

BENEDEK T. TIHANYI, ANDREA SÁGI, BARBARA CSALA,  
NÓRA TOLNAI & FERENC KÖTELES\*

## BODY AWARENESS, MINDFULNESS AND AFFECT Does the Kind of Physical Activity Make a Difference?\*

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The aim of this cross-sectional study is to explore expected differences in the connection between particular physical activities and positive and negative affect, body awareness or mindfulness. Additionally, we describe the so-called tingling phenomenon (i.e. skin-related sensations evoked by focusing on a body part) in terms of prevalence, gender differences and psychological concomitants. A total of 1,057 individuals (331 male; mean age:  $30.6 \pm 10.17$  years) practicing *yoga*, *Pilates training*, *kung fu*, *aerobic*, or *ballroom dance* completed our questionnaire. Analysing data of all sports together, weekly frequency of practice, as opposed to time elapsed since starting practice, was connected to lower levels of negative affect and somatosensory amplification, and to higher levels of positive affect. Advanced yoga and Pilates participants showed higher body awareness; advanced kung fu participants amplified bodily signals the least, and aerobic was related to the highest positive affect. Among beginners, there were no practically relevant differences in the assessed constructs. These results might help to clarify the common and different psychological properties that are needed for and/or can be developed by different sports.

**Keywords:** aerobic, body awareness, kung fu, mindfulness, physical activity, positive affect, somatosensory amplification, tingling, well-being, yoga

**Körperbewusstsein, bewusste Präsenz und die Auswirkungen: Zählt es, welche Bewegungsform du wählst?** Durch unsere Querschnittstudie wollten wir den Zusammenhang zwischen den verschiedenen körperlichen Aktivitäten und der positiven bzw. negativen Stimmung, dem Körperbewusstsein sowie der bewussten Präsenz erforschen. Ein weiteres Ziel stellte die genauere Beschreibung des sog. *Phänomens des Kribbelns* (ein durch die auf einen bestimmten Körperteil

\* Corresponding author: Ferenc Köteles, Institute for Health Promotion and Sport Sciences, Eötvös Loránd University, Bogdánfy Ödön u. 10., H-1117 Budapest, Hungary; koteles.ferenc@ppk.elte.hu.

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gerichtete Aufmerksamkeit hervorgerufenes, auf der Haut lokalisiertes Gefühl) dar (Häufigkeit, Geschlechtsunterschiede, psychologische Korrelate). Insgesamt 1057 Personen (331 Männer, Durchschnittsalter:  $30,6 \pm 10,17$  Jahre), die *Yoga*, *Pilates*, *Kung-Fu*, *Aerobic* oder *Gesellschaftstänze* ausübten, haben den Fragebogen ausgefüllt. Alle Bewegungsarten insgesamt betrachtet, hatte die wöchentliche Häufigkeit der körperlichen Aktivität inversen Zusammenhang mit der negativen Affektivität und der somatosensorischen Verstärkung und sie zeigte positive Korrelation mit der positiven Affektivität. Die seit dem Beginn des Trainings verstrichene Zeitspanne stand mit keiner der gemessenen Variablen in Zusammenhang. Die Teilnehmer, die Yoga und Pilates fortgeschritten ausüben, zeigten ein höheres Körperbewusstsein, das Niveau der somatosensorischen Verstärkung war bei den Kung-Fu praktizierenden Personen das niedrigste, während Aerobic war mit einer höheren positiven Affektivität verbunden. Unter den Anfängern haben wir keinen wesentlichen Unterschied in Bezug auf die untersuchten Variablen gefunden. Diese Ergebnisse könnten dazu beitragen, die allgemeinen und speziellen psychologischen Eigenschaften zu klären, die bei der Ausübung verschiedener körperlicher Aktivitäten nötig sind oder die dadurch entwickelt werden können.

