

YEDİTEPE UNIVERSITY
INSTITUTE OF HEALTH SCIENCES
MASTER'S PROGRAM IN PHYSIOTHERAPY AND REHABILITATION

**THE VALIDITY AND RELIABILITY STUDY OF
TURKISH VERSION OF BODY PERCEPTION
QUESTIONNAIRE**

MASTER THESIS

DENİZ ASLAN, PT., MSc.

İSTANBUL-2020

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İSTANBUL-2020

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APPROVAL

TEZ ONAYI FORMU

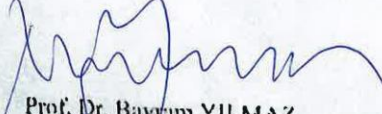
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ONAY

Bu tez Yeditepe Üniversitesi Lisansüstü Eğitim-Öğretim ve Sınav Yönetmeliğinin ilgili maddeleri uyarınca yukarıdaki jüri tarafından uygun görülmüş ve Enstitü Yönetim Kurulu'nun 29/05/2020 tarih ve 2020/05-60... sayılı kararı ile onaylanmıştır.


Prof. Dr. Bayram YILMAZ
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DECLARATION

I hereby declare that this thesis is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person nor material which has been accepted for the award of any other degree except where due acknowledgment has been made in the text.



Deniz Aslan

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LIST OF SYMBOLS AND ABBREVIATIONS

%	symbol of percentage
m	unit of length in meters
kg	unit of mass in kilograms
kg/m ²	unit of body mass index
ACC	Anterior Cingulate Cortex
AIC	Anterior Insular Cortex
AN	Anorexia Nervosa
ANS	Autonomic Nervous System
ASD	Autism Spectrum Disorder
BES	Body Esteem Scale
BFI	Big Five Inventory
BMI	Body Mass Index
BPQ	Body Perception Questionnaire
BPQ-SF	Body Perception Questionnaire Short Form
CLBP	Chronic Low Back Pain
EFA	Exploratory Factor Analysis
FMS	Fibromyalgia Syndrome
FreBAQ	Fremantle Back Awareness Questionnaire

GAD	Generalized Anxiety Disorder
HADS	Hospital Anxiety Depression Scale
ICC	Intraclass Correlation Coefficient
ISQ	The Interoception Sensory Questionnaire
KMO	Kaiser- Meyer- Olkin Measure
LISP	Lamina I Spinothalamic Pathway
MAIA	Multidimensional Assessment of Interoceptive Awareness
MDD	Major Depressive Disorder
OA	Osteoarthritis
OCD	Obsessive Compulsive Disorder
OSS	Otonom Sinir Sistemi
PTR	Physiotherapy and Rehabilitation
PTSD	Post-Traumatic Stress Disorder
RHI	Rubber Hand Illusion
SD	Standard Deviation
SPSS	Statistical Package Analyze for Social Sciences
SSD	Somatic Symptom Disorder
QOL	Quality of Life
VMb	VentroMedial Basal Nucleus
VMpo	VentroMedial Posteior Nucleus

ABSTRACT

Aslan, D. (2020). The Validity and Reliability Study of Turkish Version of Body Perception Questionnaire. Yeditepe University, Institute of Health Science, Department of Physiotherapy and Rehabilitation, MSc thesis, İstanbul. The present study aims to determine the validity and reliability of the Turkish version of the Body Perception Questionnaire (BPQ) through the Turkish translation of the questionnaire and the intercultural adaptation. The Body Perception Questionnaire (BPQ) is a self-report measure of body awareness and autonomic reactivity. Its items are based on the organization of the autonomic nervous system (ANS), a set of neural pathways connecting the brain and body. These pathways send information from the body about the status of organs and tissues (i.e., afferent projections). Some of these incoming signals form a basis for the subjective awareness of the body. The ANS also carries signals that control the functions of these organs and tissues (i.e., efferent projections). These signals can alter the functions of the body, depending on internal and external needs. The study includes 175 healthy participants and 120 participants with anxiety. Beaton's 6-step procedure was used for translation and intercultural adaptation. After the steps of the procedure were completed, the questionnaire was finalized. The tests were carried out to measure the internal consistency and the validity and reliability analyses showed that the BPQ measure was found to be highly reliable. It has been observed that the scale items could be grouped under 3 factors in the Varimax Rotation Exploratory Factor Analysis and the BPQ variance could be explained by 63.56%. The repeatability and the temporal invariance of BPQ have been studied through biweekly tests and repeated test applications and the invariance was found out to be on an good level. It was found that BPQ is a sensitive measure distinguishing the healthy people and people with anxiety ($p<0,001$). As a result, it was found that BPQ is a valid and reliable questionnaire in Turkish that can be used to evaluate the body perception of the adults.

Keywords: Anxiety, Body Perception Questionnaire, Interoception, Validity, Reliability

ÖZET

Aslan, D. (2020). Beden Algı Ölçeği'nin Türkçe Geçerlilik ve Güvenilirlik Çalışması. Yeditepe Üniversitesi. Sağlık Bilimleri Enstitüsü. Fizyoterapi ve Rehabilitasyon ABD., Master Tezi. İstanbul. Bu çalışma, Beden Algı Ölçeği'nin Türkçe'ye çevirisi ve kültürler arası adaptasyonunun yapılarak geçerlilik ve güvenilirliğinin belirlenmesi amacıyla yapıldı. Beden Algı Ölçeği, vücut farkındalığı ve otonomik reaktivitenin bir öz bildirim ölçüsüdür. Maddeleri, beyni ve vücudu bağlayan bir dizi sinir yolu olan otonom sinir sisteminin (OSS) organizasyonuna dayanmaktadır. Bu yollar vücuttan organların ve dokuların durumu hakkında bilgi gönderir. Bu gelen sinyallerin bazıları vücudun öznel farkındalığı için bir temel oluşturur. OSS ayrıca bu organların ve dokuların işlevlerini kontrol eden sinyaller taşır. Bu sinyaller, iç ve dış ihtiyaçlara bağlı olarak vücudun işlevlerini değiştirebilir. Çalışma 175 sağlıklı ve 120 anksiyeteli katılımcı içermektedir. Çeviri ve kültürlerarası adaptasyon için Beaton'un 6 aşamalı prosedürü kullanıldı. Prosedürün aşamaları tamamlandıktan sonra anket sonuçlandırıldı. Geçerlilik ve güvenilirlik analizlerinde iç tutarlılık için iç içi yaptığımız testlerde Beden Algısı Ölçeği'nin güvenilir olduğu görüldü. Ölçek maddelerinin Varimax Rotasyonu ile Keşfedici Faktör Analizinde 3 faktör altında toplanabildiği ve BPQ varyansının % 63,56'sını açıklanabildiği gözlenmiştir. BPQ'nun yinelenebilirliği ve zamansal değişmezliği iki hafta arayla gerçekleştirilen test ve tekrar test uygulamaları ile incelenmiş ve değişmezliğin iyi düzeyde olduğu bulunmuştur. Beden Algı Ölçeği'nin sağlıklı bireyler ile anksiyeteli bireyleri ayırt eden hassas bir ölçek olduğu bulunmuştur ($p < 0,001$). Sonuç olarak, Beden Algı Ölçeği, yetişkinlerde beden algısını değerlendirmek için kullanılabilecek, Türkçe, geçerli ve güvenilir bir değerlendirme ölçeği olduğu belirlendi.

Anahtar Kelimeler: Anksiyete, Beden Algı Ölçeği, Geçerlilik, Güvenilirlik, İnterosepsiyon

1. INTRODUCTION AND PURPOSE

Body awareness is the felt sense of embodiment, the consciousness of our somatic feelings (1). Body perception or body awareness strongly related to the sensory information arising from the body (2). Philosophers describe the human senses as predictors of what we will become and who we are. Sensation was described by the atom's friction, and all senses thought to be a variant of the touch sense by Democritus. Aristotle described four different senses, and linked each with one of the four elements - smell with fire, sound with air, touch with the earth, and vision with water. The ideas of Socrates that there are many other senses besides the known senses, such as smelling, hearing, and sight, are supported by scientists (3). Research across different scientific disciplines has pointed that sensory experiences are capable of regulating physiology. For example, animal studies showed that enriched environments capable to improve many genetically predetermined disease, such as epilepsy (4). On the other hand, sensory deprivation is recognized to affect a wide range of developmental areas, including learning, attention, memory, and inhibitory control, as well as internalizing and externalizing behavioral problems. Studies about children that raised in an orphanage -which is deprived sensory environment- have showed that those children are susceptible to disease than children growing up with their families (5).

Body awareness is used as a term that describes as a person's perception of sensory signals from his/her own body. From this perspective, it is clear that body awareness is constructed with sensory information coming from the body itself and/or from inside. Body awareness emerges from a complex network of efferent and afferent pathways and their feedback loops between the central nervous system (CNS) and body structures (6–12). Sensory information from the body itself is called proprioception, while sensory information from inside is called interoception, and both are associated with body awareness (13). Signals about internal body functions originate in sensors that carry information from target tissues and organs, are integrated and propagated through afferent pathways that involve the spinal and cranial nerves, are routed to brain structures that monitor incoming information, and are regulated by descending efferent signals.

Progressively, the role of impaired body awareness and autonomic reactivity

could be seen across a range of clinical problems, including anxiety (14,15), depression (16), post-traumatic stress (17), autism (18), schizophrenia (19), and eating disorders (20). With rising interest and methodological availability, knowledge about how neural and physiological processes are associated with the subjective body experiences and psychiatric dysfunction has developed noticeably (21).

There are many questionnaires which developed to measure body perception, body awareness, interoception using by The Interoception Sensory Questionnaire (ISQ) (22), Big Five Inventory (BFI) (23), Multidimensional Assessment of Interoceptive Awareness (MAIA) (24), Fremantle Back Awareness Questionnaire (FreBAQ) (25). The questionnaire that measures body awareness and reactivity is Body Perception Questionnaire (BPQ). The BPQ (26) was developed to evaluate the subjective experiences of the function and reactivity of target organs and structures that are innervated by the autonomic nervous system (ANS). The original BPQ, totaling 122 items, included the questions about cognitive-emotional-somatic stress response, body awareness, body and cognitive stress response styles, ANS reactivity, and health history. This questionnaire can be used by the researchers who want to work in "awareness of internal body", "emotion-bodily responses", or similar topic of them. Furthermore, BPQ will not only appropriate questionnaires among the person with psychiatric problems such as anxiety, depression and we consider it may also give the contribution with a practitioner assessment tool to the field of physical disabilities.

Since its introduction, the BPQ has been used in more than 25 peer-reviewed publications and has been translated into several languages. The BPQ was suggested to determine both body awareness and autonomic reactivity profile among target groups (27)(28). This questionnaire, which original one is in English, is translated into several languages like Sweden, Spanish, German, Portuguese, Czech, Chinese, Dutch, and Catalan which were published on own website. However, it has not translated to Turkish, and also there is not any reliable and validated questionnaire to evaluate body awareness and ANS reactivity for Turkish population.

As far as we know, this self-reported questionnaire will be the first translated instrument about body perception for our country. In this current study, we intended to

make the cross-cultural adaptation, reliability, and validation of the Turkish version of the BPQ, which is a self-report of body awareness and autonomic reactivity.



2. THEORETICAL FRAMEWORK AND LITERATURE REVIEW

2.1. Sensory Systems

Sensory systems provide information about the human body and the physical condition of the environment. These senses are classified into three main groups; exteroceptive, proprioceptive, and interoceptive senses (29).

1. Exteroceptive Senses: This system perceives the outer environment through visual, auditory, olfactory, gustatory, tactile senses.
2. Proprioceptive Senses: These systems give information about the body's own spatial orientation and movement.
3. Interoceptive Senses: The interoceptive system sends information to the brain from internal organs like stomach, kidney, lungs, heart, liver about the state of them, such as pain, heat, illness, hunger, toileting (30).

2.1.1. Exteroceptive Senses

2.1.1.1. Visual System

The least developed among the senses at birth is the sense of vision. Visual acuity at birth is 20/600. Like the development of other areas, the development of vision depends on experience. The visual cortex begins to mature, and the visual pathways begin to myelinate from birth. The baby follows the objects with rhythmic eye movements until the 3rd month and starts to follow continuously after the 3rd month. A color vision reaches the adult level in about four months. Even very young babies look at pictures - that are similar to human faces with two eyes, one mouth- longer than any other picture. At four to five months, they start to choose a particular face, and this becomes apparent at nine months. This has been associated with the rapid growth of the face and color recognition region called fusiform gyrus and the inferior temporal gyrus, which is responsible for functions requiring high visual memory, such as shape-face recognition (Figure 1). Conditions such as congenital cataract, lazy eye, and strabismus will deprive the necessary experience for the development of vision and should be diagnosed and treated in the first months (31).

Along with proprioception and vestibular work, the visual framework plays a vital part within the capacity of a person to control, adjust, and keep up an upright posture. When these three conditions are confined and adjust is tried, it has been found that vision is the foremost critical donor to adjust, playing a more significant part than either of the two other inborn instruments (32). The clarity with which a person can see his environment, as well as the measure of the visual field, the helplessness of the person to light and glare, and destitute profundity recognition, play imperative parts in giving criticism circle to the brain on the body's development through the environment. Anything that influences any of these factors can harm adjusting and keeping up posture (33). This impact has been seen in investigating, including elderly subjects, when compared to youthful controls (34), in glaucoma patients compared to age coordinated controls (35), cataract patients pre and post-surgery (36), and indeed something as essential as wearing security goggles (37). Monocular vision (one looked at vision) has moreover been appeared to contrarily affect balance, which was seen within the already referenced cataract and glaucoma studies (35,36), as well as in healthy adults and children (38).

According to Pollock et al. (2010), stroke is the most cause of particular visual disability, most regularly visual field misfortune (homonymous hemianopia- a visual field imperfection). By the by, prove for the adequacy of cost-effective mediations pointed at these visual field abandons is still conflicting (39).

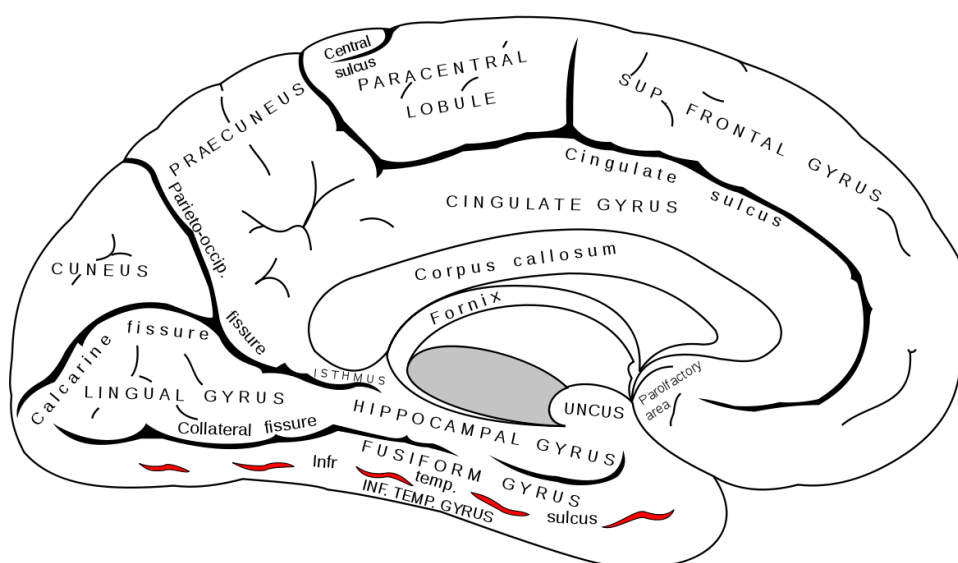


Figure 2.1. The appearance of gyrus and sulcus in the sagittal brain section.

The loss of limb consequences the changes in peripheral proprioceptive and visual stimuli as well as morphological variations. Variations to these stimuli will accordingly alter the developments of emotional control of the CNS at different levels. Patients are conscious of the fact that their limbs have been lost; nevertheless, they will sense them as if they were not lost (40) (41).

Fisher (1986) (42) describes body image as the image of our own body. It mentions to the body as a psychological experience which involves our attitudes and emotions, established through our experience, toward our own body': Kudar wrote, Schilder (1935) sees body awareness as a subjective experience of bodies; the complication of the principles of body position, body schema, and body posture with spatial motions (43).

2.1.1.2. Olfactory and Gustatory Systems

Babies are born with enhanced taste and smell senses. Taste buds in the tongue occur in the 8th week of pregnancy. The amniotic fluid in the womb is vital for the development of the smell and taste preference: the smells reach the epithelium with the amniotic fluid in the womb, and the earliest responses to the smell have been shown to occur in the 7th month of pregnancy. Therefore, the food preferences of the mother are transferred to the baby while the baby is still in the womb. It is seen that babies grimace to bad smells (like broken eggs) even within the first 12 hours after birth. Breastmilk stimulates the sense of smell and taste in the newborn baby: it prefers its mother's breast and milk. The emergence of subsequent odor and taste preferences, the development of the olfactory cortex, and olfactory pathways in the brain depend on experience (Figure 2). Taste signals pass through the brain stem to the brain region (gustatory cortex). The brain stem also receives signals from the gastrointestinal and cardiovascular systems. The brain prefers high-nutrient and non-bitter tastes. It is imperative to introduce the babies with different tastes while they are still in the womb, to continue this during the breastfeeding period and to allow them to experience different tastes during the transition to a new food. Children who do not experience different tastes may have eating problems during these sensitive periods (44).

