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PSYCHOSOCIAL BALANCE, LIFE SATISFACTION AND LONELINESS OF YOGA PRACTITIONERS IN CONTEMPORARY CULTURE – A SOCIOLOGICAL ANALYSIS

DOI 10.57136/2233-0852/2025.23.37.7 Expert work

Merima Jašarević, Esved Kajtaz

ABSTRACT: The main goal of this scientific work was related to the sociological analysis of the quality of life, individuals, yoga practitioners in contemporary culture, as well as contemporary culture itself. More precisely, in this papper we tried to prove that the erosion of contemporary man is reflected in man's complete alienation from himself and others. Yoga, as an ancient cultural heritage and as a universal tool for positive human development, helps modern man maintain psychosocial balance, satisfaction with life, and prevents feelings of sadness, depression and loneliness. For the purposes of proving this hypothesis, the following instruments were used: the life satisfaction scale, the mental and social balance subscale, the loneliness scale, and the attitude scale about yoga as a tool for the development of human resources. The research results showed that yoga practitioners (mostly women were examined) are in psychosocial balance, have a social life, are satisfied with their own lives and do not feel lonely. However, what the research certainly showed is that there was no spiritual link for yoga practice among the respondents, because a small number of respondents do not go to additional education, do not read spiritual literature and do not meditate regularly. Conclusion of the research shows that yoga is strictly related to social and kinesiological activity and not to spiritual activity.

Keywords: *psychosocial balance, life satisfaction, loneliness, yoga, practicing yoga, contemporary culture*

INTRODUCTION

The aim of this paper is to offer answers concerning the quality of life of individuals in contemporary culture, more precisely, yoga practitioners, and to define and describe the basic characteristics of contemporary culture. Finally, the paper seeks to elaborate a sociological synthesis for understanding yoga practitioners within the context of contemporary culture.

In an environment of general social uncertainty and imbalance, are yoga practitioners protected from external negative factors such as narcissism, dehumanization, and alienation? We witness yoga's global popularity. Yoga is a 5,000-year-old discipline originating from India and is part of the ancient Indian Vedic culture. Originally developed as a practice to unite the physical body with the mind and spirit, yoga today represents a means of relaxation and stress reduction for some, while for others it is a form of exercise that benefits health and improves physical endurance. There are many branches and styles of yoga, but we can say with certainty that yoga is part of contemporary culture, part of the social, cultural, and urban lifestyle of people. For some, the practice of yoga is a sport, while others perceive it as a life commitment, or an escape from reality. We have not raised these questions and reasons for practicing yoga for the purposes of this article. We emphasize that practicing yoga can act preventively in maintaining physical and psychological health. Through a combination of various yoga postures (asanas), breathing techniques (pranayama), and meditation, yoga improves physical, mental, and spiritual well-being. Some benefits of yoga are felt soon after beginning practice, while others require more time. The importance of yoga lies in its comprehensive benefits for body, mind, and spirit. It reduces stress, improves physical fitness, and promotes spiritual well-being. Owing to its focus on breath and movement, yoga helps achieve inner peace, improves posture and endurance, and can serve as a complementary therapy for certain illnesses[1]. Many scientific studies have confirmed the beneficial effects of yoga in regular

1 "Yoga is an ancient spiritual discipline intended to awaken our spiritual nature. According to the Vedas, knowledge of yoga is apaurusheya – is not of human origin, timeless, and derived from a divine source. Several thousand years ago, we were given instructions on how to begin, how to sustain ourselves, and how to progress along this path. This spiritual practice includes the internalization of Yama and Niyama, i.e., ethical principles found deeply in a person's consciousness, the practice of asanas (postures), breathing exercises (pranayama), as well as various techniques of concentration and meditation. The term 'yoga' translates as 'religion,' in the sense of 'connection'. However, the term itself does not denote an organization or adherence to any particular religious affiliation. Rather, yoga represents the root of all religions, the wisdom underlying all sacred texts. Through yoga, we cultivate abilities that enable success in any sphere of life, remaining open to all possibilities. It helps one become a better human being, whether as a Protestant, Catholic, Muslim, Jew, athlete, musician, or scientist. The word 'yoga' means 'to connect, to unite'. It derives from the Sanskrit root yuj (to join, unite) and ghan (completion). Thus, the meaning of yoga is connection with our divine nature, that is, with our divine source, with God. We may therefore define yoga as an ancient method of spiritual practice through which the ātma, the living being, is united with the Paramātmā, the Supreme Divine Being. What separates us (the ego) is precisely what prevents us from experiencing freedom, since the ultimate goal of any yoga practice is the attainment of moksha – liberation or freedom." (Source: https://www.dharmawayyoga.com/scaronto-je-yoga.html, accessed July 15, 2025).

practice on reducing stress and helping to maintain inner peace and balance. That is very significant in today's fast-paced times. Likewise, positive effects have been established in the treatment of certain diseases.

DIFFERENT APPROACHES TO UNDERSTANDING MODERNITY AND CULTURE

Historically, we live in the final stage of capitalism, which is in fact consumerist capitalism. Be that as it may, it is certain that contemporary culture is also referred to as *a culture of hedonism or a culture of narcissism, a McDonald's culture, or more simply, global culture.* Almost all sociologists of culture[2] share a common denominator for today's way of life: money is the essence, or the only unsurpassed criterion/ benchmark of Western European capitalist values. Almost everything is packaged in a materialistic dogma (Bell, 1976; Bert & Keller,1991).

Contemporary culture and its standard of living are most often referred to as global culture, which in its essence is a global capitalist culture (Čolić, 2004). Consumption, the race for a more comfortable life, the pursuit of a kind of perfectionism which, at its core, promises to saturate modern man with complete happiness are all crude characteristics of today (many theorists have elaborated many such characteristics).

Moreover, today's culture is very often associated with rigid individualism, the impossibility of reaching social solidarity, with clear high indicators of the absence of empathy and compassion. We recall Lefebvre's (1982) interpretation of neoliberalism, who said that the neoliberal goal is in fact a striving toward absolutely controlled consumerism in societies, not only in terms of consumer goods and services but also in the form of promised sophistication through them. The result is a general feeling of discomfort, dissatisfaction, and a total crisis of values, showing no signs of remorse within the existing horizon of capitalism.

Contemporary societies are mesmerized by the capitalist mode of production with consumption becoming the *"cultural telos of capitalism"*. In other words, purchasing and consuming are no longer mere acts but rather practices that hold deeper significance for the individual. Consumption frequently emerges as a substitute for the "lost self", which is not established through social interaction but through intensified alienation, offering, albeit superficially, mechanisms of social support and psychological relief. This dynamic generates so-called pseudo-needs that displace authentic human needs, with mass media functioning as their primary generator. As Hromadžić (2012:55) observes, "everyday life comes under the invasion of the culture of spectacle to the extent that it becomes increasingly difficult to distinguish reality from the staging of the spectacular."

The history of societal development represents, to put it mildly, a distancing from both tradition and original human authenticity, resulting in the erosion of traditional social frameworks and the uprooting of their customs, values, beliefs, and sentiments (Touraine 1995:10, in Žažar 2008:185). Modernization, driven primarily by science, anchored the modern individual in a scientific context and its dogmas, marked by secular movements and a withdrawal from any form of transcendental ideas or practices. Processes of urbanization and political revolutions further consolidated the view that investing in economic progress and science represented the most adequate vision of social development. Materialism thereby became the dominant value, while the spiritual dimension of humanity was relegated to the realm of the magical, backward, or simply irrelevant. As Štulhofer and Rimac (2002) note, "rationalization becomes a constitutive part of modernity and of the society in which we live. At the same time, materialist values come to the fore, where individual goals are framed as the maximization of personal gain and the growth of purchasing power. It is also assumed that industry will improve living standards, and that human development, aided by science and technology, will solve social challenges and problems." (Jordanić, 2017).

A recent German study reveals that the phenomenon of *alienation* is not limited to Germany, but extends to all Western democratic, capitalist, and consumerist societies. "Loneliness is becoming an increasingly pressing problem in Germany, according to a new survey conducted by one of the country's leading public health insurance providers. Approximately 60 percent of Germans report feeling lonely often, occasionally, or rarely, according to a study recently presented in Berlin by the Techniker Krankenkasse (TK). The survey, conducted in May by the Forsa Institute, included 1,403 participants interviewed by telephone. Loneliness appears to have a particularly pronounced impact on younger people, that is people between 18 an39 of whom 68 percent report feeling lonely often, occasionally, or rarely. Moreover, 36 percent of young respondents indicated that loneliness affects them strongly or very strongly, compared with only 19 percent in the 40–59 age group and 21 percent among those aged 60 and over" (Deutsche Welle)[3].

Modernity, then, is marked by spectacle, superficiality, alienation, narcissism, and the collapse of moral value systems. At the height of modernism, that is, at the peak of capitalism, postmodern society recognized that materialist culture required a *"more spiritual"* dimension for human survival. Toward the end of the twentieth century, this recognition led to a revitalization of religiosity through new religious movements such as *New Age*, which sought to provide modern individuals with an avenue of escape from an alienated and chaotic world[4]. Zygmunt

2 Marcuse, Horkheimer, Adorno, and the other members of the so-called Frankfurt School raised critical questions concerning the role of culture in capitalist, developed societies.

3 https://www.vecernji.hr/vijesti/muskarce-i-zene-usamljenost-pogada-podjednako-no-u-jednome-se-razlikuju-1823707; accessed June 30, 2025.

4 "New Age – a term denoting the central idea of a worldview movement that emerged in the United States during the 1960s (within the 'demodernization' of youth cultures in California) and a decade later spread to

Bauman (2011) highlighted the new phenomenon of *neotribalism* in capitalist societies, emphasizing that modern individuals would derive pleasure from such loosely structured communities, which allow for easy entry and exit. Theological authors such as Fussel, Solle, and Steffensky argued that postmodernity never offered a platform for serious theological discourse but rather fostered a cultural climate of indifference, in which all individuals are regarded as "equally important, equally valuable." In this framework, God and religion become phenomena refracted through politics, sport, money, and entertainment. Religiosity is transformed into a new mode of consumerism, a fatal worship of idols within culture, and subservience to the only enduring criterion, i.e., money as the postmodern totem, often the most decisive factor for inclusion in global consciousness and culture. As early as the 1970s, Richard Easterlin (1974) argued that economic growth does not necessarily result in greater happiness. The idea that development fails to enhance happiness stems from the claim that people pursue alternative sources of fulfillment beyond economic advancement. These alternatives include traditions, spirituality, and anti-materialist values, which are particularly prominent in New Age movements (Veenhoven 2012:5). Similarly, Robert Lane (2000) stated that we will derive more happiness from friendship than from consumption. It is for this reason that the present study examined eight values among students and assessed the extent to which friendship influences their subjective life satisfaction (Veenhoven 2012:5, according to Zlopaša, 2017).

CONTEMPORARY CULTURE AND MENTAL HEALTH

Stress, anxiety, depression, bipolar disorder, passive or active aggression, post-traumatic stress disorder, and many other psychological conditions represent only a fraction of what, under the influence of the media, the environment, and one's own thoughts, modern individuals permit themselves, in varying degrees, to experience in modern everyday life. As intellectual and emotional beings, we are witnesses to the constant inner battles we fight – novel-like struggles against individuals or groups because of the ongoing conflict between heart and mind, or, as those engaged in spiritual traditions might describe it, between the "ego" and the "higher self." Our heart (not in the sense of its medical function, but rather in terms of the human "software" called the soul) knows what we desire, while our mind knows (at least presumes to know) what we deserve. This misalignment often affects those around us, yet according to global WHO statistics, every 40 seconds one suicide occurs, amounting to around 800,000 suicides annually. That indicates that the suffering does not only extend to others, but to individuals themselves[5].

Mental and physical health are inseparable components of overall health. Mental health denotes a broad concept that encompasses both positive (well-being) and negative (dysfunctional) states of mental health. Good mental health is a condition in which an individual realizes their capacities, is able to cope with the stresses of everyday life, works productively, and contributes to the community. Impaired mental health involves problems and dysfunctional functioning associated with distress, symptoms, or clinically manifest mental disorders (Radić, Silobčić, 2011).

According to estimates from 2017, more than 20% of the adult population in Europe was, at any given time, affected by a mental health problem or disorder. Among adolescents, the prevalence was estimated to be comparable.

In view of constantly rising indicators, it is evident that the world must pay greater attention to one of its most crucial challenges: mental health. Some projections suggest that by 2030, the leading cause of illness will be conditions directly related to mental health, which in turn provoke additional disorders within the human body and social reality.

According to 2009 research, presented in the article Mental Health, Dr. Maja Radić reported that men are more prone to certain conditions, particularly alcohol dependency, while women are more likely to experience various forms of depressive disorders, the leading type of mental illness in Croatia.

Before the COVID-19 pandemic, one in six people in the EU experienced mental health problems. Further crises in recent years have exacerbated this situation. The pandemic represented a serious threat to mental health, particularly among young people and those already facing psychological difficulties[6]. Rapid technological, environmental, and social changes have further undermined the ability of some individuals to cope with these transformations.

Today, we live in an era in which individuals are largely left to themselves, an era in which security is difficult to attain. Quite evidently, the opposite has emerged across societies worldwide: insecurity as a dominant narrative. In other words, individuals are left to find meaning by relying on themselves and their own capacities. With the transformation of families, insecurity has entered even the domestic sphere. Many crises affecting societies are felt most

Europe. The movement emphasizes experience while opposing technologies and the scientific worldview. It promotes a transformation of consciousness into a new planetary consciousness, advocating ecology and a shift from anthropocentrism to biocentrism. It appears as a syncretistic spiritual movement that combines elements of the Judeo-Christian tradition, Eastern religions, Gnosis and occultism, together with modern natural sciences permeated by astrology. Its symbol is Aquarius, with which a new light arrives, and the era of Pisces (the symbol of Christianity) ends. New Age is thus the proclamation of a new age that brings with it the transformation of the human soul and of the world as a whole." New Age. Hrvatska enciklopedija, online edition. Leksikografski zavod Miroslav Krleža, 2013–2025. Accessed June 30, 2025. https://www.enciklopedija.hr/clanak/new-age

5 https://www.abc-doctors.com/vaznost-mentalnog-zdravlja.

6 https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/promoting-our-european-way-life/european-health-union/comprehensive-approach-mental-health_hr

turbulently within families, where high rates of divorce and domestic violence contribute to feelings of insecurity not only among children but also among adults. Constant social crises, economic instability as well as wars, further exacerbate the rise of mental health disorders among contemporary individuals (Milić, 2007).

Furthermore, "the consequence of late modernity is a world in which individuals have withdrawn into themselves, no longer relying on the networks of meaning and material security characteristic of 'solid' modernity, but instead on the 'liquid' and shifting qualities of their own emotional and intellectual capacities" (Baćak, 2007, p. 11). This results in individuals seeking additional knowledge and information in order to find meaning and a role within society, one that enhances their quality of life and equips them to cope with social transformations and the changing ways of living that life itself entails. Giddens argues that the ontological security of solid modernity has dissolved under the pressures of change brought about by late modernity (Baćak, 2007).

Contemporary societies are undoubtedly struggling to confront challenges related to mental health, particularly due to the absence of a holistic approach. Instead, mental health is predominantly treated as a matter of individual cases, especially when behavioral disorders are concerned. There are no comprehensive statistical data on the prevalence of mental illness across countries, despite the availability of data on material wealth, employment, birth rates, and mortality. The only indicators that can indirectly reflect mental health are statistics on suicides, homicides, and alcoholism. It is generally assumed that the rates of suicide and homicide are closely tied to the state of mental health and stability within a society.

