulation, DNA repair, and aging processes by catalyzing the acetylation of histone and nonhistone proteins by depleting the NAD+ co-substrate.

**FOXO Proteins:**

Stress Resistance and Antioxidant Defense: Stress is defined as a general and non-specific systemic adaptation response that occurs in order to re-establish and maintain physiological and psychological balance (homeostasis) following the perception of internal or environmental threats or overloads to which the organism is exposed (Tekce et al., 2020; Kaya, 2023; Bayraktar et al., 2023;Kirbaş et al., 2024a;Kirbaş et al., 2024b). The FOXO (Forkhead Box O) family of transcription factors is a group of key proteins that regulate basic biological processes such as cellular stress resistance, DNA repair, metabolism and apoptosis (programmed cell death) and play a critical role in longevity (Martins et al., 2016). The FOXO (Forkhead Box O) family of transcription factors, which has a critical role in longevity, stress resistance and repair and is closely associated with the insulin/IGF-1 signaling pathway, is inactivated by being confined to the cytoplasm by phosphorylation caused by Akt/PKB kinase activated by high insulin/IGF-1 signaling under fed conditions (Ziv and Hu, 2011). However, in the fasting phase, with the decrease in signaling, it is translocated to the nucleus and increases its activity synergistically with the deacetylation of SIRT1 (Li et al., 2023). By this means, it instructs the cell to activate the expression of antioxidant enzymes such as Catalase and SOD that neutralize ROS accumulation and essential autophagy genes such as Atg and LC3, thus improving its overall resilience and resistance to aging stresses. leads to a pro-longevity phenotype that increases resistance (Zhou et al., 2022).

## 2.Intermittent Fasting (IF) and Its Physiological Effects

Intermittent fasting (IF) is a nutritional strategy that has gained attention in recent years due to its potential effects on metabolic and cellular health. This approach primarily focuses on meal timing rather than food restriction, focusing on the cycling between periods of energy intake restriction and release. Intermittent fasting (IF) refers to eating patterns that cycle between periods of voluntary fasting and non-fasting for a defined period. Unlike traditional diets that focus on what to eat, IF primarily determines when to eat. Common methods include fasting for 16 hours, an 8-hour eating window, and restricting calories for five days without success. IF triggers a metabolic shift that shifts the body's primary fuel source from glucose during feeding (satiety) to ketone bodies during fasting. This transition initiates several molecular and cellular responses:

### 1. Metabolic Transition and Ketogenesis

• **Glucose Depletion:** After approximately 1 hour of fasting, hepatic (liver) glycogen stores are depleted (Gonzalez et al., 2016).

• **Transition to Ketosis:** The body begins to break down fatty acids for energy (lipolysis). The liver produces ketone bodies from fatty acids (ketogenesis). Ketones (especially hydroxybutyrate) provide an alternative fuel source for the brain and muscles.

**2. Hormonal Regulation**

• **Insulin and Glucose Depletion:** During fasting, insulin and Insulin-Like Growth Factor-1 (IGF-1) levels drop significantly. This decrease suppresses signaling pathways associated with cell proliferation and aging (Renström et al., 2007).

• **Growth Hormone Increase:** Growth hormone (IGF-1) levels increase to support fat burning and the preservation of muscle mass (Herndon et al., 1999).

• **Increased Norepinephrine:** Norepinephrine (noradrenaline) increases the release of fatty acids from fat cells, increasing basal metabolic rate and energy expenditure.

**3. Cellular Repair and Stress Resistance**

• **Activation of Autophagy:** A low insulin/high insulin ratio (Nicotinamide Adenine Dinucleotide) strongly stimulates autophagy, a vital "self-eating" and recycling process by which cells clear damaged proteins, organelles, and pathogens. Autophagy supports cellular health and longevity (Nakamura and Yoshimori, 2018).

• **Sirtuin Activation:** Fasting increases the insulin ratio, activating sirtuin proteins such as SIRT1. Sirtuins deacetylate and activate genes involved in DNA repair, metabolism, and stress resistance (Madkour et al. 2019).

**4. Neurological Benefits**

• **Increased Brain-Derived Neurotrophic Factor (IF):** BDNF is a critical peptide growth factor belonging to the neurotrophin family (along with nerve growth factor, neurotrophin-3, and neurotrophin-4/5) and widely expressed in the central and peripheral nervous systems (Bayraktar, 2019;Okur and Bayraktar, 2025a). Structurally a dimer, BDNF is synthesized by nerve cells (neurons) and nervous system support cells (glia) and is found in high concentrations in regions such as the hippocampus and cortex, areas involved in learning and memory (Bayraktar, 2019; Kirbaş et al., 2025; Okur and Bayraktar, 2025a). BDNF is upregulated by and works in conjunction with CREB (cAMP Response Element-Binding Protein), an important transcription factor that is activated intracellularly to drive the expression of genes essential for neuronal survival and plasticity (Okur and Bayraktar, 2025b).Shown to increase the production of IF. It improves learning, memory, and cognitive function by supporting the growth of new neurons and the repair of synapses (Lu et al., 2014).

• **Neuroprotection:** It has been suggested that ketone bodies may protect against neurodegenerative diseases (Alzheimer's and Parkinson's) through their anti-inflammatory and antioxidant effects (Yang et al., 2019).

Intermittent fasting has emerged as one of the most popular nutritional approaches in recent years. Rather than a diet plan, it's a nutritional regulation focused on when you eat. It's based on eating during specific time periods and restricting calorie intake during the remaining time. This eating pattern aims to influence the body's metabolic processes by changing the timing of meals rather than restricting food intake. The most common types of intermittent fasting include 16/8 (16 hours of fasting, 8 hours of eating), 5:2 (normal eating for 5 days per week, 2 days of restricted calorie intake), and 24-hour fasting (1-2 times per week). The primary purpose of intermittent fasting is to encourage the body to use fat stores for energy through prolonged periods of fasting, increase insulin sensitivity, and trigger autophagy, a cellular repair process. It's favored by many for its potential positive effects on weight control, blood sugar regulation, and overall metabolic health. However, it's important to remember that intermittent fasting is a lifestyle habit and may not be suitable for everyone. It's particularly important for those with chronic conditions, pregnant women, or those taking regular medications to consult a professional before starting this regimen.

## EFFECTS OF INTERMITTENT FASTING ON VARIOUS DISEASES

• **Diabetes:** The weight loss benefits of IF can be particularly beneficial for patients with Type 2 Diabetes (T2DM) (Zang et al., 2022). TRF has been shown to improve glucose tolerance (Morales-Suarez-Varela et al., 2021).

• **Cardiovascular Diseases (CVD):** IF has been shown to directly or indirectly reduce the risk of CVD (Allaf et al., 2021).

• **Obesity:** Clinical trials have demonstrated the benefits of IF through weight loss and improved cardiometabolic parameters for many health conditions, particularly obesity, diabetes, and cardiovascular disease (Patikorn et al., 2021; Morales-Suarez-Varela et al., 2021).

• **Cancer:** Research is ongoing to evaluate the role of IF in cancer prevention and cancer-related outcomes (Clifton et al., 2021).

• **Neurological Diseases:** Some studies have shown improved cognition in Alzheimer's (AD) patients during the diet (Morales-Suarez-Varela et al., 2021).Intermittent Fasting (IF) offers a more flexible structure than traditional diets by focusing on timing rather than calorie restriction, which increases its long-term sustainability.

### 1. Highly Applicable Protocols

According to the text, there are significant differences in applicability between intermittent fasting protocols:

**Time-Restricted Eating (TRE) and the 16/8 Method:** This variant has the highest potential for applicability (Mengi Çelik et al., 2023).

**Circadian Synchronization:** The ability to easily align the eating window with an individual's natural biological clock (circadian rhythm) and daily routines (work, social life) provides significant flexibility (Moore, 2020).

**Reduced Cognitive Load:** It eliminates the burden of constant energy-restricted diets, such as counting calories and calculating macronutrients. This reduces the burden of constant diet thought and planning (Freedman et al., 2001).

**Including Sleep Time:** Since a large portion of the fasting period coincides with sleep hours, hunger-related discomfort is minimized (Haslam and Wittert, 2014).

