

Unpacking the link between physical activity and psychological well-being among employed adults: a focus on self-perception and mental toughness

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Abstract: Despite empirical evidence demonstrating the benefits of physical activity (PA) for mental health, the mechanisms linking PA and mental health remain uncertain. Thus, this study aims to investigate the mediating role of self-perception of PA and mental toughness in the relationship between PA and psychological well-being. In this cross-sectional study, a sample of 381 employed adults aged 21 to 42 years ($M = 32.01$, $SD = 5.34$; 64.53% female) completed scales measuring PA intensity, mental toughness, and psychological well-being, and reported their self-perceived PA level. Data was analysed using serial mediation analysis. The results indicated that PA's direct contribution to psychological well-being was not statistically significant. The serial path of the mediation model revealed a statistically significant positive contribution of PA to psychological well-being via increased self-perception of PA and enhanced mental toughness. The findings suggest that the relationship between PA intensity and psychological well-being may be explained through individuals' self-perception of their PA and their mental toughness. Specifically, those who engage in more intense PA also tend to perceive themselves as more physically active, which is associated with higher levels of mental toughness and ultimately contributes to enhanced psychological well-being.

Keywords: physical activity, psychological well-being, self-perception, mental toughness, mental health

Introduction

Physical activity (PA), recognised for its benefits to physical health, has increasingly

been advocated for in its positive effects on psychological well-being and overall mental health. A wealth of studies indicating a positive relationship between PA and men-

tal health indicators support this (e.g., Noetel et al., 2024; Huang et al., 2024; Wanjau et al., 2023). Acknowledging these potential benefits, significant research and theoretical frameworks have focused on identifying and elucidating the determinants of sustained and consistent PA (see Biddle et al., 2021). However, the mechanism underpinning the relationship between PA and health, as well as the determinants of this relationship, remains insufficiently understood. Two seminal experimental studies offered possible mechanisms that may help harvest the physiological (Crum & Langer, 2007) and psychological (Desharnais et al., 1993) benefits of PA. Crum and Langer (2007) found that hotel housekeepers who were informed their work met exercise recommendations showed improvements in weight, body fat, waist-to-hip ratio, and systolic blood pressure after four weeks, despite no changes in PA levels.

Desharnais et al. (1993) observed that participants in a 10-week exercise program who believed it was intended to enhance psychological well-being experienced significant improvements in self-esteem, while the control group did not. These findings suggest that beliefs influenced by placebo mechanisms can heighten the psychological effects of exercise, a notion further supported by Lindheimer et al. (2015), who estimated that placebo beliefs contribute to about half of the psychological benefits of exercise.

However, not all studies supported the placebo explanation. Stanforth et al. (2011) found no significant placebo effect among building service employees, with both the experimental and control groups showing similar health outcomes, except for blood pressure improvements in the experimental group. Arbinaga et al. (2018) expanded on Desharnais et al. (1993) by including a no-exercise control and varied exercise conditions. Although exercise improved self-esteem and psychological

well-being, heightened expectations did not enhance these effects, suggesting that mindset alone does not strongly influence health outcomes.

In interpreting the empirical insights mentioned, it is relevant to consider the observation of Arbinaga et al. (2018) that some studies simultaneously manipulated both expectancy and PA, while others focused solely on manipulating expectancy. These variations in research design may influence the scope of empirical findings. Firstly, in study designs that included exercise groups with and without manipulated beliefs, PA itself may serve as a source of psychological benefit. This is supported by the findings of Arbinaga et al. (2018), which demonstrated improvements in psychological well-being and self-esteem across all exercise groups. Furthermore, Bandura's (1977) insights highlight that simply informing participants about potential benefits may not lead them to accept or believe in those benefits, especially when such information contradicts or runs counter to their own experiences. The crux lies in whether expectancy manipulations can genuinely enhance belief in the psychological advantages of PA, although some studies sought to control for this effect (e.g., Arbinaga et al., 2018).