At the height of modernity and the emergence of postmodernity, it was believed that the material wealth of certain societies would enable nations to become happier and more content. However, this did not occur. Humanity has not mastered nature; rather, human helplessness in the face of natural disasters is a daily reality. The relationship between humans and nature has thus been reduced to a scientific, alienated intellect.

The modern individual experiences nature as a shopping mall, as an endless source of commodities that serve to fulfill desires, from which one simply takes what is needed. Yet economic progress remains a privilege of wealthy nations and individuals. International economic institutions consistently publish new data on the widening gap between rich and poor states, as well as between wealthy and impoverished individuals within the same society. Injustice in the distribution of wealth and the economic exploitation of weaker and poorer groups has become a normalized feature of contemporary society. This preoccupation with the self and the prioritization of one's own needs does not foster harmony or peace. It only reinforces greed and egocentrism (Fromm, 1975, according to Devčić, 2023).

Baudrillard identified as a defining element of contemporary culture, one that generates profound human disintegration, the phenomenon of commodification, where everything becomes a product. Everything is replaceable and everything is for sale, including the buyer. This extraordinary hyper-superficiality and indifference leads to a universal human crisis. Commodities are not confined to store shelves; they surround us everywhere, and we ourselves are commodified. Supermarkets, in this sense, constitute the nucleus of a synthetic agglomeration that no longer has anything in common with the city. Within contemporary society, most people, outside of their working hours, spend time in synthetic environments composed of massive billboards and spaces where the newest commodities are offered at the lowest possible prices (Baudrillard, 1991).

The contemporary individual, increasingly commodified, inhabits a space detached from the centers of knowledge and spirit, enclosed within a materialized world of advertisements and consumer goods, and interacting primarily through technological novelties. One might argue that the individual is no longer genuinely social and that authentic communication has largely ceased. Mass media absorb and erode the social sphere, as information itself dissolves meaning and transforms the social into a kind of nebulous abstraction. The modern individual emerges as a voluntary slave who consciously accepts the rules of a game structured by virtual forms of expression, advertising, and commodified imagery. In this context, meaning is lost through the mimicry of trivial actions and superficial fascinations with material products. Individuals seek a sense of self through the imitated behaviors of television soap operas, films, and so-called "reality" programs, thereby suffocating their being in favor of external, "plasmatic" projections of beauty and desirability (Baudrillard, 1991).

With the advent of post-industrial modernization, Beck (1986, as cited in Tomić-Koludrović & Leburić, 2002) identifies an intensification of individualization and the pluralization of identity. Societies, in this process, turn inward toward the cultivation and elaboration of personal identity. Contemporary societies provide new possibilities and choices for identity construction, but these also entail new risks. As Tomić-Koludrović and Knežević (2004) note, the trajectories of identity formation in late modernity cannot be fully predicted or controlled: "In other words, in the new modernity opportunities for personal development are opening up that were less accessible, less visible, or approached with greater skepticism in earlier periods; yet the outcomes of contemporary identity construction remain indeterminate." (Jordanić, 2017)

The lifestyle of the newly wealthy, as Westherill (2005) argues, is ostentatious and superficial. Such a mode of existence lacks true creativity, which presupposes confronting paranoid-schizoid anxieties, immersing oneself in chaos, and ultimately achieving a renewed integration. Instead, what we witness is a detachment, a separation of the individual from that which ought to inspire genuine engagement. This releases infantilized desires, accompanied by narcissistic feelings of omnipotence and exhibitionism, and results in living without place, without roots, and therefore in extreme instability. The modern human being is thus a voluntary

slave within a contemporary system of servitude, subjugated through information and manipulation. As Baudrillard (1998) observes: "What occurs without the slave? In the end, he terrorizes himself. And with the slave without a master? In the end, he exploits himself. Today these two conditions are united in the modern form of voluntary servitude: subjugation to data systems, computer systems, universal efficiency, universal performance. We have become masters, at least virtual masters of this world, but the objects of such mastery have disappeared along with its very purpose."

The blind development of technology, as a matter of fact, leads to greater oppression of the social sphere, and of the human being itself. Increasingly, as we can see in examples from California (Baudrillard's case in point), people lack genuine relations with others: there are no gazes directed toward those around them, nor physical forms of contact such as embraces or handshakes. A large number of California's inhabitants attend contact therapy sessions in order to secure one of the essential dimensions, even though every inherently individual possesses it, of human existence: sociality. In the absence of interpersonal contact, in situations of extreme alienation, people are compelled to seek out different forms of therapy: contact therapy is one such form, but there are also dance therapy, music therapy, yoga, tai chi, and the like. In California, as elsewhere in the developed West, individuals attempt to recover and reconstruct functions that have been lost in the postmodern age. Some engage in work on the body in order to enrich sociality as a fundamental element of being human, and through corporeality they also rediscover spirituality within themselves. Others seek to restore their sense of self through health practices and healthy nutrition.

In his essay *The Ecstasy of Communication*, Baudrillard observes that we ourselves, that is, our bodies and our minds, have become saturated with television images: no longer subjects, but rather objects, like the image displayed on the screen, living in the age of the "remote control." In this sense, we are governed by an environment that itself functions as a universal remote. Baudrillard also recalls Roland Barthes's earlier suggestion concerning drivers: gradually, the idea of "driving" shifted from the act of driving itself to driving a "computer on wheels." Cars have become capsules equipped with controls and command systems, transformed into dashboards filled with instruments that reproduce landscapes much like television screens. What Baudrillard finds particularly striking is that cars now feature a human voice system that spontaneously addresses the driver with useful information. The fundamental outcome of such a talking car is the establishment of communication between driver and vehicle, a sudden test of the subject's presence with its object in the form of uninterrupted confrontation. Every system, he argues, seeks to develop its own "ecological niche," the essence of which is the maintenance of continuous communication, whether between car and human, computer and human, stove and human, and so forth (Baudrillard, in Foster, 2002).

We live in an extraordinary age, one of hyperreality, which in many ways entails a life without metaphysics, metaphor, or mental meaning. Today, everything is projected into reality devoid of sense. What remains after the last scene of performance and fantasy is "a large useless body, deserted and condemned" (Baudrillard, in Foster, 2002, p. 149). The reality of our lives emerges as a useless body. Very often our bodies are displayed superficially, as extensions of our own uselessness, since existence today is reduced to questions of the brain and genetic codes, which themselves operationalize and finalize the definition of being. Our consumerist society sustains itself on alienation, meaninglessness, and spectacle. Everyday life, basic practices such as eating, sleeping, and dwelling, exists "only as a prisoner within the illusory wealth of enhanced survival, which constitutes the real foundation for the general acceptance of illusion in the consumption of modern commodities. The true consumer thus becomes a consumer of illusions. The commodity itself is that illusion which is in fact real, while the spectacle is its general manifestation" (Debord, 1992).

THE PRACTICE OF YOGA, LIFE SATISFACTION, AND LONELINESS IN CONTEMORARY CULTURE – A SOCIOLOGICAL ANALYSIS

For the purposes of this article, we conducted an online survey in July 2025. The questionnaire included several assessment scales in addition to the standard demographic framework of the study[7]. Lacković-Grgin et al. (2002) adapted and developed a Life Satisfaction Scale, which consists of seventeen items based on global satisfaction and three items based on situational satisfaction. For the present study, twelve global satisfaction items and three situational satisfaction items were used. Respondents indicated their answers on a Likert-type scale.

The mental and social balance subscale – through exploratory factor analysis, Jordanić (2017) examined the Healthy Lifestyle and Personal Control scale (Darviri et al., 2014), which revealed three factors: (1) healthy diet and physical activity (12 items), (2) daily routines (6 items), and (3) mental and social balance (6 items). For this study, only the third factor (subscale) concerning mental and social balance was applied. The UCLA Loneliness Scale (Russell, Peplau, & Cutrona, 1980) was also employed. This revised version consists of twenty items, and respondents rated their agreement on a four-point Likert scale ranging from 1 (never) to 4 (always). Finally, the Scale of Attitudes toward Yoga as a Tool for Human Resource Development (Patel & Chauhan, 2018)

7 The sociodemographic questionnaire was adapted to the theme and the structure of the respondents. It consisted of nine questions that examined: the respondent's gender, level of education, family status, occupation, religiosity, engagement in meditation, practice of yoga or similar techniques, reading of books on personal or spiritual development, and participation in workshops, training sessions, or lectures related to personal or spiritual development.

was used. It comprises twelve items, with responses collected on a Likert-type scale.

Main Hypothesis: the erosion of the contemporary human condition is reflected in the individual's profound alienation from oneself and from others. Yoga, as both an ancient cultural heritage and a contemporary tool for positive human development, assists modern individuals in maintaining psychosocial balance and life satisfaction, while preventing feelings of sadness, depression, and loneliness.

Sample: the respondents were affiliated with two yoga schools in Mostar and Sarajevo. The total sample consisted of 54 participants. The majority were women, who accounted for 94.4% of the sample (51 participants). Most of the respondents (66.7%) had completed higher education. Regarding marital status, 55.6% were married, while 34% were without a partner (14.8% divorced, 20.4% single). The largest proportion of respondents worked in the social sciences sector (22.2%), followed by 13.3% in administrative occupations, with the smallest number working in the IT sector.

The demographic analysis revealed that the majority of respondents identified as religious but rarely practiced (25.9%), or as non-religious yet respectful of all religions (25.9%). Only 16.7% of yoga practitioners identified as religious and regularly practiced their faith.

From these results, it can be concluded that the sample predominantly consisted of educated women from Mostar and Sarajevo, who are not religious practitioners and are largely affiliated with the social sciences. A significant number were occasionally active in meditation practices, with only 14.8% meditating regularly. Many participants practiced yoga as well as other related techniques such as Tai Chi, Qigong, or Pilates, with 59.3% doing so regularly and 33.3% occasionally.

In addition to yoga and meditation, respondents were asked whether they read literature on spiritual development. Of these, 20% reported reading books on spiritual development regularly, while 51.9% do so occasionally, making this the largest group. We also employed a measurement scale to assess the extent to which participants attend workshops, training sessions, or lectures related to personal or spiritual development. As many as 59.3% reported that they do not attend such events at all, while 25.9% attend them occasionally. These findings suggest that yoga practitioners in our sample approach yoga primarily as a kinesiological or sporting activity rather than a spiritual practice.

Life satisfaction among yoga practitioners

For the purposes of this article, we developed a life satisfaction scale consisting of 15 items. The analysis yielded the following findings and conclusions:

A majority of respondents expressed satisfaction with their living conditions – 51.9% agreed that their living conditions are excellent, while 31.5% fully agreed with this statement. In a similar distribution of responses, the majority either agreed or fully agreed that they are satisfied with their lives. Furthermore, 56% stated that they would not change anything about their lives if given the chance to live again, while 10% indicated that they would.

A striking 88.8% of respondents described themselves as very happy. Similarly, 83.3% reported that life brings them considerable satisfaction. However, when compared to others, responses revealed slight variation, with a smaller proportion perceiving themselves as less happy than their peers. Specifically, 70.4% disagreed or strongly disagreed with the claim that, overall, they are less happy than others.

Respondents also demonstrated a positive outlook on the future, with 81.5% reporting that they view their future as good. In line with this, 74.1% expressed satisfaction with the way their life plans are being realized. The vast majority, i.e., 90%, stated that they enjoy life, 60% reported feeling loved by others, and as many as 70% indicated that they have experienced complete happiness.

Taken together, these findings suggest that the majority of yoga practitioners in our sample, drawn from two yoga schools in Mostar and Sarajevo, are greatly satisfied with their lives. It is worth noting that most participants were highly educated women living urban lifestyles. They contribute to their life satisfaction in the form of a diverse range of cultural and social opportunities, including yoga practice. It may also be assumed that respondents hold stable, well-paid jobs that further support their standard of living.

In addition to the life satisfaction scale, we examined the *mental and social balance of yoga practitioners*. This brief section of analysis indicates that participants, the majority of whom were women, are generally well-adjusted socially and maintain both mental and social equilibrium. Specifically, 73% reported being able to focus on positive thoughts during challenging situations. A majority of 70% of respondents stated that they meet and converse with friends and succeed in balancing work and private life. Indeed, 83% reported frequently or always managing to achieve such balance. Moreover, 77% indicated that they often or sometimes have friends to confide in regarding personal concerns. Finally, 66% stated that they clear their minds of daily concerns before going to sleep.

YOGA PRACTITIONERS AND LONELINESS

The loneliness scale confirms that our respondents, yoga practitioners, do not generally feel lonely and report having social support. For instance, a large majority (68.5%) stated that they always have someone to talk to, and 72.2% indicated that there are people they can always turn to. Moreover, 86% of practitioners reported that there are people in their environment who truly understand them. Most respondents also perceive themselves as extroverted, with 66% disagreeing that they are sad due to being socially withdrawn. Responses were more divided regarding the perception that people are around them but not truly with them: about half of respondents frequently feel their relationships are superficial,

while the other half disagrees. Additionally, 53% of participants do not feel isolated from others, whereas 42.6% do. Around 58% believe that no one knows them well, and 59.3% perceive their social relationships and lives as superficial. Overall, yoga practitioners in this study are socially active and view themselves and their lives positively, though the data suggest that their social relationships are not particularly deep or close. Notably, 68.5% of respondents reported that their personal interests and ideas are not shared with those around them.

YOGA PRACTICE

Finally, the online questionnaire assessed participants' attitudes toward yoga practice itself. As expected, 83.3% fully agreed that yoga refreshes the mind, 81.5% agreed that it helps revitalize human energy, and 94.4% fully agreed that yoga supports the maintenance of vitality. Furthermore, 68.5% believe that yoga enables the full development of the individual, and 61.1% fully agreed that it strengthens the human heart.

CONCLUSION

Yoga was first introduced by Vedic priests in northern India approximately 5,000 years ago. During the colonial period in India, yoga gained greater popularity as Indian yogis sought to demonstrate its health benefits to colonizers. Over time, yoga gradually entered Western mainstream culture and is now widely practiced across different social strata (Askegaard & Eckhardt, 2012, p. 45). While some individuals practice yoga for spiritual reasons, others focus on its physical aspects and the contributions it makes to human well-being. Some researchers (Thompson-Ochoa, 2019) have raised questions about whether yoga's popularity and place in modern culture constitute cultural appropriation (Young & Brunk, 2012). Additionally, scholars have emphasized that a strict focus on the physical aspects of yoga in modern culture risks undermining its original spiritual and philosophical dimensions (Antony, 2014).

Although we did not investigate our respondents' motivations for practicing yoga, our study's hypothesis was fully confirmed. Our findings indicate that yoga practitioners (predominantly women in this sample) maintain psychosocial balance, have social lives with close friends and their "tribe," are satisfied with their lives, and do not feel lonely. However, the study also revealed that the spiritual dimension of yoga practice is largely absent: very few participants regularly attend additional personal development courses, read spiritual literature, engage in regular meditation (only 14.8%), or maintain a religious practice.

Accordingly, our research suggests that yoga, as practiced by our respondents, is primarily a social and kinesiological activity rather than a spiritual one. Participants do not feel isolated from others but lack close, deeply knowing relationships, indicating a deficit of deeper social connections.

