Chapter

Dynamic and Static Models of Body-Mind Approaches from Neurobiological Perspectives

Practical Ethics for Researchers and Practitioners in the Medical and Educational Fields

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Abstract

Body-mind approaches (e.g., yoga, mindfulness meditation, Pilates method, and cognitive behavior therapy) are commonly used by the public today. However, the comprehensive neurobiological framework of effects of body-mind approaches is unknown. To begin, we discuss the dynamic and static models of each body-mind approaches from neurobiological perspectives, as well as from the standpoint of practical issues. By the dynamic components of body-mind approaches, people enhances meta-cognitive function, and it lead to decreases in avoidance behavior in social aversive context are suggested. On the other hand, it is assumed that static components of body-mind approaches enhance non-reactive monitoring function for baseline of self. Therefore, we discuss the implications of these findings for practitioners and for future research on body-mind researchers. Additionally, this chapter covers the essential ethical guidelines of body-mind approaches within the domain of medical or educational fields.

Keywords: body-mind approaches, psychiatric disorder, dynamic components, static components, resonance effect, meta-cognitive function

1. Introduction

No doctor or medical treatment can be comparable in efficacy to the human feelings of joy and happiness [1]. The variety of feelings we have as humans and our process of recognition make our lives interesting and meaningful. The inter-individual differences in subjective feelings and the processes of recognition are affected by individual differences in our physical function [2]. The human mind comprises both a bottom-up peripheral nervous system and a top-down central nervous system interaction that controls it. For example, playing football or baseball, which are moderate whole-body exercises, creates feelings of happiness. It is thought that this is due to an increase in body temperature, which is the result of an increase in momentum. This

rise in temperature leads to an improvement in autonomic nervous system control through exercising the muscles of the torso and other parts of the body, which we then recognize as positive emotions. Also, when people hear of painful experiences of those close to them (e.g., friends, significant others, family), this affects emotions in a way that makes the listener want to help. Altruistic behavior arises when we perceive changes in own body sensations in social interactions and when we guess the feelings of others. On the other hand, before people speak in public, individuals often have shortened breath and a rapid heartbeat, feelings we understand as being nervous. Subsequently we attempt to relax. Stress in both the workplace and academic situations increases our sympathetic nervous system, long-term stress which is difficult to control is harmful for physical and mental health. According to the World Health Organization, one in three people suffer from some type of psychiatric disorder, a statistic that holds true in many countries around the world. In Japan, the economic loss related to mental illness exceeds seven trillion yen yearly, a number that combines direct and indirect expenses. Psychiatric disorders can be interpreted as abnormalities in bodily functions due to external factors, and a breakdown in basic mental functions. For example, depression and anxiety disorder result in abnormalities in the control of cardiac autonomic nervous system. Also, persons with depression and anxiety disorder have abnormal functional connectivity between the prefrontal cortex and insula when compared to healthy subjects. Recently, there is increased attention to body-mind approaches as effective treatment for psychiatric disorders. However, as in terms of the treatment mechanisms of these body-mind approaches, there has been little discussion of a comprehensive framework from neurobiological perspectives. Therefore, the current paper explores two basic frameworks: (1) a dynamic and static model of body-mind approaches from neurobiological perspectives and (2) basic ethical guidelines of the body-mind approach when practicing in the fields of medical care and education.

2. Body-mind approach

Body-mind approaches (e.g., yoga, mindfulness meditation, Pilates method, and cognitive behavior therapy) are commonly used by the public today [3]. A body-mind approach focuses on the relationships between the brain, mind, body, and behavior, and their effects on health and disease [4]. To begin, we discuss the dynamic and static models of each body-mind approach from neurobiological perspectives, as well as from the standpoint of practical issues (**Figure 1**).

