FILIPE CÉSAR ROSA DOS SANTOS

A RELAÇÃO DA PREFERÊNCIA E TOLERÂNCIA PELA INTENSIDADE DO EXERCÍCIO EM PRATICANTES RECREACIONAIS DE CROSSFIT

Orientador: Professor Doutor Diogo dos Santos Teixeira

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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, especialização em Fitness, conferido pela Universidade Lusófona de Humanidades e Tecnologias no dia 16 de Novembro de 2022, com o Despacho de Nomeação nº 326/2022, de 26 de Outubro de 2022, com a seguinte composição de júri:

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Dedicatória

Dedico este trabalho à minha querida avó Maria Alice, uma verdadeira guerreira e a minha maior inspiração. A forma corajosa, resiliente e ao mesmo bondosa e doce com que consegue encontrar forças para ultrapassar todas as adversidades, deu e continua a dar-nos lições de vida impagáveis. Foi a nossa base e maior apoio quando vimos o avô Luís partir, que, esteja onde estiver, está decerto a olhar por nós. Até já.

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"A winner is a dreamer who never gives up." –
Nelson Mandela

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"It is the supreme art of the teacher to awaken joy in creative expression and knowledge." – Albert Einstein

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Por fim, uma palavra de apreço a todas as pessoas que aceitaram participar no estudo observacional transversal das boxes (sem ordem de importância): CrossFit Adamastor, CrossFit

Barcelos, CrossFit Lusíadas, CrossFit MoveOn, CrossFit N14, CrossFit Neverland, CrossFit Niner, CrossFit Odivelas, CrossFit Urban Wolves, CrossFit 2725, Hill Box, Iron Box, Lousã CrossFit, No Pain Box e Viriato CrossFit, o meu muito obrigado por terem despendido do vosso tempo nas respostas aos questionários. Aos responsáveis das referidas boxes por terem sido tão prestáveis e gentis comigo só posso agradecer. Obrigado a todos.

Resumo geral

Objetivo. Os constructos preferência e tolerância podem ser considerados traços relevantes na compreensão das relações entre a intensidade do exercício e diversas variáveis (e.g., divertimento, adesão ao exercício físico, vitalidade subjetiva e frequência) e o questionário - Preferência e Tolerância à Intensidade do Exercício (PRETIE-Q) - tem sido utilizado para melhor entender essas relações. O CrossFit caracteriza-se principalmente pela alta intensidade a que é executado e, apesar de ser um programa de treino de grupo relativamente recente, o número de praticantes tem tido um crescimento muito considerável nos últimos anos estimando-se que existam cerca de cinco milhões de pessoas em todo o mundo a praticar CrossFit. No entanto, as razões que levam as pessoas a aderir e continar a praticar esta modalidade independentemente da alta intensidade e das relações negativas que são conhecidas entre treinar a essas intensidades e a resposta afetiva ao exercício, ainda não são claras. Assim, a presente dissertação tem como objetivo geral compreender a relação da preferência e tolerância pela intensidade do exercício físico numa população de praticantes recreacionais de CrossFit. Para o efeito, dois estudos foram realizados, sendo o primeiro uma revisão sistemática de literatura na qual o objetivo passou pela análise da utilidade e viabilidade da utilização da preferência e tolerância que advém da PRETIE-Q na regulação de práticas de exercício. Em relação ao segundo estudo (um estudo observacional transversal), foram definidos três objetivos: (1) caracterizar o perfil de preferência e tolerância pela intensidade do exercício físico em praticantes recreacionais de CrossFit; (2) analisar a concordância dos traços de intensidade com a intensidade do treino atualmente desenvolvido; (3) analisar a relação entre os perfis de concordância e seus efeitos de moderação entre o divertimento, vitalidade subjetiva, intenção para continuar a praticar exercício e frequência semanal.

Método. Foi realizada uma revisão sistemática de literatura no sentido de analisar a evidência científica existente sobre a utilização do questionário *Preference for and Tolerance of the Intensity of Exercise Questionnaire* (PRETIE-Q). Foram utilizadas as bases de dados PubMed, SportDISCUS, PsycINFO e B-on (última pesquisa em Julho de 2022) e a revisão foi escrita respeitando as recomendações do protocolo PRISMA. Foi também realizado um estudo observacional transversal com uma amostra de 330 praticantes recreacionais de CrossFit de 15 boxes espalhadas pelo território nacional. Foram avaliados através de questionários psicométricos, a preferência pela intensidade do exercício, a tolerância à intensidade do exercício, o divertimento no exercício, a vitalidade subjetiva, a intenção para continuar a

praticar exercício, a frequência semanal, a qualidade da experiência no exercício e a concordância dos traços de intensidade com a intensidade do exercício atual dos participantes. Em termos de análise estatística, foram realizados testes descritivos, correlações de Pearson e testes de moderação.

Resultados. Na revisão sistemática foram qualitativamente analisados 36 estudos publicados entre 2005 e 2022, demonstrando os resultados que ambos os constructos (i.e., preferência e tolerância) aparentam ser úteis e aplicáveis numa grande variedade de contextos de atividade física, não tendo sido reportadas limitações relevantes. No estudo observacional transversal, os resultados demonstram que os participantes apresentaram valores acima da média da escala para preferência e tolerância (i.e., moderado a vigoroso), divertimento e vitalidade subjetiva. Foram obtidos ainda valores muito altos para intenção e qualidade da experiência. Também a concordância da preferência e concordância da tolerância apresentaram resultados muito altos significando que o treino atual está de acordo com a preferência e tolerância da maioria dos participantes. Foram encontradas correlações positivas entre a maioria das variáveis e nenhum dos modelos testados mostrou efeitos de moderação.

Conclusão. Da revisão sistemática de literatura concluímos que os traços de preferência e tolerância à intensidade do exercício parecem fornecer uma avaliação simples, mas útil nas relações com outras variáveis em diversos contextos de atividade física. No estudo transversal observacional, os resultados demonstram que os praticantes recreacionais de CrossFit apresentam valores para preferência, tolerância e concordância dos traços com o treino atual similares quando comparados com outros praticantes de atividades realizadas em intensidades mais baixas, o que nos leva a concluir que os construtos preferência e tolerância devem ser relacionados somente com as características individuais dos participantes e não com a atividade que praticam.

Palavras-chave: preferência, tolerância, intensidade do exercício, atividade física, CrossFit

Abstract

Objective. The preference and tolerance constructs may be considered relevant traits for understanding the relationships between exercise intensity and several variables (e.g., enjoyment, exercise adherence, subjective vitality and frequency) and the preference for and tolerance of the intensity of exercise (PRETIE-Q) has been used to better understand those relationships. CrossFit is characterized mainly by the intensities present in its execution and, although it is a relatively recent training program, the number of participants had a considerable growth in the past few years estimating that about five million people worldwide practice CrossFit. Nonetheless, the reasons that lead people to adhere and continue practicing CrossFit, despite the high intensity and the known negative relationships between training at such intensities and affective responses, are yet unclear. That said, the present dissertation has the general objective of understanding the relationship between of preference and tolerance for exercise intensity in a population of recreational CrossFit participants. For that matter two studies were developed, being the first a systematic review aiming to analyze the utility and feasibility of the preference for and tolerance of exercise intensity constructs in physical activity settings. Regarding the second study (a cross-sectional study), we had three main objectives were: (1) to define the preference and tolerance profiles in CrossFit recreational participants; (2) to analyze the accordance of intensity-traits with the intensity of current training; (3) to analyze the relationship between the agreement profile and its moderation effects with enjoyment, vitality, intention, and frequency.

Methods. A systematic review was made in order to analyze the existing evidence about the use of the Preference for and Tolerance of the Intensity of Exercise Questionnaire (PRETIE-Q). To attain that objective, a broad search of the literature was conducted on the following databases: PubMed, SportDISCUS, PsycINFO and B-on (the last search was conducted in July 2022) and the systematic review was written following the recommendations by the PRISMA protocol. A cross-sectional study was also made with a sample of 330 recreational CrossFit participants enrolled in 15 boxes across the national territory. Preference for exercise intensity, tolerance to exercise intensity, exercise enjoyment, subjective vitality, intention to continue exercising, frequency, quality of the experience and intensity-trait agreement were assessed through psychometric questionnaires. In terms of statistical analysis, descriptive tests, Pearson correlations and moderation tests were performed.

Results. The systematic review, qualitatively analyzed 36 studies published between 2005 and 2022, depicted results suggesting that both constructs (i.e.., preference and tolerance) appear to be useful and feasible in a broad variety of physical activity settings, and no relevant limitations were reported of its use. In the cross-sectional study, the results showed that participants demonstrated above midpoint score results for preference, tolerance, enjoyment and subjective while intention and quality of the experience depicted very high scores. Both preference-agreement and tolerance-agreement showed positive results meaning that the intensity of most participants' current training is in accordance with their preference and tolerance. Positive correlations were present between most of the variables and none of the tested models depicted moderation effect.

Conclusion. From the systematic review, we can conclude that the preference and tolerance intensity traits appear to provide a simple but useful assessment in the relation with several physical activity outcomes. In the cross-sectional study, the results showed that CrossFit recreational participants depict similar intensity-trait preference/tolerance when compared with other non-HIIT activity participants suggesting that, these constructs should be related solely with the individuals' characteristics and not with the activities in which they are enrolled.

Keywords: preference, tolerance, exercise intensity, physical activity, CrossFit

Abreviaturas e siglas

BAS – Behavioral activation

BIS – Behavioral inhibition

ECP – Extreme condition program

EF – Exercício físico

FFT – Functional fitness training

HIC – High-intensity body-weight circuit

HIFT – High intensity functional training

HIIE – High-intensity interval exercise

HIIT – High intensity interval training

HIMT – High intensity multimodal training

MIAE – Moderate-intensity aerobic exercise

OMS – Organização Mundial de Saúde

PA – Physical activity

PACES – Physical Activity Enjoyment Scale

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

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

RVV – Relative reinforcing value

SVS – Subjective Vitality Scale

WHO – World Health Organization

WOD – Workout of the day

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Introdução geral

A atividade física (AF) regular é apontada como um dos fatores mais importantes não só na prevenção e controlo de doenças crónicas não transmissíveis (e.g., doenças cardiovasculares, diabetes tipo 2 e cancro) mas também na manutenção do peso saudável e melhoria dos marcadores de bem-estar geral (Adams & Linke, 2019; Colberg et al., 2010; Idorn & Thor Straten, 2017; Mandolesi et al., 2018; Ruegsegger & Booth, 2018). Segundo vários estudos, a atividade física tem também benefícios significativos a nível da saúde mental que vão desde a prevenção da ansiedade e depressão até ao retardamento do declínio cognitivo (Blondell et al., 2014; Salmon, 2001; Schuch & Stubbs, 2019). De acordo com dados da Organização Mundial de Saúde (OMS), mais de um quarto (27,5%) da população adulta mundial não é suficientemente ativa (i.e., atividade aeróbia por 150-300 minutos a intensidade moderada ou 75-150 minutos a intensidade vigorosa por semana, ou uma combinação similar de atividade física moderada a vigorosa, e ainda a inclusão de dois dias por semana de treino resistido) e a maioria dos adolescentes (81%) não cumpre com as recomendações da OMS (i.e., pelo menos 60 minutos por dia) (Bull et al., 2020).

Recentemente, alguns estudos sugerem que tem aumentado a popularidade de alguns programas de treino em grupo. Nesses programas, (e.g., CrossFit) os participantes realizam múltiplas modalidades com movimentos funcionais executados a alta intensidade, sendo que, segundo os autores, este tipo de treino apresenta resultados benéficos na melhoria da saúde e capacidade física (e.g., redução dos fatores de risco para doenças cardiovasculares e diabetes tipo 2 e aumento do VO_2max), praticando exercício físico (EF) menos tempo por semana a intensidades mais altas (Babraj et al., 2009; Burgomaster et al., 2008; Claudino et al., 2018; Feito et al., 2018; Heinrich et al., 2014; Kliszczewicz et al., 2014; Martínez-Gómez et al., 2022; Patterson et al., 2020). Visto que, segundo dados do Eurobarómetro para a Atividade Física e Desporto de 2022, a falta de tempo é a principal razão apontada (41%) para não praticar EF, uma abordagem deste género (i.e., sessões de treino mais curtas realizadas a intensidades mais altas) poderia ser benéfica para aumentar os níveis de atividade física (Comissão Europeia, 2022). No entanto, esta hipótese foi recentemente desconstruída por Ekkekakis & Biddle (2022), numa revisão sistemática em que analisaram oito estudos experimentais com duração de pelo menos 12 meses comparando exercícios de intensidade moderada com exercícios de alta intensidade, o *high intensity interval training* (HIIT), no sentido de perceber se estes dois tipos de intensidades apresentavam diferenças na adesão. Os autores concluíram que os

indivíduos que treinam sem supervisão tendem a exercitar-se a intensidades mais baixas que as prescritas e que não foi encontrada vantagem na adesão sustentada ao EF para os grupos de HIIT (Ekkekakis & Biddle, 2022).

O CrossFit

Feito et al. (2018) incluem o CrossFit numa modalidade de exercícios que denominam de *high intensity functional training* (HIFT). Os autores afirmam ainda que o HIFT é frequentemente comparado com o HIIT, tratando-se, no entanto, de metodologias distintas. Enquanto o HIIT, amplamente estudado demonstrando benefícios ao nível das adaptações metabólicas e cardiorrespiratórias, consiste num programa de exercícios que utiliza maioritariamente exercícios aeróbios (e.g., corrida, bicicleta ou ciclo ergómetro entre outros) e se caracteriza por períodos relativamente curtos de trabalho intenso intercalados por períodos de descanso ou exercício de baixa intensidade, com o intuito de recuperar entre esforços, algo diferente acontece no HIFT. Segundo os autores, o HIFT consiste numa modalidade de treino relativamente recente que foca a sua ação em movimentos funcionais e multiarticulares adaptáveis a qualquer nível de preparação física, acontecendo, portanto, um maior recrutamento muscular e que sugerem maiores melhorias a nível cardiovascular, ganhos de força e flexibilidade (Feito et al., 2018). Ainda assim, Cosgrove et al. (2019) afirmaram que embora os efeitos benéficos do HIFT no curto prazo estivessem já provados, não existia ainda evidência em estudos com duração superior a 16 semanas, pelo que, no seu estudo, se propuseram a verificar se existiam melhorias na condição física geral, com 6 meses de prática em 45 adultos (23 mulheres e 22 homens), através da realização de uma bateria de testes realizada antes e após a participação num programa de HIFT. Os autores chegaram à conclusão de que acontecem de facto efeitos positivos em várias componentes de *fitness* tais como: equilíbrio, coordenação, precisão, agilidade, flexibilidade, potência, endurance muscular, força, velocidade e endurance cardiovascular/respiratório (Cosgrove et al., 2019). Perante a aparente confusão que existe na definição/classificação do CrossFit como atividade, Dominski et al. (2022) no seu artigo afirmam que embora sejam utilizadas várias terminologias além de HIFT para o definir, tais como *high intensity multimodal training* (HIMT) e *extreme condition program* (ECP), existe uma que, segundo os autores, é a mais inclusiva e suficientemente abrangente para descrever as atividades realizadas no CrossFit, o *Functional Fitness Training* (FFT), o qual visa o desenvolvimento da competência das pessoas em diversos domínios como a capacidade aeróbia, força, resistência muscular e potência (Dominski et al., 2022). Esta posição aparece reforçada pela forma como a mesma terminologia é utilizada na 16.ª edição da sondagem

mundial, realizada anualmente pelo *American College of Sports Medicine* (ACSM) (i.e., fitness trends survey), que serve para determinar as tendências no mercado do fitness, colocando o FFT em 14.º lugar a nível mundial (Thompson, 2022).

O CrossFit, apresentou um crescimento exponencial a todos os níveis desde a sua criação, contando, neste momento, com cerca de quinze mil ginásios afiliados (box) e aproximadamente cinco milhões de praticantes espalhados por todo o mundo de acordo com dados do próprio website da marca (https://map.crossfit.com/). Glassman (2002), o criador do Crossfit, defende que esta metodologia de treino visa a melhoria da capacidade física em dez vertentes, tais como capacidade cardiorrespiratória, resistência muscular, força, mobilidade, potência, velocidade, coordenação, agilidade, equilíbrio e precisão (Glassman, 2002). Glassman (2004) define o CrossFit como sendo um programa de força e condicionamento físico constantemente variado ou mesmo aleatório, baseado na execução de movimentos funcionais a alta intensidade que engloba todos os movimentos mais naturais realizados pelo ser humano como estar em pé, sentar, atirar ou levantar objetos, empurrar, puxar, correr e saltar entre outros (Glassman, 2002, 2004). É ainda referido tratar-se de um desporto funcional que engloba múltiplas modalidades, tais como levantamento de peso olímpico, powerlifting, pliometria, calistenia, ginástica e corrida, praticadas em alta intensidade com planeamento de treino constantemente variado e completamente adaptável a todos os níveis de capacidade física (Glassman, 2010b). Como referido anteriormente, os treinos de CrossFit consistem normalmente na execução de movimentos funcionais a alta intensidade naquele que se denomina como *workout of the day* (WOD) e aparece englobado numa aula base de CrossFit que compreende 3 partes distintas: (1) aquecimento - tipicamente constituído por exercícios de mobilidade, estabilização e ativação; (2) habilidade/força - nesta parte da aula, normalmente é focado apenas um exercício onde se trabalha para aperfeiçoar a técnica e em seguida é executado um determinado número de séries e repetições desse exercício; e (3) WOD que pode ser considerado como sendo a parte fundamental da aula/sessão de treino. Normalmente, o WOD inclui exercícios com alta intensidade executados rápida e repetitivamente com pouco ou nenhum descanso entre séries (Glassman, 2010a). Ainda segundo Glassman (2010c), a metodologia em que se baseia o CrossFit é totalmente empírica (Glassman, 2010c).

A resposta afetiva e a intensidade do exercício

Alguns autores afirmam que o envolvimento na prática futura de EF pode ser influenciado pela criação de boas memórias na sequência de uma resposta afetiva positiva experienciada durante o exercício, afirmando ainda que esta hipótese se encontra relacionada

com a teoria da motivação hedónica. Segundo os autores, esta teoria defende que se uma pessoa obtiver prazer da prática de EF, presumivelmente, procurará repetir esse comportamento, mas se, pelo contrário, sentir desprazer, a probabilidade de o repetir fica reduzida (Kahneman et al., 1993; Vandoni et al., 2016).

A tomada de posição do ACSM, no ano de 2011, apontou como um importante fator influenciador da adesão à prática de EF as preferências individuais e respostas afetivas (Garber et al., 2011) e, segundo as suas recomendações para a avaliação e prescrição de exercício, as medidas de valência afetiva (i.e., prazer ou desprazer durante o exercício) podem ser utilizadas para definir ou apurar a intensidade do exercício a prescrever, no sentido de completar a informação aferida através da frequência cardíaca ou das escalas de perceção de esforço (e.g., a escala de perceção subjetiva de esforço de Borg, o *Talk Test* e a *Feeling Scale*) (Riebe et al., 2018).

De acordo com o estudo de Ekkekakis et al. (2008b), a intensidade do exercício é apontada, tanto pelos profissionais do exercício como os de saúde pública, como sendo um fator de grande interesse não só por se tratar de uma das variáveis mais importantes no treino cardiovascular e de aumento da incidência de lesões, mas também por se encontrar inversamente relacionada com a adesão ao exercício. Os autores apontam ainda como possível explicação para essa relação inversa o facto de que à medida que a intensidade aumenta, o prazer que os praticantes experienciam reduz, principalmente quando se trabalha a intensidades que excedam o limiar ventilatório ou o limiar de lactato (Cox et al., 2003; Ekkekakis et al., 2008b; Ekkekakis & Petruzzello, 1999; Lee et al., 1996; Perri et al., 2002).

Também Kwan e Bryan (2010) identificam uma relação entre a resposta afetiva sentida durante a prática de EF e a adesão, ao afirmar que a resposta afetiva ao exercício é um antecedente da motivação e, como tal, uma resposta mais favorável pode corresponder a uma maior intenção de repetir o comportamento. Os autores afirmam ainda ser expectável que a resposta afetiva influencie não só os níveis de motivação relacionados com o exercício, mas também uma motivação continuada no tempo para a prática de EF, aumentando assim a adesão continuada (Kwan & Bryan, 2010). Por sua vez, Williams (2008) afirma que existe de facto evidência da seguinte relação: "o exercício executado a intensidade auto selecionada aponta para uma melhor resposta afetiva do que exercício realizado a uma intensidade de exercício prescrita, e a resposta afetiva positiva ao exercício conduz a uma maior adesão a programas de exercício", afirmação reforçada também por Ekkekakis e colegas (2011) que defendem que, a par da relação que parece existir entre a intensidade e a adesão ao EF, a resposta afetiva

desempenha um papel muito importante nestas relações (Ekkekakis et al., 2011; Williams, 2008).