Global culture today functions as a "global consumption space" ("global village") and represents the cultural mainstream. All cultural forms are transformed due to extensive international economic, cultural, and technological flows, which facilitate cultural exchange and connect consumers across distant cultures. It is no secret that everything is subject to the global market and that, in fact, everything constitutes a market. As Merry (1998) notes, this transformation also affects how yoga is perceived and practiced outside its original context. The growing popularity of yoga in the Western world raises questions about whether such practices constitute cultural appropriation (Askegaard & Eckhardt, 2014). According to Tupper (2009), cultural appropriation can be defined as "…taking intellectual property, cultural expressions or artifacts, history, and ways of knowing from a culture that is not our own." The ethical problem is that non-indigenous populations may lack the moral or ethical authority to appropriate elements of a culture (nor do they respect elements of appropriation to a just degree) developed and practiced by a particular ethnic group. Moreover, the appropriation of cultural elements is often unprotected by laws, leaving indigenous cultures vulnerable. Currently, yoga is promoted as a set of techniques that can help individuals improve and optimize their health and physical performance. Our study confirms that yoga also supports the maintenance of psychosocial balance. Askegaard and Eckhardt argue that the strong marketing of yoga makes it appealing not only to Westerners but also to Indians. Contemporary yoga is associated with the demystification of old paradigms, offering pragmatic and scientifically grounded solutions for various health issues. Even in contemporary India, many local yogis present their teachings as scientific methods, influenced by Western perspectives.

Finally, numerous researchers emphasize that contemporary yoga practice is largely separated from its philosophical and religious origins. Most practitioners focus on or adhere to a form of "abstract spiritualism," expecting physical practice to trigger spiritual engagement in yoga practitioners. Contemporary yoga practices are thus part of modern cultural evolution. Yoga's global popularity reflects cultural appropriation by Western culture, creating a paradox in which the acceptance of yoga in the West has turned it into a trend, extremely popular among urban consumers worldwide, including middle-class Indians. This process has contributed to the rebranding of yoga in India, making it more attractive to the modern consumer while intensifying sociological discussions on the adoption of cultural elements by global consumers, ultimately enhancing the popularity and success of yoga both domestically and internationally (Thompson-Ochoa, 2019).

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AN ANALYTICAL-METHODOLOGICAL MODEL FOR TEACHING HANDSTAND IN KINESIOLOGY PRACTICE

DOI 10.57136/2233-0852/2025.23.37.15 Expert work

Sunčica Delaš Kalinski

ABSTRACT: The handstand represents a fundamental gymnastics skill and a key component of numerous sport disciplines requiring control of an inverted body position. The aim of this paper is to present an analytical–methodological model for learning the handstand, grounded in biomechanical and motor learning principles as well as contemporary scientific insights. The learning phases are systematically elaborated, ranging from the development of an initial postural representation, through progressive *methodological* approaches and assisted techniques, to independent execution. The model incorporates the development of specific upper-body strength, postural control, and mobility, with particular emphasis on technical accuracy and safe methodological implementation. Common errors and corresponding corrective strategies are also outlined. The proposed model may serve as a practical guide for coaches, physical education teachers, and kinesiologists, as well as a theoretical framework for future research aimed at optimizing handstand skill acquisition.

Keywords: *handstand, teaching methodology, motor learning, balance, gymnastics*

INTRODUCION

The handstand is a fundamental element of artistic gymnastics and is defined as supporting the body in a stable, inverted and vertical position on the hands (Wyatt et al., 2021). Within gymnastics literature and coaching practice, it is frequently emphasized as one of the most important beginner skills and a prerequisite for higher-level performance, as it appears on five of the six apparatuses in men's and women's artistic gymnastics; the only exception is vault, although the WAG Code of Points still notes that an ideally executed vault passes through a handstand position at some phase of the movement. Consequently, optimal technical execution of the handstand is of vital importance for progression toward more complex skills across apparatuses and under varying (stable and unstable) conditions, whereas technical deviations increase the risk of injury and suboptimal training or competitive performance. Beyond gymnastics, the handstand is increasingly incorporated in athletic strength and conditioning programs, CrossFit training, yoga practice, and rehabilitation settings as a means to develop postural control, shoulder girdle strength, and neuromuscular stability (Claudino et al., 2018; Faigenbaum & Myer, 2010; Cowen & Adams, 2005; Telles et al., 2012; Behm & Colado, 2012).

Proper handstand technique begins from an upright stance with arms overhead. The movement is initiated by a forward lunge, followed by trunk flexion and placement of the hands on the floor in parallel alignment while simultaneously swinging the lead leg upward. By pushing off the ground with the support leg and stopping the swing leg above shoulder level, the gymnast reaches the handstand position: the body is fully extended at the shoulder and hip joints, arms and legs remain straight, and the head is held in line with the body with the gaze directed toward the hands. The handstand position is held for 2–3 seconds, after which one leg and then the other descend to the floor, the arms push away from the ground, the trunk rises from the forward bend, and the arms finish again in an overhead position (Figure 1).

Figure 1. Handstand execution**.** Created by author

From a technical standpoint, high-quality handstand performance requires a straight, fully aligned body position without angular deviations at the shoulders, elbows, hips, or knees (Hedbávný et al., 2013; Uzunov, 2008), with the center of mass fixed above the hands, the head aligned axially with the spine, and no space between the shoulders and the ears (Gerling, 2009; Uzunov, 2008). Such a position demands synchronized action across multiple joints — including the wrists, elbows, shoulders, hips, ankles, and cervical spine — and specific muscle activation patterns (e.g., trapezius, biceps/triceps brachii, deltoid, rectus femoris), which vary depending on the athlete's level of experience and technical proficiency (Kochanowicz, 2019).

From a biomechanical perspective, handstand stability relies primarily on the wrist strategy, which facilitates precise postural adjustments in the anteroposterior plane (Kerwin & Trewartha, 2001; Yeadon & Trewartha, 2003; Mohammadi & Yazici, 2016). The shoulder and hip joints also contribute to balance control; however, excessive activation in these segments may reduce balance efficiency (Kerwin & Trewartha, 2001; Gautier, Marin, Leroy, & Thouvarecq, 2009).

THEORETICAL FOUNDATIONS OF HANDSTAND LEARNING

Handstand learning is conducted through an analytical method, which involves decomposing the movement into smaller components, mastering a sequence of

preparatory exercises, and subsequently integrating them into the final technically correct execution. Because the effectiveness of specific methodological strategies varies among individuals, methodological diversity is essential to accommodate differences in motor abilities, morphological characteristics, and individual learning styles.

Given the pervasive importance of the handstand in artistic gymnastics, instruction should begin at an early age, with repeated practice and refinement of technique to enhance balance control in both upright and inverted body positions (Gautier, Thouvarecq, & Larue, 2007; Croix, Chollet, & Thouvarecq, 2010; Asseman, Caron, & Crémieux, 2004). Nevertheless, despite consensus regarding the essential role of correct technique, optimal teaching and development methods for the handstand remain insufficiently defined (Uzunov, 2008).

Existing, albeit limited, research on feedback during handstand learning suggests that precise verbal cues (e.g., *"shoulders over finger joints"*) can be highly beneficial for children (Masser, 1993), observational practice using animated models is more effective than verbal instruction alone for improving balance (Ghavami, Hosseini, & Mohammadzadeh, 2012), and the combination of visual and verbal instruction yields superior outcomes when observational practice follows verbal instruction by one hour (Maleki et al., 2010). Additionally, a light tactile contact with the fingertips on the lateral thighs may enhance performance and compensate for visual deprivation (Croix et al., 2010). Although both feedback and physical practice are essential for motor learning (Shea et al., 2000), the extent to which skill improvements result from feedback itself versus repetition remains unclear. Recent applied motor-learning studies further indicate that tactile-verbal and visual-comparative feedback exert distinct yet beneficial effects on posture and performance in beginners, supporting the recommendation to integrate both forms of feedback (Rohleder & Vogt, 2018).

METHODOLOGY OF HANDSTAND LEARNING

In the initial stages of handstand learning, it is necessary to simultaneously develop two components: (I) technical knowledge through analytical instruction (Figures 2 -14) and (II) physical preparedness, to enable maximal technical precision in execution (Figures 15-49). Accordingly, handstand learning is grounded in technical, physical, and mental preparation, with the aim of enabling the performer to master and recognize the correct body position (Uzunov, 2008). The primary objective is to eliminate fear of inversion and acquire the fundamental structure of the movement.

I) Learning the Handstand Using the Analytical Method

Developing the perception of the vertical body position

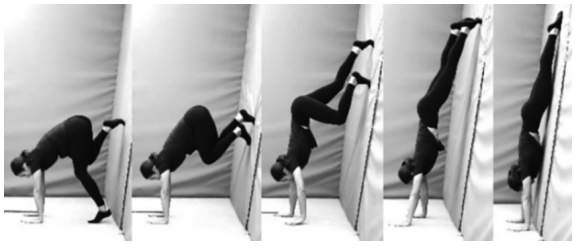

Figure 2. Attaining the handstand by "climbing" up a vertical surface

3. From a prone support position, transitioning into a handstand with assistance

Two-foot take-offs and single-leg swings to elevate the trunk/hips into a vertical position

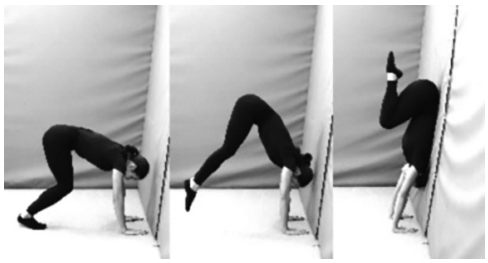

Figure 4. Two-foot take-offs to a "half-handstand" with assistance/wall

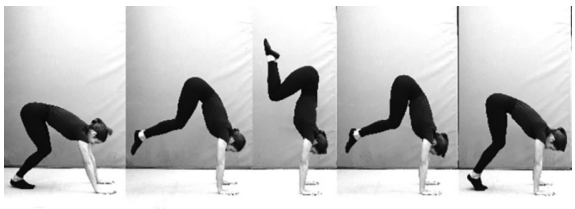

Figure 5. Two-foot take-offs to a "half-handstand" independently

Figure 5. From a kneeling support, swinging into a handstand: with assistance/against the wall/independently

Lunge and backward leg swing preparation

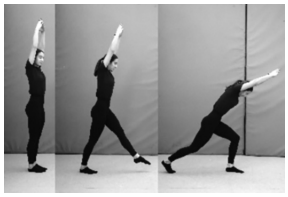

Figure 6. Lunge and hold with arms in overhead position, gaze directed toward the hands

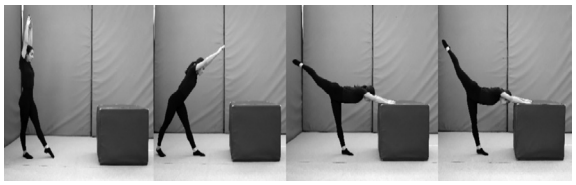

Figure 7. Lunge and hold with the swing leg extended backward, trunk flexed with arms overhead

Figure 8. From a forward bend with hands on the floor, swinging the lead leg against a wall, then free in space

Handstand execution with assistance

Figure 9. Handstand execution with assistance (assistant positioned on the swing-leg side)

Independent handstand practice with a vertical support

Figure 10. From a forward bend with leg extension and take-off from the support leg, handstand against a wall

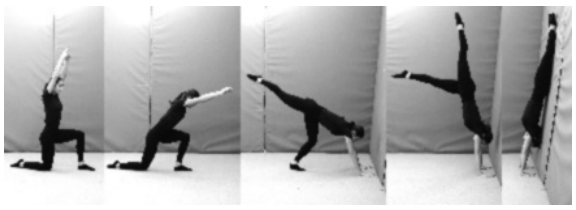

Figure 11. From kneeling, swinging into a handstand against a wall

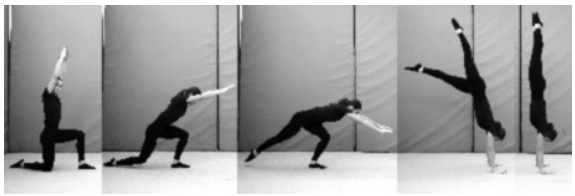

Figure 12. From kneeling, swinging into a handstand in free space

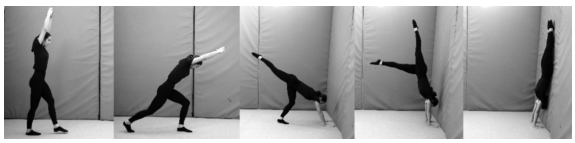

Figure 13. From a standing position with arms overhead, handstand with wall support (wall or stall bars) / with assistance

Figure 14. From a standing position with arms overhead, performing a free-standing handstand in space

II) Development of Physical Preparedness

In parallel with the aforementioned methodological procedures, it is necessary to simultaneously develop upper-limb and shoulder-girdle strength and endurance, proper posture, and flexibility. At this stage, training volume and technical precision take priority over intensity. Static exercises should be held for 15–30 seconds, and dynamic exercises should be performed in sets of 5–10 repetitions (Figures 15-49).

There are several key components of handstand performance that require specific preparatory exercises and conditioning:

- Hand and wrist positioning and strengthening
- Body shape control
- Shoulder-girdle positioning and strengthening
- Maintaining posterior pelvic tilt

Hand and Wrist Preparation Exercises for Handstand Learning

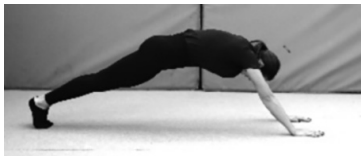

Figure 15. "Gymnastics hollow" position

Figure 16. Handstand with both feet supported on an elevated surface

Figure 17. Handstand with one foot supported on an elevated surface

Figure 18. "Frog stand" hold

Figure 19. Wall walk-ups

Figure 20. Mixed support movements on an elevated surface (with assistance)

Body Shape Exercises for Handstand Learning

Figure 21. Front hang on bar

Figure 22. Inverted hang

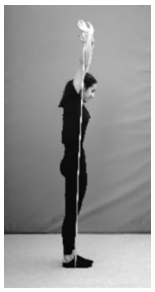

Figure 23. Upright standing hold with arms overhead using resistance band

Figure 24. From prone support, raising into a handstand with assistance

Shoulder-Girdle Preparation Exercises for Handstand Learning

Figure 25. Scapular protraction/retraction with feet on the floor

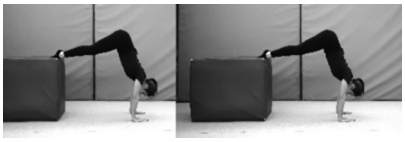

Figure 26. Scapular protraction/retraction with feet on on an elevated surface

Figure 26. From front support to plank support and back

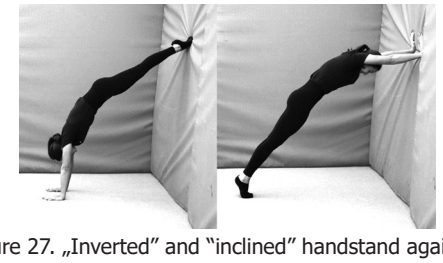

Figure 27. „Inverted" and "inclined" handstand against a vertical surface

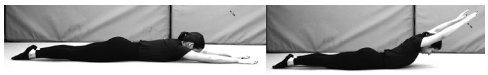

Figure 28. Scapular retraction

Figure 29. Shoulder flexion work

Figure 29. Shoulder elevation drills

Figure 30. Prone support on a balance board

Figure 31. Prone support on a balance board with legs on support

Figure 32. Handstand on a balance board

Figure 33. Rotating the balance board in prone support

Figure 34. Rotating the balance board in handstand position

Exercises for Maintaining Posterior Pelvic Tilt in Handstand Learning

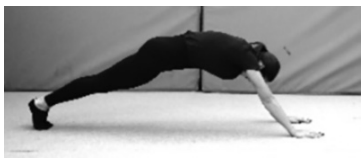

Figure 35. Static hold emphasizing posterior pelvic tilt – variation 1

Figure 36. Static hold emphasizing posterior pelvic tilt – variation 2

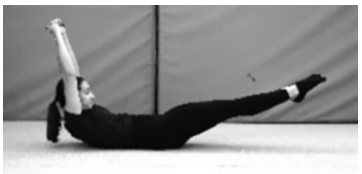

Figure 37. Static hold emphasizing posterior pelvic tilt – variation 3

Figure 38. Static hold emphasizing posterior pelvic tilt – variation 4

Figure 39. Static hold emphasizing posterior pelvic tilt – variation 5

Figure 40. Static hold emphasizing posterior pelvic tilt – variation 6

Figure 41. Static hold emphasizing posterior pelvic tilt – variation 7

Figure 42. Static hold emphasizing posterior pelvic tilt – variation 8

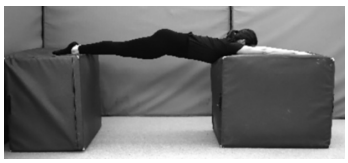

Figure 43. Static hold emphasizing posterior pelvic tilt – variation 9

Figure 44. Static hold emphasizing posterior pelvic tilt – variation 10

Figure 45. Static holds in various positions emphasizing posterior pelvic tilt – variation 11

