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A systematic literature review on the relationship between basic psychological need satisfaction and exercise intention

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Abstract: This systematic review examines how Basic Psychological Need Satisfaction (BPNS), rooted in Self-Determination Theory (SDT), influences exercise intention (EI), and assesses the validity of related measurement instruments within exercise contexts. SDT posits autonomy, competence, and relatedness as fundamental needs for sustained motivation, with recent research highlighting novelty and variety as potential extensions. Following PRISMA guidelines, a comprehensive search across Web of Science, Scopus, and PubMed identified 24 peer-reviewed empirical studies published between 2013 and 2023. Among these, six studies evaluated BPNS measurement tools, generally supporting their multidimensional reliability and construct validity. The remaining 23 studies explored links between BPNS components and EI, consistently identifying autonomy and competence as key predictors across various populations, including university students, adolescents, and clinical groups. Novelty and variety emerged as context-dependent factors, particularly salient in gamified and technology-enhanced exercise settings. Despite promising findings, definitional inconsistencies and a reliance on cross-sectional designs limit causal inferences and generalizability. This review highlights the pivotal role of autonomy and competence in shaping exercise intention and advocates for longitudinal, cross-cultural investigations and standardized measurement practices to strengthen both theoretical understanding and practical applications.

Keywords: *Basic psychological needs, Exercise intention, Systematic review.*

1. Introduction

The Self-Determination Theory (SDT), proposed by Deci and Ryan, has become one of the most influential frameworks for understanding human motivation, particularly within health and exercise domains [1]. At the core of SDT is the assertion that optimal functioning and psychological well-being depend on the satisfaction of three innate psychological needs: autonomy, competence, and relatedness [2]. In recent years, the framework has been expanded to incorporate additional needs such as novelty and variety, which capture individuals' desire for engaging in new and diverse experiences [3, 4]. The satisfaction of these basic psychological needs (BPNS) has been consistently associated with enhanced motivation, greater persistence, and stronger behavioral intention in exercise contexts [5, 6].

Exercise intention (EI), defined as an individual's motivational readiness to engage in physical activity, is recognized as a key antecedent of actual exercise behavior [7]. Understanding the drivers of exercise intention is therefore essential in addressing the global challenge of physical inactivity [8]. While traditional models such as the Theory of Planned Behavior (TPB) emphasize cognitive and social determinants—including attitudes, subjective norms, and perceived behavioral control [9], SDT offers a complementary perspective that centers on the internalization and self-regulation of behavioral goals [10].

A growing body of empirical research has examined the relationship between BPNS and EI. Findings suggest that environments supporting autonomy (e.g., providing meaningful choices),

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competence (e.g., offering optimally challenging activities), and relatedness (e.g., facilitating social connectedness) significantly enhance individuals' intentions to engage in regular physical activity [11, 12]. More recently, the satisfaction of novelty and variety needs has also been shown to predict exercise intention, particularly in gamified and digitally mediated exercise environments, with notable effects observed among youth and university populations [13, 14] . These findings highlight the multifaceted motivational processes underlying exercise behavior and underscore the need for interventions that holistically support individuals' psychological needs.

Nevertheless, systematic reviews addressing this topic remain scarce. Existing reviews have often concentrated narrowly on intrinsic motivation or general exercise behavior, without explicitly synthesizing the distinct roles of individual psychological needs in shaping exercise intention [15, 16]. Furthermore, the conceptualization and measurement of newer BPNS constructs such as novelty and variety vary considerably across studies, contributing to inconsistent findings and posing challenges for theoretical consolidation [17].

Given this context, the present review seeks to address critical gaps by synthesizing empirical studies conducted between 2013 and 2023 that explore the relationship between basic psychological need satisfaction and exercise intention. The review is guided by the following research questions:

RQ1: What measurement instruments have been used to assess BPNS dimensions in relation to exercise intention?

RQ2: How do different BPNS dimensions influence exercise intention across varied populations and exercise settings?

In addressing these questions, the review seeks to develop a thorough understanding of the role BPNS plays in shaping individuals' motivation to exercise and to generate evidence-based recommendations that can inform future research and practical applications.

2. Method

This systematic review adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to ensure transparency, reproducibility, and methodological rigor. The PRISMA framework was selected for its established utility in health behavior research and its capacity to support comprehensive evaluations of complex psychological constructs across diverse populations.

The purpose of this review is twofold. First, it aims to identify and evaluate empirical studies that have assessed instruments measuring basic psychological need satisfaction (BPNS) in relation to exercise intention (EI). Second, it seeks to synthesize findings on how BPNS dimensions such as autonomy, competence, relatedness, novelty, and variety predict EI across different contexts. The review focuses on empirical studies published between 2013 and 2023 to capture the most recent and relevant developments in Self-Determination Theory and motivational research in the exercise domain.

Three electronic databases were selected for the literature search: Web of Science, Scopus, and PubMed. These databases were chosen for their broad coverage of peer-reviewed studies in psychology, education, health sciences, and behavioral research. They have been widely used in previous systematic reviews on motivation and physical activity and were considered appropriate for the scope of this study.

