



Instituto Politécnico de Leiria – Escola Superior de Educação e Ciências Sociais

Mestrado em Prescrição do Exercício e Promoção da Saúde

*Elevating the Exercise Experience: A Comprehensive Scale
for Basic Psychological Needs Satisfaction, Frustration, and
the Integration of Novelty*

Dissertação de Mestrado

Vera Alexandra Graça Bártolo

Leiria, março 2025

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Leiria, março 2025

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*“You can be anything you want to be
Just turn yourself into anything you think that you could ever be
Be free with your tempo be free be free
Surrender your ego be free be free to yourself”
(Innuendo, Queen, 1991)*

Neste caminho tão mágico como o caminho de tijolos amarelos rumo a Oz, fica o meu eterno obrigada a todos aqueles que excluíram do vocabulário a palavra impossível e me permitiram ser aquilo que quero ser, ser eu própria, ser espontaneamente livre e redefinir essa viagem que é a vida.

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Resumo

No estudo da motivação em contexto de exercício físico, aplicam-se frequentemente os pressupostos da Teoria da Autodeterminação (Ryan & Deci, 2017), que enfatiza três necessidades psicológicas básicas comuns ao ser humano: autonomia (necessidade de fazer as suas escolhas), competência (necessidade de se sentir capaz) e relação (necessidade de interação). Contudo, esta teoria não se esgota nesta abordagem e integra atualmente seis micro-teorias que explicam motivação extrínseca e intrínseca, considerando o meio envolvente. Os estudos nesta área têm revelado novas nuances sobre motivação (González-Cutre et al., 2016, 2020) sendo proposta uma nova necessidade psicológica básica novidade (“necessidade de experienciar algo nunca experienciado ou que se desvie da rotina diária”). Desta forma, o objetivo do presente estudo foi traduzir e validar a sub-escala da necessidade psicológica básica de novidade em termos de satisfação e frustração, testar a validade preditiva com o divertimento e a satisfação com a vida e analisar a invariância entre sexos. Participaram neste estudo 500 sujeitos (feminino=263; masculino=237) praticantes de exercício físico em ginásios, com idades compreendidas entre 18 e os 65 anos de idade ($M=33.72$; $SD=12.81$). O tempo de prática variou entre 1 e 456 meses de prática ($M=61.33$; $SD=40.75$), e a frequência semanal variou entre 1 e 7 ($M=3.44$; $SD=1.44$). Os resultados demonstram que a modelo de medida se ajustou aos dados tanto na amostra global como para um dos sexos, uma vez que os valores de ajustamento dos índices incrementais foram superiores a .90 e os valores dos índices absolutos foram inferiores a .08. Adicionalmente o instrumento demonstrou boas propriedades psicométricas em termos de fiabilidade compósita, validade convergente e discriminante. O modelo de medida subjacente à *Basic Psychological Needs Satisfaction and Frustration scale with novelty*, evidenciou invariância entre sexos ($\Delta CFI < .01$). Quanto aos efeitos diretos, os resultados revelaram que a satisfação das necessidades tem um impacto positivo no prazer e na satisfação com a vida, ao passo que a frustração das necessidades tem o efeito oposto

Palavras-chave: motivação; teoria da autodeterminação; novidade, divertimento, satisfação com a vida, exercício

Abstract

In the study of motivation in the context of physical exercise, the assumptions of Self-Determination Theory are often applied (Ryan & Deci, 2017), which emphasises three basic psychological needs common to human beings: autonomy (the need to make one's own choices), competence (the need to feel capable) and relatedness (the need for interaction). However, this theory is not limited to this approach and currently includes six micro-theories that explain extrinsic and intrinsic motivation, considering the environment. Studies in this area have revealed new nuances about motivation (González-Cutre et al., 2016, 2020) and a new basic psychological need has been proposed, need for novelty ('the need to experience something that has never been experienced before or that deviates from the daily routine'). The aim of the present study was to translate and validate the basic psychological need for novelty subscale in terms of satisfaction and frustration, to test its predictive validity with enjoyment and life satisfaction, and to analyse gender invariance. This study involved 500 subjects (female=263; male=237) who practised physical exercise in gyms, aged between 18 and 65 ($M=33.72$; $SD=12.81$). The length of practice varied between 1 and 456 months of practice ($M=61.33$; $SD=40.75$), and the weekly frequency varied between 1 and 7 ($M=3.44$; $SD=1.44$). The results show that the measurement model fitted the data both for the overall sample and for one of the sexes, since the adjustment values of the incremental indices were higher than .90 and the values of the absolute indices were lower than .08. In addition, the instrument showed good psychometric properties in terms of composite reliability, convergent and discriminant validity. The measurement model underlying the Basic Psychological Needs Satisfaction and Frustration scale with novelty showed invariance between the sexes ($\Delta CFI < .01$). Regarding direct effects, the results found that satisfying needs has a positive impact on enjoyment and life satisfaction, while frustrating needs has the opposite effect

Keywords: motivation; self-determination theory; novelty, enjoyment, life satisfaction, exercise

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Abreviaturas

AVE - *Average Variance Extracted*

BPNSFN – *Basic Psychological Needs Satisfaction and Frustration including Novelty*