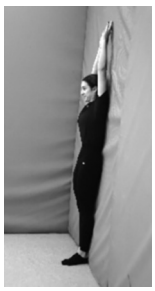

Figure 46. Static hold emphasizing posterior pelvic tilt – variation 12

Figure 47. Static hold emphasizing posterior pelvic tilt – variation 13

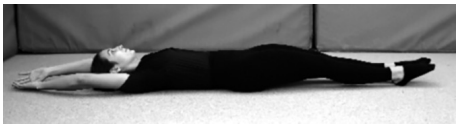

Figure 48. Static hold emphasizing posterior pelvic tilt – variation 14

Figure 49. Static holds in various positions emphasizing posterior pelvic tilt – variation 15

Common Errors and Corrective Strategies

Error	Cause	Correction
"Banana" position	Insufficient trunk control	Hollow body exercises, posterior pelvic tilt cues
Shoulders dropped	Inadequate scapular activation	Scapular shrugs, wall-facing handstand variations
Excess pressure on heel of hands	Lack of active hand engagement	"Fingers as brakes" cue
Looking forward	Cervical extension, shortened neck position	Gaze between the hands
Excessive kick-up	Poor entry control	"Tuck kick-up" drill against the wall

CONCLUSION

The handstand is one of the fundamental motor skills in artistic gymnastics and one of the most widely applicable elements, as it is performed on nearly all apparatuses in both men's and women's competition. This paper presents and elaborates a comprehensive model for learning and refining the handstand, structured through systematically organized methodological procedures and exercises that form the foundation of general and specific conditioning required for optimal technical execution and stable balance in an inverted position.

The proposed model can serve gymnastics coaches as a practical and theoretical framework for planning, progression, and monitoring training processes, emphasizing the importance of ideal body alignment, postural control, and neuromuscular activation during performance. Moreover, it is applicable to other sport disciplines that integrate handstand elements, such as acrobatic gymnastics, capoeira, circus arts, and various dance forms.

Given its broad applicability, biomechanical complexity, and high technical demands, the handstand remains a key topic for further scientific and methodological research, particularly within the domains of motor learning, biomechanics, and kinesiology education.

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SPORTS PERFECTIONISM: GENDER AND AGE DIFFERENCES IN THE CADET AND JUNIOR VOLLEYBALL POPULATION

DOI 10.57136/2233-0852/2025.23.37.23 Original scientific work

Miroljub Ivanović, Irina Ćosić

ABSTRACT: The aim of this cross-sectional online study was to test statistically significant differences between the dimensions of the construct of multidimensional sports perfectionism in volleyball players of both sexes (cadets and juniors). A pertinent heterogeneous sample included 225 respondents with an average age (Myears = 23.60, SD years = 3.45). The Sports Multidimensional Perfectionism questionnaire (SMPS-2) was administered online. Cronbach's alpha coefficients (Cronbach's α) showed satisfactory reliability of internal consistency, so the measuring instrument can be operationalized on the Serbian population. The parametric methods used (univariate analysis of variance - ANOVA, t-test for independent samples and F-statistics) only in volleyball women, at the error level ($p \leq 0.05$), determined a statistically significant difference in the perception of sports perfectionism only in the variables: concern about mistakes and perceived pressure from the coach. The empirical findings obtained using the app (Google Forms) suggest that cadets and juniors differ significantly from each other with regard to the measured sports perfectionism, i.e. they do not belong to the same volleyball age group of the population. The results were discussed in the context of current empirical and theoretical material. The results of this empirical study obtained via email and digital communication channels contribute to a better understanding of sports perfectionism, and serve as a guideline for better education and improvement of the dimensions of sports perfectionism in the Serbian volleyball population of cadet and junior age.

Keywords*: adolescence, individual organization, perceived coach pressure, training quality, volleyball*

INTRODUCTION

A common characteristic of the achievement motivation construct of multidimensional perfectionism is the person's desire to perform perfectly (Fleming et al., 2023). Perfectionists most often strive individually or interpersonally towards precisely defined high performance criteria. Individuals who set or demand high standards and expectations for their athletes for their effective performance are most often the following: parents of athletes and sports coaches who manage the training and competition process (Matijašević et al., 2024). The dimension of perfectionism is relevant for scientific research in the context of competitive sports during adolescence. Researchers (Taylor et al., 2022) examined the relationships between perfectionistic tendencies, perfectionistic concerns, optimism, and worries oriented towards the expected game in young female athletes, immediately before an important competition, and found that: a maladaptive profile of perfectionism, i.e. high tendencies combined with high worry, is positively correlated with the dimensions of high anxiety and low optimism, while adaptive perfectionism combined with low levels of worry positively interacts with the dimensions of low anxiety and high optimism. In addition, the aforementioned authors concluded that the pre-competitive conceptions of athletes' thought processes, reflected in the level to which they are worried and perceive optimism, are analogous to the perfectionistic orientation of competitors. The authors (2021) found that self-confidence in female athletes is negatively associated with maladaptive perfectionism in a sample of Hungarian handball players, and they concluded that it is necessary to target the level of manifestation of maladaptive perfectionistic tendencies, especially in those whose constitutional anxiety is interdependent with the quality of sports performance. In his doctoral dissertation (Keats, 2025), using a random effects model on the American volleyball population, he defined that perfectionistic tendencies are low to medium correlated with combined maladaptive and adaptive motivation and quality performance, while, on the contrary, perfectionistic concern is moderately correlated with maladaptive motivation, but not with performance. Therefore, perfectionistic tendencies are less problematic compared to perfectionistic concern. In the sports environment until the beginning of the 21st century, a multidimensional perfectionism questionnaire with four psychological dimensions of this construct was commonly used: personal expectations, concern about mistakes, perceived parental pressure and perceived pressure from coaches (Frost et al., 1990). However, the instrument did not allow for the interpretation of sports perfectionist orientations, so the authors Gotwals and Dunn (2009) reconstructed it with two additional predictors of sports perfectionism: dilemmas about the quality of training and individual organization and named the new version as SMPS-2. Živković (2023) tested the validity of the subscale dimensions of sports perfectionism on a sample of senior basketball players in Croatia and noted their satisfactory metric characteristics - homogeneity and reliability. In his research on a sample of adolescent football players (Baxter, 2024) he examined the relations between optimism and perfectionism with regard to parenting style. The findings showed that a higher level of positive perfectionism is manifested by football players who perceive their mothers' parenting style as authoritative. In addition, a significant positive correlation was defined between

pessimism and positive perfectionism, as well as a negative mutual relationship between pessimism and negative perfectionism. However, no significant difference was established in the manifestation of pessimism and negative perfectionism in relation to the perceived parenting style of the mother and father. In their study (Cunha et al 2023) they determined that perfectionistic tendencies are correlated with better quality of sports performance, and that perfectionistic concerns do not interact with aspects of sports performance. In addition, the authors (Gerber & Colledge, 2023) tested cognitive anxiety and self-confidence of athletes, and concluded that it is relevant to motivate optimism, not reduce pessimism and maladaptive perfectionism in athletes. Given that the results of previous studies of relationships are inconsistent, the aim of this research was to examine statistically significant differences between cadet and junior age volleyball players in the construct of multidimensional sports perfectionism. In accordance with the aim of the research, the *hypothesis* (H) was tested: Significant differences are expected between male and female cadet and junior volleyball teams in certain dimensions of multidimensional sports perfectionism.

METHODS

Respondents and research procedure

The pertinent online sample (N=225) included volleyball players of both genders from the Serbian First League from 16 clubs: "Batajnica" - Belgrade, "Borac" – Čačak, "Crnobele 011" - Belgrade, "Kolubara" - Lazarevac, "Leskovac" - Leskovac, "Desetka" - Niš, "Takovo" - Gornji Milanovac, "Valjevo" - Valjevo, "Zlatibor" - Čajetina, "Novi Pazar" - Novi Pazar, "Novi Sad" - Novi Sad, "Borac" - Starčevo, "Volly" - Novi Sad, "Smederevo" - Smederevo, "Spartak" - Ljig. The average age of the respondents was 19.60 ± 3.45 years. All respondents (U-18, U-20) had at least two years of systematic and organized training lasting at least five times a week.

Using the *Google Forms* app, respondents digitally registered for participation in a voluntary and anonymous survey via a link, via social networks (*Viber, Facebook, Message and Whats up*). They could withdraw at any time, and in the event of withdrawal, no traces of their participation were recorded. The average time for the anonymous survey was about 15 minutes, and it was conducted during October 2025 at the 1st time point in accordance with the Declaration of Helsinki, in compliance with the code of ethics of the Serbian Academy of Innovation Sciences in Belgrade (opinion no. 17/2025).

Sports Multidimensional Perfectionism – SMPS-2

The SMPS-2 questionnaire (*Sports Multidimensional Perfectionism;* Dunn et al., 2006; Gotwals & Dunn, 2009) includes six subscales with 42 items on a 5-point Likert scale. Respondents self-assessed the degree of perfectionistic tendencies in the statements (1 = strongly disagree to 5 = strongly agree). The following dimensions of perfectionism were tested: personal expectations (six statements), concern about mistakes (seven statements), perceived parental expectations (eight statements), perceived pressure from coaches (six statements), dilemmas about the quality of training (five statements), and individual organization (five statements). The original statements of the questionnaire were adapted for volleyball sport as needed. Higher scores on the scales of the measuring instrument represent a higher level of perfectionism manifestation. For easier comparison of perfectionism with different numbers of items, all scores are presented in the form of the sum of the data of statements in the subscale, which is divided by the number of items in the same subscale. In addition, the respondents indicated their chronological age. For each variable of sports perfectionism, verification was carried out on a sample of volleyball players, basic metric characteristics of homogeneity (principal component analysis), internal reliability (Cronbach's alpha coefficient) and sensitivity (indicators of asymmetry/skewness of the distribution and elongation/flattening of deviations from normal distribution) were calculated. Finally, in order to improve the homogeneity and reliability of the dimensions on the subscales, the item selection method was used.

Statistical data processing

In the statistical processing of data, descriptive parameters (arithmetic means, standard deviations, minimum and maximum results) of the tested variables were first calculated, then the coefficient of skewness and kurtosis were used to check the deviations of the variables from the normal distribution, and the basic metric characteristics were calculated using Crombach's reliability coefficients. Finally, parametric statistical methods were applied (t-test for independent samples and univariate analysis of variance (ANOVA). The statistical significance of the results in the observed variable according to the age and gender of the respondents was tested at the error level ($p \leq 0.05$). Empirical data were processed using the Statistics SPSS (Version, 14) software package. The results are presented in tables and are additionally interpreted in the text.

RESULTS AND DISCUSSION

Table 1 shows the descriptive parameters of numerical variables of sports perfectionism in junior volleyball players.

Table 1. Descriptive statistical, metric parameters of sports perfectionism in volleyball players (N = 225)

Variables	*M (SE)*	*SD.*	*Min.*	*Max.*	*Sk.*	*Ku.*	*α*
Personal expectations	3.05 (0.10)	0.76	1.16	5.00	0.83	0.37	0.82
Worry about mistakes	2.48 (0.27)	0.89	1.00	5.00	0.10	0.95	0.90
Perceived parental pressure	1.76 (0.14)	0.82	1.00	4.40	0.75	0.86	0.85
Perceived coach pressure	2,30 (0.23)	0.90	1.00	4.79	0.26	0.66	0.78
Dilemmas about the quality of training	2.37 (018)	0.88	1.00	5.00	0.64	0.73	0.80
Individual organization	2.99 (0.25)	0.87	1.00	5.00	0.53	0.69	0.82

Legend: M = arithmetic mean; SE = standard error of the arithmetic mean; SD = standard deviation; Min - minimum score; Max - maximum score; *Sk* = skewness; Ku = kurtosis; α = Krombahov alfa koeficijent; The value of the standard error of the skewness (SE) was 0.04, while the standard error of the kurtosis was 0.09.

Based on empirically calculated arithmetic means in the descriptive matrix, it is observed that respondents, on average, have the most pronounced dimension of personal expectations and the least pronounced dimension of perceived parental pressure, while standard deviations (0.76 – 0.90) indicate *moderate* variability of responses. In addition, the internal consistency coefficients – Cronbach's alpha subscale of sports perfectionism showed satisfactory metric characteristics: α personal expectations = 0.82, α worry about mistakes = 0.90, α perceived parental pressure = 0.85, α perceived coach pressure = 0.78, α dilemmas about the quality of training = 0.80 and α individual organization 0.82. Also, the obtained skewness and kurtosis scores of the distribution of perceived numerical variables are not outside the range of ±2, which is a prerequisite for implementing subsequent statistical parametric methods (Kline, 2023).

In order to determine statistically significant gender differences in sports perfectionism in volleyball players, basic descriptive parameters and t-test values for independent samples were calculated (Table 2).

Table 2. Differences in sports perfectionism of volleyball players according to gender (N = 225)

Variables	*Female volleyball players*		*Male volleyball players*			
	M	*SD*	*AS*	*SD*	*t-test*	*p*
Personal expectations	2.92	0.79	2.90	0.77	0.05	0.84
Worry about mistakes	2.90	0.80	2.30	0.90	3.96	≤ 0.05
Perceived parental pressure	1.94	0.75	1.69	0.83	1.18	0.19
Perceived coach pressure	2.56	0.82	2.24	0.92	2.30	0.03
Dilemmas about the quality of training	2.73	1.10	1.98	0.79	4.25	≤ 0.05
Individual organization	3.28	0.86	3.01	1.05	2.26	0.03

Legend: M = arithmetic mean; SD = standard deviation; *t*-test – coefficient of t-testa; *p* = level of significance of differences = p ≤ 0.005.