**2. Protocols Requiring More Intense Discipline**

Protocols that involve longer fasting periods can present more challenges, especially during the adaptation period, and require a higher level of motivation:

**Alternate-Day Fasting (ADF) and Extended Fasts:**

**Adaptation Challenges:** Fatigue, cognitive focus difficulties (symptoms similar to "keto flu," as popularly known), and social restrictions (dinner parties, business dinners) that occur during the adaptation phase make these protocols difficult to maintain.

**Higher Discipline:** These types of intense protocols demand stronger willpower and determination from the individual.

**3. Key to Applicability: Personalization and Nutritional Quality**

The clinical effectiveness and sustainable success of IF depend not only on the fasting-eating timing but also on two critical factors:

**Personalization:** The selected protocol (TRE, ADF, 5:2, etc.) must be specifically tailored to the individual's physiological needs (current health status, chronic diseases) and lifestyle (work hours, physical activity level).

**Nutrition Quality:** Regardless of the fasting window, it is essential that the food consumed during the eating window is of high quality and balanced, containing adequate macronutrients (protein, fat, carbohydrates) and micronutrients (vitamins, minerals). Otherwise, the risk of nutritional deficiencies may arise.

## APPLICABILITY OF INTERMITTENT FASTING IN DAILY LIFE

Intermittent fasting (IF) protocols offer a flexible framework based on meal timing rather than strict caloric restrictions, demonstrating a higher potential for long-term adherence and sustainability compared to traditional continuous energy-restricted diets. In this context, Time-Restricted Eating (TRE) and its common variant, the 16/8 method, are considered to have the highest applicability due to advantages such as easily synchronizing the eating window with an individual's circadian rhythm and daily routines (work and social interactions), eliminating the need for calorie counting, which creates cognitive load, and incorporating the fasting period largely into sleep time. However, Alternate-Day Fasting (ADF) or other long-term fasting protocols require more discipline and motivation, particularly during the adaptation phase, due to fatigue, cognitive focus difficulties, and social restrictions. Therefore, ensuring the clinical effectiveness and sustainable success of IF depends on personalizing the chosen protocol (TRE, ADF, 5:2, etc.) to the individual's physiological needs and lifestyle. Furthermore, it is essential to adopt a high-quality, balanced diet that includes adequate macro and micronutrients throughout the eating window. Study questionnaires found that participants adhered to the intermittent fasting dietary model (Wegman et al., 2015). Overall, intermittent fasting strategies have been found to be relatively practical in daily life for improving metabolic health (Reszetylo et al., 2021).

## CONCLUSION

Intermittent fasting is a nutritional strategy based on biological mechanisms, considered an alternative to traditional continuous energy restriction, that cyclically regulates periods of eating and fasting. The effectiveness of this dietary model is associated with increased metabolic flexibility during periods of fasting and the induction of a metabolic switch. The metabolic switch induced by fasting (shifting from glucose to ketone utilization) makes ketone bodies, formed by hepatic metabolism of fatty acids, the primary energy source. It is thought that this biochemical adaptation, beyond improving body composition by reducing adipose mass, may also trigger mitochondrial biogenesis by switching cellular metabolism from glucose to ketone bodies.

One of the important physiological benefits of intermittent fasting is the potent induction of autophagy. Autophagy is a regenerative process by which cells break down and recycle damaged organelles, faulty protein aggregates, and waste products, and is vital for cellular housekeeping and quality control. Thanks to this mechanism triggered by fasting periods, the effects of IF are not limited to weight loss; scientific evidence suggests that it also contributes to the maintenance of cellular homeostasis, anti-aging effects, and the promotion of longevity.

Clinical and preclinical studies demonstrate that intermittent fasting (IF) has broad therapeutic potential for improving risk factors (insulin sensitivity, blood pressure, inflammation) associated with chronic conditions such as Type 2 Diabetes (T2DM), Cardiovascular Disease (CVD), and obesity. IF offers a higher potential for individual adaptation compared to other energy-restricted diets. However, due to performance decline and difficulties in maintaining muscle mass in professional athletes and high-intensity exercise populations, IF implementation must be carried out with meticulous scientific planning under the supervision of a dietitian. Intermittent Fasting: In modern nutritional science, it is considered as a holistic nutritional strategy that not only increases metabolic flexibility but also is based on cellular adaptations and regeneration, thus having a high protective potential against chronic diseases, and is thought to contribute to scientific research in this field.

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# CHAPTER 4

## INTEGRATION OF HIGH-RISK ATHLETE HEALTH CONDITIONS (THYROID DISEASES EXAMPLE) INTO EVENT MANAGEMENT AND COMPETITION ORGANIZATION

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## INTRODUCTION

The thyroid gland is a small but vitally important butterfly-shaped endocrine organ located in the front of the neck, under the Adam's apple (laryngeal cartilage) (Bayraktar, 2020) (Figure 1). The primary function of the thyroid gland is to produce and secrete the two main hormones, Thyroxine (T4) and Triiodothyronine (T3), into the bloodstream (Bayraktar, 2020). Hyperthyroidism (toxic goiter), resulting from excessive secretion of T3 and T4 hormones produced by the thyroid gland, is a serious endocrine disorder that dangerously increases the body's metabolic rate (Bayraktar, 2020). This condition negatively impacts the patient's quality of life, leading to a wide range of systemic symptoms such as weight loss, palpitations, irritability, increased sweating, heat intolerance, muscle weakness, and bone destruction (Joshi, 2024).

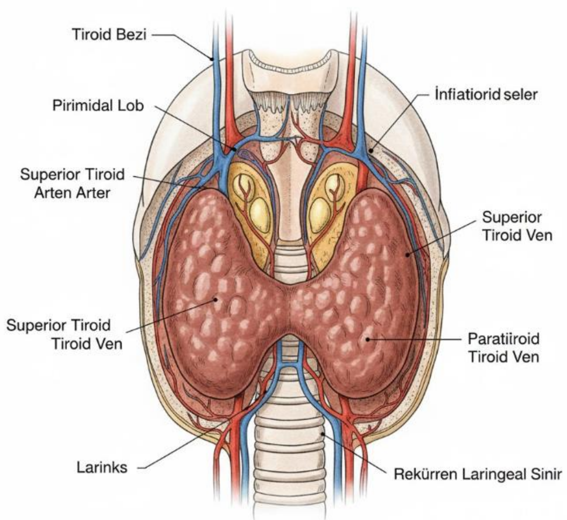


**Figure 1.** Anterior View of the Human Thyroid Gland, Its Lobes and Vascular Structures

The accelerated metabolism caused by hyperthyroidism leads to high energy expenditure, increased nutrient requirements, and risks, particularly for bone health. MBT aims to balance this complex metabolic landscape, minimize the stimulation of an overactive thyroid gland, and alleviate symptoms.

Nutritional interventions include high-calorie and nutrient-dense diets to meet increased energy needs, particularly iodine restriction; adequate calcium and vitamin D intake to maintain bone mineral density; and balanced provision of micronutrients such as antioxidants and selenium, which play a role in thyroid hormone metabolism. While hyperthyroidism is a classic endocrine disease with systemic effects, it is now considered a multidisciplinary condition requiring collaboration between different specialties in diagnosis and treatment (Fellbrant et al., 2024). Because its symptoms are often general and vague, patients often first consult their general practitioner, cardiologist, psychiatrist, or ophthalmologist. Therefore, it is crucial for all healthcare professionals, not just endocrinologists, to recognize the different facets of the disease. Typically, hyperthyroidism presents with symptoms such as tachycardia, weight loss, flushing, irritability, tremors, insomnia, and eye discomfort. These symptoms are particularly prominent in young and middle-aged individuals. However, in older age groups, the disease can often follow a monosymptomatic course. Cardiac arrhythmias, particularly atrial fibrillation, can be the first and sometimes the only symptom of hyperthyroidism in the elderly (Boelaert et al., 2010). Therefore, earlier and more widespread use of thyroid function tests in older individuals is recommended. Stress is a complex series of physiological and emotional responses that the body responds to perceived or threatened threats to both psychological and physical balance (homeostasis) of an individual, and is mainly characterized by the release of hormones such as cortisol and adrenaline (Tekce et al., 2020; Bayraktar et al., 2020; Kaya, 2023; Bayraktar et al., 2023; Kirbaş et al., 2024a; Kirbaş et al., 2024b). Chronic stress, which continuously increases cortisol levels in the body, can suppress the Hypothalamus-Pituitary-Thyroid (HPT) axis, reduce the release of Thyroid Stimulating Hormone (TSH), and also directly negatively affect thyroid metabolism by making it difficult for the inactive thyroid hormone, thyroxine (T4), to its active form (T3) that cells can use (Bayraktar et al., 2021; Bayraktar et al., 2023). The relationship between BDNF (Brain-Derived Neurotrophic Factor) and thyroid hormones (T3 and T4) is of critical importance, particularly for brain development and neuroplasticity (the flexibility and self-renewal ability of nerve cells) (Kirbaş et al., 2025; Okur and Bayraktar, 2025a). CREB is a transcription factor that binds to the cAMP (cyclic adenosine monophosphate) response element, an important component of intracellular signaling pathways (Okur and Bayraktar, 2025b).