**Schlüsselbegriffe:** körperliche Aktivität, Yoga, Kung-Fu, Aerobic, Wohlbefinden, Körperbewusstsein, positive Affektivität, Präsenz, somatosensorische Verstärkung, Kribbeln

## 1. Introduction

The concept that physical activity (PA) plays a fundamental role in maintaining and regaining physical and psychological health appeared in human culture millennia ago. Growing evidence shows that PA has a positive impact on many organ systems and it plays a fundamental role in maintaining and developing physical health – it has even been called a ‘miracle drug’ (PIMLOTT 2010). Positive impact of PA on mental problems has also been reported. For example, in the case of depression, PA proved to be an efficient treatment (FOX 1999), and its efficacy increased with the severity of the disorder (MEYER & BROOCKS 2000).

It is also well known that PA improves mental functioning even among healthy people. As for cognitive functioning, PA can help to avoid neurological dysfunctions and cognitive decline in old age (COTMAN & ENGESSER-CESAR 2002), to improve school performance in childhood (FISHER et al. 1996), and to improve attentional functions, intelligence, decision making, and effortful memory in adults (MCDOWELL et al. 2003; TRUDEAU & SHEPHARD 2010). The positive effect of PA on subjective well-being is also reported (FOX 1999). According to a meta-analysis based on more than 100 studies, increase in well-being as a result of regular aerobic exercise was mediated by positive affect (REED & BUCK 2009). The decrease of negative affect was also described (SCULLY et al. 1998). Another mediating construct between PA and well-being is self-esteem. FOX (2000) identified 36 randomised controlled studies and 44 controlled studies since 1971 and found that approximately 50% indicated positive changes in self-esteem. Evidence suggests that participation in certain physical activities throughout the adolescent years positively affects self-esteem, body image and physical strength (JAFEE & MANZER 1992). PA affects global self-worth through

body areas satisfaction, appearance evaluation and athletic competence (HAUGEN et al. 2011; MCAULEY et al. 2000). Interestingly, these aspects mainly represent an external (i.e. a third-person) point of view of the body.

Beyond exteroceptive information on physical appearance improved by PA, regular exercise can have an impact on body awareness that might also contribute to subjective well-being. Elevated levels of body awareness are often regarded as a negative phenomenon in medical context as it can lead to amplification of perceived symptoms (i.e. somatosensory amplification) and to catastrophisation (BARKSKY et al. 1988; WICKRAMASEKERA 1995). On the other hand, body awareness may be helpful in identifying important bodily sensations, and it gives the opportunity to react to them appropriately (e.g. by resting or by visiting a physician, etc.; BAKAL 1999). Moreover, it has been proposed that states of the body heavily influence the contents and processes of the brain and that these so-called 'somatic markers' are indispensable for decision making and emotions (DAMASIO et al. 1996). The advantage of paying attention to bodily signals was also shown in the field of sport. Professional marathoners as opposed to non-elites attempt to read and process somatic information during running (MORGAN & POLLOCK 1977). In summary, outcome of higher body awareness partly depends on the individual's emotional reaction. While compulsive focus and anxiety (somatosensory amplification) is maladaptive, non-judgemental recognition might be adaptive.

Although skin-related information is traditionally regarded as part of exteroception, it also contributes to the internal representation (i.e. a first-person point of view) of the body (MEHLING et al. 2009). Recent findings suggest that skin-related sensations (tingling, crawling, etc.) may indeed represent an important component of body-related information. Such tingling sensations were usually considered beneficial (e.g. reducing pain, easing traumatic memories or simply being consequences of the therapeutic touch) in some studies (COX & HAYES 1999; FANG et al. 2013; LEVINE 1997, 2008; MELOY & MARTIN 2001). However, negative aspects were also reported (LAZARUS & MAYNE 1990). A possible explanation of the tingling sensation may be that the majority of sensory information from the skin is usually filtered out in order to free attentional resources to process information from more important (e.g. visual and auditory) sensory modalities (NELSON 2010, 197–218). When we focus on a body part, however, skin and muscle-related information can reach consciousness, the body area in question 'pops out', and the change in perception is accompanied by a new sensation. As our knowledge on this phenomenon is scarce, its precise description (prevalence, gender differences, related psychological constructs, etc.) would be extremely important for the development of a more comprehensive model of body awareness.

