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# Affect and Exercise

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## Abstract

The increase in the number of studies involving affect and exercise published in the last two decades presents new directions and important advances in the field of exercise psychology, expanding the theoretical knowledge of the theme and highlighting new possibilities for practical application. This chapter aims to address the relationship between affect and exercise by defining their concepts, characteristics, and interactions with physiological and perceived exertion factors. In addition, it aims to demonstrate how different strategies in exercise prescription can influence the affective responses, provide the physiological and psychological benefits of exercise, and assist in the adherence and adoption of an active lifestyle.

**Keywords:** affective response, exercise, intensity, adherence, pleasure

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## 1. Introduction

Over the past few decades, studies have found that physiological data and the appeal of health benefits are insufficient to encourage people to maintain regular physical activity. Therefore, understanding the relationship between affect and exercise is a vital step toward revealing what factors lead to maintenance of or dropout from exercise programs. This chapter presents the concept of basic affect and its distinction from moods and emotions, as well as the possibility of measuring affect in the context of exercise from a dimensional perspective. In terms of the affect-exercise relationship, it will address the importance of the intensity of the exercise prescription model (self-selected or imposed) in affective responses and the use of motivational music to stimulate pleasurable sensations or distract from the discomfort that exercise can cause.

## 2. Affect

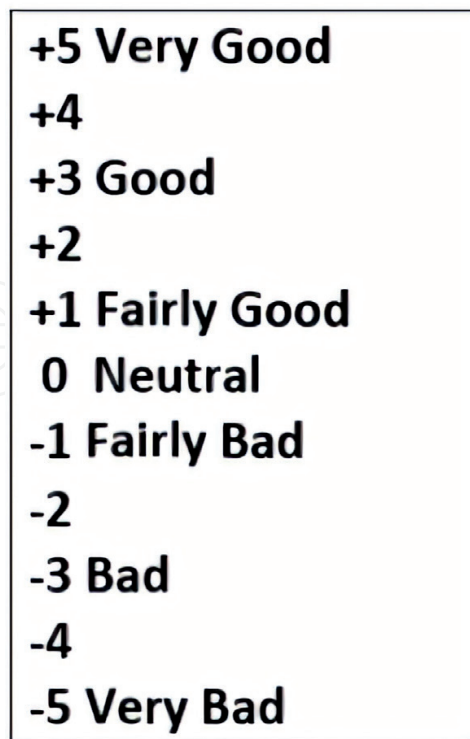
The analysis of affective constructs from general and abstract aspects (such as mental health, psychological well-being, and psychological health) has provided a plethora of terms, such as humor, emotion, and affect, with similar and diverse definitions, not all of which are universally accepted [1]. To understand the meaning of affect and its application in the context of exercise, it is important to define the concepts of mood and emotion. Emotions are immediate responses to specific stimuli (often directed at a specific object), typically characterized by a short duration and high intensity. In contrast, moods are characterized as diffuse and lacking a specific target, are typically associated with downward or no-action trends, and may be less intense and longer lasting than emotions [1, 2]. In this sense, moods refer to the larger and more diffuse existential issues of life, while emotions refer to an immediate response, having a specific and relatively narrow purpose in an encounter with variable environmental stimuli [1].

The term “affect” can be defined as the intrapersonal or experiential basis of all contrasting responses (positive or negative, pleasant or unpleasant), including, but not limited to, emotions and moods [2, 3]. Unlike emotions and moods, affect encompasses a more general description of the psychological response and can be considered basic and central. Therefore, the use of the word affect encompasses the notion that all emotions are affective conditions, but not all affective conditions are emotions [2, 4].

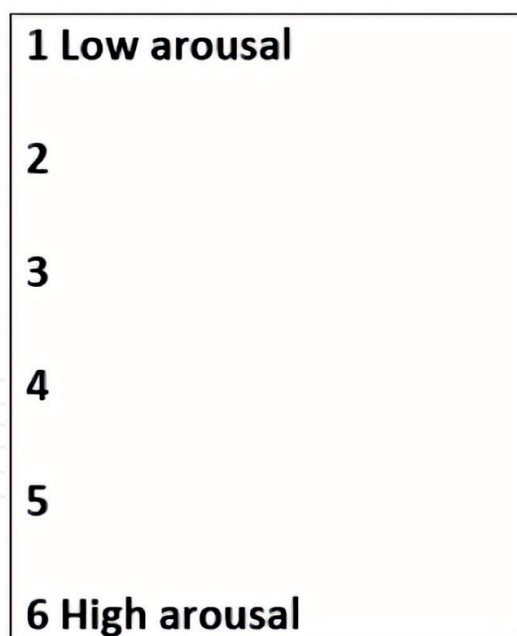
The investigation of affective phenomena can be envisioned from a categorical or dimensional perspective. In the categorical view of affect, affective states are ordered into different categories, comprising states that resemble the prototypical examples, such as anger, fear, sadness, disgust, happiness, love, and pride [4]. In the dimensional perspective, affective states are systematically interrelated, and their relationships can be modeled by a stringent set of dimensions. Although both categories have advantages and limitations, the dimensional approach provides a wider perspective, corroborating the characteristics of basic affect and providing a model or “map” of the affective space that offers a broad and balanced scope for investigation of affect in exercise [2, 4]. The dimensional model of affect allows the exercise-induced affective experience to be captured and the observation of affective changes throughout the exercise context [2, 4, 5].