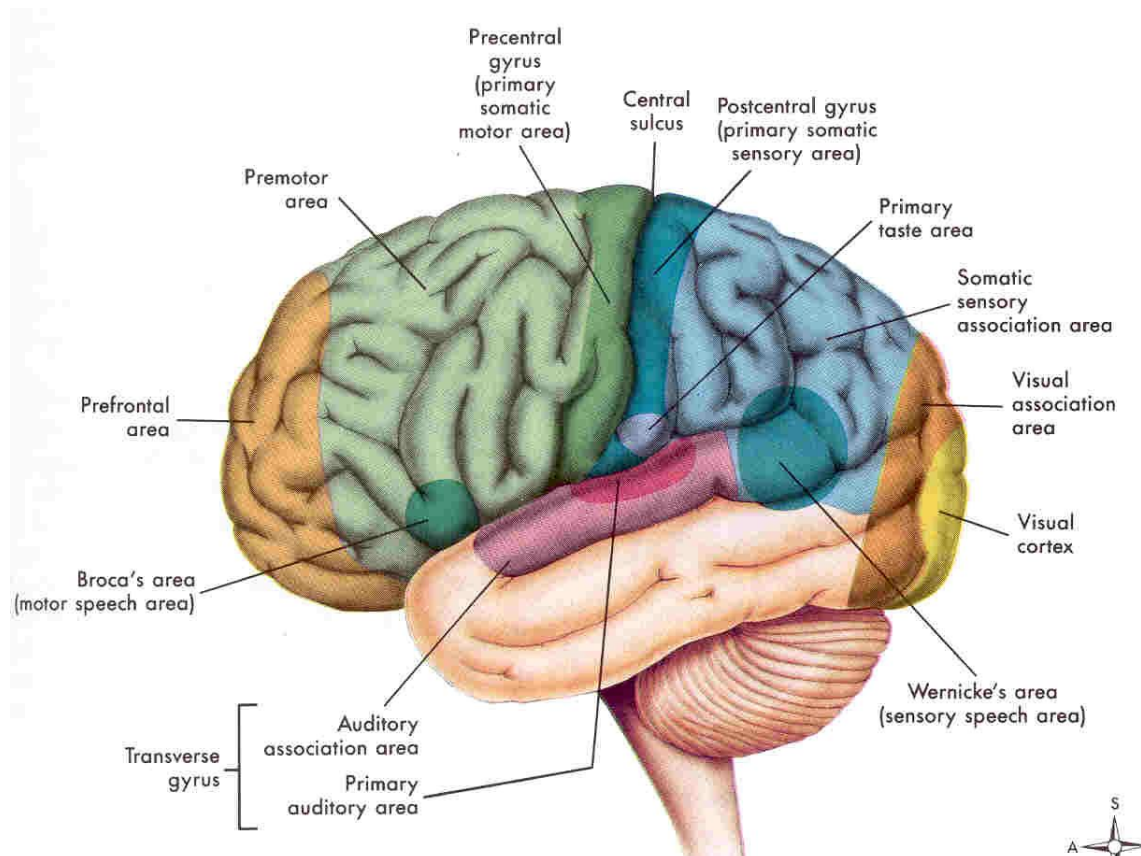


Figure 2.2. Primary motor cortex: precentral lobule, Rolandic (Central) sulcus, and paracentral lobule, primary sensory cortex: postcentral gyrus, visual cortex: calcarine and cuneus, auditory cortex: superior gyrus and Heschl gyrus

Several reports have confirmed that the quality of life (QOL) in people who suffer from decreased olfactory perception is destructively compromised (45). These people complain about the incapability to recognize unsafe states, like the perception of smoke, fire, or gas, or to notice wasted food (46–48). Besides, interpersonal relationships are extremely predisposed by the inability to observe body smells, since this lack leads to wonderful indecision (49). Based on these situations, it is consequently not surprising that olfactory disorders habitually consequence in weakening of emotional well-being. Studies by Pollatos et al. (2007), and also Croy and colleagues (2014), have described that decreased olfactory perception was also related with depressive symptoms. In addition to its impact on emotional well-being and QOL, decreased olfactory function has also been related with different body mass index (BMI) and body weight (50). Except that olfactory dysfunction, interoceptive awareness interconnects with depressive symptoms, more specifically, with psychiatric disorders categorized by emotional

impairment (51,52). Patients with a loss of the smell sense like eating fewer had reported dietary modifications since adjustments in food preferences like preferring spicier food, or the beginning of disease (50). Studies show that there is poorer olfactory performance on specific diseases (38) that associate with the BMI, as well as reduced olfactory awareness for food stimuli in the patients with anorexia (53). In addition to decreased olfactory function, anorectic as well as bulimic patients were discovered to show deficits in interoceptive awareness (54,55)(56).

2.1.1.3. Auditory System

The inner ear structures involved in the hearing function mature in the second trimester of pregnancy, and hearing starts from the beginning of the third trimester. The mother's voice reaches the baby powerfully through the mother's body. Therefore, when the baby is born, the baby prefers its mother's voice to someone else's voice. The sounds that the baby had heard before birth, like the songs that the mother listens, the mother's pulse are more relaxing for the baby. Conditions affecting the baby's development, such as prenatal infections and low birth weight, can disrupt the hearing system. If the hearing loss is detected early, it can be taken precautions. Therefore, all newborns should be screened for hearing (57).

Although it is seldom taken into account in perception-action studies, we perceive and integrate direct auditory feedback of our actions outside the domain of speech perception and musical activity. In our everyday life, we expect auditory feedback from many movements we perform routinely. For example, hearing the sound of cracking a nut validates our action, and we would be astonished if no sound was emitted during the process (58). We use auditory information in a way we are not aware of, in conjunction with motor processes. Recent experimental studies even suggest that sound can be used to plan grasping movements, providing further evidence of the function of audition in the control of our movements (59).

We observed that when the performer could not develop a feeling of agency over the rendered sound field, her relationship with space was utterly perturbed. Outer space did not seem to exist anymore for her, and all her attention was captured by her attempt to make sense of the sounds she was hearing. This happened when the system was not convincing (for example because of a long delay in its answer to a movement, of a failure

to recognize a movement, or of its instability in giving the same output to the same input), leading to misattribution of self-generated sounds to the sound rendering system itself. When the system was convincing, and the auditory feedback was linked to spatial measurements, the system changed the experience of the performer by providing agency over the external environment, which she does not usually have (60).

Whereas, reports on body ownership and agency have predictably concentrated on exteroceptive sensory processing, and less consideration has been paid to interoceptive signals (61). Interoceptive sensitivity mentions to the ability to observe our internal bodily states, such as heart rate, thirst, and hunger, based on visceral signals. A specific example of interoceptive sensitivity is the ability to observe one's pulses or heart rate. In the 1960s (62), scientists began to examine individual changes in heart rate perception (63). The topic of heart rate perception established specific interest because of its potential for biofeedback training (64) and its supposed relative with emotional processing (65) and psychopathology (66)(67)(68)(69). Different methods have been used to evaluate people's ability to observe their pulses during brief fixed intervals of various periods (70,71). The subjective assessment is then compared to the actual number of pulses for each period, permitting calculating a mean sensitivity index. Whereas in the pulse tracking task, attention is directly focused on interoceptive signal (72). More precisely, in the pulse detection task (also known as the simultaneity paradigm), participants are required to specify whether pulse sensations are simultaneous with externally presented stimuli, such as sounds or lights, which are presented with different time delays following the onset of myocardial contraction (28,73). In the Method of Constant Stimuli, sounds are presented at changed intervals concerning the R-wave, ranging in 100-ms steps from 0 to 500 ms (74). For each of the different conditions, subscribers are necessary to specify whether they think the sound presented was simultaneous with their pulse or not. For each participant, it is then determined whether the detected distribution of reactions differs from chance, and based on their scores, subscribers are categorized as 'bad' or 'good' perceivers (75,76)(77).

2.1.1.4. Tactile System

Receptors (receptors) in the skin that perceive external senses such as touch, pain, heat, and cold develop at birth. Sensory signals from the skin reach the sensory cortex in

the brain in the newborn; however, the spinal reflex response is more pronounced and widespread than the cortical response. Therefore, young babies can perceive the senses but cannot locate them. Pain in newborn infants is a subject that has just started to be understood. Infants who experience more pain in the early period may be more sensitive to pain in later life, and may even have a delay in cognitive and motor development. Therefore, anesthesia should be applied in painful procedures in newborns. Deep sensory receptors mature with muscle-joint development and myelination of nerve sheaths. Sensory homunculus is similar to the motor homunculus, and sensory development occurs according to this representation. This is why babies discover objects with their mouths before their hands. The sense of touch is essential for the emotional and cognitive development of the baby and is influenced by experiences such as hugging, caressing, handling objects. Developmental retardation occurs in infants who are not adequately touched during the first years of life. The mental problems of the orphan children who grow up in the dormitories adopted after six months of age are higher than those adopted before six months of age. This is thought to be due primarily to the low experience of tactile stimuli (78).

Our consciousness of touch needs to integrate the stimulation of a much greater receptor superficial as compared to vision. It has been projected that our skin and its tactile receptors account for 18% of our body mass (79). The sense of touch constantly notifies our awareness about areas of the body that are presently out of view (i.e., a person's back) and, in difference with vision, it can do this regardless of the position or status of our head or eyes. As far as this point is concerned, one cannot fail to note that we can close our eyes and prevent visual stimuli from entering consciousness, nevertheless possibly as an eventual form of bodily protection against injury, we can never voluntarily shut down our sense of touch (80) (for evidence that the overall neural level of activation in the somatosensory system varies as a function of whether the eyes are open or closed (81)). It is for causes such as these that developing an understanding of how our consciousness of tactile senses occurs about should be considered of great significance (82).

2.1.2. Proprioceptive Senses

2.1.2.1. Vestibular

The vestibular apparatus involves the semicircular canals and the otolith organs, the utricle, and the saccule. Receptors for the vestibular system are positioned within these structures in the inner ear, close to those of the auditory system. The endolymph that bathes the receptors for the auditory system moves freely between the auditory and vestibular systems.

Vestibular receptors are hair cells located in the otolith organs and in swelling at the base of the three semicircular canals (i.e., lateral, posterior, and anterior,). The otolith organs are principally answerable for static purposes. The knowledge treated by these receptors is used to identify the position of the body and head in space and control of posture. The dynamic element of the vestibular system is the semicircular canals. These structures answer to the movement of the head in space.

Utricle and saccule otoliths are saclike organs oriented in vertical and horizontal planes. In the receptor region of the otolith organs, the macula, hair cells synapse with developments from the vestibular ganglion cells. Hair cell developments extend into an overlying substance with gelatinlike qualities, the otolith membrane, in which are embedded otoconia (calcium carbonate crystals). In the vertical position, the hair cells in the macula of the utricle are oriented in a horizontal plane, with the otoconia resting on top of them. When the head tilts or moves linearly, there is a dislocation of the otoconia and the embedded hair cell stereocilia, beginning the development of stimulus detection and transduction. Movement of the stereocilia builds electrical discharges within the hair cell. This electrical energy is charged to chemical energy at the synapse between the macular hair cells and the vestibular ganglion projections. The hair cells in each quadrant of the utricle are methodically oriented in a different direction. Thus, the systematic variation in the orientation of the utricular hair cells results in the utricle detecting head movement or position (e.g., tilt) in the three orthogonal planes of space. The utricle answers to linear, sustained, and low-frequency stimuli (i.e., stationary head position or slow head movements less than 2 degrees per second)(83–85).

Semicircular canals that are actually closed tubes, detect variations in the direction and rate of angular acceleration or deceleration of the head. Angular acceleration results in rotary head movement- that is, head movements that, if continued long enough, would result in the head-turning in a circle (e.g., spinning, head nodding). Within each vestibular apparatus, the three semicircular canals are oriented at right angles so that they represent all three planes in space. When the head is tilted forward 30 degrees, the horizontal canal is oriented in the horizontal plane, and the posterior and anterior canals are vertical and oriented at right angles to each other (86).

Most of the studies have showed that how vestibular signals and signals from other sensory modalities integrate (87). For example, visual and vestibular signals are combined for perception of self-motion. It has been recommended that this communication is vital to update a vestibular world-centered frame of reference that constantly effects visual responses in the parietal cortex when the head moves (88,89). Multisensory conjunction of vestibular and visual signals occurs quickly, at the sub second time scale of visual motion. There is also increasing evidence for collaboration between somatosensory and vestibular signals (90). Specially, vestibular inputs effect the gain of different phases along the somatosensory afferent pathway (91). Vestibular input may play a key role in producing the normal experience of a coherent body, linked to the self. But, it remains uncertain how vestibular inputs contribute to bodily awareness (92). Because vestibular inputs produce activation of extensive right-hemisphere cortical multisensory network (93), coupled with deactivation of visual areas (94), we hypothesized that vestibular input might contribute to bodily awareness by balancing intrinsic proprioceptive and somatosensory knowledge against extrinsic visual knowledge. Adjustments in the relative strengths of these projections might be responsible for restoration of the normal sense of bodily awareness during vestibular-induced remission of somatoparaphrenia. Conversely, we measured an alternative hypothesis of non-specific effects on bodily awareness, because vestibular stimulation is a extremely salient stimulus, and quite different from normal vestibular inputs. For instance, vestibular stimulation is identified to have non-specific effects on general arousal and attention (95).

2.1.2.2. Proprioception

Proprioception is defined as a perception of body movements and joint as well as the position of the body or body parts in space (10). A more recent description of proprioception involves sensing the velocity and direction of movement, besides determining the effort needed to lift and grasp objects (96). Proprioception notifies us about the spatial orientation of the body or body segments, the rate, and timing of movements. The amount of force our muscle is being stretched (97–99), while Sherrington (1906) identified muscle afferents, joint receptors, and the vestibular labyrinth as proprioception.

Before the early 1970s, researchers distinguished between aware joint proprioception (kinesthesia), supposed to arise primarily from joint receptors, and unconscious proprioception supposed to rise from the muscle spindle and tendon receptors. Lately, proprioception and kinesthesia terms have been begun to use. Though controversy regarding this issue continues to occur, experimental proof now specifies that all proprioceptive inputs can contribute to aware proprioception (100,101).

For purposes of studying sensory integration theory, it is more important to understand the distinction between proprioceptors (i.e., proprioceptive receptors) and proprioception (i.e., proprioceptive feedback and perception of joint and body movements). Not all proprioception is resulting from peripheral proprioceptive receptors. Internal connects of motor signals that are sent to the muscles after an action is planned (i.e., corollary discharge) are also an significant for discriminating between passive and active (internally generated) movement produced by an external stimulus, recognizing if we have programmed an suitable level of motor activity, the development of body scheme, and perception of force (102). Knowledge of the body and its movements is essential in motor planning.

The sense of one's own body is a important creation of the human mind. Though, it is difficult in order to work experimentally, because the body is “always there” (103) in the background of mental life. Also, the bodily self includes two aspects that are usually confused: sense of agency and the sense of body ownership (104). Agency is the sense of executing and intending actions, including the feeling of regulatory one's own body movements, and, through them, events in the external environment. Agency includes a

hard efferent component, because centrally created motor instructions precede voluntary movement. Body possession references to the sense that one's own body is the source of sensations. The sense of body ownership involves a strong afferent component, through the various peripheral signals that specify the body state. Essentially, the sense of body ownership is current not only during voluntary actions, but also during passive experience. In contrast, only voluntary actions create a sense of agency. This asymmetry mentions that agency and ownership should have different effects on awareness of the body (105). In the current context, body awareness refers to proprioceptive awareness, that is, the aware experience of the location of a specific body-part (e.g., a finger or a hand) in space (106).

2.1.3. Interoceptive Senses

The current concepts describe interoception as a sense of the physiological condition of the body, and universal knowledge network used to represent one's body from within. It is the ability to notice subtle variations in bodily systems, involving joints, muscles, viscera, and skin. It involves a range of physiological sensations, involving tickle, coolness, warmth, hunger, thirst, pain, itch, sexual arousal, air hunger, pulse, muscular activity, distension of bladder, vasomotor activity, rectum or esophagus, wine tasting (in sommeliers), distension of stomach, and sensual touch (107).

Interoception is described as the sense of the internal state of the body (108). This can be achieved both non-conscious and conscious. It includes the brain's progression of integrating signals transmitted from the body into precise sub regions like the anterior cingulate cortex (ACC), insula, brainstem, thalamus, and somatosensory allowing for a nuanced demonstration of the body's physiological state (109)(110). This is essential for continuing homeostatic situations (111) in the body and, hypothetically, aiding in self-consciousness (112).

Interoceptive signals are reached to the brain through a variety of neural pathways, which permit for the sensory processing of internal bodily states. Changes of internal states, or a disconnection between the body's signals and the brain's signals, have been expected some mental illnesses such as somatic symptom disorder (SSD), anxiety (113), autism spectrum disorder (ASD), depression, panic disorder, illness disorder, illness anxiety disorder, and post-traumatic stress disorder (PTSD).

The present description of interoception is not identical with the term “visceroception” (114). Visceroception mentions to the perception of bodily signals rising exactly from the insides: bladder, stomach, lungs, and the heart along with other inner organs in the trunk of the body (115). This does not incorporate organs like the skin and brain. Interoception includes visceral signaling, however more approximately relates to all physiological tissues that communicate a signal to the CNS about the present state of the body (116). Interoceptive signals are communicated to the brain via multiple pathways, including the lamina I spinothalamic pathway (LISP), the classical viscerosensory pathway, the vagus nerve, and the glossopharyngeal nerve, chemosensory pathways in the blood, and somatosensory pathways from the skin.

Interoceptive signals develop from numerous altered physiological systems of the body. The most ordinarily studied system is cardiovascular interoception that is characteristically measured by directing attention towards the senses of the pulse during numerous jobs (70,117,118). Other physiological systems essential to interoceptive processing incorporate the immune systems, respiratory system, thermoregulatory system, gastrointestinal endocrine, nociceptive system, and genitourinary systems. Soft cutaneous touch is alternative sensory signal often incorporated within the interoceptive processing system.