Another significant and recently much investigated construct that is also connected to body awareness and can increase well-being is mindfulness (KABAT-ZINN & HANH 2009). Mindfulness has a role in enhancing positive outcomes in several important life domains, including mental health, physical health, behavioural regulation and interpersonal relationships, and in curtailing negative functioning (BROWN

et al. 2007). Mindfulness showed significant positive correlation with positive affect, positive emotion, joviality, attentiveness and vitality, and negative correlation with anxiety (KEUNE & PERCZEL FORINTOS 2010). HÖLZEL and colleagues proposed a model for the interaction of the factors required for the state of mindfulness (2011). They consider mindfulness meditation practice as a process of enhanced self-regulation, consisting of an interplay of attention regulation, body awareness, emotion regulation (in form of reappraisal and extinction) and a change of perspective regarding the self.

In the present study, correlates of regular PA in five sports (ballroom dance, aerobic, kung fu, yoga, and Pilates) were investigated. We deliberately chose sports which explicitly aim to improve body awareness (yoga and Pilates; DAUBENMIER 2005; LYNCH et al. 2009), sports which are expected to improve mindfulness (yoga and kung fu) and sports which do not directly target these changes (ballroom dance, aerobic). First, it was hypothesised that PA, regardless the particular activity, is connected to lower levels of negative affect and somatosensory amplification, and to higher levels of positive affect and body awareness. Second, we expected differences in the assessed characteristics among those practising the five PAs. More precisely, we hypothesised that yoga and Pilates training relates to higher levels of body awareness and to lower levels of somatosensory amplification, and that yoga and kung fu training is linked to higher levels of mindfulness. We were also curious about whether the assessed personality characteristics had an impact on choosing a certain physical activity or not (e.g. whether beginners with a marked proneness to somatic absorption prefer yoga or Pilates to aerobic, etc.). Finally, we aimed to obtain detailed descriptive information on the above-mentioned ‘tingling’ phenomenon.

## 2. Methods

### 2.1. Participants

Overall, 1,057 individuals (331 male; mean age =  $30.6 \pm 10.17$  years; range: 18–69 years) participated in the study. Trainers and participants under the age of 18 years were excluded. Participants were reached through the centres they exercised in. Online and paper-based forms of the questionnaires were available. Questionnaires were completed anonymously and voluntarily, participants did not receive any reward for their participation. The study was approved by the Institutional Ethical Board of Eötvös Loránd University.

### 2.2. Questionnaires

The *Positive and Negative Affect Schedule* (PANAS) (WATSON et al. 1988) consists of two independent scales rated on a five-point Likert scale. The negative affect scale

measures the general dimension of subjective distress and unpleasant engagement that subsumes a variety of aversive mood states (e.g. guilt, fear, nervousness), while the positive affect scale assesses the extent to which a person feels enthusiastic, active and alert. In the current study, the short (5-item) version of the scales was used (THOMPSON 2007). The Hungarian version of this scale had acceptable internal consistency (GYOLLAI et al. 2011). In the current study, Cronbach's alpha coefficients were 0.72 and 0.71, respectively.

The *Somatosensory Amplification Scale* (SSAS) (BARKSKY et al. 1988; 1990) is a scale that assesses the tendency to experience a somatic sensation as intense, noxious, and disturbing. The SSAS evaluates sensitivity to mild bodily sensations that are uncomfortable and unpleasant but not pathological. It consists of ten self-rated statements that are estimated on a five-point Likert-scale. The Hungarian version proved to be valid and psychometrically sound (KÖTELES et al. 2009). Its Cronbach's alpha coefficient was 0.70 in the present study.

The 19-item *Somatic Absorption Scale* (SAS) was developed by David Watson to measure the dispositional aspects of body awareness, especially the attention focusing on somatosensory processes (posture, heart beating, bodily changes caused by sport or meal, etc.). The developer aimed to create a questionnaire that is independent of negative affectivity/neuroticism, has a single factor structure and assesses the proneness to continuously monitor body processes (D. Watson, personal communication). The Hungarian version of the scale proved to be valid and showed good internal consistency (Cronbach's alpha = 0.84) in a previous study (KÖTELES et al. 2012). Its Cronbach's alpha coefficient was 0.87 in the present study.