Looking at the descriptive matrix of the Student's t-distribution, with a confidence level of 95%, statistically significant gender differences are observed between the arithmetic means in four of the six dependent variables of perfectionism (components of dilemma about the quality of training, worry about mistakes, perceived pressure from the coach and individual organization, which suggests that female volleyball players are more prone to more pronounced manifestations of these dimensions.In order to test the overall sports variability of the arithmetic means of the sports perfectionism dimension in the population of groups of volleyball players of cadet and junior age, the parametric method of univariate analysis of variance - ANOVA was used (Tables 3 and 4).

Table 3. Univariate analysis of variance (ANOVA) of sports perfectionism in female volleyball players (N = 225)

Variables	***Female cadets***		***Female juniors***			
	M	***SD***	***AS***	***SD***	***F***	***p vrednost***
Personal expectations	2.90	0.89	2.60	0.78	1.90	0.20
Worry about mistakes	2.79	0.85	2.80	0.66	4.90*	**0.05**
Perceived coach pressure	1.92	0.70	1.77	0.90	4.16	**0.05**
Perceived parental pressure	2.37	0.80	2,23	0.65	2.96	0.046
Dilemmas about the quality of training	2,58	0.90	2.74	1.03	0.53	0.70
Individual organization	3.26	1.05	3.15	0.78	0.10	0.90

Table 4. Univariate analysis of variance (ANOVA) of sports perfectionism in male volleyball players *(N = 225)*

Variables	***Male cadets***		***Male juniors***			
	M	***SD***	***AS***	***SD***	***F***	***p vrednost***
Personal expectations	2.84	0.85	2.80	0.49	0.18	0.60
Worry about mistakes	2.30	0.89	2.10	0.78	0.50	0.72
Perceived coach pressure	1.83	0.76	1.70	0.80	0.70	0.48
Perceived parental pressure	2.09	0.90	2.28	1.17	0.37	0.70
Dilemmas about the quality of training	1.88	0.92	2.12	1.01	0.29	0.67
Individual organization	3.05	1.03	2.80	0.68	0.70	0.49

Legend: M = arithmetic mean; SD = standard deviation; *F* = univariate analysis of variance coefficient; * = statistical significance of the F coefficient at the level of $p \leq 0.05$; *p* = level of statistical significance F statistic.

Univariate analysis of variance (one-way ANOVA), calculated F-values of differences between standard deviations, with a probability level of 95%, defined a statistically significant difference between different competition ranks only in the sample of female volleyball players, and only in two variables: *worry about mistakes and perceived pressure from the coach*. This suggests that the variability between competition categories is significantly greater than the variability within groups, which shows that cadets and juniors are statistically

significantly different from each other, i.e., they do not belong to the same volleyball age group of the population. On the other hand, the analysis of variability in the sample of volleyball players found that there were no significant differences between different competitive volleyball categories, which with a risk level of 5%, indicates the relative independence of sports perfectionism in cadet and junior volleyball players.

CONCLUSION

Definitely, the most relevant conclusions in this online study are the following: the SMPS-2 questionnaire was effectively validated on an online subsample of professional volleyball players in adolescence (1), female volleyball players in two variables, concern about mistakes and perceived pressure from the coach, at a 95% confidence level, perceive the construct of multidimensional sports perfectionism more dominantly than male volleyball players (2), and in the subsample of volleyball players, sports perfectionism is relatively independent of their chronological age (3). The obtained empirical findings confirmed the tested hypothesis of significant differences between male and female volleyball teams in cadet and junior age in certain dimensions of multidimensional sports perfectionism. Although this cross-sectional study yielded new findings, which have relevant implications for sports practice, the results suggest focusing on future longitudinal studies with larger and more balanced samples to examine self-reported perfectionism questionnaires, and to identify interactions between the tested psychological construct and other relevant anthropological variables in the sports population across different gender and competitive categories.

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PREOPERATIVE MANAGEMENT OF ACL INJURY AND ISOMETRIC EXERCISES AS A STRATEGY TO PREVENT PATELLAR TENDON PAIN AFTER ACL RECONSTRUCTION: IMPLICATIONS FOR RETURN TO PLAY

DOI 10.57136/2233-0852/2025.23.37.28 Original scientific work

Naida Halilović Šehić, Merima Aljić

ABSTRACT: The aim of this paper is to integrate three key components of rehabilitation following anterior cruciate ligament (ACL) injury: (1) preoperative management (prehabilitation), (2) the role of isometric exercises in the prevention and short-term reduction of patellar tendon pain after ACL reconstruction, and (3) the implications of pain for return to sport. A cross-sectional retrospective study was conducted using a questionnaire in a sample of 43 participants after ACL reconstruction. Most injuries were non-contact (37/43), most commonly during landing (20) and cutting/change of direction (11). Patellar tendon pain after surgery was reported by 32/43 (74%) participants, most frequently 3–4 months postoperatively (14). Twenty-seven participants reported completing preoperative treatment; the difference in pain prevalence between groups was not statistically significant ($p = 0.769$). Thirty-five of 43 participants (81%) returned to their pre-injury level of activity. Considering that isometric contractions can produce immediate analgesic effects in patellar pain (Rio et al., 2015), their systematic inclusion in the early phases of rehabilitation is proposed, alongside careful dosing of load on the knee extensor mechanism and criteria-based return-to-sport decision-making.

Keywords: *ACL rekonstrukcija; bol patelarne tetive; pre-rehabilitacija; izometrijske vježbe; povratak sportu*

INTRODUCTION

Patellar tendon pain is a common problem after ACL reconstruction and may slow quadriceps loading progressions, complicate rehabilitation planning, and delay return to play. The purpose of prehabilitation (preoperative management) is to achieve an adequate range of motion before surgery, reduce swelling and pain, and establish good neuromuscular control (a "quiet knee"). In addition, short blocks of isometric contractions are used as a modality for short-term pain reduction and facilitation of quadriceps activation in patellar pain, which may also be relevant in postoperative protocols after ACL reconstruction. The ACL is a key stabilizer of the knee, limiting anterior tibial translation and rotational instability. ACL injuries are particularly common in sports that involve landing, cutting, and rotational movements, with non-contact mechanisms (dynamic valgus, insufficient trunk and knee control) representing a frequent loading pattern associated with increased ACL strain (Dos'Santos et al., 2019).

Although ACL reconstruction restores stability, postoperative anterior knee pain and patellar tendon symptoms can restrict quadriceps loading, slow rehabilitation progression, and delay return to sport. Rehabilitation guidelines emphasize a criteria-based approach (not purely time-based), gradual load progression, and clear criteria for transitioning between phases (van Melick et al., 2016). In patellar tendinopathy rehabilitation, controlled load dosing and progressive strengthening of the knee extensor mechanism are recommended (Muaidi, 2020). Short blocks of isometric contractions can provide immediate analgesia and facilitate quadriceps activation (Rio et al., 2015), which may be useful in the early stages after ACL reconstruction.

AIM OF THE STUDY

The aim of this study was to analyze the prevalence and timing of patellar tendon pain after ACL reconstruction, assess the association between preoperative treatment and pain occurrence, and consider the role of isometric exercises and criteria-based return-to-play decisions in rehabilitation planning.

METHODS

Participants

This research was conducted as a cross-sectional retrospective study using a questionnaire. The study included 43 participants after anterior cruciate ligament (ACL) reconstruction. Inclusion criteria were: having undergone ACL reconstruction, regular participation in a rehabilitation program according to protocol, and no other serious injuries or conditions that could affect recovery (e.g., severe osteoarthritis or neuromuscular disorders). Exclusion criteria were: absence of ACL reconstruction, non-adherence to the rehabilitation program, and the presence of serious comorbidities that interfere with rehabilitation.

Variables

Data were collected on the presence of patellar tendon pain and the timing of symptom onset, participation in preoperative treatment, time from injury to surgery, preventive work after surgery, and return to the activity during which the injury occurred.

Dana analysis

Normality of distribution was assessed using the Kolmogorov–Smirnov test. Associations between categorical variables were analyzed using the chi-square test, while between-group comparisons under non-normal distributions were performed with the Mann–Whitney U test. Statistical significance was set at $p < 0.05$.

RESULTS AND DISCUSSION

Table 1. Summary of key findings

Sample	n = 43
Injury mechanism	37/43 non-contact; 6/43 contact
Most common injury situation	landing 20; change of direction 11
Associated injuries	meniscus 20; collateral ligaments 7; none16
Patellar tendon pain after surgery	32/43 (74%)
Most common time of pain onset	3–4 months postoperatively (14)
Mean VAS	4.8
Preoperative treatment and pain	21/27 (78%) vs 11/16 (69%); p = 0.769
Return to previous activity	35/43 (81%)

Patellar tendon pain after surgery was reported by 32/43 (74%) participants. The most common time of pain onset was 3–4 months after surgery (14), followed by 1–2 months (11), 5–6 months (5), and more than 6 months (2). The mean pain intensity reported by participants was 4.8/10.

Most injuries were non-contact (37/43), most commonly during landing (20) and cutting/change of direction (11). As the most frequent reasons for postoperative pain, physiotherapists cited quadriceps weakness (9), overtraining (6), and overly rapid load progression (5), suggesting the need for careful load dosing and symptom monitoring during rehabilitation progression. Thirty-five of 43 participants (81%) returned to their pre-injury level of activity.

The findings indicate that patellar tendon pain is a common symptom after ACL reconstruction (32/43; 74%) and most frequently manifests in the 3–4-month period, when functional loads typically increase (running, jumping, and more demanding changes of direction). The predominance of non-contact injury mechanisms (37/43) further underscores the importance of neuromuscular control, landing technique education, and criteria-based load progression (van Melick et al., 2016; Dos'Santos et al., 2019).

The most commonly reported triggers (quadriceps weakness, overtraining, rapid progression) suggest that pain often emerges as a consequence of a mismatch between tissue capacity and applied load. The absence of a statistically significant association between preoperative treatment and pain occurrence ($p = 0.769$) may reflect variability in the content and quality of prehabilitation, as well as a potential selection effect.

PRACTICAL IMPLICATIONS

Preoperative management (prehabilitation)

Minimum objectives of preoperative management include: full knee extension, functional flexion, minimal swelling, good quadriceps activation, and load tolerance. In practice, this means achieving a "quiet knee" before surgery (controlled pain and swelling), range-of-motion exercises, neuromuscular control work, and progressive strengthening of the quadriceps, gluteal muscles, and hamstrings, accompanied by education on appropriate load dosing.

Isometric exercises for prevention/short-term pain modulation

In the early phases of rehabilitation, isometric exercises (e.g., isometric knee extension in mid-range or a wall sit within a pain-free range) can be used as a short-term analgesic stimulus and as a bridge to subsequent strengthening. A practical example of a pain-modulation protocol is 5 sets × 45 s of isometric contraction with approximately 2 min rest, with symptom monitoring (Rio et al., 2015). After symptom reduction, a gradual transition to isotonic/eccentric exercises and progressive load increases is recommended, in line with patellar tendinopathy rehabilitation principles (Muaidi, 2020).

Return to play

In this sample, 35/43 (81%) participants returned to their pre-injury level of activity, confirming that return to sport is not universal. Return-to-play decisions should be based on criteria (not only time): pain and swelling control, symmetry of strength and functional test performance, tolerance to sport-specific loading, and psychological readiness (Ardern et al., 2014; van Melick et al., 2016). Persistent patellar tendon pain may require load modification (reducing running/jumping volume), progressive dosing of extensor loading, and technique adjustments.

CONCLUSION

Patellar tendon pain after ACL reconstruction is common and may be clinically relevant for load planning and return-to-sport decisions. In this sample, pain was reported by 32/43 (74%) participants, most often in the third to fourth postoperative month, when functional loading typically increases. The data suggest that quadriceps weakness, overtraining, and rapid load progression are frequent symptom triggers. Integrating high-quality prehabilitation, controlled progressive loading, targeted isometric contractions in early phases (when needed as a pain-modulation stimulus), and criteria-based return to sport may contribute to a safer and faster return to play.

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EFFECTS OF AN INDIVIDUALIZED TRAINING PROGRAM ON CHANGES IN BODY COMPOSITION AND SELECTED BIOCHEMICAL PARAMETERS – A CASE STUDY

DOI 10.57136/2233-0852/2025.23.37.31 Original scientific work

Amela Bajrektarević, Almir Kalabušić, Naida Halilović Šehić

ABSTRACT: The aim of this study was to examine the effects of an individualized training program on changes in body composition in a female participant over a period of 12 weeks. The research was conducted as a case study, with changes monitored using InBody body composition analysis. The primary variables included body weight, fat-free mass, fat mass, muscle mass, and skeletal muscle mass. Measurements were taken initially, during transition, and finally, with weekly monitoring throughout the training process. A total of 62 training sessions were performed, evenly distributed on a weekly basis. In addition to basic indicators of body composition, selected laboratory parameters of mineral and hormonal status were analyzed as secondary indicators, aiming to assess physiological adaptation of the organism. The results showed a significant reduction in body weight and fat tissue, alongside an increase in fat-free, muscle, and skeletal muscle mass, indicating successful body recomposition. Laboratory findings remained within reference values throughout the process. It is concluded that an individualized training program can effectively contribute to the improvement of body composition while maintaining biochemical and hormonal balance in the organism.

Keywords: *individualized training, body composition, InBody analysis, biochemical parameters, case study*

INTRODUCTION

Every day, we face the realization that people increasingly strive to achieve the best possible results in the shortest possible time, and thus, training technology and the transformation process advance daily. The modern approach to planning and programming sports training is based on individualization, aiming to achieve optimal adaptations while preserving health. Targeted physical activity, along with movement, is undoubtedly significant in health protection, which can be considerably improved (Andrijašević, 2000). Due to gender differences reflected in morphological, motor, and functional segments of anthropological dimensions, there are also differences in programming training with loads for women (Jukić et al., 2007). The training program in this study lasted 12 weeks and was designed to gradually influence the participant, with the training process structured into three phases: adaptation, hypertrophy, and the final phase, i.e., the phase of maximal strength and definition development. Four to five training sessions per week were performed throughout the cycle, with balanced rotation of muscle groups and a balanced ratio of multi-joint and isolation exercises. The training program was aimed at improving body composition by reducing fat tissue and increasing muscle mass. The program included a combination of strength and hypertrophy training, functional exercises, and high-intensity interval training (HIIT), with additional cardio activities of low and moderate intensity. The program utilized compound and isolation exercises such as squats (box, sumo, and goblet squat), Romanian deadlift, hip thrust, lunges, leg press, leg extension and flexion, rowing, lat machine, chest and shoulder presses, biceps and triceps curls, and core stabilization exercises (plank, air bicycle, heel touch). Training was conducted according to principles of progressive overload, tempo control (especially eccentric phase), repetitions in reserve (RIR), supersets, circuit training, and HIIT protocols. Each training session included structured warm-up, activation, and mobility, while stretching and foam rolling were used at the end of training to enhance recovery and reduce injury risk. A total of 62 training sessions were performed. Trainings were scheduled at the beginning, middle, and end of the week to ensure adequate rest and prepare the body for subsequent activity. Early diagnosis of obesity is an important step in combating this disease in today's society (Novaković, Ademović, Šolakhodžić & Ćemalović, 2024). Regular physical exercise positively affects all bodily functions, reduces depression and anxiety, and contributes to increased overall mood (Đorđević, 2005). Monitoring changes in body composition is an important segment in evaluating the effects of the training process, as it provides insight into the relationship between muscle mass, fat tissue, and overall body structure. Unlike classical anthropometric measures, modern methods such as bioelectrical impedance (InBody) allow for more detailed and non-invasive assessment of body composition. In addition to morphological changes, adaptation of the organism to physical load can also be monitored through biochemical parameters, among which mineral status plays a significant role in regulating metabolic and neuromuscular processes. Analyzing changes in body composition and simultaneously monitoring biochemical parameters provides a broader picture of the individual's condition before, during, and after the program.The aim of this paper is to analyze changes in body composition determined by InBody analysis, with supplementary analysis of mineral status, in a female participant after an individualized training program.