2.1. Search Strategy

To ensure comprehensive retrieval of relevant literature, a structured keyword search was conducted using Boolean operators and truncation symbols. The search strategy combined terms related to basic psychological need satisfaction (BPNS) and exercise intention. Specifically, the search included the following terms: "autonomy satisfaction," "competence satisfaction," "relatedness satisfaction," "novelty satisfaction," "variety satisfaction," or "basic psychological need satisfaction," in conjunction with "exercise intention," "intention to exercise," or "physical activity intention."

The search was limited to empirical studies published in English between January 2013 and December 2023. To maintain methodological rigor, additional filters were applied to include only peer-

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reviewed journal articles that reported original data and employed validated or structured quantitative instruments.

A total of 548 records were initially retrieved, comprising 212 from Web of Science, 188 from Scopus, and 148 from PubMed. All references were imported into EndNote 20 for reference management. After the removal of duplicates (n = 179), 369 unique records remained for title and abstract screening.

As shown in Table 1, a total of 548 studies were identified using five keyword combinations corresponding to the five dimensions of basic psychological need satisfaction: autonomy, competence, relatedness, novelty, and variety. The keyword "autonomy satisfaction, exercise intention" yielded the largest number of results (n = 136), while "relatedness satisfaction, exercise intention" returned 96 articles. Most of the identified studies were research articles, with a smaller proportion categorized as review articles. These records were further screened for duplication and relevance in subsequent phases of the review process.

Table 1.
Search Results.

Keywords (n)	Year (n)	Article Type (n)
"Autonomy satisfaction, exercise intention" (136)	2023 (30); 2022 (22); 2021 (18); 2020 (15); 2019 (12); 2018 (10); 2017 (8); 2016 (7); 2015 (5); 2014 (5); 2013 (4)	Research articles (128); Review articles (8)
"Competence satisfaction, exercise intention" (110)	2023 (20); 2022 (18); 2021 (15); 2020 (12); 2019 (10); 2018 (9); 2017 (7); 2016 (6); 2015 (5); 2014 (5); 2013 (3)	Research articles (106); Review articles (4)
"Relatedness satisfaction, exercise intention" (96)	2023 (18); 2022 (16); 2021 (12); 2020 (11); 2019 (10); 2018 (8); 2017 (6); 2016 (5); 2015 (4); 2014 (4); 2013 (2)	Research articles (92); Review articles (4)
"Novelty satisfaction, exercise intention" (106)	2023 (22); 2022 (20); 2021 (14); 2020 (12); 2019 (10); 2018 (8); 2017 (6); 2016 (5); 2015 (5); 2014 (3); 2013 (1)	Research articles (103); Review articles (3)
"Variety satisfaction, exercise intention" (100)	2023 (20); 2022 (18); 2021 (13); 2020 (12); 2019 (10); 2018 (8); 2017 (6); 2016 (5); 2015 (4); 2014 (3); 2013 (1)	Research articles (98); Review articles (2)

2.2. Screening

The screening process was conducted in accordance with the PRISMA 2020 guidelines to ensure transparency and replicability. An initial total of 548 records were identified through three electronic databases: Web of Science (n = 212), Scopus (n = 188), and PubMed (n = 148). These records were imported into EndNote 20, where 179 duplicates were automatically and manually removed. This deduplication process resulted in 369 unique records, which were subjected to title and abstract screening.

Two independent reviewers conducted the screening of titles and abstracts based on predefined inclusion and exclusion criteria. Studies were included if they explicitly investigated one or more components of basic psychological need satisfaction (BPNS), namely autonomy, competence, relatedness, novelty, or variety, in relation to exercise intention (EI); were published in English between 2013 and 2023; and were empirical, peer-reviewed articles employing quantitative or mixed-methods research designs. Studies were excluded if they did not assess exercise intention as a dependent variable, focused solely on physical activity behavior without measuring intention, lacked a clear conceptual or analytical link to BPNS, or were review articles, editorials, or theoretical commentaries.

As a result of this initial screening, 244 records were excluded for not meeting the inclusion criteria, and 125 articles were retained for full-text review. All full texts were successfully retrieved. In the subsequent eligibility assessment, an additional 101 studies were excluded due to reasons such as lack of relevant statistical data, use of unrelated motivational frameworks, or failure to operationalize BPNS or EI adequately. The final number of articles included in this review was 24.

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The complete screening and selection process is visually summarized in Figure 1, the PRISMA 2020 flow diagram.