The direct relationship between CREB (cAMP Response Element Binding Protein) and the thyroid is further complicated by the psychological and behavioral responses to stress, as the intense competitive pressures and performance perfectionism often experienced by athletes can lead to the development of dysfunctional attitudes (Kirbaş et al., 2024c) a bodily reflection of modern humans' tendency to self-proclaim as masters of the earth (Köse, 2025). These maladaptive cognitive patterns often manifest as high-risk coping behaviors such as disordered eating (binge eating or excessively restrictive diets), thus exacerbating the physiological risks associated with chronic stress and potentially inhibiting the neurotrophic benefits mediated by BDNF and CREB. Thyroid hormones regulate the levels of BDNF in the brain by directly or indirectly affecting its expression (production) and function. Graves' disease is an autoimmune thyroid dysfunction that can be triggered by environmental factors such as intense stress or traumatic life events in genetically predisposed individuals. This is caused by the immune system mistakenly stimulating the thyroid gland, leading to overproduction of thyroid hormones (hyperthyroidism), which accelerates metabolism. Numerous studies have demonstrated that stress can trigger the onset and relapse of the disease. It has been reported that stressful life events can trigger both the initial attack and relapses in individuals with Graves' disease (Winsa et al., 1991; Vita et al., 2015). Therefore, psychosocial factors should be considered not only in managing symptoms but also in controlling the disease. Treatment of hyperthyroidism is not only a biological process but also a psychological and social one. One of the most important diagnostic parameters is the TSH level. A low TSH level, along with a high fT4 level, confirms the diagnosis of "overt hyperthyroidism." If only TSH is low but fT4 and fT3 are normal, "subclinical hyperthyroidism" is present (Spencer et al., 1990; Ross et al., 2016). Subclinical hyperthyroidism is diagnosed solely based on laboratory findings, and the patient is often asymptomatic. However, this condition can lead to serious long-term health consequences. Subclinical hyperthyroidism increases the risk of heart failure, atrial fibrillation, and osteoporosis, especially in older individuals. Literature has shown that this condition increases cardiovascular mortality by 24%. Therefore, subclinical hyperthyroidism should not be taken lightly, and treatment should be considered, especially if the TSH level is below 0.1 mIU/L (Collet et al., 2016).

## Hyperthyroidism

Hyperthyroidism is a systemic disorder characterized by the secretion of excessive amounts of thyroxine (T4) and triiodothyronine (T3) hormones into the blood due to overstimulation or autonomous thyroid function. This leads to a pathological increase in the body's basal metabolic rate. This leads to serious cardiovascular arrhythmias such as tachycardia and atrial fibrillation. It can also lead to excessive irritability, anxiety, and tremors in the nervous system. It can also lead to heat intolerance and excessive sweating in the thermoregulatory system. It can also lead to rapid weight loss despite a constantly increasing appetite, thus reducing quality of life. The most common cause is Graves' disease, which produces antibodies against thyroid receptors (TRAb). It is diagnosed with suppressed TSH and elevated free thyroid hormone levels. Treatment is aimed at controlling the gland's activity with antithyroid medications, radioactive iodine, or surgery. Hyperthyroidism is an endocrine disorder resulting from overactivity of the thyroid gland and has systemic effects. It is characterized by suppression of TSH and elevation of serum free T4 or T3 levels. Overt hyperthyroidism is seen in 0.2-1.4% of cases worldwide, while subclinical hyperthyroidism ranges from 0.7-1.4% (Lee & Pearce, 2023). If left untreated, it can lead to serious complications such as osteoporosis, cardiac arrhythmias, heart failure, and metabolic disorders.

## Graves' Disease

Graves' disease is the most common cause of hyperthyroidism, causing the thyroid gland to produce and secrete more thyroid hormones (T4 and T3) than normal. It is a chronic autoimmune disorder in which the immune system produces autoantibodies called Thyroid Stimulating Immunoglobulins (TSIs) that stimulate TSH receptors. This constantly stimulates the thyroid gland, independent of the pituitary gland's control. This overdrives the body's metabolism, causing common hyperthyroidism symptoms such as tachycardia (palpitations), weight loss, anxiety, tremors, and heat intolerance. In some patients, Graves' Ophthalmopathy (Exophthalmos), a unique autoimmune condition characterized by swelling and inflammation of the tissues behind the eye socket, can lead to vision problems.

The most common cause of hyperthyroidism is Graves' disease, which affects 2% of women and 0.5% of men. Other causes include toxic nodules and the thyrotoxic phase of thyroiditis. In Graves' disease, excessive hormone production occurs due to autoantibodies stimulating the thyroid gland, while autonomous hormone production is observed in toxic nodular goiter and adenomas. Subacute thyroiditis, amiodarone-induced thyrotoxicosis, and immune checkpoint inhibitor-associated thyrotoxicosis are other important causes (Lee & Pearce, 2023).

Symptoms of hyperthyroidism include palpitations, weight loss, anxiety, heat intolerance, and tremor. Ophthalmopathy and diffuse thyroid enlargement may also occur in Graves' disease. Diagnosis is made by low serum TSH levels; free T4, total T3, and TSH receptor antibody tests are used to determine the exact etiology. Thyroid scintigraphy is recommended in the presence of nodules or when the cause is unclear (Ross et al., 2016).

## Hashimoto's Thyroiditis

Hashimoto's Thyroiditis is a common autoimmune endocrine disorder characterized by the immune system's production of antibodies (TPOAb) targeting proteins such as Thyroid Peroxidase (TPO), which are essential for the normal function of the thyroid gland, slowly destroying the gland. This leads to chronic inflammation and, over time, insufficient hormone production (hypothyroidism). Clinically, it manifests with symptoms related to a slowed metabolism, such as excessive fatigue, weight gain, cold intolerance, and depression. Once diagnosed, it requires lifelong treatment with Levothyroxine (a synthetic hormone) to maintain optimal levels by continuously monitoring TSH and free hormone levels. The dosage must be carefully adjusted, particularly during pregnancy, to ensure both maternal and fetal neurological development. Hashimoto's thyroiditis is a chronic autoimmune inflammation of the thyroid gland, characterized by damage to thyroid cells due to the effects of thyroid peroxidase (TPO) and thyroglobulin (TG) antibodies. The disease occurs as a result of the interaction of genetic and environmental factors and has a high prevalence, especially in women (Ihnatowicz et al., 2021).

## Integratıon Of Hıgh-Rısk Athlete Health Condıtıons (Thyroıd Dıseases Example) Into Event Management

Thyroid dysfunctions are among the most common endocrine disorders in the general population. The rate of accurate diagnosis is low, especially among athletes undergoing intensive training, because symptoms stemming from thyroid imbalances (such as unexplained fatigue, performance regression, abnormal heart rate, and heat intolerance) are frequently misinterpreted as overtraining syndrome or poor nutrition. Furthermore, these conditions (Hypothyroidism and Hyperthyroidism) arising from excessive or insufficient thyroid hormone secretion can mimic typical athlete complaints, like severe muscle pain and delayed recovery, thereby posing a serious threat to performance. This necessitates the effective integration of high-risk athlete health conditions, such as general thyroid diseases, into event and competition organizations as both an ethical and legal requirement.In this context, significant deviations in thyroid hormone levels create excessive metabolic imbalances by dangerously increasing or decreasing the body’s basal metabolic rate. These imbalances pose a high risk, particularly when combined with exercise, by critically stressing the cardiovascular system. Managing these physiological risks is of key importance for sports management.