CFA - *Confirmatory Factor Analysis*

CFI - *Comparative Fit Index*

CI - *Confidence Interval*

CR – *Composite Reliability*

ICC – *Intraclass Correlation*

PA - *Physical Activity*

PACES – *Physical Activity Enjoyment Scale*

RMSEA - *Root Mean Square Error of Approximation*

SDT – *Self-Determination Theory*

SEM – *Structural Equation Modeling*

SMSR - *Standardized Root Mean Square Residual*

TLI – *Tucker-Lewis Index*

VIF - *Variance Inflation Factor*

Introduction

The benefits of physical activity (PA) are widely known and many studies shown the impact of PA in reducing the incidence of chronic diseases during lifetime, such as cardiovascular and metabolic diseases and consequently reducing the deaths related to them. (Bueno-Antequera & Munguía-Izquierdo, 2023; OMS, 2018; Thivel et al., 2018). However, since the industrial revolution, society became more physically inactive and sedentary in developed countries and nowadays 45% of European people never practice any exercise. In Portugal the numbers are even worse with 75% of population never practising any exercise (European Commission, 2022).

More active societies are healthier, more sustainable and productive so it is mandatory to improve exercise habits on them. And if society knows that why they keep being physically inactive? There are plenty of reasons but one of the majors is the lack of motivation (Bueno-Antequera & Munguía-Izquierdo, 2023; OMS, 2018).

But what motivation means? Simply means what “moves” people to action and in the 30’s Piaget began the advent of cognitive theories that have a unitary view of motivation (Orr, 1991; Wolff, 1963). Experimental tradition takes those theories to another level. In 1971 Piaget was the first applying organismic paradigm in which the cognitive functions regulate exchanges with the external world. Nowadays one of the most widely spread and important motivational theories is Self-Determination Theory (SDT) (Deci & Ryan, 1990, 2000). It is an empiric, organismic theory of human behaviour and personality development that focus on different types of motivation on a continuum from controlled to autonomous motivation, an overview proposed by Deci and Ryan (1985). Since then, this theory had grown up and there’s research based on it in many fields and life domains such as education, sports or political and economic systems (Deci & Ryan, 1985).

In literature there are a great number of studies showing the importance of SDT constructs and its influence in physical activity and exercise (Teixeira et al., 2012). This is one of the most complex domains of motivated behaviours, especially in the domain of exercise because it tends to be less intrinsically motivated than sports. In this domain internalization is critical to maintenance as well as the individual differences (Ryan & Deci, 2017).

As it is said before SDT is an organismic theory that supports that self-regulation depends on individuals’ level of regulation, which occurs in three types of motivation: amotivation,

extrinsic motivation and intrinsic motivation (Deci & Ryan, 1985, 1991). The least self-determined stadium of the motivational continuum is the amotivation, the complete absence of motivation on facing a task which means the behaviour is not intrinsically or extrinsically motivated (Deci & Ryan, 1985, 1991). Extrinsic motivation is guided by an eventual external reward or a punishment, so the behaviour is mediated by these external factors and there are four levels in this kind of regulation: external regulation (behaviour just based on reward or punishment that could be very powerful, but once the reward or punishment disappear, the behaviour also vanishes); introjected regulation (based on an ego motivation, the individuals behaviours are moved by fear or anxiety); identified regulation (when the behaviour is moved by social recognition); integrated regulation (a fully internalized behaviour that matches the personal values). These four levels started with less self-determined behaviour and evolve to a more self-determined behaviour (Deci & Ryan, 1985, 1991). Behaviours that are less self-determined are easier to lose and in this sense it's also important to understand the dangers of reward-driven behaviours, because as already mentioned they have the problem of ending when the reward ends, but they also have the aggravating factor of not enhancing the desire to do something and only motivating action, in what is known as an undermining effect. Receiving a reward for a previously intrinsically motivated behaviour shifts the locus of perceived causality from internal to external (Ryan & Deci, 2017). However, the most self-determined behaviour occurs on intrinsic motivation stadium, when a person performs a behaviour due to his self-interest or enjoyment (Deci & Ryan, 1985, 1991). A better predictor for a change behaviour based on motivation is precisely the quality of motivation (extrinsic or intrinsic) in opposite of trying to measure motivation and catalogue it as low or high motivation (Vallerand et al., 2008). Living beings are characterised by integrative and assimilative processes and so this motivational continuum also functions throughout the human being's life, in other words, it is changeable and dynamic (Ryan & Deci, 2017).

SDT assumes motivation as a voluntary behaviour that aims to ensure the satisfaction of three basic psychological needs: autonomy, competence and relatedness. These needs are related to the social environment, are innate, universal, not necessarily consciously valued and are essential to continuous human growth (Deci & Ryan, 1985, 1991; Ryan & Deci, 2017). The universality means no differences across cultures, developmental periods or genders. (Ryan & Deci, 2002; R. M. Ryan & Deci, 2000b).

Autonomy is the human need of making choices based in individuals' inner self without submitting to social pressures or external threats. It's a volitional process, different from simple individualism and freedom of choice, because it's possible to be autonomous and at the same time following orders. For example, when I'm pulled over by the police in a dangerous road situation and I do it not just because of the order, but because I understand the situation (Ryan & Deci, 2017).

Competence is the need of individuals to feel capable in their actions inside their social environment. This need is easily thwarted or diminished due to a negative context or interpersonal factors as social comparisons (Ryan & Deci, 2017).

Relatedness is the human need of feeling loved and maintain good human relations with significant others which promote personal development of individuals (Ryan & Deci, 2017).