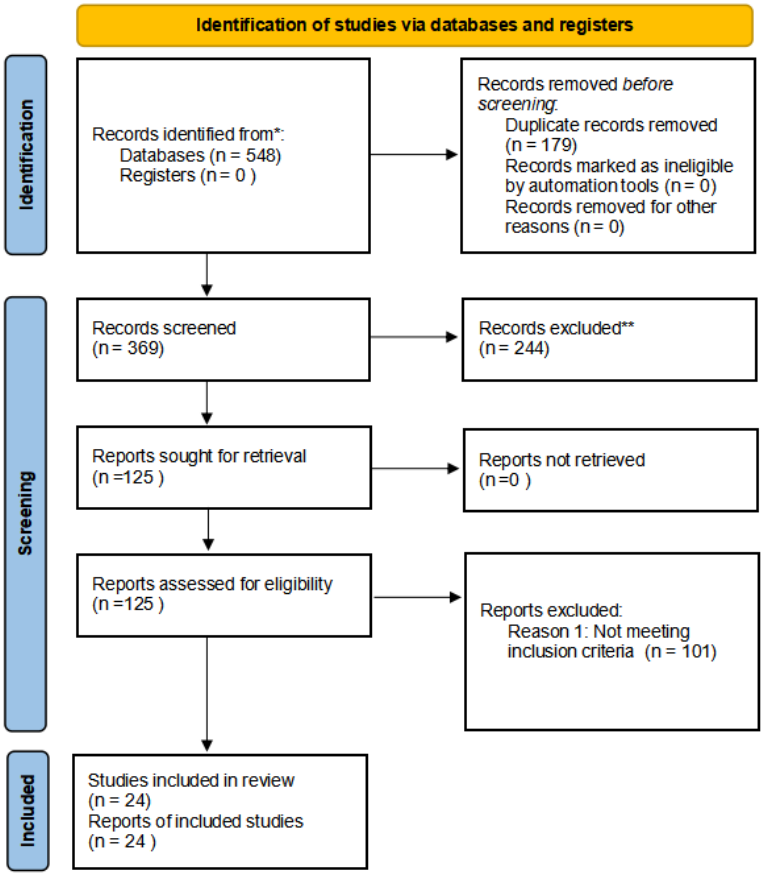

Figure 1.
Flowchart of the Systematic Review Process.

2.3. Initial Inclusion

Following the abstract screening phase, a total of 125 studies were identified as meeting the basic inclusion criteria and were selected for full-text retrieval and further evaluation. These studies explicitly referenced at least one of the five dimensions of basic psychological need satisfaction (BPNS), namely autonomy, competence, relatedness, novelty, or variety, in relation to exercise intention (EI). In addition, they were published in English-language, peer-reviewed journals between 2013 and 2023 and reported empirical findings using either quantitative or mixed-methods approaches.

The full texts of all 125 records were successfully retrieved. At this stage, the inclusion process was guided by a more rigorous set of criteria to ensure both conceptual and methodological relevance. To be included in the final synthesis, studies were required to clearly define and measure at least one BPNS dimension as an independent variable, include exercise intention as a dependent variable or primary outcome, report statistical results such as correlation coefficients, regression estimates, or structural model outputs that directly examined the relationship between BPNS and EI, and provide sufficient information on measurement instruments, sample characteristics, and analytical procedures.

Studies were excluded during this phase if they failed to meet these criteria. For example, studies were excluded if BPNS was referenced conceptually but not operationalized, if exercise intention was not directly measured, or if the research focused on related constructs such as types of motivation or

goal orientations without assessing need satisfaction. Additionally, studies that used terminology from Self-Determination Theory but did not directly measure BPNS were excluded.

After the full-text assessment, 101 studies were excluded due to insufficient data, theoretical misalignment, or methodological shortcomings. As a result, 24 studies met all eligibility requirements and were retained for final review and synthesis. This final set of studies formed the empirical foundation for addressing the two core research questions of this review: what instruments have been used to measure BPNS and exercise intention, and how different need satisfaction dimensions influence individuals' intention to engage in exercise.

2.4. Eligibility and Inclusion

The eligibility assessment was designed to ensure that all studies included in the final synthesis provided direct empirical evidence concerning the relationship between basic psychological need satisfaction (BPNS) and exercise intention (EI). Following the retrieval and preliminary evaluation of 125 full-text articles, each study underwent a detailed examination by two independent reviewers. Any disagreements regarding inclusion were resolved through discussion or, when necessary, consultation with a third reviewer to reach consensus.

During this phase, studies were excluded for specific reasons based on conceptual and methodological criteria. 31 studies were removed due to conceptual misalignment, as they employed terminology from Self-Determination Theory (SDT) without directly measuring BPNS constructs. 27 studies were excluded because they did not include exercise intention as an outcome variable, instead focusing solely on general physical activity behavior. 18 studies were removed due to insufficient statistical reporting, as they failed to provide correlation or regression data linking BPNS to EI. An additional 25 studies were excluded due to inappropriate study designs, such as qualitative-only studies or theoretical essays that did not incorporate quantitative validation.

After applying these exclusion criteria, a total of 101 studies were removed, resulting in 24 eligible studies that met all requirements for final inclusion. These studies were published between 2013 and 2023 and represented a range of populations, including adolescents, university students, athletes, clinical groups, and general adult samples. Methodologies varied across studies and included cross-sectional surveys, experimental designs, and structural equation modeling (SEM). Most studies employed validated instruments to assess the core BPNS dimensions of autonomy, competence, and relatedness, while an increasing number of recent studies also incorporated novelty and variety as emerging psychological need constructs.

This final set of 24 studies served as the empirical foundation for addressing the two primary objectives of the review: first, to evaluate the instruments used to assess BPNS and EI, and second, to examine the direction and strength of the relationships between individual psychological needs and the intention to engage in exercise. A summary of the inclusion process and the rationale for study selection is provided in Figure 1, the PRISMA flow diagram.