A recent study (Glavaš & Pavela Banai, 2024) that surveyed participants' opinions regarding the psychological benefits of PA, rather than manipulating variables, offered additional empirical insight into this mechanism. The authors investigated the mediating role of belief in the psychological benefits of PA (mindset) in the relationship between PA and mental health. The findings revealed that, in addition to the direct contribution of PA in reducing symptoms of depression and anxiety among young adults, beliefs about the psychological benefits of PA served as a significant mediating factor. Specifically, higher levels of PA were associated with stronger beliefs in its

psychological benefits, which, in turn, contributed to reductions in depression and anxiety symptoms. These findings, derived from self-reported beliefs, corroborate previous empirical insights about the crucial role of an individual's mindset in maximising the advantages of PA. Simultaneously, these findings necessitate caution regarding the potentially detrimental effects of insufficient awareness of one's own PA. The importance of perceiving one's own PA has recently been highlighted by Zahrt and Crum (2020) through the introduction of the concept of activity adequacy mindset, which pertains to beliefs about the adequacy of PA and its health consequences. It is essential to distinguish between the general self-perception of PA, which refers to how active individuals perceive themselves, and the more specific activity adequacy mindset introduced by Zahrt and Crum (2020). The latter goes beyond mere perception of activity level and reflects individuals' beliefs about whether their PA is sufficient and beneficial for their health. In other words, it is not just about how much one believes they are active, but how adequate and health-beneficial they perceive that activity. Zahrt and Crum (2020) posited that individuals hold mindsets about the adequacy of their PA levels and the health consequences that follow. These mindsets are shaped by both their actual levels of PA and their beliefs about the adequacy and health benefits or drawbacks of their PA. Furthermore, they suggested that official recommendations can shape mindsets and potentially inflict harm, such as cultivating an inadequate mindset. Based on their findings, they recommend that endorsing a lower rather than a higher level of PA may be more effective for promoting healthy activity and adaptive mindsets. The effect of mindset on health indicators was also demonstrated by Zahrt et al. (2023) in a longitudinal, randomised controlled study. By manipulating the feedback on daily step counts

through wearable fitness trackers, the authors demonstrated that participants who received accurate step counts adopted healthier diets, improved their mental health, and increased their aerobic capacity, but also experienced reduced functional health. In contrast, those exposed to deflated step counts ate unhealthy foods, exhibited reduced self-esteem, and had higher blood pressure and heart rate. The importance of self-perception of one's own PA is illustrated by Zahrt and Crum's (2017) findings, which indicated a lower mortality risk for individuals who perceived themselves as more active than their age peers than for those who considered themselves less active. Taken together, these findings, encompassing placebo-induced beliefs on the effect of PA on mental health, self-perception of PA, and PA mindset in general, underscore the significance of perception regarding PA in examining the relationship between PA and mental health. These empirical insights provide valuable opportunities for exploring the mechanisms by which individuals' perceptions of PA may reflect the hypothesised positive effects of PA on mental health.

Building on that, this study aimed to examine the relationship between PA and psychological well-being in a sample of employed adults, with a focus on identifying potential psychological mechanisms that may account for this association. Specifically, the study sought to determine whether self-perception of PA and mental toughness jointly mediate the relationship between PA and psychological well-being. The secondary aim was to explore the unique and combined contributions of self-perception and mental toughness in this context, thereby providing a more nuanced understanding of the role of internal cognitive and affective factors in the potential psychological well-being benefits of PA. By integrating these constructs into a single model, this study aimed to provide a novel perspective on

the pathways through which PA may enhance psychological functioning.