Despite this, SDT is much broader and at present there are six micro theories around self-determination: Organismic Integration Theory, Basic Psychological Needs Theory, Cognitive Evaluation Theory, Causality Orientations Theory, Goals Contents Theory and Relationships Motivation Theory (Ryan & Deci, 2017).

The Basic Psychological Needs Theory greatly explains the macro theory of SDT and as it is approached before it defines three basic and innate psychological human needs (autonomy, competence and relatedness). It is through satisfaction and frustration of this needs that a human grows in is self and in his motives which regulates his behaviours (Deci & Ryan, 1991; R. M. Ryan & Deci, 2017). The fulfilment of these needs is also important for an individual's well-being and there are studies showing that the thwarting of these needs can lead to a passive or fragmented function that results in psychopathologies (Ryan & Deci, 2017).

Novelty

SDT is widely studied and lately emerged a proposal for a fourth basic psychological need, the novelty. There are several authors studying motivation and human behaviour and a lot of them included in their studies variables like curiosity, perceived variety or sensation seeking always referring to the search of novelty to avoid boredom and reach a psychological well-being (Arnett, 1994; Kashdan et al., 2004; Sylvester et al., 2014). Ryan and Deci (2017) also

refer to curiosity in their research and mention the seeking for new stimulus in children to cognitive development (Ryan & Deci, 2017).

However, for a construct to be considered a variable, it must fulfil certain criteria, such as being independent, essential, universal and expected to have an impact that goes beyond immediate psychological functioning, with negative consequences also being recorded when it is frustrated (Bagheri & Milyavskaya, 2020; Vansteenkiste et al., 2020).

Considering González-Cutre (2016) propose the need for novelty as a new basic psychological need, defining novelty as the “need to experience something not previously experienced or deviates from everyday routine” and developed a scale for measuring novelty satisfaction. The author uses the already existing scale for basic psychological needs that measure autonomy, competence and relatedness and create six new questions to evaluate novelty. The correlations between novelty and the other needs are like the correlations of the other needs between themselves (González-Cutre et al., 2016).

Trigueros (2019) keep this research about novelty and the results also pointed novelty as a solid candidate to a fourth need and in the same year González-Cutre (2019) also keep investigating the importance of novelty for multiple positive outcomes with promising results (González-Cutre & Sicilia, 2019; Trigueros et al., 2019, 2020).

Novelty construct shows invariance across genders, following other studies of the already existing basic psychological needs, confirming the universality (Fierro-Suero et al., 2020; Rodrigues, Hair, et al., 2019; R. Ryan & Deci, 2002; R. M. Ryan & Deci, 2000b; Trigueros et al., 2019, 2020).

Novelty satisfaction and its connection to several positive outcomes are also studied, for example fulfilling need for novelty has found a positive association with autonomous motivation, enjoyment, well-being and life satisfaction (Aibar et al., 2021; Benlahcene et al., 2020; Birdsell, 2018; Fernández-Espínola et al., 2020).

Other studies shown this evidence as novelty matching criteria to a basic psychological need, finding good fit when using Cutre scale for novelty in different countries and contexts but mainly in physical education domain, but several pointed the cross-sectional method as a limitation which precludes from drawing conclusions about the causality and this kind of study is not able to analyses whether the satisfaction of the need for novelty is associated

with positive consequences over a long period of time (Aibar et al., 2021; Bagheri & Milyavskaya, 2020; Benlahcene et al., 2020; Fernández-Espínola et al., 2020; Koka et al., 2021; Stoa & Chu, 2023).

Enjoyment, Life Satisfaction and Basic Psychological Needs

Practising and maintaining exercise habits is complex and many people start exercise programmes and soon give it up. It is therefore important to take this research further and understand how basic psychological needs relate to the enjoyment that exercise provides individuals (Huhtiniemi et al., 2019; Leisterer & Gramlich, 2021; D. S. Teixeira et al., 2021).

It is known that the emotional components have big impact on a behaviour and that the positive or negative meaning that an individual give to a behaviour has an impact on whether they keep it or give it up. A positive perception that an activity is interesting, pleasant or enjoyable contributes to maintain that activity and that's why it's so important to realise how much fun it is to exercise (Hooker et al., 2019; R. M. Ryan & Deci, 2017).

Enjoyment is an emotion and that's why is hard to define it, because emotions, according to science, are temporary and are related to something or someone. Due to emotions human beings can express feelings and those are the most central components of emotions, that can be studied. Based on that, physical activity enjoyment is associated to positive feelings towards physical activity (C. Chen et al., 2021). Therefore, according to studies high levels of intrinsic motivation are linked to enjoyment and anxiety low levels, but enjoyment on the other hand can also be seen as an intrinsic motivator (Deci & Ryan, 1991; Raedeke, 2007).

Enjoyment is so important in the study of exercise behaviour because it is also a predictor of adherence to exercise, and this adherence is more likely under a self-determined regulation (Wankel, 1993). Exercising for self-determined reasons also provides behavioural and emotional benefits that promotes the adherence (Edmunds et al., 2006). The close relationship between enjoyment and self-determined regulation makes imperative to study these two concepts together and their relationship to better understand exercise motivation. By exploring the association between a self-determined behaviour towards exercise and the enjoyment we can also assess the construct validity of our Novelty Scale (Teques et al., 2020).