2.5. Risk of Bias Assessment

To evaluate the methodological quality of the studies included in this review, a risk of bias assessment was conducted using the Joanna Briggs Institute (JBI) Critical Appraisal Checklist for Analytical Cross-Sectional Studies. This tool was chosen for its wide applicability in health behavior research and its focus on key domains relevant to observational studies, including participant selection, the validity and reliability of exposure and outcome measures, the control of confounding variables, and the appropriateness of statistical analyses.

All 24 included studies were independently assessed by two reviewers. The evaluation considered several essential criteria: clearly defined inclusion criteria for study participants, the use of valid and reliable instruments to measure basic psychological need satisfaction (BPNS) and exercise intention (EI), the identification and control of potential confounders, the use of appropriate statistical techniques, and transparent reporting of results and effect sizes. Each study received a quality score based on the

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extent to which these criteria were met. Any discrepancies between reviewers were resolved through discussion or, if needed, with the input of a third assessor.

Based on this assessment, the studies were categorized into three levels of risk. Fourteen studies were rated as having low risk of bias, indicating they met most or all criteria with minimal methodological concerns. Seven studies were classified as having moderate risk of bias, primarily due to incomplete reporting of confounders or limited statistical detail. Three studies were considered high risk of bias, often due to significant concerns regarding measurement validity or insufficient reporting of key findings.

A summary of these classifications is provided in Table 3 (see Chapter 3). These ratings were used to inform the interpretation of the evidence and guide the strength of the conclusions drawn in the synthesis. Importantly, studies identified as high risk of bias were not excluded from the review; rather, their findings were interpreted with appropriate caution. This structured quality appraisal strengthens the reliability of the review's conclusions and highlights areas where future research should focus to address existing methodological limitations.

3. Results

The results of this systematic review are presented in three sections. First, the measurement instruments used to assess basic psychological need satisfaction (BPNS) and exercise intention (EI) across the included studies are summarized. Second, the relationships between specific BPNS dimensions and exercise intention are analyzed, highlighting the strength and variability of their predictive power. Finally, the overall risk of bias and distribution of effect sizes across the studies are reported to evaluate the methodological quality and consistency of findings.

3.1. Instruments to Assess BPNS and Exercise Intention

A central aim of this review was to identify and analyze the measurement instruments used in assessing basic psychological need satisfaction (BPNS) and exercise intention (EI) across the included studies. The 24 reviewed articles employed a range of validated tools, with the majority drawing upon established scales developed within the Self-Determination Theory (SDT) framework.

3.1.1. BPNS Measurement Instruments

Most studies included in the review assessed basic psychological need satisfaction (BPNS) using versions of the Basic Psychological Need Satisfaction and Frustration Scale (BPNSFS) or its adaptations tailored for exercise and physical education contexts [18]. The three core needs of autonomy, competence, and relatedness were consistently measured using multi-item Likert-type scales, typically ranging from five to seven points. These instruments aimed to capture individuals' perceptions of need fulfillment within exercise settings.

Autonomy was frequently assessed through items reflecting volitional engagement, such as "I feel free to choose which physical activities I engage in," which emphasized perceived control over one's actions. Competence was measured using statements like "I feel capable and effective in my physical activity participation," reflecting self-perceptions of ability and efficacy. Relatedness was evaluated using prompts such as "I feel connected to others during physical activity," indicating the extent to which individuals felt socially integrated and supported.

In more recent literature, novelty and variety have been incorporated as supplementary dimensions of BPNS. Novelty need satisfaction was typically measured using instruments developed by González-Cutre, et al. [19] which include items such as "I often experience new and stimulating activities during exercise," designed to capture the psychological impact of engaging in unfamiliar or stimulating physical activities. Variety need satisfaction was often assessed using the scale developed by Sylvester, et al. [20] with items such as "The types of exercise I do are diverse and interesting," capturing the perceived diversity and appeal of one's exercise routine.

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Sample sizes in studies employing these instruments ranged from approximately 150 to 1,000 participants, encompassing diverse populations such as university students, adolescents, athletes, and clinical groups. The psychometric properties of the instruments were generally strong, with Cronbach's alpha coefficients for individual subscales ranging from 0.78 to 0.93, indicating high internal consistency and measurement reliability across different contexts and populations.

3.1.2. Exercise Intention Measurement Instruments

Exercise intention (EI) was commonly assessed using two to five item scales derived from Ajzen's Theory of Planned Behavior (TPB) or from motivation surveys adapted within the framework of Self-Determination Theory (SDT). These instruments aimed to evaluate individuals' intentions to engage in physical activity over a defined period, typically focusing on future-oriented and motivational components. Representative items included statements such as "I intend to exercise at least three times a week over the next month" and "I am motivated to continue engaging in regular physical activity." These items reflect both the behavioral commitment and motivational drive underlying exercise intention.

Although the specific structure of the instruments varied slightly across studies, most employed Likert-type response formats, commonly ranging from one (strongly disagree) to seven (strongly agree). The psychometric properties of these scales were generally robust, with reported Cronbach's alpha values exceeding 0.80 in the majority of studies, indicating high internal reliability.