2.1 Theoretical framework and practical evidence of yoga

Yoga is constructed by practices of postures, breathing techniques, and meditation. Many of the elements of yoga that have been adjusted to Western cultures and became more popular in recent years focus on weight reduction through vigorous physical exercise. However, yoga in general not only aims to help people lose weight but also seeks to modulate an individual's physical or mental condition during practice. Previous meta-analysis studies indicated that yoga is an effective intervention for psychiatric disorders [5–7]. Previous studies have demonstrated that yoga improves one's brain functions and cortical thickness, resulting in improvements in attention control, emotional regulation, and meta-cognitive function. Interestingly, it also seems to improve telomere length and autonomic nervous control in both healthy individuals and those with physical ailments [8–16]. These results are interpreted as demonstrating that asana, breathing techniques, and meditation work interactively. Here, we explain the treatment mechanisms of asana, breathing technique, and meditation. We also illustrate the dynamic and static components that work in concert with asana, breathing techniques, and meditation.

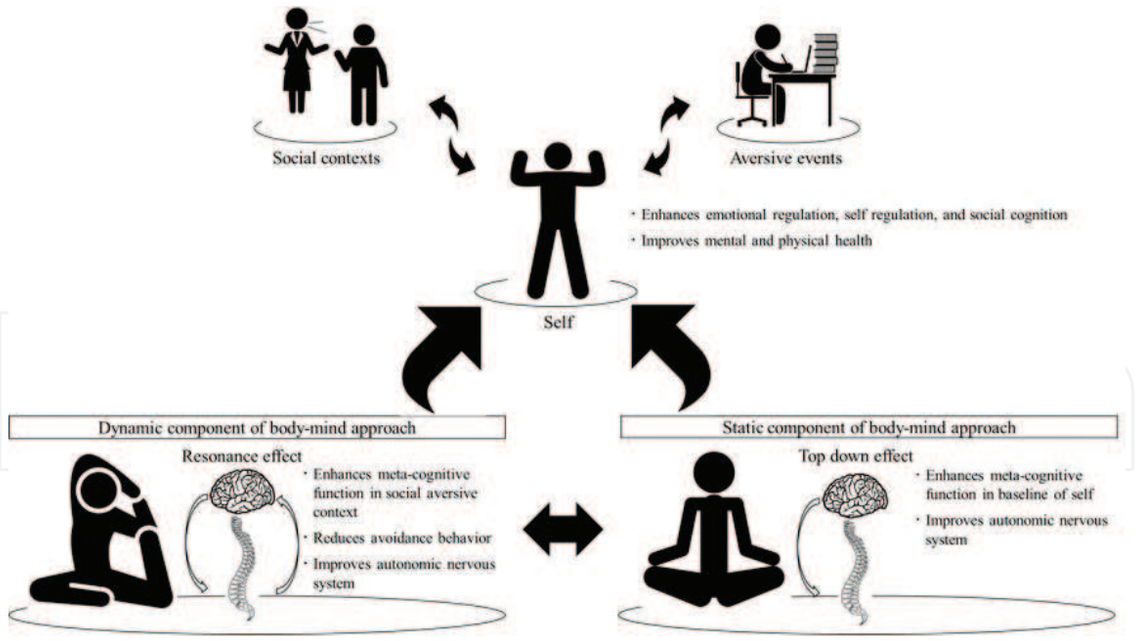

Figure 1.
The dynamic and static model of body-mind approaches.