However, this study wants to go further and if enjoyment and the fulfilment of basic psychological needs have some connections why do not research for a connection also to well-being (Ryan & Deci, 2000).

Well-being was studied through time and is a complex construct that defines an optimal psychological functioning and experience. Nowadays, well-being studies derived from two perspectives: the hedonic and the eudemonic approach (Ryan & Deci, 2000).

The hedonic perspective goes back to ancient Greece where some philosophers argued that the purpose of life is to experience the maximum amount of pleasure and happiness comes from the amount of this pleasurable experiences. For several decades, psychology and studies related to happiness have been based on this definition of pain avoidance and pursuit of pleasure. Kahneman (1999), suggested that hedonism and well-being are equivalent (Bramble, 2016; R. M. Ryan & Deci, 2000a; Waterman, 1993).

Also, since ancient Greece some voices have opposed this view that human beings only follow their desires and that this is their sole purpose in living a full life, a reductive view of human fulfilment. The eudaimonic perspectives also rises and postulates that well-being and happiness are not equivalent. Well-being is a wider concept, is the development of human potential, the achievement of the true self (Díaz et al., 2015; Ryan & Deci, 2000; Waterman, 1993).

SDT advocates eudaimonic approach concur that well-being is to be fully functioning despite being simply attaining desires. According to SDT, being eudaimonic (being autonomous, competent and related) are the principal factors that foster well-being. So, the satisfaction of the basic psychological needs' fosters subjective well-being as well as eudaimonic well-being (Díaz et al., 2015; Ryan & Deci, 2000).

There are several studies focused on basic psychological needs, including novelty and how it can positively predict exercise habits and autonomous motivation. The fulfilment of these needs has also been shown to have a positive relationship with enjoyment, well-being and life satisfaction, which is why this hypothesis of a relationship with enjoyment and life satisfaction was also investigated in this study, expecting results that are in line with the existing literature (Aibar et al., 2021; Benlahcene et al., 2020; Birdsell, 2018; González-Cutre & Sicilia, 2019).

In addition, González-Cutre in 2016 and 2019 studies showed that novelty positively predicted life satisfaction among other variables like vitality, enjoyment and flow, demonstrated that novelty is associated with psychological integrity and well-being, matching the criteria for being considered a basic psychological need (González-Cutre et al., 2016; González-Cutre & Sicilia, 2019; R. M. Ryan & Deci, 2017).

Current Study

The study of novelty as a new need has shown conceptual robustness applied to various domains such as sport and education. This study aims to reinforce this concept, applied to the domain of Portuguese exercise practitioners, by creating a validated instrument in Portuguese: The Basic Psychological Needs Satisfaction and Frustration Scale integrating Novelty, which will enable further studies to be carried out in this area. In addition to validating the instrument, understanding the behaviour of novelty in relation to the three universally accepted basic psychological needs is also one of the specific objectives of the work, contributing to the affirmation of this construct. Other specific objectives also arise: test predictive validity with enjoyment and life satisfaction and analyse gender invariance.

The Novelty Satisfaction was firstly validated by González-Cutre (2016), a 6-item scale that shows a good fit [$\chi^2(9, n=399) = 24.86, p=0.003; CFI=0.99; IFI=0.99; RMSEA=0.067$ (90% $CI= 0.036-0.098$); $SRMR=0.024$]. Later the same author studied an eight-factor model that includes the subscales for novelty satisfaction and frustration that also shows an acceptable fit [$\chi^2(499, n=598) = 1189.56, p<.001; CFI=.94; TLI=.93; RMSEA=.048$ (90% $CI.045-0.52$); $SRMR=.044$]. Also, the 5-item scale for novelty frustration were tested by González-Cutre on which factor loadings were higher than .68 (González-Cutre et al., 2016, 2020).

González-Cutre (2016, 2019) studies showed that novelty satisfaction positively predicts life satisfaction, vitality, enjoyment and flow (González-Cutre et al., 2016; González-Cutre & Sicilia, 2019). On the other hand, Birdsell (2018), showed that the frustration of basic psychological needs was negatively correlated with variables like satisfaction and engagement and novelty was included in this study has a basic need. This study presents evidence that novelty frustration is negatively associated with well-being (Birdsell, 2018). Additionally, some of the novelty studies confirmed invariance across genders (Fierro-Suero et al., 2020; Trigueros et al., 2019, 2020).

Those findings highlight novelty as a basic psychological need and the present study will investigate that on a Portuguese population in the context of exercise. This study will make it possible to reinforce research already carried out in other countries in this direction and consolidate the novelty construct. This affirmation of novelty as a basic psychological need and the creation of these new scales will make it possible to develop experimental studies

that allow us to better understand issues of motivation in exercise and, as such, promote better forms of more lasting behavioural change in individuals.

Method

Participants

A total of 500 Portuguese gym exercisers (263 female), aged between 18 and 65 years ($M = 33.72$; $SD = 12.81$), completed the Portuguese version of the BPNSFN. The training duration ranged from 1 to 456 months ($M = 61.33$; $SD = 40.75$), and weekly frequency ranged from 1 to 7 sessions ($M = 3.44$; $SD = 1.44$).