The 15-item *Mindful Attention and Awareness Scale* (MAAS) (BROWN & RYAN 2003) measures the extent to which one is able to focus on the present moment in an open and non-judgemental way. Each of the items is stated inversely using a six-point Likert scale (from *almost always* to *almost never*) asking the respondents of how often they find themselves acting automatically, inattentively or being preoccupied. The Hungarian version had a good internal consistency (Cronbach's alpha = 0.78) in an earlier study (SIMOR et al. 2013). In the present study, the internal consistency of the scale was 0.83.

*Sport practice.* Two variables were used to characterise participants' physical activity: duration (time in months since the beginning of the particular sport) and current weekly frequency of practice. Beginners were defined as individuals who had started practising maximum six months before (N = 286), while advanced participants had practiced for more than six months (N = 754). This cut-off point was chosen based on previous results that show that after six months significant psychological changes can be registered, such as reduction in anxiety and depression (O'ROURKE et al. 1990), rise in self-esteem and well-being (ALFERMANN & STOLL 2000) and shift from extrinsic to intrinsic motivation (MALTBY & DAY 2001). Moreover, approximately 50% of those who join exercise programs drop out during the first three to six months (MARCUS et al. 1994).

*Tingling phenomenon.* Participants were asked to focus on a freely chosen body area (e.g. hand, ear) with closed eyes and to report whether the perception of that particular area had changed as a result of paying attention to it (yes-no question).

### 2.3. Data analysis

Data analysis was conducted using the SPSS v20 software. As data were appropriate for parametric analysis, five multiple linear regression analyses were carried out to investigate the contribution of duration and frequency of exercising to the assessed variables regardless the type of PA. In each case, independent variables were entered in one step using the ENTER method. In all analyses, participants' gender and age, duration (time in months since starting practice) and weekly frequency of body exercises were used as independent variables. Additionally, positive and negative affect scores were also used as independent variables in the equation predicting somatic absorption score. In the two analyses with positive and negative affect as dependent variables, somatic absorption score was used as an additional independent variable. Finally, in the analyses predicting mindfulness and somatosensory amplification scores, positive and negative affect and somatic absorption scores were used as independent variables beyond the four variables mentioned earlier.

Differences among the five selected activities were estimated by separate covariance analyses for the five assessed psychological constructs. In the case of beginners, participants' age was used as a covariant in all cases. As for advanced participants, age, and duration and frequency of practice were used as covariants. Differences among sports were further explored using post hoc tests with Bonferroni correction ( $p < 0.05$  in all cases).

Gender differences in the tingling phenomenon were examined by chi-square test; differences in the other assessed variables were checked by Student t-tests. Finally, a binary logistic regression analysis was carried out with the tingling phenomenon as criterion variable. Age, gender and educational qualification were entered as control variables, and scores of the five assessed psychological constructs as predictors.

### 3. Results

#### 3.1. Descriptive statistics

Descriptive statistics of the measured variables are presented in *Table 1*.

*Table 1*  
Descriptive statistics of the assessed variables

	<i>Mean</i>	<i>SD</i>	<i>Min.–Max.</i>
<i>Positive affect</i>	19.3	2.97	5–25
<i>Negative affect</i>	9.2	3.10	5–22
<i>Somatic absorption</i>	65.0	6.02	25–94
<i>Mindfulness</i>	60.3	9.76	15–88
<i>Somatosensory amplification</i>	27.7	6.02	10–45
<i>Duration of practice (months)</i>	46.0	65.97	0–576
<i>Frequency of practice (per week)</i>	2.4	1.73	0–19

#### 3.2. Positive and negative affect

According to the results of the multiple linear regression analysis, practice frequency as opposed to practice duration was significantly related to positive affect even after controlling for participants' age and gender (*Table 2*). Positive affect also showed a positive correlation with somatic absorption. Negative affect was inversely related to frequency of practice, but the connection was very weak (*Table 2*). It is worth noting that both equations explained a very low proportion of the total variance (7.1% and 4.8%, respectively). Thus these results may have no practical importance.

