

VASCO ALAMBRE BASTOS

**RESPOSTA AFETIVA E TREINO COM RESISTÊNCIA: UMA
EXPLORAÇÃO BASEADA EM PRESSUPOSTOS HEDÓNICOS**

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Universidade Lusófona de Humanidades e Tecnologias

Faculdade de Educação Física e Desporto

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Dissertação defendida em provas públicas para a obtenção do grau de Mestre no Curso de Mestrado em Exercício e Bem-Estar, ramo Exercício, Nutrição e Saúde, conferido pela Universidade Lusófona de Humanidades e Tecnologias, no dia 26 de outubro de 2022, perante o júri, com o Despacho de Nomeação nº 283/2022, de 23 de setembro de 2022, com a seguinte composição:

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Universidade Lusófona de Humanidades e Tecnologias

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Agradecimentos

What is the fruit of these teachings? Only the most beautiful and proper harvest of the truly educated: tranquility, fearlessness, and freedom.

We should not trust the masses who say only the free can be educated, but rather the lovers of wisdom who say that only the educated are free.

Epictetus

Esta dissertação representa o meu primeiro trabalho académico e a fase mais recente do que tem sido o meu percurso no ensino superior. Após obter a minha cédula profissional por vias não académicas para trabalhar na área do exercício e saúde, não tinha qualquer razão aparente (e.g., financeira; progressão de carreira) para avançar para um curso superior. No entanto, rapidamente me senti perdido nas muitas opiniões e informações contraditórias que circulam nesta área e sem saber como continuar a melhorar a minha prática. Agora, ironicamente, a minha percepção de conhecimento é mais reduzida mas o caminho é muito mais claro e o desenvolvimento pessoal e profissional que obtive são inegáveis. Nada disto seria possível sem o apoio da minha mulher, dos meus pais e do meu irmão. Existem um número infindável de agradecimentos que poderia escrever aqui, mas não seriam suficientes.

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estudo foi imprescindível. Aproveitando a deixa, quero agradecer a todos os participantes que fizeram este trabalho possível e especialmente ao *People Family Club* por o autorizar e por elevar a fasquia da qualidade de serviço numa área em que muitas vezes tais preocupações são descartadas em prol de faturação a curto prazo. Se mais ginásios e health clubs começarem a seguir este exemplo, a nossa área poderá começar a ganhar a credibilidade necessária para ter um papel de relevo na saúde pública do nosso país.

Gostaria de dedicar esta dissertação ao meus avós: Fernanda, João, Manuela e Sérgio, por me transmitirem os valores e virtudes pelos quais tento guiar a minha vida e por me terem sempre encorajado a ser melhor.

Resumo Geral

Objectivo. O treino resistente (TR) providência inúmeros benefícios para a saúde e como tal é relevante para a saúde pública. No entanto, os principais locais de prática continuam a sofrer altas taxas de desistência, e os dados relativos à prática de exercício numa parte significativa da população mundial mostra que a maioria das pessoas leva uma vida com elevado comportamento sedentário, tornando o desenvolvimento de estratégias para a manutenção da prática de exercício de extrema importância. Uma abordagem para este problema poderá assentar na resposta afetiva ao exercício. Baseada em princípios hedónicos, a evidência sugere que o ser humano tende a desempenhar atividades que considera prazerosas enquanto evita a dor e o desprazer. Nesta abordagem, a *Feeling Scale* (FS) e a *Felt Arousal Scale* (FAS) têm sido extensivamente utilizadas na literatura para medir a dinâmica afetiva de uma sessão de treino. No entanto, a literatura atual sobre a resposta afetiva ao TR é ainda preliminar, com mais investigação a ser necessária para esclarecer questões metodológicas na sua medição e em como promover programas de TR mais prazerosos e sustentados no tempo. Como tal, o objectivo desta dissertação de mestrado consistiu em explorar a relação da resposta afetiva em dinâmicas de TR, particularmente num dos seus contextos ecológicos mais frequentes, os ginásios e *health clubs*.

Método. De modo a cumprir este objectivo, foram realizados dois estudos: uma revisão sistemática da literatura e um estudo quasi-experimental. Na revisão, uma pesquisa da literatura foi realizada com o objectivo de analisar como a FS e/ou a FAS têm sido aplicadas na medição e aferição da resposta afetiva no TR. A sua viabilidade, *timing* de aplicação, e implicações para a medição da resposta afetiva foram o foco desta análise, permitindo apresentar recomendações para a sua aplicação

tanto em situações de vida real como em investigações futuras. No segundo estudo, um programa de TR foi desenvolvido e aplicado a praticantes de exercício, com um desenho quasi-experimental, com o objectivo de: (1) explorar a dinâmica da resposta afetiva através da sua contínua avaliação depois da última série de cada exercício, prescrito até à falha muscular; e (2) analisar possíveis diferenças entre perfis de preferência e tolerância da intensidade em variáveis afetivas (*core affect* e divertimento). Para esse efeito, um total de 43 participantes foram recrutados em dois *health clubs* na zona de Lisboa. Estatística descritiva, análises correlacionais e ANOVAS de medidas repetidas, assim como vários testes não paramétricos, foram realizadas para testagem das hipóteses em estudo.

Resultados. Após uma meticulosa pesquisa em três diferentes bases de dados, um total de 26 estudos foram incluídos e qualitativamente analisados na revisão sistemática. Os resultados indicam que ambas as escalas foram eficazes na medição do *core affect* dentro de uma ampla variedade de intensidades, idades, equipamentos e em ambos os géneros. No entanto, problemas metodológicos, falta de parametrização e uma heterogeneidade geral nos protocolos aplicados foi detetada na maioria dos estudos, podendo assim enviesar resultados e limitar a sua interpretação. O segundo estudo demonstrou que a aplicação da FS/FAS imediatamente após uma série representa uma abordagem viável e ecologicamente válida de medir o *core affect*. Em praticantes regulares de exercício, uma única medição numa sessão de TR parece ser suficiente para compreender a sua resposta afetiva, salvaguardando-se vários casos onde mais medições poderão permitir uma interpretação mais detalhada. Foi possível ainda verificar que indivíduos com perfis de preferência e tolerância diferentes apresentaram respostas afetivas distintas. Em geral, perfis mais elevados nestas

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variáveis apresentavam respostas afetivas mais positivas, suportando as hipóteses previamente definidas.

Conclusão. De forma geral, a FS e a FAS são escalas viáveis e úteis na medição da resposta afetiva no TR, disponibilizando informação mais rica e detalhada quando cruzadas no modelo circumplexo de afetos. Adicionalmente, uma medição *imediatamente após* uma série parece ser uma abordagem viável e ecologicamente válida de medir o *core affect*.

Palavras-chave: Treino resistente; afeto; feeling scale; felt arousal scale; exercício.

Abstract

Purpose. Resistance training (RT) provides many health benefits and, as such, it is of relevance for public health. However, like other forms of exercise, RT suffers from high dropout rates, making the development of effective exercise adherence strategies paramount. One approach to this problem relies on the affective response to exercise. Grounded in hedonic principles, evidence suggests people tend to perform activities they consider pleasurable while simultaneously avoiding pain and displeasure. In this approach, the Feeling Scale (FS) and the Felt Arousal Scale (FAS) have been extensively used in the literature to assess the affective dynamics of an exercise session. However, the literature on the affective response for RT is still preliminary with further investigation being paramount to clarify methodological issues on its measurement and to better understand how to promote more pleasurable and sustained RT programs. As such, the objective of this masters' dissertation is to explore the affective response in RT dynamics, particularly in one of its most common ecological settings, gyms and health clubs.

Method. In order to accomplish this objective, two studies were conducted: a systematic review of the literature and a quasi-experimental study. In the review, a literature search was conducted with the purpose of analyzing how the FS and/or the FAS have been applied for affective response measurement in RT. The feasibility, timing of application, and implications for the measurement of affective response in RT were the focal points of this analysis, with the objective of presenting recommendations for real-life application and future research alike. In the second study, a RT program was developed and applied to recreational exercisers in a quasi-experimental design aiming to: (1) explore the affective response dynamic through a continuous assessment after the last set of each exercise, prescribed to muscle failure;

and (2) analyze possible differences of preference and tolerance profiles in affective variables (core affect and enjoyment). A total of 43 participants were recruited in two health clubs in Lisbon. Descriptive statistics, correlational analyses, repeated measures ANOVA, and several non-parametric tests were conducted for all studied variables. Additionally, further statistical analyses were conducted to test the study's hypothesis.

Results. After a meticulous search in three different databases, a total of 26 studies were included and qualitatively analyzed in the systematic review. Results indicate that both scales were able to detect core affect within a wide array of intensities, ages, equipment, and in both genders. However, methodological issues, lack of parameterization, and protocols heterogeneity were detected in the majority of the studies, which could bias some results and limit interpretation. The second study showed that applying the FS/FAS immediately after a set represents a feasible and ecologically valid approach to tap core affect. In recreationally trained exercisers, a single measurement appears to be enough to assess the affective response, but with various scenarios existing where further measurements can potentially allow for a more rich interpretation. Results also suggest that individuals with different profiles of preference and tolerance present distinct affective responses. In general higher profiles for these variables present more positive affective responses, thus supporting the study's hypothesis.

Conclusion. Overall the FS/FAS are feasible and useful in assessing affective response in RT, providing a more fine-grained differentiation of different affective states when used to plot the circumplex model of affect. Furthermore, a measurement immediately after the final set in each RT exercise represents a feasible and ecologically valid approach to tap core..

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Keywords: Resistance training; affect; feeling scale; felt arousal scale; exercise.

Abreviaturas e siglas

1-RM – One Repetition Maximum

ACSM – American College of Sports and Medicine

AHBF – Affective Health and Behavior Framework

BMI – Body Mass Index

EC – European Commission

FAS – Felt Arousal Scale

FS – Feeling Scale

NSCA – National Strength and Conditioning Association

PA – Physical Activity

PRETTIE-Q-PT – Preference for and Tolerance of the Intensity of Exercise Questionnaire Portuguese Version

RIR – Repetitions in Reserve

RPE – Rating of Perceived Exertion

RT – Resistance Training

RT FAS – Resistance Training Felt Arousal Scale

RT FS – Resistance Training Feeling Scale

WHO – World Health Organization

Introdução Geral

Como técnico de exercício físico, tive sempre como objectivo ter uma prática baseada na evidência. Como tal, a minha necessidade de uma base para esta prática levou-me à procura de mais conhecimento tanto na fisiologia (i.e., obter uma maior eficiência na abordagem personalizada às necessidades e objectivos das pessoas) como na psicologia do exercício (i.e., adesão à prática de exercício). Foi este último aspeto que me levou a investir neste mestrado e consequentemente neste tema para a minha dissertação. Para além do conhecimento adquirido, a possibilidade de poder dar um pequeno contributo à investigação sobre a adesão continuada ao exercício é uma tarefa que considero prazerosa, particularmente numa forma de exercício que sempre foi do meu agrado: o treino resistente (TR).

O TR é uma forma de exercício que proporciona benefícios consideráveis para a saúde, como a redução do risco de doença cardiovascular, de diabetes, cancro e de mortalidade no geral, a servirem como bons exemplos (American College of Sports Medicine, 2021; Momma et al., 2022). Para além destes benefícios, o TR desempenha um papel particularmente fundamental na prevenção da osteoporose e sarcopenia, e ainda na reversão de fatores específicos do envelhecimento muscular (Schoenfeld, 2020; Westcott, 2012). No entanto, os níveis de comportamento sedentário mantêm-se altos na população mundial (World Health Organization, 2020), com a falta de motivação a ser apontada como uma das principais razões para a não realização de atividade física regular (European Commission, 2018). Da mesma forma, ginásios e *health clubs* (locais onde TR é tipicamente desenvolvido) reportam taxas de desistência elevadas (Buckworth et al., 2013; Sperandei et al., 2016). Perante este cenário tão indesejável para a saúde pública, são necessárias abordagens de mudança

comportamental que mantenham a população mundial motivada e a cumprir o seu programa de TR.

A abordagem hedónica na adesão ao exercício

Uma abordagem a este problema que tem merecido uma maior atenção na investigação relaciona-se com a compreensão dos afetos (Duke et al., 2021). Baseado em princípios hedônicos, o ‘*affectivism*’ (i.e., o estudo do afeto) postula que o ser humano tende a desempenhar atividades que considera prazerosas, enquanto evita aquelas em que sente desprazer e dor. Na investigação da resposta afetiva ao exercício, o *core affect* (i.e., um sentimento elementar não refletido mas conscientemente disponível; valência afetiva e ativação) tem sido destacado como a variável mais importante na adesão ao exercício por alguns dos modelos teóricos mais importantes (e.g., *Affect and Health Behaviour Framework*, Williams & Evans, 2014; Stevens et al., 2020). Como exemplo, Williams et al. (2008) demonstrou um valor preditivo entre uma resposta afetiva mais prazerosa durante o treino e a adesão ao exercício 6 e 12 meses após. Similarmente, a revisão de Rhodes & Kates (2015) mostrou associações positivas entre a resposta afetiva durante o treino e a manutenção de comportamento relacionado com atividade física. Neste mesmo sentido, investigação mais recente tem vindo a demonstrar que os afetos e outras variáveis dependentes dos afetos (e.g., divertimento; atitudes afetivas) demonstram algum valor preditivo relevante (Calder, Hargreaves, & Hodge, 2020; Chen, Finne, Kopp, & Jekauc, 2020; Teixeira et al., 2022).

A influência da intensidade na resposta afetiva

Na prescrição de exercício, a intensidade parece ser a variável de maior relevo na resposta afetiva, onde intensidades mais elevadas geralmente promovem respostas afetivas menos positivas ou mesmo desprazer (Ekkekakis et al., 2011; Stevens et al.,

2020). No entanto esta relação não é linear, sendo caracterizada por alguma interindividualidade. Por exemplo, nas atividades aeróbias as intensidades abaixo do limiar ventilatório resultam geralmente em respostas afetivas positivas, tal como intensidades acima do ponto de compensação respiratório resultam em decréscimos na resposta afetiva que tipicamente atingem o desprazer. É entre estes dois limiares fisiológicos que indivíduos diferentes apresentam respostas afetivas distintas (e.g., decréscimos mais perto de um limiar ou do outro; magnitude do decréscimo) (Ekkekakis et al., 2004, 2008; Ladwig et al., 2017). Isto implica que para uma mesma intensidade entre estes dois pontos, um indivíduo possa estar a sentir prazer e outro indivíduo a sentir desprazer. Em relação ao TR, alguma evidência mostra também um aumento generalizado de prazer até ao intervalo de 70-80% 1-RM, a partir do qual poderemos voltar a encontrar alguma interindividualidade na resposta (Andrade et al., 2022; Portugal et al., 2015).

Estas diferenças entre indivíduos poderão ser parcialmente explicadas por dois traços de personalidade: preferência (i.e., predisposição para selecionar uma dada intensidade, quando dada essa opção) e tolerância (i.e., capacidade de continuar o exercício a uma intensidade imposta, mesmo sentindo desprazer) pela intensidade do exercício (Ekkekakis et al., 2005a). Testando a influência destes traços na resposta afetiva, Box & Petruzzello (2020) reportaram que indivíduos com preferência por intensidades mais vigorosas tiveram uma resposta afetiva mais positiva num treino em circuito de alta intensidade. Similarmente, Bradley, Niven & Philips (2019) reportaram que indivíduos com tolerância por intensidades mais elevadas sentiram mais prazer num treino intervalado de alta intensidade, enquanto que os participantes com tolerância por intensidades mais baixas tiveram uma resposta menos positiva, chegando mesmo a sentir desprazer. Face a esta base teórica e a estudos recentes que

demonstram uma relação entre estes traços e frequência de treino, intenção e hábito (Teixeira et al., 2021, 2022), uma prescrição que tenha em consideração a preferência e tolerância por intensidade de um indivíduo deverá promover uma experiência mais prazerosa.

Medição da resposta afetiva no TR

A resposta afetiva ao exercício pode ser avaliada através da medição das duas dimensões do *core affect*: a valência afetiva (i.e., percepção de prazer-desprazer) e a ativação (Ekkekakis et al., 2011, 2013). Com o objectivo de medir estes constructos, a *Feeling Scale* (FS; Hardy & Rejeski, 1989) e a *Felt Arousal Scale* (FAS; Svebaj & Murgatroyd, 1985), têm sido extensivamente usadas na literatura (Evmenenko & Teixeira, 2020). Estas escalas podem ser cruzadas para formar o modelo circunplexo de afetos (Ekkekakis et al., 2011; Ekkekakis, 2013; Russell, 1980) para melhor compreender a resposta afetiva em toda a sessão de treino ou num momento em específico. Através desta análise, podem ser efetuados ajustes visando a promoção de uma experiência mais prazerosa e, conseqüentemente, reduzir a probabilidade de desistência (Evmenenko & Teixeira, 2020).

A medição da resposta afetiva é recomendada em diretrizes de exercício à mais de uma década (Garber et al., 2011). No entanto, a falta de recomendações sobre como e quando realizar estas medições tem resistido à passagem do tempo. Estas limitações são particularmente claras no TR, com a maior parte da literatura a focar-se em atividades aeróbias (Evmenenko & Teixeira, 2020). Na sua revisão, Evmenenko & Teixeira (2020) reportaram a falta de standardização no *timing* (i.e., quando), na frequência (i.e., quantas vezes), e no treino (i.e., pelos investigadores e participantes) na aplicação da FS e da FAS, como as três mais relevantes limitações na medição da resposta afetiva no TR. Face a estas consideráveis limitações, é fulcral reduzir

inconsistências e criar recomendações para a medição da resposta afetiva no TR (Cavarretta et al., 2019; Emanuel et al., 2020; Evmenenko & Teixeira, 2020).

Com base nas atuais limitações da literatura, o principal objectivo desta dissertação consiste em explorar a variação da resposta afetiva em dinâmicas de TR, particularmente num dos seus contextos ecológicos mais comuns, ginásios e *health clubs*. Através desta exploração pretendemos fornecer recomendações que permitam uma maior robustez metodológica em investigação futura. Este trabalho contém dois estudos que, em conjunto, procuram cumprir este objectivo.

O primeiro manuscrito é uma revisão sistemática da literatura que tem como objectivo analisar de que forma a FS e/ou a FAS têm sido aplicadas no TR para medir as duas dimensões do *core affect*, valência afetiva e ativação. Esta análise teve como principais focos a viabilidade destas escalas, o seu *timing* de aplicação, e implicações metodológicas para a avaliação da resposta afetiva no TR. Simultaneamente, esta revisão permitiu criar suporte teórico e conceptual para o protocolo do segundo estudo desta dissertação. Este estudo desenvolveu uma intervenção quasi-experimental com dois objectivos: (1) explorar a variação da resposta afetiva numa sessão de TR prescrita para atingir a falha muscular concêntrica; e (2) analisar o *core affect* e o divertimento em diferentes perfis de preferência e tolerância pela intensidade

Com este trabalho espera-se contribuir para uma melhor compreensão sobre como medir a resposta afetiva no TR, e consequentemente contribuir para a promoção de uma prática de exercício mais sustentada.

Chapter 1. Affective Valence and Activation in Resistance Training: A Systematic Review*

* Manuscript currently in revision on an international peer review journal

1.1. Abstract

Resistance training is one of the most common exercise practices worldwide, and present relevant contributions for one's health. However, and as in other exercise modes, it suffers from adherence and dropout issues. Considering that the affective response to exercise has shown some promise to the exercise adherence problem, understanding how to assess core affect in this exercise modality is paramount.

As such, the objective of this systematic review is to analyze core affect measurements with the Feeling Scale (FS) and/or the Felt Arousal Scale (FAS) in RT.

A search was conducted on PubMed, SPORTDiscus, and PsycINFO databases (last search data May 2022) following PRISMA guidelines. A total of 26 empirical studies published between 2009 and 2022 were qualitatively analyzed.

Results indicate that both scales were able to detect core affect within a wide array of intensities, ages, equipment, and in both genders. Several methodological issues, lack of parameterization, and protocols heterogeneity were detected which could bias some results and limit interpretation. In general, measuring core affect with the FS, FAS, or both, seems feasible and useful, but theoretically inconsistent assessment procedures were detected in the majority of the studies. Considerations regarding the ecological validity of such measures are explored given the present results.

Keywords: Resistance training; affect; feeling scale; felt arousal scale; exercise.

1.2. Introduction

Resistance Training (RT) is a form of exercise that promotes a plethora of health benefits, ranging from a lower risk of cardiovascular disease, diabetes, total cancer and all-cause mortality (ACSM, 2021; Momma et al., 2022), to playing a critical part in osteoporosis and sarcopenia prevention, and reversing specific aging factors in skeletal muscle (Schoenfeld, 2020; Westcott, 2012). With such relevant benefits, a callout for a greater emphasis in RT research for the public health domain has been made (Steele et al., 2017). However, most of the world's population indulges in a sedentary lifestyle (World Health Organization, 2020), with lack of motivation ranking as the main motive for not engaging in such activities (Europe Commission, 2018). Thus, the implementation of effective behavior change techniques that help individuals to be motivated and enrolled in RT, and exercise as a whole, is paramount.

The role of affect in exercise adherence

An approach to bridge the “intention-behavior” gap that has been on the receiving end of a greater focus in psychological research is affect (Duke et al., 2021). Grounded in hedonic principles, the ‘affectivism’ (i.e., the study of affect) postulates that people tend to engage in activities they consider pleasurable, while avoiding those they feel pain and displeasure. Accordingly, several studies have shown that affect and affective dependent variables (e.g., anticipated affective response to exercise; affective attitude) demonstrate some predictive value to exercise adherence related variables (e.g., habit, intention, frequency), and could help expand current theoretical models of exercise behavior (Calder, Hargreaves, & Hodge, 2020; Chen, Finne, Kopp, & Jekauc, 2020; Teixeira et al., 2022; Williams et al., 2008). In the Affect and Health Behavior Framework (AHBF, Williams & Evans, 2014; Stevens et al., 2020) emphasis is given to the affective response to exercise as a

determinant in the sustainability of such behavior. As suggested, core affect (i.e., an elementary non-reflective feeling consciously available) is the most important aspect of the affective response to exercise and has shown to be a reliable predictor of exercise adherence. The affective response to physical activity (PA) should be measured during or immediately after the activity, since it can only be experienced *in vivo* (Ekkekakis et al., 2011; Stevens et al., 2020), which may be difficult (e.g., ecological validity) given the dynamics of some activities (e.g., RT).

Notwithstanding, some advancements in these assessments have been made, but still, several methodological clarifications for proper use and interpretation are in need (Evmenenko & Teixeira, 2020).

The affective dynamics in a given exercise session can be evaluated through the measurement of two core affect dimensions: affective valence (perceived pleasure-displeasure) and arousal (perceived activation) (Ekkekakis et al., 2011; Ekkekakis, 2013). With the purpose of measuring these constructs, the Feeling Scale (FS; Hardy & Rejeski, 1989) and the Felt Arousal Scale (FAS; Svebaj & Murgatroyd, 1985), respectively, have been developed and used extensively in the exercise setting (Evmenenko & Teixeira, 2020). Both scales can be used in conjunction to form a circumplex model of affect (for a review see Ekkekakis et al., 2013; Ekkekakis et al., 2011; Russell, 1980) and map affective fluctuations throughout an exercise session. This relevant information allows for in-session adjustments that can be used to promote a more pleasurable exercise experience, thus helping to address exercise dropout and engagement (Evmenenko & Teixeira, 2020).