2.2 The bottom up effect of asana

Asana points to specific physical postures that involve using one's whole body during yoga practice. These physical postures are categorized as standing, seated, and supine postures; they also include forward folds, adopted forward bend, back bends, hip-openers, twists, and inversions [17]. Some practices, such as Ashtanga Yoga, are characterized by quite intense and continuous physical motion with a focus on creating a "flow" of movement by linking one posture to the next. In other practices, such as Hatha Yoga, the movement is less dynamic and the focus is on holding individual postures for a longer period of time. The effect of asana during yoga practice is briefly explained in the following. First, we examine the effects of asana on autonomic nervous system as a result of exercise for the dorsal vertebrae, musculus erector spinae, musculus trapezius, latissimus dorsi muscle, and adductor longus muscle. Previous review articles have indicated that yoga intervention improved autonomic nervous system control for people with psychiatric disorders and individuals with cardiovascular disease [9, 15]. Iyengar yoga, which is characterized by improving toughness and stamina and correct body distortion, has been shown to reduce anxiety, depressive symptoms, anger, neurotic symptoms, and low frequency heart rate variability for people with depression [18]. According to Lakkireddy et al. [19], structured Iyengar yoga decreased anxiety, and depressive symptoms, while improving quality of life, heart rate, and systolic and diastolic blood pressure for individuals with arrhythmia burden. Streeter et al. [20] reported asana practice significantly increased brain GABA levels. Common asana, which includes exercise for the dorsal vertebrae, musculus erector spinae, musculus trapezius, latissimus dorsi muscle, and adductor longus muscle, is included in these studies. For example, the Sun Salutation, the most popular asana, was studied by Steer et al. [20]. It includes exercises for dorsal vertebrae, musculus erector spinae, musculus trapezius, latissimus dorsi muscle, and adductor longus muscle during flow movements. Adhomukhavirasana (modified child posture), which was used Lakkireddy et al. [19], expands the latissimus dorsi muscle and lower back. The latissimus dorsi muscle is related to extension of shoulder joint, and extending this muscle eases deep breathing (abdominal breathing). During Salamba

Sarvangasana, which was used in Shapiro et al. [18], the focus in on individual exercise of the dorsal vertebrae and several muscles (e.g., musculus erector spinae, musculus trapezius, latissimus dorsi muscle, and adductor longus several muscle). We must not disregard the interaction between asana and abdominal breathing; however, from the evidence above, we speculate asana exercise improves autonomic nerve system control which should then lead to the improvement in the symptoms of psychiatric disorders. However, possible side effects of asana exercise should be carefully investigated. Asana is regarded as having bottom up treatment effects during yoga practice.

2.3 Top down effect of breathing techniques

The conscious practice of altering breathing patterns may have a number of different effects depending on the characteristic of the practice [21]. For instance, slow and rhythmic breathing is said to promote a shift to parasympathetic dominance via vagal afferent stimulation with consequent stress reduction [22], whereas more forceful breathing practices may promote sympathetic activation [23]. Voluntary change of breathing patterns can alter emotional states and influence well-being [21, 24, 25]. In fact, a typical autonomic reaction to stressful situations is rapid thoracic breathing, which in turn leads to hyperventilation, altered tidal volume, and hypocapnia [26]. Yoga is a practice that emphasizes linking breath and movement. For example, in Ashtanga Yoga each asana is coupled to a specific breathing rhythm so that the specific breathing technique helps enhance movement. Sudarshan Kriya Yoga is a yoga practice that incorporates powerful breathing, Ujjiay—slow and forced breathing, 3 cycles per minute; Bhastrika—rapid exhalation at 20–30 cycles per minute; Sudarshan Kriya—rhythmic, cyclical breathing of slow, medium, fast cycles [21]. In the practice of yoga, various breathing methods such as chest respiration, which increases the sympathetic nervous system, and abdominal breathing, which increases the parasympathetic nervous system are used. Previous studies have demonstrated that yoga breathing techniques when used alone improved symptoms in patients with psychiatric disorders and healthy elderly individuals [27–29]. Santaella et al. [28] reported that the Sudarshan Kriya Yoga breathing technique significantly improves maximum expiratory and inspiratory pressures of pulmonary function, and significantly decreases low component and low frequency/high frequency ratio (marker of sympathovagal balance) of heart rate variability in healthy older individuals. Toschi-Dias et al. [29] demonstrated that the Sudarshan Kriya Yoga breathing technique improved subjective symptoms while decreasing sympathetic modulation and cardiac autonomic control; specifically, it was shown to increase parasympathetic modulation and cardiorespiratory coupling in in patients with anxiety-depression disorders. Intentional change for respiratory rhythms translates into changes in the neural activity of brainstem [30]. Both cardiorespiratory coupling and the cardiac autonomic nervous system are controlled by a network of neurons located within the lower brainstem [31, 32]. Based on this evidence, we hypothesize that yoga breathing techniques change brain stem activation in patients with psychiatric disorders and lead to improvements in the cardiac autonomic nervous system (mainly associated with parasympathetic nervous system) and cardiopulmonary coupling through the vagus nerve. These breathing techniques represent a top down treatment mechanism of yoga. Therefore, during yoga practice, participants experience both bottom up and top down effects of yoga, and these effects can improve cognitive functions. In the next section, we discuss a third treatment mechanism in yoga, a physical technique that improves cognitive function.