A preferência e tolerância pela intensidade do exercício físico e a resposta afetiva

Ekkekakis et al. (2005) afirmam no seu estudo que existem diferenças na forma como as pessoas preferem e toleram a intensidade do EF. Os autores definem a preferência pela intensidade do exercício como a "(…) predisposição para selecionar um determinado nível de intensidade do exercício quando existe essa possibilidade (e.g., quando a pessoa pratica exercício por si selecionado e sem supervisão)" e a tolerância à intensidade do exercício como sendo uma característica que "(…) influencia a capacidade de um determinado indivíduo para continuar a executar uma atividade ou exercício a um nível de intensidade imposto, mesmo quando essa atividade/exercício se torna desconfortável" (Ekkekakis et al., 2005). Ainda assim, Ekkekakis et al. (2008b) clarificam que os constructos preferência e tolerância não devem ser considerados os únicos fatores que determinam a preferência e tolerância pela intensidade do EF. Os autores apontam como fatores conexos os fatores físicos como a idade, capacidade física ou estado de saúde; também referem fatores relacionados com a vivência dos indivíduos (e.g., historial de prática de EF); e, por último, fatores situacionais (e.g., autoeficácia), reforçando a importância de todos eles nessa determinação da tolerância e preferência pela intensidade do EF (Ekkekakis et al., 2008b). Adicionalmente, Ekkekakis e colegas (2008a) defendem que uma maior preferência e tolerância por intensidade do EF se encontra relacionada com respostas afetivas mais positivas quando se aumenta a intensidade do exercício. Os autores apresentam dados de um estudo onde 30 jovens adultos participaram num protocolo de exercício com duração de 15 minutos de corrida na passadeira por 5 sessões distintas, cujos resultados demonstraram que a intensidade não influenciou mudanças positivas no pré e pós-treino, mas influenciou a resposta afetiva durante o exercício. As conclusões do referido estudo defendem que o exercício que exceda a intensidade do limiar ventilatório parece reduzir a sensação de prazer, afirmando que esse efeito poderá impactar negativamente na adesão ao exercício (Ekkekakis et al., 2008a). Nessa sequência, Ekkekakis et al. (2011) concluíram noutro estudo que o modelo bipartido (i.e., baseando-se apenas nas considerações de que deve ser maximizada a saúde e performance bem como minimizar o risco de lesões) apresentado pelo ACSM devia ser revisto no sentido de incluir a adesão ao exercício como um dos fatores preponderantes, na medida em que, "(…) uma prescrição pode ser eficaz e segura, mas se poucos a querem seguir, então a sua relevância para a saúde pública torna-se questionável.". Os autores recomendam ainda que aconteça uma abordagem pedagógica no sentido de melhorar a automonitorização e

autorregulação, usando o *feedback* dos participantes acerca do prazer ou desprazer que sentem durante a prática de EF (Ekkekakis et al., 2011).

Também Smith et al., (2015), num estudo, com o objetivo de analisar a relação entre a intensidade do exercício e as respostas fisiológicas e afetivas em 18 mulheres com idades entre os 60 e os 74 anos, submetendo-as a um teste máximo na passadeira, concluíram que o exercício a intensidades perto do limiar ventilatório tendem a apresentar respostas positivas (Smith et al., 2015). Contrariamente, embora num contexto de exercício diferente (i.e., treino de resistência), um estudo com o objetivo de avaliar diferenças nas respostas afetivas de 16 homens adultos para treino de resistência realizado a três diferentes intensidades impostas (i.e., 40%, 60% e 80% de 1RM) e intensidade autosselecionada, concluiu que a resposta afetiva durante treino de força parece não ser influenciada pela intensidade do exercício (Portugal et al., 2015). Posteriormente, Jones et al., (2018), num estudo experimental envolvendo 48 participantes em treino de alta intensidade com o objetivo de perceber de que forma as respostas afetivas variavam, concluíram que a preferência (mas não a tolerância) pela intensidade do EF pode ser considerada no processo de prescrição do exercício no sentido de otimizar as respostas afetivas e, consequentemente, a adesão ao exercício (Jones et al., 2018). Mais recentemente, em alguns estudos realizados em *health clubs*, também foram verificadas associações entre a preferência e tolerância individuais pela intensidade do exercício físico (avaliadas com recurso à PRETIE-Q) e diversas variáveis frequentemente relacionadas com a resposta afetiva (e.g., divertimento, vitalidade subjetiva, intenção para continuar a praticar EF, hábito e frequência) (Faria et al., 2021; Marques et al., 2022; Teixeira et al., 2021b, 2022).

Já em contextos relacionados com o CrossFit, Box & Petruzzello (2020) desenvolveram um estudo com o objetivo de determinar se as diferenças nas características de preferência e tolerância pela intensidade do exercício influenciavam a forma como os participantes se sentiam durante e após um treino de alta intensidade comparado com outro de baixa intensidade. Este estudo envolveu três grupos de 30 alunos durante três semestres sucessivos. Os autores concluíram que indivíduos com preferência por intensidades superiores apresentaram respostas afetivas mais positivas do que os indivíduos com preferência por intensidades mais baixas durante um exercício em circuito (mesmo quando apresentavam perceções subjetivas de esforço semelhantes). Adicionalmente, indivíduos com preferência por exercícios de alta intensidade apresentaram respostas afetivas semelhantes em exercício de alta intensidade e de baixa intensidade, enquanto os indivíduos que preferiam baixa intensidade mostraram uma maior variabilidade na resposta afetiva (Box & Petruzzello, 2020). Para completar, um estudo

realizado por Patterson e colegas (2020), com uma amostra de 290 praticantes de três ginásios de CrossFit diferentes, concluiu existir evidência de que o contexto social inerente à comunidade do CrossFit influencia os perfis relacionados com a preferência e tolerância, associando estes fatores ao facto de os praticantes sentirem maior prazer quando praticam exercício de alta intensidade em grupo. Os autores afirmam ainda que em determinados ambientes, nomeadamente nas boxes de CrossFit pela forte componente social que os caracteriza, a preferência e tolerância pelo EF se manifesta de forma diferente quando comparado com praticantes de exercício que treinem de forma autónoma (Patterson et al., 2020).

Apesar da aparente complexidade da relação entre a intensidade e a resposta afetiva, diversos estudos defendem que promover uma experiência prazerosa (i.e., resposta afetiva positiva) pode ser relevante na adesão ao EF, revestindo-se assim de grande importância perceber a relação entre a resposta afetiva a determinado tipo e intensidade de exercício e os fatores que podem influenciar essa resposta, nomeadamente, neste caso, a preferência e tolerância por exercícios de alta intensidade (Chen et al., 2020; Rhodes & Kates, 2015; Stevens et al., 2020; Weyland et al., 2020). O instrumento existente para monitorizar estes dois constructos é o *Preference for and Tolerance of Intensity of the Exercise Questionaire* (PRETIE-Q), um questionário que se propõe determinar de que forma um indivíduo prefere a intensidade do exercício ou, por outro lado, a tolera baseando-se no prazer ou desprazer por este experienciado durante a prática de EF. O PRETIE-Q na sua versão original é um questionário de autorrelato focado na interpretação propriocetiva do EF que tem como objetivo quantificar separadamente a tolerância e preferência pela intensidade do exercício. O questionário é composto por 16 afirmações (8 para quantificar a preferência e 8 para quantificar a tolerância pela intensidade) utilizando para as classificar uma escala de Likert de 5 pontos (1 = discordo totalmente a 5 = concordo totalmente) (Ekkekakis et al., 2005). O referido questionário foi recentemente validado e traduzido numa versão mais reduzida com 10 itens (5 para a preferência e 5 para a tolerância) por Teixeira e colegas (2021a) para a língua portuguesa (i.e., PRETIE-Q-PT) (Teixeira et al., 2021a).

Presente dissertação

Considerando as limitações presentes na literatura (ainda escassa) que existe sobre o CrossFit e a possível relação entre a intensidade a que é realizado e as variáveis comportamentais que podem influenciar a adesão ao EF (e.g., divertimento, vitalidade subjetiva, intenção para continuar o exercício), a presente dissertação tem como objetivo

principal compreender a relação da preferência e tolerância pela intensidade do EF numa população de praticantes recreacionais de CrossFit, tendo sido realizados dois estudos no sentido de alcançar esse objetivo.

O primeiro estudo consistiu numa revisão sistemática de literatura na qual o objetivo passou pela análise da utilidade e viabilidade da utilização da preferência e tolerância como resultados da PRETIE-Q na regulação de práticas de exercício, enquanto o segundo estudo albergou três grandes objetivos: (1) caracterizar o perfil de preferência e tolerância pela intensidade do EF em praticantes recreacionais de CrossFit; (2) analisar a concordância dos traços de intensidade com a intensidade do treino atualmente desenvolvido; e (3) analisar a relação entre os perfis de concordância e seus efeitos de moderação entre o divertimento, vitalidade subjetiva, intenção para continuar a praticar exercício e frequência semanal.

O enriquecimento da literatura relacionada com este tema pode eventualmente contribuir para alcançar um melhor entendimento sobre o que leva as pessoas a aderir ao CrossFit em tão grande número nos últimos anos, tornando-o popular como aparentemente é. O objetivo final será, no limite, conseguir através desse entendimento melhorar comportamentos de adesão continuada ao EF.

Capítulo 1. *Are Preference and Tolerance Relevant Constructs for Exercise Intensity Understanding in Physical Activity? A Systematic Review**

* Manuscript currently in revision on an international peer review journal

1.1. Abstract

Preference and tolerance can be seen as relevant traits for the understanding of the relationship between exercise intensity and several outcomes. For that matter, the preference for and tolerance of the intensity of exercise questionnaire may be used for a better understanding of that relation, which may be fruitful for performance, adherence, and well-being promotion.

This systematic review aimed to analyze preference and tolerance constructs in physical activity settings by verifying: (1) the utility and feasibility of the scales in the multiple contexts of their application; (2) the interpretation of the scales and possible associations with other variables; and (3) the reported limitations for the scale. A broad search was conducted through PubMed, SportDISCUS, PsycINFO, and B-on databases (last search conducted on July 2022), and the studies were included following the PRISMA guidelines. Thirty-six studies published between 2005 and 2022 were qualitatively analyzed.

In general, results indicate that both constructs appear to be useful and feasible in a broad variety of physical activity settings, particularly when focused on the understanding of relative reinforcing value, exercise behavior, well-being, affective responses, and fitness/performance, and no relevant limitations were reported of its use. The preference and tolerance intensity traits seem to offer a simple but useful assessment of the individual relation with several physical activity related outcomes.

Keywords: Physical activity; exercise; intensity; preference; tolerance.

1.2. Introduction

The assessment of exercise intensity has been vastly studied throughout the last decades and its importance in exercise prescription is well stated and based on solid evidence (Hansen et al., 2021; Kilpatrick et al., 2020; Mann et al., 2013; Mazzeo & Tanaka, 2001; Perri et al., 2002; Riebe et al., 2018). The ventilatory threshold (VT) (Goldberg et al., 1988), resting heart rate (Karvonen, 1957; She et al., 2014), and the estimated maximum heart rate (Tanaka et al., 2001) are some of the most commonly measures used to assess exercise intensity (Kilpatrick et al., 2020). Additionally, subjective assessments have also been used to help understand the relationship between intensity and individual characteristics, which can be used for distinct outcomes (e.g., exercise adherence, affective response understanding, physical fitness) (Abbiss et al., 2015; Hall et al., 2014; Teixeira et al., 2022; Zourdos et al., 2015).

1.2.1. Exercise intensity assessment: why new facets of an 'old' variable warrant new efforts

A growing bulk of literature indicates that intensity is an exercise control variable of great interest due to a close relationship with exercise adherence (Ekkekakis et al., 2011; Stevens et al., 2020). The current state of knowledge, for example explored in light of the dual-mode theory (Ekkekakis et al., 2020), sustains that as intensity increases, so does the individual pleasurable feeling associated. This positive association tends to be present until near the ventilatory threshold (Ekkekakis et al., 2004, 2008) or, although a topic less explored, until approximately the 70-80 %RM in resistance training (Andrade et al., 2022; Portugal et al., 2015). After these moments, inter-individual variability will mark how soon, and in which magnitude, the pleasurable response will decrease.

Although intensity and pleasure (e.g., affective response) have a complex relationship, several studies sustain that promoting a pleasurable response may be relevant for exercise adherence (and to avoid exercise aversion) (Chen et al., 2020; Rhodes & Kates, 2015; Stevens et al., 2020; Weyland et al., 2020). Considering the current levels of physical activity (PA) and sedentary behavior reported in several countries, it urges us to rethink the approaches to exercise prescription which do not reflect an intensity selection aligned with individual needs and characteristics. For example, several works have sustained that when facing the need to select intensity for an exercise program, professionals aiming to promote adherence (e.g., through habit development, increased exercise frequency, behavioral intention) should provide adjustments between the intensity one prefers and the one prescribed (Faria et al., 2021;

Marques et al., 2022; Teixeira et al., 2021a, 2022), thus ensuring a positive reinforcement of the behavior. Other recommendations advise professionals to refine their prescriptions with measures of how one feels throughout exercise, given that it is intimately related to the experienced intensity (Ekkekakis et al., 2011; Garber et al., 2011; Stevens et al., 2020). In another relevant emerging evidence, promoting self-monitoring and self-regulating exercise intensity have been suggested to be key factors for exercise adherence (e.g., perceived autonomy; improved affective response) (Kwasnicka et al., 2016; Vazou & Ekkekakis, 2009), given their promotion of a better pleasure-displeasure relation during the activities. All in all, current evidence suggests that understanding the individual relation with exercise intensity is essential for several exercise behavior outcomes.

1.2.2. The preference for and tolerance of the intensity of exercise questionnaire (PRETIE-Q)

In 2005 an instrument called the preference for and tolerance of the intensity of exercise questionnaire (PRETIE-Q; Ekkekakis et al., 2005) proposed that there were differences in the way people prefer and tolerate the exercise intensity. The authors define preference for exercise intensity as a "predisposition to select a particular exercise intensity level when engaging in unsupervised exercise" and tolerance to exercise intensity as being a characteristic that "influences one's ability to continue exercising at an imposed intensity level beyond the point at which the activity becomes uncomfortable or unpleasant". Although not the only factors relevant for the intensity preference and tolerance understanding, these constructs represent individual traits that can account for some of the exercise behavior variability, and should be considered in conjunction with physical factors (e.g., fitness, age, or health status), life experience related factors (e.g., learned coping skills, exercise history), and situational factors (e.g., auto-efficacy, social physique anxiety) (Ekkekakis et al., 2005). This questionnaire aims to determine in what way a certain individual prefers and tolerates the exercise intensity, taking into account the pleasure or displeasure experienced while practicing physical exercise.

The PRETIE-Q is a self-report questionnaire focused on the proprioceptive interpretation of exercise and aims to quantify separately the preference and tolerance for exercise intensity. It comprises 16 items sub-divided into two dimensions: (1) the 8-item scale to measure preference for exercise intensity (e.g., "I would rather have a short, intense workout than a long, low-intensity workout."); and the 8-item scale to measure tolerance of exercise intensity (e.g., "When exercising, I try to keep going even after I feel exhausted"). Each item is accompanied by a 5-point Likert scale, ranging from 1 ("I totally disagree") to 5 ("I totally

agree"). Following the initial development and validation study for the PRETIE-Q (Ekkekakis et al., 2005), there were some other studies published in the attempt to validate, complete, and expand the use of the scales: (1) psychometric testing of the preference scale (Ekkekakis et al., 2006); (2) psychometric testing of the tolerance scale (Ekkekakis et al., 2007); (3) cross-validation in college women (Ekkekakis et al., 2008); (4) initial testing of Brazilian-Portuguese version (Smirmaul et al., 2015); (5) initial testing of European-Portuguese version (Teixeira et al., 2021a); and (5) initial testing of Chinese version (Wang et al., 2022). In sum, the development and further testing of the questionnaire presented adequate psychometric properties in several languages and physical activities contexts. Additionally, the European-Portuguese (10 items; five per construct) and the Chinese versions (8 times; 4 items per construct) presented a different final set of items, which may be relevant for the questionnaire quality understanding. This has already been suggested by Patterson et al. (2020) when claiming that the questionnaire would benefit from a revised and shortened scales, an issue that further psychometric testing could address.

1.2.3. Current study

As posited, the individual preference and tolerance traits assessment can be a relevant approach for intensity-pleasure comprehension, which brings forth a new facet of the use and understanding of exercise intensity. Although increasingly suggested as an approach to exercise adherence promotion and prescription (Faria et al., 2021; Hall et al., 2014; Teixeira et al., 2022), tools for understanding the pleasure-displeasure one feels during exercise are scarce. Given the 'indirect' ability of preference and tolerance traits assessment on the understanding of individual responses to exercise intensity (e.g., affective response) (Ekkekakis et al., 2005), a better understanding of the questionnaire use and its characteristics is in need.

Based on that, it seems important to verify: (1) the utility and feasibility of the scales in the multiple contexts of their application; (2) how the scales' interpretations have been made and if there are relevant associations with other variables (e.g., RPE; VT); and (3) what are the reported limitations of the scales. Since literature and evidence on using the PRETIE-Q are growing and there is not, to date, any relevant study with this premise, the present systematic review aims to analyze the utility and feasibility of the preference for and tolerance of exercise intensity constructs in PA settings.

1.3. Method

The present systematic literature review was written following the recommendations suggested by the PRISMA protocol (Page et al., 2021) and registered in PROSPERO with the number CRD42022339968.

1.3.1. Eligibility criteria

Inclusion criteria used were: (1) Experimental and non-experimental studies; (2) written in English; (3) based on the assessment of subjective intensity in exercise; (4) healthy individuals, including athletes; (5) studies including at least one of the following variables: tolerance and/or preference. The following exclusion criteria were adopted: (1) populations with injuries or known disease; (2) instrument validation studies with no concurrent data; (3) grey literature; (4) systematic reviews.

Eligibility criteria were checked by thoroughly reviewing all titles and abstracts in Level I study screening. Level II screening included a full-text reading of all publications that were not eliminated on the first level in order to confirm that all the eligibility criteria were met, and that no exclusion criteria were applicable.

1.3.2. Information sources and search strategy

A broad search of the literature was conducted between January 1st and July 25th, on the following databases: PubMed (host: MEDLINE), SportDISCUS (host: EBSCO), PsycINFO (host: EBSCO) and B-on (host: EBSCO). The last search was conducted in July 2022. The search was made using the following terms: “exerciser”, “athlete”, “individual”, “physical activity”, “sport”, “exercise”, “preference”, “tolerance”, “intensity traits”, and “PRETIE-Q”. The keywords were introduced for research separately in multiple combinations with the use of the conjunctions “AND” and “OR”, organized accordingly with the PICO search strategy. Additionally, bibliographic references from several related studies were examined in the attempt of finding potential studies that met the inclusion criteria.

1.3.3. Selection process

Data were extracted by one of the authors using a predefined checklist and were posteriorly verified and analyzed by another author. In order to complete the general characterization (Table 1), the following information was extracted: (1) bibliographic information (authors, year of publication, country of research); (2) study design; (3) sample size; (4) sample characteristics; (5) exercise type; (6) constructs (i.e., preference and/or

tolerance); (7) measures; (8) analysis; (9) outcomes; and (10) quality. The listing of relevant data from the studies was made by using a data extraction excel spreadsheet created for this effect.

1.3.4. Study risk of bias assessment

The Effective Public Health Practice Project (EPHPP) Quality Assessment Tool for Quantitative Studies was used to evaluate the studies quality (Thomas et al., 2004).

This instrument, along with the respective manual, provides a standardized means to assess study quality and develop recommendations for study findings. The tool comprises eight sections that include several questions each: (A) selection bias; (B) study design; (C) confounders; (D) blinding; (E) data collection methods; (F) withdrawals and dropouts; (G) intervention integrity; and (H) analysis. The aforementioned sections are thoroughly explained in the manual known as Quality Assessment Tool for Quantitative Studies Dictionary, which offers the needed guidance on how to rate methodological quality for each one of them. Afterward, users rate the overall methodological quality of the research article based on the answers gotten in those questions. The evaluation was made by two independent reviewers and the global rating was presented as: (1) strong (no weak rating); (2) moderate (one weak rating); and (3) weak (two or more weak ratings).