*Table 2*  
Positive and Negative Affect

	<i>Positive affect</i> $R^2 = 0.071; p < 0.001$ <i>Standardised <math>\beta</math> coefficients</i>	<i>Negative affect</i> $R^2 = 0.048; p < 0.001$ <i>Standardised <math>\beta</math> coefficients</i>
<i>Age</i>	0.050	-0.166***
<i>Gender</i>	0.077*	0.089**
<i>Duration of practice</i>	0.037	-0.027
<i>Frequency of practice</i>	0.114***	-0.081*
<i>Somatic absorption</i>	0.210***	-0.018

Results of the multiple linear regression analyses predicting positive and negative affect scores.

\*  $p < 0.05$ ; \*\*  $p < 0.01$ ; \*\*\*  $p < 0.001$ .

In the case of beginners, ANCOVA showed no differences among sports either for positive or for negative affect ( $F(4) = 2.274$ ;  $p > 0.05$ , and  $F(4) = 1.500$ ;  $p > 0.05$ , respectively). Regarding people who had practised for more than six months, significant differences in positive affect ( $F(4) = 2.460$ ;  $p < 0.05$ ) were found among sports. In the post hoc analysis, only one significant pairwise difference was found: those who practised aerobic showed higher levels of positive affect than kung fu practitioners ( $20.1 \pm 0.27$  vs.  $19.0 \pm 0.27$ ). As for the controlling variables, only the impact of the weekly frequency of practice was significant ( $F(1) = 4.898$ ;  $p < 0.05$ ). For people who had practised for more than six months, the effect of the frequency of practice was significant for negative affect ( $F(1) = 4.40$ ;  $p < 0.05$ ) but no significant differences among sports were found ( $F(4) = 0.931$ ;  $p > 0.05$ ).

### 3.3. Body awareness

Table 3  
Body awareness

$R^2 = 0.052$ ; $p < 0.001$	Standardised $\beta$ coefficients
Age	0.057
Gender	-0.044
Duration of practice	0.002
Frequency of practice	-0.003
Negative affect	0.038
Positive affect	0.224***

Results of the multiple regression analysis predicting somatic absorption score.  
\*\*\*  $p < 0.001$ .

According to the results of the multiple linear regression analysis, neither practice frequency nor practice duration was significantly related to body awareness (Table 3), and the explained proportion of total variance was very low (5.2%) again.

In the case of beginners, ANCOVA showed significant differences among sport types ( $F(4) = 2.970$ ;  $p < 0.05$ ). However, no significant pairwise differences were found in the post hoc analysis. Regarding advanced participants, significant differences were found among the five sports ( $F(4) = 10.578$ ;  $p < 0.001$ ). The post hoc analysis revealed that yoga practice ( $70.2 \pm 0.96$ ) was connected to significantly higher somatic absorption score than kung fu ( $65.9 \pm 1.12$ ), ballroom dance ( $63.3 \pm 0.85$ ) and aerobic practice ( $61.7 \pm 1.12$ ). Moreover, Pilates practice ( $68.0 \pm 1.06$ ) was linked to higher somatic absorption score than dance and aerobic.



### 3.4. Somatosensory amplification

According to the results of the multiple linear regression analysis, somatosensory amplification was negatively connected to practice frequency and positively related to negative affect and somatic absorption (*Table 4*).

*Table 4*  
Somatosensory Amplification

$R^2 = 0.299; p < 0.001$	Standardised $\beta$ coefficients
<i>Age</i>	-0.069*
<i>Gender</i>	0.122***
<i>Duration of practice</i>	-0.008
<i>Frequency of practice</i>	-0.058*
<i>Negative affect</i>	0.242***
<i>Positive affect</i>	-0.086**
<i>Somatic absorption</i>	0.466***

Results of the multiple regression analysis predicting somatosensory amplification score.

\*  $p < 0.05$ ; \*\*  $p < 0.01$ ; \*\*\*  $p < 0.001$ .

In the case of beginners, ANCOVA showed significant differences among sports ( $F(4) = 3.130$ ;  $p < 0.05$ ). No significant pairwise differences were found in the post hoc analysis, however. Regarding advanced participants, significant differences were found among the five sports ( $F(4) = 2.953$ ;  $p < 0.05$ ). Post hoc analysis revealed that kung fu practice ( $26.2 \pm 0.56$ ) was connected to significantly lower somatosensory amplification than Pilates practice ( $28.7 \pm 0.53$ ). Significant controlling variables were age ( $F(1) = 11.425$ ;  $p < 0.01$ ) and practice frequency ( $F(1) = 7.398$ ;  $p < 0.01$ ).