## The Necessity of Integration in Sports Management and Comprehensive Protocols

This integration in sports management not only serves the purpose of reducing the risk of sudden death, which is essential for protecting the athlete's life, but is also vital for preserving the integrity of competition and avoiding organizational legal liability. These requirements trigger a detailed set of protocols covering the pre-, intra-, and post-competition periods:

### 1. Cardiovascular Risk Management and the Need for Emergency Response

Focusing on Cardiovascular Burden and the Need for Emergency Response, organizations are required to request a euthyroid report from athletes prior to competition confirming their metabolic stability and the optimal TSH target range (Fellbrant et al., 2024) because the risk of hyperthyroid symptoms, such as tachycardia and atrial fibrillation (Boelaert et al., 2010), which can occur even in the elderly, significantly increases the likelihood of a sudden cardiac event during high-intensity exercise. During competitions, the uninterrupted presence of fully equipped emergency medical teams with defibrillator (AED) access and advanced cardiac life support (ACLS) capabilities at strategic locations throughout the field is an absolute logistical necessity.

### 2. Thermoregulation, Environmental Management, and Heat Stroke Risk

In the context of thermoregulation and heat stroke risk, physiological responses such as heat intolerance and increased sweating caused by hyperthyroidism, which can cause an uncontrolled rise in body temperature, make athletes vulnerable to premature fatigue and the risk of life-threatening heat stroke, especially in hot and humid competition environments. Therefore, it is essential for organizations to proactively integrate specialized cooling stations (ice baths) and advanced hydration protocols into their logistical plans for athletes at risk.

### 3. Doping, Pharmacological Compliance, and Fair Competition Control

In terms of Doping and Pharmacological Compliance Management, beta-blockers (e.g., propranolol), which are used in the symptomatic treatment of disease and are effective in reducing complaints such as palpitations and tremors, may be on the prohibited substance lists of many sports. To ensure that competitions are conducted fairly and ethically, event managers must meticulously monitor whether athletes using medication in competitions hold a Medical Use Exemption (TUE) document within the framework of the International Anti-Doping Rules.

### 4. Cognitive Dysfunction and Psychosocial Support

Beyond all this, as indicated by the heading "Performance and Cognitive Dysfunction," dysfunctional behaviors caused by hyperthyroidism, such as irritability, tremors, and "brain fog" that can persist even after treatment, directly affect an athlete's ability to focus, reaction speed, and therefore performance and safety. This condition requires psychological support and vocational rehabilitation processes. Therefore, hyperthyroidism management requires a multifaceted approach encompassing early diagnosis, accurate classification, symptomatic treatment, definitive treatment, and follow-up. This complex process can only be successfully managed with the contribution of many healthcare professionals, including not only endocrinologists but also cardiologists, psychiatrists, dietitians, and social workers (Fellbrant et al., 2024).

## Conclusion

Thyroid dysfunction is common in the general population, but particularly in athletes undergoing intense training, symptoms often overlap with overtraining, leading to delays in diagnosis and therefore posing a high risk. This makes the comprehensive approach outlined in "Integrating High-Risk Athlete Health Conditions (Hyperthyroidism Example) into Event Management and Competition Organization" an absolute necessity. Due to the acute cardiovascular instability (tachycardia, atrial fibrillation) caused by hyperthyroidism, organizations must have access to a defibrillator (AED) and teams with Advanced Cardiac Life Support (ACLS) capabilities ready. To prevent life-threatening heat stroke, logistical integration of environmental risk management and specialized cooling protocols is essential. Furthermore, ethical oversight of Medical Use Exemption (TUE) documents for the use of medications such as beta-blockers is essential to maintain the integrity of competition. Finally, it forms the essential basis for a proactive and scientifically based multidisciplinary management model that combines the expertise of endocrinology, cardiology and organizational logistics, centering on athlete safety and fair competition, including the need for psychosocial support for cognitive impairments such as "brain fog" and dysfunctional attitudes that may persist even after treatment.

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# CHAPTER 5

## SOCIAL PHYSICAL ACTIVITY POLICIES IN NEURODEGENERATIVE DISEASES AND THE CASE OF PARKINSON'S DISEASE

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## INTRODUCTION

Neurodegenerative diseases (ND), characterized by progressive degeneration of the nervous system, are among today's leading public health priorities. This group of diseases comprises a range of chronic disorders whose prevalence is rapidly rising with the increasing global aging population and poses a significant socioeconomic burden (Aarsland et al., 2021). In this context, Parkinson's disease (PD) stands out as the second most common neurodegenerative disorder after Alzheimer's disease. Affecting approximately 6.1 million individuals according to 2016 data, this disease is a complex neurodegenerative disorder with increasing prevalence and a significant increase in incidence over the past two decades (Global Burden of Disease 2016 Parkinson's Disease Collaborators, 2018; GBD 2016 Parkinson's Disease Collaborators, 2018). The disease characteristically follows a slowly progressive course that can lead to permanent disability, imposes significant economic burdens on the public health system (Kowal et al., 2013), and leads to burnout in caregivers (Schrag & Schott, 2006).

Brain-Derived Neurotrophic Factor (BDNF) is a critical protein found widely in the nervous system, regulating neuronal survival, synaptic plasticity, and neurogenesis (Bayraktar et al., 2020; Okur and Bayraktar, 2025a; Kirbaş et al., 2025). Thanks to this property, BDNF is considered the key biological bridge through which regular physical activity exerts a neuroprotective effect in Parkinson's disease, characterized by dopaminergic neuron loss, and supports the brain's natural repair mechanisms (Palasz et al., 2025).

PD is characterized by the loss of dopaminergic neurons in the substantia nigra and the accumulation of alpha-synuclein protein aggregates known as Lewy bodies. However, the clinical presentation is not limited to prominent motor symptoms such as tremor, rigidity, and bradykinesia. Non-motor symptoms such as depression, cognitive impairment, pain, and loss of smell also significantly reduce patients' quality of life and increase the complexity of treatment approaches (Chaudhuri et al., 2006). The heterogeneous nature of the disease, resulting from the interaction of genetic and environmental factors, suggests the existence of different subtypes and makes each patient's experience unique (Postuma et al., 2015; Lang & Tanner, 1998; Espay et al., 2018).

Current PD management is primarily based on dopamine replacement therapy (levodopa). However, the long-term effects of these pharmacological approaches, such as serious motor fluctuations and dyskinesias, and their limited effectiveness, particularly in addressing non-motor symptoms, have increased the scientific importance of alternative and complementary strategies (DeLong & Wichmann, 2015). In this scientific void, physical activity and exercise are of critical importance due to their potential to directly intervene in the pathophysiology of PD.

Scientific Importance of Physical Activity: Neurobiological research over the last two decades has shown that exercise not only provides symptom management in PD but also triggers neuroprotective and neuroplastic effects (Hirsch & Farley, 2009). Stress is the body's set of nonspecific responses to threatening, challenging, or excessively demanding environmental or internal stimuli, aimed at restoring physiological and psychological homeostasis (balance) (Tekce et al., 2020; Kaya, 2023; Bayraktar et al., 2023; Kirbaş et al., 2024a; Kırbaş et al., 2024b). Dysfunctional attitudes, on the other hand, were developed by cognitive behavioral therapy (CBT) theorist Aaron Beck and are defined as a set of negative, rigid, and unrealistic cognitive beliefs or schemas that an individual holds about themselves, their environment, and their future (Kirbaş et al., 2024c; Köse, 2025). In addition to biological and environmental barriers, dysfunctional attitudes (DSA), defined as a set of negative, rigid, and unrealistic cognitive schemas about oneself, one's future, and one's environment (Beck, 1976), also play a critical role in the management of Parkinson's disease (PD). Because of the chronic and progressive nature of the disease, mobility limitations, and recurrent fear of falling (kinesiophobia), PD patients often internalize dysfunctional attitudes such as learned helplessness, low self-efficacy, and the expectation of social isolation (Kirbaş et al.2025). These negative cognitive schemas not only exacerbate the severity of non-motor symptoms such as depression, anxiety, and fatigue, but also hinder active participation in therapeutic interventions, such as physical activity (PA), which have proven neuroprotective and symptom-alleviating benefits. They should be considered a key psychosocial barrier, driving patients toward avoidance and inactivity, exacerbating the disease's motor symptoms (rigidity, bradykinesia), and limiting the success of societal physical activity policies. Exercise increases the expression of neurotrophic factors (especially BDNF), which support neuronal health and ensure neuronal survival (Bayraktar, 2019). Beyond increasing BDNF production, physical activity also modulates the activity of