Method

Participants

The study sample was identical to the sample encompassed in Glavaš and Pavela Banai's (2024) study. It consisted of 381 employed adults from various regions of Croatia aged between 21 and 42 years ($M = 32.01$, $SD = 5.34$, 64.53% female) who participated in the project titled "Physical activity and psychological well-being: from habit to identity". All participants reported no difficulties performing routine physical activities. Of the participants, 56.4% completed graduate studies, 14.2% completed undergraduate studies, 12.9% attained postgraduate qualifications, and 16.5% graduated from high school. Eleven participants were eliminated from the final analysis due to incomplete responses on any of the measures employed.

Study Design

The study employed a cross-sectional design.

Instruments

Physical Activity Intensity

We assessed physical activity (PA) intensity using the Godin-Shephard Leisure-Time Physical Activity Questionnaire (GSLTPAQ) (Godin, 2011). In the questionnaire, participants indicated the frequency of their engagement in strenuous (e.g., running, jogging, football), moderate (e.g., fast walking, tennis), and

mild (e.g., yoga, bowling) physical activities over a typical week. The total score was determined by multiplying each score by its respective weight (3 for mild exercise, 5 for moderate exercise, and 9 for strenuous exercise) and then aggregating the resultant scores. A higher score indicated greater PA intensity.

Mental Toughness

To measure mental toughness, we utilised the Mental Toughness Index (MTI) (Gucciardi et al., 2015). Participants responded to 8 items, such as "I consistently overcome adversity", using a 7-point Likert scale ranging from 1 (False 100% of the time) to 7 (True, 100% of the time). The scale operationalises a single mental toughness factor, with the total score derived from responses to all eight items. Higher MTI scores indicate greater mental toughness. The scale's reliability in this study, as assessed by Cronbach's α , was high (.93).

Psychological Well-being

We assessed psychological well-being using a shortened version of the Psychological Well-being (PWB) Scale (Ryff & Keyes, 1995). This version comprises 18 items that measure six dimensions of well-being (autonomy, environmental mastery, personal growth, positive relations with others, purpose in life, and self-acceptance), as well as overall psychological well-being. Participants rated items, such as "I am good at managing the responsibilities of daily life", on a 6-point Likert scale, from 1 (strongly disagree) to 6 (strongly agree), with a higher score indicating greater well-being. The internal consistency coefficient of the overall scale indicated good reliability (Cronbach's $\alpha = .83$).

Self-perception of Physical Activity

We operationalised participants' perceptions of their PA by using the item: "On a scale from 0 (not at all) to 10 (extremely much), indicate how physically active you think you are."

Procedure

The data was obtained online as part of a broad research project entitled “Physical Activity and Psychological Well-being: From Habit to Identity,” financed by the Catholic University of Croatia and approved by the Ethics Committee of Catholic University of Croatia (Document Classification: 641-03/22-03/10; Reference Number: 498-15-06-22-005). The project survey was administered via the SurveyRock web platform. The team of research project associates and partner universities distributed the invitation letter to ensure coverage across all regions of the country, although participants did not specify their exact region of origin. Engagement in the project was voluntary. The research team provided participants with specific insights into the project’s scientific objectives, practical applications, and recommendations on PA and mental health. Prior to participating in the survey, participants provided informed consent via a document outlining the study’s aims, the confidentiality and anonymity of the data, and their right to withdraw from the study without repercussions. Alongside the survey design, which guarantees data security and anonymity, we modified the web platform settings to inhibit the retention of IP addresses. Participants indicated their consent to participate in

the study by selecting the “next” option and proceeding to the survey.

Data analysis

The contribution of PA intensity to psychological well-being was examined through direct and indirect pathways via self-perceptions of PA and mental toughness, using a serial mediation analysis (model 6) with a PROCESS macro (Hayes, 2018).

Results

Descriptive statistics and correlation analysis

The descriptive statistics for physical activity (PA) intensity, self-perception of PA, mental toughness, and psychological well-being, together with the correlations among these variables, are presented in Table 1.