2.4 Neurobiological resonance effects in dynamic components of yoga

Resonance effects between bottom up and top down effects within individuals produced by yoga practice generate a third type of treatment effect. During an asana sequence, the range of motion in a person's joints expands and joint load will largely be maintained at submaximal levels. As a result, physical stress increases over time, manifesting in the muscles, joints, and connective tissue. Therefore, by stimulating the autonomic nervous system, individual arousal is accelerated. As a result, subjective emotional reaction increases, which prompts avoidance behavior. These negative emotional reactions are similar to emotional reactions in negative situations individuals face in social contexts. This is a bottom up effect of yoga. On other hand, the yoga breathing technique used during asana sequence enhances parasympathetic nervous control and cardiopulmonary coupling. This top-down relax effect reduces the subjectively negative emotional reaction that occurs in the asana sequence. This is the top down effect of yoga. The bottom up and top down effects are functionally resonant within an individual during the asana sequence. These resonance effects reduce one's subjectively negative emotional reaction and promote awareness of bodily sensations that produce them. Through this increase in body awareness, an individual can monitor (meta-cognition) perceived emotional events that may occur from moment to moment that arise in the context of yoga practice. Therefore, by enhancing meta-cognitive function, an individual's emotion regulation and self-regulation in practical an aversive context are improved. Previous meta-analysis studies indicated that yoga intervention improved cognitive function for both people with psychiatric disorders and healthy individuals [33, 34]. Eyre et al. [12] reported that patients with mild cognitive impairment who participated in yoga classes had statistically significant improvements in alleviating depression and enhancing visuospatial memory. Jensen and Kenny [13] demonstrated that children with attention deficit hyperactivity disorder who participated in yoga intervention had significantly improved emotional lability at post intervention compared to pre intervention. Furthermore, some studies indicated that yoga intervention significantly enhanced body awareness in individuals with eating disorders [10, 11]. A previous neuroimaging study also demonstrated that gray matter volume of bilateral insula was positive correlated with pain tolerance, and also had positive correlation with yogic experience in yoga practitioners [16]. Additionally, another fMRI study reported healthy elderly yoga practitioners significantly increased gray matter volume in the left lateral prefrontal cortex compared to an age matched healthy control group [8]. The resonance effect of yoga promotes cognitive reappraisal of individuals in terms of negative emotional reactions faced in practical contexts. Cognitive reappraisal gained by the resonance effect of yoga may give new meaning to an individual's emotional reactions, which in turn lead to improved emotional regulation and self-regulation. Thus, interoceptive awareness and monitoring are essential for most affective, cognitive, and interpersonal processes [35]. These observations suggest that the experience of yoga practice decreases avoidance behavior, and this experience may be generalized to other behaviors in social contexts. These are the dynamic components of yoga. Next we focus on meditation, which is a static component of yoga.

2.5 Meditation and breathing technique in static components of yoga

As a static component of yoga, meditation aims to develop mental silence and non-reactive consciousness. Before yoga meditation, participants are instructed to maintain focus on abdominal breathing and observe their interoceptive and physical sensations while keeping their minds blank. During yoga meditation,

individuals develop awareness of both their inner experience, and how this experience functions on a meta-cognitive level. Here, the top-down control of using abdominal breathing reduces the emotional response occurring in an individual during meditation. One's awareness of both their emotional reactions and body are enhanced due to the resonance effect generated by the dynamic component of yoga. Through these effects, individuals can observe emotions and thoughts objectively (non-reactive) without being caught up in them. Static components of yoga promote cognitive reappraisal of one's self as a baseline. Therefore, static components are also found for mindfulness meditation.