1.4. Results

1.4.1. Study selection

As represented by the studies flow chart (Figure 1), a total of 938 titles were identified from the database search. After the deduplication process, 8 studies were excluded. With the examination of bibliographic references from other sources, aiming to find potential studies that met the inclusion criteria, 10 more studies apparently relevant were added and, after citation searching, two more studies were included. 942 studies were screened and 900 were excluded for several motives after a complete read-through of titles and abstracts. As the screening was considered complete, the selection was reduced to 42 papers. Following the full-text review, six studies were excluded since they did not contain the study constructs “preference for exercise intensity” nor “tolerance of exercise intensity” or met the exclusion criteria, namely “instrument validation studies”. Thus, a total of 36 papers were included in the present systematic literature review.

1.4.2. Study summaries

A sum of 36 empirical studies published or accepted for publication was included in the present review. All the studies that used the PRETIE-Q were evaluated and Table 1 presents a synthesis of the data extracted from those studies. The studies list is organized by the main author's name in alphabetical order.

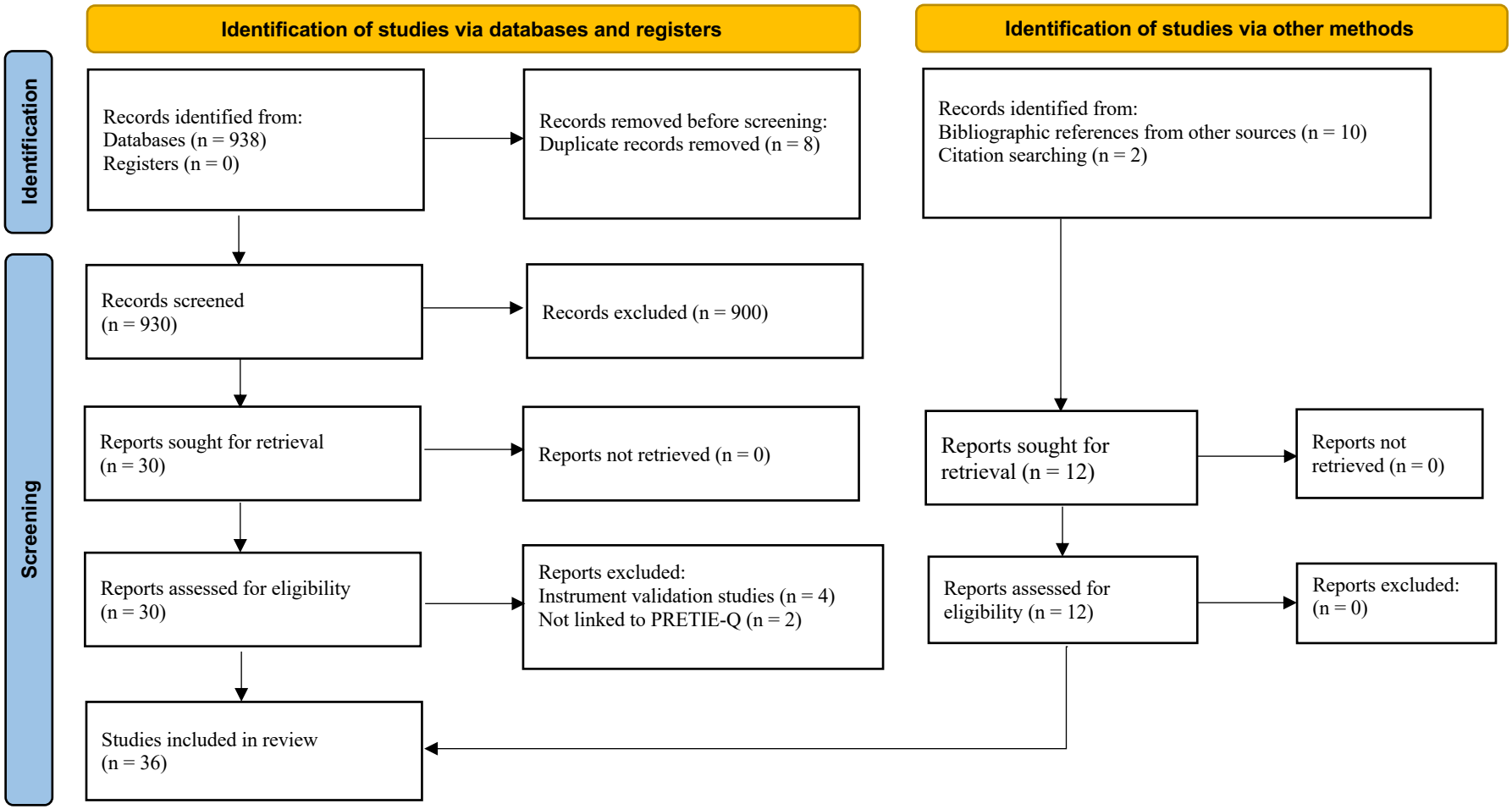

Figure 1 - Studies chart flow

1.4.3. Study characteristics

In the sum of all studies, the sample used for this review totalizes 5263 apparently healthy exercisers, predominantly female (n=3414). Table 1 represents the descriptive data of all 36 papers that were analyzed. Two of the referred papers comprise more than one study, and all of those which met the inclusion criteria were selected (Ekkekakis et al., 2007; Hall et al., 2014). The studies were considered separate studies in Tables 1-3 when their substudies used independent participant samples. Even though the majority of the study samples were characterized by active, non-athlete, regular exercisers (n=28), some studies included insufficiently active (Jones & Ekkekakis, 2019; Overstreet & Strohacker, 2018) and sedentary individuals (Ekkekakis et al., 2006; Epstein et al., 2021; Flack et al., 2019a; Flack et al., 2019c; Jones & Ekkekakis, 2019) from several age groups. In most of the studies, the sample consisted of adults, although in one of the studies there were used adolescents (Schneider & Graham, 2009), and in another, there were used older adults (Smith et al., 2015). Two of the studies used overweight individuals (Flack et al., 2019a; Jones & Ekkekakis, 2019). Regarding the construct used in each study, the majority (n=25) of the studies used both scales (i.e., preference scale and tolerance scale), but three of them only used the preference scale (Hutchinson et al., 2017; Jones & Ekkekakis, 2019; Vandoni et al., 2016) and nine of them only used the tolerance scale (Bradley et al., 2019; Carlier & Delevoye, 2017, 2021; Epstein et al., 2021; Flack et al., 2019b; Hutchinson et al., 2017; Marin et al., 2019; Tempest & Parfitt, 2015; Zhang et al., 2022). In Table 2, it is represented a summary of the studies and sample characteristics (i.e., sample size, gender, location, and mean age).

Table 3 was created to refine the results for this systematic review. In the referred table are represented: (1) author; (2) the setting/protocol used for data collection; (3) usefulness (why and with what purpose, the constructs preference and/or tolerance were used); (4) feasibility (showing if the PRETIE-Q was useful/valid in each study); (5) interpretation (represents the specific preference and/or tolerance outcomes from the included studies and its correlations with any additional measures used); (6) limitations (reported on using the PRETIE-Q); and (7) reliability (indicators for the PRETIE-Q presented in each study).

1.4.4. Risk of bias in studies

The studies were evaluated accordingly to the results from the assessment tool previously mentioned (i.e., Quality Assessment Tool for Quantitative Studies) and were

assessed as “strong” (8 studies), “moderate” (16 studies), or “weak” (12 studies), as presented in Table 1.

Table 1 - General descriptive characteristics of the studies' main outcomes

Author (s)	Location	Design	Size (%F)	Features (age M□SD)	Exercise type	Construct	Measures	Analysis	Outcomes	Quality
Astorino et al. (2020)	USA	Experimental study	85 - 42 (40) below average VO2max; 43 (56) above average VO2max	Healthy adults (above VO2max 23.6 ± 6.5 years, below VO2max 22.8 ± 3.6 years)	Aerobic	Preference and tolerance	VO2max; BMI; Affective valence; PRETIE-Q; RPE; PACES	Shapiro-Wilks test; Independent t-test; Repeated two-way ANOVA; Greenhouse-Geisser correction; Tuckey's post hoc test; Pearson pairwise correlation	The total change in affective valence was correlated to baseline affective valence, change in RPE, peak affective valence from the VO2max test and enjoyment across all participants but was unrelated to relative power output, tolerance (p=0.10), or preference.	Moderate
Baiamonte et al. (2016)	USA	Experimental study	24 (38)	Active adults (male 23.87 ± 0.99 years, female 21 ± 0.97 years)	Resistance	Preference and tolerance	PRETIE-Q; Pain tolerance; Pain threshold; Heart rate; Blood lactate; RPE	One-way repeated measures ANOVA; Pairwise comparisons; Bivariate correlations	Participants exhibited increases in pain tolerance, blood lactate levels, HR and perceived exertion following resistance exercise. Preference for exercise intensity was positively correlated with lactate post-exercise and tolerance for exercise intensity was positively correlated with pain tolerance and lactate post-exercise.	Moderate
Bastos et al. (2022)	Portugal	Experimental study	43 (51)	Healthy active adults (34,69 ± 7.72 years)	Resistance	Preference and tolerance	Affective valence (FS); Perceived activation (FAS); PRETIE-Q-PT; PACES; RPE/RIR	RMANOVA; Bonferroni correction	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. 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.	Strong

Box & Petruzzello (2020)	USA	Experimental study	245 (61)	Mostly active (82%) University Students (male 20.2 ± 0.9 years, female 20.4 ± 2.5 years)	Resistance and aerobic	Preference and tolerance	PRETIE-Q; Affective valence (FS); Perceived activation (FAS); RPE; PACES	Reapeated measures ANOVA; Simple linear regressions	The findings suggest that for individuals with a high-intensity exercise preference, reported affective valence was more pleasant than their lower-intensity preference counterparts during high-intensity exercise circuit.	Weak
Box et al. (2022)	USA	Experimental study	34 (59)	Healthy active adults (33 ± 8 years)	Resistance and aerobic	Preference and tolerance	PRETIE-Q; PACES; Exercise performance (number of repetitions)	MANOVA; Pearson's correlations; Cohen's *d* effect sizes	The findings suggest that performance on a high-intensity workout is influenced by the preference for exercise intensity, while performance explained variance in enjoyment.	Moderate
Bradley et al. (2019)	Scotland	Experimental study	36 (67)	Healthy adults (21 ± 2 years)	Aerobic	Tolerance only	PAR-Q; Perceived functional ability (PFA); PRETIE-Q; Affective valence (FS); Perceived activation (FAS); RPE	Shapiro-Wilks test; Mann-Whitney U test; One-way independent ANOVA; Games-Howell test; mixed method two-way ANOVA; Kruskall-Wallis test; Bonferroni correction; Cohen's *d* effect sizes	Practitioners may screen potential HIIE participants for tolerance of intensity of exercise using the PRETIE-Q to assist in the prescription of appropriate activities. Although there is evidence that some individuals have positive motivating experiences participating in HIIE, that is not likely to be for everyone and VLT of the intensity of exercise could be a key determinant.	Strong
Carlier & Delevoye-Turrell (2017)	France	Experimental study	63 (65)	Healthy adults (22.85 ± 4.78 years)	Aerobic	Tolerance only	IPAQ; PRETIE-Q; Affective valence (FS); Enjoyment PACES; Investment assessment; Well-being (SAM); Rating of perceived exertion (RPE)	ANCOVA; Mixed model ANCOVA; Partial eta squares; Bonferroni-adjusted pairwise comparisons	While controlling for self-reported physical activity level, results revealed that for the same perception of exertion and a similar level of enjoyment, the High Tolerance group produced more power output than the Low Tolerance group. Hence, tolerance to physical effort must be considered to conceive training sessions that seek to use distracting methods as means to sustain pleasurable exercising over time.	Weak

Carlier & Delevoye-Turrell (2022)	France	Experimental study	40 (75)	Healthy adults (22.13 ± 3.77 years	Aerobic	Tolerance only	IPAQ; Affective valence (FS); PRETIE-Q	Cohen's *d*; Mixed model ANCOVA; Partial eta squares; Bonferroni-adjusted pairwise comparisons; regressions analysis; correlational analysis	The findings demonstrated that the tolerance to effort, which is a psychological factor, plays a non-negligible role in the way the activity sessions were experienced. The affective responses to physical activity predict the desire to re-engage and thus, must be considered when designing fun physical activity routines for sustained engagement and benefit.	Weak
Ekkekakis et al. (2006)	USA	Experimental study	23 (100)	Previously sedentary female adults (43.43 ± 4.85 years)	Aerobic	Preference and tolerance	PRETIE-Q; Ventilatory threshold; VO2peak.	Hierarchical regression analyses; Standardized regression coefficients; Multiple correlation coefficients	The study provided some evidence of discriminant validity for the preference and tolerance scales, because only the preference, not tolerance, scale predicted self-selected exercise intensity. (...) In conjunction with other variables, it would be possible to construct models that can identify individuals with a tendency to select intensities either too low or too high.	Strong
Ekkekakis et al. (2007) - Study I	USA	Experimental study	30 (47)	Physically active students (21.21 ± 2.04 years)	Aerobic	Preference and tolerance	PRETIE-Q;	Hierarchical regression analysis	Tolerance correlated significantly with overall test duration and duration after VT; Preference did not correlate significantly with the total duration of the test; The correlation between preference and tolerance was moderately positive.	Moderate
Ekkekakis et al. (2007) - Study II	USA	Experimental study	24 (100)	Apparently healthy female adults (43.29 ± 4.80 years)	Aerobic	Preference and tolerance	PRETIE-Q;	Bivariate correlations; Hierarchical regression analysis	Tolerance did not correlate with the total duration of the test; Preference presented a significant correlation with the duration after VT; The correlation between preference and tolerance was moderately positive, albeit not significant.	Strong
Epstein et al. (2021)	USA	Experimental study	44 (52)	Sedentary adults (19.64 ± 1.83 years)	Aerobic	Tolerance only	BMI; PAR-Q+; PACES; Affect grid; Reinforcing value task; RPE; PRETIE-Q	Mixed ANOVA; Zero order correlations	None of the variables studied were related to reinforcing value of HIIT, which is different from previous studies in which preference and tolerance for intense exercise was a predictor of the reinforcing value of exercise.	Weak

Faria et al. (2021)	Portugal	Non-experimental	299 (61)	Active healthy adults (36.4 ± 10.61 years)	N/A	Preference and tolerance	PRETIE-Q-PT; Subjective vitality scale (SVS); Self-report behavioral automaticity index (SRBAI)	Descriptive statistics; Bivariate correlations; Single mediator analysis model (model 4)	Both preference and tolerance presented positive associations with vitality and habit and results depict some preliminary evidence that the intensity traits related to exercise may be relevant for health club professionals to adjust their intervention aiming the promotion of a better subjective experience and exercise adherence.	Weak
Flack et al. (2017)	USA	Non-experimental	88 (57)	Healthy Adults (female 24,5 ± 6.4 years, male 25.6 ± 6.7 years)	N/A	Preference and tolerance	RRVat; RRVrt; PRETIE-Q; Physical activity (Yale physical activity questionaire)	*T*-tests; Pearson correlation; step-wise multiple linear regression	Having greater RRV of a mode of exercise is associated with meeting activity guidelines for that mode of exercise. Discomfort tolerance during exercise is associated with greater RRV of resistance exercise. The study demonstrated that finding exercise more reinforcing is associated with choosing to exercise in sufficient quantities to meet the physical activity guidelines.	Weak
Flack et al. (2019a)	USA	Experimental study	29 (72)	Sedentary overweight adults (female 27.1 ± 9.3 years, male 26.3 ± 6.7 years)	Aerobic	Preference and tolerance	Relative reinforcing value of exercise and liking of exercise; PRETIE-Q; Exercise energy expenditure	Covariance; Regression analysis	The results demonstrate that repeated exposures to exercise via a structured exercise program that expends at least 300kcal/session, performed 5 days/week, for 12 weeks, increases the RRVexercise by decreasing the reinforcing value of sedentary alternatives. However, increases in RVV exercise were observed only at a greater dose of 600 kcal/session.	Strong
Flack et al. (2019b)	USA	Non-experimental	178 (71)	Healthy adults (female 27.1 ± 9.3 years, male 26.3 ± 6.7 years)	N/A	Tolerance only	Liking; RRVexercise; PRETIE-Q	Unpaired t-tests; ANOVA; multiple regressions	Similar to other reinforcing behaviours, there is a genetic contribution to exercise reinforcement, tolerance for exercise intensity, and MVPA.	Strong

Flack et al. (2019c)	USA	Experimental study	89 (82)	Sedentary adults (150 kcal group 28.9 ± 10.8 years; 300 kcal group 27.1 ± 9.1; Control group 28.2 ± 9.7)	Aerobic	Preference and tolerance	Liking; Exercise reinforcement; Physical activity end sedentary behavior; PRETIE-Q	Paired *t*-tests; ANCOVA; Tukey contrasts; Bonferroni adjustments for multiple comparisons; Glimmix procedure; Gaussian distribution; Pearson correlation; Moderation analysis	The results provide extend cross-sectional evidence that increasing the preference and tolerance to exercise intensity may be important for increasing RRV exercise, and exercise intensity is a key component in increasing preference and tolerance for exercise intensity.	Strong
Hall et al. (2014) - Study I	USA	Experimental study	516 (63)	Healthy adults (female 19.6 ± 5.7 years, male 20.1 ± 6.2 years)	Resistance and aerobic	Preference and tolerance	PRETIE-Q; Muscular strength; Upper body muscular endurance; Abdominal muscular endurance; Cardiovascular endurance; flexibility; Body composition	Independent samples *t*-test; bivariate and partial correlations	Preference and Tolerance exhibited significant correlations with all fitness variables, body composition, and physical activity. Among women, both Preference and Tolerance were related mainly to push-ups, curl-ups, the percentage of body fat, and physical activity. The results were similar among men but, unlike in the women, controlling for age and BMI weakened most relationships.	Weak
Hall et al. (2014) - Study II	USA	Experimental Study	42 (0)	Healthy adults (27.1 ± 4.3 years)	Resistance and aerobic	Preference and tolerance	PRETIE-Q; Muscular strength; Upper body muscular endurance; Abdominal muscular endurance; Cardiovascular endurance; flexibility; Body composition; Perceived physical fitness	T-test for dependent means (dependent measures); bivariate and partial correlations	The 6-week training program was effective in improving performance on most fitness variables, with the sole exception of the bench press test. Notably, although perceived fitness also improved, scores on the Preference and Tolerance scales of the PRETIE-Q did not change significantly.	Moderate

Hutchinson et al. (2018)	USA	Experimental study	17 (47)	Active healthy adults (28.1 ± 9.9 years)	Aerobic	Preference only	BMI; Ventilatory Threshold; Affective valence (FS); Remembered pleasure; PRETIE-Q (Preference only)	Paired-samples *t*-test; ANCOVA	The results illustrate a positive ergogenic and psychological influence of music during affect-regulated exercise. Encouraging people to exercise at an intensity that "feels good" elicits a level of intensity sufficient to get cardiorespiratory benefits and may lead to improved adherence. Moreover, the use of self-selected music appears to augment this effect.	Moderate
Jones & Ekekkakis (2019)	UK	Experimental study	21 (76)	Low-active, overweight Adults (34.67 ± 9.62 years)	Aerobic	Preference only	Attentional focus (AS); Perceived imersion (IEQ); Affective valence (FS); Enjoyment (PACES); Prefrontal hemodynamics; PRETIE-Q	ANOVA; Greenhouse-Geisser adjusted corrections	Compared with conventionally delivered audiovisual stimulation, using a virtual reality headset strengthens the dissociative effect, further improving affective responses to exercise at the ventilatory threshold among overweight, low-active adults.	Moderate
Jones et al. (2018)	UK	Experimental study	48 (44)	Healthy adults (30.33 ± 7.54 years)	Aerobic	Preference and tolerance	PRETIE-Q; International personality item pool (IPIP); Sensation seeking scale (SS-V); Affective valence (FS)	Predictive discriminant function analysis (PDA); MANOVA	Preference for exercise intensity was the strongest predictor among all measures. Individuals who experience no change or a positive change in pleasure (neutral/positive responders) reported higher preferred exercise intensity and were more likely to be female than individuals who experienced a decline in pleasure (negative responders) during heavy exercise.	Moderate
Lochbaum et al. (2009)	USA	Experimental study	286 (46)	University students (female 19.6 ± 5.7 years, male 20.1 ± 6.2 years)	Aerobic	Preference and tolerance	Achievement goals (AGQ); PRETIE-Q; 20-*meter shuttle run*	MANOVAs with univariate post-hoc-tests; Multiple regressions	The results indicated that the performance-aproach goal mediated strenuous physical activity history, and preference for strenuous physical activity on shuttle run performance for men, but not for women.	Weak
Marin et al. (2019)	Brazil	Experimental study	14 (0)	Active men (24 ± 4 years)	Resistance and aerobic	Tolerance only	Affective valence (FS); Perceived activation (FAS); RPE Scale - Brazilian	RMANOVA; Greenhouse-Geisser adjustment; pairwise	In a practical setting, personal trainers and exercise professionals may use the tolerance scale of the PRETIE-Q to modify the exercise prescription in individuals who	Moderate

