

**SUBJECTIVE BODY AWARENESS AND WELL-BEING IN ATHLETES AND
ACTIVE EXERCISERS**

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Tutkimusnäyttö kehotietoisuuden ja hyvinvoinnin yhteydestä on viime vuosina lisääntynyt, mutta on edelleen paikoin ristiriitaista ja vähäistä. Lisäksi kehotietoisuuden eri aspekteja on tutkittu vähän aktiiviliikkujien ja urheilijoiden keskuudessa. Tämän tutkimuksen tarkoituksena oli tutkia subjektiivisen kehotietoisuuden eri aspektien yhteyttä urheilijoiden ja aktiiviliikkujien koettuun hyvinvointiin. Lisäksi tässä tutkimuksessa pyrittiin selvittämään, miten aktiiviliikkujat ja urheilijat eroavat interoseptiivisen herkkyyden, kehovalppauden, kekokompetenssin, sekä yksityisen ja julkisen kehotietoisuuden suhteen.

Subjektiivisen kehotietoisuuden viittä eri osa-aluetta mitattiin kolmen kyselylomakkeen avulla. Hyvinvoinnin mittareina toimivat tutkittavien arviot tyytyväisyydestä itseensä ja elämäänsä. Koehenkilöiden (n=49) kyselylomakkeista saatuja pistemääriä analysoitiin Pearsonin korrelaatiokertoimella sekä monimuuttujaisen lineaarisen regressioanalyysin avulla.

Tutkimuksen ensimmäinen päätulos oli, että kahdella subjektiivisen kehotietoisuuden aspektilla oli tilastollisesti merkitsevä yhteys hyvinvoinnin mittariin. Tulosten perusteella havaittiin, että yksityinen kehotietoisuus sekä julkinen kehotietoisuus olivat negatiivisesti yhteydessä hyvinvointiin ja yhteydet olivat tilastollisesti merkitsevät. Tutkimuksen toinen päätulos oli, että urheilijat ja aktiiviliikkujat eivät eronneet subjektiivisen kehotietoisuuden aspektien suhteen, mutta urheilijat kokivat korkeampaa hyvinvointia aktiiviliikkujiin verrattuna.

Tulokset antavat ymmärtää, että subjektiivinen kehotietoisuus ja hyvinvointi voivat olla yhteydessä toisiinsa. Tämän tutkimuksen tulokset tukevat aikaisempia tutkimuksia sen suhteen, että korkea yksityinen kehotuntemus ja julkinen kehotietoisuus ovat yhteydessä alhaisempaan hyvinvointiin. Toisaalta tulokset eivät näyttäneet kehotietoisuuden eroavan liikuntaaktiivisuuden mukaan. Tutkimuksen tulokset viittaavat lisäksi siihen, että urheilijoiden hyvinvointi ei ole yhteydessä sisäisen tai ulkoisen kehotietoisuuden tasoon.

Tutkimuksen tulokset korostavat tarvetta subjektiivisen kehotietoisuuden eri osa-alueiden lisätutkimukselle. Keskeistä olisi selvittää, miten ja milloin ne ovat yhteydessä hyvinvointiin. Näin voidaan saada lisää tietoa siitä, mitkä kehotietoisuuden eri aspektit lisäävät tai vähentävät hyvinvointia. Lisäksi on tarpeen tuoda tutkimuksen avulla tarkennusta siihen, voidaanko erilaisten harjoitusten avulla edistää adaptiivista kehotietoisuutta. Tulevaisuudessa on myös tarve selvittää tarkemmin, miten liikunnan ja eri kehotietoisuuksien osioiden yhteydet saattavat vaikuttaa urheilijoiden hyvinvointiin, itseluottamukseen, suorituskykyyn sekä motivaatioon.

Asiasanat: subjektiivinen Kehotietoisuus, interoseptiivinen herkkyyden, kehotietoisuus, kehovalppaus, yksityinen kehotietoisuus, julkinen kehotietoisuus, kekokompetenssi, fyysinen aktiivisuus, urheilijat, elämäntyytyväisyys, subjektiivinen hyvinvointi

ABSTRACT

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Although the evidence is emerging, research on the relationship between interoceptive sensibility, body awareness, and well-being is still in its infancy, rather divergent and sometimes even contradictory. Further, the multidimensionality of subjective body awareness has rarely been considered in the context of sports and exercise. First, the purpose of this study was to identify the relation of different aspects of subjective body awareness with well-being. Second, differences in subjective body awareness and well-being between active exercisers and professional athletes were investigated.

Five aspects of subjective body awareness were measured with three different questionnaires. Well-being was measured with the individual's satisfaction with self and life. The relation of subjects (n=49) responses on questionnaires was analysed with Pearson's correlation coefficient and Multivariate linear regression analyses. The first main result of this study was that two aspects of subjective body awareness (private and public body consciousness) were related significantly with measures of well-being. Both aspects correlated negatively with satisfaction with self and life. The second main finding of this study was that athlete's reported higher levels of well-being compared to exercisers, and these results were independent of any other variables measured.

The results of this study indicate that subjective body awareness and well-being can relate with each other. The results support previous findings that increased interoceptive sensibility and external body awareness are related to diminished well-being. However, this study was unable to distinguish between beneficial and maladaptive aspects of other subjective body awareness measures. Further, no differences were found between athletic and exercising groups in subjective body awareness. Instead, findings of this study imply that athletes' well-being is independent of their levels of internal, external, or evaluative body awareness.

The results highlight the need to investigate the differences amongst aspects of subjective body awareness to clarify how and when they associate with well-being. Further, it needs to be investigated if contemplative, mindfulness training could enhance an adaptive view of body awareness. In addition, more research is needed to study how participation in sports relates to athletic well-being, self-confidence, performance and motivation.

Keywords: subjective body awareness, interoceptive sensibility, body awareness, body vigilance, private body consciousness, public body consciousness, body competence, physical activity, athletes, life satisfaction, subjective well-being

USED ABBREVIATIONS

IAc	Interoceptive accuracy
IS	Interoceptive sensitivity
IA	Interoceptive awareness
BAQ	Body Consciousness Questionnaire
BVS	Body Vigilance Scale
PrBc	Private Body Consciousness Subscale
PuBc	Public Body Consciousness Subscale
Bc	Body competence

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1 INTRODUCTION

Optimal sensing, interpretation and integration of bodily signals, conscious or unconscious, are critical for many essential physiological functions, more complex physiological and behavioural responses, as well as high level cognitive and emotional processes (Chen et al. 2021). Recent findings from the field of neuroscience support the James-Lang theory of emotion, which suggests that emotions are closely connected to interoceptive information and the primary motivators of behaviour (Emmanuel et al. 2015). Thus, it may be that individuals capable of adaptively using interoceptive abilities may pursue those activities reflecting psychological well-being more actively and intentionally.

Clinically, an increased focus on physiological sensations has generally been associated with anxiety, hypervigilance and catastrophization (Mehling 2011). Dysfunction of interoception has been increasingly recognized as an important component of many neurological, psychiatric, and behavioural disorders (Chen et al. 2012). However, with new mindfulness, mind-body approaches and bodywork techniques emerging into the scientific field, an adaptive, mindful dimension of body awareness has become a topic of interest for a growing group of researchers (Khalsa et al. 2018). Recent studies propose that sensing and consciously paying attention to the body can be beneficial for health and well-being (Farb et al. 2015).

Interoceptive abilities and body awareness have also been shown to vary widely across individuals and modalities (Herbert et al. 2012; Pollatos et al. 2005). Studies among athletes suggest that there are interindividual differences in perception of information, sensations, and emotional experiences (Hall & Davies 1991; Simmons et al. 2012), but less is known about the relationship of interoceptive sensitivity, body awareness, and well-being, especially in the context of sports and exercise. Moreover, subjective body awareness and its relation with different aspects of psychological health and performance have not been studied in depth. In this study, we focus on a growing literature to examine the concepts of body awareness to better understand the mind-body relationship as it relates to athletic well-being.

2 SUBJECTIVE BODY AWARENESS AND INTEROCEPTION

Body awareness is a multidimensional concept used across different fields, including psychology, medicine, and sports and exercise sciences (Busch et al. 2020; Crescentini & Capurso, 2015). Body awareness is the subjective perception of bodily states, processes and actions that originate from sensory proprioceptive and interoceptive afferents that enter an individual's conscious awareness (Mehling et al. 2009). The term includes an attentional focus on and sensitivity to specific physical sensations (e.g., awareness of heart activity) as well as more complex syndromes (e.g., pain and sense of relaxation) (Mehling et al. 2009). Body awareness, as an interactive and dynamic processing of the nervous system, is strongly influenced by mental processes including attitudes, beliefs, conditioning, and experience, as well as social and cultural environments (Mehling et al. 2009). Thus, assessing body awareness always remains a compromise between objective and subjective information.