3. Theoretical framework and practical evidence of mindfulness meditation

Mindfulness can be defined as the ability to observe thoughts, and bodily sensations or feelings in the present moment with an open and accepting orientation toward one's experiences [36]. Mindfulness meditation that develops mindfulness uses abdominal breathing in a way similar to yoga, and it is seen as a body-mind approach with static components. Mindfulness meditation has been employed for centuries within Buddhist traditions, yet it is has only been since the 1970s that mindfulness has become a target of intervention for several psychological problems [37]. Through facilitating awareness and non-judgmental acceptance of moment-to-moment experiences, these mindfulness-based meditation techniques alleviate intense emotional states [37, 38]. As evidenced by previous meta-analyses, mindfulness meditation based intervention has proven effective in reducing psychological distress, anxiety, depression, and improving well-being and quality of life in individuals with mental disorders [39–41]. In this section, we explain the interaction between three types of meditation (focused attention meditation, open monitoring meditation, and compassion meditation) and breathing technique; these are basic techniques that employ several types of mindfulness meditation.

3.1 Focused attention meditation, open monitoring meditation, and compassion meditation: mindfulness meditation involving a static component

Meditation that develops mindfulness consists of three types of meditation: focused attention meditation, which improves concentration abilities, open monitoring meditation, which improves the ability to monitor our experiences without reactions or judgments, and compassion meditation, which integrates focused attention meditation and open monitoring meditation [42, 43]. Focused attention meditation is a type of systematic training aimed at directing and sustaining attention on a chosen neutral object (e.g., the breath), noticing when the mind wanders from the object, and disengaging from distractions, negative emotions, rumination, or worry by redirecting or shifting one's attention back to the chosen neutral object [42]. Focused attention meditation cultivates both calmness and stability of mind and reduces attention on negative thoughts and emotions [42]. Open monitoring meditation does not involve any specific object of focus, nor does it focus on disengagement from negative thoughts or emotions or expecting them to diminish [42]. Open monitoring meditation entails cultivating non-reactive awareness of automatic cognitive and emotional interpretations of sensory, perceptual, and endogenous stimuli, regardless of valence [42]. During compassion meditation, meditators focus on developing love and compassion first for themselves and then gradually extend this love to evermore "unlikeable" others, and various other creatures [44]. Compassion meditation is often entails that helps practitioners

develop cognitive schemas which cultivate a sense of equanimity and hopefulness. According to a previous review article [45], mindfulness meditation, which consists of focused attention meditation, open monitoring meditation, and compassion meditation, enhances attention control, emotional regulation, and self-awareness in both healthy subjects and individuals with psychosis. Goldin and Gross [46] reported that mindfulness meditation intervention improved self-esteem, and lessened anxiety and depressive symptoms. They additionally reported reduced amygdala activity that corresponded to emotional reactivity during reacting to negative self-beliefs in people with social anxiety disorder. Tomasino and Fabbro [47] demonstrated that focused attention meditation increased activation in the right dorsolateral prefrontal cortex and in the left insula, and that it decreased activation in the rostral prefrontal cortex and in right parietal area. According to Fujino et al. [48], both focused attention meditation and open monitoring meditation specifically reduced functional connectivity between the striatum and posterior cingulate cortex, which is a core hub region of the default mode network. Additionally, open monitoring meditation reduced functional connectivity of the ventral striatum in both the visual cortex related to intentional focused attention in the attentional network and the retrosplenial cortex related to memory function in the default mode network. In contrast, focused attention meditation increased functional connectivity in these regions. Furthermore, other previous studies revealed stronger neural responses to emotional sounds in the anterior insula and anterior cingulate cortex during compassion meditation than when an individual was in a resting state [49, 50]. From these reports, we speculate that mindfulness meditation increases emotional regulation, attention control, and self-awareness. Additionally, we assume the abdominal breathing technique, which is a physical movement, is enormously important in this respect.