Assessing core affect in resistance training

Exercise guidelines first recommended the measure of the affective response (e.g., with the FS) to exercise over a decade ago (Garber et al., 2011). Fast-forward to

the latest edition of the ACSM's guidelines for exercise prescription, and such recommendations are still present in the form of '*affect regulation*' (ACSM, 2021; p. 455). However, how to effectively *regulate* affect in exercise prescription (i.e., operationally; how and when to make the necessary adjustments) is a gap that has persisted. This is particularly clear for RT, as seen in a recent review on the topic (Evmenenko & Teixeira, 2020). While most research have focused in aerobic activities, other modes still lack evidence regarding methodological and operational applications and interpretations.

One important limitation in RT concerns the timing of application (i.e., when) (Andrade et al., 2022; Evmenenko & Teixeira, 2020). In their review, Evmenenko & Teixeira (2020) reported that no apparent timing standardization exists in the RT studies that plotted the circumplex model of affect. In fact, timing of assessment is of concern due to a possible “affective rebound” phenomenon (i.e., improvement of the affective response after exercise termination) that has been documented in aerobic activities (Ekkekakis et al., 2011), as well as in some of the limited body of evidence that has emerged from RT (Cavarretta et al., 2019; Emanuel et al., 2020; Hutchinson et al., 2021) which may lead to biased results, and thus, an assessment of something other than core affect.

Alongside, the frequency of FS/FAS application for an adequate affective interpretation is another concern that remains vastly unexplored in RT (Evmenenko & Teixeira, 2020). As suggested by Haile et al. (2015) and Zenko & Ladwig (2021), measurements should be applied at regular intervals in order to effectively assess an exerciser's affective response, while simultaneously avoiding the burden of excessive assessments. It is proposed that this balance is influenced by several variables (e.g., experience, exercise mode, health status), making the frequency of measurement an

important aspect in the contextual application of these scales. However, no clear indication in literature or exercise guidelines emerged regarding the frequency of assessment in RT, which once again, limits the intent of promoting an affect regulation in this exercise mode.

Another important factor to consider is the experience of both the exerciser and the data collector with these scales. The comprehension of what is being evaluated, contextual experience anchorage, and prior training, is recommended for both assessors and respondents to ensure the reliability of the results (Ekkekakis, 2013; Duda, 1998). For example, the lack of training in the FAS application and interpretation within a given setting/exercise mode, may lead the responder to confuse activation/arousal with effort in the activity, which are distinct constructs, and in the latter case, do not reflect the key component for core affect understanding. For the purpose of methodological advancements of the affect-based exercise evaluation and prescription, an understanding of prior training for these scales use and interpretation is needed for future research efforts.

Present study

Given the need to reduce inconsistency and promote specific guidelines for affect assessment during RT activities, more research to improve methodological quality is warranted (Cavarreta et al., 2019, Emanuel et al., 2020, Evmenenko & Teixeira, 2020). These advancements will allow further developments, and the needed translation to contextual practices and professional intervention. Indeed, the adherence to a RT program is simultaneously important for public health and challenging to accomplish. With lack of consistency in the way this field of research is studied, one must consider the risk of creating more confusion instead of taking the necessary steps towards a more sustainable, and pleasurable, exercise practice.

On accounts of current limitations and topic knowledge, the main objective of this systematic review is to analyze the application of the FS and/or the FAS in resistance training. Focus will be given to its feasibility, timing of application, and implications for the affective response measurement in RT. By gathering the information on how affective valence and arousal have been measured in the literature so far, along with its current limitations, we hope to present recommendations for real-life application and for future research alike.

1.3. Method

This review was written following the recommendations proposed by the PRISMA protocol (Page et al., 2021), and was registered in PROSPERO with the number CRD42022332897.

1.3.1. Eligibility criteria

The present review applied the following inclusion criteria: (1) experimental and non-experimental studies; (2) published until June 30, 2022; (3) written in English; (4) utilizing the FS and/or the FAS in RT activities; (5) samples with individuals of any age (children, teenagers, adults and the elderly); (6) focused on apparently healthy individuals. The exclusion criteria were as follows: (1) populations with mental disease; (2) mixed exercise programs (i.e., circuit training and similar exercise program structures); (3) instrument validation studies; (4) grey literature; (5) review studies.

1.3.2. Information sources and search strategy

A wide search of the literature was conducted from February 1, 2022 till June 30, 2022 on the following databases: PubMed (host: MEDLINE): last search run February 2022, SportDISCUS (host: EBSCO) and PsycINFO (host: EBSCO): last search run February 2022. The search was executed with the following entries:

“physical exercise”, “physical activity”, “feeling scale”, “felt arousal scale”, “resistance training”, “strength training”. The PICOS strategy was applied, searching for these keywords separately and in various combinations through conjunctions such as “AND” and “OR”.

Bibliographic references from related research and other sources were examined with the purpose of including more studies that potentially met this review’s inclusion criteria (last search conducted on June 30th, 2022).

1.3.3. Selection process

Two authors (independently) were involved in the articles selection process. Level I screening consisted of analyzing the title and abstract of all identified records from the database search, in order to check those against eligibility criteria. Full-text publications of every study not eliminated in the previous screening were retrieved for complete review at Level II screening, which involved reading the full-text publication to guarantee that the inclusion criteria were met and no exclusion criteria present. The complete search and screening process is illustrated in Figure 1.

1.3.4. Data collection process and data items

For general description (Table 1), the following characteristics were extracted from the included studies: (1) bibliographic information (authors, year of publication, country of research); (2) study design; (3) sample size (including if effect size and/or power calculations were applied to determine the respective study’s sample size); (4) sample characteristics; (5) intervention; (6) measures; (7) statistical analyzes; (8) outcomes of interest. A data extraction sheet was made in Excel to summarize all data of interest from the studies. For a summary of the main characteristics of interest (Table 2), the following data was collected: (1) sample size; (2) gender; (3) location;

(4) age; (5) effect size and/or power calculation; (6) instruments applied; (7) prior training with FS/FAS; (8) timing of application.

1.3.5. Study risk of bias assessment

The quality of study content was evaluated with the Quality Assessment Tool for Quantitative Studies, developed by Effective Public Health Practice Project (Thomas et al., 2004). This tool evaluates six methodological domains: study design, blinding, selection bias, withdrawals/dropouts, cofounders, and data collection. Each domain is classified as having strong, moderate, and weak methodological quality based on specific criteria. A global rating is determined based on the scores of each component. Two reviewers analyzed the included studies and independently rated each of the six domains and overall quality. The reviewers' classifications, when in disagreement, were discussed. If disagreement persisted, an external reviewer solved the divergences. All reviewers were debriefed and instructed prior to the use of the Quality Assessment Tool for Quantitative Studies.

1.4. Results

1.4.1. Study selection

A total of 237 studies were identified during the database search (see Figure 1) for potential inclusion. After the removal of five duplicate records, 232 studies entered the screening process. Following a meticulous read-through of the title and abstract of every record, 206 were ultimately excluded for various reasons. Of the 26 resulting studies, two additional studies were excluded after full-text reviews (Kaus, 2014 excluded due to not following a traditional RT program structure; Pereira et al., 2022 excluded due to only measuring affective response 15 minutes after the RT).

Additionally, five other potentially relevant studies were identified through bibliographical references from other sources, two of which met the final inclusion

criteria (Lacharité-Lemieux et al., 2014 excluded due to not following a traditional RT program; de Oliveira Segundo et al., 2016, excluded due to researching an unhealthy population; Ribeiro et al., 2019 excluded due to only measuring affective response 15 minutes after the RT), resulting in a final number of 26 studies that proceeded to an in-depth analysis.

These studies have been published or accepted for publication until June 2022. A synthesis of the data extracted from the studies that comprise this review can be observed in Table 1 and Table 2. This list is organized by alphabetic order according to the main author's name.

1.4.2. Study characteristics

A summary of the descriptive data collected from the 26 included studies can be observed in Table 1 and Table 2. Briefly, all studies had an intervention/experimental design, three of which were randomized controlled trials. All studies used convenience methods of recruitment. Overall, exercise experience can be considered mixed, with 12 studies sampling individuals with RT experience, nine sampling inactive individuals, four not reporting the sample's exercise experience (Alves et al., 2014; Chang & Etnier, 2009; Hutchinson et al., 2020; Tavares et al., 2020) and one choosing to not control exercise experience (Miller et al., 2009). Participants complied with inclusion criteria set, allowing for a wider coverage of possible physical activity contexts, and using the Feeling Scale and/or Felt Arousal Scale in RT exercises. Most studies presented a sample size with less than 30 participants (61%), eight studies had a sample between 30 and 50 individuals (31%), and two studies presented a sample size between 50 and 100 participants (8%). Altogether, 706 participants shape the sample of this review. The majority of the

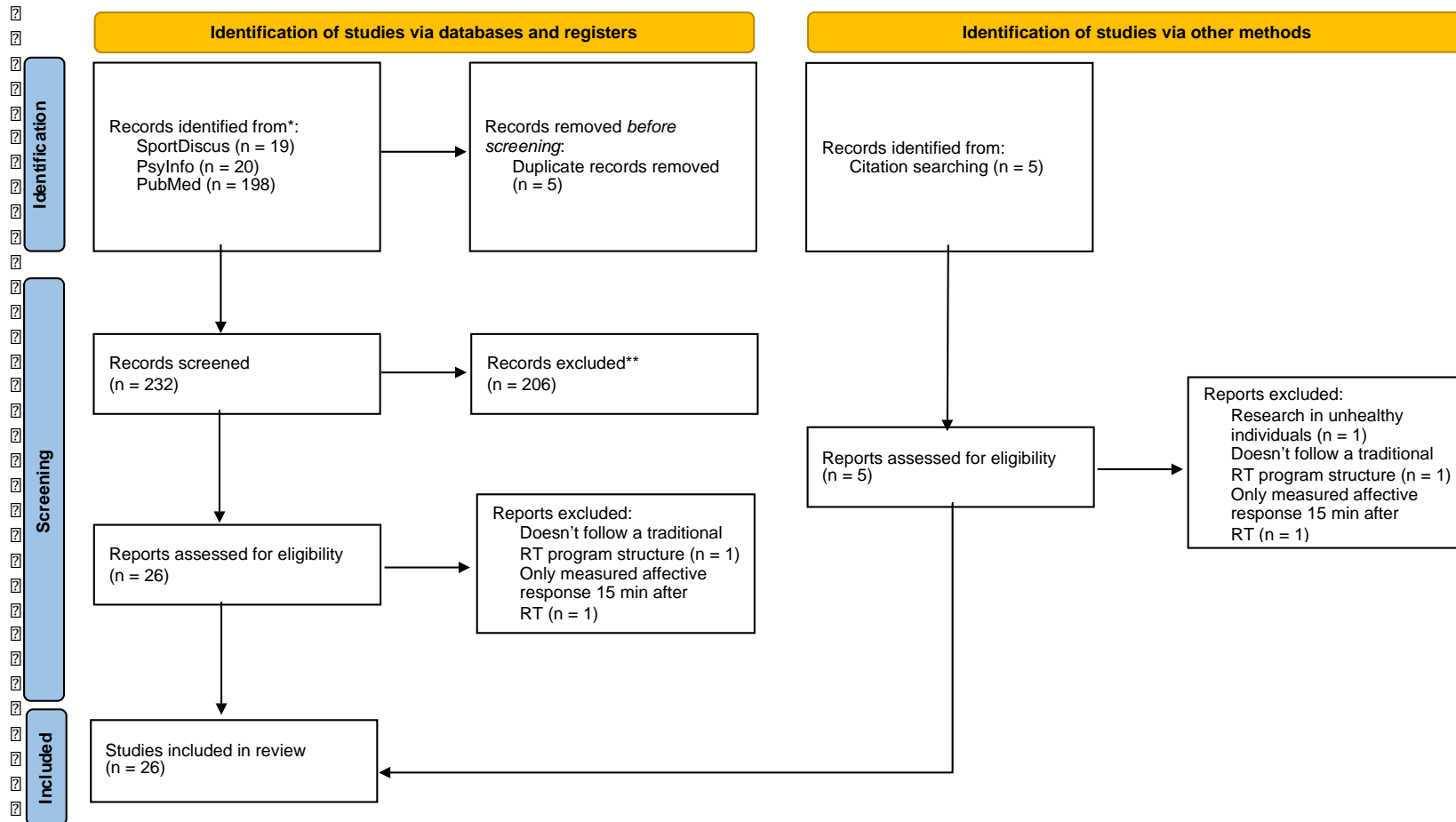


Figure 1 - Studies Chart Flow

participants were apparently healthy, with the exception of two studies that included overweight and/or obese individuals (Alves et al., 2014; Hutchinson, 2020). As it can be seen in Table 2, most of the studies (88%) included adult individuals (18-64 years), although in some studies the target population were the elderly (Elsangedy et al., 2021; Ferreira et al., 2013; Richardson et al., 2018; Richardson et al., 2019) or adolescents (Alves et al., 2014). Half of the studies had both genders represented, with female only and male only samples being presented in eight and five studies, respectively.

1.4.3. Risk of bias in studies

Methodological quality of the studies was either assessed as strong (1), moderate (2) or weak (3). This assessment was conducted using the previously mentioned six dimension tool. A total of 5 studies were assessed as weak (Bellezza et al., 2009; Cavarretta et al., 2022; Hutchinson et al., 2020; Miller et al., 2009; Stults-Kolehmainen et al., 2016), 11 as moderate (Alves et al., 2017; Carraro et al., 2018; Chang & Etnier, 2009; Chmelo et al., 2009; Elsangedy et al., 2018; Greene & Petruzzello, 2015; Orssatto et al., 2020; Portugal et al., 2015; Richardson et al., 2018; Richardson et al., 2019; Tavares et al., 2020), and 10 as strong (Alves et al., 2014; Andrade et al., 2022; Bastos et al., 2022; Cavarretta et al., 2019; Elsangedy et al., 2021; Emanuel et al., 2020a; Emanuel et al., 2020b; Ferreira et al., 2013; Fochth et al., 2015; Schwartz et al., 2021). Quality classification is presented in Table 1.

1.4.4. Results of individual studies

FS/FAS measurement procedures

Prior training and familiarization with the FS and/or FAS for the participants was reported in 12 studies. Of this number, prior training for the researchers that conducted the data collection was only reported in two studies (Andrade et al., 2022;

Bastos et al., 2022). Verbal encouragement was performed by the researchers in four studies (Bellezza et al., 2009; Orssatto et al., 2020; Richardson et al., 2019; Stults-Kolehmainen et al., 2016).

A wide array of different timing of measurement combinations was used across all studies. No standardization in either the timing or the number of measurements could be disclosed. Most measurements were conducted during the RT session immediately after the set (46%) and/or between sets (50%). It should be noted that when the measurement was not described as “immediately after” a set it was accounted as “between sets”. Additionally, the timing of application could not be precisely defined in three studies (Bellezza et al., 2009; Carraro et al., 2018; Tavares et al., 2020) due to methodological issues (e.g., randomization of measures; other measures potentially being applied before the scales). Four studies (Andrade et al., 2022; Cavarretta et al., 2019; Emanuel et al., 2020a; Hutchinson et al., 2015) measured the affective response during the set, while the muscles were under tension. Only one study did not apply the scales during the RT session but adjusted the exercise intensity according to predetermined FS descriptors (e.g., adjusting the intensity to ensure the participants felt “good” – descriptor for ‘3’) (Elsangedy et al., 2018). Affective response was also (in addition to other assessment points) measured outside of the RT session, either before (refs) (35%) or 5 min (Cavarretta et al., 2019; Greene & Petruzzello, 2015) (8%), 10 min (Bellezza et al., 2009; Greene & Petruzzello, 2015; Portugal et al., 2015) (12%), 15 min (Chmelo et al., 2009; Focht et al., 2015; Greene & Petruzzello, 2015) (12%), 20 min (Greene & Petruzzello, 2015; Portugal et al., 2015) (8%), 30 min (Cavarretta et al., 2019) (4%), 60 min (Miller et al., 2009) (4%) after exercise.

Table 1 - General descriptive characteristics of the studies and main outcomes.

| Author(s) | Location | Design | Size (%F) | Features (age M±SD) | Intervention | Measures | Analysis | Outcomes | Quality |
|------------------------|----------|--------------------------|--|---------------------------|--|--|--|---|----------|
| Alves et al. (2014) | Brazil | Quasi-experimental study | n = 11 No effect size or power calculations | 13.7 ± 2.1 | A training session consisting of three exercises: bench press, leg press and barbell curl with 3 sets of 10 repetitions at a self-selected intensity with a 1-minutes interval for rest 1-RM was measured in a previous session | FS after each set | Repeated Measures ANOVA | The three exercises resulted in a positive affective response in this sample of obese adolescent women, with the bench press and leg press presenting a significantly higher result than the barbell curl. | Strong |
| Alves et al. (2017) | Brazil | Quasi-experimental study | n = 14 No effect size or power calculations | 39.2 ± 11.1 | A training session at a self-selected intensity consisting of 3 sets x 10 reps of 5 exercises: bench press, leg extension, front lat pulldown, barbell curl, and leg curl. A preparatory session took place before the training session | FS after each set and 30 minutes after the exercise session | One-way ANOVA; paired t-test | All exercises presented a positive affective response, with the barbell curl resulting in the least pleasurable response and the leg curl presenting a lower value in comparison with the leg extension No significant differences between the in-session and 30' post-session affective response | Moderate |
| Andrade et al. (2022) | Portugal | Quasi-experimental study | n = 33 Effect size and power calculations | 36.42 ± 7.72 | The back squat and bench press were performed at 60% RM (2 sets of 15-17 reps), 75% RM (3 sets of 8-10 reps) and 90% RM (4 sets of 5-6 reps) 1-RM was measured in a previous session | FS & FAS at three time points: intra-set, immediately after the set and 5 to 10 seconds afterward PRETIE-Q-PT | Shapiro-Wilk test; Levene's test; Mauchly's test; repeated Measures ANOVA; Bonferroni correction; η^2 effect size | No differences among the 3 different affective response assessment time points and %RM | Strong |
| Bastos et al. (2022) | Portugal | Quasi-experimental study | n = 43 Effect size and power calculations | 34.69 ± 6.71 | Six resistance training exercises (pulldown, back squat, bench press, deadlift, dumbbell shoulder press and leg extension) and two bouts of aerobic training (preparatory phase and cool-down) comprised the exercise session A preparatory session took place before the main exercise session | FS & FAS after the third set of each resistance training exercise (after reaching concentric failure) and after the two aerobic bouts PRETIE-Q-PT; PACES; RPE/RIR | Shapiro-Wilk test; Levene's test; Mauchly's test; repeated Measures ANOVA; Bonferroni correction; η^2 effect size; Krustall-Wallis test | The affective response remained in the high pleasure/activation quadrant of the circumplex model of affect for the 6 resistance training exercises. Results support that a single measurement with the FS and the FAS can be enough in assessing affective response in an RT session with experienced exercisers | Strong |
| Bellezza et al. (2009) | USA | Quasi-experimental study | n = 29 No effect size or power | 20.9 ± 1.9 _{SEP} | Two training sessions with either a large to small (chest press, leg press, rows, leg extension, overhead press, hamstring curl, | FS & FAS before, during (mid-point), immediate | Repeated measures GLM; T-test; Bonferroni correction | The small to large muscle groups protocol showed a more pleasurable response during and 10 minutes post-session | Weak |

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|--------------------------|-------|-----------------------------|--|---|---|---|--|--|----------|
| | | | calculations | | bicep curl, calve raise and triceps extension) or small to large (the reverse) exercise order 1-RM was measured in a previous session | y after and 10 minutes after the training session RPE | | Both protocols presented an increase in affective valence and activation, with a low-activation pleasure response immediately after exercise | |
| Carraro et al. (2018) | Italy | Quasi-experimental study | $n = 30$ No effect size or power calculations | 23.8 ± 5.1 | Two training sessions on 2 separate days, one with 3 machines (chest press, shoulder press machine and leg press) and the other with three free weight exercises (bench press, front military press and squat) | FS & FAS were applied immediately after the exercise session RPE; PACES | T-test; Cronbach's α ; Pearson's correlations | Free weights resulted in increased pleasantness and activation compared with machine training | Moderate |
| Cavarretta et al. (2019) | USA | Quasi-experimental study | $n = 28$ No effect size or power calculations | Males ($n = 7$): 22.6 ± 4.6 Females ($n = 21$): 23.4 ± 8.6 | Two workouts consisting of 4 machines (leg press, row, chest press and leg curl) or 4 free weight (goblet squat, row, bench press and stiff-leg deadlift) exercises for 3 sets of 9-11 repetitions at 80% 10RM | FS was measured before, during (both intra-set and inter-set), and at 5-min and 30-min post-exercise | Repeated Measures GLM | A more positive affect was verified 5-min and 30-min post exercise, compared to before. Additionally, affect was more positive at 5-min compared to 30-min post ($p = 0.015$) and higher for the inter-set measurement compared to the intra-set measurement | Strong |
| Cavarretta et al. (2022) | USA | Quasi-experimental study | $n = 29$ Power calculation | Males ($n = 8$): 22.3 ± 4.4 Females ($n = 21$): 23.4 ± 8.6 | A 10RM test was completed for 4 machine exercises (leg press, row, chest press and leg curl) in one session and 4 free-weight exercises (goblet squat, row, bench press and stiff-leg deadlift) in another session | FS was measured after each successful 10RM attempt RPE/RIR | ANOVA; Fisher's LSD pairwise comparison | Affect became less positive only at 100% 10RM compared with all other loads. The affective response was also more positive for upper-body exercises compared to lower-body exercises and more positive for machines compared to free-weights | Weak |
| Chang & Etnier (2009) | USA | Randomized controlled trial | $n = 68$ Power calculation | 25.95 ± 3.2 | Four randomly assigned groups: control, 40%, 70%, or 100% 10RM. The intervention groups performed 2 sets of 10 repetitions of 6 exercises: bench press, right and left rowing, lateral arm raises, and right and left arm curl. | FS & FAS were measured at baseline (after sitting quietly in a room for 15 minutes), and immediately after each of the six exercises RPE | ANOVA; MANOVA; Tukey post hoc comparison | Affect did not differ between treatment groups. Activation showed significant differences between groups with a tendency for higher values in the groups with the higher load intensity. | Moderate |
| Chmelo et al. (2009) | USA | Quasi-experimental study | $n = 32$ No effect size or power calculations | 21 ± 1.4 | Participants took part in two sessions of eight exercises either with or without mirrors in a randomized fashion. The first seven exercises (chest press, rows, squats, lateral raises, bicep curls, tricep extensions and dead lifts) were completed in two sets (60% and 100% | FS & FAS were measured prior to, during (middle point, after the lateral raises exercise) immediately following | Repeated measures GLM; Fisher's LSD | Affect was more pleasant and activated during and following exercise, but did not differ between the mirrored or no mirrors conditions | Moderate |