							Portuguese; PACES; Self-efficacy questionnaire - Brazilian Portuguese; PRETIE-Q - Brazilian Portuguese: Subjective Exercise Experiences Scale	comparisons; chi-squared	choose to perform upper-body sprint interval exercise (SIE). In addition, it is recommended that exercise professionals implement personalized regimens of SIE which require near-maximal exertion yet do not elicit aversive affective valence, especially for low tolerant individuals.	
Marques et al., 2022	Portugal	Non-experimental	485 (56)	Active healthy adults (39.9 ± 11.6 years)	N/A	Preference and tolerance	PRETIE-Q-PT; Subjective vitality scale (SVS); Self-report behavioral automaticity index (SRBAI)	Descriptive statistics; bivariate correlations; ANOVA; Shapiro Wilk test; Kolmogorov-Smirnov test; Levene's test; Tukey pairwise comparisons; Games-Howell pairwise comparisons	The results of this study present support for the importance of preference and tolerance intensity traits in exercise prescription and supervision.	Moderate
Morton et al. (2019)	USA	Experimental study	17	Active adults (32 ± 7.2 years)	Aerobic	Preference and tolerance	Readiness to Change Physical Activity Survey; Treatment Self-Regulation Questionnaire (TSRQ); PRETIE-Q	Descriptive statistics; chi-square; independent paired-sample t tests; RMANOVA; Bonferroni adjusted pairwise comparisons	There was no significant interaction between motivation and race and there were no significant differences between rece groups for the PRETIE-Q.	Weak
Overstreet & Strohacker (2018)	USA	Experimental study	32	Insufficiently active adults (20.4 ± 4 years)	Aerobic	Preference and tolerance	PAR-Q; PRETIE-Q; BREQ-2	Pearson correlation coefficients; Hierarchical regression;	The results suggest that introducing a greater variety of exercise intensities may result in an overall more vigorous workout contributing to an increased total volume.	Weak

Patterson et al. (2020)	USA	Non-experimental	197 - Gym 1 - 58 (59); Gym 2 - 31 (58); Gym 3 - 108 (70)	Healthy adults (Gym 1 - 36.56 ± 9.77 years); (Gym 2 - 43.31 ± 15.73 years); (Gym 3 - 33.57 ± 9.10 years)	N/A	Preference and tolerance	PRETIE-Q; Personality; Depressive symptoms; Sense of community; Sociometric network data	Linear network autocorrelation models; Exponential random graph models; Homophily; Non-directional covariates; Sender/receiver covariates	Using social network analyses, the authors were able to demonstrate evidence for the social influence of preference and tolerance within CrossFit networks. Understanding situations and environments where preference and tolerance could be optimized might result in increased levels of beneficial exercise among adults.	Weak
Schneider & Graham (2009)	USA	Experimental study	146 (45)	Healthy adolescents (14.79 ± 0.46 years)	Aerobic	Preference and tolerance	Ventilatory threshold; DEXA; BIS/BAS; PRETIE-Q; PACES; Affective valence (FS); Activation deactivation adjective chceklist (AD ACL); RPE;	Repeated measures ANOVA; zero-order correlations; Bonferroni adjustments for multiple comparisons	Behavioral inhibition (BIS) was negatively correlated with cardiovascular fitness and tolerance for high-intensity exercise, and adolescents with high BIS scores reported more negative FS in response to exercise at both moderate and hard intensities.	Moderate
Smith et al. (2015)	Australia	Experimental study	18 (44)	Older participants (64.4 ± 3.9 years)	Aerobic	Preference and tolerance	RPE; Affective valence (FS); PRETIE-Q	ANOVA; hierarchical linear regression analyses; Kolmogorov-Smirnov test; Levene's statistic; Mauchly test of sphericity; Post-hoc tests; Bonferroni correction	Findings indicate that exercise around VT, whether administered during an exercise test, or self-selected by the participant, is likely to result in positive affective responses in older adults.	Strong
Teixeira et al. (2021a)	Portugal	Non-experimental	445 (56)	Active adults (29.6 ± 8.2 years)	N/A	Preference and tolerance	PRETIE-Q-PT; Subjective vitality scale (SVS); Subjective exercise experiences scale	Descriptive statistics; Cronbach's coefficients; Confirmatory factor analysis (CFA);	The PRETIE-Q-PT seems to be a valid scale that can be used to assess intensity-trait characteristics in health club exercisers and may allow professionals to better adjust exercise prescription to subjective needs aiming to achieve theoretically	Moderate

							(SEES); Self-report behavioral automaticity index (SRBAI)	Comparative fit index (CFI); Tucker-Lewis index (TLI); Standardized root mean square residual (SRMR); Root mean square error of approximation (RMSEA); Average variance extracted (AVE); composite reliability coefficients.	suggested promotion of pleasure exercise experiences.	
Teixeira et al. (2021b)	Portugal	Non-experimental	160 (54)	Healthy adults (34.12 ± 9.23 years)	N/A	Preference and tolerance	PRETIE-Q;Basic psychological needs satisfaction and frustration scale in exercise (BPNSFS-E); PACES	Descriptive statistics; Bivariate correlations; Multiple mediator analysis model (model 4)	The results indicate that intensity traits presented positive associations with enjoyment, and negative associations with all the need frustration variables. A mediation role of needs frustration emerged in the intensity traits and enjoyment associations that was analyzed according to relatable theoretical considerations.	Moderate
Teixeira et al. (2022)	Portugal	Non-experimental	273 (53)	Active healthy adults (female 36.21 ± 11.29 years)	N/A	Preference and tolerance	PRETIE-Q-PT, PACES, SRBAI, intention to continue exercising, exercise frequency	Descriptive statistics, bivariate correlation, mean center for construction of products	The results suggest that assessing and tailoring exercise prescription and supervision aiming to contemplate intensity delivery and exposure may augment future exercise behavior.	Moderate
Tempest & Parfitt (2016)	Australia	Experimental study	28 (50)	Healthy adults (High-tolerance group females - 20.7 ± 1.4 years; males - 20.1 ± 1.1	Aerobic	Tolerance only	PRETIE-Q (tolerance only); Near infrared spectroscopy; Affective valence (FS)	ANOVA; Greenhouse-Geisser corrections; Bonferroni-adjusted pairwise comparisons; simple main effects test	The findings provide direct neurophysiological evidence of differential hemodynamic responses within the PFC that are associated with tolerance in the presence of increased physiological demands. This study supports the role of dispositional traits and previous theorizing into the underlying	Weak

				years/Low-tolerance group females . 21.5 ± 3.4 years/males - 21.3 ± 2.7 years)					mechanisms (cognitive vs. sensory processes) of affective responses.	
Vandoni et al. (2016)	Italy	Experimental study	27 (37)	Active young adults (female 23.3 ± 2.2 years, male 22.5 ± 2.0 years)	Resistance and aerobic	Preference only	REP; Affective valence (FS); Perceived activation (FAS); PRETIE-Q (preference only); Physical self-efficacy scale (PSES); Perceived physical ability (PPA); Physical self-presentation confidence (PSPC)	ANOVA; Greenhouse-Geisser corrections; Huynh Feldt corrections; Bonferroni corrections; Pearson correlation *r* coefficients	The results suggest that the psychophysiological responses to group exercise training sessions are intensity dependent. From an adherence perspective, interventionists are encouraged to emphasize group exercise training sessions at a moderate intensity to maximize affective responses and to minimize exertional responses, which in turn may positively affect future behavior.	Moderate
Zhang et al. (2022)	China	Non-experimental	1117 (50)	College students (18.90 ± 1.25 years)	N/A	Tolerance only	Depression anxiety stress scale (DASS-21); Connor-Davidson resilience scale (CD-RISC); Physical activity level (IPAQ-SF)	Pearson correlations; mediation analysis; regression analysis	Physical activity, intensity tolerance, and resilience were negatively correlated with negative emotional states. Additionally, the relationship between physical activity and negative emotional states was partially mediated by exercise tolerance and resilience.	Moderate

Table 2 - Summary of samples' characteristics

Characteristics	Studies (%)	Population (%)
SAMPLE SIZE	36 total	5263 total
<30	11 (31%)	242 (5%)
30-50	9 (25%)	349 (7%)
50-100	4 (11%)	325 (6%)
>100	12 (33%)	4347 (82%)
SEX		
Female only	2 (6%)	47 (1%)
Male only	2 (6%)	56 (1%)
Mixed genders	32 (88%)	5160 (98%)
LOCATION		
Asia	1 (3%)	1117 (21%)
North America	20 (55%)	2146 (41%)
South America	1 (3%)	14 (0,3%)
Oceania	2 (6%)	46 (0,9%)
Europe	12 (33%)	1940 (37%)
MEAN AGE (Years)		
<18	1 (3%)	146 (3%)
18-64	35 (97%)	5117 (97%)
≥65	0	0

1.4.5. Exercise setting/protocol

Regarding the 36 studies that met the inclusion criteria, 27 studies used experimental protocols and 9 did not. From the studies with exercise protocols, 19 represented aerobic exercise, two depicted resistance exercise, and six used a combination of these activities (i.e., aerobic and resistance exercise). Of the studies that used aerobic protocols, 12 of them consisted in walking or running activities (Carlier & Delevoye, 2021; Ekkekakis et al., 2006, 2007 - study I & II; Epstein et al., 2021; Flack et al., 2019a, 2019c; Hutchinson et al., 2017; Jones et al., 2018; Lochbaum et al., 2009; Overstreet & Strohacker, 2018; Smith et al., 2015) and seven used cycle ergometers (Astorino et al., 2019; Bradley et al., 2019; Carlier & Delevoye, 2017; Jones & Ekkekakis, 2019; Morton et al., 2019; Schneider & Graham, 2009; Tempest & Parfitt, 2015). The studies with the protocol of resistance exercise depicted two different settings: (1) a maximal strength session and a circuit training session comprising 3 sets of 12 repetitions at 60% of a predicted one-repetition maximum (1RM) for 9 exercises (Baiamonte et al., 2016), and (2) one set of 12 repetitions at ~70% of 1RM in six resistance training exercises (pulldown, back squat, bench press, deadlift, dumbbell shoulder press, and leg extension) (Bastos et al., 2022). The studies that presented a combination of activities/exercise modes (i.e., aerobic and resistance exercise), had diverse settings, such as: (1) high-intensity circuit with various body weight movements (e.g., jumping jacks, burpees, squat jumps) where the participants were encouraged to go “hard as you can” (Box & Petruzzello, 2019); (2) two sub studies enrolled performance tests regarding the evaluation of muscular strength, upper body muscular endurance, abdominal endurance, cardiovascular endurance and flexibility (Hall et al., 2014 - study I & II); (3) all-out sprint interval exercise protocols with battle rope (Marin et al., 2019); (4) group training classes completing, according to music and choreography sequences, body weight exercises that involved the major muscle groups (Vandoni et al., 2016); (5) high-intensity functional training consisting in a 12 minute bout with the objective of completing as many repetitions as possible (AMRAP) of the following sequence – 5 pull ups, 10 box jumps and 15 wall balls (Box et al., 2022).

Regarding the nine non-experimental studies, five of them used health club participants (Faria et al., 2021; Marques et al., 2022; Teixeira et al., 2021a, 2021b; 2022), three studies had participants enrolled in general PA settings (Flack et al., 2017, 2019b; Zhang et al., 2022), and one study used a sample of CrossFit practitioners (Patterson et al., 2020).

1.4.6. PRETIE-Q usefulness, feasibility, interpretation, and limitations reported

1.4.6.1. Usefulness

As represented in Table 3, several studies state that the use of the preference and tolerance constructs can be an important tool, not only in assessing and tailoring exercise prescription but also in finding exercise preferences. (Box et al., 2022; Box & Petruzzello, 2019; Bradley et al., 2019; Faria et al., 2021; Jones et al., 2018; Teixeira et al., 2021a, 2021b, 2022).

Specifically, in the included studies, the preference and tolerance scales (as outcomes from the PRETIE-Q) were mainly used to test: (1) associations between self-selected exercise intensity and affective responses (Astorino et al., 2019; Bastos et al., 2022; Box & Petruzzello, 2019; Bradley et al., 2019; Carlier & Delevoye, 2017, 2021; Ekkekakis et al., 2006; Hutchinson et al., 2017; Jones et al., 2018; Jones & Ekkekakis, 2019; Marin et al., 2019; Overstreet & Strohacker, 2018; Tempest & Parfitt, 2015; Vandoni et al., 2016); (2) associations between the preference and tolerance of exercise intensity and well-being constructs (e.g., enjoyment, liking, vitality) (Box & Petruzzello, 2019; Faria et al., 2021; Flack et al., 2019a,2019c; Teixeira et al., 2021a, 2021b); (3) associations between the preference and tolerance of exercise intensity and behavior outcomes (e.g., exercise frequency, adherence, habit, intention) (Faria et al., 2021; Flack et al., 2019b; Marques et al., 2022; Schneider & Graham, 2009; Teixeira et al., 2021a, 2022); (4) associations between the preference and tolerance of exercise intensity and relative reinforcing value (RRV) of exercise (Epstein et al., 2021; Flack et al., 2017, 2019a, 2019b, 2019c); (5) the role of the preference and tolerance constructs in fitness tests performance (Hall et al., 2014; Lochbaum et al., 2009); (6) the predicting ability of the scales for time to volitional exhaustion in exercise tests (Ekkekakis et al., 2007; Smith et al., 2015); (7) the correlation between the preference and tolerance constructs and pain tolerance (Baiamonte et al., 2016); (8) the relation between preference and tolerance and social connections in CrossFit groups (Patterson et al., 2020); and (9) the mediating effects of tolerance and resilience on PA and negative emotional states (Zhang et al., 2022).

Table 3 - Usefulness, feasibility, interpretation, limitations, and reliability on the use of the PRETIE

Author (s)	Setting/protocol	Usefulness	Feasibility	Interpretation	Limitations reported on using the PRETIE-Q	Reliability
Astorino et al. (2020)	Participants completed two visits to the laboratory consisting of incremental exercise to assess VO2max followed by completion of a reduced exertion high-intensity interval training (REHIT) session using a cycle ergometer at least 48 h later.	The study used preference and tolerance to analyze if those constructs moderated perceptual responses during a single reduced exertion high-intensity interval training (REHITT).	Both scales appeared to be feasible in a REHITT session.	The baseline affective valence, change in RPE, peak affective valence from the VO2max test and enjoyment across all participants were unrelated to relative power output, tolerance, or preference.	Tolerance and preference to exercise intensity may not need to be considered for most clients when REHIT is employed.	Not reported.
Baiamonte et al. (2016)	A preliminary session was conducted to obtain a 3-RM on all added resistance lifts that were going to be utilized in the experimental session. These lifts included leg press, military (shoulder) press, lat pull downs, pec-deck flies, rows, and leg extensions. The protocol for the 3-RM was a modification of the one-repetition maximum (1-RM) protocol by Kraemer et al. (1991).	Intensity preference was used to test its correlation with lactate post-exercise and intensity tolerance was used to test its correlation with both lactate post-exercise and pain tolerance.	Preference and tolerance appeared to be feasible when used on maximal strength testing and circuit training.	Preference for exercise intensity was positively correlated with lactate post-exercise and tolerance for exercise intensity was positively correlated with pain tolerance and lactate post-exercise.	None to report.	Not reported.
Bastos et al. (2022)	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).	Preference and tolerance were used to test if distinct intensity traits profiles would depict different pleasure/displeasure responses in a RT intensity equivalent workout.	Both scales appeared to be feasible in a common exercise program performed in health clubs.	Results suggest that exercisers with distinct profiles of preference/tolerance depicted differentiated patterns for the affective response.	Preference and tolerance were treated independently, but recent evidence 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).	Cronbach's alpha: preference $\alpha = 0.76$; tolerance $\alpha = 0.69$.
Box & Petruzzello (2020)	Participants completed 15-minutes of high-intensity circuit (HIC), walking, and reading condition, respectively, on three separate days with a week between each session. The HIC consisted of	Trait differences in exercise intensity-preference and intensity-tolerance were used to determine the influence on how participants felt	The PRETIE-Q appeared to be feasible in assessing preference and tolerance during	Individuals with high-intensity preference reported similar results concerning RPE for HIC; Individuals with high intensity-tolerance presented no differences in RPE for HIC.	None to report.	The study found the PRETIE-Q to be sufficiently reliable

	various body weight movements (e.g., jumping jacks, push-ups, burpees, plyo lunges, squat jumps, mountain-climbers), where participants were encouraged to perform as “hard as you can”.	during (i.e., core affect) and following (i.e., enjoyment) high intensity, light intensity, and sedentary control conditions.	HIC in college-age students.			(Cronbach’s α = .810).
Box et al. (2022)	12 min bout requiring completion of as many repetitions as possible (AMRAP) of 5 pull-ups, 10 box jumps [either a 24” (males) or 20” box (females)], and 15 wall-balls [20 pound ball (males) or 14 pound ball (females)] – totaling 30 repetitions.	Preference for and tolerance of exercise intensity was used to predict the association between performance and enjoyment.	Intensity preference, but not tolerance, may provide utility in explaining high-intensity workout performance, but fail to explain variance in workout enjoyment.	The findings suggest that exercise- intensity preference explained variance in performance and that those with higher preference performed more repetitions in the HIW, but neither preference nor tolerance were meaningfully associated with workout enjoyment.	The findings may not be generalizable to those individuals who are novice exercisers, less fit, or do not actively seek out and engage in high-intensity exercise.	Cronbach's alpha: preference α = 0.84; tolerance α = 0.80.
Bradley et al. (2019)	Participants completed 10 × 6 s cycle sprints with 60s recovery.	Tolerance was used to Investigate the influence of tolerance of the intensity of exercise on affective responses to high-intensity interval exercise (HIIE).	The tolerance scale appeared to be feasible in HIIE using cycle ergometer.	Self-reported tolerance of exercise intensity influences affective responses and intentions to engage with HIIE.	Authors reported that future studies on the influence of HIIE and continuous exercise on affect should control for self-reported tolerance of the intensity of exercise as a confounding variable.	Cronbach's alpha: tolerance α = 0.72.
Carlier & Delevoye-Turrell (2017)	Three different conditions: (1) resting condition (watching TV); (2) cycling in silence; (3) cycling in music condition.	Tolerance was used to find out if low tolerant individuals have weaker resistance to sensorial feelings of discomfort than high tolerant individuals and thus, self-pace the physical session at lower intensities.	The tolerance scale appeared to be feasible in resting conditions, cycling in silence, and cycling in music condition.	The results showed that high tolerant participants when compared to low tolerant individuals, were characterized by greater power output. It was also confirmed by the study that non-athlete men and women are able to self-regulate physical effort on the basis of a score selected on the RPE scale.	The dissociation phenomena of music may distract the participants from detecting negative feelings linked to loss of homeostasis; low tolerant individuals may have been perturbed by the activating effects of music.	Not reported.