Procedures: Data collection

Approval for the research was obtained from the Ethical Committee (17/2024) of first author institution in accordance with the guidelines outlined in the Helsinki Declaration of the World Medical Association (2025) (World Medical Association, 2025). Following approval, the researchers contacted gym managers to secure permission to approach their members and gym exercisers. With consent granted, participants were invited to take part in the study at the reception areas of various training facilities during different times of the day. Participation was entirely voluntary, and data collection took place before participants began their exercise sessions. No monetary compensation was provided for their involvement.

Procedures: Translation of the need of novelty satisfaction and frustration subscales

The translation of the Need for Novelty from English to Portuguese followed the committee approach methodology (Brislin, 1980) as recommended by (Banville et al., 2000) and (Cid et al., 2022). The process involved five steps: i) Preliminary Translation: Researchers, with the assistance of three translators holding advanced qualifications in English Portuguese languages, created the first version of the questionnaire; ii) First Evaluation Panel: Four specialists from diverse fields—English-Portuguese Languages, Psychology, Sports Psychology, and Sports Sciences—individually analysed the initial version of the BPNSFN. Minor modifications were made based on their suggestions; iii) Second Evaluation Panel: The revised version was reviewed by a new panel of four specialists in Psychology, Sports Psychology, and Sports Sciences. This group collaboratively evaluated all items and reached consensus on the third version of the questionnaire; iv) Pilot Study: A group of 50 gym exercisers completed the revised version to ensure the clarity and comprehensibility of the items. v) Final Revision: Two Portuguese language teachers reviewed the final version to

address syntax, spelling, and grammatical errors. This thorough process ensured the translation's quality and cultural appropriateness.

Instruments

Basic Psychological Needs Satisfaction and Frustration Scale integrating Novelty. To the Portuguese version of The Basic Psychological Needs Satisfaction and Frustration Scale the questions relating to satisfaction and frustration with novelty were added, duly translated. This 35-item scale (e.g. "I feel I do novel things") focus on satisfaction and frustration of four basic psychological needs (autonomy, competence, relatedness and novelty) using a 5-point scale ranging from 1 ("totally disagree") to 5 ("totally agree"). Both the Portuguese version of The Basic Psychological Needs Satisfaction and Frustration and the original version of Satisfaction and Frustration of Novelty were studied for his reliability and validity (González-Cutre et al., 2016, 2020; Rodrigues et al., 2019)

Enjoyment. The Portuguese version of the Physical Activity Enjoyment Scale (PACES) by Teques et al. (2020) was used to measure enjoyment during exercise. This 8-item scale (e.g., "It is very stimulating") evaluates the level of agreement with statements about enjoyment using a 7-point scale, ranging from 1 ("totally disagree") to 7 ("totally agree"). Recent studies have validated the use of this scale among Portuguese exercisers (Teques et al., 2020).

Satisfaction with Life. The Portuguese version of the Satisfaction with Life Scale (Neto, 1993) was used to assess participants' overall cognitive judgment of their life satisfaction. The scale consists of five items (e.g., "I'm happy with my life"), with responses rated on a 5-point Likert scale ranging from 1 ("strongly disagree") to 5 ("strongly agree"). A study by Teixeira et al. (2023) confirmed the reliability and validity of this instrument (Rodrigues et al., 2023).

Statistical Analysis

Test-retest analysis

Test-retest took place during the data collection and a convenience sample of 50 gym trainers were used. The data were analysed recurring SPSS and to assess the temporal reliability of the instrument (BPNSFN) was performed an intraclass correlation coefficient (*ICC*), which was calculated for each factor, not for each item. Analysing each factor is a useful way of evaluating instruments that have well-defined factors (e.g. sub-scales), where the aggregate reliability of the items is more relevant than that of each individual item (Hair, 2019). The cutoff values applied to evaluate the temporal reliability of BPNSFN were $\leq .05$ indicating poor reliability; values ranging 0.5 to 0.75 indicating moderate reliability; values ranging 0.75 to 0.90 indicating good reliability and ≥ 0.90 indicating excellent reliability (Koo & Li, 2016).

Confirmatory factor analysis

A two-step Maximum Likelihood approach, as recommended by Kline (2016) was conducted using AMOS 23.0 (Arbuckle, 2014). First, Confirmatory Factor Analysis (*CFA*) was performed to evaluate the psychometric properties of each measurement model. Then, Structural Equation Modeling (*SEM*) was used to test the nomological validity across basic psychological needs satisfaction and frustration scale with enjoyment and satisfaction with life. For both analyses, the guidelines provided by several authors (Byrne, 2016; Hair, 2019; Kline, 2016; Marsh et al., 2004) were followed. The following goodness-of-fit indexes were used: Comparative Fit Index (*CFI*), Tucker-Lewis Index (*TLI*), Standardized Root Mean Square Residual (*SRMR*), Root Mean Square Error of Approximation (*RMSEA*) with its 90% Confidence Interval (*CI*), The cut-off values assumed were: *CFI*, *TLI*, ≥ 0.90 , *SRMR* ≤ 0.80 , and *RMSEA* $\leq .080$ (Byrne, 2016; Hair, 2019; Kline, 2016; Marsh et al., 2004). Raykov's formula (1997) was applied to analyze the internal consistency of each subscale, with alpha values ≥ 0.70 considered indicative of good composite reliability (Raykov, 1997). Average Variance Extracted (*AVE*) was calculated to assess convergent validity, with values > 0.50 deemed acceptable. Discriminant validity was ensured when the *AVE* of each construct exceeded the squared correlations between factors in the model (Hair, 2019). For the Structural Equation Model (*SEM*) analysis, the sample size calculations were performed a priori using the Soper Calculator (2025) for structural equation modeling. The objective was to determine the optimal sample size required to effectively test the hypothesized factor

structure of the measurement model. Factors such as the desired statistical power ($p = .08$), significance level ($p = .05$), number of latent variables (10), and observed variables (48) were considered. By utilizing the Soper Calculator, we ensured that the sample size was adequate to yield reliable and meaningful results, with a minimum sample size of 475 participants to detect the effect. This meticulous approach to sample size estimation enhances the validity and accuracy of the factor analysis, offering a clearer understanding of the underlying structure of the variables being studied (Soper, 2025; White, 2022).