CREB (cAMP Response Element-Binding Protein) through cellular signaling pathways, a key factor in synaptic plasticity and neuronal function (Okur and Bayraktar, 2025b). At the molecular level, physical activity has been shown to improve mitochondrial dysfunction (one of the fundamental mechanisms of neurodegeneration) (Bayraktar et al., 2024), reduce oxidative stress, and modulate inflammation. Furthermore, there is strong preclinical evidence that intense exercise may potentially slow the formation and spread of alpha-synuclein aggregation, a key pathological hallmark of PD (Petzinger et al., 2013). Physical activity also has the ability to functionally compensate for losses in the dopaminergic system by increasing striatal dopamine release and utilization. Despite these powerful neurobiological mechanisms, PD patients often lack access to adequate levels of physical activity due to barriers stemming from motor (bradykinesia, balance problems) and non-motor symptoms (apathy, depression), as well as a lack of appropriate facilities and programs. Therefore, accessible and sustainable societal structures must be established to elevate physical activity from an individual recommendation to a core component of disease management. This study, titled "Societal Physical Activity Policies in Neurodegenerative Diseases: The Case of Parkinson's Disease," aims to examine how scientific knowledge can be integrated into clinical practice and a broader societal policy framework, assess structural barriers to accessing physical activity, and develop evidence-based policy recommendations at the societal level.

## Clinical Presentation and Diagnostic Criteria for Parkinson's Disease

The motor symptoms of Parkinson's disease are often prominent and difficult to ignore. Visual materials and motor examinations of newly diagnosed individuals reveal striking findings. However, Parkinson's is not limited to motor symptoms; non-motor symptoms such as depression, cognitive impairment, and pain are also important components of the disease (Chaudhuri et al., 2006). These non-motor symptoms can seriously impact an individual's quality of life (Shulman et al., 2011). In particular, core motor symptoms such as bradykinesia, rigidity, and balance disorders, combined with non-motor symptoms such as apathy and depression, severely limit patients' ability to engage in regular and sustained physical activity. Overcoming this limitation requires the establishment of environmental and social support mechanisms, beyond pharmacological treatment. The early stages of the disease are often unnoticed, resulting in a long delay between the onset of the first symptoms and diagnosis (an average of 10 years) (Pont-Sunyer et al., 2015). Initial symptoms may include constipation, restlessness during REM sleep (REM sleep behavior disorder), loss of smell, asymmetric shoulder pain, or depression (Postuma et al., 2015). Because diagnosis is difficult during this period, it is understandable that general practitioners may overlook the disease. These symptoms are not specific to Parkinson's disease alone but can be associated with many different disorders. Delays in diagnosis are particularly common when tremor is not predominant, the legs are more affected, or the disease begins at a young age (Hoehn & Yahr, 1967). Parkinsonism may share pathological foundations with various neurodegenerative diseases, such as Alzheimer's, tauopathies, or polyglutaminopathies (Kalia & Lang, 2015). According to the Queen Square Brain Bank's diagnostic criteria, Parkinson's disease is primarily defined by levodopa-responsive motor symptoms and is associated with dopaminergic cell loss in the substantia nigra and dopaminergic denervation in the striatum (Hughes et al., 2018). The Movement Disorders Society's current diagnostic criteria recommend paying particular attention to these non-motor symptoms, which largely determine patients' quality of life and disease-related morbidity (Chaudhuri et al., 2006). Pathologically, Parkinson's disease is often characterized by Lewy bodies and neurites characterized by α-synuclein accumulation (Spillantini et al., 1997). A recent view suggests that these pathological changes can be observed not only in the brain but also in other tissues such as the skin, intestine, and salivary glands in the early stages. This suggests that Parkinson's is a systemic disease (Zang et al., 2020). In daily clinical practice, the diagnosis of Parkinson's disease is based on history and neurological examination. The criteria of the International Parkinson and Movement Disorders Society, although primarily focused on clinical research, can guide physicians in the diagnostic process (Postuma et al., 2015). A good response to dopaminergic medications such as levodopa is a key finding supporting the diagnosis (Quinn et al., 1987). Furthermore, some findings that are not specific to Parkinson's and complicate the diagnosis are called "red flags." Such symptoms can suggest different types of parkinsonism and facilitate differential diagnosis (Postuma et al., 2015). However, the interpretation of such findings may require the expertise of movement disorder specialists, particularly. For example, while some red flags, such as an impaired tandem gait, are considered highly specific findings, they are not definitive diagnostic findings on their own (Postuma et al., 2015).

### Factors Complicating Diagnosis

Accurately diagnosing Parkinson's disease in daily clinical practice is not always easy. Clinical studies report that approximately 15% of cases, especially in early-stage Parkinson's, are misdiagnosed (Hughes et al., 2002). This rate can be even higher among healthcare professionals who are not neurologists (Parkinson's Disease Research Group of the UK, 2015). One factor that complicates diagnosis is the presence of other health problems accompanying Parkinson's disease (Hely et al., 2005). For example, cerebrovascular lesions, commonly seen on brain imaging, can lead to gait disturbances, cognitive slowing, and bladder control problems, which are also seen in Parkinson's disease (Hely et al., 2008). The increased susceptibility of Parkinson's patients to infection has been particularly noted during the COVID-19 pandemic. Although individuals in the early stages of the disease have not been found to have an increased risk of contracting COVID-19, it has been observed that patients with advanced-stage Parkinson's disease are particularly vulnerable to respiratory complications (Marra et al., 2021). This may increase the risk of death and worsen disease symptoms. Additionally, pandemic-related life changes such as social isolation, increased stress levels, and decreased physical activity can negatively impact Parkinson's symptoms (Bhidayasiri et al., 2020). These observations demonstrate the vital importance of flexible, accessible, and inclusive social policies to maintain physical activity as a primary treatment strategy, whether during individual crisis periods or during normal life. Otherwise, even external factors can lead to chronic symptom worsening.

### Genetics

Parkinson's disease has a genetic basis associated with both rare genetic mutations and common risk alleles (Lill, 2016). The genetic contribution has been estimated between 22% and 40% using twin studies and genetic modeling methods. This suggests that the disease is shaped by both hereditary and environmental components. To date, three autosomal dominant genes (SNCA, LRRK2, VPS35) and three autosomal recessive genes (PRKN, PINK1, DJ1) have been identified as being linked to Parkinson's disease. Furthermore, some genetic variations, such as those in the GBA1 gene, have been shown to be associated with disease risk (Lesage & Brice, 2009). Population-specific genetic variations can lead to differences in the incidence of Parkinson's disease. For example, the Gly2019Ser mutation in the LRRK2 gene is common in individuals of European, North African, and Jewish descent, while different mutation types are more prevalent in Asian populations (Paisán-Ruiz et al., 2004). Another variant in the same gene, Gly2385Arg, has been identified as a risk factor for Parkinson's disease, particularly in Chinese and Korean populations (Tan et al., 2008). Interestingly, the LRRK2 gene is associated not only with neurodegenerative diseases but also with Crohn's disease, leprosy, and mycobacterial infections. This suggests that LRRK2 has an impact on the immune system (Wernick et al., 2020). Genome-wide association studies (GWAS) have allowed the identification of numerous disease-associated variants. To date, nearly 90 variants have been identified in 74 different gene loci that modestly increase disease risk (Nalls et al., 2019). While the SNCA and MAPT loci show the strongest associations in European populations, GBA1 variants have been shown to confer a more pronounced risk in individuals of African descent (Nalls et al., 2019). However, as the majority of studies to date have included individuals of European descent, information on PD genetics in other ethnic groups remains limited. Therefore, projects carried out through international collaborations, such as initiatives such as the Global Parkinson's Genetics Program, aim to address this knowledge gap (The Global Parkinson's Genetics Program, 2021).