Interoception refers to the processing of sensory input from inside the body, including both the perception of physical sensations related to internal organ functions, and the autonomic nervous system activity related to emotions (Mehling et al. 2009; Paulus et al. 2010). Perhaps the most well-known model presented by Garfinkel et al. (2015) measures interoception along three main dimensions: interoceptive accuracy (IAc), interoceptive ability (IS), and interoceptive awareness (IA). *Interoceptive accuracy* refers to the ability to accurately detect signals from within the body and is measured by performance on objective tests of interoceptive accuracy, such as the heart-beat detection task (Garfinkel et al. 2015). *Interoceptive sensibility* is the individuals' subjective confidence in accurately identifying the internal bodily signals and is measured by subjective self-report questionnaires (Gibson 2019). Interoceptive sensibility is the focus of this study and will be discussed in greater detail in the next chapter. *Interoceptive awareness* is a meta-cognitive dimension, which combines both IAc and IS, objective and subjective measures, to analyse the correspondence between accuracy and sensibility of interoceptive abilities (Khalsa et al. 2018).

Interoception plays an important role in modulating behaviours that help maintain homeostasis, as well as provide relevant signals for survival and well-being (Brani et al. 2014; Herbert &

Pollatos 2012; Mehling et al. 2009). Awareness of physical sensations associated with emotions is a key element for affect regulation and for the sense of self (Mehling et al. 2009). It is also important to note that much of this information is processed unconsciously, although some signals may rise to the level of conscious awareness for higher order processing (Chen et al. 2021). Moreover, while unconscious, pre-cognitive interoceptive signals do influence one's psychological state, the signals and sensations that do reach conscious awareness seem to have a greater effect on cognitions, emotions, perceptions, and behaviour than those that do not (Gibson 2019). Interoceptive information therefore is not identical to interoceptive awareness.

In this study, subjective body awareness is an overall term for its internal, external, and evaluative constructs. Subjective body awareness will be examined through *internal subjective body awareness* and *external and evaluative body awareness*. Internal subjective body awareness is used to describe self-perceived awareness of internal body processes, which is often referred to as interoceptive sensibility and private body consciousness (Emmanuel et al. 2015). External and evaluative subjective body awareness on the other hand describes the subject's self-perceived awareness of the appearance and evaluation of the body, which include aspects of public body consciousness, trust, and body competence.

2.1 Internal subjective body awareness (interoceptive sensibility)

Internal subjective body awareness represents the conscious inner representation of the body, i.e., interoceptive sensibility (Emmanuel et al. 2015). Interoceptive sensibility is defined as the perceived sensitivity to internal bodily sensation, and includes dimensions of attention intensity, appraise, interpretations, and use of physiological signals (Mehling et al. 2009). Interoceptive sensibility as a perceptual phenomenon, is strongly influenced by top-down cognitive processes (attitudes, memories, expectations etc.), and does not necessarily reflect accurate sensing of the body (Emmanuel et al., 2015; Gibson 2019; Paulus et al. 2020).

Internal subjective body awareness has been assessed by numerous self-report questionnaires and scales (Arnold et al. 2019). In an attempt to refine the construct of body awareness, Mehling et al. (2009) conducted a conceptual review of twelve body awareness questionnaires and their

psychometric properties. From these questionnaires they identified the following key dimensions of body awareness; 1) perceived body sensations, 2) attention quality, 3) attitude, and 4) mind-body integration. As the present study used questionnaires of body vigilance (Schmidt et al. 1997), body awareness (Shields et al. 1989) and private body consciousness (Miller et al. 1981) table 1 presents the qualitative differences of key concepts identified by Mehling et al. (2009) between the questionnaires.

Table 1. Qualitative differences between questionnaires of body vigilance, body awareness and private body consciousness

Aspect of internal subjective body awareness	Definition	Key domains identified by Mehling et al. (2009)
Body awareness (Shields et al., 1989)	Awareness of body sensations part of regular non-emotive body processes and reactions of the body (Shields, Mallory, & Simons, 1989). It is also considered to include the prediction of physical reactions such as the onset of illness or changes in energy levels (Shields, Mallory, & Simons, 1989).	1) Perceived body sensations: C) neutral/ambiguous body sensations and A) sensations of distress, worry, pain and tension
Body vigilance (Schmidt et al., 1997)	Adaptive tendency to be aware of the body (Schmidt, Lerew, & Trakowski, 1997). It is the attentional tendency to focus or ignore body sensations and perturbations (Mehling et al., 2009). Hypervigilance has been associated with panic sensitivity anxiety disorders (Schmidt, Lerew, & Trakowski, 1997).	2) Attention quality: A) intensity, actively paying attention vs. ignoring and suppressing perceptions

Private body consciousness (Miller et al., 1981)	Awareness of internal body sensations and sensitivity to changes in bodily states. The disposition to focus on internal bodily sensations, primarily those of distress, worry, pain, and tension (Miller et al. 1981).	1) Perceived body sensations: A) distress worry, pain, and tension, and C) neutral/ambiguous sensations 2) Attention quality: A) intensity, C) mode: thinking/ labelling vs. experiencing the present-moment immediacy of sensations 3) Attitude: A) trusting
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The questionnaires used in the present study covered subdomains in three of the four dimensions identified, specifically perceived body sensations, attention quality and attitude. Mehling et al. (2009) defined perception of body sensations as the ability to note changes in body processes, to identify inner sensations (e.g., muscle tightness, fatigue, pain) and varying functional states of the body or its organs, as well as the emotional/physiological state of the body (relaxed—tense). The BAQ and PBCS both measured this dimension, namely the subdomains of A) distress, worry, pain and tension and C) neutral/ambiguous sensations. Mehling et al. (2009) also found that the BAQ emphasized more the perception of neutral sensations, while PBCS focused more on distressing sensations. In addition, the PBCS took into account attention quality and attitude towards bodily cues, as in trusting and viewing sensations as helpful for decision-making and sense of self. It has been noted that individuals with high private body consciousness consistently report more physical symptoms compared to those with low body consciousness (Pennebaker & Lightner 1980).

The Body Vigilance Questionnaire on the other hand only covered the sub-domain of intensity, which Mehling et al. (2009) classified under the dimension of ‘attention quality’. Intensity of attention quality was described as ‘actively paying attention versus ignoring, distracting, or suppressing perceptions’. Intensity also reflected the importance of body sensations to the subject. Thus, the framework provided by Mehling et al. (2009) helps to understand how different questionnaires of internal subjective body awareness differ from each other qualitatively.

2.2 External and evaluative subjective body awareness

Body awareness depends on the integration of both interoceptive and exteroceptive bodily signals. The external and evaluative aspect of body awareness refers to a diverse psychological construct encompassing subdomains that pertain to perceptions of physical appearance (e.g., attractiveness, body fat), and physical abilities (e.g., body competence, self-efficacy, fitness) (Murray et al. 2021; Zamariola et al., 2017). External and evaluative body awareness relies primarily on visual information, emotional attitudes, and subjective evaluation of the body (i.e., whether the individual is satisfied or dissatisfied with their physical appearance and/or functions of the body) (Cash et al. 2002; Mehling et al. 2009). From this perspective, external and evaluative body awareness encompasses all representations of the body that are not used for action.

Methods of body consciousness research include behavioural and self-report measures as well as brain imaging. The current study used the Body Consciousness Questionnaire by Miller et al. (1981) to measure the external and evaluative dimensions of subjective body awareness. These were assessed by public body consciousness and body competence.

Public body consciousness (PubBC) is described as a chronic attentional focus on the external appearance of one’s body, such as facial features, posture, and body weight (Miller et al. 1981). Public body consciousness refers to awareness of the body in non-affective states and it has been found to relate with increased negative emotionality and self-objectification (Ainley & Tsakiris 2013). According to Fenigstein et al. (1975) individuals with high public self-

consciousness focus on the self as a social object and tend to be more concerned about how they present themselves and how they are perceived by others. High public self-consciousness has also been shown to translate into adaptive behavioural habits and coping mechanisms designed to increase social approval and reduce negative evaluation by others (Scandell 1998).

Body competence has been associated with higher self-esteem and trust in one's physical body (Miller et al. 1981). In the sports context, perceived athleticism is one dimension of body competence that specifically measures the amount of confidence an individual has related to performing the tasks required (Babic et al., 2014). According to Sonstroem and Morgan's (1989) model, body competence relates to physical competence, self-efficacy, and acceptance of one's physical competence. Each of these factors has an objective (actual physical performance) and a subjective (i.e., evaluative) component (Köteles et al. 2016). In addition, the subjective evaluative component (e.g., based on social comparison or expectations) has a dominant impact on physical self-concept as compared to objective measures of performance (Köteles et al. 2016).

Generally, external subjective body awareness has often been associated with body image dissatisfaction, mental distress (Miller et al. 1981), and self-objectification among women (McKinley & Hyde 1996). In the Western cultures, objectifying women's bodies and the internalization of beauty ideals portrayed by the media predisposes women to value their bodies in terms of physical attractiveness and adopt an observer's perspective of their own bodies (Fredrickson & Roberts 1997). As self-objectification directs attentional resources to physical appearance rather than internal traits, it may account for the relative insensitivity of internal bodily cues and deficits in self-reported body awareness, which has been reported in studies of interoception (Emanuelson et al. 2014; Myers & Crowther 2008; Peat & Muehlenkamp 2011). Consequently, self-objectification is proposed to be an important factor in women's mental health, and it has been associated with body shame, anxiety and eating disorders (Tiggemann 2013). While men generally maintain a higher level of body satisfaction than women, body dissatisfaction is also becoming more common in men (Emanuelson et al. 2015). Relative to self-objectification and body image dissatisfaction, public body consciousness is a more neutral attitude towards the appearance of the body.