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| | | | | | 10RM) of 10 repetitions with the last exercise (crunches) being performed to failure | and 15 minutes post-exercise | | | |
| Elsangedy et al. (2018) | Brazil | Quasi-experimental study | $n = 16$ No effect size or power calculations | 39.7 ± 7.5 | Three familiarization sessions, two 1RM sessions and 16 RT sessions (4 for each FS descriptor; randomized) were performed The RT exercises were the leg press, chest press, knee extension, and seated bicep curl (3 sets of 10 repetitions) | AD ACL Four FS descriptors were utilized to select the intensity of load: “very good” (FS+5), “good” (FS+3), “fairly good” (FS+1), and “fairly bad” (FS-1) OMNI-RES scale | Three-way analysis of variance ANOVA; Greenhouse-Geisser correction; eta squared; Bonferroni correction | The lower the FS descriptor the higher the weight lifted | Moderate |
| Elsangedy et al. (2021) | Brazil | Randomized controlled trial | $n = 32$ Effect size and power calculations | 66.0 ± 3.0 | Experimental group performed a self-selected resistance training program three times per week over 12 weeks The RT exercises performed were bench press, leg press, lateral pulldown, knee extension, lateral shoulder raise, knee curl, biceps curl, and triceps pushdown (3 sets of 15 repetitions) | FS scale were applied at the end of each set of every exercise during all training sessions OMNI-RES | Generalized linear model; one-way repeated-measures analysis of variance; boxplots; Shapiro-Wilk’s test; Mauchly’s test; Greenhouse-Geisser epsilon correction; Bonferroni correction | All components of functional capacity improved compared to the control group The exercise sessions were perceived as pleasant and of low to moderate effort | Strong |
| Emanuel et al. (2020a) | Israel | Quasi-experimental study | $n = 20$ Effect size and power calculations | Males ($n = 10$): 28 ± 6 Females ($n = 10$): 32 ± 6 | Three sessions of 3 sets to task failure with either (1) 70% 1-RM bench press, (2) 70% 1-RM squat (squat-70%), or (3) 80% 1-RM squat (squat-80%) 1-RM was measured in a previous session | FS was applied after each and every repetition across all sets RPE; ROF scale | Mixed regression models; mixed analysis of variance; Mauchly’s test; Greenhouse-Geisser correction; Holm corrected for multiple comparisons | FS ratings predicted proximity to failure and bar velocity reduction in all three conditions It could be observed that the timing of FS measurement can considerably influence the results | Strong |
| Emanuel et al. (2020b) | Israel | Quasi-experimental study | $n = 20$ Effect size and power calculations | Males ($n = 10$): 30 ± 4 Females ($n = 10$): 29 ± 4 | Two sets of squats followed by two sets of bench press to task failure, using 70% or 83% of 1-RM, were completed in two sessions 1-RM was measured in a previous session | FS was measured within 10 seconds after set completion RPE; HOF; exercise enjoyment scale; load preference | Linear, and quadratic mixed models; mixed regression models; Mauchly’s test; Greenhouse-Geisser correction; Holm corrected for multiple comparisons | RPE scores accurately reflected reaching task failure across loads and conditions. The lack of significant differences in affective valence, rating of fatigue, enjoyment, and load preference between load conditions indicate that when sets are taken to task failure, loads can be selected based on individual preferences | Strong |

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| Ferreira et al. (2013) | Brazil | Quasi-experimental study | $n = 14$ No effect size or power calculations | 68.5 ± 4.6 | Three sessions of concentric, eccentric, or dynamic training were applied in a randomized order. Each session consisted of 5 exercises (lying supine, leg extension, front pulley, leg curl, and side lifting) performed for 3 sets of 8-10 repetitions 1-RM was measured in a previous session | FS & FAS were presented during the rest interval between sets, in a randomized order OMNI-RES | Repeated measures ANOVA; Bonferroni correction; Greenhouse-Geisser correction; partial eta squared | The affective and RPE responses were similar between the different muscle actions, with the exception of the front pulley exercise in the eccentric training, which exhibits a better perceptual and affective (albeit non-significant) response | Strong |
| Focht et al. (2015) | USA | Quasi-experimental study | $n = 20$ Effect size and power calculations | 23.15 ± 2.92 | Three sessions involving 3 sets of 10 repetitions of 5 exercises (leg extension, chest press, leg curl, and lat pull-down) using loads of 40% 1-RM, 70% 1-RM and a self-selected load. 1-RM was measured in a previous session | FS was applied before, during (after the third set of each exercise), and after (immediately and 15 minutes postexercise) each session Intention; self-efficacy | Repeated-measures ANOVA; univariate ANOVA; Huynh and Felt test; LSD test; bivariate correlations | Self-selected and imposed load RT resulted in comparable improvements in post exercise affect, when compared to baseline. However, the 70% 1-RM condition showed a decrease in affect from baseline during the exercise session, only improving after the termination of the training session. In contrast, both the self-selected and 40% 1-RM conditions presented an increase in positive affect from baseline | Strong |
| Greene & Petruzzello (2015) | USA | Quasi-experimental study | $n = 22$ No effect size or power calculations | 21.5 ± 3.0 | Training protocols at 70% and 100% 10-RM (randomly assigned) were completed on separate days. Both protocols included the same 7 exercises (bench press, leg curls, bent over rows, leg extensions, shoulders press, bicep curl, and triceps extension) performed for 3 sets of 10 repetitions 1-RM was measured in a previous session | FS measures were collected before, immediately after every set for every exercise, and at 5, 10, 15, and 20 minutes post training FAS and RPE were applied before, immediately after each exercise, and 20 minutes post training AD ACL; PACES; SA | MANOVA; repeated measures ANOVA; t test; Cohen's <i>d</i> | The in-session positive affect in the 70% 10-RM protocol remained relatively high while in the 100% 10-RM protocol a decreased could be observed, only recovering after the end of the training session. Both protocols resulted in a post exercise increase in energy and calmness, while tiredness and anxiety decreased. The 70% 10-RM condition also resulted in a larger reduction in tension and higher reported enjoyment | Moderate |
| Hutchinson et al. (2020) | USA | Quasi-experimental study | $n = 40$ Effect size and power calculations | 35.0 ± 9.2 | Two sessions consisting in 3 sets of 10 repetitions of six exercises (leg press, hex bar deadlift, chest press, seated row, overhead press, and pulldown) in circuit, with an increase in | FS assessment occurred during the last 10 s of both the work and recovery | Repeated-measures analysis of variance; Greenhouse-Geisser correction; repeated | The increase in intensity condition resulted in a decrease in pleasure, while the decrease in intensity condition resulted in a slope of increasing pleasure and overall greater pleasure | Weak |

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| | | | | | intensity per circuit round (55%, 65% and 75% 1-RM) or the opposite (reverse order). 1-RM was measured in a previous session | intervals (i.e., during the last 2–3 repetitions of the exercise and during the last 10 s of the 30-s recovery period) PRETIE-Q; PACES; EVS; RPE | measures MANOVA | than the first condition The decrease in intensity condition also resulted in significantly greater post exercise pleasure, enjoyment of RT, and remembered pleasure | |
| Miller et al. (2009) | USA | Quasi-experimental | $n = 31$ No effect size or power calculations | 20.6 ± 1.3 | Three sessions with three different interventions: concentric, eccentric and traditional RT. Three sets of chest press, seated row, overhead press, and biceps curl were performed at 80%, 100%, and 120% of 10-RM 10-RM was measured in a previous session | FS & FAS were measured before, immediately after, and 60 minutes after each exercise session AD ACL; RPE | Repeated-measures general linear model | All three interventions resulted in increases of core affect immediately after and 60 minutes after their conclusion | Weak |
| Orssatto et al. (2020) | Brazil | Quasi-experimental study | $n = 14$ Effect size and power calculations | Males ($n = 7$): 27.1 ± 6.0 Females ($n = 7$): 28.3 ± 5.7 | Men and women were divided in two groups and performed two sessions of 6 sets, 12 repetitions, in a calf-raise machine to concentric failure 12-RM was measured in a previous session | FS & FAS were measured before exercise, and after each set PAAS; PACES; VAS; RPE-E; RPE-D | Repeated-measures ANOVA; Mauchly's test of sphericity; Greenhouse-Geisser correction; Bonferroni correction | Women reported displeasure and high activation after both exercise sessions, while men's affective response stayed in the low activation-pleasure quadrant | Moderate |
| Portugal et al. (2015) | Brazil | Randomized Controlled Trial | $n = 16$ Effect size and power calculations (failed to meet the required number $n = 18$) | 25.1 ± 5.5 | Four sessions performing 3 sets of 8 repetitions of 4 exercises (pulldown, leg extension, chest press and leg curl) at three prescribed intensities (40, 60, and 80% 1RM) and one self-selected intensity. 1-RM was measured in two previous session | FS & FAS were measured before exercise, immediately after the third set of each exercise, 10 minutes and 20 minutes post session CR-10 | One-way ANOVA; repeated-measure ANOVA; Bonferroni correction | No significant differences in the affective response between the exercise groups; the 80% 1-RM group reached a negative affective response but it returned to baseline at 10 and 20 minutes post; the leg curl exercise had the least positive affective response | Moderate |
| Richardson et al. (2018) | England | Randomized, counterbalanced, cross-over study | $n = 10$ Effect size and power calculations | Males ($n = 5$): 66 ± 3 Females ($n = 5$): 68 ± 2 | Participants completed three sets (chest press, leg press, calf raise, leg extension, leg curl, and tricep extension) of eight exercises on six separate occasions: three high-velocity, low-load (at 40% 1-RM) and three low-velocity, high load (at 80% 1-RM) sessions 1-RM was measured in a previous session | FS was measured prior to exercise and following every set of each exercise; FAS was measured before and after exercise RPE; | Repeated-measures ANOVA; Mauchly's test of sphericity; Huynh-Feldt adjustment; Greenhouse-Geisser correction; Bonferroni correction; <i>t</i> -test | FS & FAS ratings did not differ between conditions but did increase from pre- to post exercise | Moderate |

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| | | | | | | | | | |
|----------------------------------|---------|--|--|---|--|---|---|--|----------|
| | | | | | | PAAS; VAS; PACES | | | |
| Richardson et al. (2019) | England | Randomized, multiarmed, parallel study | $n = 40$ Effect size and power calculations | HVLL1 ($n = 10$): 66 ± 5 LVHL ($n = 10$): 67 ± 4 HVLL2 ($n = 10$): 67 ± 6 LVHL2 ($n = 10$): 66 ± 6 | For 10 weeks, participants were assigned to either a high velocity, low load or low velocity, high load RT program either once or twice a week; each session consisted of three sets of eight exercises (leg press, seated row, chest press, leg extension, leg curl, calf raise, triceps extension, and bicep curl) performed for 14 repetitions at 40% 1-RM (both high velocity, low load conditions) or seven repetitions at 80% 1-RM (both low velocity, high load conditions) 1-RM was measured before the start of the intervention | FS & FAS were measured before and immediately after the exercise session in weeks 1, 5 and 10 RPE; PAAS; VAS; PACES | Repeated-measures ANOVA; one-way ANOVA; Mauchly's test of sphericity; Greenhouse-Geisser correction; Bonferroni correction; t -test | There were significant increases in affective response from before to after the exercise session but no differences between conditions | Moderate |
| Schwartz et al. (2021) | Israel | Quasi-experimental study | $n = 20$ No effect size or power calculations | 34.4 ± 6.5 | Participants undertook two sessions of three sets of four exercises (leg-press, knee-extension, chest-press and lat-pulldown) in either a predetermined condition (fixed for 10 repetitions in all sets) or by terminating the sets two repetitions from failure 1-RM was measured in a previous session | FS was applied before and after each set EES | Paired t -test; one sample t -test; mixed regression analysis | Both conditions elicited similar levels of affective valence, enjoyment, and approach preferences | Strong |
| Stults-Kolehmainen et al. (2016) | USA | Quasi-experimental study | $n = 57$ No effect size or power calculations | 25.1 ± 5.5 | A two-phase, acute heavy-resistance exercise protocol: first phase consisting of a 10-RM leg press test and a second phase consisting of six sets at 80-100% of 10-RM. | FS & FAS were measured before the exercise sessions, at odd-numbered sets and after the last set of the first phase, and at sets 1, 3, 5, and 6 during the second phase | Pearson's product correlations; Kolmogorov-Smirnov test | Higher levels of stress were related to less affect | Weak |
| Tavares et al. (2020) | Brazil | Quasi-experimental study | $n = 17$ No effect size or power | 24.5 ± 3.2 | 10RM protocol for bench press and knee extension to measure test re-test reliability in the first and second sessions | FS, FAS, RPE and attention focus after each set. | Repeated-measure two-way analysis of variance; Shapiro-Wilk test; Levene's | Even with a low load, the use of low tempo may not present advantages when the purpose is to enhance psychophysiological | Moderate |

| | | | | | | |
|--|--|--------------|---|--|--|--|
| | | calculations | In the third and fourth sessions subjects performed 4 sets of 10 repetitions of bench press and knee extension exercises with either a low tempo with 50% of 10RM or with a moderate tempo with 80% of 10RM | | test; Bonferroni correlation; Mauchly's test, Greenhouse-Geisser epsilon correction; Partial eta squared; paired t-test; Hedge's g | responses such as positive affective valence, lower activation, RPE, and attentional focus when compared with moderate tempo Affective valence decreased through the session while arousal displayed the opposite trend |
|--|--|--------------|---|--|--|--|

Intensity prescription and control

The majority of the included studies (92%) established exercise intensity by using the one repetition maximum (1-RM) test or another similar prediction protocol to define the desired 1-RM percentage for the procedures. Intensity ranged from low (e.g., 40% 1-RM in Focht et al. (2015) and Portugal et al. (2015), to vigorous (e.g., 90% 1-RM in Andrade et al. (2022)). Other methods reported include self-selection by the participants (Alves et al., 2014; Alves et al., 2017; Elsangedy et al., 2021; Focht et al., 2015; Portugal et al., 2015), self-selection according to FS descriptors (Elsangedy et al., 2021), and by using a scale of repetitions in reserve (RIR; Zourdos et al., 2016) to measure the proximity to concentric failure (Bastos et al., 2022). Furthermore, intensity has mostly been controlled during the RT session through subjective scales, with the Borg Rating of Perceived Exertion (present in 6 studies) and the Borg 10 point Category Ratio scale (present in five studies) being the

Table 2 - Summary of studies' and samples' characteristics.

| Characteristics | Studies (%) | Samples K (%) |
|--|---------------|-----------------------------------|
| SAMPLE SIZE | 26 total | 706 total |
| <30 | 16 (61%) | 300 (42%) |
| 30-50 | 8 (31%) | 281 (40%) |
| 50-100 | 2 (8%) | 125 (18%) |
| SEX | | |
| Female only | 8 (31%) | 174 (25%) |
| Male only | 5 (19%) | 112 (16%) |
| Both genders | 13 (50%) | 420 (59%) |
| LOCATION | | |
| North America | 10 (38%) | 356 (50%) |
| South America | 8 (31%) | 134 (19%) |
| Europe | 5 (19%) | 156 (22%) |
| Asia | 3 (12%) | 60 (9%) |
| MEAN AGE (years) | | |
| <18 | 1 (4%) | 11 (2%) |
| 18-64 | 21 (81%) | 625 (88%) |
| ≥65 | 4 (15%) | 70 (10%) |
| EFFECT SIZE AND/OR POWER CALCULATION | | |
| Yes | 13* (50%) | |
| No | 13 (50%) | |
| INSTRUMENTS APPLIED | | |
| FS only | 11 (42%) | |
| FAS only | 0 (0%) | |
| FS & FAS | 15 (58%) | |
| PRIOR TRAINING (FS/FAS) | | |
| Participants | 12 (46%) | |
| Researchers | 2 (8%) | |
| TIMING OF APPLICATION (FS and/or FAS) | Studies (%)** | Total measurements per RT Session |
| Before the session | 11 (42%) | 9 |
| During the set | 4 (15%) | 16 |
| Immediately after the set | 12 (46%) | 85 |
| After the set but unclear*** | 3 (12%) | 10 |
| Between sets | 13 (50%) | 114 |
| 5 min post exercise | 2 (8%) | 2 |
| 10 min post exercise | 3 (12%) | 3 |
| 15 min post exercise | 3 (12%) | 3 |
| 20 min post exercise | 2 (8%) | 2 |
| 30 min post exercise | 1 (4%) | 1 |
| 60 min post exercise | 1 (4%) | 1 |

*One study failed to meet criteria due to dropouts (Portugal et al., 2015)

**Percentage calculated considering the total number of studies included

***Due to methodological issues (e.g., randomization of measures), the FS/FAS application timing could not be precisely defined

most used. Concentric task failure was only reported in four studies (Bastos et al., 2022; Emanuel et al., 2020a; Emanuel et al., 2020b; Orssatto et al., 2020) for all exercises and in Chmelo et al. (2009) for one exercise (crunches on a stability ball).

Transitional affective states plotted on the circumplex model of affect

Of the 15 studies that used both the FS and the FAS, only six did not plot the affective response data in a circumplex model of affect (Andrade et al., 2022; Chang & Etnier, 2009; Ferreira et al., 2013; Greene & Petruzzello, 2015; Richardson et al., 2019; Stults-Kolehmainen et al., 2016). Generally, most of the studies that sampled individuals with RT experience showed a transition from the low-activation pleasure quadrant (i.e., calmness, relaxation) to the high-activation pleasure quadrant (i.e., energy, vigor) (Bastos et al., 2022; Bellezza et al., 2009; Chmelo et al., 2009; Portugal et al., 2015). Orssatto et al. (2020) is the only study that reported no transition to the high-activation pleasure quadrant with experienced exercisers, showing a shift from low-activation pleasure to high-activation displeasure in a group of women, while a group of men stayed in the low-activation pleasure quadrant despite a residual increase in activation. Additionally, in the only two studies that plotted the circumplex model with a sample considered not experienced in RT, Richardson et al. (2018) reported a trend for higher pleasure and activation throughout the RT session, while Tavares et al. (2020) reported the opposite trend with a shift from low-activation pleasure to high-activation displeasure.

Sample size calculation

A total of 13 studies reported selecting and applying an effect size and/or power calculation when determining sample size. Of this number, one RCT (Portugal et al., 2015) failed to meet its predetermined criteria due to dropouts (only 16 of the necessary 18 completed the intervention). The remaining 13 studies did not report sample size calculations (or information given was imprecise).

1.5. Discussion

The present review aimed to analyze the application of the FS and/or the FAS in resistance training. Focus was given to its feasibility, timing of application, and implications for the affective response measurement in RT. A total of 26 studies met the inclusion criteria, ranging from 5 low quality, 11 moderate quality, and 10 high quality. The FS/FAS were applied to assess the affective response in RT performed within a wide array of intensities (40% 1-RM to 90% 1-RM), particularly in trained individuals, in both free weights and machines, men and women, and in a large age interval (14-69 years). Overall, both scales showed to be feasible for core affect assessments in RT. However, several methodological issues were detected in the included studies, which will be further discussed for proper results interpretation.

One of the major aspects emerging from this review results is the lack of standardization on the timing of these scales application. In general, they were defined given study protocols or other (non-specified) needs, and not based on methodological (i.e., affective assessment evidence; recommendations) reasons. This produced a variation of the results that makes it hard to compare and extrapolate. Current literature suggests that the affective response during training should be obtained during or immediately after exercise, on the grounds that as time increases between the behavior and the assessment moment, it becomes more difficult to assess core affect without perturbation of cognitive processes (which usually reflects an improvement on the affective response) (Andrade et al., 2022; Bastos et al., 2022; Stevens et al., 2020). This suggests that measurements that are not applied during or immediately after exercise may fail to capture what was the true affective response to RT. As such, four of the included studies showed that measuring *during* the exercise is feasible (Andrade et al., 2022; Cavarretta et al., 2019; Emanuel et al., 2020a;

Hutchinson et al., 2020), thus aligning with the affective assessment recommendations made by, for example, the AHBF. However, 12 studies also align with that recommendation when assessing *immediately* after a set (Alves et al., 2014; Andrade et al., 2022; Bastos et al., 2022; Cavarretta et al., 2022; Chang & Etnier, 2009; Chmelo et al., 2009; Elsangedy et al., 2018; Focht et al., 2015; Greene & Petruzzello, 2015; Miller et al., 2009; Portugal et al., 2015; Richardson et al., 2019). Although they seem equally feasible, some considerations should be made when interpreting the possibilities for timing of assessment. For example, stopping mid-set (or any another point while muscle is tensed) can affect the exercise dynamic (e.g., interrupt the intended exercise cadence and create an isometric contraction when only isotonic movement was intended), influence the target objectives (e.g., increasing fatigue due to the stoppage to answer the scales) and even have safety issues (e.g., with a heavy load in a barbell bench press). Thus, and considering the limited evidence available, results suggest that the scales application immediately after the load removal/set termination can avoid the mid-set disruption and be hasty enough to avoid a potential affective rebound effect (Andrade et al., 2022).

Regarding the number of affective response measurements per RT session, this matter remains vastly unexplored. In the included studies, the number of FS/FAS applications served only methodological purposes, with no attempt to provide recommendations for a feasible number of applications coming forth. Bastos et al. (2022) is the only exception, showing that in apparently healthy and recreational trained exercisers a single core affect measurement may suffice to understand the pleasure/displeasure response. The matter of affective measurement frequency can be relevant in maximizing a pleasurable experience in RT. For example, in the RCT of Portugal et al. (2015), high-activation pleasure was the norm for the affective

response in every condition, with the exception of the leg curl exercise when performed at 80% 1-RM, where core affect shifted to the high-activation displeasure quadrant. Not measuring core affect frequently enough could result in such unpleasant responses being masqueraded by the session's overall affective response, but measuring it too often could result in less ecological validity, less overall feasibility (e.g., reactivity to the test; variance carry over effects), and burden the participant with assessments (Zenko & Ladwig, 2021). As such, the definition of recommendations in this regard that take into account individual (e.g., exercise experience; health status) and exercise (e.g. intensity; volume) characteristics is paramount for the advancement of the affect regulation approach to exercise promotion.

Also of note when analyzing the literature is that 15 studies used both the FS and the FAS, 11 studies used only the FS, and no study applied only the FAS. These results reflect the view of Stevens et al. (2020, p. 4), which states that much of the literature on affective response to PA as a determinant of future PA adherence has emphasized on measuring core affective valence. According to the researchers that developed the FS (Hardy & Rejeski, 1989) "*the scale was designed to evaluate the core emotions: pleasure / displeasure*" (p. 305). Thus, while the FAS measures levels of activation, the FS is necessary to differentiate positive activation from negative activation (Stevens et al., 2020; Watson et al., 1999). Likewise, the FS alone cannot dissociate different states of positive (i.e., energy from calmness) or negative (i.e., distress from fatigue) affect from each other without the measurement of arousal.

Nine of the 15 studies that used both the FS and the FAS plotted the circumplex model and successfully reported different states of affective response. While using both scales collectively will result in a more complete understanding of

affective response, it is the application of the circumplex model that will allow an even more fine-grained degree of affective states differentiation. Thus, it is the plotting of both scales into the circumplex model of affect that makes them particularly useful and valid tools to assess different states of affective valence in RT (Russel, 1980; Ekkekakis & Petruzzello, 2002; Evmenenko & Teixeira, 2020).