Correlation analyses indicated PA intensity strongly correlated with self-perception of PA and weakly positively correlated with mental toughness and psychological well-being. These findings suggest that individuals participating in more intensive PA perceived themselves

Table 1. Descriptive statistics and intercorrelation between PA intensity, self-perception of PA, mental toughness, and psychological well-being

	<i>M (SD)</i>	<i>Range</i>	1	2	3	4
PA intensity (1)	43.61 (24.37)	0 - 136	-	.61**	.19**	.18**
Self-perception of PA (2)	7.24 (2.11)	0 - 10		-	.30**	.21**
Mental toughness (3)	45.89 (7.47)	15 - 56			-	.66**
Psychological well-being (4)	83.35 (9.23)	50 - 106				-

** $p < 0.01$.

as more physically active and reported higher mental toughness and psychological well-being. Furthermore, self-perception of PA was positively correlated with mental toughness and psychological well-being, suggesting that individuals who perceive themselves as more physically active tend to have higher levels of both. Additionally, the results showed a high positive correlation between mental toughness and psychological well-being, indicating that individuals with higher mental toughness tend to exhibit higher psychological well-being.

Mediation analysis

The serial mediation model examined the mediating roles of self-perception of PA and mental toughness in the relationship between

PA and psychological well-being (Table 2, Figure 1).

The direct pathway from PA to psychological well-being was not statistically significant ($\beta = 0.08$, 95% CI [-0.02, 0.17]), suggesting that PA did not directly predict psychological well-being when the mediators were considered. Similarly, the self-perception of PA did not significantly predict psychological well-being ($\beta = -0.04$, 95% [-0.14, 0.06]). In contrast, mental toughness was a significant predictor of psychological well-being ($\beta = 0.65$, 95% CI [0.57, 0.73]).

Furthermore, the specific indirect pathways, from PA through self-perception of PA alone ($\beta = -0.02$, 95% CI [-0.08, 0.04]) and through mental toughness alone ($\beta = 0.01$, 95% CI [-0.07, 0.08]), were also not statistically significant.

Table 2. Regression (mediation) analysis predicting psychological well-being

	β	<i>se</i>	<i>t</i>	<i>p</i>	<i>LLCI</i>	<i>ULCI</i>
Direct effects						
PA → PWB	0.08	0.05	1.61	.11	-0.02	0.17
PA → Self-perception of PA	0.61	0.04	14.61	<.001	0.52	0.69
PA → Mental toughness	0.01	0.06	0.15	.88	-0.11	0.13
Self-perception of PA → PWB	-0.04	0.05	0.73	.46	-0.14	0.06
Mental toughness → PWB	0.65	0.04	15.83	<.001	0.57	0.73
Indirect effect						
PA → Self-perception of PA → PWB	-0.02	0.03			-0.08	0.04
PA → Mental toughness → PWB	0.01	0.04			-0.07	0.08
PA → Self-perception of PA → Mental toughness → PWB	0.11	0.03			0.06	0.17
Total	0.10	0.04			0.01	0.18
R ²	43.41***					

Note. PA - Physical Activity, PWB - Psychological well-being, LLCI = lower level confidence interval (95%); ULCI = upper level confidence interval (95%)

****p* < .001

However, the mediation pathway from PA through self-perception of PA and mental toughness to psychological well-being was statistically significant ($\beta = 0.11$, 95% [0.06 – 0.17]). This pathway suggested that individuals reporting a higher intensity of PA tended to perceive themselves as more physically active, which was associated with higher mental toughness, and, in turn, with greater psychological well-being. Thus, the contribution of PA to psychological well-being was significant through the sequential influence of self-perception of PA and mental toughness.

Overall, the model explained 43.41% of the variance in psychological well-being scores ($F(3, 366) = 93.59$, $p < 0.001$).