2.2. What is Interoception?

Interoception is the perception of the senses coming from the inner side of the body (119). It includes the physical sensations related to internal organ functions like respiration, satiety, pulse, and also includes ANS activity related to emotions (109,120). Most of these perceptions remain unconscious; becoming conscious, for example, interoceptive awareness, involves the processing of internal senses, so that they are accessible for conscious awareness (116). There are several processes included in interoception that are reflected in conceptual variations of interdisciplinary interoceptive consciousness (108), and the appearance of interdisciplinary models to address conceptual and measurement questions in the developing science (121)(122).

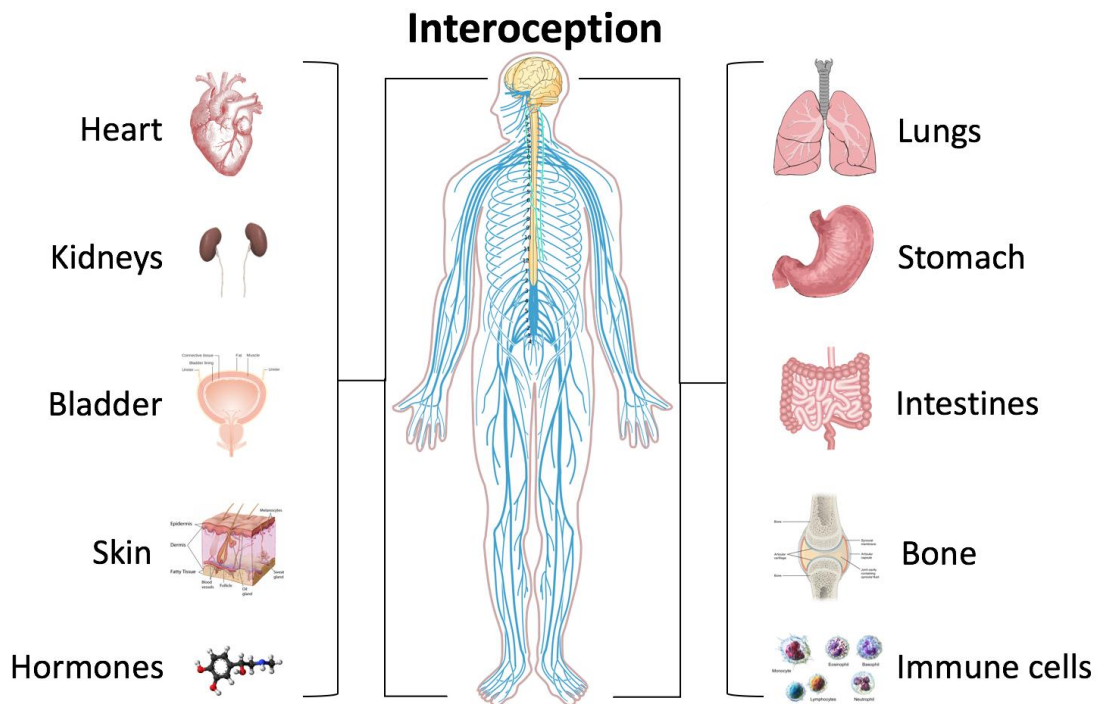


Figure 2.3. Interoception is elaborated in many different physiological systems like the gastrointestinal system, cardiorespiratory system, nociceptive system, immune and endocrine systems.

Interoceptive sensations are triggered by stimulation of unmyelinated sensory nerve endings (free nerve endings) that project into the insular cortex (IC) (123) (Figure 3). Feelings from these senses are not only a sensory, however an emotional, motivational aspect. At the same time, it is always related to the body's homeostasis needs. They are associated with the behavioral motivations necessary to maintain physiological body integrity (109,112,124). Irritable bowel syndrome, depression, anxiety, eating disorders, Posttraumatic Stress Disorder (PTSD), schizophrenic disorders, allergy (emotional blindness), and possibly fibromyalgia are considered to be associated with impaired interoception and altered insular procedures. It has been suggested that interoceptive nerve pathways can be considered as a potential correlation for consciousness (112).

2.3. History of Interoception

2.3.1. Early to mid-1900s

Charles S. Sherrington in 1906 firstly introduce "interoception" as a receptor in the body based on their function and location (114). In this description, interoception has excluded all receptors and information about "exteroceptive" or "proprioceptive" from the body. Interoception was limited to the viscera. According to Sherrington's model, information from stimuli of outside, like light, touch, sound, and odor, was received by exteroceptive receptors. Moreover, nociception and temperature were classified as an exteroceptive sensation by Sherrington; however, now these have interoceptive qualities (125)(116). Besides, he divided the internal body into autonomic and somatic functions. Skeletal tissues, controlling voluntary movement, localize proprioceptors. Interoceptors in modern literature was limited to the visceral smooth involuntary muscle (126).

Although there were many experiments about interoceptive processing in the 1950s and 1960s, the study did not begin after conversation of interoceptors of Sherrington because of John Newport Langley's book stating that the ANS used for efferent signaling to apply its function (127). Research about interoceptive receptors was stopped due to this narrowed perspective (128). Animal experiments that have searched the afferent signals (body to brain) started to see if interoceptive conditioning exists after the foundation of interoceptive receptors in many places in the human body.

2.3.2. The mid-1900s to 2000

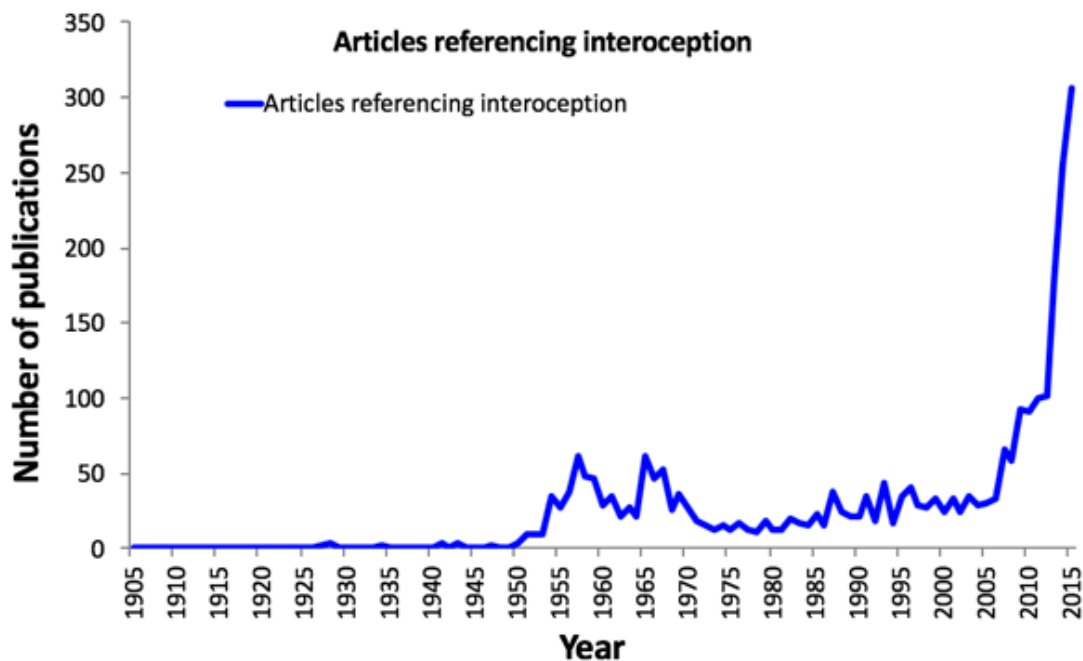
The late of 1950 and the 1960s saw an improved awareness in interoception founded on the several publications released throughout that period that referenced the term. This growth has been referred to as the "biofeedback blip," where scientists observed the ability of a person to increase control over autonomic functions as a method of treatment for variable situations (108).

Interoception did not have massive popularity from scientists before 1950s. Some researchers define interoceptor and visceroreceptor as the same meaning, as the definition of Sherrington; (128). Some researchers used a combination of visceroreceptive and

proprioceptive information into one category as "interoception" (129,130), and some argued that interoception is not just about endogenous (internal) stimuli (114). There is controversy as to that sensory signals should, or could be categorized as "interoceptive."

Psych physiologists started to study cardiovascular interoception, presenting numerous different works on pulse perception: pulse detection(131),(132), pulse tapping (133), and pulse counting (70) in the 1980s. They were also started to search about panic disorder symptoms if there was the effectiveness of pharmacological stimulation (39). Due to this, the popularity of interoception grew with the development of theoretical models of interoceptive information (134).

Figure 2.4. A number of the article referencing interoception from 1905 to 2015.



2.3.3. 2000 and on

Publications about interoception increased in the 21.Century (108). The increasing interest in interoception appeared in different ideas of it. A definition extends to include the function and perception of bodily movement (110) to better recognize everything under the skin in psychosomatic processes (116). Similarly, neuro-anatomists, hoping to find the anatomical basis of interceptive functioning, expressed the existence

of a homeostatic pathway representing "the physiological state of all tissues in the body" from the body to the brain. They also expressed the importance that this mapping provides the individual with subjective emotions that are critical to human emotions and self-awareness (125).

As an example, interoception forms the basis of the present view of allostasis and allostatic load. The regulatory model of allostasis argues, which the primary function of the brain as an organ is the predictive regulation, which refers to the ability of the brain to anticipate needs, and make to fulfill them before they emerge, of internal senses (135). Consequently, in this model, the brain is answerable for the effective regulation of the inner environment.

"The perception of internal body states" (118) which is generally used is the definition of interoception; and significantly, interoception process is made probable through a process of "integrating the knowledge coming from inside of the body into the CNS." although interoceptive processes exist in the body that does not understand (136). This definition is different from the original proposition of Sherrington; however, examples of interoception in modern literature.

2.4. Interoceptive Physiology

2.4.1. Cardiovascular system

Cardiac interoception is one of the methods of measurement of interoceptive sensation, which is used as different tasks, including pulse, tapping (137), heart attention (138,139), pulse counting (70), and pulse detection (140,141) tasks. The way to use of pulse counting task is asking count of the pulses that they feel. And then, the actual count obtained with an electrocardiogram is compared with their reported count. A pulse counting task shows the ability of subjects who report his or her pulse, but the participant may know any knowledge about his or her heart rate (142,143). Furthermore, consequences may be influenced due to insensitivity to heartrate changes (144). Pulse detection task is listening to musical tone to participants, which are played at the same time or not with her or his pulse. Then they are asked if the tones are simultaneous or non-simultaneous with the heartrates.

This task is used to understand their ability to the recognition of their function above chance levels, which is called "good detectors." but detection rates of this task are generally only 35% (108). The participant's self-report, discrimination, attention, accuracy, and detection of the interoceptive process are also measured by pulse detection (108). Pulse attention task includes basically the top to the down way of attention for interoception sensation like stomach, breath, or pulse (138). Elevated arousal states or physical exertion like watching a horror movie, having a panic attack, riding a roller coaster, or public speaking anxiety is changed body state internally or externally. These homeostatic perturbations occur perceptions of heart rate sensations. Inducing perturbation of the state of the body also gives information about cardiac interoception. If adrenaline-like drugs are used, like activating mimics of the sympathetic nervous system (118), "fight or flight" response similarity, resulting in increased respiratory rate and heart rate (145,146), inducing the perception of bodily state can be done. This approach physiologically ensures a basis to understand neurological and psychiatric disorders, which are described by increased sympathetic nervous system activity (118).

2.4.2. Respiratory system

Respiratory awareness can be different from additional interoceptive physiological signs due to an individual's talent to apply volunteer control over the method with breathing exercises or controlled breathing (110). This system is frequently measured using CO₂ inhalation (147) and restrictive breathing loads (148) that designed to imitate painful breathing sensations. Effort breathing is a usually felt feeling related to panic attacks; but, because of the voluntarily breathing control, this effected area of interoception frequently requires the application of much more precise experimental controls to calculate in contrast to interoception of cardia.

2.4.3. Genitourinary and gastrointestinal systems

Fullness and hungriness are usual interoceptive sensations associated with genitourinary (GU) and gastrointestinal (GI) systems. GU and GI systems are homeostatic signals, which tell a person when he or she eats and when he or she stops intake. The dorsal mid-insula seems to be important in taste processing during GI interoceptive attention tasks (149). A homeostatic environment of GI and GU systems is troubled by the use of the bladder and rectal distensions. Different stimulus intensities are

achieved by using balloon catheters for bladder and rectal distensions. Associative panic learning models have been utilized to work how harmless signs may lead to anomalous conditions of anxiety and GI hypersensitivity (150). Positive outcomes for individuals with gastrointestinal interoception problems had found by using biofeedback therapy (151).

2.4.4. Nociceptive system

Nociception refers that the CNS induces stimuli for the receiving and processing. The IC is activated while giving painful stimulation to the skin with warmed probes, by electric shock, and mechanical compression on functional brain imaging studies (152). Before anatomical evidence and functional imaging, the pain was a component of an exteroceptive sensation; now, it is known that pain is in the interoceptive sensation.

2.4.5. Thermoregulatory system

Pain and temperature are supposed to be shown as "feelings" of unpleasantness/pleasantness and warmth/coolness in the brain. These useful and sensory features of thermoregulation may motivate specific behavioral responses that depend on the body's state (for example, moving away to a more relaxed space from a source of heat). Such complexity in the inner homeostatic milieu of an organism is known to be critical features of a motivational process-giving increase to expressive situations and has been proposed to be represented primarily by the IC as feelings (112). These feelings then affect drives when the ACC is activated.

2.4.6. Immune and endocrine systems

Body systems that aid for homeostatic and allostasis controls are the immune and endocrine systems. Interoceptive dysregulation in depression may be associated with the imbalances of these systems, along with other social and genetic issues (153). The improved allostatic variations may reason Hypo-awareness of exteroceptive signaling and hyperawareness of interoceptive signaling in depression.

2.4.7. Soft touch

Soft touch is attended by a pleasantness sense and refers to slow and unmyelinated C Tactile afferent stimulation. It is shown like other interoceptive modalities like nociception and thermoregulation due to the same features in anatomical task (154). Soft touch rather than somatosensory cortex stimulates Insula. Furthermore, it is shown that it has a practical significance absent in A fibers. When soft touch uses a different pathway, it may have social relevancy, that allows the body to discrete the "sound" of external stimulus from stimuli which arouses an affective feeling (154).

2.5. Neuroanatomical Pathways of Interoception

Several neural pathways send knowledge primary to interoceptive processing to the brain from the body. These involve the LISP, the visceroreceptive pathway, and the somatosensory pathway.

2.5.1. Lamina I spinothalamic pathway

It is usually known that the knowledge about pain and temperature are transported to the brain by the LISP. However, now it is known that it brings knowledge of the body's homeostatic condition (152).

- "Afferent signals enter the spinal cord at the superficial layer of the dorsal horn"
- "Second-order neurons cross the midline of the spinal cord and project up the opposite side, synapsing on the nucleus of the solitary tract, parabrachial nucleus, and periaqueductal gray in the brainstem"
- "Third-order neurons in the ventromedial posterior nucleus (VMpo) in the thalamus relay the signal to the dorsal posterior insula"
- "The signal is re-represented on either the right or left side"

2.5.2. Visceroceptive pathway

The visceroreceptive pathway sends knowledge to the brain about visceral organs.

- Afferent signals from the vagus nerve enter the brainstem making synaptic connections with the nucleus of the solitary tract and parabrachial nucleus
- The signal is relayed to the ventromedial basal nucleus (VMb) of the thalamus
- Third-order neurons send the signal to the posterior insula

2.5.3. Somatosensory pathway

The somatosensory pathway sends knowledge about discriminative touch and proprioception to the brain within different receptors in the skin.

- Afferent signals from the mechanoreceptors or proprioceptors enter the spinal cord at the dorsal root ganglia
- Second-order neurons cross the midline in the medulla, projecting up the opposite side and synapse on third-order neurons in the ventral posterior lateral nucleus or ventromedial posterior nucleus (VMpo) of the thalamus
- Third-order neurons in the thalamus relay the signal to the primary somatosensory cortex in the brain

2.6. Cortical Processing of Interoception

2.6.1. Thalamus

During interoceptive processing, thalamus takes signals from parasympathetic and sympathetic afferents. The VMpo is a subregion of the thalamus that receives sympathetic knowledge from LISP. The human VMpo is much larger than that of primates and sub-primates (155) and is significant for processing of visceral, thermoregulatory, and nociceptive sensations. The VMb takes parasympathetic knowledge from visceral and gustatory systems (156).

2.6.2. Insular cortex

The insula is critically involved in the integration, cortical representation, and processing of interoceptive and visceral knowledge. Vagal and lamina I spinothalamic afferents project via the thalamus and brainstem to the mid-dorsal and posterior insula,

respectively (Figure 5). From there, knowledge travels to the mid-dorsal and posterior, which combines somatosensory and visceral knowledge. The insula is also stimulated through a variety of practical and exteroceptive tasks. The insula is known as a "hub" region (Figure 6). Because it has an extraordinary amount of networks with other brain areas and also recommended, it may be significant for the integration of lower-level physiological salience and information (157).

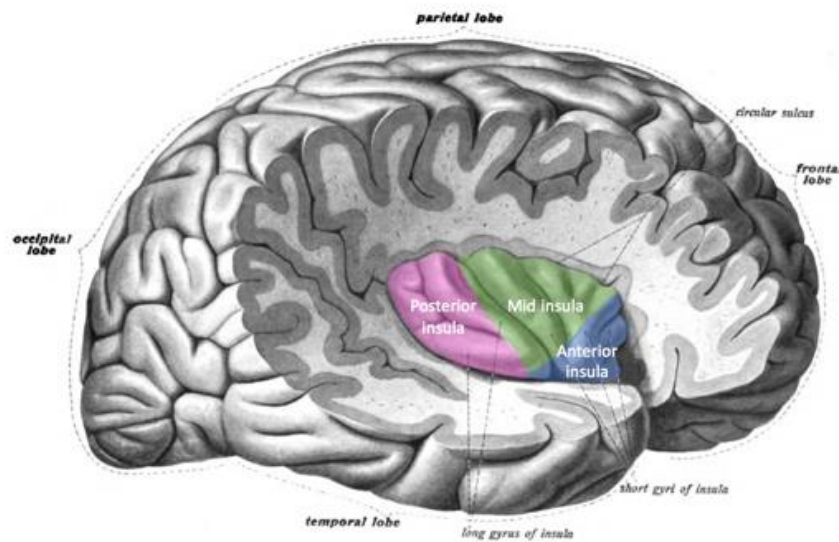


Figure 2.5. The image divides the insula into its anterior, mid, and posterior regions, with each being denoted by different colors.