The evaluative dimension of body awareness is often conceptualized as body satisfaction, with a focus on body dissatisfaction rather than body appreciation (Tiggemann & McCourt 2013). According to Mehling et al. (2009), an individual's attitude of body awareness describes how they relate to bodily cues, as in trusting or viewing bodily sensations as helpful for decision-making and sense of self (Mehling et al. 2009). Mehling et al. (2009) identified 'trusting' as a subdomain of the construct of body awareness. Trusting refers to experiencing one's body as safe and trustworthy, which includes being relatively free of trait anxiety and having strong body-listening skills. According to Mehling et al. (2009), mindful observation, being aware of how emotions affect one's behavior, having little difficulty with emotional awareness, and not being dissociated from one's body were also moderately correlated with evaluative body awareness.

2.3 Body awareness, health, and well-being

Interoceptive abilities are a fundamental aspect of self-awareness and have a significant impact on an individual's self-concept, playing a crucial role in the maintenance of emotional and physical well-being (Ferentzi et al. 2018; Herbert & Pollatos 2012). There is growing evidence supporting the role of interoception in emotional processing (Pollatos et al. 2007a; Pollatos et al. 2007b), decision-making (Dunn et al. 2010; Werner et al. 2009), behavioural self-regulation (Herbert et al. 2007) and body image (Badoud & Tsakiris 2017; Zamariola et al. 2017). Research also suggests that accurate perception of body signals may facilitate better stress management (Bornemann & Singer 2017), healthier eating habits (Herbert et al. 2013), improvements in social relationships (Gibson 2019) and other adaptive behaviours (Brani et al. 2014; Ferentzi et al. 2018).

Studies suggest that awareness to bodily signals may entail two different psychological processes which affect the response to the somatic sensations (Ginzburg et al. 2015). Namely, what differentiates these processes is the mode of attention towards the bodily signals, categorized as maladaptive and adaptive orientation (Ginzburg et al. 2015). The adaptivity view, in accordance with body-mind theorists, suggests that paying more attention to the body and bodily sensations may be the prerequisite of healthy psychological functioning, with

benefits ranging from prevention and management of various chronic diseases, such as low back pain, congestive heart failure and irritable bowel syndrome (Daubenmier 2005; Ferentzi et al. 2018; Mehling et al. 2011). Body awareness may be helpful in identifying important bodily sensations and give the opportunity to react to them appropriately (Tihanyi et al. 2016a). Greater cardiac perception has also been associated with better learning (Werner et al. 2013) and intuitive eating, which is often described as a characteristic related to well-being (Herbert et al. 2013). The advantage of paying attention to bodily signals has also been shown in the field of sport, which will be discussed in greater detail in the next chapter.

The empirical evidence concerning the association between interoceptive abilities and well-being remains mixed. Several studies performed in clinical populations have shown a correlation between deficits in different interoceptive dimensions and various neurological, psychiatric, and behavioural disorders (Chen et al. 2021; Courtois et al. 2015; Duquette 2017). For example, low interoceptive accuracy has been related to depression and eating disorders, such as anorexia nervosa (Berner et al. 2018; Pollatos et al. 2009; Terhaar et al. 2012). Moreover, a heightened focus on internal signals and enhanced cardiac perception have been linked to anxiety disorders and psychosomatic problems (Courtois et al. 2015; Garfinkel & Critchley 2013). Traditionally, heightened body awareness has often been regarded as a negative phenomenon as it can lead to amplification of perceived symptoms, catastrophizing, and hypervigilance (Tihanyi et al. 2016a). Hypervigilance has also been associated with worse chronic pain and seems to have a negative impact on cognitive function (Eccleston et al. 1997).

While empirical findings suggest the relevance of interoception in mental well-being, the exact nature of the connection remains unclear (Ferentzi et al. 2018). Individuals that experience their bodies as safe and trust their bodily sensations are more likely to report greater psychological well-being (Hanley et al. 2018). Research also suggests that elevated body awareness and well-being have a bidirectional connection, with body awareness contributing to mental well-being and positive emotional states helping individuals connect better to bodily signals (Tihanyi et al. 2016a). Body awareness may therefore attest either to a catastrophizing interpretation bias or a non-judgemental acceptance towards bodily sensations (Mehling et al. 2009), which are important in understanding the relationship between body awareness and well-being. The level

of well-being therefore seems to depend more on one's subjective perception and interpretation than on the actual accuracy of bodily sensations (Ferentzi et al. 2018).

2.4 Body awareness in sports and exercise

Physical activity has been shown to strengthen body awareness (Skrinar et al. 1986). All exercisers must consciously pay some level of attention to bodily processes, which may promote self-regulation and the ability to recognize inner sensations more accurately (Da Silva Machado et al. 2019). Self-awareness of body functions (e.g., heartbeat, breathing, fatigue) can result in more efficient and effective management of an individual's energy, exhaustion, and injury prevention (Tihanyi et al. 2016a). Research has also shown body awareness to be an important characteristic of performance and found positive correlations between greater fitness levels and good heartbeat accuracy (Georgiou et al. 2015; Herbert et al. 2007). Likewise, the positive perceptions related to the body may affect an individuals' emotional state, and thus contribute to the continuation of exercise by increasing levels of enjoyment and overall performance (Jetzke & Mutz 2019).

Research in sports and exercise science has shown athletes to have higher levels of body awareness than nonathletes (Erden & Emirzeoglu 2020; Minev et al. 2017). Athletes pay more attentional focus on bodily signals because physical sensations are an integral source of information for adaptation and achieving optimal performance (Philippe & Seiler, 2005; Thom et al. 2014). For example, experienced runners harmonize their breathing with their strides, allowing them to run as fast and as economically as possible (Pisk 2017). Previous studies suggest that exercise activates similar brain regions involved in the processing of interoceptive awareness, which is likely due to increased afferent signalling during exercise (Da Silva Machado et al. 2019). According to Craig (2003), interoception accuracy may also enable an athlete to enhance their performance by "listening to their body", and by differentiating and refining internal feelings. Studies have also demonstrated that elite athletes perform greater under challenging situations; athletes must inhibit elite characteristics, such as mental toughness, achievement motivation, physical strength and endurance, emotional stability, and body functioning for achieving optimal performance (Paulus et al. 2019; Simmons et al. 2012).

Attentional control and concentration, such as the ability to shift attention when necessary and ability to distinguish task-relevant cues from irrelevant ones, are also considered key psychological skills that all great athletes exhibit (Lawless & Grobbelaar 2015). During physical exercise, internal sensory information and external environmental cues compete for an individual's attentional focus (Pennebaker & Lightner 1980). Because individuals are limited in the amount of information that can be processed at any given time, one stimulus must be chosen over the other. Depending on the sport and exercise setting, the amount of information and the degree to which individuals must attend to that information varies (Pennebaker & Lightner 1980). Certain types of stimuli are also more likely to be processed than to others. Berlyne (1960) noted that novel, complex, and dynamic stimuli were more likely to receive greater attention compared to simple, redundant, or stationary stimuli. The novelty of an activity often requires increased initial attention to external cues and/or internal sensations in order to perform the unfamiliar movements (Pennebaker & Lightner 1980). As the activity becomes more familiar, less conscious attention is required. Existing research suggests that mental and physical skills that are highly practiced eventually become automatic (Fisher & Wrisberg 2006).

Pennebaker and Lightner (1980) found that forced attention on the body in an exercise setting resulted in greater perceptions of fatigue, than if attention was directed elsewhere. Emphasis on external attentional focus has also been shown to result in significantly less symptoms, but only in those relevant to the task performed. However, distraction from negative bodily signals such as pain and fatigue during an activity is associated with greater post-activity pain (Mehling et al. 2009). Furthermore, some sports such as martial arts, systematically train athletes to tolerate pain through repressing bodily signals, whereas repression can have a negative effect in other sports (McEwen & Young 2011). However, awareness of bodily sensations and its relation to behaviour and emotions in performance have not been studied in depth.

Physical activity produces changes in nearly all organs of the body, especially the heart (Healy 2013; Schandry et al. 1993). At rest, the cardiovascular system is predominantly modulated by the parasympathetic nervous system. However, during exercise, heart rate gradually increases from greater sympathetic activity, creating a strong increase in other interoceptive signals such as temperature, muscular tension and activation, and pain (Da Silva Machado et al. 2019). Athletes also regularly experience large increases in ventilation and perceptions of

breathlessness and appear to have improved ventilatory perception accuracy (Faull et al. 2018). Whilst exercise training is known to induce a widespread of changes in the body, results of previous studies suggest that the influence of bodily signals on the physical, physiological, and perceptual responses to exercise might be dependent on exercise intensity, mode (e.g., dynamic, static) and design (e.g., constant, or incremental load) (Da Silva Machado et al. 2019). The body awareness of athletes may also depend largely on the technical and tactical requirements and on the benefits that they gain from the sport in terms of physical functioning, mental toughness, and general health (Erden & Emirzeoglu 2020). The results from Erden & Emirzeoglu (2020) clearly indicated that the level of body awareness of athletes in different disciplines (i.e., individual and team sports) is similar but influenced by many factors. Several studies also support the position that heartbeat perception can vary according to cardiac output, stroke volume, body fat, posture, and levels of exercise-induced cardiovascular activation (O'Brien et al. 1998; Schandry et al. 1998).