### 2.1. Measuring affect

The measurement of affect can be performed with one- or two-dimensional models [6]. Some scales are commonly used to measure affective valence and perceived activation from both models. The Feeling Scale is used to measure affective valence (**Figure 1**). This instrument comprises an 11-point scale, ranging from +5 (“very good”) to −5 (“very bad”) [7]. Its purpose is to quantify the exercise-related sense of pleasure and displeasure. The Felt Arousal Scale is an instrument used to measure perceived activation [8] (**Figure 2**); the scale comprises six levels of activation, ranging from low activation (1) to high activation (6). High perceived activation can be characterized by excitement, anxiety, or anger, whereas low activation may be described as relaxation, boredom, or tranquility.

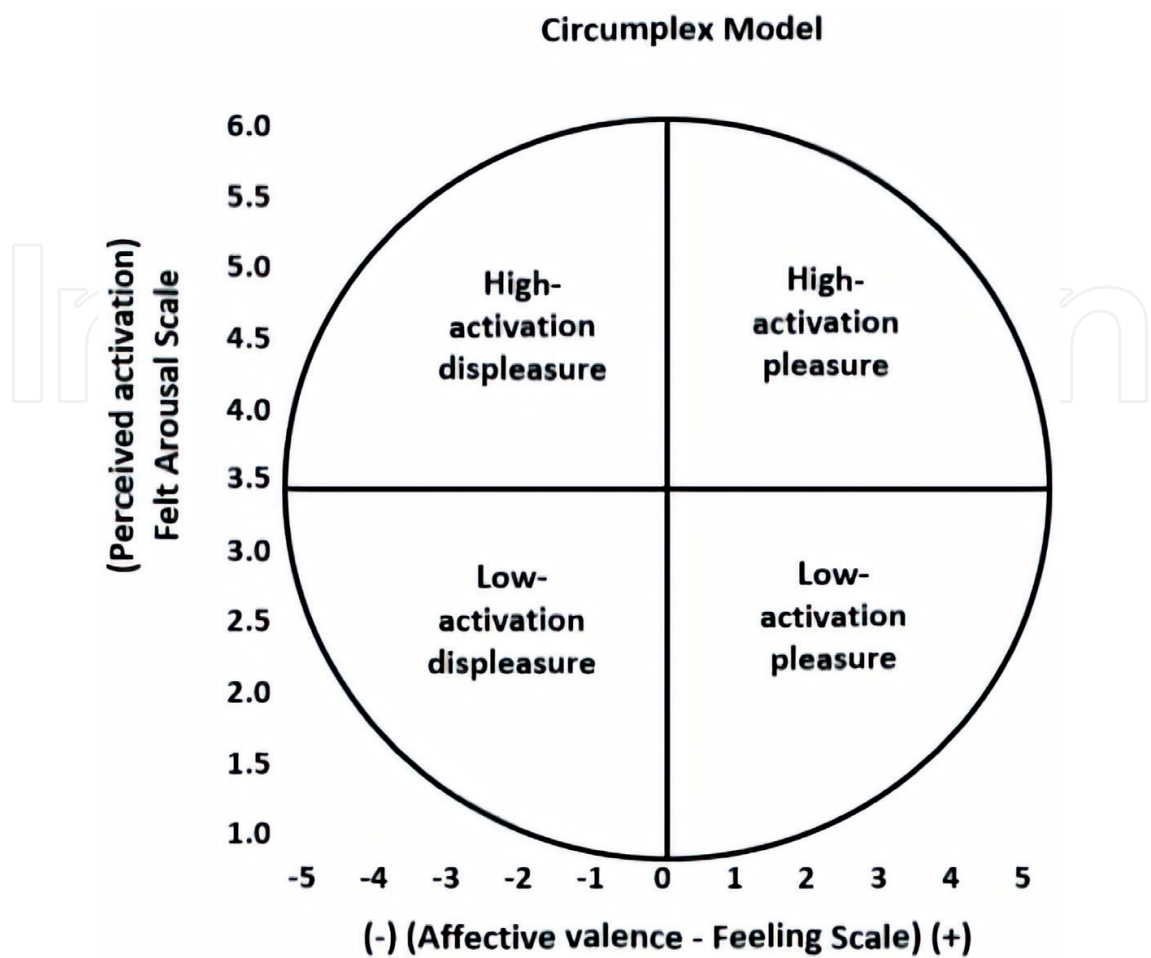


**Figure 1.** Feeling scale.



**Figure 2.** Felt arousal scale.

The circumplex model measures affect from a two-dimensional model, which involves an affective valence dimension (also called pleasure-displeasure) and a perceived activation dimension (also called arousal) [6, 9]. The use of the circumplex model in exercise is



**Figure 3.** Circumplex model of affect (adapted [5]).

intended to avoid measuring affect with terms such as anxiety, depression, and various mood descriptions and to provide a map of affect in the broad context of exercise (before, during, and after activity) [10].

In the circumplex model (**Figure 3**), the horizontal dimension represents the affective valence (pleasure-displeasure), and the vertical dimension represents the perceived activation. Affective spaces are divided into four quadrants: quadrant 1 corresponds to a sense of high activation and displeasure (tension, nervousness, distress); quadrant 2 corresponds to a sense of high activation and pleasure (energy, excitement, vigor); quadrant 3 corresponds to a sense of low activation and displeasure (fatigue, boredom, tiredness); quadrant 4 corresponds to a sense of low activation and pleasure (tranquility, relaxation, calmness) [5, 6, 10].

Several studies using dimensional models of affect have verified the importance of measuring affective responses in exercise, as well as the factors that may influence this relationship [11–13].

### 3. Affective responses in exercise

The relationship between exercise and affective response is complex and multifaceted [2]. Although many studies relate exercise to affect as a single phenomenon, there is evidence that considerable complexity lies beneath this factor. This complexity is based on the nature of the affective changes and patterns in their relationship with relevant variables, such as contextual factors (exercise scenario), exercise stimulus aspects (intensity), and individual differences (physical activity level) [2, 14]. These factors may influence affective responses during exercise.