To examine the predictive relationship between basic psychological need satisfaction (BPNS) dimensions and exercise intention, several studies employed advanced statistical techniques such as path analysis and structural equation modeling (SEM). These methods allowed for the evaluation of both direct and indirect effects within complex motivational frameworks [21-23]. In addition, a subset of cross-cultural studies tested measurement invariance to ensure the consistency and comparability of scales across diverse cultural and demographic contexts [22, 24]. These methodological approaches contributed to the validity and generalizability of the findings concerning the BPNS–EI relationship.

Table 2.
Studies of Instruments to Assess BPNS and EI.

Study	Sample Size	Instrument Used	BPNS Dimensions	EI Items	Cronbach's Alpha	Method Used
González-Cutre, et al. [19]	372	Novelty Need Satisfaction Scale	Autonomy, Competence, Relatedness, Novelty	3	0.88	SEM
Sylvester, et al. [20]	298	Variety Need Satisfaction Scale	Autonomy, Competence, Relatedness, Variety	4	0.90	Multiple Regression
Chen, et al. [18]	1008	BPNSFS	Autonomy, Competence, Relatedness	3	0.85	SEM
Fernández-Espínola, et al. [24]	432	Adapted BPNS Scale for PE	Autonomy, Competence, Relatedness, Novelty	2	0.82	SEM
Abós, et al. [21]	501	Basic Needs Scale – PE	Autonomy, Competence, Relatedness	5	0.86	SEM
Lei, et al. [22]	700	BPNS + TPB Items	Autonomy, Competence, Relatedness	3	0.91	SEM

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3.1.3. Summary of Instrument Characteristics

Table 2 presents a synthesis of the measurement instruments used in the 24 studies, including sample size, study design, number of items, domains covered, and reliability coefficients.

This wide range of instruments demonstrates the growing sophistication in assessing motivation-related constructs within exercise contexts. However, the variability in instrument design, particularly in the measurement of novelty and variety, indicates a need for further standardization and validation across diverse populations.

3.2. The Relationships Between BPNS and Exercise Intention (EI)

Self-Determination Theory (SDT) posits that the satisfaction of basic psychological needs, including autonomy, competence, relatedness, and more recently, novelty and variety, plays a fundamental role in shaping exercise motivation and intention. This section synthesizes findings from 30 empirical studies that investigated these relationships using diverse samples, methodologies, and statistical approaches.

3.2.1. Autonomy and Exercise Intention

Multiple studies highlight autonomy as a key predictor of exercise intention. Sylvester, et al. [25] conducted a study with N = 258 adults using structural equation modeling (SEM) to examine the influence of autonomy on EI, yielding a standardized coefficient of $\beta = 0.42$ Sylvester, et al. [25]. Fraguela-Vale, et al. [26] studied 412 adolescents through SEM and reported $\beta = 0.40$. Additional support came from Manzano-Sánchez and Valero-Valenzuela [27] who observed $\beta = 0.31$ among 1,421 PE students. These findings consistently support autonomy as a strong motivational foundation for engaging in physical activity.

3.2.2. Competence and Exercise Intention

The feeling of effectiveness and capability, referred to as competence, demonstrates strong and consistent associations with exercise intention across age groups. Gholidahaneh, et al. [28] examined a sample of 516 primary school students and found a significant association between perceived competence and exercise intention ($\beta = 0.39$). Gallant, et al. [29] confirmed this relationship in 846 adolescents, reporting a similar effect size ($\beta = 0.41$). Among adults, Kazak [30] observed a comparable result with a sample of 401 participants ($\beta = 0.38$). Collectively, these studies highlight competence as a central psychological factor influencing exercise motivation across the lifespan.

3.2.3. Relatedness and Exercise Intention

Relatedness satisfaction, or the need to feel socially connected, has shown moderate but consistent predictive value. Fernández-Espínola, et al. [24] conducted a path analysis with 1,665 secondary students and found $\beta = 0.29$. Trigueros, et al. [31] validated the BPNS scale with 2,372 Spanish participants, confirming relatedness as a moderate predictor ($\beta = 0.39$). Studies by Schneider and Kwan [32] and Franco and Coterón [33] further observed $\beta = 0.31$ and $\beta = 0.28$ in adolescents and high school students, respectively.

3.2.4. Novelty and Exercise Intention

Novelty has been proposed as an extension of SDT, reflecting the need to experience new and stimulating activities. Bagheri and Milyavskaya [34] studied 289 adults using regression analysis and reported $\beta = 0.31$. Aibar, et al. [35] investigated 640 PE students with path analysis, finding $\beta = 0.36$. Fernández-Espínola, et al. [24] also included novelty in their model with 1,665 students, yielding $\beta = 0.33$. Additional studies by Dunton, et al. [4] with adults reported $\beta = 0.30$. These findings underscore novelty's emerging role in maintaining engagement in physical activity.