Research has suggested athletes develop an increased physical, social, and emotional awareness due to engagement in sporting events and competitions (Da Silva Machado et al. 2019; Fox 2000). Farb and colleagues (2015) suggested that interoceptive accuracy may be acquired through engagement with any training involving both (a) elicitation of—and attention to—bodily signals (such as heartbeats, sweat response, muscle contraction), as well as (b) the use of these signals for the expression of states and emotions. Interoceptive awareness appears to be a complex learning process that includes updating and integrating current somatic information with previous bodily signals, mental models, goals, and personality, which may or may not override the interoceptive signals from the body (Craig 2009; Farb et al. 2015). Although accurate body sensations are associated with elite performers, it is still unclear whether or not there is a way to practice and become more interoceptively aware or not. While some recent studies have found minor but statistically significant improvements in heart-beat detection in longitudinal interoceptive training practices (Bornemann & Singer 2017; Daubenmier et al. 2013; Fischer et al. 2017), most studies have reported no changes in heart-beat detection (Bornemann et al. 2015; Khalsa et al. 2008; Melloni et al. 2013). Also, individuals whose training requires perception of bodily signals, such as dancers and yoga and Pilates practitioners, exhibit better interoceptive awareness, but not better interoceptive accuracy (Daubenmier et al. 2013; Khalsa et al. 2008; Tihanyi et al. 2016b).

3 WELL-BEING IN SPORTS AND EXERCISE

Subjective well-being represents an important part and perception of an individual's cognitive and/or emotional life, and overall mental health (Diener & Ryan 2009). Subjective well-being can be assessed through different viewpoints, such as life satisfaction, self-reported mental health, or affective experience (Ferentzi et al. 2018). High subjective well-being has been linked to high life satisfaction, more frequent pleasant emotions, and less mood disorders (McAuley et al. 1985). Subjective well-being has also been widely used in sport psychology research as a global measure of self-perceived satisfaction and it has been found to be an important protective factor in the mental health of athletes (Goodger et al., 2007; Rice et al., 2016).

There is a large body of evidence indicating that exercise has a positive impact on physical, mental, and psychological well-being (Brown & Malouff 2005; Fox 1999; Moljord et al. 2014; Strelan et al. 2003). In studies showing the relationship between well-being and physical activity, physical activity has been found to reduce symptoms of depression and anxiety (Brown & Malouff 2005; Moljord et al. 2014), increase self-esteem (Fox 1999; Scully et al. 1998), stress tolerance and resilience (Strelan et al. 2003), cognitive functioning (McAuley 1985), sleep quality (Sahin et al. 2018), and psychosocial health (Morris et al. 2020). A lack of physical activity has been linked to increased psychological ailments such as low self-esteem and poor mental health, including increased anxiety and depression (Morris et al. 2020). Although physical activity has been found to be the most significant factor in perpetuating a high quality of life of the individual, research literature considers the relation between exercise and both positive and negative psychological health.

3.1 The relationship between exercise and well-being

Exercise is an effective way to improve mental well-being of the general public, mainly through improved mood, increased self-perceptions and psychosocial factors (Fox 1999; Sahin et al. 2018; Strelan et al. 2003). Participation in physical exercise contributes to positive development of mind and body promoting higher levels of happiness (Morris et al. 2020). Multiple studies indicate that regular physical activity can be as effective as drug treatment in mild depression

and anxiety disorders through its mood enhancing properties (Penedo & Dahn 2005; Sahin et al. 2018). De Mello et al. (2013) found that those who did not participate in physical activity showed symptoms of anxiety and depression twice as much as those who did. Physical activity is also suggested as a potential protective agent against mental health problems and suicidal behavior among adolescents (Sahin et al. 2018). Many exercise modes also contribute to well-being by providing a supportive social environment (Reed & Buck 2009).

Physical activity has been recognized to have positive effects on body image and elevated physical self-concept (Sahin et al. 2018). Physical self-concept represents an important determinant of healthy psychological functioning and a range of mental health outcomes (Toth et al. 2019). A recent study by Murray et al. (2021) found that individuals who are more physically active typically report higher levels of perceived physical appearance and functioning. Another study by Toth et al. (2019) showed that exercisers scored higher than non-exercisers on perceived physical self-concept (Fox et al. 2000). Research has also shown that individuals are more likely to be physically active when they have positive feelings and evaluations of their bodies and feel physically competent (Hausenblas & Fallon 2006). Perceived body competence may significantly predict future involvement in sports and physical activity (Papaioannou et al. 2006).

An important mediating construct between physical activity and well-being is self-esteem. Regular exercise improves global self-worth through enhanced appearance evaluation and body area satisfaction, as well as promotes improvements in body competence and confidence (Fox 1999; Haugen et al. 2011; McAuley et al. 2000). Body image is more closely related to self-esteem than any other single element of self, particularly within the female population (Fox 1999). However, studies also indicate that exercise may also be counterproductive to body acceptance and self-esteem. Exercise addiction, high obsessiveness and neuroticism have been shown to raise body dissatisfaction and distorted body image (Martin Ginis et al. 2014).

Motivation and reasons for exercising have also been found to correlate significantly with well-being, body self-esteem and body satisfaction (Strelan et al. 2003). Ryan and Deci (2000) proposed that intrinsic motivation, which includes one's desire for effective functioning and a

sense of personal initiative, may enhance subjective well-being and overall psychological health. Studies have confirmed that intrinsic reasons for exercising are associated with increased mood, body esteem and body satisfaction (Strelan et al. 2003; Tiggemann & Williamson, 2000), whereas extrinsic motivations, such as exercising for weight control, body tone, and attractiveness, are linked to increased body dissatisfaction, disturbed eating, and lower body esteem (Tiggemann & Williamson, 2000). Women and individuals with high self-objectification are more likely to exercise for extrinsic factors and consequently, experience reduced psychological benefits (Strelan et al. 2003; Tiggemann & Slater 2001).

Although physical activity and exercise may increase well-being through different constructs, results show that mental disorders are just as likely at both ends of the exercise spectrum (Gorczyński et al. 2017). While studies have shown collegiate athletes to report lower depression scores compared peers who did not participate in sports (Armstrong & Oomen-Early 2009), Gorczyński and colleagues (2017) noteworthy meta-analysis revealed that elite athletes were just as likely to report depressive symptoms as non-athletes.

3.2 Well-being at an elite level

Athlete well-being is recognized as an important component of sports performance, and research indicates that participation in sports directly affects athletes' health physically, emotionally, and mentally (Agnew et al. 2017). The concept of athlete well-being encompasses all aspects of an athlete's life, including those that are not sport related (Dunn 2014). Measured outcomes of athlete well-being include goal-striving and motivation, demonstrating its importance on athletes' subjective performance and mental experiences (Gorczyński et al. 2017). Sport and athletic training have both physical and mental challenges, which athletes strive to overcome to achieve their best performance. Determining the factors affecting performance are crucial not only for an athlete's health and performance, but for overall levels of well-being (Erden & Emirzeoglu 2020). It is also important to understand how well-being may change over the course of an athlete's season and career, as this may have an impact on their needs, satisfaction with sport and overall well-being (Amrose et al. 2009).

Research has found that both personal and social factors can promote well-being and protect against negative psychosocial outcomes among elite athletes (Gorczyński et al. 2017). Resilience and protective traits tied to athletic participation, such as self-confidence, self-esteem, body competence and mental toughness, may be acquired through facing adversity and overcoming physical and/or mental challenges (Tamminen et al. 2013). Current literature indicates positive associations between self-esteem and sport experience across all different age groups (Crocker et al. 2006; Morris et al. 2020; Spence et al. 2005; Wagnsson et al. 2014). Self-esteem and self-confidence, which relate to the athletes' belief in their ability to be successful and their overall confidence in their own psychological resilience, are considered significant factors in athletic success (BaCanac et al. 2014; Sar & Isilkar 2012). Mental toughness is a multidimensional personality construct including values, approaches, perceptions, and inherent emotions acquired and adopted by the individual to successfully cope with stressors and challenging situations (Madigan & Nicholls 2017). A recent study among junior athletes showed that high mental toughness predicted decreases in burnout symptoms across a 3-month time period (Madigan & Nicholls 2017).

Sport competition has also been shown to improve self-perceived physical competence. For example, emphasis on an athlete's physical abilities may contribute to greater physical self-esteem and positive self-perceptions about their bodies (Abbott & Barber 2011; Bowker 2006). Appreciating the body for its functionality rather than, or in addition to its appearance, has been shown to enhance girls' and young women's body image and sense of physical competence (Avalos et al. 2005). The physical and psychological demands and challenges of sport provide athletes many opportunities that may positively impact the development of competence skills, such as enhanced perceptions of physical strength and sport skills, as well as characteristics such as confidence, assertiveness, and independence (Crocker et al. 2006). Furthermore, the competitive nature of sport promotes the development of self-belief and self-determination, which are important aspects of self-perceived body competence (Armstrong & Oomen-Early 2009). Also, participation in sport competitions promotes the development of positive social networks and enhancement of life skills and coping mechanisms (Dodd & Vetter 2015; Melendez 2010).