3.2 Breathing technique of mindfulness meditation

Prior to mindfulness meditation, participants are instructed to focus on breathing and to let their minds wander, not to focus attention on worries or negative thoughts [51]. Previous studies demonstrated that mindfulness breathing technique used alone alleviated subjective distress and improved meta-cognitive function, emotional non-reactivity, and autonomic nervous control in healthy individuals and those with physical ailments [51–53]. According to Ng et al. [53], 5 minutes of brief mindfulness breathing technique lessened subjective distress, and improved blood pressure, pulse rate, and breathing rate in subjects in palliative care cancer patients. Furthermore, Arch and Craske [51] indicated that 15 minutes of mindfulness breathing enhances an individual's emotional non-reactivity during presentation of negative pictures. Based on these reports, focused attention on breathing is seen to reduce the attention given to distressing experiences or thoughts, and abdominal breathing reduces the role of the sympathetic nervous system and increases that of the parasympathetic nervous system during distressing experiences or thoughts.

3.3 Meditation and breathing technique in static components of mindfulness meditation

The purposes of mindfulness meditation, which is one of the body-mind approaches including static components, alleviate intense emotional states and self-awareness for psychological problems accompanied by aversive emotions, and develop cognitive schemas, which cultivate a sense of equanimity and hopefulness. Here, the psychological problems accompanied by aversive emotions include the problem that is currently occurring and occurred in the past. Participants develop

the objective monitoring function for inner emotions and thoughts without being caught up in them during focused attention meditation and open monitoring meditation. It should be also noted that participants observe psychological problems that are obstacles to cultivating love and compassion for themselves and others with objectively monitoring function during compassion meditation too. Therefore, we hypothesize that these meditations enhance individuals' metacognitive function. Furthermore, before each mindfulness meditations, participants are instructed to maintain focus on abdominal breathing. The top-down control of using abdominal breathing reduces the emotional response occurring in an individual during each meditation. There is suggested that these effects promote cognitive reappraisal of psychological problems which forming the core of the current self and as a result develop cognitive schemas which cultivate a sense of equanimity and hopefulness. This is the effect of the static component which adjusts baseline of self. Thus far, we have explained the characteristics and therapeutic effects of yoga and mindfulness respectively. Mindfulness meditation and yoga are both body-mind approaches which have static components. In addition, previous studies for patients with psychiatric disorders have demonstrated that symptom reduction via attention control, emotional control, and self-awareness are viable treatment mechanisms. On the other hand, mindfulness meditation does not have a dynamic component. Individuals must continue to focus on their own interoceptive sensations and breathing during mindfulness meditation. However, with the dynamic component of yoga, participants are able to automatically focus on their interoceptive sensations or breathing. We assume that yoga-based interventions may be more appropriate for ADHD children who have difficulty sustaining attention. Recently, in order to overcome the problems that currently exist in psychotherapy, yoga, mindfulness, and other body-mind approaches have been aggressively promoted for patients with mental disorders. For example, the aim of conventional cognitive behavioral therapies has been to modify maladaptive cognitive content affecting emotions and behavior. On the other hand, when cognitive behavioral therapy for major depressive disorder is performed, if negative self-cognitive modification is incomplete, it can lead to a return of symptoms [54]. There are also problems in the change of cognitive bias for patients with PTSD, which can increase their pain and emotional burden. These issues can lead to individuals dropping out of the treatment protocol [55–57]. Therefore, there has been more attention given to body-mind approaches that have an effect on cognitive functions through bodily functions. However, in terms of body-mind approach treatment mechanisms, there has little discussion of a comprehensive framework based on the dynamic and static component models. In the next section we examine the Pilates method, which is another body-mind approach, and behavior activation, a third generation cognitive behavior therapy.