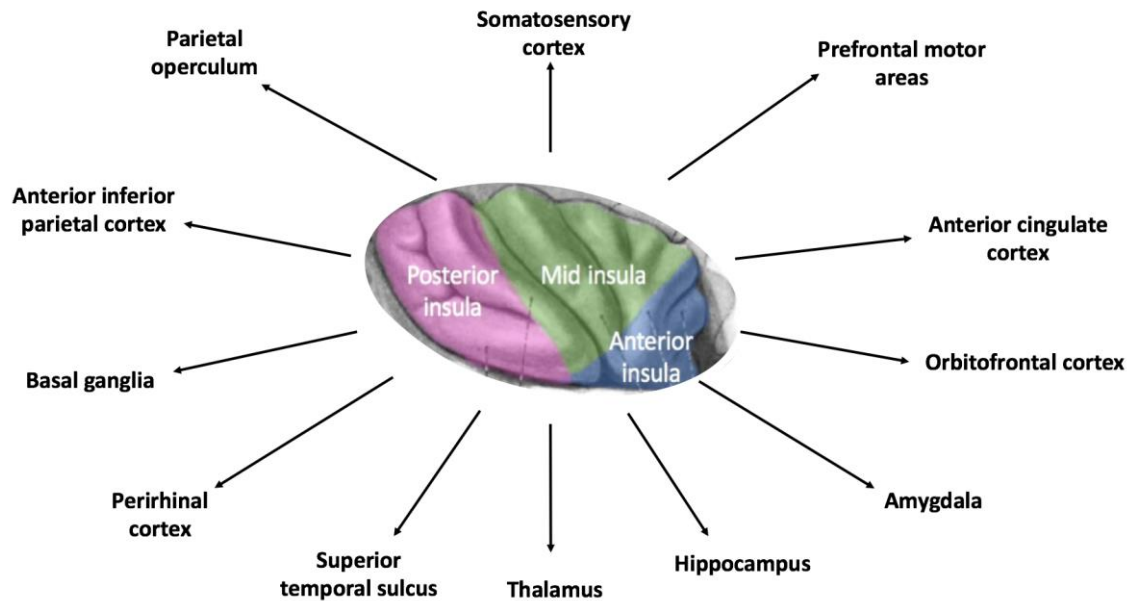


Figure 2.6. The insula connects to many regions in the brain and is highly involved in many homeostatic functions.

2.6.3. Anterior insular cortex

The anterior insular cortex (AIC) plays a role in the representation of "cognitive feelings." Cognitive feelings arise from the moment-to-moment integration of homeostatic knowledge from the body. These feelings produce self-awareness by creating an emotional being (someone able to feel and perceive) conscious of cognitive and bodily processing (152).

2.6.4. Cytoarchitecture and granulation

The insula includes three main subregions described by the absence or presence of a granule cell layer: granular, agranular, and dysgranular (slightly granulated). Each of these portions of the IC is significant for different levels of functional connectivity. Information from the thalamus is projected to all three regions. Those with enlarged granulation are considered to be talented in taking sensory input (111).

2.6.5. Anterior cingulate cortex

ACC is involved in the creation of emotion and motivation. An emotion can be understood as including both a motivation and a feeling based on that feeling. According to research, the "motivation" is characterized in the ACC, while the "feeling" is characterized in the insula (125). Many interoceptive tasks stimulate the ACC and insula together, especially tasks that elicit strong aversive feeling situations like pain (158).

2.6.6. Somatosensory cortex

The sensory-motor cortex alternates a different pathway for sensing interoceptive stimuli. Skin afferents which project to the primary and secondary somatosensory cortices provide the brain with knowledge regarding bodily knowledge, although not following the conventional pathway for interoceptive awareness. This area of the brain is generally engaged by nociceptive stimulation and gastrointestinal distension, but it likely involved in representing other interoceptive senses as well.

In one study, a patient with ACC and bilateral insula damage were given isoproterenol as a method of stimulating the cardiovascular system. Despite damage to supposed interoceptive areas of the brain, the patient was able to observe his pulse with similar precision compared to healthy people. Though once lidocaine was applied to the patient's chest over the maximum cardiac sensation region and the test was applied again, any change did not see in the pulse for the patient (159). This recommended that somatosensory knowledge from afferents innervating the skin outside of the heart might provide knowledge to the brain about the heart's pounding over the somatosensory cortex (159).

2.7. Interoception and Emotion

The relationship between emotional experience and interoception is close to each other. In the late 19th century, Charles Darwin discussed and noted the interest of feelings from the viscera by defining similarities between animals and humans' reactions to frighten in his book, "The Expression of Emotion in Man and Animals" (118). Then, Carl Lange and William James developed the James-Lange theory of emotion, which states that bodily sensations provide the critical basis for emotional experience (160). The

somatic marker hypothesis, proposed by Antonio Damasio, develops the James-Lange theory and posits that choices and the resultant behaviors are optimally guided by physiological patterns of emotional information and interoceptive (160). Ensuing models focusing on the neurobiology of feelings conditions emphasized that the mapping of the brain of different physiological body states are the critical ingredients for consciousness and emotional experience (161–163). In another model, Bud Craig claims that the intertwining of homeostatic interoceptive and processes is responsible for initiating and continuing motivational states and creating human self-awareness (112).

2.8. Interoception and Mental Health

Disruptions of interoception arise obviously and commonly in psychiatric disorders. These symptom variations are frequently seen during the most severe expression of dysfunction, and they figure conspicuously in the diagnostic classification of numerous psychiatric disorders.

2.8.1. Panic disorder

Hallmarks of panic attacks are dyspnea and palpitations. Studies have shown that panic disorder patients report an increased involvement of interoceptive sensations, but these studies have unsuccessful in describing whether this is basically due to their systematic bias regarding describing such feelings (67,164,165). However, other studies have indicated that panic disorder patients feel pulse sensations more deeply when pharmacological agents, recommending they exhibit increased sensitivity to experiencing interoceptive sensations, perturb the state of the body (108).

2.8.2. Generalized anxiety disorder

Patients with a generalized anxiety disorder (GAD) commonly report being bothered by interoceptive feelings of pain, fatigue, gastrointestinal complaints, headaches, and muscle tension.

2.8.3. Posttraumatic stress disorder (PTSD)

Functional neuroimaging reports have shown that PTSD patients show reduced activation in the right anterior insula, an area of the brain, which is mostly responsible for

recognizing the mismatch between, interoceptive and cognitive states (166). Added, because PTSD patients have shown reduced activation within many nodes of the lamina I homeostatic pathway - a pathway through that the thalamus sends interoceptive knowledge to the anterior cingulate and anterior insula - it has been recommended that PTSD patients experience decreased interoceptive awareness (166).

2.8.4. Anxiety disorders

The broad agreement of studies investigating the relationship between anxiety disorder and interoceptive awareness is that people with anxiety disorders experience increased awareness of and accuracy in recognizing interoceptive processes. Functional imaging reports provide evidence that individuals with anxiety disorders experience increased interoceptive accuracy, recommended by hyperactivation in the ACC, which is a region of the brain associated with interoception in several different types of anxiety disorders (167). The insula has been recommended to be abnormal in a large-scale study through anxiety disorders overall (168). Other studies have found that interoceptive accuracy is improved in these patients, as showed by their superior ability in pulse detection tasks in contrast to healthy controls (68).

2.8.5. Anorexia nervosa

Anorexia nervosa (AN) has been related with interoceptive disturbances. Patients with AN often develop insensitivity to interoceptive cues of hunger, and yet are extremely anxious and report disturbed interoceptive experiences, both inside and out (108). While AN patients focus on distorted perceptions of their body outside in fright of weight gain, they also report changed physical conditions within their bodies, such as vague feelings of fullness (169), or an inability to differentiate emotional states from bodily sensations in overall (170,171).

2.8.6. Bulimia nervosa

Studies recommend that patients with and developed from bulimia nervosa (BN) show irregular interoceptive sensory processing (172) and decreased interoceptive awareness under resting physiological situations (55). Primarily, patients with BN report decreased sensitivity to many other types of external and internal sensations, exhibiting

improved thresholds to heat pain compared to healthy subjects (173) and an improved gastric capacity (174). Neuroimaging literature recommends a pattern of abnormal interoceptive processing in patients with BN based on improved activity and volume in the ACC and insula that regions related with interoception and taste processing when watching the food (175).

2.8.7. Major depressive disorder

Major depressive disorder (MDD) has been hypothetically related to interoceptive dysfunction. Reports have shown that females with MDD are less precise on pulse counting tasks than are men with MDD (176) and that, overall, patients with MDD are less precise at counting pulse than are patients with anxiety or panic disorders (177). Nevertheless, patients with MDD do not always exhibit decreased cardiac interoceptive precision; depressed patients experiencing high levels of anxiety will genuinely be more precise on pulse detection tasks than depressed patients with lesser levels of anxiety (178).

2.8.8. Somatic symptom disorders

People with somatic symptom disorder (SSD) score lesser on pulse recognition tasks than healthy controls, recommending that interoceptive precision is reduced in psychosomatic syndromes (179). It has also been discovered that people with psychosomatic syndromes who are stressed or anxious report physical symptom distress at lesser heart rates during exercise treadmill tests, implying more reduced interoceptive distress tolerance in SSD with comorbid psychiatric situations (180).

2.8.9. Obsessive-compulsive disorder (OCD)

Consequences from research investigating the relationship between internal body signals and OCD found that people with OCD were more exact on a pulse perception task than healthy people and people with anxiety increased interoceptive awareness (181).

2.8.10. Autism spectrum disorder (ASD)

People with ASD may have lesser interoceptive awareness than the control group. It is imagined that this reduction in interoceptive precision is due to alexithymia, which is often associated with ASD (182). Nevertheless, it has also been discovered that children with ASD mainly show more significant interoceptive sensitivity than control subjects when measured over a long period of (182). Further research into the relationship between ASD and interoception is needed to recognize the interoceptive aspect of the disorder fully.

2.9. Measurement Methods of Interoception

Within the years, researchers have begun to reexamine body esteem (183), detection of bodily responses (184), fitness and conditioning (185), symptom reporting (186), and beliefs about bodily change in emotion (187). All of this research points to the complexity of body-related concepts as components of the self-system. Those days, available measurements of bodily attentiveness processes do not focus on body awareness as a general tendency. Instead, they specifically address physical symptoms characteristics of illness or other somatic complaints or sensitivity to emotion-related bodily responses. Miller, Murphy, and Buss (1981) devised a 5-item scale for assessing the awareness of internal bodily processes called the Private Body Consciousness scale, a subscale of the Body Consciousness Questionnaire (188). Four of the five items, however, pertain to sensations characteristic of emotion (e.g., awareness of heart activity, dry mouth or throat, internal bodily tensions, and change in body temperature). Although useful for describing the relation between body consciousness and self-consciousness, the scale's focus on emotion-related symptoms limits its use as an index of attentiveness to normal bodily processes in other research settings.

A much-needed research tool in this area is a means of quantitatively expressing individuals' attentiveness to normal bodily processes. An understanding of the structure and functioning of body-related concepts in personality requires investigation of the extent to which bodily responses and routinely monitored as well as their salience in self-judgment. The aim of the validation of the Body Awareness Questionnaire (BAQ) was to develop a self-report scale for measuring beliefs about one's sensitivity to normal, nonemotive body processes (26).

Then, the Body Perception Questionnaire (BPQ) developed by Dr. Stephen Porges has 122-item in the original version. It was aimed to develop a new questionnaire to assess body awareness stress response, ANS reactivity, stress style, and health history (189). Items were chosen based on their relationship with the ANS.

There are many questionnaires, tests, and some scales to measure body perception, body awareness, interoception like The Interoception Sensory Questionnaire (ISQ) (22), Big Five Inventory (BFI) (190), Multidimensional Assessment of Interoceptive Awareness (MAIA) (24), Fremantle Back Awareness Questionnaire (FreBAQ) (191). One of the questionnaires that measure body awareness and reactivity is Body Perception Questionnaire (BPQ).

2.9.1. The Interoception Sensory Questionnaire (ISQ)

The initial scheme for item progress of the ISQ was to base the items on the standard and dominant signs of reduced interoception in adults with autism, based on the saliency model and the findings from qualitative analyses of online vlogs and semi-structured interviews with adults on the ASD (192). These common and dominant signs involved: (a) difficulty identifying and describing interoceptive bodily signals unless extreme, (b) hypo-reactive and hyper-reactive perception, (c) effective touch allodynia, (d) external cue reliance, (e) reduced affective/motivational components to act upon bodily states. As adults with autism manage to use more literal rather than symbolic language (193), the purpose was for the phrasing of the items to be as exact as possible to aid lucidity, and to also produce many items to recognize a extensive variety of ways that reduced adults on the spectrum can state interoception. As such, the 60-item pool included these five signs of reduced interoception. Participants responded to ISQ items on a seven-point numerical response scale ranging from 1 (“not at all true of me”) through to 7 (“very true of me”). Three items were reverse-scored (e.g., “I am aware of my body and the sensations that I feel such as thirst, hunger, and pulse”). Items were recorded such that greater scores represented improved interoceptive challenges. As this is a new scale being developed and introduced in this paper, details surrounding scale convergent, refinement, reliability, and divergent validity analyses will be outlined and discussed at length in later sections (194).

2.9.2. Big Five Inventory (BFI)

The BFI is a 44-item inventory that measures an individual on the Big Five Factors (dimensions) of personality: extraversion vs. introversion, agreeableness vs. antagonism; conscientiousness vs. lack of direction; neuroticism vs. emotional stability; openness vs. closeness to experience. The reliability and validity of the BFI have been examined across age, gender, and cultures, with internal reliability ranging from 0.78 to 0.87, showing that the BFI is a reliable scale. Participants are asked to self-report how they see themselves on items such as “is talkative” and “can be moody” on a five-point Likert scale, from one (disagree strongly) to five (agree strongly). Items for each subscale are summed to produce five overall factor scores, with higher scores on each representing a tendency to be more extraverted, agreeable, conscientious, neurotic, or open to new experiences (23).

2.9.3. Multidimensional Assessment of Interoceptive Awareness (MAIA)

For the current study, four of the eight sub-scales of the MAIA were used: attention regulation, emotional awareness, self-regulation, and body listening, consisting of 19 items in total. Items such as “I listen to my body to inform me about what to do” and “I am able to focus on my body as a whole” consciously were asked on a six-point numerical response scale, ranging from 0 (*never*) to 5 (*always*). Items for each subscale are summed to produce four overall scores, with higher scores representing increased interoceptive awareness. Reliability analyses of the four sub-scales used in this study showed right internal consistency: attention regulation: $\alpha = 0.87$; emotional awareness: $\alpha = 0.82$; self-regulation: $\alpha = 0.83$; body listening: $\alpha = 0.82$. Construct validity showed that the MAIA is able to maximally distinguish between experienced teachers of mindfulness-based integration training programs and students of such programs (24).

2.9.4. Fremantle Back Awareness Questionnaire (FreBAQ)

The Fremantle Back Awareness Questionnaire (FreBAQ) is a simple tool that claims to assess back-specific altered body perception. It comprises nine items with a five-point Likert scale attempting to investigate neglect-associated features, proprioceptive acuity, and a person's perceived body image (25).

2.9.5. The Body Perception Questionnaire (BPQ)

The Body Perception Questionnaire (195) was developed to assess the subjective experiences of the function and reactivity of target organs and structures that are innervated by the ANS. The original BPQ, totaling 122 items, assessed body awareness, ANS reactivity, cognitive-emotional-somatic stress response, body and cognitive stress response styles, and health history. Since its introduction, the BPQ has been used in more than 25 peer-reviewed publications and has been translated into several languages. The BPQ aspects that have been of the highest research interest are body awareness and autonomic reactivity subscales, with studies often using only these subscales (27,28). In addition, the BPQ, which has its own website and translated to several languages, is the only self-questionnaire that gives information about body perception.

2.10. The Body Perception Questionnaire

2.10.1. Questionnaire Development

Dr. Stephen Porges at the University of Maryland developed the original 122-item measure. Its goals were to assess body awareness, stress response, ANS reactivity, stress style, and health history. Items were chosen based on their relationship with the ANS. As research using the BPQ proliferated, the questionnaire was applied to a range of international neural, behavioral, and clinical studies and translated into several languages (195).

After two decades of use, our research team set out to improve the BPQ's usability. The first step of the revision was length reduction. This was accomplished first by reducing the number of domains to those with the highest popularity – body awareness and ANS reactivity. We further reduced the item pool by selecting body awareness items, which had precision in capturing aspects of direct functional control of autonomic pathways. Items that were related to autonomic circuits but were “noisy” due to their incorporation of extra-autonomic systems were removed (e.g., the item “clumsiness of bumping into people” also includes proprioception). Importantly, all changes to the revision were reductions. No new items were added, nor was item wording altered in any way. Thus, items from the original BPQ form are compatible with the new (short form)

version. All new subscales may be scored with data collected from the original BPQ document (195).