On some final notes, most of the literature presents small, convenience samples. Half of the included studies did not conduct effect size and/or power calculations, risking confounding results due to lack of statistical power. Furthermore, less than half (42%) reported prior training with these scales for the participants, and only two (8%) reported these familiarization procedures for both researchers and participants. Verbal encouragement during data collection was reported in four studies, which troubles affective responses comparisons across studies.

All in all, these results suggest a heterogeneous approach of the training and preparation for these scales use, and contrast with the suggestions made by suggested by Duda (1998) and Evmenenko & Teixeira (2020). The knowledge of what is being assessed (i.e., feelings experienced *in the present moment*) and the definition of contextual, subjective anchoring examples by the respondents, along with the researchers' ability to provide them through contextual questioning, are important factors to achieve consistent application results. This methodological issue reflects a bias in data collection that must be addressed in future study efforts, particularly given the perceptual nature of core affect.

1.5.1. Study limitations and future directions

This review is the first to explore the application of the FS/FAS exclusively in RT activities, and as such, presents the most recent scientific evidence on how to use these instruments in this form of exercise. Nevertheless, this review is not without its

limitations. First, the current literature in the affective response to RT is still scarce, which limits the extension of the results extrapolation. While indicators of this field of research are on the rise (of the 26 studies, 23 were published in the last 10 years, 15 in the last five years, and 10 in the last two years), more research grounded on current evidence of core affect assessment methods for this exercise mode is warranted.

Secondly, the heterogeneity of some sample characteristics, but mainly the methodological assessment options, limits the interpretations of the affective response in RT. However, some consensus seem to be emerging in the most recently developed studies, and a suggestion on the timing of assessment (i.e., immediately after a set) seems granted. Given the low number of studies that have focused on the understanding of how to promote quality assessments using the FS/FAS (e.g., timing), replication studies will be paramount for this clarification and may help create a theoretically robust foundation for core affect assessment. Third, and still pertaining the studies heterogeneity, no clear indication emerged regarding the frequency of assessment. Although highly dependent of the sample characteristics (e.g., low vs. high fitness participants), protocols to be tested (common RT session vs. circuit RT), and other exercise-related variables (e.g., session length), understanding which characteristics will determine the assessment frequency will be paramount for future affect regulation guidelines emission.

1.6. Conclusion

The present review is the first to systematically analyze and appraise the application of the FS and/or the FAS in the RT literature. Overall, both scales detected core affect changes in the included studies within a wide array of load intensities, ages, equipment, and in both genders. However, several methodological issues could be observed, which should be addressed in future research efforts when

aiming to set a more robust foundation for core affect assessment in RT. Given theoretical considerations, the limited evidence suggests that assessments immediately after a set is an ecologically valid approach for affect measurement, while the matter of the number of applications remains considerably unexplored.

Overall, the FS and FAS seem to be adequate scales for core affect assessment in RT, despite the heterogeneity in their application and some methodological issues detected. The combination of both scales may present advantages when aiming to understand the affective panorama during a RT session.

1.6.1. Declarations

All the authors contributed to the study conception and design. The idea of this systematic review belongs to Diogo S. Teixeira. Vasco Bastos performed the literature search, data analysis and the draft, and Diogo S. Teixeira made the final critical revision.

1.6.2. Acknowledgement

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1.6.3. Disclosure statement

No potential conflict of interest was reported by the author(s).

1.7. References

- Alves, R. C., Prestes, J., Souza-Junior, T. P., Follador, L., Lopes, W. A., & Silva, S. G. (2014). Acute effect of weight training at a self-selected intensity on affective responses in obese adolescents. *J Exerc Physiol Online*, *17*(6), 66-73.
- Alves, R. C., Follador, L., Ferreira, S. S., Andrade, V. F., Garcia, E. D., & Da Silva, G. (2017). Do acute feelings of pleasure/displeasure during resistance training

- represent session affect in obese women. *Journal of Exercise Physiology Online*, 20(2), 1-9.
- American College of Sports Medicine. (2021). *ACSM's guidelines for exercise testing and prescription*. Lippincott Williams & Wilkins.
- Andrade, A.J., Ekkekakis, P., Evmenenko, A., Monteiro, D., Rodrigues, F., Cid, L., Teixeira, D.S. (2022). Affective responses to resistance exercise: Toward a consensus on the timing of assessments. *Psychology of Sport and Exercise*, 102223. <https://doi.org/10.1016/j.psychsport.2022.102223>
- Bastos, V., Andrade, A. J., Rodrigues, F., Monteiro, D., Cid, L., & Teixeira, D. S. (2022). Set to Fail: Affective Dynamics in a Resistance Training Program Designed to Reach Muscle Concentric Failure.
- Bellezza, P. A., Hall, E. E., Miller, P. C., & Bixby, W. R. (2009). The influence of exercise order on blood lactate, perceptual, and affective responses. *The Journal of Strength & Conditioning Research*, 23(1), 203-208. <https://doi.org/10.1519/JSC.0b013e3181889156>
- Calder, A. J., Hargreaves, E. A., & Hodge, K. (2020). Great expectations: A qualitative analysis of the factors that influence affective forecasts for exercise. *International Journal of Environmental Research and Public Health*, 17(2). <https://doi.org/10.3390/ijerph17020551>
- Carraro, A., Paoli, A., & Gobbi, E. (2018). Affective response to acute resistance exercise: a comparison among machines and free weights. *Sport Sciences for Health*, 14(2), 283-288. <https://doi.org/10.1007/s11332-018-0427-4>
- Cavarretta, D. J., Hall, E. E., & Bixby, W. R. (2019). Affective responses from different modalities of resistance exercise: timing matters! *Frontiers in Sports and Active Living*, 1, 5. <https://doi.org/10.3389/fspor.2019.00005>
- Chang, Y. K., & Etnier, J. L. (2009). Exploring the dose-response relationship between resistance exercise intensity and cognitive function. *Journal of Sport and Exercise Psychology*, 31(5), 640-656. <https://doi.org/10.1123/jsep.31.5.640>
- Chen, C., Finne, E., Kopp, A., & Jekauc, D. (2020). Can Positive Affective Variables Mediate Intervention Effects on Physical Activity? A Systematic Review and Meta-Analysis. *Frontiers in Psychology*, 11(October). <https://doi.org/10.3389/fpsyg.2020.587757>

- Chmelo, E. A., Hall, E. E., Miller, P. C., & Sanders, K. N. (2009). Mirrors and resistance exercise, do they influence affective responses?. *Journal of health psychology, 14*(8), 1067-1074. <https://doi.org/10.1177/1359105309342300>
- Duda, J. (1998). *Advances in sport and exercise psychology measurement*. Fitness Information Technology.
- Dukes, D., Abrams, K., Adolphs, R., Ahmed, M. E., Beatty, A., Berridge, K. C., . . . Clay, Z. (2021). The rise of affectivism. *Nature human behaviour, 5*(7), 816-820. <https://doi.org/10.1038/s41562-021-01130-8>
- Ekkekakis, P. (2013). *The measurement of affect, mood, and emotion: A guide for health-behavioral research*. New York: Cambridge.^[1]_{SEP}
- Ekkekakis, P., Hargreaves, E. A., & Parfitt, G. (2013). Invited Guest Editorial: Envisioning the next fifty years of research on the exercise-affect relationship. *Psychology of Sport and Exercise, 14*(5), 751– 758. <https://doi.org/10.1016/j.psychsport.2013.04.007>
- Ekkekakis, P., Parfitt, G., & Petruzzello, S. J. (2011). The pleasure and displeasure people feel when they exercise at different intensities. *Sports medicine, 41*(8), 641-671. <https://doi.org/10.2165/11590680-000000000-00000>
- Ekkekakis, P., & Petruzzello, S. J. (2002). Analysis of the affect measurement conundrum in exercise psychology: IV. A conceptual case for the affect circumplex. *Psychology of Sport and Exercise, 3*(1), 35-63. [https://doi.org/10.1016/S1469-0292\(01\)00028-0](https://doi.org/10.1016/S1469-0292(01)00028-0)
- Elsangedy, H. M., Machado, D. G. D. S., Krinski, K., PH, D. D. N., GT, D. A. O., Santos, T. M., ... & Parfitt, G. (2018). Let the Pleasure Guide Your Resistance Training Intensity. *Medicine and Science in Sports and Exercise, 50*(7), 1472-1479. <https://doi.org/10.1249/MSS.0000000000001573>
- Elsangedy, H. M., Oliveira, G. T. A., Machado, D. G. D. S., Tavares, M. P. M., Araújo, A. D. O., Krinski, K., ... & Gregório da Silva, S. (2021). Effects of Self-selected Resistance Training on Physical Fitness and Psychophysiological Responses in Physically Inactive Older Women: A Randomized Controlled Study. *Perceptual and Motor Skills, 128*(1), 467-491. <https://doi.org/10.1177/0031512520967610>

- Emanuel, A., Smukas, I. R., & Halperin, I. (2020a). How one feels during resistance exercises: A repetition-by-repetition analysis across exercises and loads. *International Journal of Sports Physiology and Performance*, 16(1), 135-144. <https://doi.org/10.1123/ijsp.2019-0733>^[1]_{SEP}
- Emanuel, A., Smukas, I. I. R., & Halperin, I. (2020b). The effects of lifting lighter and heavier loads on subjective measures. *International Journal of Sports Physiology and Performance*, 16(2), 176-183. <https://doi.org/10.1123/ijsp.2020-0065>
- European Commission. (2018). Special Eurobarometer 472 report — sport and physical activity. European Commission.
- Evmenenko, A., & Teixeira, D. S. (2020). The circumplex model of affect in physical activity contexts: a systematic review. *International Journal of Sport and Exercise Psychology*, 1-34. <https://doi.org/10.1080/1612197X.2020.1854818>
- Ferreira, S. S., Alves, R. C., Benites, M. L., Soave, J. L., Silva, A. C., Ribeiro, K. A., ... & da Silva, S. G. (2013). Perceptual and Affective Responses of Different Muscle Actions during Weight Training in Older Women. *Journal of Exercise Physiology Online*, 16(6).
- Focht, B. C., Garver, M. J., Cotter, J. A., Devor, S. T., Lucas, A. R., & Fairman, C. M. (2015). Affective responses to acute resistance exercise performed at self-selected and imposed loads in trained women. *The Journal of Strength & Conditioning Research*, 29(11), 3067-3074. <https://doi.org/10.1519/JSC.0000000000000985>
- Garber, C. E., Blissmer, B., Deschenes, M. R., Franklin, B. A., Lamonte, M. J., Lee, I.-M., . . . Swain, D. P. (2011). American College of Sports Medicine position stand. Quantity and quality of exercise for developing and maintaining cardiorespiratory, musculoskeletal, and neuromotor fitness in apparently healthy adults: guidance for prescribing exercise. *Medicine and science in sports and exercise*, 43(7), 1334-1359. <https://doi.org/10.1249/MSS.0b013e318213fefb>
- Greene, D. R., & Petruzzello, S. J. (2015). More isn't necessarily better: Examining the intensity–affect–enjoyment relationship in the context of resistance

exercise. *Sport, Exercise, and Performance Psychology*, 4(2), 75.

<http://dx.doi.org/10.1037/spy0000030>

Haile, L., Gallagher Jr, M., & Robertson, R. J. (2015). Perceived Exertion Perceived Exertion Laboratory Manual. <https://doi.org/10.1007/978-1-4939-1917-8>

Hardy, C. J., & Rejeski, W. J. (1989). Not what, but how one feels: the measurement of affect during exercise. *Journal of sport and exercise psychology*, 11(3), 304-317. <https://doi.org/https://doi.org/10.1123/jsep.11>

Hutchinson, J. C., Zenko, Z., Santich, S., & Dalton, P. C. (2020). Increasing the pleasure and enjoyment of exercise: a novel resistance-training protocol. *Journal of Sport and Exercise Psychology*, 42(2), 143-152. <https://doi.org/10.1123/jsep.2019-0089>

Jones. L., & Zenko, Z. (2021). Strategies to facilitate more pleasant exercise experiences. In Z. Zenko & L. Jones (Eds.), *Essentials of exercise and sport psychology: An open access textbook* (pp. 242–270). Society for Transparency, Openness, and Replication in Kinesiology. <https://doi.org/10.51224/B1011>

Kaus, R. J. (2014). *Affect and enjoyment associated with crossfit exercise* (Doctoral dissertation, Bowling Green State University).

Lacharité-Lemieux, M., Brunelle, J. P., & Dionne, I. J. (2015). Adherence to exercise and affective responses: comparison between outdoor and indoor training. *Menopause*, 22(7), 731-740. <https://doi.org/10.1097/GME.0000000000000366>

Miller, P. C., Hall, E. E., Chmelo, E. A., Morrison, J. M., DeWitt, R. E., & Kostura, C. M. (2009). The influence of muscle action on heart rate, RPE, and affective responses after upper-body resistance exercise. *The Journal of Strength & Conditioning Research*, 23(2), 366-372. <https://doi.org/10.1519/JSC.0b013e31818548f6>

Momma, H., Kawakami, R., Honda, T., & Sawada, S. S. (2022). Muscle-strengthening activities are associated with lower risk and mortality in major non-communicable diseases: a systematic review and meta-analysis of cohort

studies. *British Journal of Sports Medicine*. <http://dx.doi.org/10.1136/bjsports-2021-105061>

de Oliveira Segundo, V. H., Rebouças, G. M., Renee, T., de Medeiros, H. J., & Knackfuss, M. I. (2016). Self-selected intensity by controlled hypertensive older women during a weight training session. *Journal of Sports and Physical Education*, 70, 7-5. <https://doi.org/10.9790/6737-0310913>

Orssatto, L. B., Diefenthaler, F., Vargas, M., Rossato, M., & de la Rocha Freitas, C. (2020). Dissimilar perceptual response between trained women and men in resistance training to concentric failure: A quasi-experimental study. *Journal of Bodywork and Movement Therapies*, 24(4), 527-535. <https://doi.org/10.1016/j.jbmt.2020.06.030>

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., ... & Moher, D. (2021). The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *Bmj*, 372. <https://doi.org/10.1186/s13643-021-01626-4>

Pereira, L. C., Nunes, J. P., Kassiano, W., Aguiar, A. F., & Ribeiro, A. S. (2022). Acute effect of different resistance training loads on perceived effort and affectivity in older women: a cross-over and randomized study. *Aging Clinical and Experimental Research*, 1-7. <https://doi.org/10.1007/s40520-021-02062-z>

Portugal, E. M., Lattari, E., Santos, T. M., & Deslandes, A. C. (2015). Affective responses to prescribed and self-selected strength training intensities. *Perceptual and motor skills*, 121(2), 465-481. <https://doi.org/10.2466/29.PMS.121c17x3>

Rhodes, R. E., & Kates, A. (2015). Can the affective response to exercise predict future motives and physical activity behavior? A systematic review of published evidence. *Annals of Behavioral medicine*, 49(5), 715-731. <https://doi.org/10.1007/s12160-015-9704-5>

Ribeiro, A. S., Dos Santos, E. D., Nunes, J. P., & Schoenfeld, B. J. (2019). Acute effects of different training loads on affective responses in resistance-trained men. *International journal of sports medicine*, 40(13), 850-855. <https://doi.org/10.1055/a-0997-6680>

- Richardson, D. L., Duncan, M. J., Jimenez, A., Jones, V. M., Juris, P. M., & Clarke, N. D. (2018). The perceptual responses to high-velocity, low-load and low-velocity, high-load resistance exercise in older adults. *Journal of Sports Sciences*, 36(14), 1594-1601. <https://doi.org/10.1080/02640414.2017.1405710>
- Richardson, D. L., Duncan, M. J., Jimenez, A., Juris, P. M., & Clarke, N. D. (2020). Affective responses to supervised 10-week programs of resistance exercise in older adults. *Journal of sport and health science*, 9(6), 604-613. <https://doi.org/10.1016/j.jshs.2019.01.006>
- Rodrigues, F., Teixeira, D. S., Neiva, H. P., Cid, L., & Monteiro, D. (2020). Understanding exercise adherence: the predictability of past experience and motivational determinants. *Brain Sciences*, 10(2), 98. <https://doi.org/10.3390/brainsci10020098>
- Russell, J. A. (1980). A circumplex model of affect. *Journal of personality and social psychology*, 39(6), 1161. <https://doi.org/10.1037/h0077714>
- Schoenfeld, B. J. (2020). *Science and development of muscle hypertrophy*. Human Kinetics.
- Schwartz, H., Emanuel, A., Rozen Samukas, I. I., & Halperin, I. (2021). Exploring the acute affective responses to resistance training: A comparison of the predetermined and the estimated repetitions to failure approaches. *PloS one*, 16(8), e0256231. <https://doi.org/10.1371/journal.pone.0256231>
- Steele, J., Fisher, J., Skivington, M., Dunn, C., Arnold, J., Tew, G., . . . Mann, S. (2017). A higher effort-based paradigm in physical activity and exercise for public health: making the case for a greater emphasis on resistance training. *BMC public health*, 17(1), 1-8. <https://doi.org/10.1186/s12889-017-4209-8>
- Stevens, C. J., Baldwin, A. S., Bryan, A. D., Conner, M., Rhodes, R. E., & Williams, D. M. (2020). Affective determinants of physical activity: a conceptual framework and narrative review. *Frontiers in Psychology*, 11, 3366. <https://doi.org/10.3389/fpsyg.2020.568331>
- Stults-Kolehmainen, M. A., Lu, T., Ciccolo, J. T., Bartholomew, J. B., Brotnow, L., & Sinha, R. (2016). Higher chronic psychological stress is associated with

blunted affective responses to strenuous resistance exercise: RPE, pleasure, pain. *Psychology of Sport and Exercise*, 22, 27-36.

<http://dx.doi.org/10.1016/j.psychsport.2015.05.004>

Svebak, S., & Murgatroyd, S. (1985). Metamotivational dominance: a multimethod validation of reversal theory constructs. *Journal of personality and social psychology*, 48(1), 107. <https://doi.org/10.1037/0022-3514.48.1.107>

Tavares, V. D., Nascimento, P. H. D., Nidas de Oliveira Neto, L., Elsangedy, H. M., & da Silva Machado, D. G. (2020). The effect of resistance exercise movement tempo on psychophysiological responses in novice men. *The Journal of Strength & Conditioning Research*, 34(5), 1264-1273.

<https://doi.org/10.1519/JSC.0000000000003510>

Teixeira, D. S., Rodrigues, F., Cid, L., & Monteiro, D. (2022). Enjoyment as a Predictor of Exercise Habit, Intention to Continue Exercising, and Exercise Frequency: The Intensity Traits Discrepancy Moderation Role. *Frontiers in Psychology*, 13. <https://doi.org/10.3389/fpsyg.2022.780059>

Tiller, N. B., Sullivan, J. P., & Ekkekakis, P. (2022). Baseless Claims and Pseudoscience in Health and Wellness: A Call to Action for the Sports, Exercise, and Nutrition-Science Community. *Sports Medicine*, 1-5.

<https://doi.org/10.1007/s40279-022-01702-2>

Thomas, B. H., Ciliska, D., Dobbins, M., & Micucci, S. (2004). A process for systematically reviewing the literature: providing the research evidence for public health nursing interventions. *Worldviews on Evidence-Based Nursing*, 1(3), 176-184. <https://doi.org/10.1111/j.1524-475X.2004.04006.x>

Watson, D., Wiese, D., Vaidya, J., and Tellegen, A. (1999). The two general activation systems of affect: structural findings, evolutionary considerations, and psychobiological evidence. *J. Pers. Soc. Psychol.* 76, 820–838.

<https://doi.org/10.1037/0022-3514.76.5.820>

Westcott, W. L. (2012). Resistance training is medicine: effects of strength training on health. *Current sports medicine reports*, 11(4), 209-216.

<https://doi.org/10.1249/JSR.0b013e31825dabb8>

- Williams, D. M. (2008). Exercise, affect, and adherence: an integrated model and a case for self-paced exercise. *Journal of sport & exercise psychology*, 30(5), 471.
- Williams, D. M., & Evans, D. R. (2014). Current emotion research in health behavior science. *Emotion Review*, 6(3), 277-287.
<https://doi.org/10.1177/1754073914523052>
- World Health Organization. (2020). World Health Organization 2020 guidelines on physical activity and sedentary behaviour. *British journal of sports medicine*, 54(24), 1451-1462. <http://dx.doi.org/10.1136/bjsports-2020-102955>
- Zenko Z, Ladwig M. A. (2021). Affective responses to exercise: Measurement considerations for practicing professionals. *Essentials of exercise and sport psychology: An open access textbook*, 271-293.
<https://doi.org/10.51224/B1000>
- Zourdos, M. C., Klemp, A., Dolan, C., Quiles, J. M., Schau, K. A., Jo, E., . . . Merino, S. G. (2016). Novel resistance training-specific rating of perceived exertion scale measuring repetitions in reserve. *The Journal of Strength & Conditioning Research*, 30(1), 267-275.
<https://doi.org/10.1519/JSC.0000000000001049>

**Chapter 2. Set to Fail: Affective Dynamics in a Resistance Training Program
Designed to Reach Muscle Concentric Failure***

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1.1 Abstract

Grounded in hedonic assumptions, evidence suggests that people tend to engage in activities they consider pleasurable and enjoyable, while trying to avoid pain and displeasure. This suggests that the dynamic between positive and negative affect can influence current behavior and the intentions to continue performing. Regarding resistance training (RT), research focusing on how to promote a better affective response is still scarce and much needed.

Given existing limitations and theoretical suggestions, a RT program was developed and applied to recreational exercisers in a quasi-experimental design aiming to: (1) explore the affective response dynamic through an assessment after the last set of each exercise; and (2) analyze possible differences of preference and tolerance profiles in affective variables (core affect and enjoyment). For that purpose, 43 participants (21 male and 22 female; $M_{\text{age}} = 34.69 \pm 6.71$ years; $M_{\text{experience}} = 8.32 \pm 4.54$ years; $M_{\text{BMI}} = 24.26 \pm 2.64$ kg/m²) accepted to participate in this study. Descriptive statistics, correlational, and group comparisons analyses were performed to provide evidence for proposed objectives.

The present study showed that measures of affective valence/arousal applied immediately after a set represents a feasible and ecologically valid approach to tap core affect. Results presented evidence that recreationally trained exercisers in a common RT program would need a minimum of one measurement to assess the affective response. However, additional assessments could refine the understanding of exercise pleasurable experience. Results also suggest that exercisers with distinct profiles of preference/tolerance depicted differentiated patterns for the affective response, possibly justifying a distinct approach when promoting affective regulation.

Keywords: Resistance exercise; affect; preference; tolerance; pleasure; activation.

1.2 Introduction

Despite the ever-increasing evidence of the benefits of physical activity and exercise and the hazardous consequences of sedentary behaviors (American College of Sports Medicine, 2021), a considerable part of the world population is not physically active (World Health Organization, 2020). Resistance Training (RT) is one form of exercise that presents relevant contributions to the public health, but in need of further research efforts and advancements (Steele et al., 2017). The benefits of RT are vast and currently supported by a large body of evidence of its worth in health and well-being, playing a vital role in sarcopenia and osteoporosis prevention, and a reduction in all-cause mortality in both healthy and clinical populations (American College of Sports Medicine, 2021; Steele et al., 2017; Westcott, 2012).