### 3.5. Mindfulness

The multiple linear regression analysis revealed significant correlations between mindfulness and somatic absorption, positive affect, and negative affect (reverse relationship) (*Table 5*). No significant differences among sports were found either among beginners or among advanced participants ( $F(4) = 1.448$ ;  $p > 0.05$ , and  $F(4) = 1.331$ ;  $p > 0.05$ , respectively).

Table 5  
Mindfulness

<i>R</i> <sup>2</sup> = 0.302; <i>p</i> < 0.001	Standardised <i>β</i> coefficients
<i>Age</i>	0.156***
<i>Gender</i>	-0.057*
<i>Duration of practice</i>	-0.034
<i>Frequency of practice</i>	0.023
<i>Negative affect</i>	-0.382***
<i>Positive affect</i>	0.210***
<i>Somatic absorption</i>	0.069*

Results of the multiple regression analysis predicting mindfulness score.

\* *p* < 0.05; \*\*\* *p* < 0.001.

### 3.6. Tingling phenomenon

Presence of the tingling phenomenon was reported by 63.2% of the participants. Chi-square test showed no significant gender differences (chi-square = 0.439; *p* = 0.508). According to the results of Student *t*-tests, the phenomenon was not connected to age, positive and negative affect, and mindfulness, and was positively associated with somatosensory amplification and somatic absorption (see Table 6 for details). In the latter two cases, Cohen’s *d* values indicated small and medium effect sizes, respectively. In the binary logistic regression analysis (*p* < 0.001, Nagelkerke *R*<sup>2</sup> = 0.128) somatic absorption was the only significant predictor variable of the tingling phenomenon (Exp*B* = 1.054; *p* < 0.001)

Table 6  
Results of *t*-tests comparing characteristics of participants who reported and not reported the tingling phenomenon (N = 1,057)

	<i>Tingling not reported</i>	<i>Tingling reported</i>	<i>t</i> -value	<i>Cohen’s d</i>
<i>Age</i>	30.98 ± 10.378	30.44 ± 10.055	0.820	0.053
<i>Somatosensory amplification</i>	26.38 ± 5.697	28.48 ± 6.073	-5.549***	-0.357
<i>Somatic absorption</i>	60.10 ± 12.408	67.87 ± 11.517	-10.255***	-0.650
<i>Positive affect</i>	19.04 ± 3.095	19.39 ± 2.892	-1.870	-0.117
<i>Negative affect</i>	9.11 ± 3.042	9.24 ± 3.128	-0.666	-0.042
<i>Mindfulness</i>	60.59 ± 9.490	60.16 ± 9.921	0.688	0.044

\*\*\* *p* < 0.001.

#### 4. Discussion

Regardless of the type of exercise, weekly frequency of physical activity (PA) was connected to lower levels of negative affect and somatosensory amplification, and to higher levels of positive affect in a cross-sectional questionnaire study. No connections between frequency of PA and body awareness or mindfulness were found. Interestingly, time elapsed since starting the particular PA showed no connection to any assessed psychological construct. As for the tingling phenomenon, it was connected to the two constructs that assess some sort of body awareness (i.e. somatosensory amplification and somatic absorption) and was independent of mindfulness and positive and negative affect.

In the case of participants who had practised for more than six months, significant differences in positive affect, body awareness, and somatosensory amplification scores were found among the five sports included in the study. Yoga practitioners showed higher levels of body awareness than people practising kung fu, ballroom dance or aerobic. Pilates practice was linked to higher body awareness than ballroom dance or aerobic practice. Kung fu practice was connected to weaker somatosensory amplification tendency than Pilates practice. Finally, those practising aerobic showed higher levels of positive affect than kung fu practitioners.

As for beginners, no practically relevant differences were found among the five sports. Thus when starting to do sports, participants' choice was seemingly not affected by any of the psychological constructs examined here, and the differences found among the advanced either refer to the effect of the physical activity they practise or to the influence of the constructs we examined on exercise adherence and drop-out.