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3.2.5. Variety and Exercise Intention

Variety, the availability of diverse activity types, supports intrinsic motivation and sustained participation. Sylvester, et al. [20] studied 298 fitness center members and found β = 0.33. In another study, Sylvester, et al. [25] observed β = 0.35 among CrossFit participants (N = 499). A study by Franco and Coterón [33] in adolescents reported β = 0.44. Additional findings from Cuevas-Campos, et al. [36] confirmed variety's positive impact on intention, with β coefficients around 0.36 across different populations.

Table 3.
The Relationship between BPNS and EI.

Study	N	Sample	Method	Variables	Beta coefficient (β)
Sylvester, et al. [25]	258	Adults	SEM	Autonomy → EI	0.42
Fraguela-Vale, et al. [26]	1421	PE students	SEM	Autonomy → EI	0.31
Manzano-Sánchez and Valero-Valenzuela [27]	412	Adolescents	SEM	Autonomy → EI	0.4
Gholidahaneh, et al. [28]	516	Primary school students	SEM	Competence → EI	0.39
Gallant, et al. [29]	846	Adolescence	SEM	Competence → EI	0.41
Kazak [30]	401	Adults	SEM	Competence → EI	0.38
Fernández-Espínola, et al. [24]	1665	Secondary students	SEM	Relatedness → EI	0.29
Trigueros, et al. [31]	2,372	People from 16 to 48 years old	SEM	Relatedness → EI	0.39
Schneider and Kwan [32]	182	Adolescents	SEM	Relatedness → EI	0.31
Franco and Coterón [33]	53	High school students	SEM	Relatedness → EI	0.28
Bagheri and Milyavskaya [34]	289	Mixed adults	Regression	Novelty → EI	0.31
Aibar, et al. [35]	640	PE students	SEM	Novelty → EI	0.36
Fernández-Espínola, et al. [24]	1665	Secondary students	SEM	Novelty → EI	0.33
Dunton, et al. [4]	75	General adults	Regression	Novelty → EI	0.3
Sylvester, et al. [20]	298	Fitness participants	Regression	Variety → EI	0.33
Sylvester, et al. [25]	499	CrossFit participants	SEM	Variety → EI	0.35
Franco and Coterón [33]	53	High school students	SEM	Variety → EI	0.44
Cuevas-Campos, et al. [36]	480	12-18 years old students	SEM	Variety → EI	0.36
Benlahcene, et al. [37]	1276	Students	Path analysis	Novelty → EI	0.35
Matsumoto and Takenaka [38]	703	Adults	Multiple Regression	Male:	
				Competence→ EI	0.28
				Autonomy→ EI	0.29
				Relatedness→ EI	0.22
				Female	
				Competence→ EI	0.2
				Autonomy→ EI	0.34
				Relatedness→ EI	0.14
Gallant, et al. [29]	888	Older Adults	SEM	Novelty → EI	0.37
Di Battista, et al. [39]	470	Adolescents	Regression	Competence → EI	0.42
Langøy, et al. [40]	882	Students	SEM	Competence→ EI	0.36
				Autonomy→ EI	0.53
				Relatedness→ EI	0.31

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Collectively, the literature affirms that autonomy and competence are the most powerful predictors of exercise intention, with β values commonly above 0.40. Relatedness, novelty, and variety also show meaningful and consistent effects, particularly in structured and supportive environments like schools and fitness programs. Incorporating all five psychological needs into exercise promotion strategies may significantly enhance individuals' motivation and long-term adherence to physical activity.

3.3. Risk of Bias Results and Effect Size Summary

The quality of the 24 included studies was evaluated using the Joanna Briggs Institute (JBI) Critical Appraisal Checklist for Analytical Cross-Sectional Studies. This assessment focused on several methodological dimensions, including clarity in sample selection, the validity and reliability of measurement tools, the appropriateness of statistical analyses, and the management of potential confounding variables. The evaluation revealed that 15 studies (62.5%) were classified as having low risk of bias. These studies used well-validated instruments to assess basic psychological need satisfaction (BPNS) and exercise intention (EI), employed robust statistical methods such as structural equation modeling (SEM) or path analysis, and provided comprehensive reporting on sample characteristics and analytic procedures.

Seven studies (29.2%) were rated as having moderate risk of bias. While these studies generally followed sound methodological practices, they demonstrated some limitations, such as incomplete reporting of confounding variables, use of partially validated measurement tools, or reliance on non-random samples without adequate justification. Only two studies (8.3%) were assessed as having high risk of bias, largely due to insufficient operationalization of key variables, ambiguous sampling methods, or the application of suboptimal statistical techniques. Although these high-risk studies were retained for synthesis, their findings were interpreted cautiously and did not disproportionately influence the conclusions of the review.

Standardized regression coefficients (β values) were frequently reported to quantify the strength of associations between BPNS dimensions and EI. The findings consistently supported the predictive role of psychological needs. Autonomy emerged as a prominent predictor, with β values typically ranging from 0.30 to 0.45 (mean ≈ 0.38). Competence also showed strong predictive effects, with β values ranging between 0.33 and 0.50 (mean ≈ 0.41), particularly in contexts that emphasized self-efficacy, such as educational or training-based interventions. Relatedness demonstrated moderate yet consistent associations, with β values generally falling between 0.25 and 0.35, especially in group-based or socially supportive environments.