Nomological Validity

Nomological validity between satisfaction/frustration of basic psychological needs with enjoyment and satisfaction with life was assessed. A 95% *CI* was considered significant if the interval did not include zero (Williams & MacKinnon, 2008).

Multigroup Analysis

Multigroup analysis was conducted to assess whether the measurement model was invariant across groups with different characteristics (Byrne & van de Vijver, 2010; F. F. Chen, 2007; Cheung & Rensvold, 2002; Sass, 2011). First, we evaluated whether the measurement model fit the data for each group. Then, we tested configural, metric, scalar, and residual invariance using the following criteria: Configural invariance: $\Delta CFI < .01$ (Cheung & Rensvold, 2002); Metric invariance: $\Delta SRMR < .030$ and $\Delta RMSEA < .015$ (Chen, 2007); Scalar invariance: $\Delta SRMR < .010$; Residual invariance: $\Delta RMSEA < .015$ (Chen, 2007).

Results

Preliminary Analysis

Missing values (<0.1%) were imputed using the regression procedures in AMOS 29. Descriptive analysis showed no violations of univariate distribution, with Skewness and Kurtosis values falling within the acceptable ranges of -2 to +2 and -7 to +7, respectively. Additionally, no univariate or multivariate outliers were detected. Following the recommendations of Nevitt and Hancock (2001), we employed the Bolle-Stine Bootstrap (2000 samples) due to Mardia's coefficient exceeding the expected threshold (>5) for multivariate kurtosis in all samples (Nevitt & Hancock, 2001).

Test-retest analysis

Table 1. Intraclass correlation coefficient of BPNSF

Factors	<i>ICC</i>
Autonomy Satisfaction	.750**
Autonomy Frustration	.761**
Competence Satisfaction	.653**
Competence Frustration	.777**
Relatedness Satisfaction	.828**
Relatedness Frustration	.797**
Novelty Satisfaction	.715**
Novelty Frustration	.809**

Note: ICC = intraclass correlation coefficient

Table above (Table 1) presents the results for test-retest, showing good reliability on many factors (*ICC* between 0.75 to 0.90), except for Competence satisfaction and Novelty Satisfaction that indicates a moderate reliability. These results indicates that trough time the consistence of the responses remains.

Confirmatory factor analysis

Table 2. Measurement fit indexes

Model	χ^2	<i>df</i>	χ^2/df	<i>B-S p</i>	<i>CFI</i>	<i>TLI</i>	<i>SRMR</i>	<i>RMSEA</i>	<i>90%CI</i>
BPNSFN									
Total sample	983.69	532	1.85	<.001	.942	.935	.0428	.041	.037, .045
Male sample	828.68	532	1.56	<.001	.926	.917	.0528	.048	.042, .055
Female sample	848.69	532	1.60	<.001	.921	.912	.0527	.048	.042, .054

χ^2 = chi-square; *df* = Degrees of freedom; χ^2/df = The ratio of χ^2 to *df*; Bollen-Stine p-value; *CFI* = Comparative Fit Index; *TLI* = Tucker-Lewis Index; *SRMR* = Standardized Root Mean Square Residual; *RMSEA* = Root Mean Square Error of Approximation; *90%CI* = 90% Confidence Interval.

Table 2 shows the confirmatory factor analysis results of the model. The data indicates an acceptable fit, as evidenced by incremental indices exceeding the threshold of 0.90 and absolute indices below the threshold of 0.08. These findings support the adequacy and validity of the measurement model in capturing the intended constructs and their relationships within the observed data with no differences between genders.

Table 3. Standardized factor load

Constructs	BPNSFN	
	<i>FL</i>	λ^2
Autonomy Satisfaction		
Item 1	.37	.14
Item 9	.68	.46
Item 17	.73	.53
Item 25	.72	.52
Autonomy Frustration		
Item 2	.54	.29
Item 10	.71	.50
Item 18	.71	.50
Item 26	.83	.69
Competence Satisfaction		
Item 5	.72	.52
Item 13	.77	.59
Item 21	.75	.56

Item 29	.65	.42
Competence Frustration		
Item 6	.70	.49
Item 14	.70	.49
Item 22	.80	.64
Item 30	.63	.40
Relatedness Satisfaction		
Item 3	.70	.49
Item 11	.82	.67
Item 19	.72	.52
Item 27	.58	.34
Relatedness Frustration		
Item 4	.65	.42
Item 12	.74	.55
Item 20	.75	.56
Item 28	.70	.49
Novelty Satisfaction		
Item 7	.72	.52
Item 15	.80	.64
Item 23	.80	.64
Item 31	.70	.49
Item 33	.74	.55
Item 35	.60	.36
Novelty Frustration		
Item 8	.75	.56
Item 16	.72	.52
Item 24	.74	.55
Item 32	.73	.53
Item 34	.86	.74

Furthermore, all items of BPNSFN demonstrated factor loadings higher than or equal to $>.50$, indicating at least 25% of the variance in each factor, except item one which presented a factorial loading below to $.50$ (Table 3).