Interesting advancements in sports psychology regarding athletes' well-being include mindfulness training interventions and neuroscientific discoveries regarding peak experience states. Glass et al. (2019) recent study showed mindfulness training as a promising intervention for improving psychological functioning in collegiate athletes. Mindfulness skills, such as sustained attention, concentration, non-reactivity, and increased body awareness are expected to play a major role in an athlete's performance and life satisfaction (Mehling et al. 2008). In addition, mindfulness practices were linked to reductions in sport-related anxiety and increases in flow (Glass et al. 2019). Flow, a subphenomenon or type of peak experience proposed by Nakamura and Csikszentmihalyi (2014), is described as a state of consciousness characterized by being fully immersed in an activity with intense focus, concentration, and loss of reflective self-consciousness, that culminate in the realization of one's full potential. This experience has been seen as a common experience occurring in the context of sports performance and contributing to exceptional performance and increased levels of satisfaction and happiness (Nakamura & Csikszentmihalyi 2014; Walker 2010).

Although participation in sports is recognised as an avenue which can promote a sense of well-being, the adverse effects of elite sport are also well documented (Bartholomew et al. 2011; Gould & Carson 2008). Researchers have pointed out several unique stressors that elite athletes face that may partially explain mental health problems, including the demands of competition and training, dealing with injury and recovery, body image issues in aesthetic sports, and concerns with retirement (Gorczyński et al. 2017). According to a recent systematic review of the mental health of competitive athletes in Western countries, the risks athletes face include sport-related performance anxiety, negative cognitive and affective responses (e.g., motivation deficits, excessive worry, apprehension toward training), maladaptive behavioural patterns (e.g., perfectionism, overtraining, impulsivity, substance abuse or disordered eating), problematic somatic responses (e.g., irregular heart rate, muscular tension, nausea, adrenal exhaustion), and compromised well-being (Hanton et al. 2009; Rice et al. 2016). Athletes also report high expectations, relentless criticism, and the overall intense pressure to succeed as common stressors (O'Brien & Kilrea 2020). In a systematic review of the research on burnout in sport, sport-related trait anxiety and motivation deficits were found to significantly correlate with burnout, negatively impacting the subjective well-being of athletes (Gorczyński et al. 2017). Previous research states that elite athletes may try to ignore or suppress depressive

symptoms due to the stigma surrounding mental health problems (Gorczyński et al. 2017). In addition, difficulty finding balance, lack of support, and total immersion in the sport environment can lead to lower reported levels of well-being (Verkooijen et al. 2012).

3.3 The aims of this study

The aim of this study was thus to investigate the following two research questions: 1) How are different aspects of subjective body awareness (interoceptive sensibility and external and evaluative body awareness) correlated with experienced well-being? 2) a) Are the correlations between subjective body awareness and well-being different depending on exercise status (athlete/active exerciser)? b) How does exercise status affect subjective body awareness and well-being?

On the basis of theoretical analysis and the nature of the questionnaires, we assumed the existence of a statistically significant correlation between the levels of subjective body awareness and that of well-being. We hypothesized that high interoceptive sensibility and high public body awareness would be correlated with diminished well-being. Conversely, we expected a positive correlation between body competence and well-being. In accord with older research by Pennebaker and Lightner (1980) on athletic body awareness, we also expected athletic participation to lead to higher levels of subjective body awareness. Additionally, we controlled for level of exercise (athlete vs. active exerciser) in our analyses based on previous research that suggested differences may exist between the groups in psychological well-being (Paskova et al. 2019; Toth et al. 2019)

Different dimensions of subjective body awareness have been distinguished, such as interoceptive sensibility and external and evaluative body awareness. Although there is some evidence that different aspects of body awareness relate with well-being, research on body awareness has traditionally looked through the lens of maladaptivity, hypervigilance and body dissatisfaction. Also, the mechanism by which body awareness influences well-being is not clear. This is particularly evident when considering the dichotomous associations that have been drawn from heightened body awareness; while considered to be highly advantageous in certain

contexts such as elite sports, it also plays a role in the manifestation of several psychopathological disorders (Paulus & Stein 2010). In addition, the concept of interoception has mainly investigated the awareness of internal body processes, and the multidimensionality of subjective body awareness has rarely been considered. Further, based on the aforementioned research, there is a need for a deeper understanding of factors related to the mental health and psychological well-being of elite athletes.

4 MATERIAL AND METHODS

This study was part of a larger research project ‘Body Awareness, Brain and Exercise’ (Kehotietoisuus, aivot ja liikunta), which was conducted through collaboration between the Department of Psychology and the Faculty of Sports and Health Sciences at the Jyväskylä Centre for Interdisciplinary Brain Research (CIBR). The aim of this project was to investigate the brain basis of interoceptive awareness and its links to personality traits and emotion regulation, as well as identify group differences within the sports and exercise context. Data was collected through various questionnaires, Magnetoencephalography (MEG), autonomic nervous system measures and the heart-beat detection task. As the focus of this thesis was on the relation between subjective body awareness, exercise status and well-being, only data from self-report assessment methods (body awareness and well-being) and background information (participation in sports) were included.

4.1 Subjects and procedures

The sample consisted of 49 participants, 30 exercisers (61%) and 19 athletes (39%). The average age of study participants was 24 ranging from 18 to 35. Out of the participants 37% were male and 63% were female. As for their level of competition, 47% (n=9) of athletes reported competing at a national level, 5% (n=1) competing at a regional level, and 5% (n=1) internationally. ‘Highly active’ categorized exercisers, who reported engaging in moderate to vigorous physical activity at least 4 hours per week, were included in this study.

Athletes’ exercised on average 6.1 times per week (SD=0.81), participating in low intensity exercise 5.6 hours per week (SD=3.45) and vigorous exercise 9.0 hours per week (SD=3.60). Exercisers’ exercised on average 5.2 times per week (SD=1.83), participating in low intensity exercise 4.5 hours per week (SD=3.59) and vigorous exercise 5.3 hours per week (SD=2.51). The differences in the amount of weekly exercise sessions and in vigorous exercise between groups were statistically significant ($p < 0.05$).

Subjects were given written information about the study and consent was obtained before participating in the study. Next, they filled in a general form concerning background information (e.g., age, weight, height, marital status and level of education, satisfaction with self and life). Finally, participants completed the three different questionnaires used to assess subjective body awareness: The Body Awareness Questionnaire (BAQ), The Body Vigilance Scale (BVS), and The Body Consciousness Questionnaire (BCQ). The ethical committee at the University of Jyväskylä approved the procedures of the study.

4.2 Measures

Background. Demographic data such as gender, age and marital status were assessed. In addition, questions included inquiries about occupation, lifestyle, exercise, health status, and relationships. Exercise habits were assessed by frequency, duration, intensity, and attitude towards exercise. Based on the background questionnaire, participants who participated in moderate to vigorous physical activity at least 4 hours per week were included in this study.

Interoceptive sensibility. Interoceptive sensibility was assessed through BAQ, BVS and the Private Body Consciousness Sub-Scale from BCQ. All questionnaires were translated into Finnish from their original language. Internal consistency reliability was assessed using Cronbach's Alfa.

The Body Awareness Questionnaire (BAQ). Developed by Shields, Mallory, and Simons (1989), the BAQ is a widely used self-report scale for measuring interoceptive sensibility. The BAQ consists of 18 statements, which measure the attentiveness to nonpathological and non-emotive processes, and the ability to anticipate bodily reactions. Items are answered on a seven-point Likert scale (1= not at all true for me; 7= very true for me), with higher scores referring to higher perceived awareness of body sensations. Multiple studies support its reliability and consider it a valid instrument for measuring self-reported attentiveness to bodily processes. The internal consistency of the scale in this study was high (Cronbach's Alfa coefficient = 0.841).

The Body Vigilance Scale (BVS). Developed by Schmidt, Lerew and Trakowski (1997) to assess attentional focus to internal body sensations, degree of attentional focus and time spent attending to bodily sensations. The scale consists of four items, with the first three assessing the degree of attention to body sensations (*'I am the kind of person who pays close attention to internal bodily sensations'*), belief of sensitivity to body sensations (*'I am very sensitive to changes in my internal bodily sensations'*) and the time spent per day to focus on bodily sensations (*'On average, how much time do you spend each day 'scanning' your body for sensations?'*). The last item assesses the amount of attention one pays to 15 sensations, which are the physical symptoms characteristic to panic attacks. Items are answered on a 10-point Likert scale. The Cronbach's Alfa coefficient for the Body Vigilance Scale was 0.607.

The Private Body Consciousness Sub-Scale consists of five items, which focus on attentiveness to changes in bodily states (e.g., dry mouth, heartbeat, hunger, changes in body temperature). Developed by Miller, Murphy and Buss (1981), The Private Body Consciousness Sub-Scale is part of the BCQ, which is one of the earliest, widely used, and cited instruments for measuring body awareness.). Items on each subscale are answered on a 4-point Likert scale on how well each item describes them (0= very untypical; 4= very typical). The Cronbach's Alfa coefficient for BCQ was 0.535.

External and evaluative body awareness. External and evaluative body awareness was assessed by the Public Body Consciousness and Body Competence Sub-Scales from the BCQ. *The Public Body Consciousness Sub-Scale* consists of six items, which assess the disposition to focus on the importance of appearance of the body (e.g., facial features, hair, skin, posture). Body competence was assessed with a four-item evaluative *Body Competence Sub-Scale*, focusing on positive attitudes towards one's body (e.g., strength, agility, speed, and coordination). Items on each subscale are answered on a 4-point Likert scale on how well each item describes them (0= very untypical; 4= very typical). The Cronbach's Alfa coefficient for BCQ was 0.535.