Carlier & Delevoye-Turrell (2022)	The session was organized in three distinct periods following the ACSM recommendations (American College of Sports Medicine et al., 2010): warm-up (5 min), in-task (30 min), and recovery (5 min).	Tolerance was used to verify if tolerance to effort of a participant impacts in-task affective experience.	The tolerance scale appeared to be feasible in whole body stepping tasks.	The findings argue for the existence of a cognitive dimension to physical activity with tolerance to effort being a moderator of individuals' affective experience to exercise. The affective states in low tolerant individuals were always more negative than that observed in high tolerant individuals.	None to report.	Not reported.
Ekkekakis et al. (2006)	The first session involved an incremental treadmill test to volitional exhaustion to determine VO2peak and VT. The second session involved a bout of treadmill exercise at a self-selected pace. The third visit involved completing the PRETIE-Q (as well as several other questionnaires not reported here).	Preference was used to investigate the ability of the PRETIE-Q's preference scale to predict the self-selection of exercise intensity.	The preference scale appeared to be feasible in an incremental treadmill test to volitional exhaustion.	The study showed that, although the distribution of self-selected exercise intensity centered on the VT as hypothesized, there was substantial interindividual variability.	The ability of the PRETIE-Q to predict self-selected exercise intensity under different conditions (e.g., cycling, shorter or longer bouts) and different sample characteristics (e.g., among men or individuals with different demographic and anthropometric attributes) should not be assumed but instead of that, investigated.	Cronbach's alpha: preference $\alpha = 0.81$-0.85; tolerance $\alpha = 0.82$-0.87.
Ekkekakis et al. (2007) - Study I	After a 5-min warm-up walk (4.8 km/h, 0% incline), the workload was increased in 1-min stages by alternating between increases in speed by 0.8 km/h or incline by 1%, starting with an increase in speed. The increases in workload were continued until each participant reached the point of volitional exhaustion (i.e., terminated the test by pressing a button).	Tolerance was used to test if self-reported tolerance of exercise intensity (assessed by the PRETIE-Q) could influence the amount of time individuals persist on incremental treadmill tests beyond the point at which they reach VT.	The tolerance scale appeared to be feasible in a graded treadmill test to volitional exhaustion.	Tolerance correlated significantly with overall test duration and duration after VT; Preference did not correlate significantly with the total duration of the test; The correlation between preference and tolerance was moderately positive.	None to report.	Cronbach's alpha: preference $\alpha = 0.81$-0.85; tolerance $\alpha = 0.82$-0.87
Ekkekakis et al. (2007) - Study II	The incremental protocol began from a very low workload, at a speed of 4 km/h and 0% grade for 2 min. Thereafter, the speed was increased by 0.64 km/h every second minute (while maintaining the grade at 0%) until each participant reached the point of volitional exhaustion.	Tolerance was used to test if self-reported tolerance of exercise intensity (assessed by the PRETIE-Q) could influence the amount of time individuals persist on incremental treadmill tests beyond the point at which they reach VT.	The tolerance scale appeared to be feasible in a graded treadmill test to volitional exhaustion.	Tolerance did not correlate with the total duration of the test; Preference presented a significant correlation with the duration after VT; The correlation between preference and tolerance was moderately positive, albeit not significant.	None to report.	Cronbach's alpha: preference $\alpha = 0.81$-0.85; tolerance $\alpha = 0.82$-0.87.

Epstein et al. (2021)	Participants sampled both the HIIT and MIAE protocols in a counterbalanced order. Based on group assignment, HIIT exercise times were different between the groups. The protocols involved 5 min of warm-up, sampling relevant HIIT or MIAE protocols, followed by 5 min of cool down.	Tolerance was used to test its ability as a predictor of the reinforcing value of exercise during high-intensity interval training (HITT) versus moderate-intensity aerobic interval (MIAE).	The tolerance scale appeared to be feasible for HIIT and MIAE in sedentary adults.	Liking of MIAE was related to tolerance of intense physical activity, however, none of the variables studied were related to reinforcing value of HIIT.	None to report.	Cronbach's alpha: preference and tolerance α = 0.80-0.89; 3- and 4-month test-re-test reliability = 0.67-0.85.
Faria et al. (2021)	Completion of an online battery of sociodemographic and psychometric questionnaires distributed through social media and mailing lists. Data were collected anonymously through Google Forms from anyone willing to participate.	Preference and tolerance were used to find out how intensity traits profiles relate to well-being and behavioral constructs in health club exercisers.	The PRETIE-Q-PT appeared to be feasible in helping to understand the role of preference and tolerance in well-being and behavioral outcomes in health club exercisers.	The intensity traits were positively associated with all the study variables (i.e., subjective vitality and exercise habit).	None to report.	Cronbach's alpha: preference α = 0.76; tolerance α = 0.71.
Flack et al. (2017)	Participants wore an accelerometer for seven days to assess habitual physical activity (PA) and completed the Yale Physical Activity questionnaire to determine habitual engagement in different modes of exercise. The PRETIE-Q was completed at the participant's first visit.	The PRETIE-Q was used to find out if relative reinforcing value in resistance training (RRVrt) and aerobic training (RRVat) can be predicted by an individual's preference and tolerance of exercise.	Both scales appeared to be feasible in understanding the relation of preference and tolerance with RRVat and RRVrt.	The results demonstrate that an individual's preference and tolerance of exercise predicts RRVrt, but not RRVat.	None to report.	Not reported.
Flack et al. (2019a)	Sedentary men and women (body mass index, BMI: 25–35 kg/m2) were randomized into parallel exercise training groups expending either 300 (n = 18) or 600 (n = 18) kcal/exercise session, five sessions/week, for 12 weeks.	The PRETIE-Q was used to find out if preference and tolerance would affect RRV exercise results.	Both scales appeared to be feasible in understanding the relation of preference and tolerance with RRV exercise.	Increases in preference and tolerance for exercise intensity predicted increases in RRV exercise, possibly pointing to a necessary antecedent for incentive-sensitization of RRV exercise to take place.	None to report.	Not reported.

Flack et al. (2019b)	Participants provided a blood sample for genetic assessment and were given an ActiGraph accelerometer to measure usual PA. Participants wore the accelerometer for seven days before performing additional assessments. During subsequent visits, participants completed assessments of anthropometrics (height and weight), exercise reinforcement, and tolerance for discomfort during intense exercise.	The PRETIE-Q was used to find out if preference and tolerance would affect RRV exercise results.	Both scales appeared to be feasible in understanding the relation of preference and tolerance with RRV exercise.	Having greater tolerance for the discomfort associated with intense exercise and greater RRV exercise, may lead to more frequent and sustained exercise behavior.	None to report.	Not reported.
Flack et al. (2019c)	Groups included exercise exposures of 150 (n = 35) or 300 kcal/session (n = 34), 3 sessions/week for 6 weeks, or a non-exercise control group (n = 35). Assessments for exercise and sedentary behavior reinforcement (primary dependent variables) and activity and tolerance for exercise intensity were performed at baseline (week 0), post-training (week 6), and post washout (week 10).	Preference and tolerance were used to test if there is an association with incentive sensitization of exercise.	Both scales appeared to be feasible in understanding the relation of preference and tolerance with RRV exercise.	Increases in tolerance for exercise intensity discomfort were associated with increases in the RRV exercise.	None to report.	Not reported.
Hall et al. (2014) - Study I	Muscular Strength (Handgrip) - 3 maximum voluntary contractions with their dominant hand; Upper body muscular endurance - 1-minute push-up test (men did "full push-ups, women did "knee push-ups"); Abdominal Muscular endurance - 1-minute curl up test; Cardiovascular endurance - Forestry Step Test; Flexibility - Sit-and-reach test.	The PRETIE-Q was used to find out if self-reported individual differences in preference and tolerance have any association with performance in fitness tests.	Both scales appeared to be feasible in the fitness testing context.	Preference and tolerance exhibited significant correlations with all fitness variables and body composition.	The results should not be assumed to apply to samples with different characteristics nor to different types of fitness tests.	Cronbach's alpha: preference $\alpha = 0.84$; tolerance $\alpha = 0.80$.

Hall et al. (2014) - Study II	Upper body muscular endurance - 1-minute push up test and the YMCA bench press test; Abdominal Muscular endurance - 1-minute sit up test; Cardiovascular endurance - 1.5 mile run test; Flexibility - Sit-and-reach test and hip-joint flexibility, as prescribed by the ACSM.	The PRETIE-Q was used to determine how/if the scores on preference and tolerance change after a short-term training program designed to improve fitness.	Both scales appeared to be feasible in the fitness testing context.	Although perceived fitness improved, scores on the preference and tolerance scales did not change significantly.	The results should not be assumed to apply to samples with different characteristics nor to different types of fitness tests.	Cronbach's alpha: Week 01 - preference $\alpha = 0.80$; tolerance $\alpha = 0.82$; Week 06 - preference $\alpha = 0.80$; tolerance $\alpha = 0.86$.
Hutchinson et al. (2018)	Two treadmill exercise trials were performed at an intensity that was perceived to correspond to a Feeling Scale value of 3 (i.e., "good"). Sessions with either self-selected music or no music were completed 48hr apart and in a randomized counterbalanced order.	Preference was used to account for individual differences in preferred exercise intensity while exercising with self-selected music and without music.	The preference scale appeared to be feasible in affect regulated exercise on a motorized treadmill.	The relatively high preference score might account for a difference in the intensity selected.	None to report.	Cronbach's alpha: preference $\alpha = 0.73$; test-re-test reliability 0.67-0.80.
Jones & Ekekkakis (2019)	15-min sessions of recumbent cycling at the ventilatory threshold: (a) high immersion (HI, virtual reality headset and headphones), (b) low immersion (LI, television screen, and speakers), and (c) Control.	Preference was used to find out if low-preference participants would exhibit worse affective responses to exercise at VT while exercising under control conditions.	Preference (but not tolerance) scale appeared to be feasible in cycling on different conditions (i.e., high immersion, low immersion, control).	In the control conditions, low-preference participants reported substantially lower ratings of affective valence than their high-preference counterparts.	Preference and tolerance exhibited noticeably different score ranges, presumably due to the nature of the sample (i.e., low active, overweight adults).	Cronbach's alpha: preference $\alpha = 0.94$; tolerance $\alpha = 0.62$.
Jones et al. (2018)	The protocol maintained the 3 min stage markers of the Bruce Protocol (e.g., 12% gradient and 2.5mph at min 6, 14% gradient and 3.4mph at min 9), but the gradient and treadmill belt velocity increased gradually every 15s rather than steeply every 3 min.	The PRETIE-Q was used to test if preference and tolerance scores had an influence on affective responses to exercise and adherence.	The preference scale appeared to be feasible as a substantial predictor of group membership based on affective response to exercise in the zone of response variability but the tolerance scale did not.	The findings suggest that preference is an important variable when prescribing exercise in order to optimize affective response and, therefore, adherence.	None to report.	Cronbach's alpha: preference $\alpha = 0.84$; tolerance $\alpha = 0.75$.

Lochbaum et al. (2009)	200m Shuttle-run test and responding to several questionnaires (e.g., AGQ; LTEQ; PRETIE-Q).	Preference and tolerance were used to examine its influence in the exerted effort as defined by performance on the shuttle run task.	Preference and tolerance scales appeared to be feasible on shuttle run task.	Performance-approach goal mediated preference for strenuous physical activity on shuttle run performance among men, but not women.	None to report.	Cronbach's alpha: preference $\alpha = 0.73$; tolerance $\alpha = 0.81$.
Marin et al. (2019)	3 all-out Sprint interval exercise protocols consisting of battling rope exercise: P10:30 (12×10-s bouts with 30-s recovery); P15:45 (8×15-s bouts with 45 s recovery); and P30:90 (4×30-s bouts with 90-s recovery).	The tolerance scale form the PRETIE-Q (Brazilian version) was used to find out if tolerance has any effect on the relationship between changes in RPE and affective valence.	The tolerance scale (Brazilian version) appeared to be feasible in helping to predict changes in the feeling scale during Sprint interval exercise.	Tolerance of exercise intensity may be used to predict changes in affective valence during SIE.	None to report.	Cronbach's alpha: tolerance $\alpha > 0.80$.
Marques et al. (2022)	An invitation to complete an online sociodemographic and psychometric questionnaire developed in Google Forms was made available through mailing lists and social networks to anyone willing to participate.	The PRETIE-Q-PT (Portuguese version) was used to find out the agreement levels between preference and tolerance and the intensity of exercise in health clubs.	Both scales, and particularly the level of agreement, appear to be feasible for adherence understanding in health clubs.	Results suggest that having both intensity traits in agreement with current training intensity depicted the most relevant scores for vitality, habit, and exercise frequency.	None to report.	Cronbach's alpha; preference $\alpha = 0.77$; tolerance $\alpha = 0.73$.
Morton et al. (2019)	Participants completed surveys that examined motivations for group indoor cycling (GIC) participation. Treatment Self-Regulation Questionnaire (TSRQ), PRETIE-Q, and open-ended survey questions were used.	The PRETIE-Q was used to help explore factors that influence regular GIC participation.	Both scales appeared to be feasible for GIC in a non-Hispanic black and non-Hispanic white adults sample.	There were no significant differences between race groups for PRETIE-Q.	None to report.	Not reported.
Overstreet & Strohacker (2018)	Participants attended 3 visits to the laboratory to conduct an initial assessment, one 30-minute session of imposed moderate-intensity treadmill exercise, and one 30-minute session of self-paced treadmill exercise, with the latter visits occurring in a randomized order.	The PRETIE-Q was used to test the relationship between self-selected variety in exercise intensity on overall bout intensity.	Both scales appeared to be feasible in treadmill exercise.	In-task variability in exercise intensity was positively related to the average intensity of the bout.	None to report.	Cronbach's alpha: α = 0.67-0.85.

Patterson et al. (2020)	Participants received emails describing the study purpose with an invitation to participate in an online survey. After giving their electronic consent, respondents provided demographic, attribute (i.e., behavioral health data), and sociometric network data.	The PRETIE-Q was used to test whether preference and tolerance were related to social connections within CrossFit networks.	Both scales appeared to be feasible in high-intensity functional training (i.e., CrossFit).	Results showed an association between preference and tolerance scores of someone's social connections and their own; Data also demonstrated that preference and tolerance scores were associated with the presence of social ties.	The psychometric properties of the PRETIE-Q did not lend itself to retaining the original 16 items in the study sample.	Cronbach's alpha: α = 0.76-0.78.
Schneider & Graham (2009)	Participants completed a computerized questionnaire that assessed BIS/BAS, enjoyment, and preference and tolerance for high-intensity exercise, and engaged in a 30-minute exercise task on a cycle ergometer.	The PRETIE-Q was used to verify the association between tolerance to exercise intensity and persistence in high-intensity exercise, behavioral activation (BAS) and behavioral inhibition (BIS).	Both scales appeared to be feasible in cycle ergometer exercise.	BIS was negatively correlated with cardiovascular fitness and tolerance for high-intensity exercise.	None to report.	Cronbach's alpha: preference α = 0.85; tolerance α = 0.82.
Smith et al. (2015)	Participants attended the laboratory on three occasions (separated by 5–7 days). In the first session, participants completed a familiarization session involving a submaximal perceptually regulated exercise test; In sessions two and three, participants performed a GXT to volitional exhaustion to enable the patterning of physiological and psychological responses to be assessed and a 20 min bout of exercise at a self-selected intensity on a treadmill.	The PRETIE-Q was used to test if preference and tolerance of exercise intensity could predict time to exhaustion in graded exercise test.	Both scales appeared to be feasible for graded treadmill exercise test in older adults.	The results show that an individual's preference for, or tolerance of exercise intensity is associated with the total duration of the test and duration after VT is reached.	None to report.	Not reported.

Teixeira et al. (2021a)	Data were collected from three independent samples. The first and second data collections were made through online survey with 174 and 146 gym exercisers respectively and the third sample comprised a total of 125 gym exercisers through in-person data collection individually in three health clubs in the central region of Portugal. (...) Exercisers were enrolled in several fitness activities provided by health clubs (individual, group, and water activities).	The PRETIE-Q-PT (Portuguese version) was used to assess the scores of preference and tolerance in health club exercisers.	Both scales appeared to be feasible in adult health club exercisers.	The study results indicate that the preference and tolerance scales exhibited significant, albeit generally weak, positive associations with exercise frequency, habit, vitality, psychological well-being, psychological distress, and fatigue (only for preference).	The PRETIE-Q can only be used in participants with at least 3 months of practice in the measurement context because they might not know how to make a rigorous interpretation of the items present in the scales before that.	Cronbach's alpha: preference $\alpha = 0.77$-0.81; tolerance $\alpha = 0.70$-0.73.
Teixeira et al. (2021b)	The participants were engaged in individual (59%) (e.g., strength training, personal training), group (29%) (e.g., dance, choreographed aerobics), and mixed training sessions (12%). The questionnaires could be completed in two forms: in person or via Google forms accessed with a QR code.	Preference and tolerance were used to test a possible relationship between intensity traits and enjoyment.	Both scales appeared to be feasible in adult health club exercisers.	Preference and tolerance were positively associated with enjoyment; (...) Preference did not present associations with needs satisfaction, but presented a negative association with autonomy frustration, competence frustration and BPNF global; (...) Tolerance was positively associated with competence satisfaction, but not with autonomy satisfaction, relatedness satisfaction or BPNS global.	Based in the fact that the potential inexperience of participants with less than 3 months of practice may cause the impossibility for them to correctly understand the questions present in the scale, the PRETIE-Q may only be used in participants with at least 3 months of prior exercise experience.	Cronbach's alpha: preference $\alpha = 0.86$; tolerance $\alpha = 0.71$.
Teixeira et al. (2022)	273 gym exercisers from several health clubs fulfilled voluntarily a battery of questionnaires.	The PRETIE-Q was used to examine the mediating role of intensity trait level of agreement in behavior parameters.	Both scales appeared to be feasible in adult health club exercisers.	The results depict a moderation effect of exercise intensity traits agreement on exercise habit, intention to continue exercising and exercise frequency.	None to report.	Reliability through Cronbach's alpha indicated excellent scores.
Tempest & Parfitt (2016)	The participants completed an incremental cycling exercise test to exhaustion. The end of the test was determined by volitional cessation of exercise or failure to maintain pedal cadence despite strong verbal encouragement.	PRETIE-Q was used to test the influence of exercise intensity tolerance in the prefrontal cortex (PFC) hemodynamics and affective responses.	The tolerance scale appeared to be feasible in finding high and low tolerant individuals on a cohort of	The findings provide direct neurophysiological evidence of differential hemodynamic responses within the PFC that are associated with exercise intensity tolerance in the	None to report.	Cronbach's alpha: tolerance $\alpha = 0.76$-0.81.

			sports science students.	presence of increased physiological demands.		
Vandoni et al. (2016)	All participants completed two experimental trials, which were scheduled on different days and with at least 48–72hr between trials. Specifically, the participants performed two sessions of group exercise training, involving selected bodyweight exercises targeting the major muscle groups and performed according to music and choreography sequences.	Preference was used to compare the results of affective valence and perceived exertion when exercising at moderate intensity and at vigorous intensity.	The preference scale appeared to be feasible in a treadmill maximal graded test.	The results indicate that there were no significant correlations of the intensity preference and the self-efficacy components with the psychophysiological responses in any of the two exercise intensity trials. Additionally, it is demonstrated that the effects of exercise intensity on perceived exertion is unrelated to the self-efficacy and self-reported intensity preference of the participants.	None to report.	Not reported.
Zhang et al. (2022)	The researchers asked faculty members to distribute a pre-designed QR code to their students asking them to voluntarily participate in the study that consisted in responding the questionnaires (i.e., DASS-21 - Chinese version; CD-RISC - Chinese version; IPAQ-SF - Chinese version; PRETIE-Q - Chinese version.	The PRETIE-Q - Chinese version was used to study the mediating effects of tolerance and resilience on physical activity level and negative emotional states.	The tolerance scale appeared to be feasible in assessing exercise tolerance on college students.	The results indicate that exercise tolerance and resilience reached statistical significance as mediators of the physical activity - negative emotional states relationship.	None to report.	Cronbach's alpha; preference $\alpha = 0.85$; tolerance $\alpha = 0.72$.

1.4.6.2. Feasibility

In terms of feasibility, the majority of the studies have shown that the scales appeared to be feasible, except two of them which used both scales, and claim that preference is feasible but tolerance not, in: (1) explaining high-intensity workout performance (Box et al., 2022); and (2) helping to predict group membership based on affective response to exercise (Jones et al., 2018). From this point on, the feasibility representation will be divided into three different groups: (1) studies in which both scales were used; (2) studies that used only the preference scale; (3) studies that used only the tolerance scale.

Focusing the studies that used both scales, in six of them, the scales appeared to be feasible in health club exercise behavior understanding (Bastos et al., 2022; Faria et al., 2021; Marques et al., 2022; Teixeira et al., 2021a, 2021b, 2022). Also, using both scales appeared to be feasible: (1) in reduced exertion high-intensity training (REHIT) (Astorino et al., 2019); (2) in maximal strength testing and circuit training (Baiamonte et al., 2016); (3) during high-intensity body-weight circuit (HIC) (Box & Petruzzello, 2019); (4) in understanding the relation of preference and tolerance with reinforcing value of exercise (Flack et al., 2017, 2019a, 2019b, 2019c); (5) in fitness testing context (Ekkekakis et al., 2007 - study I; Hall et al., 2014 - study I & II); (6) for group indoor cycling (Morton et al., 2019); (7) in high-intensity functional training (i.e., CrossFit) (Patterson et al., 2020); in cycle ergometer exercise (Schneider & Graham, 2009); (8) for graded treadmill exercise in older adults (Smith et al., 2015); and (9) in shuttle run task (Lochbaum et al., 2009).