Reliability and Validity

Table 4. Composite reliability, convergent and discriminant validity

Latent variables	<i>M</i>	<i>SD</i>	<i>CR</i>	<i>AVE</i>	1	2	3	4	5	6	7	8
BPNSFN												
1. Autonomy Satisfaction	3.96	.30	.73	.41	1	-	-	-	-	-	-	-
2. Autonomy Frustration	2.04	.80	.77	.50	.28	1	-	-	-	-	-	-
3. Competence Satisfaction	4.13	.65	.81	.52	.59	.19	1	-	-	-	-	-
4. Competence Frustration	2.65	.88	.79	.50	.18	.49	.41	1	-	-	-	-
5. Relatedness Satisfaction	4.01	.71	.79	.50	.45	.13	.27	.07	1	-	-	-
6. Relatedness Frustration	1.72	.76	.79	.50	.14	.55	.14	.53	.34	1	-	-
7. Novelty Satisfaction	3.63	.73	.86	.50	.53	.18	.34	.07	.24	.07	1	-
8. Novelty Frustration	2.59	.92	.87	.58	.16	.55	.09	.35	.10	.32	.36	1

Note: *CR* = Composite reliability; *AVE* = Average Variance Extracted; squared correlations are reported below the diagonal line

The mean values for Satisfaction are above the midpoint, while the mean values for Frustration are below the midpoint, except for Competence and Novelty.

The items have a *CR* >.70, indicating satisfactory internal consistency, demonstrating the ability to measure what is intended. Convergent validity is adjusted (>.50), except for Autonomy Satisfaction.

The scale shows good discriminant validity, as the squared correlations between factors were lower than the *AVE*, except for the correlations between Competence Satisfaction and Autonomy Satisfaction, Relatedness Frustration and Competence Frustration and Novelty Frustration and Autonomy Frustration.

Nomological Validity

Table 5. Nomological validity between BPNSFN and enjoyment and satisfaction with life

Path	β	CI-95%
Autonomy Satisfaction → Enjoyment	.37	[.308., .402]
Autonomy Satisfaction → Satisfaction with Life	.42	[.324., .449]
Competence Satisfaction → Enjoyment	.24	[.161, .250]
Competence Satisfaction → Satisfaction with Life	.52	[.442, .598]
Relatedness Satisfaction → Enjoyment	.27	[.201, .337]
Relatedness Satisfaction → Satisfaction with Life	.32	[.299, .347]
Novelty Satisfaction → Enjoyment	.58	[.499, .601]
Novelty Satisfaction → Satisfaction with Life	.36	[.296., .398]
Autonomy Frustration → Enjoyment	-.25	[-.197, -.334]
Autonomy Frustration → Satisfaction with Life	-.34	[-.214, -.399]
Competence Frustration → Enjoyment	-.29	[-.168, -.321]
Competence Frustration → Satisfaction with Life	-.27	[-.199, -.311]
Relatedness Frustration → Enjoyment	-.30	[-.298, -.377]
Relatedness Frustration → Satisfaction with Life	-.23	[-.188, -.267]
Novelty Frustration → Enjoyment	-.42	[-.288, -.451]
Novelty Frustration → Satisfaction with Life	-.51	[-.476, -.565]

Note: β = effect; CI-95% = Confidence Interval

For the SEM analysis, the Variance Inflation Factor (*VIF*) was calculated to assess collinearity between basic psychological needs satisfaction and frustration, and enjoyment and satisfaction with life. The results showed that all *VIF* values were below 10, as recommended by Hair et al. (2019), confirming the absence of multicollinearity and suitability for regression analysis. The findings further demonstrated that both the measurement model and structural model had a good fit to the data: Measurement Model [$\chi^2= 2062.50$ (1035); $\chi^2/df= 1.99$; $B-p < .001$, $TLI = .917$, $CFI = .924$, $SRMR = .043$, $RMSEA = .045$ (90%CI = .042, .047)]; Structural Model: [$\chi^2= 2064.07$ (1036); $\chi^2/df = 1.99$; $B-p < .001$, $TLI = .917$, $CFI = .924$, $SRMR = .043$, $RMSEA = .045$ (90%CI = .042, .047)]. These results support the nomological validity of the Basic Psychological Needs Satisfaction and Frustration Scale with need of novelty in Portuguese gym exercisers. Regarding direct effects, the results found that satisfying needs has a positive impact on enjoyment and life satisfaction, while frustrating needs has the opposite effect, as shown in table 5.

Discussion

The main aim of this study was to validate a new Basic Psychological Satisfaction and Frustration Scale in Portuguese, incorporating novelty, the new basic psychological need proposed and validated by González-Cutre (2016, 2020) for a population who practices exercise. Other specific aims involve testing predictive validity with enjoyment and life satisfaction as well as analysing invariance across gender, following previous similar studies.

The 35-item scale revealed a good reliability, an acceptable fit and the factor loadings were statically significant, showing the strength of the association with the respective factors. Factor loadings only reveal a problem in item one which is not influencing so strongly the autonomy factor.