Well-being. One way of examining psychological health is to assess an individual's level of subjective well-being and satisfaction with life. The scientific evaluation of subjective well-

being measures how individuals evaluate their own lives, where they identify positive feelings and believe their life is going well (Morris et al. 2020). Well-being was assessed through 2 individual items; *satisfaction with self* and *satisfaction with life* was measured using a 10-point Likert scale (1= very unsatisfied; 10= very satisfied).

4.3 Statistical analysis

The statistical analysis was conducted using IBM SPSS statistics 22. A total score was calculated for each questionnaire according to the instructions by original papers. As there was missing data in the Body Consciousness Questionnaire, a summed aggregated mean score was calculated for each of the three subscales. Reliability of the questionnaires was tested with Cronbach's alfa model.

Three distinct analytic approaches were utilized in this study to examine the relationships between interoceptive sensibility, body competence, and well-being. The main analysis of the relation between different aspects of subjective body awareness and well-being (research question 1) was performed by first calculating Pearson's correlation coefficients for the relation between all five variables of subjective body awareness and well-being. Next, a multivariate linear regression analysis was conducted for each variable of body awareness that showed a significant correlation to well-being. Those insignificant variables, which did not have a significant effect on well-being, were excluded from the model. Lastly, correlations between all variables of subjective body awareness and well-being were performed separately for athletes and active exercisers (research question 2).

5 RESULTS

Among variables of subjective body awareness, one aspect of interoceptive sensibility (private body consciousness) and one aspect of external and evaluative body awareness (public body consciousness) correlated with well-being. Analysis of Pearson's correlation coefficient indicated that private body consciousness ($p=0.029$) and public body consciousness ($p=0.024$) correlated negatively with satisfaction with self and life, and positively with exercise status, whereas exercise status had a positive correlation ($p=0.007$). Results of the Multivariate linear regression analysis supported the significant relation between private body consciousness, public body consciousness and well-being. The link between body awareness, body vigilance and body competence with satisfaction with self and life was not significant (see table 1).

Exercise status did not relate with any aspects of subjective body awareness and well-being, when analysed separately for athletes and active exercisers. Thus, exercise status did not affect subjective body awareness, nor the correlations between subjective body awareness and well-being. Between group correlation analysis showed that only satisfaction with self and life was related to exercise status ($p=0.007$). Higher well-being values were associated with athletic participation indicating that athletes were more satisfied with themselves and their life, compared to exercisers.

Table 1. Pearson's correlation coefficients between background variables, subjective body awareness and well-being

	Age	Gender	ES	BA	BV	PrBc	PuBc	Bc	SSL
Age	1								
Gender	0.011	1							
ES	0.157	-0.089	1						
BA	0.101	0.199	-0.178	1					
BV	0.000	-0.019	0.048	0.277	1				
PrBc	0.057	0.165	-0.127	0.286*	0.078	1			
PuBc	-0.030	0.342*	-0.216	0.300*	0.022	0.607**	1		
Bc	0.005	-0.316*	0.146	-0.223	-0.189	-0.111	-0.122	1	
SSL	0.077	-0.059	0.381**	-0.043	-0.114	-0.316*	-0.326*	0.229	1

Note: *p<0.05; **p<0.01. ES= exercise status, BA= body awareness, BV= body vigilance, PrBC= private body consciousness, PuBC= public body consciousness, Bc= body competence, SSL= satisfaction with self and life

5.1 Interoceptive sensibility and well-being

The correlations between interoceptive sensibility and well-being are presented in Table 1. Among variables of internal subjective body awareness i.e. interoceptive sensibility, only the correlation between private body consciousness and satisfaction with self and life was significant (see Table 1). Results of the Multivariate linear regression analysis supported the significant relation between private body consciousness and satisfaction with self and life (see Table 2).

The relation between private body consciousness and satisfaction with self and life was negative, suggesting that subjects with high private body consciousness were less satisfied with their life and themselves ($\beta=-0.385$, $p=0.043$, $R^2=0.148$, 95% CI [-1.676, -0.029]). Significant correlations between private body consciousness and satisfaction with self and life are visualized in scatterplot 1. The relation between body awareness and body vigilance with well-being was statistically not significant (see Table 1).

Scatterplot 1. Correlation between Private Body Consciousness and Satisfaction With Self and Life

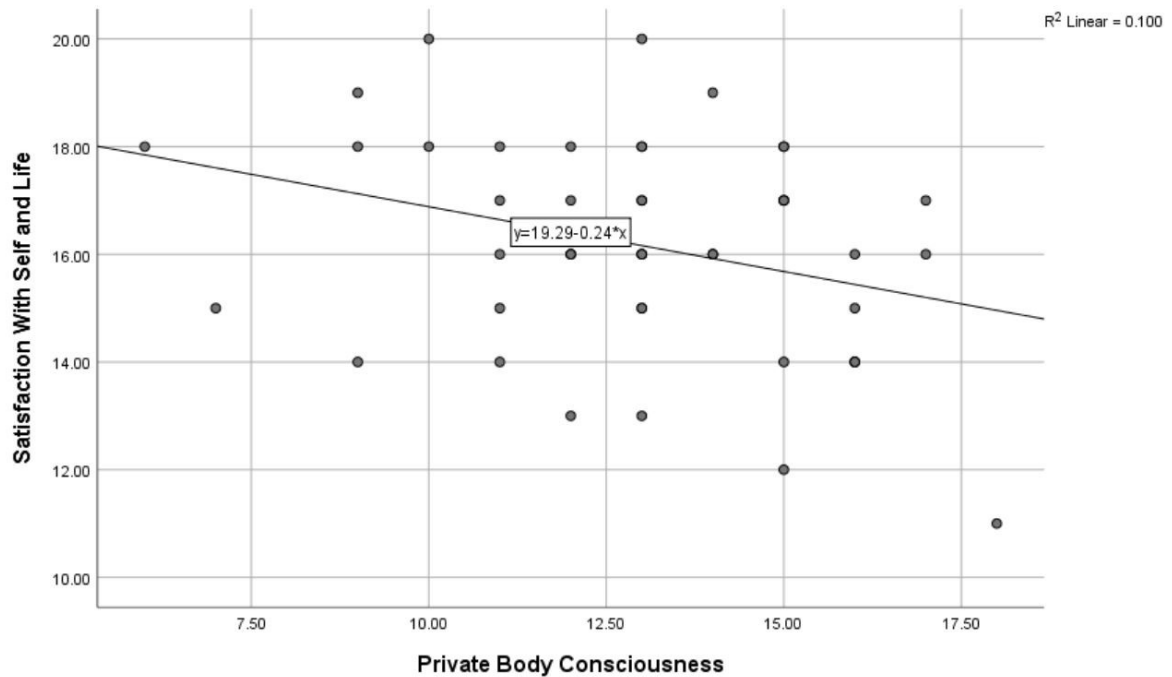


Table 2. Multivariate Linear Regression: Correlates of significant variables of subjective body awareness with well-being.

	Standardized b coefficient	Sig.	Adjusted R- square
Model 1			
Dependent variable: Satisfaction with self and life			0.080
Independent variable: Private body consciousness	-0.316*	0.029	
Model 2			
Dependent variable: Satisfaction with self and life			0.087
Independent variable: Public body consciousness	-0.326*	0.024	

Note: *p<0.05

Model 1: The effect of private body consciousness on well-being after the exclusion of insignificant interoceptive sensibility variables.

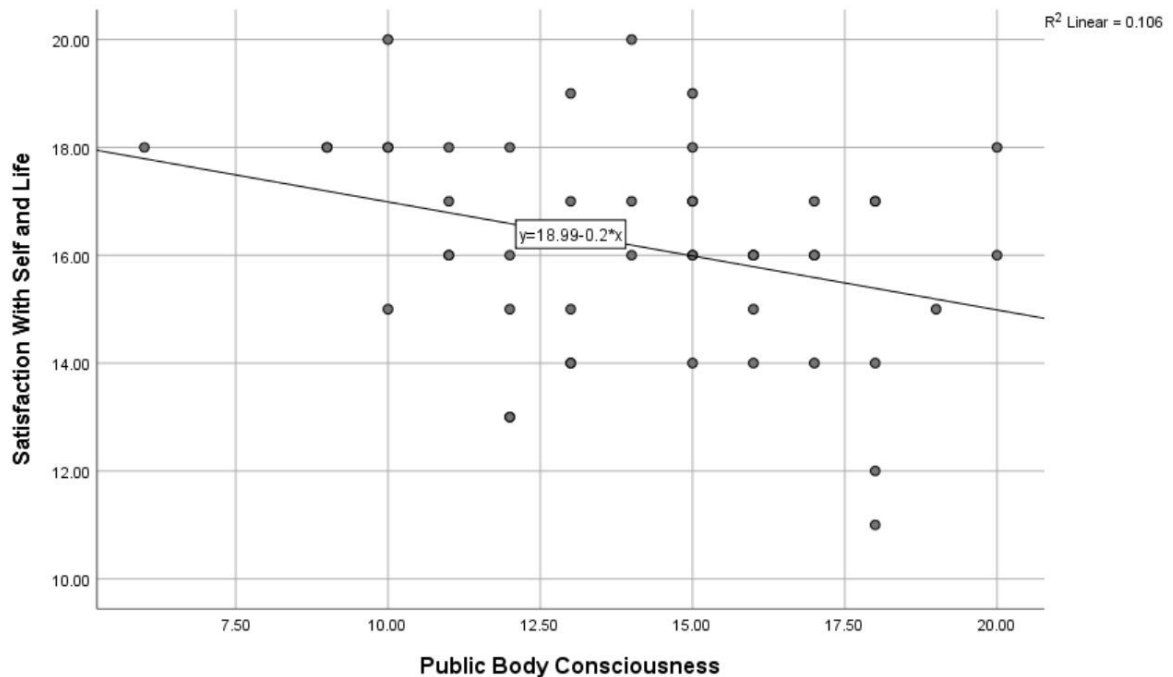
Model 2: The effect of public body consciousness on well-being after the exclusion of insignificant external and evaluative body awareness variables.