Additionally, in the studies that used only the preference scale, the utilization of the instrument seems to be feasible in: (1) incremental treadmill test to volitional exhaustion (Ekkekakis et al., 2006); (2) affect regulated exercise on a motorized treadmill (Hutchinson et al., 2017); and (3) cycling exercise on different conditions (i.e., high immersion, low immersion, control) (Jones & Ekkekakis, 2019).

Finally, in the studies that used only the tolerance scale, it appeared to be feasible in: (1) high-intensity interval exercise (HIIE) using a cycle ergometer (Bradley et al., 2019); (2) resting conditions, and cycling in two different conditions (i.e., in silence and in the music condition) (Carlier & Delevoye, 2017); (3) whole body stepping tasks (Carlier & Delevoye, 2021); (4) graded treadmill test to volitional exhaustion (Ekkekakis et al., 2007 - study II); (5) high-intensity interval training (HIIT) and moderate-intensity aerobic exercise (MIAE) in sedentary adults (Epstein et al., 2021); (6) helping to predict changes in the feeling scale during sprint interval exercise (SIE) (Marin et al., 2019); (7) finding high and low tolerant individuals

in sports science students (Tempest & Parfitt, 2015); and (8) exercise tolerance assessment in college students (Zhang et al., 2022).

1.4.6.3. Interpretation and possible correlates

When interpreting the preference/tolerance constructs use, it is possible to observe the objective outcomes obtained from the scales application, and the correlations made with other variables for each of the included studies. That said, several studies (n=7) depict positive correlations between preference and tolerance and affective responses (Bastos et al., 2022; Bradley et al., 2019; Carlier & Delevoye, 2021; Jones et al., 2018; Jones & Ekkekakis, 2019; Marin et al., 2019; Tempest & Parfitt, 2015; Vandoni et al., 2016), suggesting that participants with higher preference and tolerance profiles may present higher ratings of affective valence and more positive affective responses. Nevertheless, in one of the studies, the results present no relation between affective valence or enjoyment and preference or tolerance (Astorino et al., 2019).

Two studies used the RPE scale and the PRETIE-Q, in one of them the results showed that high intensity-tolerant participants presented no differences in RPE for the high-intensity circuit (Box & Petruzzello, 2019) and the other depicted a greater power output in cycling exercise for high tolerant individuals when compared with their low tolerant counterparts, suggesting that this discrepancy may leave some space for future research in order to gain a better understanding, in an objective way, on how RPE scale and the PRETIE-Q may be related.

The variable VT was used in four of the studies as being correlated with preference and tolerance of exercise intensity, concluding in one study that self-selected exercise based on preference centered on VT, although there was substantial inter-individual variability (Ekkekakis et al., 2006). In a second study, the duration of a test (i.e., incremental treadmill test) after VT was correlated with tolerance but not with preference (Ekkekakis et al., 2007 - study I), and in a third study, tolerance was not correlated with the duration of the test (i.e., incremental treadmill test), while preference presented a significant correlation with the duration of the test after VT (Ekkekakis et al., 2007 - study II) and the authors found support to the construct validity of the tolerance scale of the PRETIE-Q and discriminant validity of both tolerance and preference scales indicating that only the preference scale predicted self-selected exercise intensity (Ekkekakis et al., 2006, 2007). In the fourth study that used VT, the results were similar. Smith et al. (2015) showed that the scores in preference and tolerance could predict variability in self-selected exercise in older adults since those scores were positively

correlated with the total duration of the test (i.e., incremental treadmill test) and duration of the test after VT was reached (Smith et al., 2015).

The PRETIE-Q was also used to investigate the influence of preference and tolerance on RRV of exercise in five studies. Two of those studies claimed that increases in preference and tolerance can predict increases in RRV of exercise (Flack et al., 2019a, 2019c), while in the other hand, one of them concluded by dividing exercise into two dimensions (i.e., resistance training and aerobic training), that preference and tolerance predicts RRV for resistance training but not for aerobic training (Flack et al., 2017). Additionally, a fourth study concluded that greater tolerance to exercise intensity and greater RRV of exercise can lead to a higher frequency and sustained exercise behavior (Flack et al., 2019b). Finally, a study aiming to investigate the influence of preference and tolerance in RRV of exercise on HIIT concluded that it does not exist any relationship between the variables (Epstein et al., 2021).

Five other studies used preference and tolerance of exercise intensity to examine its relationship with well-being (e.g., subjective vitality and enjoyment) and behavioral (e.g., exercise habit, exercise frequency) variables in health club contexts and obtained very similar results and conclusions. These studies presented positive associations between preference and tolerance of exercise intensity, vitality, exercise frequency, enjoyment, and habit (Faria et al., 2021; Marques et al., 2022; Teixeira et al., 2021a, 2021b, 2022). In general, the outcomes from these studies seem very consistent affirming that the preference and tolerance traits and their agreement with the current training intensity, may be relevant to potentially enhance exercise habits and, consequently, adherence.

Another paper, comprising two studies with two different samples, showed in the first study that in a fitness test context, preference and tolerance presented significant positive correlations with overall fitness and body composition (Hall et al., 2014 - study I) and in the other one, after a 6-week training program aiming to enhance the capacity to perform in fitness tests, the authors concluded that perceived fitness improved, although scores in preference and tolerance did not change significantly (Hall et al., 2014 - study II). These results may provide some consistent evidence since the scores for PRETIE-Q remain very similar even when perceived fitness changes.

Two studies present very similar outcomes and conclusions since both show positive correlations between preference for exercise intensity and self-selected intensity while exercising on a treadmill, and, even though both used this exercise setting (i.e., exercise on a treadmill) for data collection, the protocols where different: (1) two sessions at self-selected

intensity (Hutchinson et al., 2017); and (2) one session with imposed moderate- intensity, and two other exercise sessions with self-selected intensity. These outcomes show that in-task variability in exercise intensity may be related to the average self-selected intensity of the exercise (Overstreet & Strohacker, 2018).

A study involving CrossFit participants showed associations between one's preference and tolerance scores and the scores of the people from their social connections, suggesting that social networking influences the way people perceive and feel the intensity of the exercise (Patterson et al., 2020). Behavioral activation (BAS) and behavioral inhibition (BIS) were two more variables studied as being in any way related to preference and tolerance and it was shown that there is a negative correlation between tolerance for high-intensity exercise and BIS (Schneider & Graham, 2009).

One study stated that there were no significant differences between race groups for the use of PRETIE-Q (Morton et al., 2019) providing evidence for racial invariance when using the questionnaire, and Baiamonte et al. (2017) in their study, positively correlated preference for exercise intensity with lactate post-exercise and tolerance with pain tolerance (Baiamonte et al., 2016). Additionally, another study showed that performance-approach goals mediated preference for more strenuous exercise on shuttle run performance and also found sex variance since the results only happened in male participants (Lochbaum et al., 2009) and another one presented results indicating that exercise tolerance and resilience can mediate the relationship between PA and negative emotional states (Zhang et al., 2022).

Finally, for interpretation purposes, the reported reliability of the scales was collected. Even though 11 of the included studies did not report any results for that matter (Astorino et al., 2019; Baiamonte et al., 2016; Carlier & Delevoye, 2017, 2021; Flack et al., 2017, 2019a, 2019b, 2019c; Morton et al., 2019; Smith et al., 2015; Vandoni et al., 2016), most of them (n=25) reported an acceptable-to-good internal consistency by referring Cronbach's alpha results ($\alpha_{min\text{-}max}$ = 0.60-0.90) (Cohen, 2013).

1.4.6.4. Reported limitations

Some studies (n=11) reported limitations in the use of the PRETIE-Q: (1) five studies point out as limitation the fact that, when considering the agreement level between the preference/tolerance-traits and current training, there might exist different traits profiles, and no clear indication on how to classify them have emerged (Bastos et al., 2022; Faria et al., 2021; Marques et al., 2022; Teixeira et al., 2021b, 2022); (2) two studies considered as limitation the need for the participants to have at least three months of practice in the measurement context,

in order to be able to do a correct interpretation of the items presented in the preference and tolerance scales (Teixeira et al., 2021a, 2021b); (3) one study reports that the tolerance and preference to exercise may not need to be considered for most participants during a reduced-exertion high-intensity interval training session (Baiamonte et al., 2016); (4) a study using music as a supposed booster for self-selected exercise intensity referred that the dissociation phenomena of music might distract participants from detecting negative feelings and thus be perturbed by its activating effects, biasing the results (Carlier & Delevoye, 2017); and (5) one study, using a HIIE protocol, stated that self-reported tolerance of the exercise intensity should be controlled as a confounding variable (Bradley et al., 2019);

The remaining 25 studies did not report any limitations in the use of the preference and/or tolerance scales. However, and as seen in Table 2, no study with a sample higher than 65 years old was present, thus precluding at this point the possibility to comprehend how the intensity traits are understood and can be used in this population.

1.5. Discussion

The need to better understand how to support and adjust PA practices has brought a new look to exercise intensity use and interpretation. Given the dual-mode theory framework, tools that allow a better understanding of the intensity-pleasure relation may be particularly relevant for that endeavor, in which the PRETIE-Q and the two explored intensity traits can be included (Ekkekakis et al., 2020; Teixeira et al., 2022). For that matter, a systematic review aimed to explore the utility and feasibility of the PRETIE-Q in PA settings was performed.

A total of 36 studies (23 published in the last five years) met the inclusion criteria and were composed of a sample total of 5263 individuals. Of these, 97% were aged between 18-64 years old, and in 88% of the studies, samples were composed of both sexes. Results show that the two measured constructs seem to have been used and useful in a vast set of activities that are common practice in PA settings, particularly when focused on the understanding of the relative reinforcing value (RRV), exercise behavior, well-being, affective responses, and fitness/performance. These activities encompassed several forms and modes of practice, like, as example, flexibility, running, walking, cycling, resistance training, and high-intensity training, which were expressed in all ranges of exercise intensity (from low to vigorous intensities). In general, scales appeared to be useful for individual intensity understanding, conjunctively, or used individually (e.g., preference scale use for intensity self-selection).

Although the intensity traits have been initially proposed to be directly associated with the affective responses (Ekkekakis et al., 2005) and had been represented in several study efforts included in this review, the subsequent research has tested them with several other variables. For example, additional testing to understand the traits' relation with the VT has been produced, and although some mixed findings, preference and tolerance seem to assist in the understanding of exercise duration, proximity to the VT, and intensity self-selection in tests where this variable was controlled. These, however, may be dependent on the type of test used (e.g., maximal test), participants' experience, and exercises (treadmill vs. bicycle), an issue that would benefit from future research clarification. Another example of the possible associations of these traits pertains to well-being variables. Several variables have been tested for this matter (e.g., subjective vitality, psychological well-being and distress, depression, anxiety) and generally week to moderate associations were present (e.g., Faria et al., 2021; Teixeira et al., 2021a). These results were discussed by several authors as an expected outcome of the traits analysis, given that it was not expected that a high or lower trait would, by itself, be an indicator of more or less well-being. Instead, some studies proposed that it should be the proximity of the current training intensity and individual preference/tolerance which should depict the most relevant associations (e.g., Marques et al., 2022; Teixeira et al., 2022), grounded on the rationale that an individually and pleasure-oriented adjusted exercise intensity would potentiate well-being (Ladwig et al., 2017; Stevens et al., 2020; Zenko et al., 2017). Some support to this hypothesis is now clearer given that several of the included studies have shown a role of the traits on the reinforcing value of exercise (Flack et al., 2017, 2019a, 2019b, 2019c) and exercise behavior like intention, habit, and frequency (Faria et al., 2021; Flack et al., 2019b; Marques et al., 2022).

In a broader look at the limitations reported, no relevant issues have emerged in most of the studies, which reinforces the scales' usefulness and feasibility. However, some concerns and suggestions have been presented in some studies that may warrant future efforts. One of these pertains to the agreement between the two intensity traits and the current practice. This emerges from the consideration proposed by the European-Portuguese version of PRETIE-Q, where two questions, one for each scale, were added as a complementary assessment of the accordance between each trait and the actual exercise intensity performed. The critique centers on the approach of how these agreement levels can be explored, given that scores have been obtain through a categorical coding (0 = not in agreement; 1 = in agreement) (e.g., Marques et al., 2022; Teixeira et al., 2021b, 2022), which do not allow the understanding of the degree of

agreement/disagreement. It is possible to assume that some exercise intensities in a given workout could be more closely aligned with individual preference/tolerance than others, or even that the general perception of an exerciser is that the training is somewhat in accordance, but not fully to represent the 1 score (i.e., in agreement). This is a distinction that the dichotomous approach cannot detect. Still, on this matter, it is important to highlight that these questions did not exist in the original version (Ekkekakis et al., 2005), nor exist in any other language translation or validation, and do not make part of the total pool of items subjected to psychometric testing.

Additionally, remarks have been presented to the profiles of preference and tolerance the individuals may present. As seen is some studies, the traits profile have been proposed as combinations of low, moderate, and vigorous preference/tolerance for intensity (e.g., moderate preference and low tolerance; vigorous preference and moderate tolerance) (Marques et al., 2022) or by categories (e.g., light intensity: 5 – 9; light- to moderate-intensity: 10 – 14; moderate- to vigorous-intensity: 15 – 19; vigorous-intensity: 20 – 25) (Bastos et al., 2022), or defined by dividing the sample in the half lowest and higher trait score (Bradley et al., 2019). These exploratory approaches allowed a better understanding of the use and interpretation of the traits on several outcomes but may limit the extrapolation to an operational application of the results. For example, although it is expected that the individual traits should represent an inclination to the exercise intensity to be selected when aiming to promote well-being and adherence (Teixeira et al., 2021b, 2022), no clear relation between the traits and levels of exercise intensity is defined. The proximity between the preferred or tolerated intensity and the actual intensity in aerobic, resistance, or flexibility exercises as set, for example, in the ACSM guidelines, is not yet clearly understood. This cautions researchers and professionals to establish direct associations between the scores of preference and tolerance and the selected intensity in an exercise program, as it seems at this point that these should act as referrals for individualization, initial selection, and adjustment of intensity, more than strict indications for its selection (Ekkekakis et al., 2005).

Another limitation reported in some studies is related to the participant's exercise experience. Some authors sustained that for adequate use of both scales, a minimum experience of three months should be present, thus allowing a correct understanding of the questions (Teixeira et al., 2021a, 2021b, 2022), and other studies have considered that time-lapse as criteria for sample inclusion (Faria et al., 2021; Marques et al., 2022). For example, item 1 (tolerance) in the original version (Ekkekakis et al., 2005) indicates that *"Feeling tired during*

exercise is my signal to slow down or stop."; or item 6 (preference) which says that *"I would rather have a short, intense workout than a long, low intensity workout."* may suggest the need for experience in a given activity. This may be the case for participants in health clubs or other specific activities and not so much in general PA, considering that even non-physically active individuals are somewhat exposed to physical efforts throughout usual daily activities. Although not clear or tested, the importance of this issue in the correct assessment of these two variables should be considered (e.g., to the context) and perhaps adjusted accordingly (e.g., wording; exercise vs. PA), as individuals traits assessment needs an adequate contextualization for proper understanding.

Finally, two aspects seem worthy of attention given the absence of results. The first pertains to the sample age. As seen in Table 2, no studies existed with samples over the age of 65 years old, and only one study had participants < 18 years old. Although individual traits are relatively stable across time, they tend to depict some associations with age and may differ across distinct aging stages (Harris et al., 2016). Besides this age range-specific limitation, the maximum time interval found to estimate results stability was found only in two studies (test-retest reliability; three months) (Ekkekakis et al., 2005; Teixeira et al., 2021a), which is insufficient to understand a possible aging relation with the intensity traits.

Secondly, another potentially relevant issue given the wide search based on the general concept of PA relates to the absence of studies in the physical education context. Given that the assumptions of the intensity-pleasure relation are also present in children and adolescents (Schneider & Schmalbach, 2015), and the relevance of physical education in the promotion of healthy adult habits (as is the case of PA) (Cid et al., 2018; Martins et al., 2015), this possibly relevant topic of study remains unexplored.

1.6. Conclusion

Given the intended objective and the qualitative analysis developed, the two scales provided by the PRETIE-Q seem to be useful and feasible in the most common PA contexts and exercise dynamics. The identified predictors and correlates tend to suggest a positive relation with well-being, the relative reinforcing value of exercise, and exercise behavior. The expansion of these scales' use and application offers new possibilities of research grounded in the exercise intensity individual preference/tolerance understanding, which may have several applications in the sport and health domains.

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1.8. Author's contribution

Both authors contributed to the study conception and design. The idea of this systematic review belongs to Diogo S. Teixeira. The literature search, data analysis, and draft were performed by Filipe Santos, and the final critical revision was made by Diogo S. Teixeira.

1.9. Declaration of interest statement

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

1.10. References

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Capítulo 2. *Are Intensity-traits Related with Exercise Behavior, Enjoyment and Vitality in CrossFit Participants? – A Cross-sectional Study*

2.1. Abstract

Background: Few people engage in enough PA despite its acknowledged importance in physical, emotional, and mental health. As a relatively new group exercise program characterized by high intensity workouts, CrossFit's popularity and its number of participants seem to grow in the past few years. However, the reasons that lead people to continue doing CrossFit, are still relatively uncertain. The present cross-sectional study aimed to define the preference and tolerance profiles in CrossFit recreational participants, to analyze the accordance of intensity-traits with the intensity of current training and the relationship between the agreement profile and its moderation effects with enjoyment, vitality, intention, and frequency.

Methods: Regular CrossFit participants (n=330) enrolled in 15 boxes (male = 185; female = 145; M_{age} = 36,37 ± 8,57 years) voluntarily responded to online (n=186) and in-person (n=144) sociodemographic and psychometric questionnaires. Descriptive, reliability and bivariate correlation analysis were calculated, and for moderation purposes Hayes' (2018) recommendations were followed using SPSS PROCESS v. 4.1, model 1 specification.

Results: The participants demonstrated above midpoint score results for preference *(M = 18.54, SD = 3.74)*, tolerance (*M = 16.44, SD = 4.09)*, enjoyment (*M = 6.22, SD = .81)* and subjective vitality *(M = 5.49, SD = .91)* while intention *(M = 6.63, SD = .83)* and quality of the experience *(M = 4.65, SD = .67)* depicted very high scores. Both preference-agreement and tolerance-agreement showed positive results (87.23%) meaning that the intensity of most participants' current training is in accordance with their preference and tolerance. Positive correlations were present between most of the variables and none of the tested models depicted a moderation effect.

Conclusions: CrossFit recreational participants depict similar intensity-trait preference/tolerance when compared with other non-HITT activity participants and there is no moderation effect from intensity-traits agreement in the relationships between enjoyment and vitality, intention or exercise frequency. Future studies trying to understand the CrossFit attrition values in the first 6 months may be useful.

Keywords: CrossFit, preference, tolerance, exercise intensity, vitality, enjoyment, intention

2.2. Introduction

Regular physical activity (PA) is pointed as one of the most important factors not only to prevent and control non-transmissible chronic diseases (e.g., cardiovascular diseases, type 2 diabetes, and cancer), but also in the maintenance of healthy weight and enhancement of general well-being (Adams & Linke, 2019; Colberg et al., 2010; Idorn & Thor Straten, 2017; Mandolesi et al., 2018; Ruegsegger & Booth, 2018). Moreover, mental health can find in PA significant benefits which go from preventing anxiety and depression to avoiding/retarding cognitive decline (Blondell et al., 2014; Salmon, 2001; Schuch & Stubbs, 2019). According to the World Health Organization's (WHO) data, over a quarter (27,5%) of the world's adult population is not sufficiently active (i.e., aerobic activity for 150-300 min of moderate intensity or 75-150 min of vigorous intensity per week, or a similar combination of moderate to vigorous PA and the incorporation of at least 2 days a week with resistance training), and 81% of adolescents do not meet the recommendations for aerobic exercise (i.e., at least 60 min a day) (Bull et al., 2020).

Nevertheless, some studies presented results suggesting that some increasingly popular group-based training programs which use multi-modality functional movements performed at high intensities (e.g., CrossFit) can provide health and fitness improvements (e.g., reduction of risk factors for cardiovascular diseases and type 2 diabetes, and increased VO_{2max}) to its participants while exercising less time per week at higher intensities (Babraj et al., 2009; Burgomaster et al., 2008; Claudino et al., 2018; Feito et al., 2018; Heinrich et al., 2014; Kliszczewicz et al., 2014; Martínez-Gómez et al., 2022; Patterson et al., 2020). This approach (i.e., shorter training sessions at higher intensities) may be useful to increase PA levels, taking in account the data published in the 2022's Special Eurobarometer for Sport and Physical Activity in which people present lack of time as being the main reason (41% of the inquired) for not practicing more PA (European Commission, 2022). Unfortunately, this assumption was recently contradicted by Ekkekakis & Biddle (2022) in a systematic review which analyzed eight trials with follow-up periods of at least 12 months comparing moderate-intensity continuous exercise to high intensity interval training (HIIT), concluding that individuals who train unsupervised tend to exercise at lower-than-prescribed intensities and, no advantage in long-term adherence for HIIT groups was found (Ekkekakis & Biddle, 2022).