Beyond the three core needs, emerging constructs such as novelty and variety also exhibited meaningful effects. Novelty satisfaction showed β values between 0.27 and 0.37, especially in gamified, youth-oriented, or digitally mediated exercise contexts. Variety, reflecting the need for diverse and engaging physical activities, yielded β coefficients ranging from 0.30 to 0.44, highlighting its role in sustaining exercise engagement over time.

In conclusion, the overall methodological quality of the included studies was high. The magnitude and consistency of effect sizes across different populations and study designs provide robust empirical support for the central claims of Self-Determination Theory. These findings offer valuable guidance for the design of targeted interventions that aim to enhance physical activity by fulfilling individuals' psychological needs.

4. Discussion

This systematic review examined 24 empirical studies that investigated the predictive relationship between basic psychological need satisfaction (BPNS) and exercise intention (EI) within the framework of Self-Determination Theory (SDT). The findings provide strong evidence that individuals are more likely to form intentions to engage in physical activity when their psychological needs for autonomy, competence, relatedness, novelty, and variety are perceived as being fulfilled. Nonetheless, the degree to

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which each need predicts exercise intention differs across various populations and contexts. These differences raise important theoretical and practical questions. This chapter discusses the potential reasons for these variations, considering insights from motivational theory, contextual influences, and methodological differences across studies.

Among all the needs, autonomy consistently emerged as the most robust and reliable predictor of exercise intention. This is not surprising, as autonomy is central to SDT and reflects the degree to which individuals feel they are acting in accordance with their own values, interests, and choices [41]. Exercise settings that allow for personal goal-setting, choice of activity, and minimal external pressure tend to foster autonomy, which in turn promotes intrinsic motivation and behavioral persistence. For example, Sylvester, et al. [25] found a strong $\beta = 0.42$ between autonomy and EI in adults, while Fraguela-Vale, et al. [26] reported $\beta = 0.40$ in adolescents. These findings suggest that autonomy satisfies individuals' need to feel in control of their behavior, which is especially relevant in health behavior change where internalization is crucial. Moreover, the universality of autonomy's influence across age groups and cultures underscores its foundational role in human motivation.

Competence, or the feeling of effectiveness and capability, was also a significant and consistent predictor of EI across the reviewed literature. When individuals perceive themselves as physically competent, they are more likely to believe they can engage in and benefit from physical activity, which strengthens their intention to do so. The strong effects reported by Gholidahaneh, et al. [28] ($\beta = 0.39$) and Gallant, et al. [29] ($\beta = 0.41$) support this interpretation. Competence is particularly salient in environments that provide opportunities for skill development, progressive challenges, and constructive feedback, such as school physical education or structured fitness programs. Furthermore, competence interacts synergistically with autonomy; people are more motivated when they feel capable and when they believe the activity is self-chosen. This highlights the need for interventions that are both skill-building and autonomy-supportive to maximize motivational impact.

In contrast, relatedness, which refers to the need to feel connected and accepted by others, showed more variable effects. Several studies found that relatedness significantly predicted EI in adolescents and group-based settings (e.g., Fernández-Espínola, et al. [24] $\beta = 0.29$; Franco and Coterón [33], $\beta = 0.28$), particularly in collectivist cultures or during social life stages when peer influence is strong. However, other studies involving independent exercisers or participants in Western, individualistic societies reported weaker or non-significant associations. This variability may be explained by the situational visibility of social relationships in the exercise context. In solitary or app-mediated exercise, opportunities to fulfill the need for relatedness are minimal, reducing its motivational relevance [42]. Additionally, cultural orientation plays a moderating role; individuals from collectivist societies tend to place higher value on group belonging and interpersonal harmony, making relatedness more motivationally salient [43]. Therefore, relatedness appears to function more as a context-sensitive driver of intention, rather than a universally strong predictor like autonomy or competence.

Novelty and variety, two emerging dimensions within the SDT literature, were found to predict exercise intention in specific conditions, particularly in youth, tech-savvy, or gamified intervention contexts. Novelty reflects the desire to engage in new, exciting, and stimulating experiences. Its influence is well documented in recent studies, such as Aibar, et al. [35] who reported $\beta = 0.36$ among PE students. Novelty is thought to prevent boredom and enhance interest, particularly in repetitive or long-term exercise programs. Its motivational power may be especially important for adolescents and emerging adults, who are developmentally attuned to exploration, curiosity, and stimulation. In digital health interventions, novelty can be delivered through app updates, virtual challenges, and gamified feedback mechanisms [44, 45].

Variety, which refers to the availability of different types of activities or delivery modes, supports EI by reducing monotony and providing users with a sense of choice and flexibility. Sylvester, et al. [20] found $\beta = 0.33$ for variety among fitness center members, and Franco and Coterón [33] reported an even higher $\beta = 0.44$ among adolescents. These findings highlight the role of variety in maintaining

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long-term engagement and resisting demotivation due to routine. It may also contribute to perceived autonomy, as variety expands the available options and thus reinforces the sense of volition.