5.2 External and evaluative body awareness and well-being

The correlations between external and evaluative body awareness and well-being are presented in Table 1. Among variables of external and evaluative body awareness, public body consciousness was the only variable to correlate significantly with well-being. Pearson's correlation coefficient revealed a negative relation between public body consciousness and satisfaction with self and life (see Table 2). Subjects with high public body consciousness reported lower levels of life satisfaction.

The relation between public body consciousness and satisfaction with self and life was stronger than private body consciousness. Multivariate linear regression analysis supported the statistically significant relation between public body consciousness and satisfaction with self and life ($\beta=-0.466$, $p=0.012$, $R^2=0.217$, 95% CI [-1.380, -0.183]). Significant correlations between public body consciousness and satisfaction with self and life are visualized in scatterplot 2. Body competence did not relate with the variable of well-being.

Scatterplot 2. Correlation between Public Body Consciousness and Satisfaction With Self and Life



5.3 Between group analysis in subjective body awareness and well-being

Table 3. Means and standard deviations of five dependent measures in exercisers and athletes.

Groups	BAQ		BVS		PrBc		PuBc		Bc		SSL	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Exercisers (n=30)	85.63	11.86	118.50	40.0	13.24	2.57	14.66	2.90	11.69	3.29	15.60	1.96
Athletes (n=19)	80.53	16.95	122.39	39.24	12.58	2.59	13.26	3.49	12.63	3.04	17.11	1.56
Total	83.65	14.11	119.96	39.34	12.98	2.57	14.10	3.19	12.06	3.19	16.18	1.94

BAQ= Body Awareness Questionnaire, BVS= Body Vigilance Scale, PrBc= Private Body Consciousness, PuBc= Public Body Consciousness, Bc= Body Competence, SSL= Satisfaction with Self and Life

The relation between different aspects of subjective body awareness and well-being was further investigated in athlete and exerciser groups. Correlations in exercise status, variables of subjective body awareness and well-being were assessed. Exercise status did not relate with satisfaction with self and life and any aspects of subjective body awareness in either group. While active exercisers scored higher on the BAQ and in PrBc and PuBc, and athletes on the BVS and in Bc, these scores were statistically not significant.

Table 4. Pearson's correlation coefficients between subjective body awareness and well-being in active exercisers.

	BAQ	BVS	PrBc	PuBc	Bc	SSL
BAQ	1					
BVS	0.100	1				
PrBc	0.259	0.155	1			
PuBc	0.306	-0.094	0.609**	1		
Bc	0.050	0.050	-0.130	-0.045	1	
SSL	-0.032	-0.299	-0.287	-0.252	0.193	1

Note: *p<0.05; **p<0.01. ES= exercise status, BA= body awareness, BV= body vigilance, PrBC= private body consciousness, PuBC= public body consciousness, Bc= body competence, SSL= satisfaction with self and life

Table 5. Pearson's correlation coefficients between subjective body awareness and well-being in athletes.

	BAQ	BVS	PrBc	PuBc	Bc	SSL
BAQ	1					
BVS	0.533*	1				
PrBc	0.288	-0.034	1			
PuBc	0.240	0.199	0.590**	1		
Bc	-0.507*	-0.617**	-0.035	-0.163	1	
SSL	0.113	0.186	-0.305	-0.311	0.184	1

Note: *p<0.05; **p<0.01. ES= exercise status, BA= body awareness, BV= body vigilance, PrBC= private body consciousness, PuBC= public body consciousness, Bc= body competence, SSL= satisfaction with self and life

Between group analysis and further results of the regression analysis revealed a significant relation only between exercise status and satisfaction with self and life ($\beta=0.381$, $p=0.016$, $R^2=0.237$, 95% CI [0.261, 2.418]). Higher well-being values were associated with exercise status indicating that athlete participants had a higher satisfaction with self and life score compared to active exercisers. The model explained 19% of variation in well-being $F(3)=4.555$

$p = 0.007$. The correlations between exercise status and satisfaction with self and life is visualized in boxplot 1.

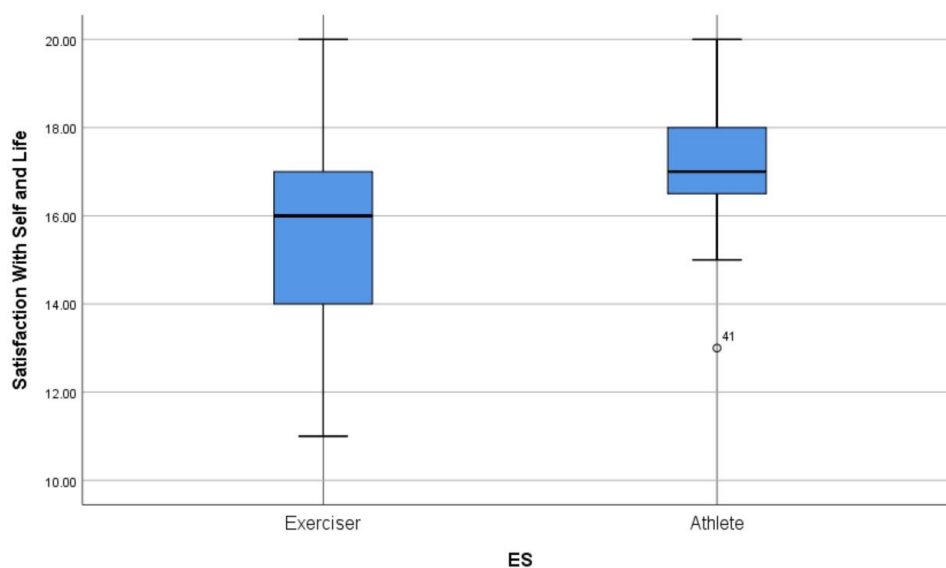
Table 6. Multivariate Linear Regression: Correlates of significant variables of group statistics with well-being.

	Standardized b coefficient	Sig.	Adjusted R-square
Model 3			
Dependent variable:			0.127
Satisfaction with life			
Independent variable:			
Exercise status	0.381**	0.007	

Note: ** $p < 0.01$

Model 3: The effect of exercise level on well-being, after the exclusion of insignificant subjective body awareness variables.

Boxplot 1. Levels of satisfaction with self and life in exerciser and athlete groups.



6 DISCUSSION

The aim of this study was to examine the relationship between different aspects of body awareness and well-being by considering the multidimensionality of subjective body awareness. Subjective body awareness included 1) interoceptive sensibility (body awareness, body vigilance and private body consciousness) and 2) external and evaluative body awareness (public body consciousness and body competence). The present study was aimed at getting more insight into the relationship between attention focusing on the inner body and attention focusing and evaluating the outward body. In addition, the focus was on the relation of different aspects of subjective body awareness and well-being in the context of sports and exercise.

The main findings of this study can be summarized as follows. Two aspects of subjective body awareness related with well-being: private and public body consciousness. High private body consciousness (attentional focus on the inner body) and high public body consciousness (attentional focus on the outward body) related to low satisfaction with self and life. Body vigilance, body awareness and body competence did not correlate with well-being. Further, exercise status did not relate with any aspects of subjective body awareness and well-being, when analysed separately for athletes and active exercisers. Exercise status was found to be the only statistically significant variable that predicted well-being, with athletes reporting higher satisfaction with self and life compared to active exercisers.

The results of this study suggest that some dimensions of interoceptive sensibility do relate with subjective well-being. Among variables of internal subjective body awareness, high private body consciousness was associated with diminished well-being. This relationship is surprising considering that private body consciousness being the primary perception of regular distress and pain, has been found to be unrelated to negative emotionality, hypochondria and social anxiety (Miller et al. 1981). However, the negative relationship between a dimension of interoceptive sensibility and well-being found in this study builds upon earlier research confirming, that heightened body awareness can lead to the amplification of perceived symptoms, catastrophizing, and hypervigilance, and therefore decrease psychological well-being. Based on the empirical evidence on interoceptive dysfunction as well as more recent

studies focused more on a mindful, non-judgemental approach to body awareness, it was expected to see significant correlations between other dimensions of body awareness as well. Interestingly, the other dimensions of internal body awareness (as assessed by BAQ and BVS) did not correlate with well-being. Previous literature shows that interoceptive sensibility is multidimensionally related to many psychological factors, both positively and negatively, which may depend more on the attentional style and subjective interpretation than the bodily signals themselves.