METHODS

Sample

The study was conducted as a case study on one female participant, aged 22, who participated in an individualized training program.

Training Program

The training program was systematically structured and tailored to the individual abilities of the participant. The program was implemented continuously over 12 weeks, with gradual increase in load.

Variables

The selection of variables for this study was based on their measurement characteristics, including validity, reliability, sensitivity, economy, as well as adaptability and suitability for the participant. Assessment of body volume and mass was performed using bioelectrical impedance via the InBody analyzer.

Primary Variables - Body Composition (InBody)

- Body Weight (kg)
- Fat-Free Mass FFM (kg)
- Total Muscle Mass (kg)
- Skeletal Muscle Mass – SMM (kg)
- Body Fat Mass (kg)
- Percentage of Body Fat – PBF (%)

Secondary Variables

Laboratory parameters of mineral and hormonal status, obtained by blood sample analysis initially and finally, were used as secondary variables to additionally assess physiological adaptation to the individualized training program.

Picture 1. InBody Analyzer (Source: Archive of the Faculty of Sport and Physical Education, Sarajevo)

Measurement Description

Data were collected during the 12-week transformational training process, which included initial, transitional, and final measurements. Body height was assessed at the beginning and end of the program using an anthropometer, while body weight was monitored with the IN BODY analyzer (Hadžikadunić, Rađo & Pašalić, 2000). Measurements were taken in the morning, on an empty stomach, with the participant appropriately dressed to minimize influence on the measurement procedure (Getto, 2020).

Statistical Analysis

Descriptive and comparative statistical methods were used in the study, with comparisons made at initial, transitional, and final stages.

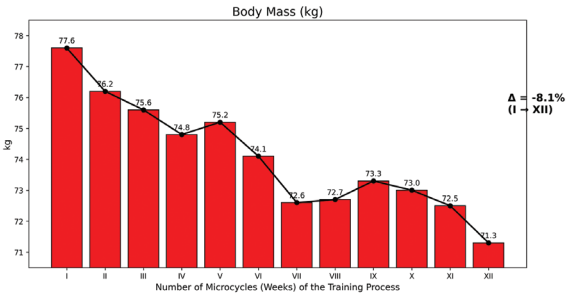
RESULTS

Results of the InBody body composition analysis are presented for initial and final measurements to assess the effects of the individualized training program over 12 weeks. Changes in body weight, fat-free mass, muscle mass, skeletal muscle mass, and the amount and percentage of body fat were analyzed.

Table 1. Initial and Final Values of InBody Variables

Variables	Initial State	Final State	Change
Body Weight (kg)	77.6	71.3	– 6.3 kg
Body Fat Mass (kg)	23.3	14.2	– 9.1 kg
Percentage of Body Fat (%)	30.1	19.8	–10.3 %
Fat-Free Mass (kg)	54.3	57.1	+2.8 kg
Total Muscle Mass (kg)	52.1	54.8	+2.7 kg
Skeletal Muscle Mass (kg)	30.6	32.6	+2.0 kg

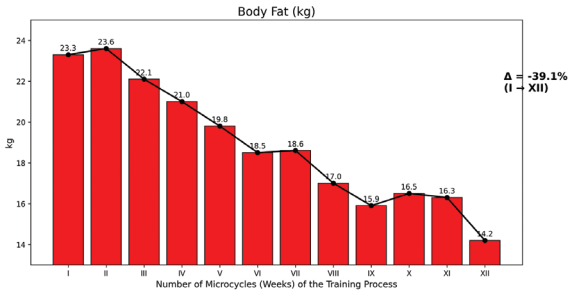
During the transformation process, a significant reduction in body weight was recorded, primarily resulting from fat tissue reduction. Simultaneously, an increase in fat-free and muscle mass was observed, indicating successful body recomposition. Notably, skeletal muscle mass increased by 2.0 kg compared to the initial measurement.



Graph 1. Body Weight Over Weeks

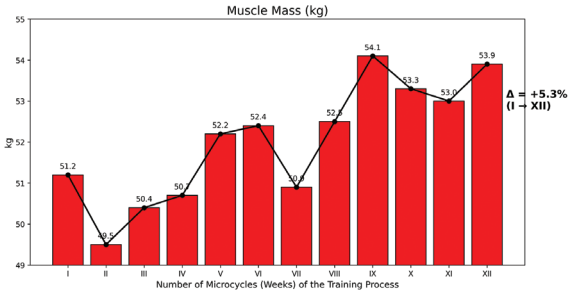
Body weight is one of the most important indicators, with a difference of 6.3 kg in reduction. Given that an adequate plan and program for both sports activities and nutrition were developed, drastic changes in the final state compared to the initial state were expected. The initial desired state was included, and the subject was directed toward body recomposition. Initial body weight was 77.6 kg, while at the end of the transformation process it was 71.3 kg. These

results indicate that the aim of the research and transformation process was successfully achieved.



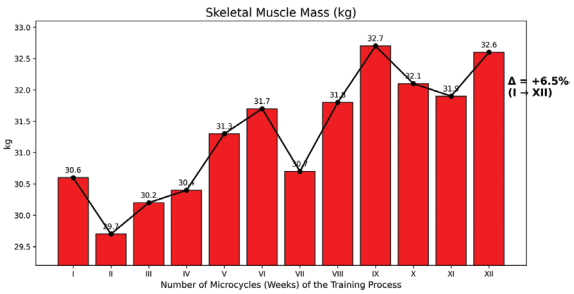
Graph 2. Body Fat in kg

The initial state of body fat, referring to the participant's condition before starting the planned training and nutrition program, was 23.3 kg. During the transitional phase, characterized by continuous weekly monitoring, a gradual and consistent decrease in body fat was recorded, as shown in the graphical representation. This trend indicates efficient adaptation of the organism to the applied training contents. At the end of the transformation process, body fat mass was 14.2 kg. The final state was determined by comparing initial and final values against predefined research objectives. Since the main goal was body recomposition, i.e., reduction of fat tissue while preserving and increasing muscle mass, it can be concluded that the achieved results are in line with expectations. The total reduction in body fat during the study period was 9.1 kg, confirming the high effectiveness of the applied training and nutrition program.



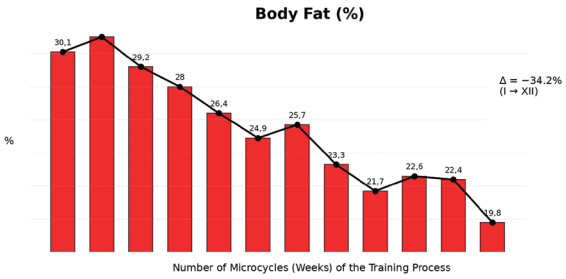
Graph 3. Muscle Mass in kg

During the transformation process, special attention was paid to optimal dosing of training loads, adequate energy intake, and proper training structure, ensuring sufficient rest and recovery. This approach resulted in an increase in muscle mass of 2.7 kg over 12 weeks.



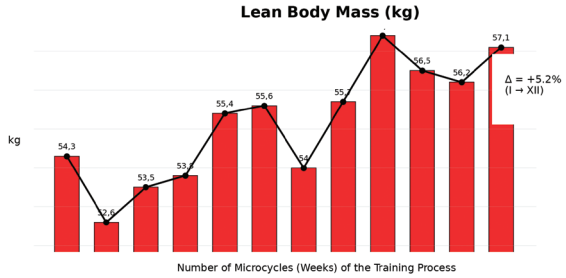
Graph 4. Skeletal Muscle Mass

Skeletal muscle mass at the initial measurement was 30.6 kg. At the final measurement, skeletal muscle mass was 32.6 kg, representing an increase of 2.0 kg compared to the initial state. This result indicates a positive effect of the applied training process on muscle mass development.



Graph 5. Body Fat Percentage

Body fat percentage is one of the key variables in the body transformation process. During the transformation, a relative change of -34.2% was recorded, while the absolute reduction in fat percentage was 10.3%. Weekly measurements showed a pronounced trend of fat tissue reduction, with occasional oscillations, especially in the seventh and tenth weeks. Despite these oscillations, the final results confirm that the transformation process proceeded in the desired direction and produced expected effects.



Graph 6. Fat-Free Mass

Fat-free mass at the initial measurement was 54.3 kg, while at the final measurement, after completing the transformation process, the value was 57.1 kg. Throughout the study period, a gradual increase in fat-free mass was recorded, clearly shown in the graphical representation. This trend indicates positive adaptive changes in the organism as a result of the planned training program and adequate nutrition.

DISCUSSION

The obtained results indicate high efficiency of the individualized training program in improving body composition. The reduction in body weight by 6.3 kg, along with a decrease in fat tissue by 9.1 kg, confirms that weight loss was predominantly due to fat loss, not fat-free mass. The increase in fat-free mass (+2.8 kg), total muscle mass (+2.7 kg), and skeletal muscle mass (+2.0 kg) indicates a positive adaptive response of the

muscular system to systematically structured physical load. These results are particularly significant as they confirm that the process simultaneously achieved fat loss and an increase in functionally active mass, representing the optimal outcome recommended in modern body transformation programs. Changes in body fat percentage further confirm the success of the process, given the recorded reduction of 10.3 percentage points. Although linear changes were not observed week-to-week, the final result indicates properly dosed load, adequate recovery, and good alignment of training and nutrition regimens.

Overall, InBody analysis results confirm that an individualized training program can lead to significant and functionally relevant changes in body composition, even within a relatively short period of 12 weeks.

In addition to changes in body composition, selected laboratory parameters of mineral and hormonal status were analyzed as supplementary indicators of physiological adaptation to the training process. The values of basic electrolytes and minerals remained within reference ranges in both initial and final measurements, indicating preserved mineral balance during the program. Thyroid hormones (TSH, FT3, and FT4) showed stable values without significant deviations, suggesting that the applied individualized training program did not negatively affect endocrine regulation. These findings further confirm that the recorded changes in body composition were achieved with preserved biochemical homeostasis. Since laboratory parameters are not the primary focus of this study, their role is exclusively supplementary, serving as additional confirmation of adequate adaptation to the training process.

CONCLUSION

Based on the results of this case study, it can be concluded that an individualized training program conducted over 12 weeks leads to significant and functionally relevant changes in body composition. A pronounced reduction in body weight was recorded, predominantly due to fat tissue reduction, alongside an increase in fat-free mass, total and skeletal muscle mass.

The obtained InBody analysis results confirm that successful body recomposition can be achieved through a systematically structured and individually tailored training process. At the same time, stable values of laboratory parameters of mineral and hormonal status indicate preserved biochemical and endocrine balance, further confirming the adequacy of the applied load.

Although this is a case study, the results of this research highlight the importance of applying modern methods for assessing body composition in evaluating the effects of the training process and confirm the justification of an individualized approach in recreational training.

RECOMMENDATIONS

Future research should include a larger sample of participants and a longer monitoring period to allow for statistical generalization of the obtained results. It is recommended to integrate training and nutrition programs, with continuous supervision by experts, to achieve optimal and sustainable results in changing body composition.

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ANALYSIS OF THE RESULTS OF THE HOK ČAPLJINA BASED ON SITUATIONAL EFFICIENCY IN THE 2022/2023 SEASON

DOI 10.57136/2233-0852/2025.23.37.36 Original scientific work

Azer Korjenić, Mile Galić, Martin Jelčić

ABSTRACT: The aim of this paper is to conduct an analysis of the results of the women's volleyball club HOK Čapljina based on situational efficiency parameters achieved in the 2022/2023 season. In this study, the sample of respondents is HOK Čapljina, which competes in the Super League of the Federation of Bosnia and Herzegovina for Women - Group South, in which ten teams participate. The data was taken from the official website of the Federal Volleyball Federation of Bosnia and Herzegovina (www.fos.bih), which was recorded by four officials, designated by the Volleyball Federation. In order to determine the connection between situational efficiency and results of the game in relation to the relative point difference, regression analysis was used, and the results confirmed that there is a significant correlation coefficient between the investigated situational variables and the relative point difference.

Keywords: *volleyball, situational efficiency, game phases, performance, correlation.*

INTRODUCION

Volleyball as a sport is a connection of simple and complex movements that are performed in cooperation conditions in fact collaboration of sport's members during the game (Milanović, 2007), because of that characteristics, it is complex sport.

It is very important to say that volleyball game, actually structure of situations,consist od next phases: service, service acceptance, raising spike, the ball, block and defendence of sport's field (Đurković, Marelić, and Rešetar, 2008).

Volleyball is one of the most dinamic polystructural complex sport games. It demands ability in rallying, speed, explosive strength,adroitness, agility, jumpiness, good movemenet, performing tehnical and tactical tasks, and above all inteligence. Volleyball is naturally multilayer, it is possible to look at it from more perspectives, depending of the role of viewer, player, coach, manager, or scientist. When analyzing volleyball as a game, we can talk about the player's situational-motor abilities as dominant to perform the complex motor tasks that volleyball requires. The purpose of this research is to analyze the resultant success of the women's volleyball team HOK ČAPLJINA, and determine the connection of indicators of situational success and relative point difference.

RESEARCH METHODOLOGY

In the methodological elaboration of this research, a review of the definition of the sample of subjects, instruments, namely the batteries of tests that analyzed the researched anthropological spaces, as well as the description of technical performance of these, then a brief description of the research, the method of statistical data processing, as well as the time frame of the research.

A sample of respondents

In this researching sample respondents presents female volleyball club HOK Čapljina which is competing in Super League Bosnia and Herzegovina for women-group south, where are ten teams participate. Resultive and situational success within 18 games played in the 2022/2023 competitive season was analyzed. HOK Čapljina played 9 home and 9 guest matches against the following teams: HOK Čapljina has played 9 home and 9 away matches against the following teams:OK „Centar ORT" Sarajevo, OK „Ilijaš" Ilijaš, OK „Breza 1934" Breza, OK „Novi Grad" Sarajevo, ŽOK „Željezara" Zenica, ŽOK „Kakanj" Kakanj i ŽOK „ Alipašino polje" Sarajevo, OK" Čelik-R" Zenica, HŽOK „Smeč" Široki Brijeg. In the same season of competition women's club HOK Čapljina, he took fourth place, and played a total of 76 sets with 52 sets won and 24 sets lost.

Sample variables

There are ten variables used for assessment of situational efficiency relative to resultant success in this researching, and the same are divided on the set predictor variables (8) and set criterion variables (2). It is also used and five variables for estimation of situational efficiency inside different phases of game, followed in all sets.

Predictors variables in atack phase: NAPGI- Attack performance error,, NAPOP-Attackk teams score , NAPPI-Attack advantage in game, NAPPIP-lost point attack..

Predictor variables in the counterattack stage attack: PNAOP – team wins point from the counter-attack,PNPDE - home team advantage ball stayed in the game, PNPPE –advantage opposing team ball left in the game, PNAPGI – performance error.

For the purposes of global analysis of resultant success, two dependent variables were allocated:. DOBSE – The resulting score, IZGSE – Lost set.

For situational efficiency assessment purposes within all sets played 5 variables were used to assess

situational effectiveness at certain stages of the game: Overall point difference: ONSER –Service (attack), OBSERVER-Serve receive, ONASM-Lunter, OOBLO-Block, OOUPO-defense in field.