This form of exercise is typically performed in health clubs and gyms (Teixeira et al., 2020). Although providing RT activities for the general and clinical populations, these facilities have struggled to keep exercisers enrolled, and behavioral change techniques have been proposed to address that issue (American College of Sports Medicine, 2021; Rodrigues et al., 2020; Sperandei et al., 2016). Moreover, among the most common forms of exercising, RT is one of the least explored when aiming to create conditions for exercise persistence (Andrade et al., 2022; Carraro et al., 2018). Thus, the current study sought to explore this issue grounded in the affective response to exercise and related theoretical assumptions (American College of Sports Medicine, 2021; Ekkekakis et al., 2011).

A dual-process approach to exercise adherence – the role of affect

Grounded in hedonic assumptions, evidence suggests that people tend to engage in activities they consider pleasurable and enjoyable, while trying to avoid

pain and displeasure. This suggests that the dynamic between positive and negative affect can influence current behavior, the beliefs regarding a given activity, the intentions to continue, and other relatable outcomes (habit, frequency, well-being) (Ekkekakis & Zenko, 2016; Rhodes & Kates, 2015; Williams, 2008). In fact, the study of affect (labeled recently as ‘affectivism’) has been revitalized in recent years and proposed to be a relevant line of reasoning in psychological research, able to enrich the understanding of current behavior models, as well as to promote and develop new behavior engagement strategies (Dukes et al., 2021).

These assumptions have been on the basis of several dual-process theoretical approaches related to exercise and/or health-related behaviors. These sustain that behavior is the result of two distinct processes: an automatic, implicit, and fast processing (i.e., type-I), and a reflective, explicit, and slower process (i.e., type-II). For example, the Affective-Reflective Theory (Brand & Ekkekakis, 2018) (ART), the Physical Activity Adoption and Maintenance model (Strobach et al., 2020) (PAAM), the Affective and Health Behavior Framework (Williams & Evans, 2014) (AHBF), and the Theory of Effort Minimization in Physical Activity (Cheval & Boisgontier, 2021) (TEMPA), represent recent attempts to explore behavior grounded in the dual-process framework. In all, affect represents a central aspect of behavior maintenance/change and has been explored either as a reflective (e.g., affective judgments, like enjoyment) or automatic (e.g., affective association) process.

Particularly in the AHBF, the affective response (immediate affective response, e.g., during running; post-behavior affective response, e.g., immediately after a workout) is considered a key determinant of health behavior. This affective response can be understood as an assessment of core affect (i.e., an elementary non-reflective feeling consciously available), and has demonstrated a relevant predictive

value for exercise adherence (Rhodes & Kates, 2015; Rodrigues et al., 2020; Williams, 2008).

Intensity as a relevant exercise control variable in affective dynamics

Exercise intensity has been shown to have a direct association with pleasurable experiences. Increases in exercise intensity are generally associated with a better affective response up until a point where it starts to undermine or negatively influence that response (Brand & Ekkekakis, 2018; Ekkekakis et al., 2011). However, the inversion point of the pleasure-displeasure response depicts a considerable inter-individual variability (Evmnenko & Teixeira, 2020; Ladwig et al., 2017). Given that exercise prescription guidelines emitted by the international entities do not adequately address how to *operationally* achieve or promote an adjusted affective response (e.g., how to assess the individual affective states, judgments, or associations; how to adjust the exercises or session to promote a better affective response), understanding how to address this variability represents a relevant contribution to the gap of the affective relation with exercise adherence (Ladwig et al., 2017; Teixeira et al., 2022).

An approach to this gap can be made through an exercise prescription aligned with two traits proposed to reflect the individual predisposition to experience affective responses related to exercise intensity, namely the preference and tolerance traits (Ekkekakis et al., 2005). Preference is considered a predisposition to select a particular level of exercise intensity, and tolerance the ability to continue exercising at an imposed level of intensity even when the activity is unpleasant/uncomfortable (Ekkekakis et al., 2005; Teixeira et al., 2021). Although experimental evidence is still lacking in the gym and health club domain, it can be hypothesized that knowing the individual preference for and tolerance of exercise intensity, and aligning the exercise prescription with those characteristics, may be a promoter of a better affective

response and, consequently, impact positively exercise behavior. Recent observational studies have supported this assumption, showing that an agreement between the training and these two traits depicts a better exercise frequency, intention to continue, and habit formation for exercising (Teixeira et al., 2021; Teixeira et al., 2022).

Another possibility to address the current gap of affect regulation knowledge is through affect assessment *during* exercise (e.g., affective response as postulated by the AHBF). This has been suggested to be made (American College of Sports Medicine, 2021; Garber et al., 2011) with the Feeling Scale (FS; Hardy & Rejeski, 1989) and Felt Arousal Scale (FAS; Svebak & Murgatroyd, 1985), thus presenting the affective valence (perceived pleasure/displeasure) and arousal (perceived activation) respectively. For core affect assessment purposes, both scales can be plotted in a circumplex model to understand the affective fluctuations of an individual in a specific moment, exercise, or, taken globally, the session (Evmenenko & Teixeira, 2020). These affective dimensions are also proposed to be effective in capturing the response to exercise intensity and may be of particular interest when considering prescribing/supervising exercise activities focused on the promotion of an individually adjusted affective response (Evmenenko & Teixeira, 2020). Both scales have been used extensively in the exercise context research, both individually and conjunctly (Cavarretta et al., 2019b; Oliveira et al., 2015). However, this assessment has been made more extensively in aerobic activities, leaving RT and other modes of practice lagging in contextual applications (Cavarretta et al., 2019b; Evmenenko & Teixeira, 2020).

Current Study

Given the role of affective responses in exercise behavior, understanding how to promote perceived pleasurable experiences during RT can be relevant for exercise

adherence. Some of the current challenges for this purpose relate to the measurement of affect during and/or after RT for the general population. For example, in a recent systematic review, the authors pinpointed three major limitations regarding the use of the FS and FAS in RT and respective plotting in the circumplex model: (1) the non-standardization of the timing of application, (2) its applicability in a real-life training context, and (3) the relevance to consider inter-individual variability (Evmnenko & Teixeira, 2020). All these limitations remain vastly unexplored but crucial for the intended affect regulation and to the application of the proposed behavioral theories and strategies for exercise adherence (ACSM, 2021).

Additionally, suggestions for individual or tailor-made exercise promotion/prescription could benefit beforehand of an additional understanding of how someone will ‘feel’ exercise intensity. It is hypothesized that the affective response should be perceived differently according to preference for and tolerance of exercise intensity (Box & Petruzzello, 2020; Diogo S Teixeira et al., 2021), but, to our knowledge, no study has explored this hypothesis in the RT setting.

Given previous limitations and suggestions, a RT program will be developed and applied to healthy exercisers in a quasi-experimental design aiming to: (1) explore the affective response dynamics in RT through an assessment after the last set of each exercise; and (2) analyze distinct profiles of preference for and tolerance of exercise intensity on core affect and enjoyment. The exercise session will be structured following general exercise recommendations for RT, and intensity of effort controlled using the Repetition in Reserve scale (Zourdos et al., 2016) (RIR; see method section). This will allow selecting the load for the defined exercises, while equalizing the intensity for all participants.

Considering the first objective of this study, the current evidence for affective response assessment, albeit preliminary for RT, suggests the application of the FS and FAS immediately after the end of a set, thus effectively assessing pleasure and activation without a significant contribution of an affective rebound effect (Andrade et al., 2022; Bellezza et al., 2009; de Oliveira Tavares et al., 2020). This procedure seems to address the two previously identified limitations regarding the time for assessment and its feasibility in a real-life setting. Moreover, considering that no specific recommendations exist regarding the number of assessments for a RT session, a continuous application of the FS/FAS will develop a first insight of the affective dynamics in this exercise mode, thus allowing to make an exploration to the needed affective valence and activation assessments. As stated by Zenko & Ladwig (2021), these scales should be used at regular intervals, achieving an adequate balance between an accurate representation of how the exerciser feels during the session, and limiting the burden of excessive assessments. This is proposed to be dependent on several variables (e.g., exercise mode, objectives, experience), but can probably be reduced given some circumstances, like exercise plan intensity homogeneity, and adaptation to exercise regimen.

As for the second objective and considering the hypothesis regarding the differences of affective responses according to exercise intensity traits, the FS and FAS scores plotted in a circumplex model should depict in exercisers with higher preference and/or tolerance a transition to a more positively-activated position in the respective quadrant (vertically to higher arousal and horizontally to feeling good; energy and vigor) (Ekkekakis et al., 2011). Although not directly, this aim reduces previously stated limitations which focused on plotting affective responses considering only global scores (i.e., sample mean scores), by testing responses in

distinct intensity preference and tolerance profiles (i.e., sub-group of reliable individuals).

1.3 Method

Participants

A priori sample size calculations were developed with G*Power v.3.1 (Faul et al., 2009) to ensure adequate statistical power. The more restrictive analysis (a repeated measures ANOVA for the three time-points of enjoyment assessment) indicated a minimum of 43 participants. This result was obtained through the definition of several conservative values and estimations: anticipated effect size of $f = .25$, statistical power $1 - \beta = .95$, correlation among repeated measures = $.50$, and $\alpha = .05$, following previous studies and authors suggestions (Brysbaert, 2019; Denis, 2018).

A total of 48 participants were recruited for this study. After data collection, 5 participants were excluded as they did not meet RIR repetition range (see study protocol). Consequently, 43 participants (male = 21; female = 22; $M_{\text{age}} = 34.69 \pm 6.71$ years; $M_{\text{experience}} = 8.32 \pm 4.54$ years; $M_{\text{BMI}} = 24.26 \pm 2.64$ kg/m²) were considered for analysis. The recruitment was made by convenience in two health clubs in the Lisbon area, considering the following inclusion criteria: volunteers aged between 20-45 years old; apparently healthy; free of injury or any other contraindication for exercise; and, at least, 3 months of continuous RT participation experience (with a minimum of 1 training session per week). An informed consent form was read and signed by all the participants before the experiment. This study was approved by the ethical review board of the Faculty of Physical Education and Sport of the Lusófona University, and was developed in accordance with the Helsinki Declaration and its later amendments.

Instruments

Preference for and Tolerance of the Intensity of Exercise

Preference (item example: “*Low-intensity exercise is boring*”) and tolerance of exercise-intensity (item example: “*Feeling tired during exercise is my signal to slow down or stop*”) were measured using the Preference for and Tolerance of the Intensity of Exercise Questionnaire Portuguese version (Teixeira et al., 2021) (PRETIE-Q-PT). The questionnaire comprises 5 items for each construct accompanied by a 5-point bipolar Likert scale anchored from 1 (“*I totally disagree*”) to 5 (“*I totally agree*”). The scores are obtained through the sum of the items per construct where five is the minimum score and 25 is the highest. This questionnaire was previously validated in a sample of health club exercisers and exhibited good psychometric properties (Teixeira et al., 2021). In present study both scales presented acceptable internal consistency (Cronbach’s alpha; preference $\alpha = .76$; tolerance $\alpha = .69$).

To analyze profiles of preference for and tolerance of exercise-intensity, the global sample was split into four profiles for each trait score: (light intensity: 5 – 9; light- to moderate-intensity: 10 – 14; moderate- to vigorous-intensity: 15 – 19; vigorous intensity: 20 – 25). Given that none of the exercisers depicted light intensity traits, only the remaining three profiles were considered. Afterwards, a total of six groups were created considering the preference for (3 groups) and the tolerance of (3 groups) exercise intensity (more information in Table 5).

Affective Valence and Activation

The Feeling Scale (Brito et al., in press; Hardy & Rejeski, 1989) (FS) was used to measure the affective valence of the participants. This 11-point scale, ranging from -5 (“*Very bad*”) to +5 (“*Very good*”), has been broadly used in the literature to assess affective valence during exercise.

Perceived activation was measured with Felt Arousal Scale (Brito et al., in press; Svebak & Murgatroyd, 1985) (FAS). The FAS is a 6-point single-item bipolar rating scale, ranging from 1 to 6 with verbal anchors of (1) “*Low arousal*” and (6) “*High arousal*”.

The FS and FAS have been shown to possess satisfactory validity and reliability in the exercise context, and have been used in conjunction to plot affective dynamics in a circumplex model of affect (Russell, 1980) (i.e., perceived activation and affective valence, respectively) (Brito et al., in press; Evmenenko & Teixeira, 2020). The circumplex model of affect is crossed by the FS and FAS and divided into four quadrants: (1) high-activation displeasure (e.g., tension; distress), (2) high-activation pleasure (e.g., energy, vigor), (3) low-activation pleasure (e.g., calmness, relaxation) and (4) low-activation displeasure (e.g., boredom, fatigue), respectively (Ekkekakis & Petruzzello, 2002).

In the present study, the scale’s scores were analyzed in 8 (all moments) and 6 (RT) moments (named RT FS and RT FAS).

Physical Activity Enjoyment

The Physical Activity Enjoyment Scale Portuguese version (Rodrigues et al., 2021) was used to measure the level of exercise enjoyment. This questionnaire includes 8 items related to “*how do you feel at the moment about the exercise you have been doing?*” that are answered using a 7-point bipolar scale ranging from 1 (“*Totally disagree*”) to 7 (“*Totally agree*”). The scale presents excellent internal consistency in all three moments of assessment in the present study (start $\alpha = .93$; end $\alpha = .91$; 24h after $\alpha = .94$).

Repetition in Reserve

The RIR (Zourdos et al., 2016) based on the ratings of a perceived exertion scale was used to measure how close to concentric failure the participants were in their last repetition. The answers can be rated in a 10 points scale (1 to 10), where each point represents an estimation of the number of repetitions to muscle failure (e.g., rating 5-6 represents 4 to 6 repetitions remaining; rating 8 represent 2 repetitions remaining). The present scale has been used in several related studies validly and reliably (e.g., Ormsbee et al., 2019).

Procedures

Study protocol

Study participants took part in two experimental sessions. The main objective of the first session was to familiarize the participants with the psychometric scales used in the present study, namely: FS, FAS, and RIR. The session started with a briefing about the upcoming activities before completing the socio-demographic and psychometric questionnaires. This was followed by a general warm-up on a treadmill (low to moderate-intensity; 5-7 minutes), 1 set of 12 repetitions in six resistance training exercises, and a brief cool-down back on the treadmill (low intensity; 2 minutes). The six resistance training exercises chosen for the present study were: the lat pulldown, back squat, bar chest press, deadlift, dumbbell shoulder press, and the leg extension, in that order. The exercise cadence was defined at 2:2 with a rest interval of 90 seconds between sets and 3 minutes between exercises. This exercise selection follows the American College of Sports Medicine (2021) guidelines for RT, which is exercises for large muscle groups and mostly multi-joint movements. The FS and the FAS were applied immediately after the termination of the warm-up, after each resistance exercise, and 5 minutes after cool-down. The data was not used for the statistical analysis of this study but merely for scale familiarization, as suggested in

previous studies (Duda, 1998; Evmenenko & Teixeira, 2020). The session exercises load and repetitions in reserve were determined by the RIR scale to adjust the effort and exercise intensity of the following session.

The second and main sessions followed the same exercise structure but with 3 sets for each resistance training exercise. The FS and the FAS were applied after the termination of the warm-up, immediately after the third set of each exercise, following Andrade et al. (2022) suggestions, and 5 minutes after the cool-down. The RIR scale was used after every set to better adjust the load for the third and final set, with the objective of approaching concentric failure. This allowed for an equalization of the resistance exercise intensity for all participants, particularly in the set (third set) that precedes the application of the FS and FAS. Participants were expected to reach concentric failure near the 12th repetition, but a range of 8-14 repetitions was deemed acceptable for study inclusion due to the expected inter-subject variability (Steele et al., 2017). This would ensure that exercises would be performed at ~70% of 1RM, following international guidelines (American College of Sports Medicine, 2021; National Strength and Conditioning Association, 2017) related to the threshold between moderate- and vigorous-intensity of load. Assessment of enjoyment was applied at the start, at the end, and approximately 24 hours after.

In both sessions, during warm-up researchers explained how and when the measures of affective valence and perceived activation would be administered, to familiarize the participants with these assessment instruments, highlighting the importance that the ratings of affective valence and perceived activation should represent these feelings as experienced *in the present moment* (e.g., immediately after the set). The instruments were presented horizontally (FS) and vertically (FAS) to better differentiate them for the participants and, simultaneously, align the scales with

their respective position on the circumplex model of affect. The standardized instructions and item stems were described to the participants and several examples were chosen to illustrate what these scales intended to assess. The participants were then asked to recall exercise-related activities, which they have experienced, for the extreme items of both bipolar scales (i.e., the FS and the FAS) to provide anchoring examples for their answers, but the emphasis was given to the importance of answering during the workout what they felt *in the present moment*. To standardize the experimental conditions, no encouragement was provided to the participants.

Three researchers conducted the data collection. Prior to the beginning of the present study, data from a small independent sample was collected for their training on the application of the psychometric instruments. This followed the recommendations of the developers of the instruments, as well as other relevant studies related to psychometric assessments (e.g., Duda, 1998).

Data analysis

The statistical analyses were conducted using IBM SPSS version 25.0. Descriptive statistics and correlational analyses were conducted for all studied variables. Normality and homoscedasticity were verified with the Shapiro-Wilk ($n < 50$) and Levene's tests. For all tests, the significance level to reject the null hypothesis was set at 5%.

First, global sample analysis procedures were developed. For differences in the dependent variables (FS, FAS, and enjoyment), repeated measures ANOVA testing was conducted. The assumption of sphericity was examined using Mauchly's test. When this assumption was not met, the Greenhouse-Geisser adjusted values and degrees of freedom were reported (Ho, 2014). The repeated measures analyses were followed by Bonferroni-adjusted post-hoc tests to analyze pairwise comparisons. The

η^2_p effect size was calculated and the assumed reference values were as follows:

"small" effect = .01, "medium" effect = .06, and "large" effect = .14 (Cohen, 1988).

After global sample analysis, the focus was given to understand FS and FAS responses across i) profiles (e.g., light- to moderate-intensity vs. moderate- to vigorous-intensity vs. vigorous-intensity) and ii) all six exercises. This was done considering three profiles for preference and three profiles for tolerance. Descriptive analysis of the profiles depicted small sample sizes, and adjusted procedures were selected for hypothesis testing. Thus, to understand if there were differences between profiles in each trait, a Kruskal-Wallis test was performed. For comparison and identification of possible differences in each profile of RT FS and RT FAS, the Friedman test was used. Both these tests are non-parametric and adjusted for small samples testing (Ho, 2014). Finally, pairwise comparisons for the two non-parametric analyses were developed, whenever $p < .05$ (Kruskal-Wallis: Dunn's post-hoc; Friedman: Wilcoxon test). A Bonferroni correction (i.e., alpha level/number of tests) was applied in these cases to account for type I errors due to multiple comparisons (Ho, 2014).

2.4. Results

The descriptive statistics and correlational analysis results are presented in Table 3. As observed, the study's participants had a mean age of 34.69 years ($SD = 6.71$), were experienced exercisers ($M = 8.32$ years; $SD = 4.54$) and presented normal body mass (BMI: $M = 24.26$ kg/m²; $SD = 2.64$).

The exercise-intensity preference ($M = 18.30$; $SD = 3.79$) and tolerance ($M = 16.63$; $SD = 3.46$) mean scores were above scale midpoint (minimum 5; medium 15; maximum 25). Preference for and tolerance of exercise-intensity presented positive associations with activation ($r = .31$, $p < .05$; $r = .41$, $p < .01$, respectively), activation

during RT ($r = .39, p < .01$; $r = .45, p < .01$, respectively) and training volume ($r = .38, p < .01$; $r = .52, p < .01$, respectively). The preference for exercise intensity also depicted a positive association with FS ($r = .34, p < .05$).

Regarding core affect, both affective valence ($M = 2.86$; $SD = 1.13$) and activation ($M = 4.42$; $SD = .53$) presented relatively high mean scores (global scores are depicted in Table 3 and Figure 2); the mean scores for the RT affective valence ($M = 2.85$; $SD = 1.49$) and activation during RT ($M = 5.01$; $SD = .85$) presented a similar pattern. In the correlation analysis, FS presented positive associations with pre-exercise enjoyment ($r = .44, p < .01$) and 24h after exercise enjoyment ($r = .44, p < .01$). The same trend of results occurred with affective valence during RT ($r = .42, p < .01$; $r = .40, p < .01$, respectively). For activation, a positive association appeared with post-exercise enjoyment ($r = .34, p < .05$), and for activation during RT a positive association with exercise volume was detected ($r = .35, p < .05$).

As for the enjoyment scores, all three assessments (pre-exercise: $M = 43.70$; $SD = 7.39$; post-exercise: $M = 46.28$; $SD = 6.51$; 24h after exercise: $M = 43.00$; $SD = 7.74$) presented values above scale midpoint.