2.2.1. Describing CrossFit

According to Dominski et al. (2022) several terminologies have been used to describe CrossFit, such as high intensity functional training (HIFT), high intensity multimodal training (HIMT), functional fitness training (FFT), and extreme condition program (ECP), appearing that all of them refer to the same thing. That said, the authors defend that "functional fitness training is the most comprehensive and inclusive term to describe the activities performed" and that "functional fitness training must develop the people's competency in various realms, including demonstrations of aerobic capacity, strength, bodyweight endurance, bodyweight skills, and power" thus considering CrossFit as a type of FFT (Dominski et al., 2022). Backing this, in the 16th edition of the American College of Sports Medicine's (ACSM) fitness trends survey, FFT is the term used. FFT is put on 14th place showing that these type of training programs (e.g., CrossFit) are, in fact, popular (Thompson, 2022). This assumed popularity is reinforced by official data from the CrossFit home website (https://map.crossfit.com/) pointing to over 14,000 CrossFit gyms (called "boxes") and over 5 million participants worldwide (Glassman, 2017).

According to its creator, Greg Glassman, CrossFit aims to enhance physical capacities in the following 10 dimensions: (1) stamina (2) muscular strength; (3) muscular endurance; (4) flexibility; (5) power; (6) speed; (7) coordination; (8) agility; (9) balance; and (10) accuracy. Regarding CrossFit classes, these are characterized by 60 minute group training sessions which comprise three distinct parts: (1) warm up – typically composed by mobility, stabilization and activation exercises; (2) skill/strength – in this section of the class, normally is focused one exercise were the trainees work to perfect their technique and/or gain strength by performing a given number of sets and repetitions; and (3) the workout of the day (WOD) which can be considered as the fundamental part of the class/workout session ranging from 5-30 minutes that normally includes two or more exercises to be performed rapid and repetitively with little or none rest between them (Glassman, 2010).

Despite the large number of CrossFit participants, literature with high level of evidence is still sparse as recently concluded by Claudino et al. (2018) in their systematic review and meta-analysis.

2.2.2. Preference for and tolerance to the intensity of the exercise

Ekkekakis et al. (2005) claim in their study that there are differences in the way people prefer and tolerate the intensity of exercise. The authors define preference for exercise intensity as being the predisposition to select a certain level of intensity when that possibility is given

(e.g., when someone practices exercise that was self-selected and without any supervision) and tolerance to exercise intensity as a characteristic that influences one's capacity to keep going in some activity or exercise at an imposed intensity level, even when that activity/exercise becomes uncomfortable or unpleasant (Ekkekakis et al., 2005). Another study, enrolling three groups of 30 students each during three whole semesters which aimed to determine if the differences in subjective preference and tolerance to exercise intensity profiles influenced the way participants felt during (i.e., core affect) and after (i.e., enjoyment) in three different conditions (i.e., high-intensity, light intensity and sedentary) concluded that individuals with higher intensity-preference levels presented more positive affective responses than the individuals which preferred lower intensity activities (even when perceived exertion was similar) (Box & Petruzzello, 2020). Also, according to Ekkekakis and colleagues (2008), higher preference and tolerance levels are associated with a more positive or, in opposition, less negative affective response when the intensity of the exercise increases. The authors presented data from their study involving 30 young adults who participated in an exercise protocol with the duration of 15 minutes running in a treadmill for 5 distinct sessions, showing that intensity only influenced the affective response during the exercise, depicting no influence in the pre or post training scores. They concluded that the exercise intensity exceeding the ventilatory threshold appears to reduce the sensation of pleasure and may negatively impact on exercise adherence (Ekkekakis et al., 2008a, 2008b).

2.2.3. Current study

It seems of great importance to gain a better understanding about the relationship between affective responses and the factors that may influence them, namely, in this case, preference and tolerance for higher or lower exercise intensity. For that matter, several studies with empirical evidence emerged in the recent years showing associations between exercise behavior, affective responses, and intensity-traits (Box et al., 2022; Box & Petruzzello, 2020; Faria et al., 2021; Marques et al., 2022; Teixeira et al., 2021a). Backing this line of thought, Box & Petruzzello (2020) and Teixeira et al. (2021b) claim that the intensity-traits present positive associations with enjoyment (Box & Petruzzello, 2020; Teixeira et al., 2021b). Additionally, several other authors described positive associations between enjoyment and exercise behavior (i.e., frequency, adherence, and intention to continue exercising) in several PA contexts such as health clubs, sports, and physical education (Box et al., 2022; Fin et al., 2019; Gardner et al., 2017; Granero-Gallegos et al., 2017; Klos et al., 2020; Rodrigues et al., 2020a; Teixeira et al., 2020, 2022). Mainly because of the high exercise intensity that

characterizes it, CrossFit is a substantially different activity from the ones in which most non-athlete adults are enrolled and evidence shows that high intensity exercise is negatively related with long term adherence (Ekkekakis et al., 2008a, 2008b; Ekkekakis & Biddle, 2022). These facts make us question if the preference for more vigorous intensities can justify the adherence to CrossFit.

That said, the present study aims to add an objective vision to the existing literature, responding to the pending question: are the intensity-traits related with exercise behavior (i.e., frequency, and intention), enjoyment and vitality in CrossFit recreational participants? To accomplish that, three main objectives were established: (1) to define the preference and tolerance profiles in CrossFit recreational participants; (2) to analyze the accordance of intensity-traits with the intensity of current training; (3) to analyze the relationship between the agreement profile and its moderation effects with enjoyment, vitality, intention, and frequency. This leads us to the hypothesis that i) CrossFit recreational participants may present higher intensity-trait preference/tolerance than in other non-HIIT activities; and ii) the intensity-traits agreement will moderate the relationship between enjoyment and vitality, intention, and exercise frequency.

2.3. Method

2.3.1. Participants

A total of 330 regular CrossFit participants enrolled in 15 boxes (male = 185; female = 145; M_{age} = 36,37 ± 8,57 years) where included since they respected the following inclusion criteria: age > 18 years old; apparently healthy regular CrossFit participants (at least 1 training session per week for the last 3 months), non-athletes, free of injury that conditions the practice of PA in the last 3 months or illness/injury that alters their perception to pain. All participants read, agreed, and signed an informed consent before the completion of the questionnaires.

2.3.2. Procedures

To get the authorization for data collection, an e-mail was sent to the boxes. As the box owners were responding to the e-mail, an explanation letter and a sample of the sociodemographic and psychometric questionnaires had been sent in order to get their authorization. The data collection was made in two different ways: (1) online questionnaires (n = 186) – once the authorization letter was signed by the box's technical director, a new e-mail was sent with the link to the questionnaire in Google Forms format, requesting the distribution of the link to their clients. Prior to the completion of the questionnaires, a letter of explanation

and an informed consent was provided followed by a question to assess the will to continue or not. In case of negative answer, the questionnaire ended there; (2) in-person questionnaires (n = 144) – as the letters of authorization were received already signed, a day and hour were agreed with the box's technical directors for the questionnaire's application. A letter of explanation and informed consent was presented in the first page so that, after signing it, the participants answer the questionnaire. The time of completion was approximately 10 to 15 minutes for data collection.

To clarify any remaining doubts on the study's participation or purpose, the lead researcher's contact information was provided, and the participants did not receive any kind of retribution. All the procedures in the present study respect the 1964 Helsinki declaration and its later amendments and were in accordance with the ethical standards of the Lusófona ethics committee. All the responses were posteriorly screened to verify the agreement with the inclusion criteria.

2.3.3. Study design

The data collection of this cross-sectional study consisted in the application of several questionnaires, such as a sociodemographic questionnaire created specifically for this study, the Preference for and Tolerance of the Exercise Intensity Questionnaire Portuguese version (PRETIE-Q-PT; Teixeira et al., 2021a), the Subjective Vitality Scale Portuguese version (SVS Portuguese version: Moutão et al., 2013), the Physical Activity Enjoyment Scale Portuguese version (PACES Portuguese version: Rodrigues et al., 2021; Teques et al., 2020) and a questionnaire to assess the intention to continue exercising (Teixeira et al., 2022).

2.3.4. Instruments

2.3.4.1. Preference for and tolerance of the intensity of exercise

To identify the high and/or low preference for and tolerance of exercise intensity, the Preference for and Tolerance of the Exercise Intensity Questionnaire in its Portuguese version (PRETIE-Q-PT; Teixeira et al., 2021a) was used. The PRETIE-Q-PT presents an acceptable internal consistency (Cronbach's alfa = .70) and adequate test-retest reliability coefficients (Cronbach's alfa = .70). The questionnaire comprises 10 items that are divided in 5 items regarding the exercise intensity-preference (e.g., *"While exercising, I prefer activities that are slow-paced and do not require much exertion"*) and 5 items regarding the exercise intensity-tolerance (e.g., *"When my muscles start to hurt during exercise, I tend to slow down a little"*) traits. To respond to each item, there is a 5-point bipolar Likert scale ranging from 1 ("*Totally*

disagree") to 5 (*"Totally agree"*) (Teixeira et al., 2021a). The original instrument (Ekkekakis et al., 2005) has been used before in HIFT context (Patterson et al., 2020) and previous studies reported strong validity and reliability using the PRETIE-Q (Ekkekakis et al., 2005, 2008b; Smith et al., 2015), Chronbach's alpha for the preference and tolerance scales was 0.77 and .76 respectively. To assess the discrepancy between current training intensity and the individual intensity-traits, two additional questions (i.e., "*The intensity of my training is in accordance with my preference"; "The intensity of my training is in accordance with my tolerance"*) were introduced before the application of the questionnaire. The results were coded with 0 (not in agreement/disagreement) or 1 (in agreement) (Teixeira et al., 2021b).

2.3.4.2. Physical activity enjoyment

To assess the level of exercise enjoyment, the Portuguese version of the Physical Activity Enjoyment Scale (PACES Portuguese version: Rodrigues et al., 2021; Teques et al., 2020) was used. This is an 8-item scale (e.g., *"It is fun"*), the responses are given by using a 7-point bipolar Likert scale ranging from 1 (*"Totally disagree"*) to 7 (*"Totally agree"*) and the scores for enjoyment are obtained through the sum of the 8 items. The question used was *"How do you feel at the moment about the exercise you are doing?"*. Cronbach alpha for the present sample was .94.

2.3.4.3. Subjective vitality

For subjective vitality, it was used the Portuguese version of the Subjective Vitality Scale (SVS Portuguese version: Moutão et al., 2013). The SVS – Portuguese version, has been translated and tested in a sample of Portuguese exercisers. It is a 6-item scale that assesses subjective vitality (e.g., *"I feel alive and vitalized"*) and the responses are given using a 7-point bipolar Likert scale ranging from 1 (*"Totally disagree"*) to 7 (*"Totally agree"*) and the score for these responses is calculated by averaging the values from each value (Moutão et al., 2013). The original SVS has been extensively used in PA-related studies presenting good reliability (e.g., Guérin, 2012). Cronbach alpha for the present sample was .88.

2.3.4.4. Intention to continue exercising

Following the recommendations from Ajzen (2006) and previous related studies applications (e.g., Rodrigues et al., 2020), to assess intention to continue exercising after 6 months, three items were used considering a previous study by Teixeira et al. (2022): (1) *"I will continue to exercise in the next 6 months as I currently do or in a very similar way (same type,*

frequency, duration and intensity)"; (2) *"I will continue to practice physical exercise in the next six months as I currently practice or in a very similar way (same type, frequency, duration and intensity)"*; (3) *"I plan to continue practicing physical exercise in the next six months as I do today or in a very similar way (same type, frequency, duration and intensity)"* (Teixeira et al., 2022). The items were answered using a 7-point Likert scale ranging from 1 (*"Absolutely not"*) to 7 (*"Absolutely yes"*) and the behavioral intention score was obtained through the sum of all the items. The items had been previously translated using several methodological recommendations (Brislin, 1970, 1980).

2.3.4.5. Exercise frequency

Exercise frequency was assessed by answering to the question *"What is your weekly frequency exercising in a CrossFit Box?"*.

2.3.4.6. Quality of the Experience in a CrossFit box

To qualify how the participants feel the experience while doing CrossFit, the question *"How do you qualify your experience of exercise in a CrossFit box?"* was introduced. To answer this item the participants had a 5-point bipolar Likert scale ranging from 1 (*"Very bad"*) to 5 (*"Very good"*).

2.3.5. Statistical Analysis

Descriptive analysis was calculated for preference, tolerance, enjoyment, vitality, intention, exercise frequency and quality of the experience. Reliability analysis was calculated for preference, tolerance, enjoyment and vitality, while bivariate correlation was calculated for preference, tolerance, enjoyment, vitality, intention, frequency, preference-agreement, tolerance-agreement, and quality of the experience. For calculation, it was used the SPSS Statistics v. 28.0 for MAC (IBM Co., United States), and statistical significance was set at $p < .05$.

For moderation purposes, Hayes' (2018) recommendations were followed while using SPSS PROCESS v. 4.1. To perform the analysis of the different models hypothesized, the model 1 specification (i.e., single moderator testing between the independent and dependent variable) was chosen. According to Teixeira et al. (2022) "This feature allows the analysis and interpretation if the estimation of the effect of the independent variable (enjoyment) on a dependent variable (e.g., intention) presents changes in size, sign, or strength of the effect (i.e., moderated; intensity-trait agreement/disagreement)". A mean center for construction of

products was used for all variables that define products allowing for the simplification of path analysis and significance interpretations without changing the moderation and interaction scores and effects. Additionally, a bootstrap with 5000 samples was used for CI95% intervals estimation, and significant effects were considered if CI did not encompass zero (Hayes, 2018).

2.4. Results

An initial screening was made to analyze the sample's integrity and no issues were detected. Descriptive analysis results are depicted in Table 4. As presented, the participants (n = 330) demonstrated preference and tolerance values corresponding to moderate intensities (*Preference – M = 18.54, SD = 3.74; Tolerance – 16.44, SD = 4.09*). Enjoyment and subjective vitality presented above midpoint scores (*Enjoyment – M = 6.22, SD = .81; Subjective vitality – M = 5.49, SD = .91)*. Intention to continue exercising and quality of the experience presented very high scores *(Intention – M = 6.63, SD = .83; Quality of the experience – M = 4.65, SD = .67)*, and exercise frequency presented an average of 4.42 sessions/week (*SD = 1.35)*. In both preference-agreement and tolerance-agreement the result was positive (i.e., the intensity of the current training was in accordance with the most of the participant's preference or tolerance) depicting the same result for the two constructs (87.23%).

Table 4 - Descriptive and reliability analysis of the studied variables

	α	Score range	Mean	SD
Preference	.77	6 - 25	18.54	3.74
Tolerance	.76	7 - 25	16.44	4.09
Enjoyment	.94	3 - 7	6.22	.81
Subjective vitality	.88	3 - 7	5.49	.91
Intention to continue exercising	-	1 - 7	6.63	.83
Exercise frequency	-	1 - 7	4.42	1.35
Quality of the experience	-	1-5	4.65	.67
		0 (Disagreement)		1 (Agreement)
Preference accordance		12.77%		87.23%
Tolerance accordance		12.77%		87.23%

Note. α = Chronbach's alpha; M = Mean; SD = Standard Deviation.

Regarding the correlation analysis depicted in Table 5: (1) preference was positively correlated ($p < .01$) with tolerance ($r = .46$), enjoyment ($r = .18$), vitality ($r = .23$) and frequency ($r = .15$); (2) tolerance presented positive correlation ($p < .01$) with vitality ($r = .18$) and frequency ($r = .26$); (3) enjoyment showed positive associations ($p < .01$) with all variables except tolerance (vitality – $r = .52$; intention – $r = .20$; frequency – $r = .19$; preference-agreement – $r = .16$; tolerance-agreement – $r = .21$; and quality of the experience – $r = .26$); (4) Subjective vitality presented positive correlation ($p < .01$) with all variables (preference – $r = .23$; tolerance – $r = .18$; enjoyment – $r = .52$; intention – $r = .17$; frequency – $r = .25$; preference-agreement – $r = .16$; tolerance-agreement – $r = .23$; and quality of the experience – $r = .18$); (5) intention to continue exercising was positively correlated ($p < .01$) with frequency ($r = .30$), preference-agreement ($r = .28$), tolerance-agreement ($r = .25$) and quality of the experience ($r = .20$); (6) exercise frequency presented positive associations with all variables (preference – $r = .15$; tolerance – $r = .26$; enjoyment – $r = .19$; vitality – $r = .25$; intention – $r = .30$; preference-agreement – $r = .16$; tolerance-agreement – $r = .20$, $p < .01$) and quality of the experience ($r = .12$, $p < .05$); (7) preference-agreement was positively correlated ($p < .01$) with tolerance-agreement ($r = .56$) and quality of the experience ($r = .29$); (8) tolerance-agreement presented positive association ($p < .01$) with quality of the experience ($r = .21$).

Finally, in terms of moderation analysis (Table 6), none of the tested models showed any moderation effect from preference nor tolerance agreement/disagreement (all interactions $p < .05$).

Table 5 - Correlation analysis of the studied variables

	1	2	3	4	5	6	7	8	9
(1) Preference	1								
(2) Tolerance	.46**	1							
(3) Enjoyment	.18**	.06	1						
(4) Subjective vitality	.23**	.18**	.52**	1					
(5) Intention to continue exercising	.05	.02	.20**	.17**	1				
(6) Exercise frequency	.15**	.26**	.19**	.25**	.30**	1			
(7) Preference-agreement	.01	-.06	.16**	.16**	.28**	.16**	1		
(8) Tolerance-agreement	-.02	-.02	.21**	.23**	.25**	.20**	.56**	1	
(9) Quality of the experience	.05	.10	.26**	.18**	.20**	.12*	.29**	.21**	1

* $p < .05$; ** $p < .01$

Table 6 - Moderation analysis of preference and tolerance agreement/disagreement

Vitality Model													
	Coeff.	se	t	*p*	LLCI	ULCI		Coeff.	se	t	*p*	LLCI	ULCI
Enjoyment	.68	.12	5.71	.000	.445	.913	Enjoyment	.68	.12	5.60	.000	.438	.914
Preference	1.05	.81	1.30	.194	-.539	2.645	Tolerance	1.19	.81	1.47	.143	-.404	2.787
Interaction	-.14	.13	-1.02	.311	-.400	.128	Interaction	-.14	.14	-1.07	.287	-.412	.122
R^2 = .28; MSE = .61							R^2 = .28; MSE = .60						
	R^2-change	F	df1	df2	*p*			R^2-change	F	df1	df2	*p*	
IV*Moderator	0.0023	1.03	1	318	0.311		IV*Moderator	.0026	1.14	1	318	.287	
Intention Model													
	Coeff.	se	t	*p*	LLCI	ULCI		Coeff.	se	t	*p*	LLCI	ULCI
Enjoyment	.20	.12	1.69	.092	-.033	.435	Enjoyment	.31	.12	2.60	.010	.076	.549
Preference	.90	.81	1.1	.270	-.703	2.497	Tolerance	1.72	.81	2.11	.035	.124	3.318
Interaction	-.02	.02	-1.16	.245	-.048	.012	Interaction	-.20	.14	-1.44	.151	-.462	.072
R^2 = .10; MSE = .63							R^2 = .10; MSE = .64						
	R^2-change	F	df1	df2	*p*			R^2-change	F	df1	df2	*p*	
IV*Moderator	.0003	0.11	1	320	.245		IV*Moderator	.0059	2.07	1	320	.151	
Frequency Model													
	Coeff.	se	t	*p*	LLCI	ULCI		Coeff.	se	t	*p*	LLCI	ULCI
Enjoyment	.26	.20	1.28	.201	-.138	.657	Enjoyment	.563	.20	2.79	.006	.166	.960
Preference	.41	1.37	.30	.765	-2.284	3.103	Tolerance	2.99	1.35	2.22	.027	.343	5.656
Interaction	.02	.23	.09	.928	-.428	.468	Interaction	-.395	.23	-1.74	.083	-.842	.052
R^2 = .05; MSE = 1.76							R^2 = .03; MSE = .63						
	R^2-change	F	df1	df2	*p*			R^2-change	F	df1	df2	*p*	
IV*Moderator	.0000	.008	1	320	.928		IV*Moderator	.0088	3.02	1	320	.083	

Note: *p* = significance value; LLCI = Lower-Level Confidence Interval; ULCI = Upper-Level Confidence Interval; MSE = Square Error

2.5. Discussion

The purpose of the present study was to get a better understanding on the possible associations between physical activity enjoyment, subjective vitality, intention to continue exercising, and weekly frequency in CrossFit recreational participants, as to assess the potential role of the preference and tolerance traits agreement as mediators in the forementioned relationship.