Researching description

Pocessed datas were taken from the official page of the Volleyball alliance Federation of Bosnia and Herzegovina (www.os.fbih), recorded by four official persons and determined by the Volleyball Federation of Bosnia and Herzegovina.

Data processing method

A statistical-mathematical data processing program in the SPSS 21.0 programming package for Windows was used for input, data processing, and analysis. For all variables applied, central and dispersion parameters were determined, that is, the average values achieved were shown, as well as the minimum and maximum values. Also, the normality of the distribution based on the Klongo - Smyrna test was established. At the univariate level, using the Pearson correlation coefficient, the association between situational efficiency variables has been investigated. Regression analyses were also done in this research at the overall number of sets played during the 2022/2023 season. In order to make the regression model as good as possible one should have insight into the selected predictors, the correlation between the predictors shoud be small as possible, that is, to weigh 0, and with the criteria to be as large as possible, that is, to weigh 1. That's because there wouldn't be a collinearity. The reason for that is that, if some predictor variable explains a certain proportion of the variance of the criterion, and is highly correlated with some other predictor variable, then the explanation of the connection to the criterion is very difficult because one cannot accurately determine which of those two variables add its influence (Milas, G., 2009). Therefore, the correlation analysis on all variables was first conducted.

RESULTS AND DISCUSSION

Data pocessing was done through two sections, where in the first quality of performance variables was analyzed for assessment of situational efficiency (in attack and counterattack).

General descriptive parameters were taken from data volley software. Along with a summary review of recorded events in 18 matches where a total of 74 sets were played, the Data volley software recorded 4931 situational moments of interest for this research. A comparative analysis was performed across the attack phases and the difference in situational success in the attack phase and the defense phase was also determined using the Fisher test.

Descriptive parameters of researched variables for situational assessment efficiency

Table 1. Competition season review 2022/2023.

Data volley softver	N
Total played games	18
Total played sets	74
Matches– 3 seta	7
Matches – 4 set	4
Macthes – 5 setova	7

Table 2. Comparison of points won and lost based on parameters of situational success in certain phases of the game

Game phases	n	Won point	Lost point
NAPOP	1800	1254	546
NAPGI	218	118	100
NAPPI	450	678	183
NAPIP	715	501	214
PNAOP	214	98	116
PNPDE	542	269	188
PNPPE	614	279	343
PNAPG	571	211	260

Legend: n=total events number, NAPGI-Performance attack error NAPOP- The team's attack wins the game, NAPPI -attack advantage in the game, NAPIP-attack lost point, PNAOP-the team wins a point from the counter attack, PNPDE- home team advantage the ball remained in the game, PNPPE-the advantage of the opposing team, the ball remained in the game, PNAPG – performance error.

From the obtained results, it is evident that the women's team of HOK Čapljina achieved the best results from the attack phase in the variables for assessing situational efficiency based on the 18 analyzed matches and that they achieved the highest percentage of success in that segment. It is also evident that the same team in the counter-attack phase achieve slightly worse results, and the same team will look for opportunities in order to improve the situational performance in the improvement of counter-attack implementation.

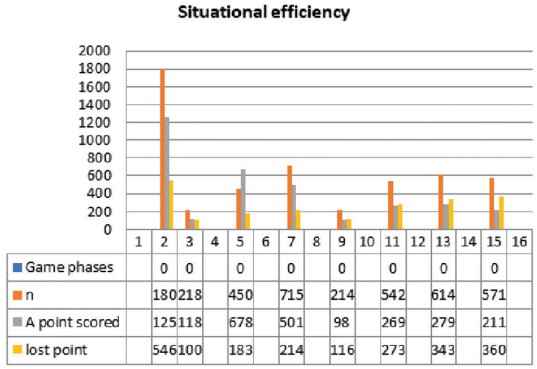

Chart Number 1. Comparation between gained and lost points on the base of situational efficiency parameters in individual game's phases.

In table 3, there are average values descriptive parameters of situational efficiency cross number of scores during 18 playes matches.

Table 3. Descriptive indicators of average resultant success in 18 games played

Match					
Point score					
Season	AS	SD	MIN	MAX	Range
2022/2023	69,92	13,11	46	94	50
Total point difference					
2022/2023	10,92	7,34	-9	31	22
Total number of rallies /attack-counterattack					
2022/2023	AS	SD	MIN	MAX	Range
	37,88	4,25	26	50	38
Total point difference					
2022/2023	10,92	5,74	-9	31	20
Relative point difference					
2022/2023	0,131	0,065	0,063	0,29	0,546
Duration of the set					
2022/2023	9,98	2,87	28	39	11

Legend: AS – arithmetic mean, SD – standard deviation, MIN – minimum score,MAX – maximum score, RANGE – difference between minimum and maximum score,

When it comes to the point balance, the data on the team's points won are listed, where the expected differences in the average number of points won by the team through 18 games played are on average 22 higher than a larger number of opposing teams, which can be confirmed by the dominance and success of HOK Čapljina, and for this reason, the placement in the 2022/2023 season, in 4th place in the Super League of the Federation of Bosnia and Herzegovina, according to the indicators shown, is very successful. Based on the maximum score achieved in all 74 sets played, the total number of points won in one set is not more than 31 points. The data about duration set present official data, and in the same there are durations of all rallyings, as same as pause score or other interuption.

Connectivity situational success parameters during volleyball game phases

In further data processing, an analysis of situational success was performed through all 5 phases of the volleyball game. For this purpose, Regression analysis was applied, which allowed us to determine the differences in the connection of all 5 phases of the volleyball game, with special attention to situational and result success per set in relation to the relative point difference. Regression analysis or techniques allow us to quantitatively express such a dependence (correlation) and we use the resulting model to predict some data for which we do not have measurements or we use it to arrive at some constants that describe this dependence, etc.

Descriptive indicators of all played sets with an emphasis on individual phases of the game

In table 4 we can see descriptive indicators of all 5 variables through the total number of sets played (74). The same table shows descriptive indicators of situational success coefficients of the five phases of the volleyball game and relative point differences.

Table 4. Descriptive indicators of situational success coefficients of five phases of volleyball game and relative point differences for all sets

Total number of sets played (74)						
Variables	AS	SD	MIN	MAX	Med	Range
Point difference	-0,001	0,132	0,311	0,349	0,029	0,381
ONSER – Service	2,011	0,179	1,725	2,618	2,151	0,893
OPSER-reception service	2,821	0,238	2,670	3,478	3,044	0,808
ONASM -Spike	3,013	0,217	2,392	3,334	3,011	0,942
OOBLO-Block	2,201	0,355	5,000	8,733	2,234	3,733
OOUPO-Defense in po.	2,096	0,311	5,200	7,111	2,240	1,911

Legend: AS-aritmethic mean, SD- standard deviation, Min-minimal resultat, Max-maximum result, Med-median, Range- difference between maximum and minimal result.

Average relative point difference is 0,000 points with its minimal result -0,311 and maximum result 0,349. Arithmetic mean (-0,001) shows that the part of won and lost sets in total sample of sets equal.

Table 4. shows us that the phase spike in volleyball game which is tend to have the bigest coefficient of succes, is 3,013 in correlation to maximum possible success coefficient. It is followed by service reception with almost equal values (2.821), then block (2.201) and field defense with a success rate of 2.096, then service with the lowest rate of (2.011).

When we talk about terms of standard deviation results, the highest result is for the block variable (0.355), which means that this is the phase of the volleyball game that was crucial for the overall success. From the same data, there is conclusion that this segment of the game also has the lowest homogeneity of the sample of respondents studied. In contrast to the block variable, we can see that the service variable has the lowest standard deviation values (0.179).

Comparing the coefficients of success of service reception and field defense, it can be clearly seen that there is a difference, namely that field defense has a higher coefficient of success (0.311) compared to field defense, whose coefficient is 0.238. There must be noted that these two researched phases of the volleyball game cannot be scored, but they certainly represent two phases that precede a successful

attack and are closely related. In this case, too, we can conclude that this is a heterogeneous sample of players in these segments of the game.

In order to analyze and determine the correlation coefficient in the researched variables that were included in the regression model of the research, the statistical-mathematical method of Pearson's correlation coefficient was applied.

Results of regression analsys of whole played sets

In the further analysis and processing of the data, the results of the regression analysis on the entire number of played sets (74) are presented. In order for the regression analysis to give the best possible results, one should have an insight into the selected predictors, so that the correlation between the predictors will be as low as possible, that is, tend to 0, or with the criterion that it should be as high as possible, that is, 1. This is so that collinearity does not occur. The reason for this is that, if a predictor variable explains a certain proportion of the variance of the criterion, and is highly correlated with another predictor variable, then the explanation of the connection with the criterion is very difficult because it is not possible to determine exactly which of those two variables to add its influence to (Milas, G., 2009). Therefore, a correlation analysis was first conducted on all variables investigated.

Table 5 shows the correlation coefficients between all variables included in the regression model.

From the results of the Pearson correlation coefficient (Table 5), it can be clearly seen that the phases of the volleyball game that have the highest mutual correlation are the block and the field defense, and the correlation coefficient is -0.43. The negative sign means that the higher the block success coefficient, the lower the field defense. Given that the block and the field defense have only 15% of the common variance, it can be concluded that their mutual correlation is low.

Then we talk about spike, whose coefficient is 0.52, we can conclude that it has a moderate or rather low correlation, with service, service reception and block (r = 0.37; 0.34; 0.28). Service and block have a correlation coefficient of r = 0.9. It should be emphasized that the statistical significance of the correlation coefficients is not shown in the table because that is not its purpose. The purpose is only to show the interrelationships between the predictors. How we could better clarify the influence of certain variables on the criterion, it is necessary to calculate partial correlation coefficients in which the influence of all other predictor variables is removed.

Table 5. Person's correlation coefficient of predictoršs variables five phases volleyball game and criterial variable relative score difference in played sets

Variables	REBRA	KOUSE	KOUPS	KOUSM	KOUBL	KOUOP
REBRA	1,00					
KOUSE	0,37	1,00				
KOUPS	0,37	0,03	1,00			
KOUSM	0,52	0,24	0,24	1,00		
KOUBL	0,28	0,21	0,01	0,18	1,00	
KOUOP	-0,43	0,19	0,23	0,02	0,29	1,00

Legend: REBRA- real point difference, KOU-Success coefficient, KOUSE-service, KOUPs-reception service, KOUSM-spike, KOUBL-block, KOUOP-place defense.

In fact, partial correlation coefficient presents conectivity coefficient of every individual variable with the criterion when the influence of other variables on that same correlation is removed. R2 is the coefficient of determination of the specified variable with all other predictor variables, which in this case is 4.

Specifically, it is the share of the variance of each variable that can be explained with the other variables (but not with the criterion). Tolerance is the proportion of variance of each individual variable that cannot be explained by other predictor variables. This is important for regression analysis because it is necessary that, as stated earlier, the connection of each individual variable with the criterion, that is, that the partial correlation coefficient be as high as possible. It is also necessary that the tolerance be as large as possible, and the coefficient of determination R2 as small as possible so that the regression model is of better quality and the criterion can be explained in a meaningful way (Dawson, 2014 cited in Aiken & West, 1991).

Looking at Table 5, it is evident that the variables KOUSE-Serve, KOUPS-Receive Service and the variable KOUSM-Smack had a statistically significant impact on the performance, or the relative number of points won, which achieved the highest correlation coefficient. Therefore, we can say that these three phases of the game had the greatest impact on the performance, or the relative number of points won.

Table 6. shows the basic, or elementary regression indicators, the parameters of the relationship between the performance coefficients of the five phases of the volleyball game with the performance in all the sets played (74).

Table 6. Elemental regression indiccators of success coefficient conectivity of five phases volleyball game with result success in whole played sets

Var.	TOL	R2(1TOL)	r	rparc	p
KOUSE	0,94	0,09	0,47	0,58	0,00
KOUPS	0,79	0,09	0,42	0,47	0,00
KOUSM	0,85	0,15	0,59	0,63	0,00
KOUBL	0,83	0,16	0,27	0,44	0,00
KOUOP	0,87	0,14	0,39	0,68	0,00

Legend: KOU-Success coefficient, KOUSE-Service, KOUPS-Rervice reception, KOUSM-Spike, KOUBL- Block, KOUOP-Field defense, TOL-tolerance (1-R 2), R 2-determination coefficient, r-corelation coefficient, rparc-partial ccorelation oefficient, p-value.

Table 6 shows us that there is possibility that tolerance for whole variables is 0,79 to 0,94 (from max.1), which are enough high inexplicable parts od predictor variance, it means there is large enough space that inexplicable variance share with criterion (number of games played). The size of the expected common variance with the criterion can be predicted from the height of individual partial correlation coefficients. Field defense has the highest (rparc = 0.68) and block has the lowest (rparc = 0.44) partial correlation coefficient.

Table 7. Quality indicators of the regression model of the relationship between the coefficients of success of the five phases of the volleyball game and the result in sets (relative point difference)

Criterion	R	R^2 (%)	R^2_{adj}(%)	df	F	p
Rel.point diff.	0,91	88,00	76,46	34	26,34	0,00

Legend: R-multiple corelation coefficient, R^2-determination coefficient, R^2 adj- adjusted coefficient of determination, df-degrees od freedom, F-Fisher's test, p-value.

In table 7, there are indicators of regression analsys quality conducted on the total number of sets played. The criterion was the set result, or the relative point difference in sets.

The coefficients of success of the five phases of the volleyball game included in this research explain a total of 88.00% of the variance of the relative point difference, while their multiple correlation coefficient is 0.91. From these indicators, it can be concluded that there is a statistically significant correlation coefficient of the connection of all 5 phases of the game (p=0.00) in the achieved result success in relation to the relative point difference in the 74 sets played, through 18 matches played in the Super League F of Bosnia and Herzegovina.

CONCLUSION

In this research, we tried to analyse success of woman volleyball club HOK Čapljina member of Super League Federation BIH, on the base of situational parameters during 5 phases of game, those they are achieved in season 2022/2023.

There were 18 matches recorded and analysed during 74 sets played. In this research, a total of 10 variables were used to assess situational efficiency in relation to the result success, and they were divided into a set of predictor variables (8) and a set of criterion variables (2). 5 variables were also used to assess situational efficiency within different phases of the game, monitored in all sets played.

IT was used statistic-mathematic programme for processing data in programme package SPSS 21.0 for Windows in aim of input , processing and analyse of data. There are determined central and dispersive parameters for all applied variables, it means the average achieved values, as well as the minimum and maximum values, are shown. Also, the normality of the distribution was determined based on the Klongo-Smirnoff test. At the univariate level, using the Pearson correlation coefficient, the relationship between the situational efficiency variables was investigated.

In this research, regression analysis was also performed on the total number of sets played during the 2022/2023 season.

From the results obtained, it is evident that the women's team HOK Čapljina, in the variables for assessing situational efficiency based on 18 analyzed matches according to general descriptive parameters, records the best results from the attack phase and that it achieved the highest percentage of success in that segment. It is also evident that the same team records slightly worse results in the counter-attack phase, and the same team will seek reasons precisely in improving the realization of counter-attack in order to improve situational efficiency. In order to determine the result efficiency, it was necessary to conduct an insight and analysis of the matches played:

It was found that there is statistical significance at the p=0.00 level in the number of games won and lost, speaking in favor of the games won (p=0.29), which tells us that there is statistical significance in the number of games won and lost.