2.10.2. Subscale Descriptions

Table 2.1. Subscale Descriptions of Body Perception Questionnaire

Domain	Subscale	Form	Description	Item Count
Body Awareness	Body Awareness	BPQ; BPQ-SF	A measure of sensitivity for internal bodily functions. Values at the high end of the scale reflect hypersensitivity, and values at a low scale reflect hyposensitivity.	26
	Body Awareness	BPQ-VSF	A shorter version of the body awareness subscale composed of selected items from full 26-form above; available for contexts in which questionnaire brevity is a priority	12
Autonomic Reactivity	Supra diaphragmatic Reactivity	BPQ; BPQ-SF	A measure of the responses of autonomically-innervated organs above the diaphragm. These are likely to reflect the withdrawal of neural circuits promoting social engagement and calm resting state as well as activation of sympathetic “fight or flight” responses	15
	Sub diaphragmatic Reactivity	BPQ; BPQ-SF	A measure of the responses of autonomically-innervated gastrointestinal organs below the diaphragm. These likely reflect reactivity of the unmyelinated vagus nerve, the sympathetic nervous system, and the enteric nervous system	6

3. MATERIALS AND METHODS

The present study is performed with examining for the validity and reliability of the Turkish translation of the Body Perception Questionnaire. The BPQ is a self-report measure of body awareness and autonomic reactivity developed by Dr. Porges and colleagues. BPQ, which includes 46 items responses from 5 (always) to 1 (never). "Body Awareness" subscale has 26 items and maximum score of this subscale is 130. "Supradiaphragmatic Reactivity" subscale has 15 items and maximum score of this subscale is 75. "Subdiaphragmatic Reactivity" subscale has 6 items and maximum score of this subscale is 30. Its items are based on the organization of the ANS, a set of neural pathways connecting the brain and body. These pathways send information from the body about the status of organs and tissues (i.e., afferent projections). Some of these incoming signals form a basis for the subjective awareness of the body. The ANS also carries signals that control the functions of these organs and tissues (i.e., efferent projections). These signals can alter the functions of the body, depending on internal and external needs (196).

3.1. Ethical Aspects of the Study

Written permission has taken from Dr. Jacek Kolacz who works with Dr. Stephen Porges in Institute Traumatic Stress Research Consortium via e-mail to study on the validity and reliability for BPQ (Appendix 1). Ethical approval was taken from the Clinical Research Ethics Committee of Yeditepe University for this study (20.11.2019-1118) (Appendix 2).

3.2. Subjects

The study included 340 volunteers over the age of 18. Participants involved in the study on a voluntary basis. 45 volunteers were excluded due to several reasons (Figure 7) then, in total 180 female volunteers and 115 male volunteers included in this present study. The aim and plan of the current study were explained and informed written consent was obtained from each participant (Appendix 3). Inclusion and exclusion criteria were determined as follows;

Inclusion criterias

- Being a volunteer to participate in the study
- Being between the age of 18 - 77
- Understand and follow commands
- Not diagnosed a psychiatric disorder

Exclusion criterias

- Younger than the age of 18
- Reported taking psychotropic drugs and/or beta-blockers
- Did not complete the questions
- Having any surgical operation in the last six months
- Diagnosed chronic cardiovascular, pulmonary or neuromuscular systemic disorder

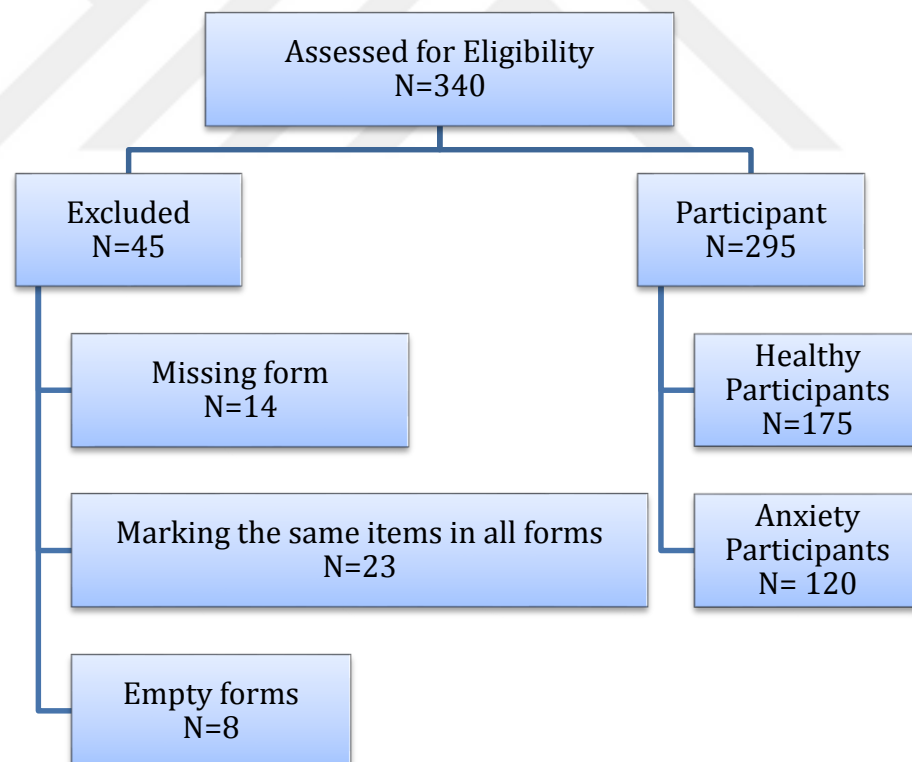


Figure 3.1. Diagram showing the inclusions of the participants

3.3. Determination of the Sample Size

We computed the sample size of the study to be 295. The literatures said that, the sample size should be at least five times or even ten times of the number of the items (197), or the sample size should be as 100 poor, 200 medium, 300 good, 500 perfect, and 1000 excellent (198), the sample size was recommended at least 200 (199).

3.4. Methods

3.4.1. General Framework of the Study

In our study, Body Perception Questionnaire was first translated into Turkish, then intercultural adaptation was performed, and the validity and reliability of the Turkish scale were tested. Turkish translation and intercultural adaptation were conducted in according to the design "Guidelines for the Process of Cross-Cultural Adaptation of Self-Report Measures" published by Beaton et al. (Figure 3.2) (200).

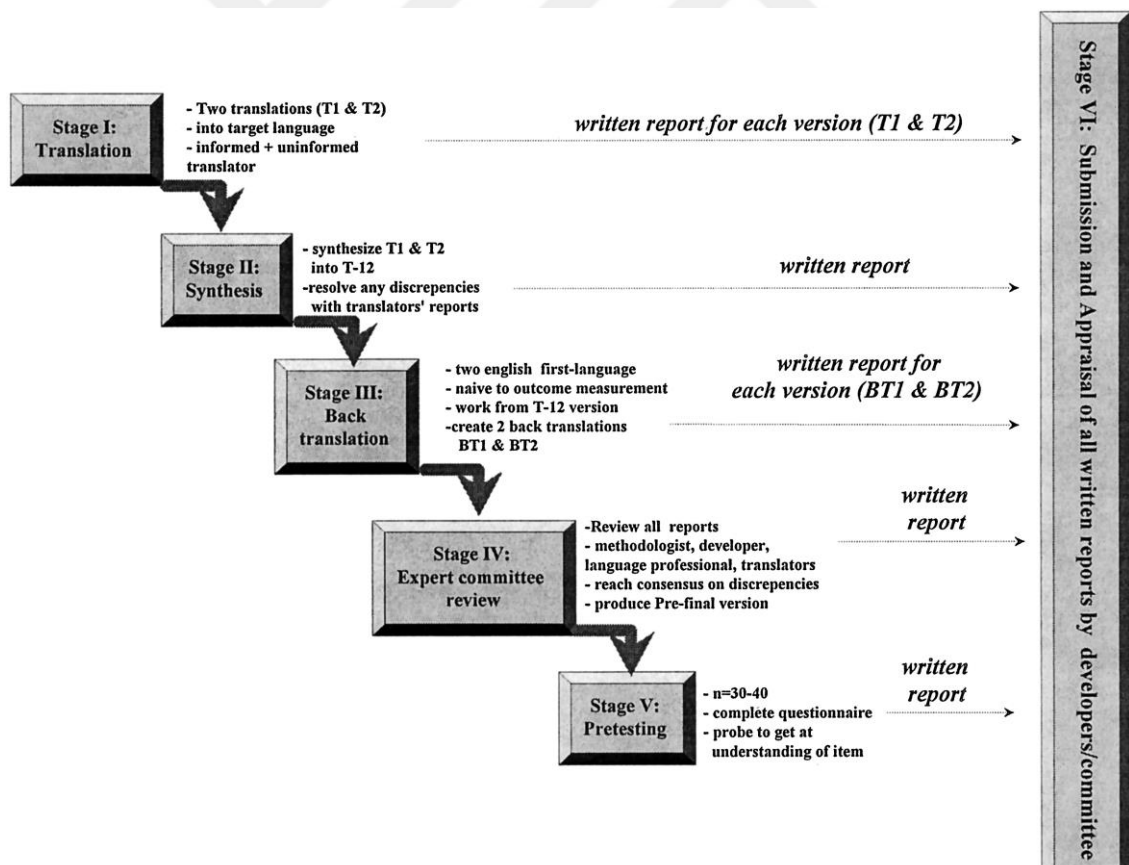


Figure 3.2. Graphic representation of the stages of cross-cultural adaptation recommended

3.4.2. Translation and Intercultural Adaptation Process

BPQ was translated into Turkish by a native English speaker and wrote her opinions on substances, content, and applicability. At the same time, a native English speaker translated BPQ into Turkish and indicated his opinions about BPQ. These two translations were combined into a single translation of BPQ. BPQ, which was translated into Turkish, was re-translated into English by a native English speaker and a physiotherapist who was fluent in English. Two retrieved English translations and one Turkish questionnaire were examined at the committee meeting in the form of conference interviews on the Internet. All the translators attended the committee meeting, and the Turkish version was revised.

3.5. Evaluation of Participants

3.5.1. Structured Questionnaire

Socio-demographic characteristics ascertained include age, gender, education level, smoking and alcohol habits, exercise behaviors, self back pain report, use of psychotropic drugs and/or beta-blockers of subjects. Data were collected by asking fill in the forms, and filled out by themselves (Appendix 4).

3.5.2. Tampa Scale for Kinesiophobia

The Tampa Scale was used in this current study to understand the kinesiophobia level of the participants. The Tampa Scale of Kinesiophobia (TSK) that was developed in 1990 is a 17 item scale initially developed to measure the fear of movement related to chronic lower back pain (Appendix 5) (201,202).

3.5.3. Oswestry Low Back Disability Questionnaire

The Oswestry Disability Index was used in this current study to examine the relationship between low back pain and body perception in future studies. The Oswestry Disability Index (also known as the Oswestry Low Back Pain Disability Questionnaire) is a vital tool that researchers and disability evaluators use to measure a patient's permanent functional disability. The test is considered the 'gold standard' of low back functional outcome tools (Appendix 6) (203,204).

3.5.4. Rolland Morris Disability Questionnaire

The Roland-Morris Questionnaire (RMQ) was used in this present study to examine the relationship between disability and body perception in future studies. The RMQ is a self-administered disability measure in which higher numbers reflect greater levels of disability on a 24-point scale. The RMQ has been shown to yield reliable measurements, which are valid for inferring the level of disability, and to be sensitive to change over time for groups of patients with low back pain (Appendix 7) (205,206).

3.5.5. Hospital Anxiety and Depression Scale (HADS)

The HADS was used in this current study to understand who has anxiety problem by giving self-report information. The HADS has been accepted as an effective screening instrument for anxiety and depression and has been extensively used in clinical settings and psycho-oncology research. The HADS is composed of two seven-item subscales, one explicitly targeting anxiety. The items excluded somatic symptoms and therefore avoided symptom overlap between somatic illnesses and mood disorders. Since both the HADS total scale (HADS-T) and the HADS depression subscale (HADS-D) can be used to detect depression, the validity of the HADS-T and HADS-D was analyzed separately (Appendix 8) (207).(208).

3.5.6. Body Perception Questionnaire

The Body Perception Questionnaire (BPQ) is a self-report measure of body awareness and autonomic reactivity developed by Dr. Porges and colleagues. BPQ, which includes 46 items responses on a 5 point ordinal scale spanning; never (1) to always (5) (Appendix 9) (209).

3.5.6.1. Calculating Raw Scores

Once the item responses have been formatted, use the following table to calculate raw scores (Table 3.1) (210).

Table 3.1. Calculating Raw Scores of Body Perception Questionnaire

Subscale	Items for Scoring		
	BPQ (122 items)	BPQ Short Form (46 items)	BPQ Body Awareness Very Short Form (12 items)
Body Awareness	1, 3, 5, 6, 7, 9, 12, 15, 16, 17, 18, 19, 22, 24, 25, 26, 28, 29, 31, 32, 33, 40, 42, 43, 44, 45	1 – 26	All items (1 – 12)
Supradiaphragmatic Reactivity	57, 59, 60, 61, 63, 64, 65, 66, 67, 69, 72, 73, 74, 79, 80	27 - 41	
Subdiaphragmatic Reactivity*	62, 63, 75, 76, 77, 78	41 - 46	

*one item (#63 in full BPQ, #41 in BPQ short form) is included in both Supra- and Sub-diaphragmatic Reactivity subscales

3.6. Statistical Analysis

In this research, the “Statistical Package for Social Sciences” (SPSS) Version 22.0 program was used.

The Mann Whitney U test was used for comparison of quantitative data that did not show normal distribution, as well as descriptive statistical methods (mean, standard deviation, median, frequency, ratio, minimum, maximum). Spearman's Correlation Analysis was used to evaluate the relationships between variables. Intraclass Correlation Coefficient (ICC) was used for test-retest evaluations. The level of significance were accepted as $p < 0.05$.

4. RESULTS

4.1. Descriptive Information

The study was performed in Yeditepe University, Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation between February 2019 and January 2020. The validity and reliability of the Turkish version of the Body Perception Questionnaire were applied for 295 healthy volunteers. %61 of the volunteers were female, %39 were male (F/M = 180/115). The distribution of the physical characteristics of the subjects (Table 4.1) and socio-demographic status and health behavior of the subjects (Table 4.2) are shown in below.

The age average of the participant was 32,15 in this current study and Body Mass Index (BMI) average was normal (23,18) according to BMI classification (Table 4.1). Education level was high (%84,9 of the participants was graduated from the university). Non-smokers are higher than smokers and, more people do not have exercise habits. Having back pain by self-report was lower (Table 4.2).

Table 4.1. Physical characteristics of the subjects

	Mean $\pm$ SD	Min-Max (Median)
Age (year)	32,15 $\pm$ 14,11	18-77 (26)
Weight (kg)	68,18 $\pm$ 14,51	40-130 (65)
Height (m)	1.71 $\pm$ 0.09	1,53-1,98 (1,70)
BMI (kg/m²)	23,18 $\pm$ 3,55	16,14-35,84 (23)

Table 4.2. Sociodemographic status and Health Behavior of the subjects

		n	%
Education Level	University	251	84,9
	Primary and High School	44	14,1
Smoking Habits	No	180	61
	Yes	115	39
Using Alcohol	No	96	32,5
	Yes	199	67,5
Exercise Habits	Yes	98	33,2
	No	197	66,8
Self-Report Back Pain	No	189	64,1
	Yes	106	35,9

According to the gender differences, there are statistically significant differences on weight and height, though BMI ($p < 0,05$; Table 4.3). Comparison of health behaviors according to the gender differences; male participants were statistically significantly higher smokers than females, and male participants have statistically more exercise habits than females. And also, education levels are statistically higher in females than male participants ($p < 0,05$; Table 4.4). When we compared the anxiety and depression levels by HADS according to the gender differences; while depression levels were statistically higher in males, anxiety level were statistically higher in females ($p < 0,05$; Table 4.5).

Table 4.3. Comparison of physical characteristics according to gender differences.

	Gender Mean± SD		U	P
	Female	Male		
Age (year)	31,52±14,17	33,44±14,19	9459,000	0,088
Weight (kg)	60,51±9,00	80,09±13,13	2065,000	0,000
Height (m)	1.65±0.06	1.79±0.07	1300,000	0,000
BMI (kg/m ²)	22,15±3,29	24,94±3,40	5364,500	0,000

*U= Mann-Whitney U test statistics; p=statistical significance at alpha= .05

Table 4.4. Comparison of health behaviors and sociodemographic status according to gender.

Health Behaviour		Gender %(n)		x² (df)	P
		Female	Male		
Smoking Habits	No	70 (126)	47 (54)	14,944 (1)	0,000
	Yes	30 (54)	53 (61)		
	Total	100 (180)	100 (115)		
Using Alcohol	No	33,9 (61)	30,4 (35)	0,164 (1)	0,686
	Yes	66,1 (119)	69,6 (80)		
	Total	100 (180)	100 (115)		
Education Level	University	88,3 (159)	80 (92)	4,557 (1)	0,033
	Pri-High School	11,7 (21)	20 (23)		
	Total	100 (180)	100 (115)		
Exercise Habits	Yes	27,8 (50)	41,7 (48)	5,569 (1)	0,018
	No	72,2 (130)	58,3 (67)		
	Total	100 (180)	100 (115)		

* x²= Chi Square test statistics; p= statistical significance at alpha= .05.

Table 4.5. Comparison of Rolland-Morris, Anxiety-Depression, Oswestry, and Tampa according to gender.

	Gender Mean±SD		U	P
	Female	Male		
Rolland Morris	1,69±3,10	1,93±3,69	10167,000	0,677
Anxiety	7,55±3,63	6,13±3,18	8035,500	0,000
Depression	4,52±3,04	5,68±3,38	8539,000	0,005
Oswestry	7,76±8,89	6,97±8,97	10016,500	0,500
Tampa	35,77±7,19	35,78±7,73	10267,000	0,810

*U= Mann-Whitney U test statistics; p=statistical significance at alpha= .05.

Older participants have statistically significantly more back pain problem than the younger participants in present study ($p<0,05$; Table 4.6). The participants who are smokers have more back pain problem (Table 4.7). The scores of the Rolland Morris, anxiety, the Oswestry and Tampa scales were statistically significantly higher in participants having back pain problems ($p<0,05$; Table 4.8).