Affective valence, based on observations in neuroscience, has shown that negative affect is one of the first signs of conscious and significant changes in energy regulation and body balance [15, 16]. Neuroanatomical and neurophysiological studies suggest that interoceptive stimuli of afferent signals from baroreceptors, chemoreceptors, and mechanoreceptors located in the viscera and muscles are linked to affective responses [17]. This hypothesis suggests that changes in the transition between aerobic and anaerobic metabolism during exercise would be accompanied by unpleasant affective responses [17].

One of the main determinants of affective responses during exercise is the intensity at which the activity is performed [18]. According to the dual model theory [2], the ventilatory threshold (VT) or lactate threshold functions as a marker of exercise intensity [19–22], demonstrating that, at prescribed intensities below or around the VT, affective responses maintain a positive predominance. However, during exercise at VT, the affective valence is less pleasant and, in some cases, negative [19, 20, 22, 23]. An important aspect of intensities below or near the VT is the great variability of affective responses between individuals, in whom exercise can increase, decrease, or stabilize affective responses of pleasure. However, above VT, individual variations are smaller, and, generally, a decline in pleasure is experienced [22].

According to Dishman [24], feelings of pleasure and well-being appear to be the most compelling reasons for continued participation in an exercise program, rather than the knowledge of or belief in the health benefits of physical activity. The idea of exercise giving pleasure may indicate its usefulness to the individual, whereas discomfort indicates damage or danger [20]. The variability in affective responses may be an indication that the situation is providing substantial benefit or imminent danger. However, whenever all or most individuals respond in a similar way, with pleasure or displeasure (within a reasonable quantitative range), it can be assumed that the situation is one that has consistent (positive or negative) implications for change [20].

### 4. Exercise intensity and affective responses

Exercise intensity is an important factor in exercise prescription [12, 25]. Performing 30 minutes of moderate-intensity exercise, i.e., 64–76% of maximum heart rate ( $HR_{max}$ ) (at least

5 days a week), or 20 minutes of vigorous intensity, i.e., 77–95% of  $HR_{max}$  (3 days a week), is the minimum recommendations proposed by the American College of Sports Medicine (ACSM) for health-related physiological benefits (ACSM, 2011). Studies published in recent decades have shown that exercise intensity is also one of the main influencers of affective exercise response [5, 26–28].