## Epidemiology

Parkinson's disease is a neurodegenerative disorder that increases with aging. Both the prevalence and incidence of the disease increase significantly with age (GBD 2016 Parkinson's Disease Collaborators, 2018). However, this should not lead to the common misconception that the disease only affects older adults. Data indicate that approximately one-quarter of Parkinson's patients are diagnosed before the age of 65, and 5-10% have an age of onset before 50. Mortality rates and the burden of disability associated with the disease have doubled over the past 20 years (GBD 2016 Parkinson's Disease Collaborators, 2018). This disease, which affects both genders, can have different courses in men and women. Although the age of onset of the disease is older in women, side effects such as motor fluctuations and dyskinesia may be observed more frequently (Scott et al., 2020). Furthermore, depression and urinary complaints are more common in women.

## The Role of Diet in Parkinson's Disease

Both motor and non-motor symptoms of Parkinson's disease (PD) can have a significant impact on an individual's eating habits. Motor symptoms such as slowed movements, muscle rigidity, and tremors can make daily activities such as meal preparation, shopping, and eating in social settings difficult (Zoccolella et al., 2010). Furthermore, impaired sense of smell and taste, depression, apathy, changes in the reward system, and impulse control problems can also lead to changes in appetite and food preferences. An increased craving for sweet foods, in particular, is common in patients with Parkinson's disease. Additionally, gastrointestinal problems such as difficulty swallowing (dysphagia), nausea, delayed gastric emptying, bacterial overgrowth in the small intestine, and constipation can negatively impact food intake. These problems can lead to early satiety and decreased levodopa absorption, particularly when consuming high-protein foods (Zoccolella et al., 2010; Lattanzio et al., 2012; Van Der Eerden et al., 2017). A meta-analysis revealed that one-third of Parkinson's patients are at risk of malnutrition, which is associated with decreased quality of life and adverse health outcomes (Van Der Eerden et al., 2017). Recent observational studies suggest a relationship between certain dietary patterns and the age of onset, rate of progression, and mortality rates of Parkinson's disease (Metcalfe-Roach et al., 2020; Krikorian et al., 2019). Nutrition and dietary interventions have the potential to both reduce disease risk and alleviate existing symptoms. Like physical activity, nutrition is considered a primary non-pharmacological treatment approach. Therefore, social policies need to be expanded to include not only access to physical activity but also access to healthy dietary patterns and nutritional counseling services.

## Neuroprotective Potential of Physical Activity in Parkinson's Disease and Its Integration into Public Health Policies

The recognition of physical activity (PA) as a neuroprotective treatment strategy with the potential to slow the progression and modulate symptoms of neurodegenerative disorders such as Parkinson's disease (PD) (Petzinger et al., 2013; Aguiar et al., 2020) demonstrates that beyond this clinical significance, PA programs represent a cost-effective long-term public health solution that reduces falls and associated hospitalization and long-term care costs in PD patients, alleviating the burden on national healthcare systems (Brown et al., 2021). However, access to exercise for PD patients is not limited to clinical concerns but also requires addressing the significant health inequalities faced by patients in low-income and rural areas regarding access to specialists, safe transportation, and access to sports facilities (Smith & Jones, 2023). Therefore, it is imperative that policymakers consider PA not as a mere expenditure item but as a preventative economic investment to address these inequalities. Moreover, objectively monitoring PA levels in PD patients through wearable technologies (activity trackers) and digital platforms, providing instant feedback, and supporting remote rehabilitation (telemedicine) services (Mancini et al., 2020) have become important tools for expanding the reach of societal policies and helping to address inequalities, especially for individuals with mobility limitations. Finally, increasing evidence suggests that PA, beyond its therapeutic role after PD diagnosis, also plays a potential role in primary prevention by slowing dopaminergic neuron loss in healthy individuals or reducing the risk of developing PD (Xu et al., 2018). This suggests that general public health and aging policies should support PD not only from a treatment but also from a pro-morbidity perspective, reinforcing the need for multi-stakeholder and integrated societal physical activity policies.

## Future Perspectıves

Although the impact of nutrition on Parkinson's disease (PD) is an important topic that attracts considerable interest from both clinicians and patients, research in this area is currently supported by a limited number of high-quality randomized controlled trials (RCTs) due to factors such as difficulties in accurate measurement (variability in nutrient content in foods and difficulties in accurately measuring dietary habits) and long-term follow-up of participants (Seçer et al., 2022); however, the use of biomarkers of dietary intake (e.g., levels of specific flavonoids) is becoming increasingly important in overcoming these methodological hurdles (Lin & Wang, 2024), necessitating new strategies such as identifying early-stage patients and using effective biomarkers to assess the potential disease-modifying or disease-modifying effects of nutrition (Seçer et al., 2022). Plant-based diets, MIND, and Mediterranean-style dietary patterns (MeDi) in general are among the most recommended models for PD due to strong observational data suggesting that they may delay the age of onset, reduce symptom burden, and improve quality of life in patients (Yu et al., 2023); however, the long-term safety of the ketogenic diet (KD), with limited short-term data demonstrating potential benefits, has not been adequately studied due to practical difficulties arising from restricting food groups such as grains, fruits, and sweets, making ketone precursors such as medium-chain triglycerides an alternative solution; other bioenergetic strategies such as Intermittent Fasting are also recommended in PD, but intervention studies in this area have not yet been published (Mattson et al., 2020). While uncertainties remain, such as the unclear relationship between PD and dairy (some studies suggest an increased risk with only certain dairy products) (Chen et al., 2018) and the lack of definitive conclusions regarding the relationship between alcohol and PD (moderate wine consumption may exert beneficial effects as part of MeDi) (Kim & Lee, 2021), a meta-analysis has shown that multi-strain probiotics reduce PD-related constipation, motor and non-motor symptoms, and depression (Park et al., 2023; Barichella et al., 2016). In this context, although nutritional interventions are attractive for people with PD (PwP) as a low-risk and accessible self-management tool, overcoming barriers such as cultural adaptations, economic constraints, gender differences, and the need for personalization for dietary effectiveness should be a primary focus of future research and clinical practice (Willett et al., 2019; Sauerbier et al., 2024).

## CONCLUSION

Parkinson's disease, with its motor and non-motor symptoms, is a multifaceted disorder that is not limited to the nervous system but also directly impacts individuals' nutritional status, quality of life, and response to treatment. A growing number of studies demonstrate that while the potential benefits of nutritional approaches such as Mediterranean-style diets are noteworthy, more robust scientific data is needed to definitively demonstrate the effects of such approaches on the disease process. Furthermore, supporting Parkinson's patients at risk of malnutrition requires a holistic and personalized approach, including sensitivity to issues such as protein intake and making dietitian support a core component of the medical team. In this context, as detailed throughout this study, along with the critical importance of nutrition in PD management, it is imperative that the neuroprotective potential of physical activity be made not only a clinical prescription but also a societal policy priority. Therefore, holistic management of the disease: In order to strengthen nutritional practices, the need for adequate training of physicians and health professionals and the need to raise awareness of patients should be integrated with physical activity policies and transformed into an interdisciplinary and societal collaboration strategy that overcomes economic constraints and social access barriers.