Table 4.6. Comparison of having back pain problem according to physical characteristics

	Back Pain Mean±SD		U	P
	No	Yes		
Age (year)	30,91±13,56	34,71±15,01	8576,500	0, 015
Weight (kg)	68,28±14,25	68,26±14,86	9942,500	0,916
Height (m)	1.71±0.09	1.70±0.09	9350,500	0,343
BMI (kg/m²)	23,17±3,50	23,40±3,78	9739,500	0,693

* U= Mann-Whitney U test statistics; p=statistical significance at alpha = .05.

Table 4.7. Comparison of having back pain problem according to the healthy behaviors.

Health Behaviour		Back Pain %(n)		x² (df)	P
		No	Yes		
Smoking Habits	No	65,1 (123)	53,8 (57)	3,800 (1)	0,063
	Yes	34,9 (66)	46,2 (49)		
	Total	100 (189)	100 (106)		
Using Alcohol	No	31,7 (60)	34 (36)	0,187 (1)	0,665
	Yes	68,3 (129)	66 (70)		
	Total	100 (189)	100 (106)		
Education Level	University	86,2 (163)	83 (89)	0,511 (1)	0,497
	Pri-High School	13,8 (26)	17 (18)		
	Total	100 (189)	100 (106)		
Exercise Habits	Yes	34,9 (66)	30,2 (32)	0,717 (1)	0,243
	No	65,1 (123)	69,2 (74)		
	Total	100 (189)	100 (106)		

* x²= Chi Square test statistics; p= statistical significance at alpha= .05

Table 4.8. Prevalence of back pain, according to Rolland Morris, Anxiety-Depression, Oswestry, and Tampa.

	Back Pain		<i>U</i>	P
	Mean±SD			
	No	Yes		
Rolland Morris	0,62±1,63	3,83±4,44	4140,500	0,001**
Anxiety	6,70±3,49	7,54±3,54	8771,000	0,048
Depression	4,72±3,12	5,42±3,36	9002,000	0,097
Oswestry	4,44±5,75	12,80±10,86	4198,000	0,001**
Tampa	34,62±7,44	37,85±6,86	7088,000	0,001**

*U= Mann-Whitney U test statistics; p=statistical significance at alpha = .05.

4.2. The Mean Value of the Responded Items From BPQ in the Study Group

The distribution of the responses of the volunteers is Table 4.9.

Table 4.9. Distribution of responses of BPQ

Questions	Mean±SD	Min-Max	Percentile (%)
Body Awareness			
1. Swallowing frequently	3,19±1,57	1-5	5

2. An urge to cough to clear my throat	3,02±1,28	1-5	5
3. My mouth being dry	2,93±1,28	1-5	5
4. How fast I am breathing	3,18±1,58	1-5	5
5. Watering or tearing of my eyes	3,09±1,37	1-5	5
6. Noises associated with my digestion	3,22±1,61	1-5	5
7. A swelling of my body or parts of my body	3,22±1,41	1-5	5
8. An urge to defecate	4,31±1,07	1-5	5
9. Muscle tension in my arms and legs	3,20±1,58	1-5	5
10. A bloated feeling because of water retention	3,18±1,64	1-5	5
11. Muscle tension in my face	3,18±1,63	1-5	5
12. Goose bumps	3,27±1,65	1-5	5
13. Stomach and gut pains	3,24±1,58	1-5	5
14. Stomach distension or bloatedness	3,21±1,62	1-5	5
15. Palms sweating	3,19±1,60	1-5	5
16. Sweat on my forehead	3,23±1,59	1-5	5
17. Tremor in my lips	3,20±1,61	1-5	5

18. Sweat in my armpits	3,18±1,62	1-5	5
19. The temperature of my face (especially my ears)	3,20±1,63	1-5	5
20. Grinding my teeth	3,14±1,58	1-5	5
21. General jitteriness	3,19±1,59	1-5	5
22. The hair on the back of my neck "standing up"	3,14±1,59	1-5	5
23. Difficulty in focusing	3,27±1,63	1-5	5
24. An urge to swallow	3,22±1,34	1-5	5
25. How hard my heart is beating	3,18±1,61	1-5	5
26. Feeling constipated	3,23±1,60	1-5	5
Autonomic Nervous System Reactivity			
27. I have difficulty coordination breathing and eating.	1,62±0,91	1-5	5
28. When I am eating, I have difficulty talking.	1,83±1,03	1-5	5
29. My heart often beats irregularly.	1,86±0,91	1-5	5
30. When I eat, food feels dry and sticks to my mouth and throat.	1,81±0,96	1-5	5
31. I feel shortness of breath.	2,04±1,05	1-5	5
32. I have difficulty coordinating breathing with talking.	1,72±0,94	1-5	5

33. When I eat, I have difficulty coordinating swallowing, chewing, and/or sucking with breathing.	1,52±0,80	1-5	5
34. I have a persistent cough that interferes with my talking and eating.	1,26±0,65	1-5	5
35. I gag from the saliva in my mouth.	1,29±0,64	1-5	5
36. I have chest pains.	1,64±0,84	1-5	5
37. I gag when I eat.	1,22±0,59	1-5	5
38. When I talk, I often feel I should cough or swallow the saliva in my mouth.	1,77±1,02	1-5	5
39. When I breathe, I feel like I cannot get enough oxygen.	1,90±0,99	1-5	5
40. I have difficulty controlling my eyes.	1,42±0,78	1-5	5
41. I feel like vomiting.	1,55±0,87	1-5	5
42. I have 'sour' stomach.	2,03±0,96	1-5	5
43. I am constipated.	1,87±1,02	1-5	5
44. I have indigestion.	1,99±0,96	1-5	5
45. After eating I have digestive problems.	2,06±0,98	1-5	5
46. I have diarrhea.	1,63±0,72	1-5	5

4.3. Factor Analyses of Body Perception Questionnaire

Body Perception Questionnaire is a Five- Point- Likert-Type scale and consists of 46 questions.

Always	5
Usually	4
Sometimes	3
Occasionally	2
Never	1

Exploratory Factor Analysis (EFA) was used for the interpretation of the relationships between the selectivity and items of the BPQ.

Prior to Exploratory Factor Analysis, Kaiser-Meyer-Olkin (KMO) test adequacy measurement and Barlett's Sphericity test were used to test whether our data were suitable for analysis. KMO sample adequacy measurement value was found 0,966 to be a good value for KMO (Table 4.10).

The Bartlett Sphericity Test was used to test the hypothesis that the correlation matrix is a similar matrix. This hypothesis was rejected at $p < 0,001$. This showed the presence of correlation between the items and showed the suitability of the data for factor analysis (Table 4.10).

Table 4.10. Results of Kaiser-Meyer-Olkin and Bartlett's Test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.966
Bartlett's Test of Sphericity	Approx. Chi-Square	17,250.576
	df	1,035
	p value	0,001

After the data was decided to be suitable for factor analysis, the first analysis was the items showing three sub-scales according to factor loads (Table 4.11) and the factor weights of the items related to factor analysis (Table 4.12).

Table 4.11. Factor Analysis Results According to Sub-scales

Factors	Sub-scales	Items of
Factor 1	Body Awareness	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26
Factor 2	Supradiaphragmatic Reactivity	27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41
Factor 3	Subdiaphragmatic Reactivity	41, 42, 43, 44, 45, 46

Table 4.12. Factor Analyses of Items

	Component					
	1	2	3	4	5	6
Q1	.941	.134	.089	.028	.057	.013
Q2	.080	.414	-.641	-.053	.187	-.157
Q3	.082	.403	-.685	.014	.185	.004
Q4	.945	.133	.092	.032	.034	-.019
Q5	.111	.368	-.692	-.045	-.110	-.054
Q6	.951	.121	.060	.002	.004	.012
Q7	.111	.414	-.600	.061	-.106	.086
Q8	.362	.250	-.308	-.053	-.266	-.096
Q9	.952	.156	.041	-.015	.001	.023
Q10	.948	.175	.070	-.008	.007	.021
Q11	.955	.121	.080	-.032	.007	-.008
Q12	.956	.152	.068	-.022	-.028	.018
Q13	.952	.155	.069	.010	.001	.023
Q14	.953	.151	.067	.014	.018	.039
Q15	.950	.156	.064	.028	-.019	-.024
Q16	.959	.134	.038	.013	.003	-.005

Q17	.956	.141	.036	-.030	.008	-.001
Q18	.960	.148	.025	-.007	.012	.013
Q19	.958	.126	.054	-.004	.012	.017
Q20	.953	.139	.047	-.013	.005	-.011
Q21	.955	.122	.054	-.004	-.016	-.031
Q22	.950	.164	.063	.008	.006	-.023
Q23	.951	.132	.084	-.003	.014	-.005
Q24	.100	.408	-.570	-.095	.074	.236
Q25	.957	.136	.031	.014	.015	.033
Q26	.952	.147	.054	.012	.007	.022
Q27	-.202	.511	.116	-.398	-.261	-.234
Q28	-.191	.445	.114	-.475	-.302	-.264
Q29	-.330	.500	.138	-.212	-.118	.363
Q30	-.406	.602	.143	-.169	-.003	.043
Q31	-.301	.524	.070	-.130	-.171	.537
Q32	-.331	.563	.204	-.379	-.174	.013
Q33	-.364	.613	.168	-.349	-.084	-.056
Q34	-.326	.448	.160	-.128	.530	.018
Q35	-.257	.459	.074	-.063	.369	.246
Q36	-.281	.483	.176	.025	.123	.141
Q37	-.242	.532	.128	-.007	.425	-.058
Q38	-.179	.530	-.030	-.089	.104	-.334
Q39	-.389	.517	.107	-.089	-.176	.131
Q40	-.372	.514	.171	-.082	.280	-.302
Q41	-.356	.452	.164	.307	.209	-.091
Q42	-.251	.458	.146	.518	-.049	.079
Q43	-.226	.484	.058	.424	-.285	-.105
Q44	-.302	.572	.063	.559	-.237	-.017
Q45	-.288	.594	.076	.554	-.077	.027
Q46	-.180	.465	.065	.339	-.079	-.235
Extraction Method: Principal Component Analysis.						
a. 6 components extracted.						

4.4. Validity and Reliability Analyses

The alpha coefficient (Cronbach's alpha) was used to test the reliability of the BPQ. Data, which obtained from 175 people were used in the analyses. In addition, the "Alpha if Item Deleted" value was calculated in order to determine effects of the items.

The findings related to the effect of the factors on the reliability level are shown in the Table 4.13. The "Cronbach's Alpha if Item Deleted" values in the table showed that removing any item from the factor would not improve reliability. In this context, the factor structure of 3 items was preserved. The value showed that our scale was highly reliable ($\alpha > 0,8$; Table 4.13).

Table 4.13. Effects of Reliability of Items Factors

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Q1	114.8034	896.329	.854	.937
Q2	114.9322	957.240	.259	.942
Q3	114.9525	957.909	.257	.942
Q4	114.8102	895.352	.857	.937
Q5	114.7966	955.530	.266	.942
Q6	114.7661	893.833	.856	.937
Q7	114.7390	952.513	.287	.942
Q8	113.8441	949.336	.416	.941
Q9	114.7932	893.375	.878	.937
Q10	114.8068	889.966	.884	.937
Q11	114.8102	892.338	.861	.937
Q12	114.7186	889.434	.879	.937
Q13	114.7458	893.428	.877	.937
Q14	114.7831	891.443	.876	.937
Q15	114.8000	892.800	.876	.937
Q16	114.7593	893.503	.871	.937
Q17	114.7864	892.196	.873	.937
Q18	114.8068	891.279	.881	.937
Q19	114.7898	891.969	.866	.937
Q20	114.8508	894.345	.869	.937
Q21	114.8034	894.662	.861	.937
Q22	114.8508	893.080	.879	.937

Q23	114.7220	892.133	.863	.937
Q24	114.7627	954.399	.274	.942
Q25	114.8102	892.685	.871	.937
Q26	114.7593	893.095	.872	.937
Q27	116.3695	974.275	.067	.943
Q28	116.1559	975.200	.041	.943
Q29	116.1288	980.616	-.044	.943
Q30	116.1797	981.576	-.059	.943
Q31	115.9458	978.378	-.008	.943
Q32	116.2678	978.986	-.016	.943
Q33	116.4678	979.073	-.016	.943
Q34	116.7254	981.275	-.068	.943
Q35	116.6949	978.587	-.002	.942
Q36	116.3525	978.903	-.013	.943
Q37	116.7729	976.952	.044	.942
Q38	116.2169	971.817	.095	.943
Q39	116.0881	983.149	-.084	.943
Q40	116.5729	981.878	-.073	.943
Q41	116.4373	983.050	-.089	.943
Q42	115.9593	978.012	.000	.943
Q43	116.1153	975.898	.031	.943
Q44	116.0034	977.112	.015	.943
Q45	115.9288	975.672	.037	.943
Q46	116.3559	975.495	.065	.942

Cronbach's Alpha Internal Consistency values of BPQ were analyzed according to sub-scales (Table 4.14). Cronbach's Alpha Score of Body Perception was 0,980, Cronbach's Alpha scores of supradiaphragmatic reactivity was 0,888, and Cronbach's Alpha scores of subdiaphragmatic reactivity was 0,838. These results showed that the reliability of the BPQ was high ($\alpha > 0,8$).

Table 4.14. Cronbach's Alpha Scores of Sub-scales of BPQ

Subscales	Question Number	Min- Max (Median)	Cronbach's Alpha
Body Awareness	26	86-130 (107)	0,980
Supradiaphragmatic Reactivity	15	15-47 (23)	0,888
Subdiaphragmatic Reactivity	6	6-21 (11)	0,838
TOTAL	46		0,942

Test-retest reliability was assessed using the intra-class correlation coefficient (ICC) in the study. Each subscale demonstrated high test-retest reliability ($ICC > 0,6$; $p < 0,05$; Table 4.15).

Table 4.15. Test-Retest Reliability of Body Perception Questionnaire

	Test (n=41)	Re-Test(n=41)	ICC*	p
	Mean±SD	Mean±SD		
Body Awareness	105,66±7,17	99,85±9,75	0,802	0,001**
Supradiaphragmatic Reactivity	24,37±6,07	26,49±6,65	0,608	0,003**
Subdiaphragmatic Reactivity	11,46±3,96	12,00±4,21	0,717	0,001**

*ICC: Intraclass Correlation Coefficient ** $p < 0,05$

The evaluation was made with the psychiatrist's recommendation. Individuals with anxiety resulting from the HADS scale, which evaluated as self-report, were selected as the study group. The BPQ also applied to individuals with anxiety in order to test the distinctiveness of BPQ scores, because people with anxiety have less body perception than healthy people. And, the results of healthy individuals (n=175) and individuals with anxiety (n=120) were compared according to age, gender, BMI, and education level (Table 4.16).

Table 4.16. Individuals by groups according to age, gender, BMI, and education level.

		Healthy Participants N=175	Participants with Anxiety N=120
Age (year)	Mean ± SD	33,78±14,59	29,78±13,08
	Min- Max(Median)	18-75 (27)	18-75 (22,50)
Gender n (%)	Female	93 (53,1)	87 (72,5)
	Male	82 (46,9)	33 (27,5)
Education	University	35 (20)	9 (7,5)
	Pri-High School	140 (80)	111 (92,5)
BMI (kg/m²)	Mean ± SD	23,55±3,41	22,63±3,70
	Min- Max(Median)	16,33-34,29 (23,43)	16,14-35,84 (22,41)

When the BPQ scores were compared in the study group, it was found that the scores of all sub-scales (Body Awareness, Supradiaphragmatic Reactivity, and Subdiaphragmatic Reactivity) were lower in the study group ($p < 0,05$; Table 4.17).

Table 4.17. Assessment of BPQ sub-scale scores of healthy individuals and people with anxiety

	Healthy Participants N=175	Participants with Anxiety N=120	^ap value
	Mean±SD	Mean±SD	
Body Awareness	109,79±9,47	106,34±8,55	0,001**
Supradiaphragmatic Reactivity	22,39±6,43	27,85±9,45	0,001**
Subdiaphragmatic Reactivity	10,127±3,64	12,40±4,53	0,001**

^aMann Whitney U Test ** $p < 0,05$

The mean score of "Body Awareness" subscales of healthy participants was found statistically higher in female ($p < 0,05$) while the mean score of "Body Awareness" subscales of participants with anxiety was found statistically similar ($p > 0,05$). According to gender comparisons, the mean value of "Supradiaphragmatic Reactivity" in healthy participants was found similar as in participants with anxiety ($p > 0,05$). The mean score of the "Subdiaphragmatic Reactivity" subscale of the female was significantly higher in both healthy individuals and individuals with anxiety than in male ($p < 0,05$; Table 4.18).

Table 4.18. The distribution of the mean scores of healthy individuals and individuals with anxiety according to gender

Sub-scales	Healthy Participants (n=175)		^a p	Participants with Anxiety (n=120)		^a p
	Female	Male		Female	Male	
	(n=93)	(n=82)		(n=87)	(n=33)	
	Mean±SD	Mean±SD		Mean±SD	Mean±SD	
Body Awareness	110,63±9,83	107,37±9	0,021	106,09±8,64	107±8,43	0,706
Supra-diaphragmatic Reactivity	23,18±6,85	21,48±5,83	0,076	27,38±8,47	29,09±11,71	0,619
Sub-diaphragmatic Reactivity	11,25±3,67	9,17±2,88	0,001	12,90±4,18	11,09±5,20	0,004

^aMann Whitney U Test ** $p < 0,05$

5. DISCUSSION AND CONCLUSION

The present study aimed to investigate the validity and reliability for the Turkish version of BPQ. Our results showed that BPQ is a valid and reliable to evaluate the interoceptive senses of adults for Turkish population.