Our results are in accordance with previous findings on the positive connection between PA and positive affect, and on the negative connection between PA and negative affect (REED & BUCK 2009; SCULLY et al. 1998). Our results also confirm that the former connection is stronger (HSIAO & THAYER 1998). As our data was cross-sectional, these relations might be explained in two ways. On one hand, exercising may improve affect; on the other hand, good mood and energy may have a positive impact on practice. Nevertheless, existence of the former connection (i.e. PA as a cause of improved well-being) was supported by longitudinal and intervention studies (NETZ et al. 2005). Interestingly, weekly frequency of practice as opposed to the time since starting practice was connected to these constructs in the present study, showing the importance of regular exercise even for advanced practitioners.

Positive affect was also connected to higher levels of body awareness, showing either that body awareness contributes to mental well-being or that optimal emotional state helps to connect properly to bodily signals. Putting all sports together, body awareness was not connected to weekly frequency and duration in the regression analysis. However, among advanced participants, yoga and Pilates practice were connected to higher levels of body awareness than the other three, which supports

our hypothesis that these activities actually improve it. The lowest levels of body awareness were found among advanced kung fu practitioners. Kung fu might train to tolerate pain through repressing negative bodily signals and thus keeps body awareness lower. Repression can be a negative effect of sports especially on a professional level as in the case of ballet (MCEWEN & YOUNG 2011).

Somatosensory amplification was positively related to body awareness and negative affect, which is in accordance with its definition (BARKSKY et al. 1990). It was negatively related to positive affect and frequency of PA, which suggests that regular exercise can decrease uncomfortable bodily signals and/or the propensity to amplify them. While advanced kung fu practitioners showed less tendency to somatosensory amplification than Pilates practitioners, no such difference was found among beginners. This might mean that kung fu decreased this maladaptive reaction more (e.g. because pain and pain tolerance are part of kung fu training), but it is also probable that those showing higher levels of amplification stopped attending the kung fu classes (because they did not tolerate painful experiences).

Finally, mindfulness was not related to PA either when we treated all sports together or when we treated them separately. The connection of mindfulness to different sports may have been hidden by our methods. Namely, different classes and studios were pooled in each sport. However, a connection between mindfulness and body awareness was found, which relates to the hypothesis that body awareness is a key element of mindfulness (HÖLZEL et al. 2011).

The present study had an additional (primarily descriptive) goal: to gain more information on what is called the tingling phenomenon. In our results it was not connected to gender, age, educational qualification, affect and mindfulness. However, it showed a positive connection to the indicators of body awareness, particularly to its non-judgemental, affect-free form (i.e. somatic absorption). Participants who had the tendency to pay attention to the current state of their body (internal feelings, posture, etc.) were also prone to experience tingling sensations in the body parts they focused on. The connection with somatic absorption found in the current study is in accordance with the attention model mentioned in the introduction: participants who generally pay more attention to their body are obviously able to allocate more attentional resources to body parts. Moreover, the recent findings suggest that tingling sensations are originally free of positive or negative emotions, and evaluation (e.g. based on the actual state of the individual or on the meaning attached to them) takes place in a later step of their cognitive processing.

The most important limitation of the present cross-sectional study is that it is not able to reveal the causal direction of the reported connections, that is, the possible effects of PA. Moreover, our sample was not representative; thus the generalisability of the results is limited. A proportion of the participants filled in the questionnaire on the internet. The conditions in these cases were uncontrollable.

## 5. Conclusion

The present findings extended our knowledge about connections among sports and psychological characteristics. Despite scientific results supporting positive effects of PA, the sedentary behaviour remains high in industrialised nations (SÁGI et al. 2012). Deeper clarification of how different sports affect mental health may help to propagate PA and to choose the proper sport which boosts intrinsic motivation and makes PA pleasant and enduring (MALTBY & DAY 2001). Such results can help practitioners and trainers to exploit the resources of PA more, that is, to recognise psychological factors which are needed for and can be developed by PA, to choose the sport that is most suitable for a person, to decrease dropout and to give valid information in order to make regular PA popular. Identifying such factors might also help us to include PA in mental healthcare and form an integrated mind-body medicine.

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