Discussion

The findings of this study provide insight into a possible pathway linking physical activity (PA) to psychological well-being. The results indicated a positive contribution of PA intensity to psychological well-being via individuals' perception of their PA and mental toughness. This mediation pathway suggests that individuals who report engaging in more intense PA are likely to perceive themselves as more physically active. This self-perception correlated with increased mental toughness, which was associated with enhanced psychological well-being. It is important to note that the direct pathway between PA intensity and psychological well-being was not statistically significant, suggesting that specific mechanisms

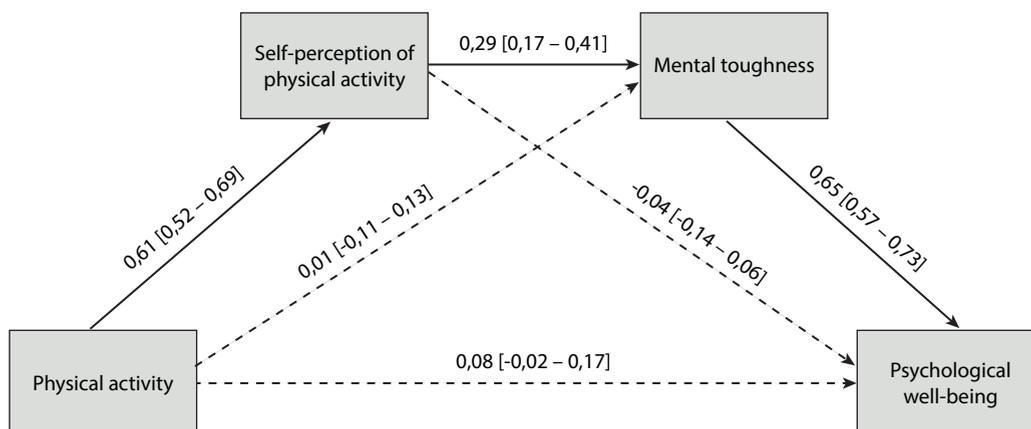


Figure 1. Mediation analysis of the relationship between PA and psychological well-being, and the mediation role of self-perception of physical activity and mental toughness

Note. Standardised coefficients are shown, along with 95% confidence intervals (CI). Solid lines represent significant paths while dashed lines indicate statistically non-significant paths.

are necessary for PA to exert a beneficial effect on psychological well-being. Furthermore, the statistically non-significant mediation pathway from PA intensity to psychological well-being, only through self-perception of PA, indicates that individuals' perceptions of their own PA do not solely mediate the relationship between PA intensity and psychological well-being. This finding seemingly contradicts empirical insights suggesting that one's perception of PA plays a significant role in the relationship between PA and physical and psychological indicators (Baceviciene et al., 2019; Glavaš et al., 2024). However, these studies did not account for additional potential factors related to self-perception, such as mental toughness, which may play a significant role in the relationship between PA and mental health, as supported by our findings. Thus, the study's findings imply that mental toughness, as predicted by the perception of one's own PA, is associated with mental health benefits commonly associated with PA. Assuming that individuals' perceptions of PA, as well as feelings of source, causation, and control, are essential elements of mental toughness, the results of this study support existing empirical evidence that underscores the significant role of beliefs and expectations in the relationship between PA and mental health (Desharnais et al., 1993; Glavaš et al., 2023; Glavaš & Pavla Banai, 2024). Furthermore, the results raised the possibility that mental toughness might be relevant for how individuals perceive the adequacy and health consequences of their own PA, a dimension emphasised by Zahrt and Crum (2020) in their concept of activity adequacy mindset.

By underscoring the significant role of self-perceptions of PA and mental toughness in the relationship between PA and psychological well-being, these findings provide a meaningful context for examining these associations through specific theoretical frameworks. Bem's (1972) self-perception theory may offer

one possible lens for conceptualising observed relationships, suggesting that individuals may infer aspects of their self-concept by observing their own activity patterns and behaviours. In this context, higher engagement in PA may coincide with perceiving oneself as physically active, disciplined, resilient, or capable, which are attributes closely related to mental toughness. Whilst our study did not directly assess identity-related constructs, this mechanism may reflect one way in which behavioural engagement in PA relates to psychological well-being through perceived self-concept.