The analysis of internal consistency of sub-scales for BPQ was found highly reliable (Cronbach's Alpha Scores are between 0.8-0.9). Cabrera et al. (2017) in their study about factor structure and psychometric properties of BPQ-SF Cronbach's Alpha Scores were between 0.83-0.99 and the result of their study confirms that BPQ-SF Turkish version is reliable.

The items were distributed to 6 factors in first factor analysis. In the exploratory factor analysis, it was found that the items could be collected under 3 factors and explain 63.56% of the BPQ variance by applying Varimax Rotation. It is suitable to use of 3 factors similarly with Cabrera et al.(2) And also, we suggested that the questions out of the 3 factors can be deleted, because the Cronbach's Alpha value increases even if it is a small amount when the questions are deleted.

Test-retest consistency of the BPQ was evaluated by giving the questionnaire on the same individuals with an interval of 2 weeks. There was Renewability, and time-invariance of BPQ was statistically found excellent (Body Awareness, ICC: 0,802, $p=0,001$; Supradiaphragmatic Reactivity, ICC: 0,608, $p=0,003$; Subdiaphragmatic Reactivity, ICC: 0,717, $p=0,001$). Czech, German, Dutch, Swedish, Portuguese, Spanish, and Catalan versions of BPQ are published (211). The reliability of the questionnaire in different cultures supports the claim that it is a useful and reliable questionnaire.

Group differences were used to differentiate the scores reflecting the construct validity of BPQ. For this reason, the results of healthy individuals and individuals with anxiety which are known they have interoceptive problems were compared according to the sub-scales of the BPQ. The scores of the individuals with anxiety according to the "Body Awareness" sub-scale were found to be statistically lower than the healthy individuals ($p < 0,05$). In the "Supradiaphragmatic Reactivity" and "Subdiaphragmatic Reactivity" sub-scales, the scores of individuals with anxiety were statistically found higher than the scores of healthy individuals ($p < 0,05$). These findings showed that BPQ is a scale that can accurately discriminate between healthy individuals and individuals with anxiety. The result of the current study is consistent with previous researches that showed the interoceptive difference at people with anxiety-based disorders. Our results

supported by Pollatos et al. showing that anxiety disorders have significantly negative correlation coefficient with interoceptive awareness (68). In another research, Harshaw and Christopher pointed that elevated stress hormones that could be caused by anxiety will lead to interoceptive dysfunction; when the people are hypersensitive to internal signals, they would have hyporesponsive to external signals (16).

Differences of the groups, which are healthy individuals and individuals with anxiety, according to the gender, were found statistically similar in the "Body Awareness" and "Supradiaphragmatic Reactivity" sub-scales ($p>0,05$). "Subdiaphragmatic Reactivity" sub-subscale was found statistically significant differences in both groups according to the gender ($p<0,05$). Our result consistent with previous research done by Cabrera et al. which found that scores of women in all subscales were higher than man scores while we found statistically higher in only two subscales which are body awareness and subdiaphragmatic reactivity. The authors of the same study concluded that these scores may reflect physiological gender differences, and suggest that other studies have been inconclusive in this area (212).

There is considerable interest in the role that disturbance of body-perception may play in long standing pain problems such as CLBP, both as a contributor to the clinical condition and as a potential target for treatment. In some chronic pain conditions body-perception has been investigated using self-report questionnaires. In another study, they described the development of a back-specific body-perception questionnaire and examine the psychometrics of it (213). That shows the importance of knowing information about the body perception on chronic pain. We think that the present study will also open research areas for body perception on specific topics.

In one study, they evaluated various aspects of body awareness in women with FMS, such as plasticity of the body schema, body esteem, and interoceptive awareness. Significantly higher scores were found in the FMS sample across awareness, stress response, autonomic nervous system reactivity, and stress style 2 subscales of the BPQ. Intensity of ongoing clinical pain was found to be strongly correlated with interoceptive awareness. The results suggest a disturbed embodiment in FMS, characterized by instability of the body schema, negatively biased cognitions regarding one's own body, and increased vigilance to internal bodily cues. These manifestations may be interpreted as related with the inability of incoming sensory inputs to adequately update negatively biased off-line somatorepresentations stored as long-term memory.

Recent systematic reviews have demonstrated that pain associated with knee osteoarthritis (OA) is a complex phenomenon that involves various contributors. People with knee OA exhibit symptoms of impaired body-perception, including reduced tactile acuity, impairments in limb laterality recognition, and degraded proprioceptive acuity. In one study, the researchers developed The Fremantle Back Awareness Questionnaire (FreBAQ) developed to assess body-perception specific to the knee pain experience. It shows that the knowledge about the body perception on chronic pain is important for the treatment processes (214).

Most cases with chronic pain present with co-morbid anxiety and depression, and comorbid conditions should take into account for the success of the treatment program. The current researches stressed the importance of non-linear systems on disease such as the effect of stress on low back pain or vice versa. Our study could shed light for a better treatment results on chronic pain disorders like chronic low back pain (CLBP) (213), fibromyalgia syndrome (FMS) (215), and knee osteoarthritis (OA) (214). Furthermore many study showed the relationship between body perception and chronic pain syndromes by using BPQ. And, Turkish version of BPQ-SF could help professionals to make that connection between body perception and pain conditions for a better treatment results.

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APPENDIX 1. Permission Letter of Translation of BPQ



Jacek Kolacz jacekkolacz@gmail.com guvercin.yeditepe.edu.tr üzerinden

3 Ara 2018 Pzt 17:53



Alıcı: Deniz ▾

Hello Deniz-

I'm delighted to hear that you are interested in translating the BPQ into Turkish.

I recommend using the back-translation method, in which the new translation is reverse translated to the original language and compared for convergence. This helps to improve accuracy of the translation and manuscript reviewers often ask for this.

As you may have seen, Dr. Porges hosts BPQ translations on his website. If you are interested, we would be very happy to host your translation once it is complete, with credit given to you and references to your publications that used the translation (or your thesis).

I'd like to point out that the Awareness subscale largely captures awareness of annoying or unpleasant body sensations. We are finding it is correlated with anxiety in several of our studies. This is different from the way awareness is conceptualized in some other studies, and may be useful to know as you plan for validity.

I'm attaching the questionnaire (please use the short form, which is the most up to date version of the scale), scoring document, and our recent psychometric paper.

Please let me know if you have questions and best of luck on your research.

Best wishes from Bloomington,

Jacek

Jacek Kolacz
Postdoctoral Research Fellow
Traumatic Stress Research Consortium
Kinsey Institute
Indiana University

APPENDIX 2. Ethical Approval



T.C. YEDİTEPE ÜNİVERSİTESİ

Sayı : 37068608-6100-15- 1773
Konu: Klinik Araştırmalar
Etik kurul Başvurusu hk.

21/11/2019

İlgili Makama (Deniz Aslan)

Yeditepe Üniversitesi Sağlık Bilimleri Fakültesi Fizik Tedavi ve Rehabilitasyon ABD Prof. Dr. Feryal Subaşı'nın sorumlu araştırmacı olduğu **“Beden Algı Ölçeği'nin Türkçe Geçerlilik ve Güvenilirlik Çalışması”** isimli araştırma projesine ait Klinik Araştırmalar Etik Kurulu (KAEK) Başvuru Dosyası **(1758)** kayıt Numaralı KAEK Başvuru Dosyası, Yeditepe Üniversitesi Klinik Araştırmalar Etik Kurulu tarafından **20.11.2019** tarihli toplantıda incelenmiştir.

Kurul tarafından yapılan inceleme sonucu, yukarıdaki isimi belirtilen çalışmanın yapılmasının etik ve bilimsel açıdan uygun olduğuna karar verilmiştir (**KAEK Karar No: 1118**).

Prof. Dr. Turgay ÇELİK
Yeditepe Üniversitesi
Klinik Araştırmalar Etik Kurulu Başkanı

APPENDIX 3. Informed Consent Form

KATILIMCI ONAM FORMU

Sayın Katılımcı,

Bu çalışma yetişkinlerin vücut farkındalığını, otonom sinir sistemi reaktivitesini, bilişsel-duygusal-bedensel stres cevaplarını ve sağlık hikayesini değerlendiren Vücut Algı Ölçeği'nin Türkçe geçerlilik ve güvenilirliğini belirlemek üzere, Fzt. Deniz Aslan'ın Yüksek Lisans bitirme tezi olarak planlanmıştır. Sizin çalışmada kullanılan anket sorularına vereceğiniz yanıtlar ile Türkçe konuşan adölesan ve yetişkinlerin duyuşsal becerilerini değerlendirirken kullanıma uygunluğunu belirlemiş olacağız. Bu nedenle sorulan soruların tümüne içtenlikle cevap vermeniz büyük önem taşımaktadır.

Araştırmaya katılmanız gönüllülük esasına dayalıdır. Bu form aracılığı ile elde edilecek bilgiler gizli kalacaktır ve sadece araştırma amacıyla (veya bilimsel amaçlar için) kullanılacaktır.

Anket üzerindeki gerekli bilgileri, adınızı, soyadınızı ve günün tarihini yazmayı unutmayınız. Anketi yanıtladığınız için teşekkür ederiz.

Çalışma ile ilgili herhangi bir sorunuz olduğunda aşağı ismi ve iletişim bilgileri verilen araştırmacı ile iletişime geçebilirsiniz.

Prof. Dr. Feryal Subaşı - Yeditepe Üniversitesi, Sağlık Bilimleri Fakültesi, Fizyoterapi Ve Rehabilitasyon Bölümü

Dr. Fzt. Aymen Balıkçı - Yeditepe Üniversitesi, Sağlık Bilimleri Fakültesi, Fizyoterapi Ve Rehabilitasyon Bölümü

Fzt. Deniz Aslan - Yeditepe Üniversitesi, Sağlık Bilimleri Fakültesi, Fizyoterapi Ve Rehabilitasyon Bölümü (24 Saat iletişim kurulabilecek kişi – 0538 339 30 74)

Çalışmaya katılmayı kabul ediyorsanız, aşağıdaki kutuya X ile işaretleyiniz ve devam ediniz.

☐

KABUL EDİYORUM

Katılımcının;

İsim- Soyisim

İmza

APPENDIX 4. Structured Questionnaire

KATILIMCI DEMOGRAFİK ÖZELLİKLER FORMU

AD-SOYAD:

DOĞUM TARİHİ:/...../.....

YAŞ:

CİNSİYET: ☐ KADIN ☐ ERKEK

BOY: KİLO:

MESLEK:

EĞİTİM DÜZEYİ: ☐ İLKOKUL ☐ LİSE ☐ ÜNİVERSİTE

SİĞARA KULLANIMI: ☐ HAYIR ☐ EVET, GÜNDE TANE

ALKOL KULLANIMI: ☐ HİÇ ☐ NADİR ☐ SIK SIK ☐ GENELLİKLE

İLAÇ KULLANIMI: ☐ HAYIR ☐ EVET,.....

DÜZENLİ EGZERSİZ YAPAR MISINIZ? ☐ HAYIR ☐ EVET

CEVABINIZ EVET İSE NE TÜR EGZERSİZ YAPARSINIZ?

VE HAFTADA KAÇ GÜN VE GÜNDE KAÇ SAAT YAPARSINIZ?

BEL AĞRINIZ VAR MI? ☐ HAYIR ☐ EVET

CEVABINIZ EVET İSE BUNUNLA İLGİLİ BİR PROFESYONELE DANIŞTINIZ MI?

☐ HAYIR ☐ EVET

DANIŞTIYSANIZ, DANIŞTINIZ KİŞİNİN PROFESYONELLİĞİ NEDİR?

HERHANGİ BİR PSİKİYATRİ GEÇMİŞSİNİZ VAR MI? ☐ HAYIR ☐ EVET

CEVABINIZ EVET İSE KISACA BAHSEDER MİSİNİZ?

.....
.....

[VERDİĞİNİZ CEVAPLAR İÇİN TEŞEKKÜRLER
FZT. DENİZ ASLAN

APPENDIX 5. Tampa Scale for Kinesiophobia

Tampa Kinezyofobi Ölçeği'nin Türkçe versiyonu (Toplam puan 17-68).

Lütfen, her soruda kendinize en uygun olan kutucuğu işaretleyiniz (*her soruda yalnızca bir kutucuğu işaretleyiniz*). *Teşekkür ederiz.*

	Kesinlikle katılmıyorum	Katılmıyorum	Katılıyorum	Tamamen katılıyorum
1. Egzersiz yaparsam kendi kendimi sakatlarım diye kaygılanıyorum.	☐	☐	☐	☐
2. Ağrıyla baş etmeye çalışacak olsam, ağrım artar.	☐	☐	☐	☐
3. Ağrımdan dolayı vücudum bana tehlikeli derecede yanlış giden bir şeyler olduğunu söylüyor.	☐	☐	☐	☐
4. Egzersiz yaparsam sanki ağrım hafifleyecekmiş gibi geliyor.	☐	☐	☐	☐
5. İnsanlar benim tıbbi sorunlarımı yeterince ciddiye almıyorlar.	☐	☐	☐	☐
6. Başıma gelen bu olay nedeni ile vücudum hayat boyu risk altında olacak.	☐	☐	☐	☐
7. Ağrımın olması her zaman, vücudumu sakatladığım/bir problemim olduğu anlamına gelir.	☐	☐	☐	☐
8. Sırf bazı şeylerin ağrımı artırıyor olması, onların tehlikeli oldukları anlamına gelmez.	☐	☐	☐	☐
9. Kendimi kazara sakatlamaktan korkuyorum.	☐	☐	☐	☐
10. Ağrının artmasını engellemenin en basit ve güvenli yolu gereksiz hareketler yapmaktan kaçınmaktır.	☐	☐	☐	☐
11. Vücudumda tehlike arz eden bir şey olmasaydı, bu kadar çok ağrı hissetmezdim.	☐	☐	☐	☐
12. Ağrıma rağmen, fiziksel olarak aktif olsaydım, durumum daha iyi olurdu.	☐	☐	☐	☐
13. Ağrı, kendimi sakatlamamam için egzersizi ne zaman bırakmam gerektiği konusunda bana sinyal verir.	☐	☐	☐	☐
14. Benim durumumda olan birinin, fiziksel olarak aktif olması pek güvenli değildir.	☐	☐	☐	☐
15. Normal insanların yaptığı her şeyi yapamam, çünkü çok kolay sakatlanırım.	☐	☐	☐	☐
16. Bazı şeyler çok fazla ağrıya neden olsa bile, bunların gerçekte tehlikeli olduklarını düşünmem.	☐	☐	☐	☐
17. Hiç kimse ağrı hissederken egzersiz yapmak zorunda olmamalı.	☐	☐	☐	☐

APPENDIX 6. Oswestry Low Back Disability Questionnaire

Oswestry Bel Ağrısı Engellilik Anketi

Oswestry Low Back Pain Disability Questionnaire V2.0

Hastanın Adı Soyadı: _____ Tarih: ____/____/____

Bu test bel (veya bacak) yakınmanızın günlük hayatınızı ne kadar etkilediği hakkında bilgi edinmek için tasarlanmıştır.
Lütfen tüm bölümleri cevaplayınız. Her bir bölümde sizi en iyi ifade eden şıkkı işaretleyiniz.

Ağrı yoğunluğu:

- 1
- ☐0 Şu an ağrım yok
 - ☐1 Şu an çok hafif bir ağrım var
 - ☐2 Şu an orta derecede ağrım var
 - ☐3 Şu an yeterince şiddetli ağrım var
 - ☐4 Şu an çok şiddetli ağrım var
 - ☐5 Şu an hissettiğim ağrı tahmin edilebilecek en şiddetli ağrıdır.

Kişisel bakım (yıkama, giyinme vb.)

- 2
- ☐0 Kişisel bakımımı fazladan ağrıya neden olmadan normal şekilde yapabilirim.
 - ☐1 Kişisel bakımımı normal şekilde yapabilirim ama bu oldukça ağırlıdır.
 - ☐2 Kişisel bakımımı yapmak ağırlıdır ve bu işleri yavaş ve dikkatlice yapıyorum.
 - ☐3 Biraz yardıma ihtiyaç duyuyorum ama çoğu kişisel ihtiyacımı halledebiliyorum.
 - ☐4 Kişisel bakımım ile ilgili pek çok konuda her gün yardıma ihtiyaç duyuyorum.
 - ☐5 Kıyafetlerimi giyemiyorum, zorlukla yıkanabiliyorum ve yataktayım.

Yük kaldırma

- 3
- ☐0 Ağır yükleri fazladan ağrı olmadan kaldırabiliyorum.
 - ☐1 Ağır yükleri kaldırırken ağrı bir miktar artıyor.
 - ☐2 Ağır ağır yükleri kaldırmama engel oluyor ama masa üstünde gibi uygun bir pozisyondaysalar kaldırabiliyorum.
 - ☐3 Ağır ağır yükleri kaldırmama engel oluyor ama masa üstünde gibi uygun bir pozisyondaysalar hafif veya orta ağırlıdaki nesneleri kaldırabiliyorum.
 - ☐4 Sadece çok hafif yükleri kaldırabiliyorum.
 - ☐5 Hiç yük kaldıramıyorum.

Yürüme

- 4
- ☐0 Ağrı herhangi bir yürüme mesafesinde beni engellemiyor.
 - ☐1 Ağrı 1,6 km'den (1 mil) daha uzun yürümeme engel oluyor.
 - ☐2 Ağrı 800 m'den daha uzun yürümeme engel oluyor.
 - ☐3 Ağrı 100 m'den daha uzun yürümeme engel oluyor.
 - ☐4 Sadece baston veya koltuk değneği ile yürüyebiliyorum.
 - ☐5 Zamanın çoğunda yataktayım ve tuvalete sürünerek gidebiliyorum.