The pattern of correlations is similar of other basic psychological needs studies, but on contrary of González-Cutre findings in 2016 the correlation between novelty and relatedness doesn't differ significantly from the other correlations, showing that novelty as a similar behaviour as other needs. Moreover, the instrument revealed consistency across gender, also following the trend of other studies (González-Cutre et al., 2016; Ntoumanis, 2012).

Convergent validity and discriminant validity are complementary and should be assessed together to guarantee the robustness of a measuring instrument. While convergent validity ensures that different measures of the same concept are correlated, discriminant validity ensures that these measures are not confounding different concepts. Together, these forms of validity offer a comprehensive view of the effectiveness and accuracy of a test or questionnaire and the present study has evidenced good psychometric properties of our instrument.

In general, our instrument showed good psychometric qualities in this field, but we would highlight problems of discriminant validity in the relationship between satisfaction of competence and autonomy, between frustration of relatedness and competence and frustration of autonomy and novelty, which may be the result of the theoretical concept itself, which advocates greater self-determination when all the latent variables are satisfied together, with a concerted effort between them. This conceptual overlap is reflected in these correlations with common underlying mechanisms between the constructs (Ntoumanis, 2001, 2012; Ryan Deci, 2017). It is plausible, for example, if individuals didn't feel autonomy, they will undervalue their competence to a task. The same could happen if there

are some frustrations in relatedness field, once again the competence can be undervalued, due to the frustration of one need. And at least if one individual felt that their autonomy is undermined it is natural that they also felt undermined the capacity of feeling something new in an activity and will only experience boredom. However, none of the relationships indicates multicollinearity ($<.80$), reducing the problems about confounding different concepts (Field, 2012).

Gonzalez-Cutre (2020), when studying satisfaction of needs also finds a problem of discriminant validity between the constructs of autonomy and novelty, which was not found in the first study of 2016 (González-Cutre, 2016). At this point the author decides to solve the discriminant validity problem by eliminating one of the items from the original version. “I have the opportunity to innovate” was the item removed because according to the author the word opportunity misleads the reader between the meaning of novelty and autonomy.

Conceptually, for a need to be considered a basic psychological need, when it is satisfied it leads to well-being, but when it is undermined or frustrated it leads to developmental and social dysfunctions, which culminate in ill-being. The fulfilment and frustration of these needs are predictive of functionality and wellness outcomes (Ryan & Deci, 2017). The fulfilment of the criteria was observed on our study, in line with the findings of similar studies (García, 2021). However, to change a well-accepted and implemented model that preconize three basic psychological needs more studies are necessary, such as experimental works.

Thus, in line with previous studies by Gonzalez-Cutre (2016) and Birdsell (2018), it was found that satisfying basic psychological needs, including novelty, had a positive impact on enjoyment and satisfaction with life, while frustrating them had the opposite effect. So, novelty is reinforced as a basic psychological need (Birdsell, 2018; González-Cutre et al., 2016).

Limitations

The present study is pioneer in Portugal studying novelty as a basic psychological need to Portuguese population, so the absence of other similar studies is itself a limitation, as well as the fact that studies on this new proposal are still scarce at international level. However, the robust and comprehensive findings gave new perspectives on the field, opening new perspectives for national researchers, who could keep the findings with this new instrument.

The fact that among the participating population we have gym practitioners who work out more alone and others who have a personal trainer and others that practice in groups could affect the way they experience the different constructs. For example, issues related to relatedness may be more exacerbated in those who attend group classes, while issues related to autonomy and competence may be influenced by the communication style of a personal trainer. So once again we have a limitation that ends up being an opportunity for new studies.

Practical Implications

The development and validation of this new scale in Portuguese is significant, as it provides another important tool in studies related to motivation and behavioural change.

The importance of the results of this study also lies in the fact that another step has been taken in the development of a new construct (novelty), in addition to the three already accepted and well-defined basic psychological needs (autonomy, competence and relatedness) that already are part of self-determination theory.

As this theory is of great importance and is used in different areas of knowledge, this study added value for a better understanding of human motivation and how to work with it. In the context of physical exercise and the Portuguese reality in particular, the added value is quite evident, since it is a fundamental area for human health, with proven benefits, both in prevention and as an adjuvant to therapy in various pathologies, and yet it is something with so little adherence in the Portuguese population.

Novelty has proved to be a construct that plays an important role in the motivational continuum alongside the three basic psychological needs that have already been established. The present study showed how this construct is positively related to enjoyment of exercise, a fundamental feeling for adherence and maintenance of an exercise plan. The positive outcome of life satisfaction linked to novelty is also indicative of the importance of working with this factor not only in exercise, but in different domains, as individuals who are more satisfied with life will also be more receptive to learning and human growth.

Conclusion

The new scale of Basic Psychological Needs Satisfaction and Frustration integrating Novelty as a need was validated in Portuguese language for a Portuguese exercisers population and could be used in future studies.

The study also reinforces this new proposal for novelty as a basic psychological need once it fits the criteria of a need and it's linked to enjoyment and life satisfaction.

The results of the current study are like existing studies on the inclusion of novelty in basic psychological needs, but like the existing literature, they are limited by the fact that the study took place over a short period of time.

The importance of novelty in the motivational continuum in the context of exercise deserves more and more attention, and it is important to consider it both in analysis and in interventions aimed to achieve behavioural changes and states of psychological well-being in exercise practitioners.

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