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# CHAPTER 6

## THE EFFECTS OF ENDOCRINE DISORDERS (HYPERTHYROIDISM) ON ATHLETE PERFORMANCE AND THE INTEGRATION OF MEDICAL NUTRITION THERAPY PRACTICES INTO TEAM AND HEALTH MANAGEMENT PROTOCOLS

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## INTRODUCTION

The endocrine system is a vital control mechanism that regulates the body's metabolic rate, energy balance, and thermoregulation through hormones secreted by the thyroid gland (Bayraktar, 2020). Hyperthyroidism, one of the fundamental disorders in this system, has traditionally been considered a subject of internal medicine and endocrinology due to its systemic effects resulting from excessive thyroid hormone production. With symptoms such as tachycardia, weight loss, muscle weakness, and anxiety, the disease significantly impacts an individual's daily quality of life and physiological capacity. However, in today's professional sports world, an athlete's health is viewed not only as a biological variable but also as a strategic asset that directly impacts club management, financial sustainability, and athletic success. The hypermetabolic state caused by hyperthyroidism fundamentally impacts athletes' maximal performance, recovery processes, and injury risks. In this context, the management of this health condition goes beyond conventional medical treatment and becomes an integral part of Sports Management and Team Health Protocols. This study examines the impact of endocrine disorders (hyperthyroidism) on athlete performance and the effectiveness of medical nutrition therapy (MNT), which plays a key role in regulating athletes' metabolism, from the perspective of how these practices can be successfully integrated into team and health management protocols. Medical nutrition supports drug therapies, potentially alleviating symptoms, stabilizing body weight, and accelerating athletes' safe return to training. This interdisciplinary approach not only protects the athlete's individual health but also enables the establishment of a proactive risk management model in sports management by ensuring that club managers fulfill their legal obligations, performance specialists optimize training loads, and event organizers are prepared for emergencies that may arise during competition. In this context, the aim of this study is to demonstrate, through the example of hyperthyroidism, why chronic health conditions are a vital integration and management imperative for modern sports organizations. While hyperthyroidism is a classic endocrine disease with systemic effects, it is now considered a multidisciplinary condition requiring collaboration between different specialties in the diagnosis and treatment process (Fellbrant et al., 2024). Because its symptoms are often general and vague, patients often first consult a general practitioner, cardiologist, psychiatrist, or ophthalmologist. Therefore, it is crucial for all healthcare professionals, not just endocrinologists, to recognize the different facets of the disease. Typically, hyperthyroidism presents with complaints such as tachycardia, weight loss, flushing, irritability, tremors, insomnia, and eye discomfort. These symptoms are particularly prominent in young and middle-aged individuals. However, in older age groups, the disease can often take a monosymptomatic course. Cardiac arrhythmias, particularly atrial fibrillation, may be the first and sometimes the only manifestation of hyperthyroidism in the elderly (Boelaert et al., 2010). Therefore, earlier and more widespread use of thyroid function tests in older individuals is recommended.

## The Relationship Between Thyroid Function and Nutrition

Thyroid function is closely linked to nutrition and is influenced by the diet-gut-thyroid axis. Various macronutrients and micronutrients play critical roles in the synthesis, metabolism, and regulation of thyroid hormones. Nutrients such as iodine, selenium, iron, zinc, copper, magnesium, vitamin A, and vitamin B12 can directly impact thyroid health. Furthermore, the gut microbiota shapes thyroid function through nutrient absorption and immunological responses (Shulhai et al., 2024).

## Gut Microbiota and Thyroid Function

The gut microbiota can influence the metabolism and immunological regulation of thyroid hormones. While intestinal absorption of iodine, selenium, zinc, and iron is mediated by the microbiota, certain bacteria can contribute to the activation of thyroid hormones (Knezevic et al., 2020).

## Thyroid Hormone and Micronutrients

### • The Effect of Iodine on Autoimmune Thyroid Disease

Iodine is a key component of thyroid hormones, and deficiency can lead to hypothyroidism, while excess can lead to thyrotoxicosis. The European Food Safety Authority (EFSA) recommends a daily intake of 70–150 µg of iodine, depending on age, while the World Health Organization (WHO) recommends an intake of 250 µg during pregnancy and breastfeeding (Shulhai et al., 2024). Excessive iodine intake may trigger autoimmune reactions and play a role in the development of Hashimoto's thyroiditis. Studies show that excessive iodine consumption stimulates the immune system by causing the formation of highly iodinated thyroglobulin in the thyroid gland (Rayman, 2018).

**• The Relationship of Iron to Thyroid Function**

The enzyme thyroid peroxidase (TPO) is essential for the synthesis of thyroid hormones, and iron deficiency can reduce the activity of this enzyme, leading to hypothyroidism (Rayman, 2018). Deficiency can negatively affect thyroid function during pregnancy (Maldonado-Araque et al., 2018). Comorbidities that can cause iron deficiency, such as autoimmune gastritis and celiac disease, are more common in individuals with autoimmune thyroid disease. Iron supplementation can improve thyroid hormone levels and alleviate the symptoms of thyroid disorders (Rayman, 2018).

**• The Role of Selenium in Thyroid Health**

Selenium is an essential trace element found in high concentrations in the thyroid gland. Selenoproteins play a critical role in managing oxidative stress and thyroid hormone metabolism. They are present in the structure of enzymes such as glutathione peroxidase (GPx) and iotothyronine deiodinases, helping to reduce oxidative stress (Wu et al., 2022). Studies suggest that selenium may positively impact the course of autoimmune thyroid diseases by reducing TPO antibody levels (Rayman, 2018).

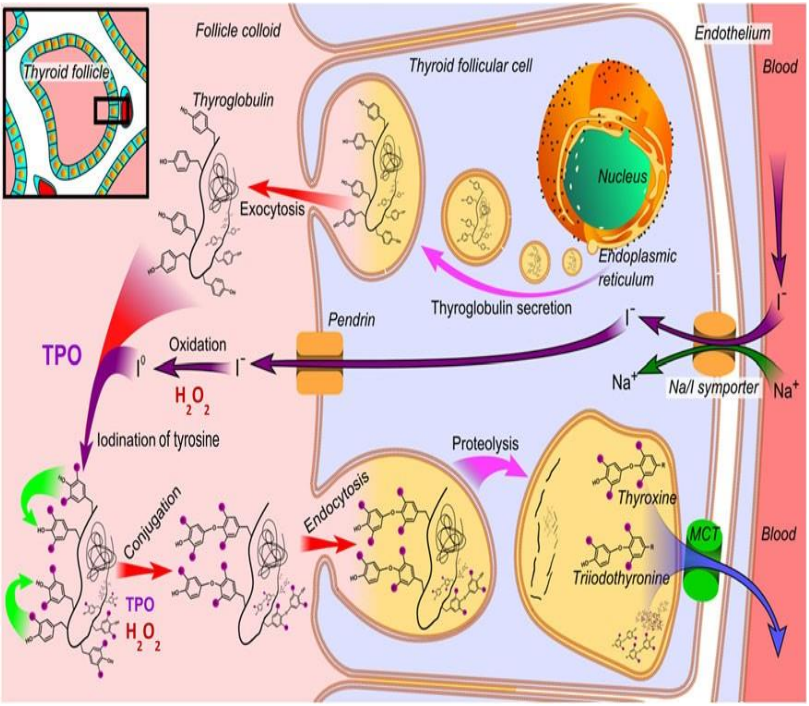


**Figure 1.** (Color online) Synthesis of thyroid hormones in the thyroid follicle (Modified from Häggström 2014). Thyroglobulin is synthesized in the rough endoplasmic reticulum and follows the secretory pathway to enter the colloid in the lumen of the thyroid follicle by exocytosis. Meanwhile, a sodium-iodide (Na/I) symporter actively pumps iodide (I-) across the endothelium into the cell by previously largely unknown mechanisms. This iodide enters the follicular lumen from the cytoplasm in a pseudo-passive manner by the transporter pendrin. In the colloid, iodide (I-) is oxidized to iodine by hydrogen peroxide (H2O2) with the help of an enzyme called thyroid peroxidase (TPO). Iodine is very reactive and iodilates thyroglobulin at tyrosyl residues in its protein chain (which contains approximately 120 tyrosyl residues in total). In conjugation, adjacent tyrosyl residues are brought together, again under the influence of TPO and H2O2. The entire complex reenters the follicular cell by endocytosis. Proteolysis by various proteases releases thyroxine and triiodothyronine molecules, which enter the blood via a pathway.

## Hyperthyroidism

Hyperthyroidism is an endocrine disease with systemic effects caused by overactivity of the thyroid gland. It is characterized by suppression of TSH and elevation of serum free T4 or T3 levels. Overt hyperthyroidism has an incidence of 0.2-1.4% worldwide, while subclinical hyperthyroidism ranges from 0.7-1.4% (Lee & Pearce, 2023). If left untreated, it can lead to serious complications such as osteoporosis, cardiac arrhythmias, heart failure, and metabolic disorders.