Oturma

- 5
- ☐0 Herhangi bir sandalyede istediğim kadar uzun oturabilirim
 - ☐1 Sadece uygun bir sandalyede istediğim kadar uzun oturabilirim.
 - ☐2 Ağrı bir saatten uzun oturmama engel oluyor.
 - ☐3 Ağrı yarım saatten uzun oturmama engel oluyor.
 - ☐4 Ağrı 10 dakikadan uzun oturmama engel oluyor.
 - ☐5 Ağrı her an için oturmama engel oluyor.

Oswestry Bel Ağrısı Engellilik Anketi V2.0 Sayfa-2

Ayakta durma

- 6
- ☐0 Fazladan ağrıya yol açmadan istediğim süre ayakta kalabilirim.
 - ☐1 İstedğim süre boyunca ayakta kalabilirim ama fazladan ağrım olur.
 - ☐2 Ağrı bir saatten daha uzun süre boyunca ayakta kalmama engel oluyor.
 - ☐3 Ağrı yarım saatten daha uzun süre boyunca ayakta kalmama engel oluyor.
 - ☐4 Ağrı 10 dakikadan daha uzun süre boyunca ayakta kalmama engel oluyor.
 - ☐5 Ağrı her an için ayakta durmama engel oluyor.

Uyku

- 7
- ☐0 Uykum ağrı nedeniyle hiç bölünmez.
 - ☐1 Uykum nadiren ağrı nedeniyle bölünür.
 - ☐2 Ağrı nedeniyle 6 saatten daha az uyurum.
 - ☐3 Ağrı nedeniyle 4 saatten daha az uyurum.
 - ☐4 Ağrı nedeniyle 2 saatten daha az uyurum.
 - ☐5 Ağrılar uyumama tamamen engel oluyor.

Cinsel Hayat (eğer uygulanabiliyorsa)

- 8
- ☐0 Cinsel hayatım normaldir ve fazladan ağrıya neden olmaz.
 - ☐1 Cinsel hayatım normaldir ve fazladan biraz ağrıya neden olur.
 - ☐2 Cinsel hayatım neredeyse normaldir ama oldukça fazla ağrıya neden olur.
 - ☐3 Cinsel hayatım ağrı nedeniyle oldukça kısıtlıdır.
 - ☐4 Cinsel hayatım ağrı nedeniyle neredeyse yok gibidir.
 - ☐5 Ağrılar cinsel hayatıma tamamen engel oluyor.

Sosyal hayat

- 9
- ☐0 Sosyal hayatım normaldir ve fazladan ağrıya neden olmaz.
 - ☐1 Sosyal hayatım normaldir ancak ağrının miktarını artırır.
 - ☐2 Ağrı spor gibi daha fazla hareket gerektiren aktivitelerimi kısıtlamak dışında sosyal yaşamımda belirgin etki yaratmıyor.
 - ☐3 Ağrı sosyal yaşamımı kısıtlıyor, bu nedenle çok sık dışarıya çıkamıyorum.
 - ☐4 Ağrı aile içi yaşamımı da kısıtlıyor.
 - ☐5 Ağrı nedeniyle sosyal hayatım kalmadı.

Seyahat

- 10
- ☐0 Herhangi bir yere ağrım olmadan seyahat edebilirim.
 - ☐1 Herhangi bir yere seyahat edebilirim ama bu bana fazladan ağrı verir.
 - ☐2 Ağrım fazla ama 2 saate kadar olan seyahatlerde durumu idare edebilirim.
 - ☐3 Ağrım beni bir saatten daha kısa süreli seyahatle kısıtlıyor.
 - ☐4 Ağrım beni yarım saatten daha kısa süreli zorunlu seyahatle kısıtlıyor.
 - ☐5 Ağrım tedavi dışındaki seyahatlerime engel oluyor.

Skorlama Yönergesi: İşaretlenen kutucuğun yanındaki rakamlar toplanır. Aynı soru içinde 1'den fazla işaretli seçenek var ise en yüksek değer hesaba katılır. Maksimum skor 50'dir.

Toplam skor = $\{[\text{toplam puan}] / [(\text{işaretli soru sayısı}) \times 5]\} \times 100$

Hastanın ODI Skoru (%):

APPENDIX 7. Rolland Morris Disability Questionnaire

Roland Morris Engellilik Anketi The Roland-Morris Disability Questionnaire (RMDQ)

Hastanın Adı Soyadı: _____ Tarih: ____/____/____

Bel ağrınız olduğunda her zaman yapmakta olduğunuz bazı işleri yapmakta güçlük çekebilirsiniz. Aşağıdaki listede, bel ağrısı olan kişilerin ifade ettiği bazı yakınmalar bulunmaktadır. Bunlardan bazıları veya hepsi sizin de bel ağrınız yüzünden çekmekte olduğunuz bazı sıkıntıları tanımlıyor olabilir. Aşağıdaki ifadeleri okuyup, her ifade için, size uygun olan EVET veya HAYIR cevabını işaretleyiniz.

	Evett	Hayır
1 Bel ağrım yüzünden zamanımın büyük çoğunluğunu evde geçiriyorum.	☐	☐
2 Belimi rahatlatmak için sık sırayakta duruş, oturuş, yatış şeklimi değiştirmek zorunda kalıyorum.	☐	☐
3 Bel ağrım yüzünden eskisinden daha yavaş yürüyorum.	☐	☐
4 Bel ağrım yüzünden evde yaptığım birçok işi artık yapmıyorum.	☐	☐
5 Bel ağrım yüzünden merdivenleri çıkarken tırabzanlara tutunuyorum	☐	☐
6 Bel ağrım yüzünden dinlenmek için sık sık uzanıyorum.	☐	☐
7 Bel ağrım yüzünden sandalyeden kalkarken bir yere tutunmak ihtiyacı duyuyorum.	☐	☐
8 Bel ağrım yüzünden bazı işlerimi başkalarına yaptırıyorum.	☐	☐
9 Bel ağrım yüzünden eskisinden daha yavaş giyiniyorum.	☐	☐
10 Bel ağrım yüzünden sadece kısa süre ayakta kalabiliyorum.	☐	☐
11 Bel ağrım yüzünden eğilmekten ve çöelmekten kaçınıyorum.	☐	☐
12 Bel ağrım yüzünden sandalyeden kalkarken zorluk çekiyorum.	☐	☐
13 Belim hemen hemen her zaman ağrıyor.	☐	☐
14 Bel ağrım yüzünden yatakta dönmekte güçlük çekiyorum.	☐	☐
15 Bel ağrım yüzünden iştahım azaldı.	☐	☐
16 Bel ağrım yüzünden çoraplarımı giymekte zorluk çekiyorum.	☐	☐
17 Bel ağrım yüzünden sadece kısa mesafeleri yürüyebiliyorum.	☐	☐
18 Bel ağrım yüzünden rahat uyuyamıyorum.	☐	☐
19 Bel ağrım yüzünden bir başkasının yardımıyla giyiniyorum.	☐	☐
20 Bel ağrım yüzünden günün büyük bir kısmını oturarak geçiriyorum.	☐	☐
21 Bel ağrım yüzünden evdeki ağır işleri yapmaktan kaçınıyorum.	☐	☐
22 Bel ağrım yüzünden eskisine göre huzursuz ve sinirliyim.	☐	☐
23 Bel ağrım yüzünden merdivenleri her zamankinden daha yavaş çıkıyorum.	☐	☐
24 Bel ağrım yüzünden zamanın çoğunu yatakta geçiriyorum.	☐	☐

Toplam Puan (0-24): _____

APPENDIX 8. Hospital Anxiety and Depression Scale (HADS)

Hastane Anksiyete ve Depresyon Ölçeği (HAD) (Hospital Anxiety and Depression Scale (HADS))

Hastanın Adı Soyadı: _____ Tarih: ____/____/____

Her maddeyi okuyun ve son birkaç gününüzü göz önünde bulundurarak nasıl hissettiğinizi en iyi ifade eden yanıtın yanındaki kutuyu işaretleyin. Yanıtınız için çok düşünmeyin, aklınıza ilk gelen yanıt en doğrusu olacaktır.

1. Kendimi gergin "patlayacak gibi" hissediyorum.

- | | |
|---|---|
| ☐ 3 Çoğu zaman | ☐ 1 Zaman zaman, bazen |
| ☐ 2 Birçok zaman | ☐ 0 Hiçbir zaman |

2. Eskiden zevk aldığım şeylerden hala zevk alıyorum.

- | | |
|---|--|
| ☐ 0 Aynı eskisi kadar | ☐ 2 Yalnızca biraz eskisi kadar |
| ☐ 1 Pek eskisi kadar değil | ☐ 3 Hiçbir zaman |

3. Sanki kötü bir şey olacakmış gibi bir korkuya kapılıyorum.

- | |
|---|
| ☐ 3 Kesinlikle öyle ve oldukça da şiddetli |
| ☐ 2 Evet, ama çok da şiddetli değil |
| ☐ 1 Biraz, ama beni pek endişelendirmiyor |
| ☐ 0 Hayır, hiç de öyle değil |

4. Gülebiliyorum ve olayların komik tarafını görebiliyorum.

- | | |
|--|---|
| ☐ 0 Her zaman olduğu kadar | ☐ 2 Kesinlikle o kadar değil |
| ☐ 1 Şimdi pek o kadar değil | ☐ 3 Artık hiç değil |

5. Aklımdan endişe verici düşünceler geçiyor.

- | | |
|---|---|
| ☐ 3 Çoğu zaman | ☐ 1 Zaman zaman, çok sık değil |
| ☐ 2 Birçok zaman | ☐ 0 Yalnızca bazen |

6. Kendimi neşeli hissediyorum.

- | | |
|---|---------------------------------------|
| ☐ 3 Hiçbir zaman | ☐ 1 Bazen |
| ☐ 2 Sık değil | ☐ 0 Çoğu zaman |

7. Rahat rahat oturabiliyorum ve kendimi rahat hissediyorum.

- | | |
|---------------------------------------|---|
| ☐ 0 Kesinlikle | ☐ 2 Sık değil |
| ☐ 1 Genellikle | ☐ 3 Hiçbir zaman |

8. Kendimi sanki durgunlaşmış gibi hissediyorum.

- | | |
|--|---|
| ☐ 3 Hemen hemen her zaman | ☐ 1 Bazen |
| ☐ 2 Çok sık | ☐ 0 Hiçbir zaman |

9. Sanki içim pır pır ediyormuş gibi bir tedirginliğe kapılıyorum.

- | | |
|---|--|
| ☐ 0 Hiçbir zaman | ☐ 2 Oldukça sık |
| ☐ 1 Bazen | ☐ 3 Çok sık |

10. Dış görünüşüme ilgimi kaybettim.

- | |
|--|
| ☐ 3 Kesinlikle |
| ☐ 2 Gerektiği kadar özen göstermiyorum |
| ☐ 1 Pek o kadar özen göstermeyebilirim |
| ☐ 0 Her zamanki kadar özen gösteriyorum |

11. Kendimi sanki hep bir şey yapmak zorundaymışım gibi huzursuz hissediyorum.

- | | |
|---|--|
| ☐ 3 Gerçekten de çok fazla | ☐ 1 Çok fazla değil |
| ☐ 2 Oldukça fazla | ☐ 0 Hiç değil |

12. Olacakları zevkle bekliyorum.

- | |
|---|
| ☐ 0 Her zaman olduğu kadar |
| ☐ 1 Her zamankinden biraz daha az |
| ☐ 2 Her zamankinden kesinlikle daha az |
| ☐ 3 Hemen hemen hiç |

13. Aniden panik duygusuna kapılıyorum.

- | | |
|---|--|
| ☐ 3 Gerçekten de çok sık | ☐ 1 Çok sık değil |
| ☐ 2 Oldukça sık | ☐ 0 Hiçbir zaman |

14. İyi bir kitap, televizyon ya da radyo programından zevk alabiliyorum.

- | | |
|-------------------------------------|--|
| ☐ 0 Sıklıkla | ☐ 2 Pek sık değil |
| ☐ 1 Bazen | ☐ 3 Çok seyrek |

Mavi renkli kutu içinde şıkları olan sorular anksiyete, turuncu renkli altı çizgili şıkları olan sorular depresyon skorlarını verir.
0-7 puan: normal ||| 8-10puan: sınırda ||| 11ve üstü anormal

Toplam Puan: Depresyon _____ Anksiyete _____

APPENDIX 9. Body Perception Questionnaire (BPQ)

1

Body Perception Questionnaire Short Form

Stephen W. Porges © 1993, 2015

I. Body Awareness

Please rate your awareness on each of the characteristics described below. Select the answer that most accurately describes you.

During most situations I am aware of:

		Never	Occasionally	Sometimes	Usually	Always
1	Swallowing frequently	☐	☐	☐	☐	☐
2	An urge to cough to clear my throat	☐	☐	☐	☐	☐
3	My mouth being dry	☐	☐	☐	☐	☐
4	How fast I am breathing	☐	☐	☐	☐	☐
5	Watering or tearing of my eyes	☐	☐	☐	☐	☐
		Never	Occasionally	Sometimes	Usually	Always
6	Noises associated with my digestion	☐	☐	☐	☐	☐
7	A swelling of my body or parts of my body	☐	☐	☐	☐	☐
8	An urge to defecate	☐	☐	☐	☐	☐
9	Muscle tension in my arms and legs	☐	☐	☐	☐	☐
10	A bloated feeling because of water retention	☐	☐	☐	☐	☐
11	Muscle tension in my face	☐	☐	☐	☐	☐
		Never	Occasionally	Sometimes	Usually	Always

		Never	Occasionally	Sometimes	Usually	Always
12	Goose bumps	☐	☐	☐	☐	☐
13	Stomach and gut pains	☐	☐	☐	☐	☐
14	Stomach distension or bloatedness	☐	☐	☐	☐	☐
15	Palms sweating	☐	☐	☐	☐	☐
16	Sweat on my forehead	☐	☐	☐	☐	☐
17	Tremor in my lips	☐	☐	☐	☐	☐
18	Sweat in my armpits	☐	☐	☐	☐	☐
19	The temperature of my face (especially my ears)	☐	☐	☐	☐	☐
		Never	Occasionally	Sometimes	Usually	Always
20	Grinding my teeth	☐	☐	☐	☐	☐
21	General jitteriness	☐	☐	☐	☐	☐
22	The hair on the back of my neck "standing up"	☐	☐	☐	☐	☐
23	Difficulty in focusing	☐	☐	☐	☐	☐
24	An urge to swallow	☐	☐	☐	☐	☐
25	How hard my heart is beating	☐	☐	☐	☐	☐
26	Feeling constipated	☐	☐	☐	☐	☐
		Never	Occasionally	Sometimes	Usually	Always

II. Autonomic Nervous System Reactivity

The autonomic nervous system is the part of your nervous system that controls your cardiovascular, respiratory, digestive, and temperature regulation systems. It is also involved in the experience and expression of emotions. The autonomic nervous system functions differently among people. This scale has been developed to measure how your autonomic nervous system reacts.

Please rate yourself on each of the statements below:

		Never	Occasionally	Sometimes	Usually	Always
27	I have difficulty coordinating breathing and eating.	☐	☐	☐	☐	☐
28	When I am eating, I have difficulty talking.	☐	☐	☐	☐	☐
29	My heart often beats irregularly.	☐	☐	☐	☐	☐
30	When I eat, food feels dry and sticks to my mouth and throat.	☐	☐	☐	☐	☐
31	I feel shortness of breath.	☐	☐	☐	☐	☐
		Never	Occasionally	Sometimes	Usually	Always
32	I have difficulty coordinating breathing with talking.	☐	☐	☐	☐	☐
33	When I eat, I have difficulty coordinating swallowing, chewing, and/or sucking with breathing.	☐	☐	☐	☐	☐
34	I have a persistent cough that interferes with my talking and eating.	☐	☐	☐	☐	☐
35	I gag from the saliva in my mouth.	☐	☐	☐	☐	☐
36	I have chest pains.	☐	☐	☐	☐	☐
		Never	Occasionally	Sometimes	Usually	Always

		Never	Occasionally	Sometimes	Usually	Always
37	I gag when I eat.	0	0	0	0	0
38	When I talk, I often feel I should cough or swallow the saliva in my mouth.	0	0	0	0	0
39	When I breathe, I feel like I cannot get enough oxygen.	0	0	0	0	0
40	I have difficulty controlling my eyes.	0	0	0	0	0
41	I feel like vomiting	0	0	0	0	0
		Never	Occasionally	Sometimes	Usually	Always
42	I have 'sour' stomach.	0	0	0	0	0
43	I am constipated	0	0	0	0	0
44	I have indigestion.	0	0	0	0	0
45	After eating I have digestive problems.	0	0	0	0	0
46	I have diarrhea	0	0	0	0	0
		Never	Occasionally	Sometimes	Usually	Always

CURRICULUM VITAE

Kişisel Bilgiler

Adı	Deniz	Soyadı	Aslan
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Öğrenim Durumu

Derece	Alan	Mezun Olduğu Kurumun Adı	Mezuniyet Yılı
Yüksek Lisans	Fizyoterapi ve Rehabilitasyon	Yeditepe Üniversitesi	2020
Lisans	Fizyoterapi ve Rehabilitasyon	Yeditepe Üniversitesi	2017
Lise	Sayısal	Çiftlikköy Atatürk Anadolu Lisesi	2012

Bildiği Yabancı Dilleri	Yabancı Dil Sınav Notu (#)
YÖKDİL	75

İş Deneyimi (Sondan geçmişe doğru sıralayın)

Görevi	Kurum	Süre (Yıl - Yıl)
Lisansüstü Busiyer	Yeditepe Üniversitesi	2017-2020

Bilgisayar Bilgisi

Program	Kullanma becerisi
Microsoft Office	İyi
Mendeley	İyi
SPSS	İyi

Bilimsel Çalışmaları

SCI, SSCI, AHCI indekslerine giren dergilerde yayınlanan makaleler

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Hakemli konferans/sempozyumların bildiri kitaplarında yer alan yayınlar

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