Table 3 - Global sample descriptive and correlational analysis of the intensity traits, affective variables, and training volume

| | M | SD | | | | | | | | | |
|---|-----------|----------|-------|-------|-------|-------|-------|------|-------|-------|------|
| Age (years) | 34.69 | 6.71 | | | | | | | | | |
| BMI (kg/m ²) | 24.26 | 2.64 | | | | | | | | | |
| Experience (years) | 8.32 | 4.54 | | | | | | | | | |
| | M | SD | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 1. Preference (5 – 25) | 18.30 | 3.79 | 1 | | | | | | | | |
| 2. Tolerance (5 – 25) | 16.63 | 3.46 | .71** | 1 | | | | | | | |
| 3. Feeling Scale (FS) (-5 – 5) | 2.86 | 1.13 | .34* | .22 | 1 | | | | | | |
| 4. Felt Arousal Scale (FAS) (1 – 6) | 4.42 | .53 | .31* | .41** | .23 | 1 | | | | | |
| 5. RT Feeling Scale (RT FS) (-5 – 5) | 2.85 | 1.49 | .19 | .17 | .91** | .19 | 1 | | | | |
| 6. RT Felt Arousal Scale (RT FAS) (1 – 6) | 5.01 | .85 | .40** | .45** | .20 | .72** | .01 | 1 | | | |
| 7. Pre Enjoyment (8 – 56) | 43.70 | 7.39 | -.02 | .06 | .44** | .14 | .42** | -.02 | 1 | | |
| 8. Post Enjoyment (8 – 56) | 46.28 | 6.51 | .04 | .03 | .22 | .34* | .15 | .17 | .81** | 1 | |
| 9. 24h Enjoyment (8 – 56) | 43.00 | 7.74 | .01 | .05 | .44** | .26 | .40** | .08 | .94** | .79** | 1 |
| 10. Training volume (sets x reps x load) | 2759750.2 | 881062.8 | .38* | .52** | .17 | .22 | .19 | .35* | -.20 | -.16 | -.14 |

Table 4 - Global sample repeated measures ANOVA for the FS and FAS in the six resistance exercises

| M (SD) | Lat pulldown | Back squat | Bar chest press | Deadlift | Dumbbell shoulder press | Leg extension | F | df1, df2 | p | η ² _p | Pairwise comparisons |
|-----------|--------------|------------|-----------------|------------|-------------------------|---------------|--------------------|-----------------------------|-------------------|-----------------------------|------------------------------|
| RT FS | 3.3 (.12) | 2.95 (.28) | 2.58 (.31) | 2.7 (.28) | 2.91 (.28) | 2.14 (.38) | 3.575 [¥] | 3.728, 156.586 [¥] | .010 [¥] | .078 [¥] | § |
| RT FAS | 4.63 (.12) | 5.19 (.13) | 5.28 (.12) | 5.23 (.12) | 4.93 (.14) | 5.28 (.15) | 9.23 | 5, 210 | <.001 | .180 | 1 ≠ 2, 3, 4, 6; 3 ≠ 5; 4 ≠ 5 |
| Enjoyment | Pre | | Post | | 24h | | 15.648 | 2, 84 | <.001 | .27 | 1 ≠ 2; 2 ≠ 3 |
| | 43.70 (7.39) | | 46.28 (6.51) | | 43.00 (7.74) | | | | | | |

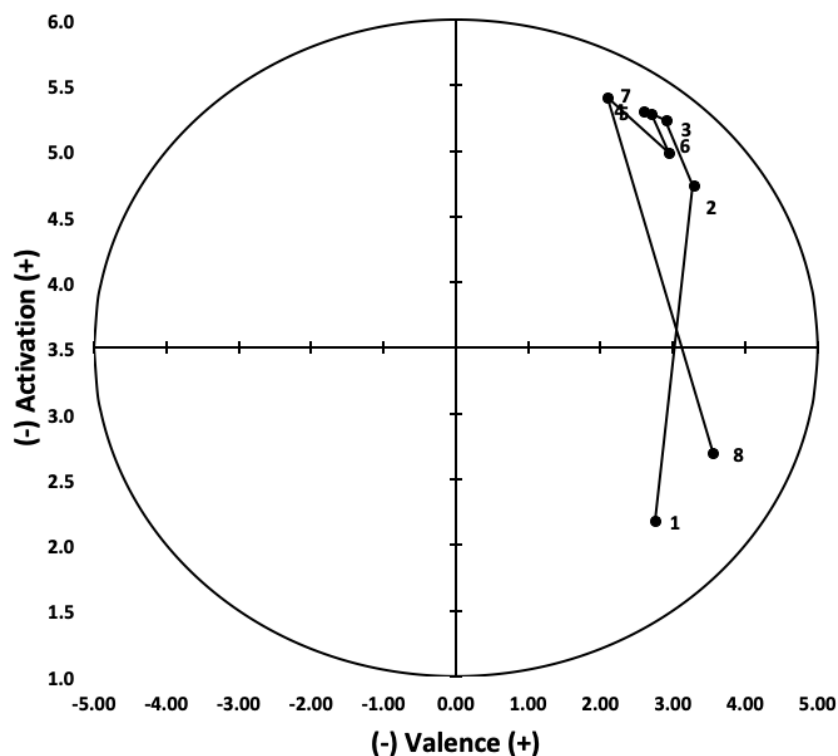


Figure 2 - Global sample circumplex model in all measured moments

Given study purposes, the next set of results relate to the affective valence and activation scores and possible differences across resistance exercises in the global sample. As seen in Table 4, no differences in affective valence emerged according to moment comparisons. Regarding activation, moment 1 presented significant differences with moments 2, 3, 4 and 6 (all $p < .001$); moment 3 with moment 5 ($p = .042$); and moment 4 with moment 5 ($p = .029$). Enjoyment in the three collected moments were also tested in the global sample. Results indicated differences between moments [$F(2, 84) = 15.648, p < .001; \eta^2_p = .27$]. In a Bonferroni-adjusted pairwise comparison, post-exercise enjoyment was significantly different from the pre-exercise (mean difference = $-2.581, p = .001$) and 24h exercise session (mean difference = $3.279, p < .001$).

Table 5 - Descriptive and Krustal-Wallis analysis of the intensity-traits, FS, FAS, enjoyment, and training volume for the six profiles

| Preference | Light-to-Moderate 10-14 (n = 9) | | Moderate-to-Vigorous 15-19 (n = 17) | | Vigorous 20-25 (n = 17) | | χ^2 | df | p | Pairwise comparisons ^{o, ¥} |
|--|-------------------------------------|---------|--|--------|----------------------------|--------|----------|----|--------|---|
| | M | SD | M | SD | M | SD | | | | |
| Preference (5 – 25) | 12.89 | 1.05 | 17.47 | 1.5 | 22.00 | 1.77 | 36.74 | 2 | < .001 | 1 ≠ 2, 3; 2 ≠ 3 |
| Tolerance (5 – 25) | 13.44 | 2.83 | 15.76 | 2.54 | 19.18 | 2.77 | 17.98 | 2 | < .001 | 1 ≠ 3; 2 ≠ 3 |
| Feeling Scale (FS) (-5 – 5) | 2.46 | 1.27 | 2.58 | 1.08 | 3.35 | .99 | 4.59 | 2 | .101 | § |
| Felt Arousal Scale (FAS) (1 – 6) | 4.21 | .57 | 4.43 | .62 | 4.53 | .41 | 1.22 | 2 | .544 | § |
| RT Feeling Scale (RT FS) (-5 – 5) | 2.87 | 1.78 | 2.35 | 1.46 | 3.32 | 1.28 | 3.88 | 2 | .113 | § |
| RT Felt Arousal Scale (RT FAS) (1 – 6) | 4.52 | 1.33 | 5.01 | 0.72 | 5.26 | .53 | 2.05 | 2 | .495 | § |
| Pre Enjoyment (8 – 56) | 44.56 | 7.38 | 42.29 | 8.07 | 44.65 | 6.88 | .71 | 2 | .701 | § |
| Post Enjoyment (8 – 56) | 45.78 | 5.43 | 46.24 | 6.54 | 46.59 | 7.32 | .28 | 2 | .868 | § |
| 24h Enjoyment (8 – 56) | 43.11 | 6.58 | 42.76 | 8.18 | 43.18 | 8.29 | .05 | 2 | .978 | § |
| Training volume (sets x reps x load) | 2566801 | 1079402 | 2451028 | 751891 | 3170621 | 766971 | 8.03 | 2 | .018 | 2 ≠ 3 |
| Tolerance | Light-to-Moderate 10-14 (n = 13) | | Moderate-to-Vigorous 15-19 (n = 22) | | Vigorous 20-25 (n = 8) | | χ^2 | df | p | Pairwise comparisons ^{o, ¥} |
| | M | SD | M | SD | M | SD | | | | |
| Preference (5 – 25) | 15.69 | 3.17 | 18.36 | 3.33 | 22.38 | 2.00 | 16.13 | 2 | < .001 | 1 ≠ 3; 2 ≠ 3 |
| Tolerance (5 – 25) | 12.54 | 1.45 | 17.18 | 1.26 | 21.75 | 1.28 | 35.38 | 2 | < .001 | 1 ≠ 2, 3; 2 ≠ 3 |
| Feeling Scale (FS) (-5 – 5) | 2.67 | 1.15 | 2.79 | 1.21 | 3.34 | .81 | 1.80 | 2 | .407 | § |
| Felt Arousal Scale (FAS) (1 – 6) | 4.23 | .58 | 4.45 | 0.52 | 4.64 | .43 | 2.52 | 2 | .284 | § |
| RT Feeling Scale (RT FS) (-5 – 5) | 2.78 | 1.62 | 2.63 | 1.50 | 3.54 | 1.18 | 2.15 | 2 | .342 | § |
| RT Felt Arousal Scale (RT FAS) (1 – 6) | 4.50 | 1.14 | 5.18 | 0.61 | 5.35 | .49 | 4.44 | 2 | .109 | § |
| Pre Enjoyment (8 – 56) | 41.54 | 6.70 | 44.32 | 7.91 | 45.50 | 6.99 | 1.93 | 2 | .381 | § |
| Post Enjoyment (8 – 56) | 45.31 | 4.35 | 46.27 | 7.23 | 47.88 | 7.79 | 1.49 | 2 | .475 | § |
| 24h Enjoyment (8 – 56) | 40.62 | 6.09 | 43.91 | 8.05 | 44.38 | 9.30 | 3.11 | 2 | .211 | § |
| Training volume (sets x reps x load) | 2212894 | 439094 | 2835821 | 993972 | 3439193 | 511865 | 8.03 | 2 | .005 | 1 ≠ 3 |

For testing differences according to preference for and tolerance of exercise-intensity, profiles for descriptive analysis and comparisons were developed (see Table 5). Differences were detected in preference for and tolerance of exercise-intensity, and training volume. Preference (in preference profiles) and tolerance (in tolerance profiles) were significantly different, aligning with the proposed profiling of the traits for this study. Exercise volume was significantly different in the preference (moderate- to vigorous-intensity vs. vigorous) and tolerance (light- to moderate-intensity vs. vigorous) intensity profiles. All pairwise comparisons were significant when considering the Bonferroni corrected value ($p = .017$; all pairwise $< .001$).

Following the previous testing, analysis of possible differences in affective valence and activation across RT exercises in each profile showed, in general, no differences between assessments. Exceptions occur in the preference and tolerance moderate- to vigorous-intensity profiles for activation, where all $p < .002$ (Bonferroni corrected $p = .003$).

When plotting the six profiles and the eight assessment points in a circumplex model, it is possible to observe that the affective response starts in the low activation/pleasure quadrant (warm-up), throughout the session shift to the high activation/pleasure quadrant (main session), and at the end again in the low activation/pleasure quadrant (cool-down). Additionally, it is possible to observe across preference and tolerance profiles, that the affective dynamics tend to shift vertically to higher activation and horizontally to a better feeling state. These results suggest an increase in the affective response as exercisers present higher preference and tolerance profiles. (Figures 3a [preference] and 3b [tolerance]).

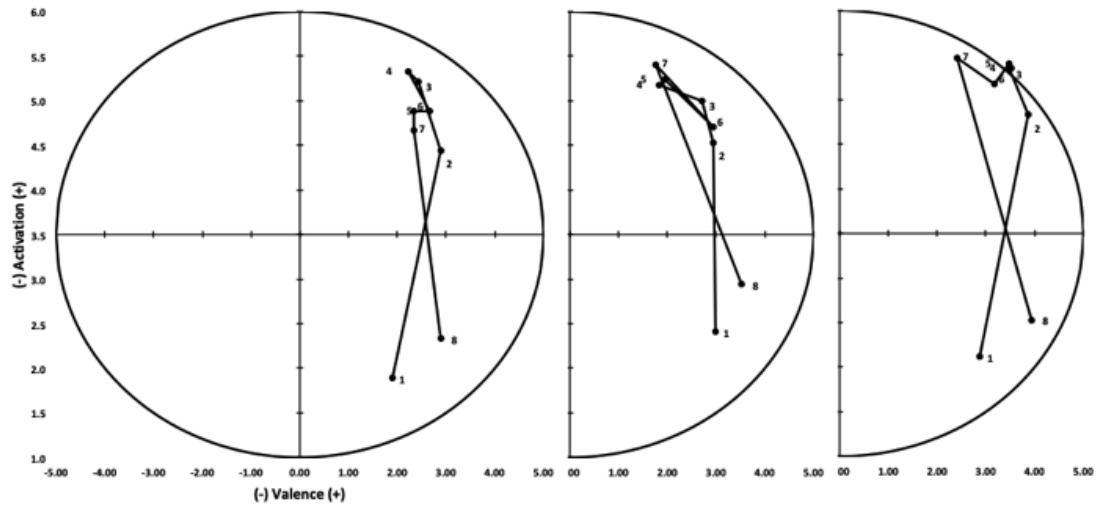


Figure 3a - Circumplex model by preference groups (from left to right: light-to-moderate intensity, moderate-to-vigorous-intensity, and vigorous-intensity)

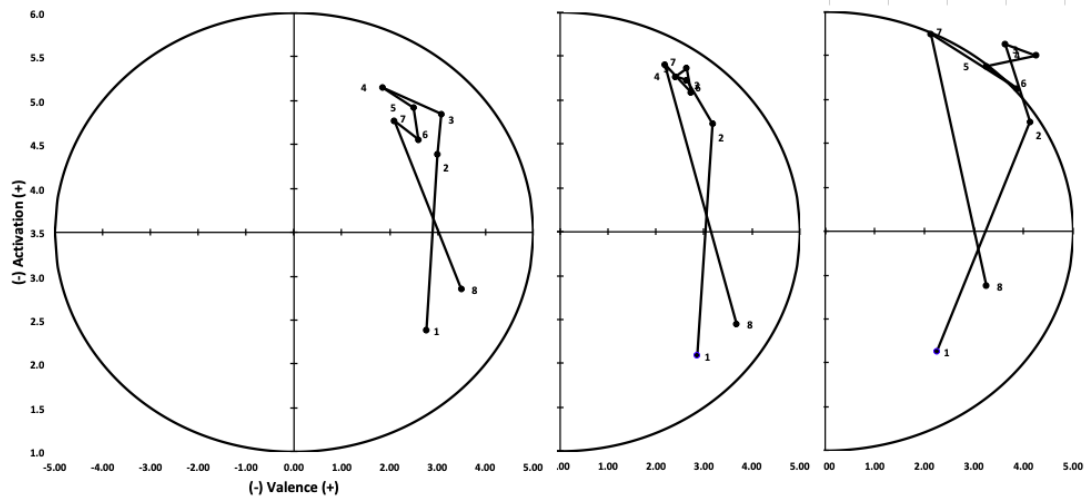


Figure 3b - Circumplex model by tolerance groups (from left to right: light-to-moderate intensity, moderate-to-vigorous-intensity, and vigorous-intensity)

Table 6 - Friedman test for affective valence and activation in the six resistance exercises in each trait profile

| | Mean Rank | Lat pulldown | Back squat | Bar chest press | Deadlift | Dumbbell shoulder press | Leg extension | χ^2 | df | <i>p</i> | Pairwise comparisons ^{§,¥} |
|-------------------------------|-----------|--------------|------------|-----------------|----------|-------------------------|---------------|----------|----|----------|-------------------------------------|
| Preference | | | | | | | | | | | |
| Light-to-Moderate (n = 9) | RT FS | 3.94 | 3.28 | 3.56 | 3.50 | 3.28 | 3.44 | 1.01 | 5 | .963 | § |
| | RT FAS | 2.28 | 4.28 | 4.39 | 3.33 | 3.39 | 3.33 | 10.37 | 5 | .065 | § |
| Moderate-to-Vigorous (n = 17) | RT FS | 2.94 | 2.71 | 1.82 | 1.94 | 2.94 | 1.76 | 14.45 | 5 | .013 | § |
| | RT FAS | 2.21 | 3.47 | 3.91 | 4.15 | 2.71 | 4.56 | 29.23 | 5 | < .001 | 1 ≠ 6; 5 ≠ 1, 4, 6 |
| Vigorous (n = 17) | RT FS | 4.15 | 3.59 | 3.71 | 3.41 | 3.47 | 2.68 | 8.65 | 5 | .124 | § |
| | RT FAS | 4.82 | 5.35 | 5.35 | 5.41 | 5.18 | 5.47 | 14.05 | 5 | .015 | § |
| Tolerance | | | | | | | | | | | |
| Light-to-Moderate (n = 13) | RT FS | 3.00 | 3.08 | 1.85 | 2.46 | 2.62 | 2.08 | 7.12 | 5 | .212 | § |
| | RT FAS | 4.38 | 4.85 | 5.15 | 4.92 | 4.54 | 4.77 | 13.91 | 5 | .016 | § |
| Moderate-to-Vigorous (n = 22) | RT FS | 3.18 | 2.64 | 2.41 | 2.64 | 2.73 | 2.18 | 6.81 | 5 | .236 | § |
| | RT FAS | 4.73 | 5.23 | 5.27 | 5.36 | 5.09 | 5.41 | 19.30 | 5 | .002 | 1 ≠ 4 |
| Vigorous (n = 8) | RT FS | 4.13 | 3.63 | 4.25 | 3.25 | 3.88 | 2.13 | 14.43 | 5 | .013 | § |
| | RT FAS | 4.75 | 5.63 | 5.50 | 5.38 | 5.13 | 5.75 | 17.50 | 5 | .004 | § |

2.5. Discussion

The present study aimed to explore the affective response dynamics in a RT program while addressing some previously reported concerns in the literature for this purpose. Additionally, the current study analyzed how distinct profiles of two intensity traits would depict core affect responses and enjoyment.

To address the issues regarding timing and the number of assessment moments, six applications of the FS and FAS were performed, all after the last set of the RT exercises. The protocol implementation (both regarding training and application) seems to align with Andrade et al. (2022) suggestions of its contextual feasibility. No issues were detected during data collection nor did incoherent results appear for FS/FAS (no outliers or random scores). For the global sample, mean scores in affective valence and activation during RT posits the exercisers in the high activation/high pleasure quadrant (or positively activated quadrant; Figure 2), and enjoyment scores suggest positive benefits from the exercise protocol and no negative impact on the 24h assessment after exercise. These results bring a first approach to the affective response and remembered affect (i.e., enjoyment) understanding in RT, when set to reach (or approximate) muscle concentric failure. Given that this intensity effort control method is based on the individual capacity to perform an exercise with a given load, and that the load was adjusted throughout the sets, approaching concentric failure would suggest an equalization of exercise intensity (~70% RM) for that given range of repetitions (Helms et al., 2016). Consequently, training close to muscle failure in the general conditions proposed by this study protocol does not seem to negatively impact the sensation of pleasure and thus is not expected, although

hypothetical at this point, to negatively affect exercise adherence and reliable outcomes. This has been proposed previously for affective valence and with this range of RM% (Cavarretta et al., 2022), but more studies are needed to adequately evaluate this result given that a wide array of training methodological variables can be used (e.g., distinct training loads, cadence, single vs. multi-joint exercises).

Still on the study's first aim, affective valence and activation scores throughout the RT session presented apparently distinct results. The affective valence presented no differences between exercises, but some differences emerged with activation scores (greatest difference between moments = .65). Two reasons may explain why arousal depicted some differences. First, the lat pulldown (as the first exercise) depicted the lowest activation score during RT and is the one that presents more pairwise differences. Probably this could represent a perceptual imprecision of the transitional change from the aerobic activity (positive deactivated quadrant) and this first exercise (positively activated quadrant), given that the remaining RT exercises depicted more homogenous responses. Additionally, Carraro et al. (2018) showed in a RT program that exercisers depicted lower activation scores in weight machines when compared to free weight, a variable that this study cannot adequately confirm due to the selected exercises (two exercises in machines vs. four with free weights), but which seems to align with data of Table 4 (global) and particularly Table 6 (profiles). On a second note, regarding affective valence and activation scores during RT, the dumbbell shoulder press also depicted two pairwise comparison differences, which may be related to the fact that, despite being a multi-joint exercise, it is the one with the smallest muscle groups activated during sets. Several studies have hypothesized that smaller muscle groups could depict different affect valence and activation scores when compared to large muscle groups (Bellezza et al., 2009;

Carraro et al., 2018; Cavarretta et al., 2019a), but research is not yet clear on that matter. Thus, although some differences emerged between exercises, in general, results tend to suggest that for this protocol, fewer assessments would suffice to capture de affective response during RT.

Regarding the intensity traits profile analysis defined as the second aim of this study, results indicate that no differences emerged in the affective valence and activation scores during RT, and between all assessments of enjoyment (Table 5). Additionally, a comparison between the six RT exercises in each profile presented the same trend of results as those in the global sample (Table 4 and Table 6). Once again, activation depicted some pairwise differences relatable with moment one assessment, but only in moderate- to vigorous-intensity in preference/tolerance profiles, thus providing preliminary evidence that for this RT program and method of assessment defined, a lesser number of measures are needed for affective responses understanding. Thus, considering results of the global and profiles samples assessment, and based on other recommendations for affective responses evaluation (Evmenenko & Teixeira, 2020; Zenko & Ladwig, 2021), current results tend to suggest that one assessment would be adequate for a RT like this study protocol. However, given the limited evidence in this mode of practice, and knowing that several close variables can influence the affective response, caution must be made when using different exercises, planning variables (e.g., rest time, cadence), and populations (e.g., beginners, pain disorders), as more measuring moments may be needed for an accurate affective representation of the session/exercises.

Interestingly, as seen in Figures 3a and 3b (and mean scores in Table 5), the FS/FAS scores plotted depict a transition to a more positively-activated position in the respective quadrant (vertically to higher arousal and horizontally to feeling good).

Although the results of per trait profiles comparisons depicted non-significant results, it is important to consider that it is in the combined effect of the FS and FAS that a closer look to core affect can be made. The trend in mean scores configured in the circumplex model does suggest that exercisers showing higher preference or tolerance experience a better affective response. This has already been partially explored in a high-intensity exercise protocol, where exercisers with higher preference showed a more pleasant response than a lower-intensity preference group, even when the perceptions for exertion were similar (Box & Petruzzello, 2020). Additionally, some studies have reported that small differences in affective valence and activation scores may be relevant to explain the lower levels of physical activity of some people, and that a difference of one unit on the FS may impact considerably the amount of future quantity of physical activity (Ekkekakis, 2009; Williams, 2008). This may suggest that for low fitness individuals (or novice/beginners), intensity profiling and affective response assessments may be even more relevant to adequately promote a pleasurable feeling while exercising. Thus, core affective responses change as depicted across intensity traits profiles should be considered relevant for exercise prescription that aims to target positive affective experiences.

2.5.1. Limitations and future directions

Although this quasi-experimental study brings novelty and addresses a relevant gap in hedonic assumptions for exercise promotion, some limitations must be reported. First, sample size, their characteristics, and study protocol must be considered when trying to extrapolate for other similar situations. As stated previously, several factors may influence affective response during exercise. This study aligns with several others that have been trying to better understand a method for adequate assessment of these questions in this exercise mode, but several

confounding variables (e.g., experience; exercise selection; age) may still emerge that warrant caution when interpreting the results. However, and grounded in current evidence, some directions now seem clearer (e.g., timing for assessment; applicant and exerciser previous training for FS/FAS interpretation and application) and should be a concern by researchers that aim to advance this field of study.

The intensity traits now explored have received some attention in recent years but are still lacking experimental research and evidence, as for methodological orientations, particularly for leisure physical activity purposes. In the present study, preference and tolerance were treated independently, but recent evidence (Teixeira et al., 2021) proposes the creation of profiles that can encompass a different conceptualization than those proposed here (e.g., high preference – low tolerance; high preference – high tolerance; traits agreement). For this purpose, advancements must be made to test experimentally and with larger samples some of these possible traits combinations, as preliminary evidence does suggest their relevant role in exercise behavior (Teixeira et al., 2022).

2.6. Perspective

For exercise adherence, professionals should also focus on developing positive affective responses. In the exercise domain, that purpose can be achieved through an individual approach to exercise intensity prescription and supervision, thus aligning with current behavioral frameworks and strategies. Additionally, this approach can help to expand the predictive value of several other theoretical models, thus targeting contemporary methods for the understanding of human behavior (Dukes et al., 2021). Particularly relevant is the ease of application and respective exercise counseling/prescription adjustments that can emerge from the present study instruments. These target relevant gaps for the professional's practice and address a

commonly used expression of physical exercise (i.e., resistance exercise), thus allowing their use in a very large sample of recreational exercisers.