Firstly, the present sample of CrossFit participants demonstrated above midpoint scores results for both preference and tolerance constructs, in accordance (although depicting higher scores in the present study) with previous studies in this context (Box et al., 2022; Patterson et al., 2020). Additionally, according to Bycura et al. (2017) enjoyment showed positive associations with increased training frequency and duration of participation in CrossFit training, results that were also verified in our study (Bycura et al., 2017). These results also align with several other studies conducted in health club contexts refuting what we first hypothesized (i.e., CrossFit recreational participants may present higher intensity-trait preference/tolerance than in other non-HIIT activities) (Bastos et al., 2022; Faria et al., 2021; Marques et al., 2022; Smirmaul et al., 2015; Teixeira et al., 2021a, 2021b, 2022). Regarding the results of preference accordance and tolerance accordance it is possible to conclude that most of the participants exercise at an intensity level that they prefer and tolerate (both preference and tolerance agreement with the same value – 87,23%) presenting very similar results with those demonstrated in other studies enrolled in health club contexts (Faria et al., 2021; Teixeira et al., 2022). The fact that the results are so similar with the ones depicted in several other studies with distinct PA contexts, suggest that the individualization of the intensity is dependent of the individual and not the activity.

Secondly, the moderation effect of intensity-traits agreement/disagreement was tested for three relevant outcomes of exercise enjoyment (i.e., subjective vitality, intention to continue exercising, and exercise frequency) and none of the tested models showed any moderation effect from preference nor tolerance agreement/disagreement (all interactions $p < .05$) diverging from the results depicted in a similar study with health club participants (Teixeira et al., 2022). This might have happened because of the eventual high exercise experience and frequency levels among participants who had possibly already found the balance between current training intensity and the motivational characteristics needed to continue exercising. Also, trait-

disagreement depict extremely low levels while the intention to continue exercising and quality of experience's values are extremely high, which may support the idea of a ceiling effect.

Finally, CrossFit adherence motives are still being studied but it seems that, according to the existing literature, motivation related psychological variables (e.g., challenge, commitment, community, affiliation, social recognition, empowerment, and competition) are the main factors that lead people to keep doing CrossFit, despite the high intensity and possible discomfort that may derive from it (Dominski et al., 2021; Fisher et al., 2017; Simpson et al., 2017). Moreover, according to Prochnow et al. (2022) group exercises settings like CrossFit and the social connections between the participants can promote sustained exercise habits through social influence, support and norms, and Simpson et al. (2017) research also suggest that the motivations for engaging in a CrossFit training program, can be similar to those present in sports participation (Prochnow et al., 2022; Simpson et al., 2017).

2.6. Limitations and future directions

Despite its strengths, the current study is not without limitations which must be admitted aiming the proper interpretation of the results and providing directions for future studies. Firstly, considering the cross-sectional study design, the sample's characteristics might depict a selection bias related with high exercise experience since the results depict above midpoint and very high values for all variables and very low levels (12.77%) of trait disagreement.

Secondly, it seems important to study the influence of the intensity traits in CrossFit beginners or less experienced recreational participants and to analyze the attrition values in the first 6 months, trying to understand what leads people to dropout CrossFit.

2.7. Conclusion

In conclusion, the present study showed that CrossFit recreational participants depict similar intensity-trait preference/tolerance when compared with other non-HIIT activity participants suggesting that these constructs should be related solely with the individuals' characteristics and not with the activities in which they are enrolled. Additionally, the intensity-traits agreement did not moderate the relationship between enjoyment and subjective vitality, intention to continue exercising nor exercise frequency, results which may be biased due to the sample's characteristics.

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Discussão geral

Com a presente dissertação pretendemos perceber melhor as relações entre a preferência e tolerância pela intensidade do exercício em praticantes recreacionais de CrossFit através da realização de dois estudos: em primeiro lugar, uma revisão sistemática de literatura e, em segundo, um estudo observacional transversal.

Na revisão sistemática de literatura, o objetivo foi analisar a utilidade e viabilidade da utilização da preferência e tolerância como resultados da PRETIE-Q na regulação de práticas de exercício. Para alcançar esse objetivo, foram avaliados qualitativamente 36 estudos (23 publicados nos últimos 5 anos) e os resultados mostraram que os dois constructos avaliados (i.e., preferência e tolerância) parecem ter tido utilidade em diversos contextos de atividade física, particularmente quando orientados para a compreensão do valor de reforço relativo, comportamentos de exercício, bem-estar, resposta afetiva e aptidão física/*performance*. As referidas atividades englobaram diversas formas e modalidades de treino (e.g., flexibilidade, corrida, caminhada, bicicleta, treino de resistente, treino de alta intensidade) em todo o espectro de intensidades do exercício (i.e., de intensidade baixa até intensidade vigorosa).

Assim, em geral, as escalas parecem ser úteis na interpretação da intensidade individual quando utilizadas em conjunto ou mesmo individualmente (e.g., escala da preferência utilizada para a autosseleção da intensidade). As relações dos traços de intensidade foram testadas com diversas variáveis além da resposta afetiva, tais como proximidade com o limiar ventilatório e duração do exercício a essas intensidades, existindo, no entanto, alguns resultados contraditórios possivelmente devido ao tipo de testes utilizados (e.g., testes máximos) e o tipo de exercícios (e.g., passadeira vs. bicicleta). Neste contexto, estudos futuros poderiam ajudar a clarificar estas relações. Também algumas variáveis relacionadas com o bem-estar foram testadas nesse sentido (e.g., vitalidade subjetiva, depressão e ansiedade), tendo sido encontradas associações geralmente fracas ou moderadas (Faria et al., 2021; Teixeira et al., 2021a). Esses resultados foram discutidos por alguns autores teorizando que a concordância dos traços de intensidade com o treino atual poderiam apresentar associações mais relevantes (Marques et al., 2022; Teixeira et al., 2022). Esta hipótese baseia-se na premissa de que o exercício individualizado e orientado para uma experiência de treino prazerosa pode potenciar o bem-estar geral, havendo inclusive evidência de que os traços de intensidade se relacionam com o valor de reforço relativo, e ainda com variáveis como intenção, hábito e frequência (Faria et al., 2021; Flack et al., 2017, 2019a, 2019b, 2019c; Ladwig et al., 2017; Marques et al., 2022; Stevens et al., 2020; Zenko et al., 2017).

Para o estudo observacional transversal, foram definidos 3 grandes objetivos: (1) caracterizar o perfil de preferência e tolerância pela intensidade do EF em praticantes recreacionais de CrossFit; (2) analisar a concordância dos traços de intensidade com a intensidade do treino atualmente desenvolvido; e (3) analisar a relação entre os perfis de concordância e seus efeitos de moderação entre o divertimento, vitalidade subjetiva, intenção para continuar a praticar exercício e frequência semanal. Neste estudo, os participantes apresentaram valores acima da média da escala para ambos os constructos (i.e., preferência e tolerância) em linha com resultados já apresentados em estudos anteriores no contexto do CrossFit (Box et al., 2022; Patterson et al., 2020). De referir que estes resultados também coincidem com diversos outros estudos realizados em contexto de *health club*, o que acabou por refutar a primeira hipótese do estudo (i.e., os praticantes recreacionais de CrossFit podem apresentar níveis de preferência e tolerância mais elevados que os praticantes de outras atividades realizadas a intensidades mais baixas) (Bastos et al., 2022; Faria et al., 2021; Marques et al., 2022; Smirmaul et al., 2015; Teixeira et al., 2021a, 2021b, 2022). No que diz respeito à concordância dos traços de intensidade, os resultados demonstraram que a maioria dos participantes treinam a uma intensidade que preferem e toleram (87.23% para concordância da preferência e concordância da tolerância), resultados estes também muito semelhantes aos obtidos em contexto de *health club* (Faria et al., 2021; Teixeira et al., 2022). Resultados de tal forma semelhantes a outros estudos realizados em contextos diferentes de AF sugerem que a individualização da intensidade depende do indivíduo e não da atividade que este realiza. No mesmo estudo também foram realizados testes para avaliar a existência de moderação da concordância dos traços de intensidade sobre três variáveis relevantes para o divertimento no exercício (i.e., vitalidade subjetiva, intenção para continuar o exercício e frequência semanal). Neste caso, nenhum dos modelos testados apresentou efeitos de moderação da concordância da preferência nem da tolerância, divergindo estes resultados dos obtidos num estudo semelhante em indivíduos que treinam em *health clubs* (Teixeira et al., 2022). Estes resultados podem eventualmente ser explicados pelo facto de a amostra do presente estudo ter já muita experiência na prática e altos níveis de retenção/fidelização e, por conseguinte, terem alcançado um equilíbrio entre a intensidade do treino atual e as características motivacionais necessárias para continuar no CrossFit. Adicionalmente, os valores da discordância dos traços de intensidade apresentam valores muito baixos, enquanto a qualidade da experiência relatada é extremamente alta, suportando a eventual hipótese de um efeito de teto.

Os motivos que levam as pessoas a continuar a praticar CrossFit continuam a ser estudados mas, de acordo com a literatura, a evidência sugere que variáveis psicológicas relacionadas com a motivação (e.g., desafio, sentimento de comunidade, afiliação, reconhecimento social, competição) parecem ser os fatores de maior relevo para a adesão a este tipo de treino, apesar da alta intensidade e possível desconforto que pode dele advir (Dominski et al., 2021; Fisher et al., 2017; Simpson et al., 2017). Inclusive, segundo Simpson et al. (2017), as motivações para entrar num programa de treino de CrossFit podem ser semelhantes às que levam à prática do desporto (Simpson et al., 2017).

Limitações e direções futuras

Relativamente à revisão sistemática, no geral, os estudos não apresentam limitações relevantes, o que reforça a utilidade e viabilidade das escalas. No entanto, e apesar das diversas abordagens exploratórias realizadas no sentido de melhor perceber o uso e interpretação dos traços de intensidade em diversas relações e associações, a extrapolação dos resultados para uma aplicação operacional pode não ser viável visto que, embora seja esperado que os traços individuais de preferência e tolerância possam representar uma aproximação do nível de intensidade a ser escolhido para potenciar o bem-estar e adesão continuada, não existe uma relação clara entre os traços e o nível específico de intensidade (Teixeira et al., 2021b; 2022).

Outra limitação reportada relaciona-se com a experiência (i.e., tempo na prática) que os indivíduos já possam ter. Teixeira et al. (2021a, 2021b, 2022) defendem que, para que aconteça o uso adequado das escalas é importante que os utilizadores possam ter a capacidade de as interpretar corretamente afirmando que um mínimo de três meses de experiência deve ser respeitado (Teixeira et al., 2021a, 2021b, 2022). Neste contexto, e seguindo essas indicações, outros autores também consideraram esse período como critério de inclusão para a amostra (Faria et al., 2021; Marques et al., 2022).

Finalmente, mais duas limitações surgem: uma delas relativamente à idade das amostras, sendo que não existem estudos com indivíduos maiores de 65 anos e apenas um estudo com menores de 18; e a segunda, que se prende com o facto de não existirem estudos realizados em contexto de educação física.

O estudo observacional transversal também apresenta algumas limitações, nomeadamente a nível das características da amostra, que podem eventualmente apresentar um viés de seleção relacionado com a alta experiência no exercício, visto que os resultados mostram valores muito acima da média das escalas para a maioria das variáveis e valores muito baixos para a discordância dos traços de intensidade (12.77%). Torna-se assim importante estudar a

influência dos traços de intensidade em principiantes e praticantes menos experientes de CrossFit, no sentido de analisar os valores de desistência nos primeiros seis meses e perceber o que leva as pessoas a parar de fazer CrossFit.

Conclusão geral

Em suma, nesta dissertação pretendemos alcançar um melhor entendimento sobre a relação entre os traços de intensidade e algumas das variáveis que podem influenciar direta ou indiretamente a adesão ao EF (e.g., divertimento, vitalidade, intenção e frequência). Ao avaliar a preferência e tolerância em indivíduos que praticam uma atividade que, por si só, é caracterizada pela elevada intensidade a que se executa, ambicionou perceber-se de uma forma geral se os traços de intensidade estariam relacionados com o facto de as pessoas continuarem a fazer CrossFit. Os dois estudos que a compõem complementam-se, na medida em que a revisão sistemática afere a utilidade e viabilidade do instrumento usado para avaliar os traços de intensidade no segundo estudo (i.e., PRETIE-Q).

Na revisão sistemática de literatura, considerando o objetivo proposto e a análise qualitativa que foi realizada, ambas as escalas presentes na PRETIE-Q mostraram ser úteis e viáveis numa grande variedade de contextos de atividade física. Os preditores e correlações que foram identificados, na sua maioria, sugerem relações positivas com bem-estar, valor de reforço relativo e comportamentos no exercício. Conclui-se desta revisão sistemática que a expansão do uso e aplicação das escalas podem garantir novas possibilidades de pesquisa para o entendimento da preferência e tolerância individual, podendo eventualmente ter diversas aplicações nos domínios da saúde e desporto.

No que ao segundo estudo diz respeito, foi possível concluir que os participantes recreacionais de CrossFit apresentam valores para os traços de intensidade semelhantes aos que se encontram relatados para praticantes de outras atividades que se desenrolam a intensidades mais baixas, sugerindo que estes construtos devem ser relacionados apenas com as características individuais de cada pessoa e não com a atividade que praticam. Completando, a concordância dos traços de intensidade não apresentou efeitos de moderação nas relações entre o divertimento e vitalidade subjetiva, intenção nem frequência semanal.

Numa perspetiva geral, uma pesquisa futura, abordando a avaliação dos traços de intensidade e sua utilização como instrumentos complementares no processo de personalização e da prescrição do EF, pode ser útil. Os profissionais do exercício podem beneficiar com estes dados no sentido de proporcionar uma resposta afetiva mais positiva (i.e., treinos mais prazerosos e ajustados à pessoa em questão), potenciando assim a adesão sustentada.

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APÊNDICES

Apêndice I - Pedido de autorização para a recolha de dados

_____, __ de _____de 202_

Exmo (a). Sr(a)._____,

A Faculdade de Educação Física e Desporto da Universidade Lusófona gostaria de realizar um estudo que terá como objetivo analisar a qualidade da experiência subjetiva no exercício em praticantes de CrossFit. A informação recolhida neste estudo poderá, no futuro, ajudar no desenho de estratégias eficientes que contribuam para a saúde e bem-estar dos praticantes tendo por base uma adesão continuada ao exercício.

Para tal, gostaríamos de solicitar a sua autorização e colaboração para recolher dados de sócios da vossa Box através da aplicação de questionários. Mais informamos que não sendo os sócios identificados no referido estudo estamos perante um tratamento de dados que não exige a identificação e como tal não está abrangido pelo Regulamento Geral da Proteção de Dados. Este tratamento de dados só fica submetido ao regulamento caso o titular dos dados fornecer informações que permitam a sua identificação.

Informamos que o estudo envolve a coleta de alguns dados sociodemográficos gerais e dados psicométricos específicos. Após o procedimento inicial, que englobará o consentimento do cliente para recolher os dados, é que iniciaremos toda a coleta destes, que assenta num preenchimento voluntário de questionários. Anexamos a este pedido a carta explicativa do estudo e exemplo do consentimento informado para seu conhecimento e clarificação.

Certo que o seu contributo é imprescindível para nos auxiliar a desenvolver esta investigação, agradecemos antecipadamente a sua colaboração e disponibilidade.

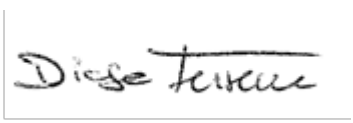
PEDIDO DE AUTORIZAÇÃO AO RESPONSÁVEL DO CLUBE:

Eu,_____,

responsável do _____ autorizo a recolha de dados.

O(A) Responsável: _____ Data / /

Profissional do Exercício que delega o estudo:



(Professor Doutor Diogo S. Teixeira)

Apêndice II - Carta explicativa do estudo

A Faculdade de Educação Física e Desporto da Universidade Lusófona de Humanidades e Tecnologias gostaria de o(a) convidar a participar num estudo que terá como objetivo analisar a qualidade da experiência subjetiva do praticante no CrossFit. 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 Box de CrossFit há pelo menos 3 meses.

A escolha de participar ou não no estudo é voluntária. O presente estudo não acarreta qualquer risco e não irá interferir diretamente no treino. A coleta de dados consistirá no preenchimento deste questionário online.

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 cientifica, nunca sendo os participantes identificados de forma individual.

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

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

Apêndice III - Consentimento informado

Reconheço que os procedimentos de investigação descritos 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.
Fui informado(a) que tenho o direito a recusar participar e que a minha recusa em fazê-lo 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)

_____

Declaro que li o Consentimento Informado, Livre e Esclarecido para participar voluntariamente na investigação sobre questões de experiência subjectiva em contexto de exercício físico.

_____

Apêndice IV - Questionário sociodemográfico

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.

Box: _____
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 Box de CrossFit? ____ dias/sem
7. Quantas aulas de CrossFit frequenta por semana? _____
8. Quanto tempo por semana pratica treino livre em "Open Box"?
☐ 0 min. ☐ 30-45 min. ☐ 40-60 min. ☐ + de 60 min.
9. <u>No caso de realizar treino livre em "Open Box"</u>, o seu atual treino foi prescrito/realizado por um profissional da Box onde treina?
☐ Sim ☐ Não (se não treina em "Open Box" deixe a resposta em branco)
10. Participa em competições de Crossfit?
☐ Sim ☐ Não
11. Sofreu de alguma lesão nos últimos 3 meses que condicione a sua capacidade atual para praticar exercício físico?
☐ Sim ☐ Não
12. Sofreu de alguma doença/lesão que altere a sua perceção à dor?
☐ Sim ☐ Não
13. Qual a sua experiência de prática em Box de CrossFit? (ex: 3 meses / 2 anos)
_____
14. Como qualifica a sua experiência de exercício em Box de CrossFit numa escala de 1 a 5 (coloque um círculo à volta do número):

1	2	3	4	5
Muito Má	Má	Razoável	Boa	Muito Boa

Apêndice V - Intenção para continuar o Exercício - Adaptado da versão original de Ajzen (2006)

Em seguida iremos questionar sobre a sua intenção para continuar a praticar exercício. Por favor leia com atenção cada item em baixo. Pode escolher entre **1 (absolutamente não) a 7 (absolutamente sim)** para indicar o grau em que cada declaração é verdadeira neste momento da sua vida.

1	Vou continuar a fazer exercício nos próximos meses como faço atualmente ou de uma maneira muito semelhante (o mesmo tipo, frequência, duração, intensidade).	1	2	3	4	5	6	7
2	Eu pretendo continuar a praticar exercício nos próximos meses com a mesma dinâmica ou similar do que faço hoje (o mesmo tipo, frequência, duração, intensidade).	1	2	3	4	5	6	7
3	Vou continuar a praticar exercício físico nos próximos meses como eu pratico atualmente ou de uma maneira muito semelhante (o mesmo tipo, frequência, duração, intensidade).	1	2	3	4	5	6	7

Apêndice VI - 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

Apêndice VII - 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 começarem 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

Apêndice VIII - Vitalidade Subjetiva (SVS)

Versão Original: Ryan e Frederick (1997)
Versão Portuguesa: Moutão, Cid, Leitão e Alves (2013); Couto et al. (2017)

De um modo geral, gostaríamos de saber qual o grau de energia que sente no seu dia-dia.

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) Sinto-me vivo(a) e vitalizado(a).	1	2	3	4	5	6	7
2) Por vezes sinto-me com tanto vigor que parece que vou explodir de entusiasmo.	1	2	3	4	5	6	7
3) Tenho energia e carisma.	1	2	3	4	5	6	7
4) Olho com optimismo para cada novo dia.	1	2	3	4	5	6	7
5) Quase sempre sinto-me alerta e desperto(a).	1	2	3	4	5	6	7
6) Sinto-me com força e pujança.	1	2	3	4	5	6	7

Apêndice IX - 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

Muito obrigado pela sua disponibilidade!