4. Theoretical framework and practical evidence of Pilates method

Pilates method was developed in the 1920s by Joseph Pilates and consists of comprehensive body conditioning, which aims to develop better body awareness and improve posture. The Pilates method requires core stability, strength, and flexibility, as well as attention to muscle control, posture, and breathing [58]. At first, the Pilates method gained popularity in rehabilitation settings [59]; however, in recent years Pilates based exercise has become popular among the general population. In the modern Pilates method, after adjusting one's breath (a costal breathing technique), an individual performs a series of approximately 25–50 simple, low-impact flexibility and muscular endurance exercises with emphasis on muscular exertion in the abdominals, lower back, hips, thighs, and buttocks

in combination with timed breathing [60, 61]. The Pilates method is one of the body-mind approaches featuring a dynamic component. According to previous meta-analysis studies, the Pilates method improves physical flexibility, dynamic balance, and muscular endurance in healthy people [62], as well as physical balance in older adults [63]. Additionally, some randomized controlled trials studies have demonstrated that the Pilates method improved subjective degree of pain, subjective degree of disability, and kinesiophobia [62, 64, 65]. However, to the best of our knowledge, few studies have investigated intervention effects of the Pilates method for symptoms of psychiatric disorders, as compared to the research in this area employing other body-mind approaches. We assume that the primary objective of the other body-mind approaches is improving mental condition, while the primary goal of Pilates method is to improve physical health. Second, we speculate that present interventions which use the Pilates method are not sufficient to be effective for psychiatric disorders. However, if the dynamic component of the Pilates method could be adjusted, it is possible this method could be an effective intervention for some psychiatric disorders. In the next section we examine the potential intervention effect of the Pilates method for individuals with psychiatric disorders.

4.1 Potential intervention effects of the Pilates method for individuals with psychiatric disorders

In the Pilates method, participants adjust their physical condition using costal breathing before exercise. This is one of the main differences from yoga. As previously mentioned, costal breathing increases the activity of the sympathetic nervous system. This boost of the sympathetic nervous system both increases the heart rate and enhances the metabolism of one's body. We speculated that if the aim of the Pilates method is dieting or physical fitness for healthy individuals, this breathing technique is appropriate. However, previous meta-analysis studies have demonstrated that patients with psychiatric disorders had reduced high frequency of heart rate variability (which is influenced by the parasympathetic nervous system) compared to healthy subjects [66, 67]. Therefore, we consider that it may be better to adopt the breathing technique which increases parasympathetic activity, such as abdominal breathing, in the Pilates method. In fact, a numerous interventions which use the modern Pilates method have adopted this breathing technique [58]. However, these techniques are used only to adjust physical condition prior to exercise and are not used during exercise. We assume if one adjusts abdominal breathing while engaging in an easy pose, such as a "cat stretch" or "mermaid stretch", the effects of the dynamic component of Pilates method may be more effective. In this case, the Pilates method may be an effective intervention for psychiatric disorders.

5. Theoretical framework and practical evidence of behavioral activation

Based on the approach of Lewinsohn et al. [68], behavioral activation is focused on enhancement of self-monitoring, increasing healthy goal-oriented behavior, and increasing environmental reward frequency. In the course of behavioral activation interventions, participants monitor and assess their daily activities and work to change their habitual behaviors in a way that aims to increase pleasant events and interactions and reduce depressive symptoms [69]. Behavioral activation is another body-mind approach including a dynamic component. Previous meta-analysis studies have demonstrated that behavioral activation is an effective treatment for depression [70, 71]. Dimidjian et al. [72] indicated that treatment effects of behavioral activation

are comparable in efficacy to pharmacological therapy for individuals suffering from depression. Our previous studies reported that behavioral activation improved abilities both to access positive reinforcing activities and to engage in rewarding behaviors under adverse circumstances [73, 74]. Additionally, Jacobson et al. [69] showed behavioral activation significantly improved self-concept in people with depression. A few previous neuroimaging studies have also demonstrated that behavioral activation enhances one's cognitive function and corresponds to brain activations in people with subthreshold depression [75–77]. Specifically, our previous studies indicated that brief behavioral activation had increased activation in the dorsomedial prefrontal cortex in individuals with subthreshold depression, which is associated with meta-cognitive function, and that this activation is also correlated with an improvement in depressive symptoms [76, 77]. Based on these reports, we hypothesized that there should be two treatment mechanisms of behavioral activation for depression. The first is involved in reducing depressive symptoms to improve the reward system, and the second involved in improving depressive symptoms to enhance meta-cognitive function. Future research is needed to verify the above hypotheses related to these two treatment mechanisms.