2.7. Conclusion

Concluding, the present study showed that in a RT session developed to approach concentric failure, the FS and FAS applied immediately after the final set in each RT exercise represents a feasible and ecologically valid approach to tap core affect. Results presented evidence that recreationally trained exercisers enrolled in a common RT program would need a minimum of one measurement to assess the affective response of the session. Finally, results also suggest that exercisers with distinct profiles of preference or tolerance depict a differentiated pattern for affective valence and activation responses, possibly justifying a distinct approach when aiming to promote affective regulation.

2.8. References

- American College of Sports Medicine. (2021). ACSM's guidelines for exercise testing and prescription (11th ed.). Lippincott Williams and Wilkins.
- Andrade A, Ekkekakis P, Evmenenko A, et al. Affective responses to resistance exercise: toward a consensus on the timing of assessments. *Psychology of Sport and Exercise*. 2022;102223. doi:<https://doi.org/10.1016/j.psychsport.2022.102223>
- Physical Fitness*, <https://doi.org/10.23736/S0022-4707.20.10907-1>.
- Box, A. G., & Petruzzello, S. J. (2020). Why do they do it? Differences in high-intensity exercise-affect between those with higher and lower intensity preference and tolerance. *Psychology of Sport and Exercise*, 47, 101521.
- Brito, H., Teixeira, D. S., & Araujo, D. (in press). Construct validity of the feeling scale and felt arousal scale in the Portuguese context. *Cuadernos de Psicología del Deporte*
- Brysbaert, M. (2019). How many participants do we have to include in properly powered experiments? A tutorial of power analysis with reference tables. *Journal of cognition*.
- Carraro, A., Paoli, A., & Gobbi, E. (2018). Affective response to acute resistance exercise: a

- comparison among machines and free weights. *Sport Sciences for Health*, 14(2), 283–288. <https://doi.org/10.1007/s11332-018-0427-4>
- Cavarretta, D. J., Hall, E. E., & Bixby, W. R. (2018). The acute effects of resistance exercise on affect, anxiety, and mood—practical implications for designing resistance training programs. *International Review of Sport and Exercise Psychology*, 12(1), 295–324. <https://doi.org/10.1080/1750984X.2018.1474941>
- Cavarretta, D. J., Hall, E. E., & Bixby, W. R. (2019a). Affective Responses From Different Modalities of Resistance Exercise: Timing Matters! *Frontiers in Sports and Active Living*, 1, 5. <https://doi.org/10.3389/fspor.2019.00005>
- Cavarretta, D. J., Hall, E. E., & Bixby, W. R. (2019b). The Effects of Increasing Training Load on Affect and Perceived Exertion. *Journal of Strength and Conditioning Research*, Publish Ah(December), b. <https://doi.org/10.1519/jsc.0000000000003393>
- Cheval, B., & Boisgontier, M. P. (2021). The theory of effort minimization in physical activity. *Exercise and Sport Sciences Reviews*, 49(3), 168.
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*. Hillsdale, NJ: Lawrence Erlbaum Associates.
- de Oliveira Tavares, V. D., Nascimento, P. H. D., Nidas de Oliveira Neto, L., Elsangedy, H. M., & da Silva Machado, D. G. (2020). The effect of resistance exercise movement tempo on psychophysiological responses in novice men. *The Journal of Strength & Conditioning Research*, 34(5), 1264-1273.
- Denis, J. D. (2009). *SPSS Data Analysis for Univariate, Bivariate, and Multivariate Statistics* (1st ed.). EUA, John Wiley & Sons.
- Duda, J. L. (1998). *Advances in sport and exercise psychology measurement*. Morgantown, W.: Va: Fitness Information Technology, Inc.
- Dukes, D., Abrams, K., Adolphs, R., Ahmed, M. E., Beatty, A., Berridge, K. C., . . . Clay, Z. (2021). The rise of affectivism. *Nature human behaviour*, 5(7), 816-820.
- Ekkekakis, P. (2009). Let them roam free? *Sports medicine*, 39(10), 857-888.
- Ekkekakis, P., Hall, E. E., & Petruzzello, S. J. (2005). Some like it vigorous: Measuring individual differences in the preference for and tolerance of exercise intensity. *J Sport Exercise Psy*, 27.
- Ekkekakis, P., Parfitt, G., & Petruzzello, S. J. (2011). The pleasure and displeasure people feel when they exercise at different intensities: Decennial update and progress towards a tripartite rationale for exercise intensity prescription. *Sports Medicine*, 41(8), 641–671.

<https://doi.org/10.2165/11590680-000000000-00000>

- Ekkekakis, P., & Petruzzello, S. J. (2002). Analysis of the affect measurement conundrum in exercise psychology: IV. A conceptual case for the affect circumplex. *Psychology of Sport and Exercise*, 3(1), 35–63. [https://doi.org/10.1016/S1469-0292\(01\)00028-0](https://doi.org/10.1016/S1469-0292(01)00028-0)
- Ekkekakis, P., & Zenko, Z. (2016). Escape from cognitivism: Exercise as hedonic experience. In *Sport and exercise psychology research* (pp. 389-414). Academic Press.
- Evmenenko, A., & Teixeira, D. S. (2020). The circumplex model of affect in physical activity contexts: a systematic review. *International Journal of Sport and Exercise Psychology*, 1–34. <https://doi.org/10.1080/1612197x.2020.1854818>
- Faul, F., Erdfelder, E., Faul, F., Buchner, A., & Lang, A. G. (2009). Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods*, 41(4), 1149–1160. <https://doi.org/10.3758/BRM.41.4.1149>
- Hardy, C. J., & Rejeski, W. J. (1989). Not what, but how one feels: The measurement of affect during exercise. *J Sport Exercise Psy*, 11.
- Helms, E. R., Cronin, J., Storey, A., & Zourdos, M. C. (2016). Application of the repetitions in reserve-based rating of perceived exertion scale for resistance training. *Strength and conditioning journal*, 38(4), 42.
- Ho, R. (2014). *Handbook of Univariate and Multivariate Data Analysis with IBM SPSS* (2nd ed.). New York: CRC Press.
- Jones, L., Hutchinson, J. C., & Mullin, E. M. (2018). In the zone: an exploration of personal characteristics underlying affective responses to heavy exercise. *Journal of sport and exercise psychology*, 40(5), 249-258.
- Ladwig, M. A., Hartman, M. E., & Ekkekakis, P. (2017). Affect-based exercise prescription. *ACSM's Health and Fitness Journal*, 21(5), 10–15. <https://doi.org/10.1249/FIT.0000000000000332>.
- NSCA. (2017). NSCA Strength and Conditioning Professional Standards and Guidelines. *Strength & Conditioning Journal*.
- Oliveira, B., Deslandes, A., & Santos, T. (2015). Differences in exercise intensity seems to influence the affective responses in self-selected and imposed exercise: a meta-analysis. *Frontiers in psychology*, 6, 1105.
- Ormsbee, M. J., Carzoli, J. P., Klemp, A., Allman, B. R., Zourdos, M. C., Kim, J. S., & Panton, L. B. (2019). Efficacy of the repetitions in reserve-based rating of perceived exertion for the bench press in experienced and novice benchers. *The Journal of*

Strength & Conditioning Research, 33(2), 337-345.

Rhodes, R. E., & Kates, A. (2015). Can the Affective Response to Exercise Predict Future Motives and Physical Activity Behavior? A Systematic Review of Published Evidence. *Annals of Behavioral Medicine*, 49(5), 715–731. <https://doi.org/10.1007/s12160-015-9704-5>

Rodrigues, F., Forte, P., Teixeira, D. S., Cid, L., & Monteiro, D. (2021). The Physical Activity Enjoyment Scale (Paces) as a Two-Dimensional Scale: Exploratory and Invariance Analysis. *Montenegrin Journal of Sports Science and Medicine*, 10(1). <https://doi:10.26773/mjssm.210309>

Rodrigues, F., Teixeira, D. S., Neiva, H. P., Cid, L., & Monteiro, D. (2020). The bright and dark sides of motivation as predictors of enjoyment, intention, and exercise persistence. *Scandinavian Journal of Medicine & Science in Sports*, 30(4), 787-800.

Russell, J. A. (1980). A circumplex model of affect. *Journal of personality and social psychology*, 39(6), 1161.

Schoenfeld, B. J. (2020). *Science and development of muscle hypertrophy*. Human Kinetics.

Schoenfeld, B. J., Contreras, B., Krieger, J., Grgic, J., Delcastillo, K., Belliard, R., & Alto, A. (2019). Resistance training volume enhances muscle hypertrophy but not strength in trained men. *Medicine and science in sports and exercise*, 51(1), 94.

Sperandei, S., Vieira, M. C., & Reis, A. C. (2016). Adherence to physical activity in an unsupervised setting: Explanatory variables for high attrition rates among fitness center members. *Journal of Science and Medicine in Sport*, 19(11), 916–920. <https://doi.org/10.1016/j.jsams.2015.12.522>

Steele, J., Endres, A., Fisher, J., Gentil, P., & Giessing, J. (2017a). Ability to predict repetitions to momentary failure is not perfectly accurate, though improves with resistance training experience. *PeerJ*, 5, e4105.

Steele, J., Fisher, J., Skivington, M., Dunn, C., Arnold, J., Tew, G., Batterham, A. M., Nunan, D., O’Driscoll, J. M., & Mann, S. (2017b). A higher effort-based paradigm in physical activity and exercise for public health: making the case for a greater emphasis on resistance training. *BMC public health*, 17(1), 1-8.

Strobach, T., Englert, C., Jekauc, D., & Pfeffer, I. (2020). Predicting adoption and maintenance of physical activity in the context of dual-process theories. *Perform. Enhanc. Health*. 8. <https://doi.org/10.1016/j.peh.2020.100162>

- Svebak, S., & Murgatroyd, S. (1985). Metamotivational Dominance. A Multimethod Validation of Reversal Theory Constructs. *Journal of Personality and Social Psychology*, 48(1), 107–116. <https://doi.org/10.1037/0022-3514.48.1.107>
- Teixeira, D. S., Ekkekakis, P., Andrade, A. J., Rodrigues, F., Evmenenko, A., Faria, J., Marques, P., Cid, L., & Monteiro, D. (2021a). Preference for and Tolerance of the Intensity of Exercise Questionnaire (PRETIE-Q): Validity, Reliability and Gender Invariance in Portuguese Health Club Exercisers. *Current Psychology*.
- Teixeira, D., Monteiro, D., Rodrigues, F., Sousa, M., Chaves, C., & Cid, L. (2020). Ginásios e health clubs em Portugal: Estaremos perante uma república das bananas? *Motricidade*, 16, 3-17.
- Teixeira, D. S., Rodrigues, F., Cid, L., & Monteiro, D. (2022). Enjoyment as a Predictor of Exercise Habit, Intention to Continue Exercising, and Exercise Frequency: The Intensity Traits Discrepancy Moderation Role [Original Research]. *Frontiers in Psychology*, 13. <https://doi.org/10.3389/fpsyg.2022.780059>
- Teixeira, D. S., Rodrigues, F., Machado, S., Cid, L., & Monteiro, D. (2021b). Did You Enjoy It? The Role of Intensity-Trait Preference/Tolerance in Basic Psychological Needs and Exercise Enjoyment. *Frontiers in Psychology*, 12, 1-10.
- Westcott, W. L. (2012). Resistance training is medicine: effects of strength training on health. *Current sports medicine reports*, 11(4), 209-216.
- World Health Organization (2020). Guidelines on physical activity and sedentary behaviour. *British journal of sports medicine*, 54(24), 1451-1462.
- Zourdos, M. C., Klemp, A., Dolan, C., Quiles, J. M., Schau, K. A., Jo, E., ... & Blanco, R. (2016). Novel resistance training–specific rating of perceived exertion scale measuring repetitions in reserve. *The Journal of Strength & Conditioning Research*, 30(1), 267-275.

Discussão Geral

O presente trabalho procurou explorar a resposta afetiva em dinâmicas de TR, particularmente em ginásios e *health clubs*. Para cumprir este objectivo, dois estudos foram efetuados: uma revisão sistemática da literatura e uma intervenção quasi-experimental.

A revisão sistemática procurou analisar a aplicação da FS e/ou da FAS no TR. O foco foi dado à sua viabilidade, *timing* de aplicação, e implicações para a medição da resposta afetiva no TR. Um total de 26 estudos foram incluídos com ambas as escalas a demonstrarem serem viáveis na medição do *core affect* em intervenções de TR. No entanto, vários problemas metodológicos foram detetados nos estudos incluídos. Falta de standardização no *timing* de aplicação e falta de recomendações para a sua frequência emergem como as duas principais limitações da literatura. Em relação ao *timing* de aplicação, uma considerável heterogeneidade no momento de medição foi detetada, o que pode originar resultados enviesados e dificultar a sua extrapolação. A literatura atual sugere que a medição da resposta afetiva deve ser aplicada durante ou imediatamente após um exercício (Stevens et al., 2020). Apesar de ambas as hipóteses aparentarem serem viáveis, no TR uma medição imediatamente após uma série parece oferecer algumas vantagens, nomeadamente para a segurança do praticante e para a manutenção das dinâmicas do exercício pretendidas (Andrade et al., 2022). Por exemplo, uma medição durante uma série com cargas elevadas (e.g., 90% de uma repetição máxima) pode originar um efeito de intrusão que comprometa a segurança e a capacidade do praticante de finalizar o número de repetições pretendido (e conseqüentemente influenciar variáveis de treino como a cadência do exercício e o volume total). Em relação ao número de medições, a resposta afetiva

deve ser medida com uma frequência suficiente que permita avaliar a dinâmica afetiva geral de uma sessão de TR, limitando simultaneamente o fardo de uma avaliação excessiva para o participante (Zenko & Ladwig, 2021). Esta tarefa é tão importante como desafiante, especialmente considerando a inexistência de recomendações nesse sentido.

Outra questão detetada refere-se a inconsistências na familiarização de participantes (descrita em 42% dos estudos) e investigadores (descrita em apenas 8%) com as escalas. Estas incongruências contrastam com as recomendações de, por exemplo, Duda (1998) e Evmenenko & Teixeira (2020) que destacam a importância de treino prévio com as escalas para assegurar a sua devida compreensão e aplicação. De referir ainda que o tamanho de efeito e/ou cálculos de potência foram realizados em apenas metade dos estudos, muitos dos quais apresentam amostras de tamanho reduzido. De forma geral, sugere-se que investigações futuras devem ter estes factores em consideração ao estruturarem os seus procedimentos metodológicos, de modo a aprimorar as suas intervenções e evitar resultados errôneos.

No estudo quasi-experimental, dois principais objectivos foram apresentados: (1) explorar a flutuação da resposta afetiva numa sessão de TR prescrita para atingir a falha muscular; (2) analisar a valência afetiva, ativação e divertimento em perfis distintos de preferência e tolerância por intensidade. Em relação ao primeiro objectivo, a média da resposta afetiva da amostra global permaneceu no quadrante de alta ativação/prazer do modelo circumplexo o que, teoricamente, poderá ser o ideal na promoção da adesão ao exercício. Da mesma forma, a sessão de TR resultou em níveis positivos de divertimento reportado, sem qualquer impacto negativo 24 horas após exercício (quando comparado com os resultados de *baseline*).

Ainda no primeiro objectivo, as pequenas diferenças na resposta afetiva de cada exercício de TR, a juntar à sustentabilidade da dinâmica afetiva no quadrante de alta ativação/prazer, deixam indicações que uma única medição poderá ser suficiente numa amostra de praticantes treinados, num protocolo de TR semelhante ao deste estudo. Apesar destes resultados representarem as primeiras indicações (preliminares) referentes a um número viável de medições de *core affect*, será imprudente extrapolar estes resultados a amostras distintas (e.g., previamente destreinadas; em recuperação de uma lesão) ou a sessões de TR com características diferentes (i.e., outra combinação das variáveis de treino, como candências distintas, intervalos de repouso, entre outros). Por exemplo, pode ser hipotetizado que mais medições poderão ser necessárias em indivíduos a iniciar a sua prática regular de TR (i.e., < 6 meses de treino regular) considerando as altas taxas de desistência aos 3 e 6 meses (75% e 50% respetivamente; Buckworth et al., 2013). Como tal, mais medições poderão contribuir para uma experiência de exercício mais prazerosa e na promoção de uma adesão sustentada.

Em relação ao segundo objectivo, uma tendência para uma posição mais positivamente-ativada no respetivo quadrante do modelo circumplexo pode ser observada nos grupos com traços por intensidade mais elevadas (nos grupos da preferência e particularmente nos grupos da tolerância). Apesar de os resultados (FS e FAS independentes) entre grupos de diferentes perfis não serem estatisticamente significativos, é no efeito coletivo da valência afetiva e da ativação que conseguimos analisar mais detalhadamente o *core affect*. Adicionalmente, já foi previamente explorado que a diferença de uma única unidade na FS pode impactar significativamente a manutenção da prática de exercício (Ekkekakis, 2009; Williams, 2008). O que estes resultados do segundo estudo sugerem é que os indivíduos com

preferência e (principalmente) com tolerância por intensidades mais elevadas tiveram uma resposta afetiva mais prazerosa nesta sessão de TR prescrita até à falha. Esta tendência já foi previamente reportada em outros estudos com outras dinâmicas de exercício, onde indivíduos com preferência (Box & Petruzzello, 2020) e tolerância (Bradley, Niven & Phillips, 2019) por intensidades mais elevadas reportaram uma resposta afetiva mais positiva. Isto sugere que estes traços por intensidade são relevantes na promoção de uma prática de exercício mais prazerosa e devem ser considerados na intensidade prescrita.

Para aplicar esta abordagem hedónica no TR e noutras formas de exercício, parece ser necessária uma mudança de paradigma na sua prescrição. As últimas diretrizes do *American College of Sports Medicine* (2021) mantêm recomendações com intervalos fixos (e.g., 60-70% 1-RM). No entanto, uma abordagem mais individualizada poderá ser mais viável na promoção de uma prática mais prazerosa e sustentada no tempo (Ekkekakis et al., 2011; Ladwig et al., 2017; Teixeira et al., 2022). Esta abordagem poderá ser operacionalizada através do apuramento dos traços de preferência e tolerância por intensidade numa avaliação inicial, da prescrição de exercício individualizada de acordo com estes traços, e de diversas medições durante a sessão de treino que poderão originar os ajustes necessários na intensidade. Isto significaria então uma importante ruptura para com a mentalidade “no pain, no gain” e da perspectiva puramente biomédica (i.e., racional dose-efeito) na prescrição de exercício (Pereira, Teixeira, & Sousa, 2022).

Limitações e direções futuras

Em relação à revisão sistemática, as suas principais limitações espelham as da literatura atual na resposta afetiva ao TR. A ainda escassa literatura sobre o assunto e heterogeneidade reportada tanto nas opções metodológicas de medição (i.e., *timing*,

numero de medições) como nas características da amostra (tamanho reduzido; utilização de cálculos de potência) limitam a interpretação e extrapolação dos resultados. Recomendações recentes parecem sugerir algum consenso no *timing* de aplicação (i.e., imediatamente após uma série; Andrade et al., 2022; Stevens et al., 2020) mas mais estudos são necessários para dar uma maior robustez teórica a estas recomendações. Por exemplo, apesar de recomendar uma medição imediatamente após a ultima repetição de uma série, os resultados de Andrade et al. (2022) mostram algumas ligeiras diferenças entre a resposta afetiva intra e pós série que devem ser tidas em consideração. Adicionalmente, partindo do pressuposto que a intensidade é a variável de maior relevo na medição da resposta afetiva, pode ser especulado que diferentes *timings* intra série poderão originar diferentes respostas (e.g., repetições iniciais *versus* repetições finais). Nesse sentido, a fase concêntrica da ultima repetição poderá ser considerada o momento de maior intensidade de uma série de TR. No entanto, segundo nos foi possível apurar, nenhum estudo tentou compreender a resposta afetiva neste momento. Apesar de uma medição imediatamente após parecer ser de facto a mais viável, o conhecimento destas potenciais variações da resposta afetiva são importantes para a sua melhor compreensão no TR.

No que toca à frequência de medição, o estudo quasi-experimental forneceu algumas recomendações preliminares, mas mais estudos com amostras (e.g., experiência de treino) e protocolos (e.g., intensidades distintas) mais diferenciados serão importantes para uma melhor compreensão de um número adequado de medições. Da mesma forma, o impacto dos traços por intensidade na resposta afetiva devem ser explorados em maior medida com amostras de maior dimensão.

Apesar da utilidade e viabilidade da FS e da FAS que este trabalho demonstrou, existem outros instrumentos para medir a resposta afetiva que devem ter

a sua devida consideração. Por exemplo, a *Activation Deactivation Adjective Check List* (Thayer, 1989) representa uma opção satisfatória de medir a resposta afetiva ao exercício também num modelo circumplexo dos afetos (Ekkekakis et al., 2005b). Se o foco da investigação for apenas a valência afetiva, a *Empirical Valence Scale* (Lishner, Cooter, & Zald, 2008) pode ser uma alternativa à FS, particularmente se por motivos metodológicos for pretendida uma escala análoga visual em vez de uma escala de Likert. Esta escala foi também adaptada para medir o prazer lembrado, que a par do prazer antecipado poderão ser variáveis de relevo para a adesão continuada ao exercício (Zenko, Ekkekakis, & Ariely, 2016). Como tal, deverão ser alvo de um maior foco em investigações futuras.

No ponto prévio da mudança de paradigma na prescrição de exercício, mais estudos são igualmente necessários. Enquanto as questões metodológicas do TR aqui levantadas estão mais esclarecidas no treino aeróbio (i.e., medição durante o exercício; Ekkekakis et al., 2011; Evmenenko & Teixeira, 2020), as limitações na medição da resposta afetiva no treino de flexibilidade são ainda mais consideráveis (Henriques & Teixeira, em revisão; Evmenenko & Teixeira, 2020). Igualmente, na abordagem de apurar os traços de intensidade numa avaliação inicial, é necessário também compreender se a preferência e tolerância por intensidade de um indivíduo são características transversais para as diferentes manifestações do exercício físico. Por exemplo, será que um indivíduo que prefira intensidades vigorosas no TR terá esta mesma preferência no treino de flexibilidade e no treino aeróbio? Estudos futuros devem ter esta hipótese em consideração.

Conclusão Geral

Este trabalho demonstra as limitações atuais da literatura na medição da resposta afetiva no TR e, simultaneamente, o seu potencial na promoção de sessões de treino mais prazerosas e de uma adesão ao exercício mais sustentada. Espera-se que a revisão sistemática desenvolvida faça uma necessária contribuição para investigações futuras, e que a intervenção quasi-experimental promova processos de validação ecológica para o modelo circunflexo ao demonstrar a sua viabilidade na medição da dinâmica afetiva numa sessão de TR num dos seus locais de práticas mais comuns.

Face à atual incapacidade de inverter o sedentarismo generalizado na população mundial, parece ser necessário explorar diferentes abordagens que permitam que o TR e outras formas de exercício tenham o seu devido contributo para a saúde pública. Uma das grandes vantagens do ‘*affectivism*’ (i.e., estudo do afeto) é o seu objectivo em complementar outras abordagens e modelos de mudanças comportamental atuais, permitindo assim a criação de estratégias de adesão à prática de exercício mais eficazes e sustentáveis. Para este contributo ser implementado eficazmente, instrumentos psicométricos viáveis com claras recomendações de aplicação baseadas na evidência precisam de ser estabelecidos na literatura.