From the external and evaluative body awareness standpoint, increased public body consciousness was also associated with decreased satisfaction with self and life, confirming our hypothesis. The inverse relationship between public body consciousness and well-being was stronger than that of private body consciousness. As mentioned earlier, public body consciousness has been found to relate to increased self-objectification, beautification among women, and negative emotionality (Ainley & Tsakiris 2013; Miller et al. 1981). While the objectification theory suggests that self-objectification leads to decreased interoceptive sensibility, some studies suggest that low levels of interoceptive sensibility may be the cause of heightened self-objectification (Ainley & Tsakiris 2013). The results of this study however support previous findings in that an increased attentional focus on the external body relates with a diminished sense of well-being.

The results of this study were unable to proffer support for a direct relationship between exercise status, subjective body awareness and well-being in a group comparison. From the theoretical position which drove this study, it was assumed that sports would have a positive effect on body awareness. As mentioned earlier, previous studies have shown body awareness levels of athletes to be above average as a result of the general benefits and effects of long-term training and sports activity, including enhanced sensitivity to body movement, changes in brain function and structure, higher trait emotional intelligence, and mental toughness (Erden & Emirzeoglu 2020). Several studies have proposed interoceptive learning to be a process of updating and integrating information from current bodily signals with previous body signals and mental models (Farb et al. 2015; Gibson 2019; Mehling et al. 2011). As internal bodily states exert changes in brain function and mental activity, repetition over time is assumed to strengthen these connections.

We anticipated that athletes would have higher body awareness compared to exercisers, specifically in the subdomain of body competence. However, although athletes did score higher in body vigilance and body competence, the differences were statistically insignificant. The similarities between the athlete group and active exercisers group in the current study were similar to those reported by (Dodd & Vetter 2015) who reported a lack of significant differences on physical self-perceptions between athletes and vigorous exercisers. Similar to athletic participation, regular physical activity has also been shown to have a positive impact on perceptions of physical self and identity (Dodd & Vetter 2015). Toth and colleagues (2019) compared how exercisers and non-exercisers differ in regards with physical self-concept and found that the mere involvement in regular exercise had positive effects on physical self-concept and was unaffected by one's physical performance. The similarities in these studies suggest that even though fitness goals likely differed between the two groups, opportunities to experience physical improvements or achievements may have led to similar perceptions in the subdomain of body competence.

It is thought that the lack of a significant difference in subjective body awareness between the groups may also be caused by the common effects of consistent, highly engaging physical activity provided to individuals. Also, the mean body awareness scores of athletes and exercisers may depend largely on the technical, tactical, and cultural demands of the sport or exercise they are involved in, as well as on the common benefits associated with exercise such as physical functioning, social support, and general health. From an athletic standpoint, there may also be separate effects in terms of different sports. Erden and Emirzeioglu (2020) showed that not only do interoceptive skills differ between team and individual sports, but also within the physiological demands of the specific sport. However, this study did not take in account the type of sport athletes were involved in. Future studies including these factors in the assessment of body awareness and well-being should be considered.

In the current study, between group comparisons showed significant correlations between exercise level and well-being. Exercise status was the most important factor associated with well-being, and the results of this study showed that athletes were more satisfied with their lives and themselves compared to exercisers. While the empirical evidence of the athlete-well-being relationship remains mixed, the present study built on previous research that has linked

participation in sports with an increase in well-being (Paskova et al. 2019). This association was independent of other factors, indicating that athletes' higher satisfaction with self and life is mediated by other variables than the ones measured in this study.

Potential mediating variables that can account for the relationship between participation in sports and satisfaction with life according to the literature presented earlier, could be perceived stress, social support, and psychological capital. For many, sports participation represents an effective method for coping with stress as well as an outlet for increasing resilience and mental toughness (Madigan & Nicholls 2017). High athletic performance requires proper rest, healthy lifestyle choices, positive thinking, emotional control and psychological capital, which all help balance the increased demands and stress of the sport. Olympic athletes have been shown to react more positively to stress, control their anxiety, block out any distractions, and to set and achieve their goals (Gould & Carson 2008). In addition, Gould and Carson (2009) found them to possess high levels of confidence, hope, and optimism, as well as demonstrate a strong work ethic and adaptive perfectionism. This is further highlighted in a study by Houlberg and colleagues (2018), who investigated how particular self-narrative profiles of elite athletes contributed to their psychological well-being. They found that a global sense of self-worth, purpose and a constructive way of dealing with disappointing performances promotes mental health and well-being amongst athletes. Athletes with a purpose-based narrative identity (i.e., high purpose, global self-worth, positive view of self after sport) reported the highest levels of psychological well-being and life-satisfaction, along with the lowest levels of depression, anxiety and shame. On the contrary, athletes who based their self-worth on performance demonstrated the highest levels of psychological disruptions (Houlberg et al. 2018).

While participation in sports has many benefits, the competitive aspect may provoke, augment or expose psychological issues in athletes. Practicing sport at an elite level presents an entirely different set of stressors, circumstances and constraints that influence mental health in athletes. Common disorders affecting elite athletes are personality issues, the athletic culture, psychological response to injury and illness, as well as select psychological challenges such as overtraining, eating disorders, performance anxiety, or the abuse of illegal substances (Gould & Carson 2008). Earlier it was assumed that athletes were less likely clinically depressed (Morris et al. 2020). However, recent studies have shown otherwise, although the stigma around

mental health problems in the athletic culture still exists (Morris et al. 2020). Also the athletic culture promotes “mental toughness”, which may prevent athletes from seeking professional help, or admitting it in studies.

Another potential mediator of the relationship between exercise status and well-being is social support. Researchers have identified that individuals with a strong social network report higher levels of well-being and life satisfaction (Malinauskas & Malinauskiene 2018). In addition, previous research has shown that participants of team sports have reported higher levels of subjective happiness compared to those of individual sports (Morris et al. 2020). Morris and colleagues (2020) found that athletes competing in individual sports were more prone to depressive symptoms and internalization of failure than those competing in team sports. This confirms the findings of other studies in the sport context that have shown social support to be an effective buffer between adverse sports events and associated with injured athletes' well-being (Lu & Hsu, 2013). Thus, although the present study did not take in account the type of sport athletes participated in, having a strong social network and team support could be a potential mediator in the association between athletic participation and well-being.

6.1 Limitations of this study

There are also several limitations to this study that should be pointed out. Although we found a link between public body consciousness, private body consciousness and well-being, the effect sizes were small. As a result, it might be argued that the effect is not very strong and, by implication, not very important. In addition, we assessed subjective well-being with two independent questions and left out the Satisfaction With Life Scale (SWLS) due to a large number of missing values. Developed by Diener, Emmons, Larsen and Griffin (1985), SWLS is a 5-item unidimensional measure of global life satisfaction. This scale could have given a more comprehensive measure of well-being, and thus increased the reliability of the results.

The cross-sectional design and the use of self-report measures limited the ability to determine causality and introduced the possibility of conscious and/or unconscious biases. For a deeper understanding, it is of importance to note that self-reported body awareness is a complex and

more abstract representation of the body, and a result of both bottom-up and top-down perceptual processes. Furthermore, interoception may include sensing, interpreting, and integrating information from the inner body, and this process can be largely influenced by attention tendency, discrimination, accuracy, sensibility, and coherence between actual physiology and subjective experience (Khalsa et al. 2018). Questionnaire items assessing body awareness tend to focus on the intensity or frequency of various sensations and have been shown to correlate poorly with interoceptive accuracy (Ferentzi et al. 2018). In addition, well-being itself may be influenced by the way individuals interpret different interoceptive signals. Thus, subjective well-being is proposed to be associated only with the self-reported (perceived) aspect of interoception but not related to the sensory measures of interoceptive accuracy. In summary, self-reported body awareness measures the beliefs about and subjective perception of bodily processes, rather than actual, physiological events.

6.2 Conclusions and future directions

Overall, there is a need for further investigation to clarify the relationship between various dimensions of subjective body awareness and well-being. Given that a large portion of the literature has focused on the maladaptive view of body awareness, studies including an adaptive, mindfulness-based approach to body awareness are particularly warranted. Recent developments in mindfulness interventions and body psychotherapies aiming to investigate the mind-body connection and increase well-being suggest that increased body awareness may be beneficial for health (Khalsa et al. 2018). The present study did not support this notion, as most aspects of subjective body awareness were independent of well-being. Rather, this study suggests that high levels of subjective body awareness are associated with diminished well-being, as two aspects of subjective body awareness related negatively with satisfaction with self and life.

Future research should examine how well-being can be supported by awareness of the body, and how the different dimensions of body awareness impact psychological well-being. Furthermore, further studies in the athletic population are warranted and could contribute to the development of an athlete-specific body awareness questionnaire. While participation in sports

has many benefits, the nature of competition may provoke or expose various psychological issues in athletes. Coaches, physicians and other sports professionals should be familiar with the psychological, cultural and environmental factors that influence mental health in athletes, as well as common mental health challenges unique to the athletic population. In addition, further studies are needed with diverse and larger samples to explore possible group differences.

Two dimensions of subjective body awareness were found to correlate negatively with well-being. Thus, some subjective body awareness aspects may relate with well-being. Between group comparisons revealed no significant correlations between subjective body awareness and well-being in athletes and active exercisers. Exercise status correlated significantly with well-being, with athletes' reporting higher levels of well-being, which were found to be independent of any variables of subjective body awareness. Thus, athleticism is thought to be an advantage for satisfaction with self and life.

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