As we have already mentioned, a total of 74 sets were played, and we determined that there is statistical significance in the number of won and lost sets, and determined that the statistical significance at the p=0.00 level speaks in favor of lost sets (p=0.19).

In further data processing, an analysis of situational success was performed through all 5 phases of the volleyball game. For this purpose, Regression analysis was applied, which allowed us to determine the differences in the connection of all 5 phases of the volleyball game, with special attention to situational and result success by sets in relation to the relative point difference.

This analysis allowed us to quantitatively express such a dependence (correlation), and we use the obtained model to predict some data for which we do not have measurements or use it to arrive at some constants that describe this dependence, etc.

From the obtained results of the Pearson correlation coefficient (table 5), it can be clearly seen that the phases volleyball games that have the highest correlation between block and field defense, and the correlation coefficient is -0.43. The negative sign means that the higher the coefficient of success of the block, the lower the defense of the field. Given that block and field defense have only 15% of common variance, it can be concluded that their correlation is low.

The coefficient with 0.52, we can conclude that it has a moderate or rather low correlation, with service, service reception and block (r = 0.37; 0.34; 0.28). Service and block have a correlation coefficient of r = 0.9. It should be emphasized that the statistical significance of the correlation coefficients is not shown in the table because that is not its purpose. The purpose is only to show the interrelationships between the predictors. In order to better clarify the influence of individual variables on the criterion, it was

necessary to calculate partial correlation coefficients in which the influence of all other predictor variables was removed. From the obtained results it is evident that there is a significant interconnection within the 5 phases of the game, and the highest interconnection is with the block and field defense.

The quality indicators of the regression model of the correlation of the coefficients of success of the five phases of the volleyball game with the result in all sets (relative point difference) tell us that the coefficients of success of the five phases of the volleyball game included in this research explain a total of 88.00% of the variance of the relative point difference, while their multiple correlation coefficient is 0.91. From these indicators, it can be concluded that there is a statistically significant correlation coefficient of the connection of all 5 phases of the game ($p=0.00$) in the achieved result success in relation to the relative point difference in the 74 sets played, through 18 games played in the Super League F of Bosnia and Herzegovina.

It is expected that the results of this research will contribute to the future work of the women's team HOK Čapljina, but also to offer certain guidelines to other volleyball clubs regarding situational and result success. We believe that this research will also have a certain impact on the training process of both senior and junior teams. and younger age categories.

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DIFFERENCES IN SELECTED MORPHOLOGICAL CHARACTERISTICS OF HIGH SCHOOL STUDENTS ACCORDING TO SEX AND PLACE OF RESIDENCE

DOI 10.57136/2233-0852/2025.23.37.42 Original scientific work

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ABSTRACT: The aim of this study was to examine differences in selected morphological characteristics among high school students with respect to sex and place of residence. A total of 214 students participated in the research. The mean age of the participants was 16.5 ± 0.7 years. The sample was divided into four subgroups: male students from peripheral areas (n = 38), male students from lowland areas (n = 38), female students from peripheral areas (n = 69), and female students from lowland areas (n = 69). Differences between sexes and residential groups were tested using independent samples t-tests in SPSS 25. The results showed no statistically significant differences in height, body mass, waist circumference, hip circumference, or Body Mass Index (BMI) ($p > 0.05$). Students from peripheral areas demonstrated slightly lower BMI and more favorable waist circumference, although without statistical significance. Sex and place of residence did not appear as significant determinants of basic morphological characteristics, suggesting that overall physical activity and lifestyle habits may play a more substantial role.

Keywords: *anthropometry, body composition, adolescents, peripheral and lowland areas*

INTRODUCTION

Morphology is a fundamental scientific discipline for assessing growth, development, and nutritional status in children and adolescents. Modern literature clearly indicates that disturbances in body mass—particularly overweight and obesity—have become major public health issues in childhood (Kobylińska et al., 2022; Ozer et al., 2024). Morphological indicators such as height, body mass, BMI, waist circumference, hip circumference, and derived ratios (e.g., WHR) represent simple yet highly informative indicators of growth, nutritional status, and fat distribution (CASA Junior et al., 2017).

Differences in morphological characteristics among adolescents may be associated with sex, age, biological maturity, lifestyle, socioeconomic status, and the environment in which they grow up (Katanic et al., 2023; Muhammad et al., 2018). Studies show that boys often demonstrate higher waist circumference and higher BMI values, whereas girls tend to have greater hip circumference and higher fat percentage, with these patterns varying across developmental stages (Kobylińska et al., 2022; CASA Junior et al., 2017).

At the same time, global guidelines highlight the importance of physical activity and the reduction of sedentary behavior among youth. The World Health

Organization recommends that children and adolescents aged 5–17 engage in at least 60 minutes of moderate-to-vigorous physical activity daily, while minimizing sedentary behavior and screen time (Chaput et al., 2020; WHO, 2020).

In this context, school commuting becomes an important component of daily physical activity. Active forms of transport (walking, cycling) have been linked to increased levels of total physical activity and more favorable nutritional outcomes (Lee et al., 2008; Lam et al., 2023), although some studies find limited association with BMI (Wiersma et al., 2020; Martin-Moraleda et al., 2022). Recent work highlights that research on active school transport is often 'weight-centric,' focusing predominantly on BMI despite broader health effects (Kent et al., 2023).

Given the rising prevalence of overweight among adolescents in urban environments (Pan et al., 2025; Naskar & Roy, 2020; Satapathy et al., 2024), and findings indicating significant differences between urban and rural settings (Katanic et al., 2023; Gautam et al., 2024), it is justified to examine whether similar differences appear in our context. The aim of this study was therefore to examine differences in anthropometric characteristics of high school students with respect to sex and place of residence.

METHODS

Sample of Participants

A total of 214 secondary school students participated in the study. The mean age of the participants was 16.5 ± 0.7 years. The sample was divided into four subgroups: male students from peripheral areas (n = 38), male students from lowland areas (n = 38), female students from peripheral areas (n = 69), and female students from lowland areas of residence (n = 69). All participants were healthy and had no chronic conditions that could significantly affect growth or movement.

The study was conducted in accordance with the Declaration of Helsinki (2024), with approval from school authorities and informed consent obtained from parents or legal guardians for underage participants.

Variables

Morphological variables included:

- Body height (BH) – measured using a Martin anthropometer with an accuracy of ±0.1 cm. Measurements were performed in a standing

position, barefoot, with maximal body extension. The unit of measurement was centimeters (cm).

- Body mass (BM) – measured using a digital scale with an accuracy of ±0.1 kg, with participants wearing light clothing and no footwear. The unit of measurement was kilograms (kg).
- Body Mass Index (BMI) – calculated as body mass in kilograms (kg) divided by height squared (m^2), according to World Health Organization (WHO) recommendations for children and adolescents and following the protocol proposed by Katanic et al. (2023).
- Waist circumference (WC) – measured using a flexible anthropometric tape at the narrowest part of the torso, between the lower rib and the iliac crest (crista iliaca), according to the protocol of CASA Junior et al. (2017). The unit of measurement was centimeters (cm).
- Hip circumference (HC) – measured at the widest part of the gluteal region using a flexible anthropometric tape, following the protocol of CASA Junior et al. (2017). The unit of measurement was centimeters (cm).

  These indicators are commonly used as discriminators of elevated body fat percentage and cardiometabolic risk in children and adolescents (CASA Junior et al., 2017; Kobylińska et al., 2022).

  Place of residence variables were assessed using a short questionnaire in which students indicated:
- Peripheral place of residence (PRS 1).
- Lowland place of residence (PRS 2).

Statistical Analysis

Data analysis was conducted in SPSS 25. Descriptive statistics included mean, standard deviation, and standard error. Independent samples t-tests were used to examine differences between groups in all measured variables. Significance level was set at $p < 0.05$.

RESULTS

The analyzed data presented in Table 1 illustrate the basic anthropometric characteristics of male students from peripheral and lowland areas of residence, with both groups being numerically equal. Overall, it can be observed that students from urban environments achieved slightly higher mean values of body height compared to their peers from peripheral areas. This difference in height may be partially explained by differences in living conditions, including nutritional quality, availability of sports programs, healthcare access, and growth tempo, which often varies depending on socioeconomic conditions and the degree of urbanization.

However, when other anthropometric indicators such as body mass, waist circumference, hip circumference, and Body Mass Index are considered, the differences between students from peripheral and lowland areas are minimal and do not indicate clear trends favoring either group. Mean values of body mass are almost identical, while waist circumference, hip circumference, and BMI values are only slightly higher among students from rural areas. These differences are so small that they cannot be considered either practically or statistically significant.

Standard deviations indicate a certain degree of variability in body measurements within both groups; however, variability in body height is particularly pronounced among students from peripheral areas. This may reflect different stages of pubertal development or potential differences in nutritional status within the rural population, where lifestyle patterns are often more heterogeneous compared to urban environments. Overall, the results suggest that place of residence does not exert a significant influence on the selected anthropometric characteristics of male students.

Table 1. Independent Samples t-test Results (Male Students)

Variable	RMS 1 Mean	RMS 2 Mean	SD RMS 1	SD RMS 2	SE RMS 1	SE RMS 2	N
Height (cm)	178.4461	184.3316	30.36329	7.84154	4.92558	1.27207	38 / 38
Body Mass (kg)	77.5816	77.3921	11.33530	12.72090	1.83883	2.06360	38 / 38
Waist Circumference (cm)	84.4289	82.9947	9.62954	9.99078	1.56212	1.62072	38 / 38
Hip Circumference (cm)	97.6500	96.0658	8.81717	10.00390	1.43033	1.62285	38 / 38
Body Mass Index (BMI)	23.1395	22.7553	3.36681	3.34880	0.54617	0.54325	38 / 38

Note: RPS 1 = Peripheral residential group; RAV 2 = Lowland residential group; N = Number of participants; MEAN = Mean value; SD = Standard deviation; Std. Error Mean = Standard error of the mean.

Table 2. Independent Samples t-test Results (Female Students)

Variable	RMS 1 Mean	RMS 2 Mean	SD RMS 1	SD RMS 2	SE RMS 1	SE RMS 2	N
Height (cm)	168.3246	168.8174	6.15079	4.90576	0.74047	0.59058	69 / 69
Body Mass (kg)	61.8913	62.3275	8.50429	8.91167	1.02380	1.07284	69 / 69
Waist Circumference (cm)	71.4188	70.5594	7.90311	7.53816	0.95142	0.90749	69 / 69
Hip Circumference (cm)	92.5638	92.1377	9.95401	14.69846	1.19832	1.76949	69 / 69
Body Mass Index (BMI)	21.8870	21.8377	3.12795	2.79327	0.37656	0.33627	69 / 69

Note: RPS 1 = Peripheral residential group; RAV 2 = Lowland residential group; N = Number of participants; MEAN = Mean value; SD = Standard deviation; Std. Error Mean = Standard error of the mean.

The results presented in Table 2, based on a larger subsample of participants, demonstrate a very similar pattern compared to the previously analyzed data. Anthropometric indicators of students from rural and urban environments are almost entirely comparable, indicating a homogeneous adolescent population without a pronounced influence of residential environment on growth and nutritional status.

Mean values of body height in both groups are nearly identical, with only a marginally higher average height observed among students from urban areas. However, such a minor difference does not indicate the presence of a clear trend and may be considered a random variation within the sample. Body mass is also extremely similar between groups, without evidence of significant differences in nutritional status or physical development.

When waist and hip circumferences are examined, the recorded differences are minimal and do not reflect systematic patterns specific to place of residence. Both groups exhibit typical ranges of values for the adolescent population, suggesting that students follow a similar developmental trajectory regardless of whether they live in rural or urban environments.

Body Mass Index (BMI) values further confirm the very similar nutritional status of the observed groups. The mean BMI in both groups falls within the range of normal nutritional status, with negligibly lower variability among students from urban areas. These findings suggest that dietary habits, levels of physical activity, and other factors influencing adolescent nutritional status likely do not differ substantially across geographic environments within this sample. Overall, the results from this larger subsample further corroborate the findings obtained from the smaller sample, indicating that place of residence does not represent a key factor in determining the anthropometric characteristics of adolescents. This uniformity between rural and urban environments may be explained by contemporary lifestyles, similar educational and sporting opportunities, and widespread access to health- and nutrition-related information in modern society.

DISCUSSION

The results presented in Table 1 (male students) and Table 2 (female students) indicate that, within the examined sample of secondary school students, place of residence—whether peripheral (peri-urban) or lowland—does not produce significant differences in the majority of analyzed anthropometric indicators (body mass, waist circumference, hip circumference, and BMI). Similar findings regarding the absence of substantial urban–rural differences in adolescent nutritional status have been reported by Hoffmann et al. (2011) and by Iljkić et al. in the CRO-PALS study (2020). Although minor differences in height or other variables were observed in certain cases, these differences are minimal and do not provide clear evidence that place of residence directly determines variations in growth or body composition. Several factors may explain why the observed differences were not significant. Contemporary lifestyles and the urbanization of peri-urban zones lead to similar conditions in terms of diet, mobility, and access to sports facilities across both types of settlements. Lifestyle habits, overall physical activity levels, sedentary behavior, and family socioeconomic status often exert a greater influence on anthropometric status than place of residence alone. Within-group heterogeneity and pubertal variations contribute to standard deviations, which is particularly evident in body height within the peripheral group and may be attributed to different stages of adolescent growth and maturation. Place of residence does not appear to be a sufficiently strong predictor of anthropometric status among youth in contemporary, demographically homogenized environments. Public health interventions and school-based programs should therefore focus on promoting healthy habits, ensuring access to sports programs, and providing nutritional education universally, regardless of settlement type. The relatively small sample size may limit the detection of subtle differences. Reliance solely on basic anthropometric measures, without direct assessment of body composition, represents a methodological limitation. Future research should incorporate longitudinal designs, larger samples, and measures of lifestyle habits, physical activity, and socioeconomic status in order to more precisely identify factors contributing to interindividual differences among adolescents.

CONCLUSION

The results of the present study indicate that, in the examined sample of high school students, place of residence does not have a statistically significant influence on the selected morphological characteristics, including body height, body mass, waist and hip circumference, and body mass index (BMI). A comparison between students from lowland and peripheral areas revealed only minimal differences without a clear pattern, suggesting a high degree of homogeneity in terms of growth and body constitution.

These findings imply that urban and geographical characteristics of the living environment are no longer decisive factors in adolescent morphological development, as modern lifestyle patterns are increasingly becoming uniform regardless of residential location. Furthermore, the results suggest that factors such as dietary habits, levels of daily physical activity, access to sports and recreational facilities, socioeconomic conditions, and the prevalence of sedentary behaviors likely exert a greater influence on the morphological status of adolescents than geographical origin alone. In this context, educational institutions, families, and the broader community play a crucial role in supporting healthy growth and development by promoting healthy lifestyle habits and ensuring the availability of sports and recreational opportunities.

Although place of residence did not demonstrate a determining role in this study, further research

is recommended to examine a broader range of variables that may shape the physical development of adolescents. Future studies should include larger samples, longitudinal monitoring of developmental changes throughout adolescence, and additional health- and function-related indicators, such as body composition and levels of physical activity. This approach would enable a more comprehensive understanding of the complex factors influencing growth, development, and health in youth populations. Overall, the findings of this study highlight the importance of universal preventive measures and public health programs targeting adolescents, regardless of whether they live in lowland or peripheral areas. The focus should remain on fostering healthy lifestyle behaviors and creating environments that support optimal growth, well-being, and the long-term health of younger generations.

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