Nesse sentido, a FS e a FAS aparentam ser escalas adequadas para a medição do *core affect* no TR, providenciando uma diferenciação mais rica e detalhada do panorama afetivo quando utilizadas para desenhar o modelo circunflexo. Adicionalmente, conforme os resultados do segundo estudo demonstram, uma medição imediatamente após a última série de um exercício de TR representa um abordagem viável e ecologicamente válida para medir *core affect* numa sessão de treino prescrita para atingir a falha muscular.

Referências Gerais

- American College of Sports Medicine. (2021). *ACSM's guidelines for exercise testing and prescription*. Lippincott Williams & Wilkins.
- Andrade, A.J., Ekkekakis, P., Evmenenko, A., Monteiro, D., Rodrigues, F., Cid, L., Teixeira, D.S. (2022). Affective responses to resistance exercise: Toward a consensus on the timing of assessments. *Psychology of Sport and Exercise*, 102223. <https://doi.org/10.1016/j.psychsport.2022.102223>
- Box, A. G., & Petruzzello, S. J. (2020). Why do they do it? Differences in high-intensity exercise-affect between those with higher and lower intensity preference and tolerance. *Psychology of Sport and Exercise*, 47, 101521
- Bradley, C., Niven, A., & Phillips, S. M. (2019). Self-reported tolerance of the intensity of exercise influences affective responses to and intentions to engage with high-intensity interval exercise. *Journal of Sports Sciences*, 37(13), 1472-1480.
- Buckworth J., Dishman R., O'Connor P., Tomporowski, P. (2013). *Exercise Psychology* (2nd ed.). Champaign: Human Kinetics.
- Calder, A. J., Hargreaves, E. A., & Hodge, K. (2020). Great expectations: A qualitative analysis of the factors that influence affective forecasts for exercise. *International Journal of Environmental Research and Public Health*, 17(2). <https://doi.org/10.3390/ijerph17020551>
- Cavarretta, D. J., Hall, E. E., & Bixby, W. R. (2019). Affective responses from different modalities of resistance exercise: timing matters! *Frontiers in Sports and Active Living*, 1, 5. <https://doi.org/10.3389/fspor.2019.00005>
- Chen, C., Finne, E., Kopp, A., & Jekauc, D. (2020). Can Positive Affective Variables Mediate Intervention Effects on Physical Activity? A Systematic Review and Meta-Analysis. *Frontiers in Psychology*, 11(October). <https://doi.org/10.3389/fpsyg.2020.587757>
- Duda, J. (1998). *Advances in sport and exercise psychology measurement*. Fitness Information Technology
- Dukes, D., Abrams, K., Adolphs, R., Ahmed, M. E., Beatty, A., Berridge, K. C., . . . Clay, Z. (2021). The rise of affectivism. *Nature human behaviour*, 5(7), 816-820.

- Ekkekakis, P. (2013). *The measurement of affect, mood, and emotion: A guide for health-behavioral research*. New York: Cambridge.^[1]_{SEP}
- Ekkekakis, P., Hall, E. E., & Petruzzello, S. J. (2004). Practical markers of the transition from aerobic to anaerobic metabolism during exercise: rationale and a case for affect-based exercise prescription. *Preventive medicine*, 38(2), 149-159.
- Ekkekakis, P., Hall, E. E., & Petruzzello, S. J. (2005a). Some like it vigorous: Measuring individual differences in the preference for and tolerance of exercise intensity. *Journal of Sport and Exercise Psychology*, 27(3), 350-374.
- Ekkekakis, P., Hall, E. E., & Petruzzello, S. J. (2005b). Evaluation of the circumplex structure of the Activation Deactivation Adjective Check List before and after a short walk. *Psychology of Sport and Exercise*, 6(1), 83-101.
- Ekkekakis, P., Hall, E. E., & Petruzzello, S. J. (2008). The relationship between exercise intensity and affective responses demystified: to crack the 40-year-old nut, replace the 40-year-old nutcracker!. *Annals of Behavioral Medicine*, 35(2), 136-149.
- Ekkekakis, P., Hargreaves, E. A., & Parfitt, G. (2013). Invited Guest Editorial: Envisioning the next fifty years of research on the exercise-affect relationship. *Psychology of Sport and Exercise*, 14(5), 751– 758.
<https://doi.org/10.1016/j.psychsport.2013.04.007>
- Ekkekakis, P. (2009). Let them roam free? *Sports medicine*, 39(10), 857-888.
- Ekkekakis, P., & Dafermos, M. (2012). Exercise is a many-splendored thing, but for some it does not feel so splendid: Staging a resurgence of hedonistic ideas in the quest to understand exercise behavior. In E. O. Acevedo (Ed.), *Oxford library of psychology. The Oxford handbook of exercise psychology* (p. 295–333). Oxford University Press.
- Ekkekakis, P., Parfitt, G., & Petruzzello, S. J. (2011). The pleasure and displeasure people feel when they exercise at different intensities. *Sports medicine*, 41(8), 641-671. <https://doi.org/10.2165/11590680-000000000-00000>
- Ekkekakis, P., & Zenko, Z. (2016). Escape from cognitivism: Exercise as hedonic experience. In *Sport and exercise psychology research* (pp. 389-414). Academic Press.

- Emanuel, A., Smukas, I. R., & Halperin, I. (2020). How one feels during resistance exercises: A repetition-by-repetition analysis across exercises and loads. *International Journal of Sports Physiology and Performance*, 16(1), 135-144. <https://doi.org/10.1123/ijpspp.2019-0733>^[1]_[SEP]
- European Commission. (2018). Special Eurobarometer 472 report — sport and physical activity. European Commission.
- Evmenenko, A., & Teixeira, D. S. (2020). The circumplex model of affect in physical activity contexts: a systematic review. *International Journal of Sport and Exercise Psychology*, 1-34. <https://doi.org/10.1080/1612197X.2020.1854818>
- Garber, C. E., Blissmer, B., Deschenes, M. R., Franklin, B. A., Lamonte, M. J., Lee, I.-M., . . . Swain, D. P. (2011). American College of Sports Medicine position stand. Quantity and quality of exercise for developing and maintaining cardiorespiratory, musculoskeletal, and neuromotor fitness in apparently healthy adults: guidance for prescribing exercise. *Medicine and science in sports and exercise*, 43(7), 1334-1359. <https://doi.org/10.1249/MSS.0b013e318213fefb>
- Hardy, C. J., & Rejeski, W. J. (1989). Not what, but how one feels: the measurement of affect during exercise. *Journal of sport and exercise psychology*, 11(3), 304-317. <https://doi.org/https://doi.org/10.1123/jsep.11>
- Henriques, L., & Teixeira, D.S., (in review). Affective Valence and Activation in Stretching Activities: A Systematic Review
- Ladwig, M. A., Hartman, M. E., & Ekkekakis, P. (2017). Affect-based exercise prescription. *ACSM's Health and Fitness Journal*, 21(5), 10–15. <https://doi.org/10.1249/FIT.0000000000000332>.
- Lishner, D. A., Cooter, A. B., & Zald, D. H. (2008). Addressing measurement limitations in affective rating scales: Development of an empirical valence scale. *Cognition and Emotion*, 22(1), 180-192.
- Momma, H., Kawakami, R., Honda, T., & Sawada, S. S. (2022). Muscle-strengthening activities are associated with lower risk and mortality in major non-communicable diseases: a systematic review and meta-analysis of cohort

studies. *British Journal of Sports Medicine*. <http://dx.doi.org/10.1136/bjsports-2021-105061>

Pereira, H.V., Teixeira, D.S., & Sousa, A. (2022) “No pain, no gain”: receita para o sucesso ou fracasso na promoção da atividade física? In CIDEFES, ULHT. *Mitos vs. Factos no Desporto, Educação Física, Exercício e Saúde* (CIDEFES, ULHT, ed.). Lisboa; 2022

Portugal, E. M., Lattari, E., Santos, T. M., & Deslandes, A. C. (2015). Affective responses to prescribed and self-selected strength training intensities. *Perceptual and motor skills*, 121(2), 465-481. <https://doi.org/10.2466/29.PMS.121c17x3>

Rhodes, R. E., & Kates, A. (2015). Can the affective response to exercise predict future motives and physical activity behavior? A systematic review of published evidence. *Annals of Behavioral medicine*, 49(5), 715-731. <https://doi.org/10.1007/s12160-015-9704-5>

Rodrigues, F., Teixeira, D. S., Cid, L., & Monteiro, D. (2019). Have you been exercising lately? Testing the role of past behavior on exercise adherence. *Journal of Health Psychology*, 26(10), 1482-1493.

Russell, J. A. (1980). A circumplex model of affect. *Journal of personality and social psychology*, 39(6), 1161. <https://doi.org/10.1037/h0077714>

Schoenfeld, B. J. (2020). *Science and development of muscle hypertrophy*. Human Kinetics.

Sperandei, S., Vieira, M. C., & Reis, A. C. (2016). Adherence to physical activity in an unsupervised setting: Explanatory variables for high attrition rates among fitness center members. *Journal of Science and Medicine in Sport*, 19(11), 916–920. <https://doi.org/10.1016/j.jsams.2015.12.522>

Stevens, C. J., Baldwin, A. S., Bryan, A. D., Conner, M., Rhodes, R. E., & Williams, D. M. (2020). Affective determinants of physical activity: a conceptual framework and narrative review. *Frontiers in Psychology*, 11, 3366. <https://doi.org/10.3389/fpsyg.2020.568331>

- Svebak, S., & Murgatroyd, S. (1985). Metamotivational dominance: a multimethod validation of reversal theory constructs. *Journal of personality and social psychology*, 48(1), 107. <https://doi.org/10.1037/0022-3514.48.1.107>
- Thayer, R. E. (1989). The biopsychology of mood and arousal. New York: Oxford University Press.
- Teixeira, D. S., Rodrigues, F., Cid, L., & Monteiro, D. (2022). Enjoyment as a Predictor of Exercise Habit, Intention to Continue Exercising, and Exercise Frequency: The Intensity Traits Discrepancy Moderation Role. *Frontiers in Psychology*, 13. <https://doi.org/10.3389/fpsyg.2022.780059>
- Teixeira, D. S., Rodrigues, F., Machado, S., Cid, L., & Monteiro, D. (2021). Did You Enjoy It? The Role of Intensity-Trait Preference/Tolerance in Basic Psychological Needs and Exercise Enjoyment. *Frontiers in Psychology*, 12, 1-10. <https://doi.org/10.3389/fpsyg.2021.682480>
- Westcott, W. L. (2012). Resistance training is medicine: effects of strength training on health. *Current sports medicine reports*, 11(4), 209-216. <https://doi.org/10.1249/JSR.0b013e31825dabb8>
- World Health Organization. (2020). World Health Organization 2020 guidelines on physical activity and sedentary behaviour. *British journal of sports medicine*, 54(24), 1451-1462. <http://dx.doi.org/10.1136/bjsports-2020-102955>
- Williams, D. M. (2008). Exercise, affect, and adherence: an integrated model and a case for self-paced exercise. *Journal of sport & exercise psychology*, 30(5), 471.
- Williams, D. M., & Evans, D. R. (2014). Current emotion research in health behavior science. *Emotion Review*, 6(3), 277-287. <https://doi.org/10.1177/1754073914523052>
- Zenko, Z., Ekkekakis, P., & Ariely, D. (2016). Can you have your vigorous exercise and enjoy it too? Ramping intensity down increases postexercise, remembered, and forecasted pleasure. *Journal of Sport and Exercise Psychology*, 38, 149–159. doi: 10.1123/jsep.2015-0286
- Zenko Z, Ladwig M. A. (2021). Affective responses to exercise: Measurement considerations for practicing professionals. *Essentials of exercise and sport psychology: An open access textbook*, 271-293. <https://doi.org/10.51224/B1000>

Anexos

CARTA EXPLICATIVA DO ESTUDO AOS PARTICIPANTES E CONSENTIMENTO INFORMADO

A Faculdade de Educação Física e Desporto da Universidade Lusófona gostaria de o convidar a participar num estudo que terá como objetivo analisar a resposta afectiva no treino de resistência muscular. A informação recolhida neste estudo poderá, no futuro, ajudar no desenho de estratégias eficientes que contribuam para a saúde e bem-estar das populações. Para participar neste estudo deverá ser praticante regular de exercício em ginásios/health clubs há pelo menos 3 meses e não ter limitações de saúde associadas à prática de exercício físico.

O estudo consistirá na realização de alguns exercícios de força numa sala de exercício. A duração da sessão será, aproximadamente, de 60 min. Não se antecipam problemas ou desvantagens pessoais com a participação no estudo. Poderá existir algum desconforto físico ou dores musculares pós-treino como resultado dos exercícios realizados, expectáveis como resultado normal de um processo de treino muscular.


Entraremos depois em contacto 24 horas após a sessão para lhe pedir o preenchimento de um questionário para averiguarmos o divertimento que sentiu durante a sessão de exercício. Para esse efeito, iremos solicitar uma forma de contacto da sua preferência.

Este estudo seguirá as recomendações de diversas entidades internacionais e de autores de referência para garantir a realização de um treino seguro e com o menor risco possível. No entanto, existe sempre na prática desportiva o risco de lesão. Se sentir que o presente estudo pode colocar em risco a sua saúde, por favor dê indicação aos investigadores sobre essa situação e sinta-se livre de não participar no estudo.

Se decidir participar no estudo, poderá abandonar o mesmo em qualquer momento sem ter que fornecer qualquer tipo de explicação. Todo o material recolhido será codificado e tratado de forma anónima e confidencial.

Os resultados do estudo serão apresentados apenas para divulgação científica, nunca sendo os participantes identificados de forma individual.

Caso surja alguma dúvida, ou necessite de informação adicional, por favor contacte pessoalmente ou através do email o responsável do estudo:



Professor Doutor Diogo S. Teixeira
(diogo.teixeira@ulusofona.pt)

DECLARAÇÃO DE CONSENTIMENTO INFORMADO

Reconheço que os procedimentos de investigação descritos na carta anexa me foram explicados e que todas as minhas questões foram esclarecidas de forma satisfatória. Compreendo igualmente que a participação no estudo não acarreta qualquer tipo de potenciais desvantagens para além das enunciadas na carta explicativa.

Fui informado que tenho o direito a recusar participar e que a minha recusa em o fazer não terá consequências para mim. Compreendo que tenho o direito de colocar agora e durante o desenvolvimento do estudo, qualquer questão relacionada com o mesmo. Compreendo que sou livre de, a qualquer momento, abandonar o estudo sem ter de fornecer qualquer explicação.

Assim, declaro que aceito participar nesta investigação, com a salvaguarda da confidencialidade e anonimato e sem prejuízo pessoal de cariz ético ou moral.

Profissional do Exercício responsável pelo estudo:



(Professor Doutor Diogo S. Teixeira)

O Participante:

_____, ____ de _____ de 2021

Código participante (a preencher pelo investigador): _____

Leia cuidadosamente cada questão antes de responder. As questões são de resposta simples e não existem respostas certas ou erradas, o que se procura é conhecer a sua opinião e experiência face ao exercício. Assim, agradecemos que responda com a máxima sinceridade. As suas respostas são confidenciais e apenas serão tratadas estatisticamente por investigadores afetos à investigação.

Ginásio: _____ **Nº Sócio:** _____

Investigador: _____ **(não preencher)**

1. **Sexo:** F M

2. **Data de Nascimento:** ___ / ___ / ___

3. **Estado Civil:** Solteiro Casado (ou União de Facto) Divorciado Viúvo

4. **Estatura:** ___ cm 5. **Peso:** ___ Kg

6. **Com que frequência semanal pratica exercício em ginásio?** _____ dias/sem

7. **Qual a sua experiência de prática em ginásios? (ex: 3 meses / 2 anos)**

Preferência e Tolerância à intensidade no Exercício

Pense nos seus treinos e responda se a intensidade (esforço que o treino exige) está de acordo com a sua **preferência** (gostava que fosse mais intenso / menos intenso) e **tolerância** (consigo tolerar mais / não consigo tolerar tanto). Por favor leia cada uma das afirmações seguintes e utilize a escala para indicar se concorda ou discorda delas.

1 - Discordo totalmente; 2 - Discordo; 3 - Nem concordo nem discordo; 4 - Concordo; 5 - Concordo totalmente

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | A intensidade do meu treino está de acordo com a minha preferência . | 1 | 2 | 3 | 4 | 5 |
| 2 | A intensidade do meu treino está de acordo com a minha tolerância . | 1 | 2 | 3 | 4 | 5 |

Preferência e Tolerância à intensidade no Exercício – PRETIE-Q (Teixeira et al., 2021)

Inventário de hábitos de exercício: por favor leia cada uma das afirmações seguintes e utilize a escala para indicar se concorda ou discorda delas. Não há respostas certas ou erradas. Responda rapidamente e assinale a resposta que melhor descreve o que acredita e como se sente quando pratica exercício. Certifique-se que respondeu a todas as questões.

1 - Discordo totalmente; 2 - Discordo; 3 - Nem concordo nem discordo; 4 - Concordo; 5 - Concordo totalmente

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | Sentir-me cansado(a) durante o exercício é o meu sinal para abrandar ou parar. | 1 | 2 | 3 | 4 | 5 |
| 2 | Eu prefiro treinar a baixa intensidade por um período mais longo do que treinar a alta intensidade num período mais curto. | 1 | 2 | 3 | 4 | 5 |
| 3 | Durante os exercícios, se os meus músculos começaram a doer excessivamente ou se me sentir a respirar de forma muito intensa, é sinal para eu abrandar. | 1 | 2 | 3 | 4 | 5 |
| 4 | Eu prefiro treinar com calma, mesmo que isso demore mais tempo. | 1 | 2 | 3 | 4 | 5 |
| 5 | Quando treino, costumo preferir um ritmo lento e constante. | 1 | 2 | 3 | 4 | 5 |

| | | | | | | |
|----|---|---|---|---|---|---|
| 6 | Eu prefiro abrandar ou parar quando um treino começa a ficar muito exigente. | 1 | 2 | 3 | 4 | 5 |
| 7 | Enquanto treino, prefiro atividades que são de ritmo lento e não requerem muito esforço. | 1 | 2 | 3 | 4 | 5 |
| 8 | Quando os meus músculos começam a doer durante os exercícios, eu costumo abrandar um pouco. | 1 | 2 | 3 | 4 | 5 |
| 9 | Quanto mais rápido e difícil for o treino, mais prazer eu sinto. | 1 | 2 | 3 | 4 | 5 |
| 10 | Durante o treino, eu continuo a treinar mesmo sentindo dores musculares e fadiga. | 1 | 2 | 3 | 4 | 5 |

Por favor forneça os dados seguintes para o contacto aproximadamente 24h após o treino.

Email: _____

Telefone: _____

Muito obrigado pela sua disponibilidade!

Physical Activity Enjoyment Scale (PACES)

Versão original de Mullen et al. (2011); versão portuguesa Teques et al. (2017)

Como é que se sente neste momento acerca do exercício que realiza?

Pode escolher entre 1 e 7 para indicar o seu grau de concordância com as afirmações:

1 - Discordo totalmente 2 - Discordo bastante 3 - Discordo 4 - Não concordo nem discordo 5 - Concordo 6 - Concordo bastante 7 - Concordo totalmente

| | Discordo Totalmente | Discordo Bastante | Discordo | Não Concordo, Nem Discordo | Concordo | Concordo Bastante | Concordo Totalmente |
|---------------------------|---------------------|-------------------|----------|----------------------------|----------|-------------------|---------------------|
| 1) Acho que é agradável. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 2) É muito divertido. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 3) É muito porreiro. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 4) É muito revigorizante. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 5) É muito gratificante. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 6) É muito animado. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 7) É muito estimulante. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 8) É muito refrescante. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

Até à Falha: Variações da Valência Afetiva num Treino com Resistência Prescrito para Atingir a Falha Muscular

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Resumo:

Introdução: O Modelo Circumplexo dos Afetos permite uma melhor compreensão do panorama afetivo ao longo de uma sessão de treino. No entanto, continua a existir um *gap* na literatura sobre a aplicação deste modelo no treino com resistência (TR).

Objectivo: (1) Estabelecer o número ideal de medições da Feeling Scale (FS) e da Felt Arousal Scale (FAS) no TR; (2) Analisar a flutuação da dinâmica afetiva em contexto de health club, de modo a permitir uma validação ecológica do Modelo Circumplexo dos Afetos; (3) Identificar diferenças entre perfis de preferência e tolerância distintos; (4) Analisar a variação do divertimento num treino com resistência.

Metodologia: 33 participantes experientes (M=34,49±16,68 anos) responderam a FS e a FAS em oito ocasiões: no final de dois momentos de treino cardiorrespiratório (fases preparatórias e de retorno calma) e no final da terceira série de seis exercícios de TR, após terem atingido a falha concêntrica (definida através de uma escala subjetiva de esforço que utiliza repetições em reserva).

Resultados: A resposta afetiva ao TR manteve-se no quadrante de alta ativação- prazer do modelo circumplexo. Quanto mais elevados os traços da preferência e tolerância da intensidade, mais prazerosa foi a resposta reportada. Os seis momentos após a falha não apresentaram uma diferença significativa entre si. O divertimento pós-treino apresentou valores superiores ao pré-treino 24h após.

Conclusões: Quando a intensidade é igualada, uma única medição pode ser suficiente para medir a resposta afetiva no TR. A falha muscular parece também induzir uma resposta afetiva positiva em praticantes experientes, especialmente nos que apresentam uma preferência e tolerância de intensidade mais elevada. O TR parece ainda elevar o *enjoyment* percebido pós-treino. Este estudo representa o primeiro deste modelo com o momento de medição definido segundo a literatura, num contexto próximo da realidade.

Endereço para correspondência

XXII JORNADAS DA SOCIEDADE PORTUGUESA DE PSICOLOGIA DO DESPORTO

04 > 06 de novembro 2021

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COM CATEGORIA DE DESPORTO E ATIVIDADE FÍSICA ASSOCIADAS

INSTITUTO DE INVESTIGAÇÃO E INOVAÇÃO EM PSICOLOGIA DO DESPORTO

CERTIFICADO



Certifica-se que

A comunicação intitulada:

Até à Falha: Variações da Valência Afetiva num Treino com Resistência Prescrito para Atingir a Falha Muscular

Da autoria de; Vasco Bastos, Ana Andrade, Diogo Monteiro, Filipe Rodrigues, Luis Cid, Diogo Santos Teixeira

venceu o Prémio de investigação António Paula Brito, nas XXII JORNADAS DA SOCIEDADE PORTUGUESA DE PSICOLOGIA DO DESPORTO, organizadas pelo Departamento de Motricidade Humana e Linguagens Artísticas da Escola Superior de Educação e Ciências Sociais do Politécnico de Leiria e pela Sociedade Portuguesa de Psicologia do Desporto, realizadas de 4 a 6 de novembro de 2021.

O Presidente da SPPD

António Paula Brito

O Diretor da ESECS - Politécnico de Leiria

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