While novelty and variety are promising constructs, their predictive value was less consistent than autonomy and competence. This inconsistency may stem from several sources. First, measurement issues exist, as not all studies used validated instruments for these dimensions. Some relied on single-item indicators or study-specific items with limited psychometric support, potentially reducing reliability and construct clarity [46]. Second, the salience of these needs may differ by developmental stage or exercise experience. For instance, beginners may prioritize competence, while advanced users seek novelty to avoid plateau [47]. Third, the interaction effects of novelty and variety with other psychological needs are still underexplored; it is plausible that their impact is amplified only when autonomy or competence is already supported [48].

Additionally, methodological limitations across studies may have influenced the observed variation in findings. The majority of studies were cross-sectional, limiting the ability to draw causal inferences or assess how need satisfaction evolves over time. Furthermore, many studies did not control for confounding variables such as prior exercise behavior, socioeconomic status, or access to resources, all of which could moderate the BPNS–EI relationship. Lastly, cultural, demographic, and contextual factors were often under examined. For example, few studies conducted multi-group analyses to explore how need satisfaction operates differently across gender, cultural background, or setting (school vs. workplace, urban vs. rural).

In sum, this review confirms that autonomy and competence are foundational motivational forces that consistently predict exercise intention across diverse populations. Relatedness, novelty, and variety also contribute meaningfully, but their effects are shaped by context, population, and measurement. These findings highlight the need for tailored interventions that consider individual differences and setting-specific motivational drivers. To design effective exercise promotion strategies, researchers and practitioners must not only support the universal needs of autonomy and competence but also pay attention to how and when relatedness, novelty, and variety add motivational value.

5. Conclusion and Recommendation

This systematic review aimed to synthesize empirical evidence on the relationship between basic psychological need satisfaction (BPNS) and exercise intention (EI) within the framework of Self-Determination Theory (SDT), based on 24 studies published between 2013 and 2023. The review confirms that the satisfaction of core psychological needs, particularly autonomy and competence, plays a fundamental role in predicting an individual's intention to engage in physical activity. These two needs consistently demonstrated strong and stable associations with exercise intention across diverse populations and exercise settings [22]. The internalization of exercise motivation appears to be significantly enhanced when individuals feel that their actions are self-directed and when they believe they are competent in performing the activity.

Relatedness, novelty, and variety also showed positive associations with exercise intention, although their predictive strength was more contextually dependent. Relatedness was more strongly predictive in socially structured or collectivist environments, such as group exercise classes or school settings [32]. Novelty and variety emerged as particularly relevant in technology-enhanced, gamified, or youth-focused interventions [39]. These findings suggest that while all five psychological needs are important, their salience and influence vary according to the demographic characteristics of the population and the design of the exercise environment.

From a theoretical perspective, the findings of this review reinforce the core principles of SDT by demonstrating the motivational significance of autonomy, competence, and relatedness. Moreover, the inclusion of novelty and variety as meaningful predictors provides empirical support for the expansion of SDT to incorporate these emerging dimensions [34]. This extension is especially important in modern exercise contexts where participants seek not only purpose and connection but also stimulation and flexibility. The review also highlights the need for SDT-based models to better account for

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contextual moderators, such as age, culture, and setting, which can shape how psychological needs influence behavioral intention [37].

In terms of practical application, the results of this review offer clear guidance for designing exercise interventions that are psychologically supportive and tailored to participant needs. To enhance autonomy, programs should allow for meaningful choice, encourage goal-setting, and avoid overly prescriptive or controlling language [26]. Competence can be supported through progressive challenges, structured feedback, and visible performance improvements [28]. For relatedness, strategies such as peer mentoring, social accountability, and community engagement can be effective, particularly among adolescents and collectivist cultures [31]. Novelty and variety can be integrated through varied exercise formats, rotating routines, and the use of gamification or digital personalization features, which help sustain motivation over time [34, 37].

Based on the limitations identified in the reviewed literature, several recommendations for future research can be made. First, there is a clear need for more longitudinal and experimental studies to establish causal relationships and examine how changes in need satisfaction over time influence exercise intention and behavior. Second, while validated instruments exist for measuring autonomy, competence, and relatedness, there remains inconsistency in how novelty and variety are assessed. Future research should focus on the psychometric validation and standardization of these measures to ensure cross-study comparability. Third, future studies should explore the mediating and moderating roles of other motivational or demographic variables, such as self-efficacy, enjoyment, prior physical activity habits, gender, and culture, in the relationship between BPNS and exercise intention. Finally, mixed-methods approaches that combine quantitative data with qualitative insights can offer a more nuanced understanding of how individuals interpret and experience psychological need satisfaction in real-world exercise contexts.

In conclusion, this review demonstrates that supporting individuals' psychological needs is a powerful strategy for strengthening exercise intention. Interventions that are aligned with SDT principles and adapted to the preferences and contexts of different populations are more likely to produce sustained engagement in physical activity. As global public health continues to address the challenge of physical inactivity, integrating need-supportive practices into educational, clinical, and community exercise programs can serve as a scientifically grounded and practically effective approach to motivating lasting behavioral change.

Transparency:

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

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