Similarly, Dweck's (2006; Yeager & Dweck, 2020) growth mindset framework may offer additional conceptual insight into the interplay between self-perceptions and beliefs in personal development and change. Although we did not directly assess mindset, the observed mediation pathway may align with theoretical concepts that clarify the relationship between perceptions of progress and dimensions such as mental toughness, ultimately influencing psychological well-being. In this context, engagement in PA may be associated with individuals perceiving themselves as capable of improvement, thereby reinforcing a growth-oriented self-perception over time. These interpretations should be viewed as theoretical implications rather than evidence of tested mechanisms, and they necessitate future empirical verification, preferably through longitudinal or experimental studies utilising validated measures of mindset and identity-related constructs.

Implications for Applied Settings

Building on these insights, this study's findings, previous empirical insights, and relevant theoretical frameworks provide fruitful avenues for practical implications among younger and early middle-aged adults in the general population. Recognising the empiri-

cally supported benefits of PA for mental health and psychological growth, promoting and encouraging PA is undoubtedly the first step. However, as highlighted by our study and other abovementioned studies, the way individuals perceive their PA and their beliefs about PA's beneficial impact on mental health appear to be important factors. Fostering more adaptive self-perceptions and strengthening beliefs in PA's mental health benefits can be cultivated through skills and awareness of PA's benefits. Additionally, providing individuals with meaningful experiences in tangible PA environments, where they receive feedback that their efforts lead to improvement, may enhance a sense of control, self-efficacy, and overall mental toughness. Together, these factors appear to be associated with improved psychological well-being. The described practical approaches may be applicable across various contexts of individual functioning, aiming to support and improve psychological well-being. In workplace settings, health promotion initiatives and interventions should provide access and opportunities for PA while also creating psychologically supportive environments that convey the mental health benefits of PA and encourage positive and more adaptive self-perception among employees. This may include structured feedback, collaborative goal-setting, and peer support initiatives. Similarly, public health campaigns targeting young, generally healthy adults, who are likely less inclined to such initiatives, are essential for effectively conveying the psychological benefits of PA. These campaigns are likely to be more effective when they explicitly highlight the psychological benefits of PA and the significance of individuals' perceptions of their own activity, promote small, meaningful steps, and recognise personal progress. By targeting both behaviour and underlying beliefs, such initiatives can more effectively support psychological well-being at the population level.

Despite utilising a non-clinical sample, this study also points to the possible directions for clinical practice. The identified pathway, from PA to psychological well-being through self-perception and mental toughness, may guide the creation of supplementary interventions in clinical settings. Mental health professionals may incorporate PA components not merely as behavioural recommendations, but as integral elements of a comprehensive intervention framework designed to modify people's beliefs and self-assessments. Further research in clinical populations is necessary. However, such integrative approaches have the potential to improve psychological well-being and treatment outcomes.

Study Limitations and Future Research Suggestions

Although this study identifies specific features that may elucidate potential pathways linking PA and psychological outcomes, several limitations must be acknowledged. The proposed mediation model and its interpretation are limited by the cross-sectional design, which precludes causal inference and instead suggests the potential presence of dynamic feedback loops. Consequently, the relationships among the observed variables may signify complex, bidirectional, and circular processes rather than straightforward linear cause-and-effect pathways. For instance, while more intense PA and more positive self-perceptions of PA may correlate with higher mental toughness and psychological well-being, it is also plausible that individuals exhibiting greater well-being or mental toughness are more inclined to engage in PA and to view themselves as more active. These reciprocal patterns indicate a dynamic interaction wherein psychological and behavioural factors may mutually reinforce each other over time, potentially fostering beneficial cycles of

health-related behaviours and psychological well-being. A more in-depth understanding of these processes is essential for the strategic development of interventions that employ both cognitive and behavioural pathways to facilitate change. Therefore, future longitudinal or experimental studies are required to clarify the directionality and mechanics of these reciprocal interactions. These designs would allow for stronger causal inferences and the identification of temporal sequences. Randomised controlled trials, in particular, would enable researchers to test specific mechanisms of change and disentangle the effects of PA engagement from pre-existing psychological traits.