In a study by Vandoni [25], which compared the affective responses of exercise performed at moderate and vigorous intensities, the results showed that vigorous exercise promoted lower affective responses than moderate exercise. Alves [29], when observing weight training in elderly women, found higher affective pleasure responses in exercises performed with a low one-repetition maximum (1RM) percentage (35%) in relation to higher intensities (50% and 70% 1RM). Follador [30] observed that, even in moderately active adults, high-intensity protocols promoted less pleasure responses, and protocols prescribing maximal or supra-maximal intensities were the most likely to stimulate the affective response of displeasure and probably have the highest negative impact on exercise program adherence.

The relevance of affective responses in the exercise program should be to prioritize the task response over the postexercise response [31]. Studies have shown that, when exercise intensity exceeds the VT, there is a decrease in affective response and this change has a greater impact on the future behavior of maintaining exercise continuity than the affective responses obtained after exercise [31, 32]. However, the difficulty and complexity of conducting medium- to long-term studies have not facilitated much investigation into adherence to exercise programs. Parfitt [28] verified the 6-month effect on physical fitness and affective responses of sedentary people after an 8-week intervention program. Three groups participated in the training: a control group, a group that exercised in PSE 13 (Borg 06–20), and group in PSE 15. Their results show that the group that performed the training at a lower intensity (PSE 13) showed more positive affective responses during the intervention, maintaining the level of physical fitness acquired during training, in relation to the control and PSE 15 groups. In the study by Perri [33], which aimed to observed the relationship between intensity, frequency, and adherence to exercise over 6 months, the results showed that exercise prescription of moderate intensity produced greater exercise adherence (66 vs. 58%) than exercise prescription of higher intensity.

#### 4.1. Affective responses and self-selected intensity

A self-selected intensity exercise is an activity in which the participant chooses the preferred intensity [34]. For beginners, exercise at intensities above the anaerobic/VT may provide affective responses of displeasure and stimulate changes in exercise intensity toward self-selected intensities. In this sense, beginners of exercise programs seek lower perceptions of effort and greater affective pleasure responses [35].

Motivational aspects related to the practice of exercise have been investigated using behavioral theories. To better understand the factors leading to the permanence, or dropout, of beginners of exercise programs, the hedonic theory and the self-determination theory have been important in understanding self-selected exercise [36–38].

The hedonic theory of motivation suggests that when one experiences a situation that promotes pleasure, joy, or fun, one will seek to repeat that activity. However, if the situation

induces displeasure, pain, or discomfort, the chance of adherence or repetition of the activity is lower [37, 39]. The self-determination theory is a general theory of human motivation that prioritizes autonomous aspects of behavior over controlled ones. Its emphasis is on providing a sense of granted autonomy and can promote a pleasant, self-gratifying feeling and greater intrinsic motivation [36, 39, 40]. The sense of autonomy and positive feelings forms the fundamental aspects of self-selected exercise.

The psychological elements of behavioral theories are linked to the physiological components of effort. Lower-intensity activities are inversely correlated with feelings of displeasure and, consequently, with adherence [34]. However, the duration of activity may also be related to displeasure, with shorter duration exercises being more conducive to adherence than very long activities [39, 41].

Self-selected intensity exercise has been proposed by several authors as a strategy to improve the participation and adherence of physical activity programs by sedentary people [3, 34]. Studies have shown that insufficiently active people are able to self-select an exercise intensity according to the ACSM parameters for maintaining and/or developing cardiorespiratory fitness, associated with lower exertion perceptions and positive affective responses [27, 28, 42]. Although some studies have addressed the fact that affective responses are more dependent on exercise intensity than on how it is prescribed (imposed or self-selected exercise) [43, 44], other studies point out that, even when the exercise session is prescribed at the same intensity as the self-selected exercise session, the affective responses may be different. Hamlyn-Williams [45] observed that aerobic exercise lowers perceptual responses and affective responses are higher during self-selected intensity than during imposed intensity. Similar results were observed in the study by Da Silva [46] on resistance training, in which three of the four exercises used in the study had lower perceptual responses, and all exercises showed higher affective responses for self-selected intensity.

In intervention studies, self-selected intensity has been shown to be an excellent strategy to provide similar or more pleasurable affective responses than imposed intensity exercises [47]. In the study by Freitas [27], which compared walking exercise programs at self-selected and imposed intensities (10% above VT) over 12 weeks of training, the results showed that self-selected exercise induced more pleasurable affective responses, where the percentage of HR and PSE responses were lower than in the imposed exercise regime. In addition, walking at a self-selected intensity was sufficient to promote improvement in maximal oxygen uptake at the end of training. Yang [48] concluded, from a 12-week study, that both self-selected and prescribed intensities improved the level of physical activity and positive affect and reduced physiological parameters (waist circumference, systolic and diastolic blood pressure) in retirees. However, the self-selected intensity was more favorable to the increase of positive affect than the prescribed intensity.