6. Ethical guidelines of body-mind approach within the medical and educational domains

The primary purpose of medical research involving human subjects is to understand the causes, development, and effects of diseases and improve preventive, diagnostic, and therapeutic interventions (methods, procedures and treatments). Even the best proven interventions must be evaluated continually through research for safety, effectiveness, efficiency, accessibility, and quality [78]. In this section we review four body-mind approaches that have gained attention in recent years. Each approach has different characteristics (see **Table 1**). Here, for practitioners and researchers, we discuss the current and future issues of each approach. First, further neurobiological examination is necessary for the body-mind approach. For example, yoga and mindfulness are speculated to be very similar approaches in their emphasis on enhancing attention control, emotional regulation, and self-awareness which using one's interoceptive sensations or breathing. However, to the best of our

	Dynamic component	**Static component**	**Subject**	**Degree of structuralization**	**Intervention effect**
Yoga	Asana sequence and abdominal breathing	Meditation	Healthy -mental diseases	Medium	Medium
Mindfulness meditation	—	Meditation	Healthy -mental diseases	High	High
Pilates method	Pose sequence and costal breathing	—	Healthy	Medium	Low
Behavioral activation	Positive activities	—	Healthy -mental diseases	Low	High

Table 1.
The difference of characteristics for each body-mind approaches.

knowledge, there are few neurobiological studies that compare yoga and mindfulness. This is also true for research comparing the effects of the Pilates method to other approaches. A second important point regards the enhancement of treatment effects in each of the body-mind approaches. According to a previous meta-analysis study [79], the treatment effect of yoga is not sufficient compared to other types of active control (Hedges' g = 0.30). However, this study did not fully examine the therapeutic effect of each asana. We assume that a structured asana sequence is necessary to more greatly enhance the therapeutic effect of yoga. Third, as we noted above, there are many therapies applying the mindfulness meditation in recent years (e.g., dialectical behavior therapy, mindfulness-based cognitive therapy, and acceptance and commitment therapy). This is because the disease to be treated, the duration of the treatment effect, and the intervention duration are different for each therapy. On the other hand, it can be more conveniently implemented by someone, and versatility treatment is necessary. Thereby, it is necessary to examine the treatment model used in conventional mindfulness-based therapies from neurobiological perspectives to extract essential factors. Furthermore, new mindfulness meditation-based treatment, which integrates essential factors in conventional mindfulness-based therapies, should be developed. Forth, we speculate it is necessary to examine the treatment effects of body-mind approach for not only basic emotions (e.g., fear, anger) but also complex emotions (e.g., awe, shame) and social cognition. A few previous studies [80] indicated that mindfulness meditation alleviated subjective symptoms of anxiety and enhanced social skills for people with learning disabilities. From the evidence, it could be considered that other body-mind approaches may enhance complex emotions and social cognition. It is necessary to provide a higher-quality body-mind approach based on previous evidence that can be adjusted to fit the needs of medical institutions and school schedules. Finally, the research that uses the body-mind approach for psychiatric disorders is at an early stage at present. We speculate that it is necessary to establish more detailed ethical guidelines for each approach corresponding high-quality body-mind approach in the near future.

7. Conclusion

In this chapter, we introduced and discussed neurobiological treatment effects and mechanisms of yoga, mindfulness meditation, Pilates method, and cognitive behavior therapy. In recent years, these body-mind approaches have been actively adopted in the educational and medical fields in Western countries. In the future, it is necessary to clarify the detailed neurobiological mechanisms of each body-mind approach and provide higher quality service in both medical and educational settings. At the same time, we should also extend knowledge and technology to countries and regions where body-mind approaches are not widely available.

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Conflict of interest

None of the authors have any conflicts of interest to declare regarding the findings of this study.

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