## Graves' Disease

Graves' disease is the most common cause of thyrotoxicosis (excess thyroid hormone in the blood) and is classified as a chronic autoimmune disorder. In this condition, the immune system produces autoantibodies called Thyroid-Stimulating Immunoglobulins (TSIs) that overstimulate the thyroid gland, causing it to produce and secrete more thyroid hormones (T4 and T3) than normal. These antibodies continuously activate the thyroid gland, independent of pituitary control (Hofmann et al., 2024).

## Therapeutic Approaches

Treatment for hyperthyroidism should be individualized according to the patient's characteristics. There are three main treatment methods for overt hyperthyroidism:

1. Antithyroid Drugs (ATDs): Methimazole (MMI) and propylthiouracil (PTU) inhibit thyroid hormone synthesis. Remission rates in Graves' disease range from 30-50% (Laurberg et al., 2008).
2. Radioactive Iodine (RAI) Therapy: While it provides permanent hypothyroidism in over 90% of Graves' disease cases, treatment for toxic nodular goiter varies (Sundaresh et al., 2013).
3. Surgery: The thyroid gland is partially or totally removed. Iodine therapy is preferred in patients with contraindications.

Treatment for subclinical hyperthyroidism is recommended, particularly for patients with a TSH <0.1 mIU/L, the elderly, and those at risk for heart disease or osteoporosis (Biondi & Cooper, 2018).

## Hashimoto's Thyroiditis

Hashimoto's Thyroiditis is characterized by the immune system producing autoantibodies against proteins such as Thyroid Peroxidase (TPOAb) and Thyroglobulin (TgAb), which are essential for thyroid hormone synthesis, causing chronic inflammation and cell destruction in the thyroid gland. This autoimmune disorder leads to hypothyroidism by permanently reducing the hormonal production capacity of the gland over time. It is clinically manifested by symptoms related to slowed metabolism such as excessive fatigue, weight gain, cold intolerance and depression. It occurs as a result of the interaction of genetic predisposition and environmental factors. It is the most common endocrine disease requiring lifelong replacement therapy with Levothyroxine (L-T4), requiring continuous monitoring of TSH and free hormone levels (Chaker et al., 2024).

## Pathogenesis of the Disease and the Role of Nutrition

Nutrition has a direct impact on the immune system, and deficiencies or excesses of certain micronutrients can trigger autoimmune reactions. Nutrients such as selenium, iodine, zinc, iron, and vitamin D play a critical role in thyroid hormone synthesis and immune regulation (Ihnatowicz et al., 2021).

## The Importance of Macronutrients

Adequate protein intake is essential for thyroid hormone synthesis and immune function. Furthermore, omega-3 fatty acids can reduce inflammation in thyroid tissue through their anti-inflammatory effects (Ihnatowicz et al., 2021).

## Gluten and Lactose Elimination

Gluten sensitivity and lactose intolerance are frequently observed in patients with Hashimoto's thyroiditis. Because gluten can trigger autoimmune processes in some individuals, a gluten-free diet is recommended, especially for those with celiac disease. In cases of lactose intolerance, eliminating lactose from the diet helps reduce gastrointestinal symptoms (Ihnatowicz et al., 2021).

## Thyroid Physiology in Pregnancy

Increased estrogen levels during pregnancy increase thyroxine-binding globulin (TBG) synthesis, leading to elevated total T4 and T3 levels. Furthermore, human chorionic gonadotropin (hCG) weakly activates TSH receptors, leading to decreased TSH levels, especially in the first trimester. These physiological changes necessitate the evaluation of thyroid function tests with trimester-specific reference ranges (Lee & Pearce, 2022).

### Hypothyroidism in Pregnancy

Overt hypothyroidism is associated with complications such as preeclampsia, placental abruption, preterm labor, and impaired fetal neurodevelopment. Therefore, levothyroxine therapy should be initiated immediately upon diagnosis (Lee & Pearce, 2022). Treatment decisions for subclinical hypothyroidism should be based on individual risk factors such as TSH levels, the presence of anti-TPO, and obstetric history (Lee & Pearce, 2022). Treatment is recommended for pregnant women with antibody positivity and a TSH value above 4.0 mIU/L (Lee & Pearce, 2022).

### Hyperthyroidism in Pregnancy

The most common cause of hyperthyroidism in pregnancy is Graves' disease. Transient thyrotoxicosis due to hCG should also be considered in the differential diagnosis. Clinically, antithyroid drug (ATD) treatment is necessary in severe cases. Propylthiouracil (PTU) is preferred in the first trimester and methimazole (MMI) in the second and third trimesters. Given the potential teratogenic effects of ATDs on the fetus, treatment should be kept at the minimally effective dose (Lee & Pearce, 2022).

### Postpartum Thyroiditis

Postpartum thyroiditis (PPT) is an autoimmune inflammation of the thyroid gland that develops within the first year after delivery and often progresses to transient hyperthyroidism followed by hypothyroidism. Symptoms can be mild or confused with postpartum depression. Therefore, thyroid function tests should be evaluated in women experiencing mood disorders in the postpartum period. Some patients may develop persistent hypothyroidism, which may require long-term levothyroxine therapy (Lee & Pearce, 2022).

## CONCLUSION

Hyperthyroidism and autoimmune thyroid diseases are complex endocrinological conditions that directly affect maternal and fetal health, particularly during pregnancy and the postpartum period, and require multidisciplinary management. The diagnosis, treatment, and monitoring of these diseases are not solely the responsibility of endocrinologists; they should be conducted in collaboration with general practitioners, cardiologists, psychiatrists, dietitians, and other healthcare professionals. Clinical manifestations of these diseases encompass a wide range of symptoms and can have systemic effects. Accurately interpreting physiological changes in thyroid hormone levels, particularly during pregnancy, using trimester-specific reference ranges, and appropriate disease management are vital to preventing both maternal and fetal complications.

Hypothyroidism and hyperthyroidism during pregnancy can lead to serious consequences, such as preterm birth, preeclampsia, fetal growth restriction, and neurodevelopmental disorders. Therefore, regular monitoring of thyroid function, screening for high-risk pregnancies, and initiation of appropriate pharmacological treatment when necessary are essential. In hyperthyroidism, Graves' disease in particular should be controlled with low-dose antithyroid medications, and the potential teratogenic effects of these medications should be considered. Postpartum thyroiditis, while often presenting with mild symptoms, is mandatory, as it can be confused with mood disorders. Levothyroxine treatment is necessary in patients with long-term hypothyroidism.

The importance of nutrition and micronutrients on thyroid health is increasingly emphasized. Trace elements such as iodine, selenium, iron, and zinc play a significant role in the synthesis, metabolism, and immune mechanisms of thyroid hormones. It is thought that nutritional strategies can positively impact the course of the disease, particularly in autoimmune thyroid diseases, and dietary approaches such as gluten and lactose elimination also contribute to reducing patient symptoms. Furthermore, it is anticipated that the gut microbiota is influential in the metabolism of thyroid hormones and immune regulation, and that new research in this area may bring significant innovations to the management of thyroid diseases in the future. In the treatment of hyperthyroidism, pharmacological approaches such as beta-blockers and antithyroid medications, radioactive iodine therapy, and surgical options should be individualized based on the patient's age, disease severity, pregnancy status, and risk of complications. Even early and mild conditions such as subclinical hyperthyroidism increase long-term cardiovascular and osteoporotic risks, so careful monitoring and treatment are crucial.

Furthermore, post-treatment monitoring, dose adjustments, and quality of life support are the cornerstones of multidisciplinary care.

In conclusion, early diagnosis, accurate classification, and individualized treatment strategies are vital in the evaluation and management of thyroid diseases, particularly during pregnancy and the postpartum period. This situation necessitates considering not only the biological processes of diseases but also the psychosocial and nutritional dimensions, which play a critical role in improving patient outcomes, as can be seen in the case of hyperthyroidism, as well as the need to reduce the impact of endocrine disorders on athlete performance and the integration of Medical Nutrition Therapy (MNT) practices into Team and Health Management Protocols. Therefore, the dissemination of multidisciplinary approaches and patient-centered care models in clinical practice is necessary to reduce the complications of thyroid diseases and improve the quality of life of patients. Future research is expected to make significant contributions to the optimization of treatment protocols by revealing the relationships between thyroid functions and intestinal microbiota, nutrition, and genetic factors in more detail.

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