## 5. Influence of music on affective exercise responses

The evolution of technology in recent decades has provided facilities and amenities that were difficult or restricted to access in the past. Music has benefited in this respect, and with the

creation and evolution of smartphones, headphones, MP3 players, and the Internet, access to music content of different styles and from various countries has become easier and more commonplace, and the technology has increased our capacity to transport music [3]. Nowadays, people have become more accustomed to listening to music during their various daily activities, such as walking in the park, commuting, doing homework, exercising at the gym, and leisure times [3].

In sport and exercise, music has been used for the purpose of improving performance, reducing the monotony of the activity, or as a musical background [49, 50]. Music can improve mood and emotion, reduce the perception of effort, dissociate from pain and fatigue, etc. The psychophysiological responses of music are supported by four pillars: rhythmic response, musicality, cultural impact, and association [50].

The rhythmic response represents the natural response to musical rhythm, which refers to the speed of music in beats per minute. Musicality refers to related elements such as pitch and harmony. Cultural impact is the representativeness of music to society or a cultural group. Association is the extramusical reflection that music can promote. These four factors are presented in their hierarchical order, so that there is a greater importance conferred on musical rhythm and less importance on association [49, 51]. In this sense, the use of motivational music is thought to be an important strategy in exercise for promoting acute and chronic benefits and assisting in exercise adherence [49].

Motivational music can be defined as stimulating music with a fast musical tempo and prominent beat. Studies that have investigated the acute effects of music on exercise have demonstrated the psychological and physiological influences on different populations [52, 53]. In diabetic patients, the practice of exercise with music provided greater affective responses than exercise without music [54]. In Silva's research [55], motivational music provided a greater shift of focus from feelings of discomfort and effort than when exercise was performed without music in overweight and obese women. Macone [56] found positive changes in young adults in tension, depression, mood, confusion, and fatigue and improved running performance with motivational music compared to no music. Finally, music performs different functions in the context of exercise, and its action on motivational and dissociative aspects can affect psychophysiological factors and promote a positive and enjoyable experience during physical activity.

## 6. Discussion

The definitions of the terms "affect," "humor," and "emotion," from a perspective that allows us to analyze their differences, are fundamental for the evolution of understanding "affect" and its application in exercise—a fact that has enabled researchers and other professionals to focus on observing "affect" from a categorical or dimensional perspective [1, 2]. In the field of exercise science, dimensional vision has allowed the appropriation and adaptation of instruments of affect measurement to be more appropriate to the context of the area, contributing to the growth of research, the comparison between studies, and the development of the field [32].

The observation of affective responses before, during, and after exercise does not replace the prescription and observation of exercise-related physiological and perceived exertion responses, but their interrelated aspects complement the importance of the psychological and physiological benefits derived from regular practice [42]. The analysis of the relationship between intensity and affective responses has challenged exercise science to investigate exercise prescription strategies that provide pleasurable sensations and achieve appropriate physiological parameters for health benefits, as well as strategies for making exercises that require a higher physiological stimulus more enjoyable [39, 55, 57].

Prescribing exercise at a self-selected intensity was one of the possibilities that emerged in order to make exercise practice more enjoyable for sedentary individuals and beginners [39]. Investigations in this area present important results, with several limitations, such as reaching physiological stimuli beyond the ventilatory threshold [2, 57]. The use of music reaches broader parameters in the context of affective responses, stimulating positive changes from its rhythmic and cultural elements, as well as dissociating feelings of discomfort arising from exercise [47, 58]. Thus, the effects of music, according to its specificities, may provide benefits independent of the intensity or mode of prescription.

Using physical exercise as a nonpharmacological tool in disease prevention and treatment is a reality that tends to increase in the coming years; thus, the importance of understanding the affect-exercise relationship and its challenges will help in adhering to and, consequently, in obtaining the physiological and the psychological benefits from regular exercise.

## 7. Conclusions

Understanding affect from a dimensional perspective provides a broader view of the affect-exercise relationship. Although affect is understood to be a complex phenomenon, exercise intensity seems to be one of the main determinants of its quality and quantity. Selecting an appropriate exercise prescription mode and musical stimulation can also induce a more pleasurable affective experience and assist in the consistent adherence to exercise programs.

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