A further limitation is the single-item operationalisation of PA self-perception. As this study was part of a broader project aimed at including a wider array of PA and well-being indicators, we operationalised self-perception using a single-item measure. In other words, the decision to operationalise this construct with a single item was driven by practical considerations and aligned with the principles of omnibus research. Furthermore, we drew on previous research (e.g., Crum et al., 2007) to demonstrate that a single, well-formulated item can capture meaningful variation in perceived PA. Nonetheless, we recognise the limitations of this approach as a single item may not fully capture the multidimensional nature of self-perception of PA and may be insufficiently sensitive to subtle differences across individuals. Thus, future studies would benefit from employing validated, multi-item instruments that assess different facets of self-perceived PA, thereby enhancing the construct validity of self-perception of PA.

In addition to this direction and the identified need for future studies to employ longitudinal or experimental designs, subsequent research must include theoretically relevant moderators such as gender, age, prior PA ex-

perience, the personal significance of PA, and cultural context. These designs and improvements in methodology offer promising directions for generating valuable insights into the complex link between PA and psychological well-being, an area of growing importance with profound implications for both individual prosperity and growth and public health promotion.

Conclusion

This study advances our comprehension of the relationship between physical activity (PA) and psychological well-being. The findings indicate that the link between psychological well-being and PA is indirect, mediated by individuals' self-perceptions of their PA and their mental toughness. By elucidating this psychological pathway, the study offers a more nuanced understanding of the complex relationships between PA and psychological well-being, emphasising indirect associations that warrant further examination into possible causative interconnections and additional influencing factors.

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Analiza odnosa tjelesne aktivnosti i psihološke dobrobiti zaposlenih odraslih: fokus na samopercepciju i mentalnu čvrstoću

Sažetak: Unatoč empirijskim dokazima koji pokazuju pozitivne učinke tjelesne aktivnosti (TA) na mentalno zdravlje, mehanizmi koji povezuju TA i mentalno zdravlje još uvijek nisu u potpunosti jasni. Stoga je cilj ovog istraživanja bio ispitati posredujuću ulogu samopercepcije TA i mentalne čvrstoće u odnosu između TA i psihološke dobrobiti. U ovom presječnom istraživanju sudjelovala je 381 zaposlena odrasla osoba u dobi između 21 i 42 godine ($M = 32,01$; $SD = 5,34$; 64,53 % žena), koja je ispunila skale za procjenu intenziteta TA, mentalne čvrstoće i psihološke dobrobiti te procijenila vlastitu razinu TA. Podaci su analizirani serijskom medijacijskom analizom. Rezultati su pokazali statistički neznatčan izravni doprinos TA psihološkoj dobrobiti. Serijski medijacijski put pozitivnog doprinosa TA psihološkoj dobrobiti putem povećane samopercepcije TA i više razine mentalne čvrstoće pokazao se statistički značajnim. Nalazi upućuju na to da se odnos između intenziteta TA i psihološke dobrobiti može objasniti kroz samopercepciju TA i mentalnu čvrstoću pojedinca. Osobe koje se bave intenzivnijom TA imaju tendenciju percipirati sebe tjelesno aktivnijima, što je povezano s višom razinom mentalne čvrstoće, a posljedično i s izraženijom psihološkom dobrobiti.

Ključne riječi: tjelesna aktivnost, psihološka dobrobit, samopercepcija, mentalna čvrstoća, mentalno zdravlje