

Relationship Between Basic Psychological Needs and Exercise Motivation in Japanese Adults: An Application of Self-Determination Theory

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Abstract: Grounded in self-determination theory (SDT), this study aimed to examine the relationship between satisfying basic psychological needs when exercising and motivation for exercise. Participants ($n_{\text{male}} = 324$; $n_{\text{female}} = 379$) were Japanese adults who completed a survey using a cross-sectional, non-experimental design. Bivariate correlations supported positive associations between satisfying each psychological need via exercise, and revealed that adjacent motivations spanning the self-determination continuum were more positively correlated in comparison to distal motivations. Multiple regression analyses by participant gender indicated that three basic psychological needs satisfaction via exercise predicted intrinsic motivation in men and women and identified regulation in the female subsample. Relatedness need satisfaction did not significantly contribute to predicting identified regulation in the male subsample. Limited support for the role of basic psychological need fulfillment was evident in the regression models related to controlled motivations or amotivation. Overall, the results of this study indicated that SDT could be employed to advance our understanding of the psychological mechanisms that shape exercise motivation in Japanese adults.

Key words: self-determination theory, motivation, basic psychological need satisfaction, physical activity, exercise.

It is well documented that the regular pursuit of sedentary activities combined with insufficient physical activity increases risk for chronic health problems (e.g., metabolic syndrome; Kim, Tanabe, Yokoyama, Zempo, & Kuno, 2013). Notwithstanding these observations, data from the International Prevalence Study on Physical Activity (Bauman et al., 2009) indicated that

only 21.2% of Japanese adults are considered highly active. Additional population-health research among Japanese adults showed a yearly decline in the average number of steps walked in both men and women between 2001 and 2011, irrespective of age (Koba et al., 2011). Furthermore, approaches to increase physical activity have commonly

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¹We would like to thank Dr. Philip M. Wilson (Brock University) for his support and helpful comments on an earlier version of this manuscript.

resulted in modest improvements in physical activity (Heath et al., 2012). Therefore, it is important to understand the factors that affect one's engagement in and maintenance of physical activity.

Motivation is an essential component in retaining a habit of regular physical exercise (Rodrigues, Teixeira, Cid, Machado, & Monteiro, 2019). One theory that holds promise for understanding motivational issues relevant to physical activity is self-determination theory (SDT; Deci & Ryan, 2002; Ryan & Deci, 2017). SDT is a macro-level theory of human motivation and development, which was formulated by Deci and Ryan (2012). It has been applied to numerous life domains, including physical activity, to advance our understanding of behavior and well-being. The broad appeal of SDT for understanding motivated behavior is hardly surprising considering Deci and Ryan (2002, 2012) have outlined the psychological mechanisms theorized to regulate enduring behavior and promote greater psychological health. The present study particularly focused on two facets of the SDT framework: organismic integration theory (OIT; Deci & Ryan, 2002) and basic psychological needs theory (BPNT; Deci & Ryan, 2002). Within the SDT framework, OIT outlines the quality of motivation theorized to regulate behavior, while BPNT provides insight into psychological processes that facilitate (or forestall) motivational development (Deci & Ryan, 2002, 2012).

According to OIT, motivation can be conceptualized as existing along with a self-determination continuum that designates as autonomous motivation and controlled motivation (Jenkins, Hargreaves, & Hodge, 2020). An overview of the self-determination continuum is presented in Figure 1. While autonomous motivation is composed of three types, namely, intrinsic motivation, integrated regulation, and identified regulation, controlled motivation comprises introjected regulation and external regulation. Intrinsic motivation is characterized by engaging in an activity for no specific reason other than enjoyment and satisfaction derived from the behavior itself (Deci & Ryan, 2002, 2012). Four different extrinsic motivations are

illustrated within OIT, ranging from the most to the least self-determined. Integrated regulation, which is the most self-determined of these types, describes the behavior itself that is aligned with other core values assimilated with the person's identity (Deci & Ryan, 2002, 2012). Identified regulation encompasses the personal importance of engaging in an activity (Deci & Ryan, 2002, 2012). Introjected regulation coerces behavior to avoid negative emotions (e.g., guilt, shame) or fuel contingent self-worth (Deci & Ryan, 2002, 2012). External regulation manages behavior through a desire to appease outside demands, such as punishments and surveillance (Deci & Ryan, 2002, 2012). While integrated and identified regulations epitomize autonomous forms of extrinsic motivation within OIT, introjected and external regulations typify controlled forms of extrinsic motivation (Deci & Ryan, 2002, 2012). Finally, amotivation is determined as a state in which persons demonstrate a lack of motivation, or behave without intention (Ryan & Deci, 2017).

The importance of distinguishing autonomous from controlled motivations originates from Deci and Ryan's (2002, 2012) research and theorizing that focused on the motivation-consequence link. In brief, Deci and Ryan (2002, 2012) contended that optimal behavioral and psychological consequences ensue when people are motivated by autonomous rather than controlling reasons (Ryan & Deci, 2000). An impressive body of research now supports the theoretical distinction made by Deci and Ryan (2002) within OIT. A systematic review of adults suggests that promoting autonomous motivation is positively related to exercise and physical activity behaviors across a range of samples (Teixeira, Carraça, Markland, Silva, & Ryan, 2012). A meta-analysis review revealed similar results in children and youth: Autonomous motivations were more strongly and positively linked with physical activity behaviors than controlled motivations (Owen, Smith, Lubans, Ng, & Lonsdale, 2014).

Complimenting OIT within the SDT framework advanced by Deci and Ryan (2002, 2012) is BPNT, which focuses on how fulfillment of basic psychological needs impacts motivation

and well-being. Within SDT, Deci and Ryan (2002, 2012) have highlighted the importance of the three basic psychological needs of competence, autonomy, and relatedness as innate and universal forces nurturing optimal development and growth. “Competence” refers to feeling effective while mastering challenging tasks within one’s environment (White, 1959). “Autonomy” involves feeling self-governing insofar as the person experiences a sense of volition and internal locus of causality over his or her behavior (de Charms, 1968). “Relatedness” refers to feeling meaningfully connected to others within one’s social milieu (Baumeister & Leary, 1995). SDT posits that these basic psychological needs are universal and innate. Furthermore, fulfilling these three needs leads to one’s positive psychosocial adjustment and well-being in various social contexts (Puklek Levpušček & Podlesek, 2019). Support for Deci and Ryan’s (2002, 2012) theorizing within SDT is evident in the physical activity literature. Exercisers who report feeling competent and autonomous while engaged in activity typically endorse more autonomous than controlled motivations for exercise participation (Wilson & Rogers, 2008). Satisfaction of each basic psychological need has been linked with more

positive than negative affect experienced when physically active in young adults (Gunnell, Crocker, Mack, Wilson, & Zumbo, 2014; Wilson & Bengoechea, 2010). Clinical subgroups (e.g., osteoporosis sufferers, cancer survivors) who experience greater fulfillment of each basic psychological need when physically active have reported higher levels of personal well-being (Gunnell, Mack, Wilson, & Adachi, 2011; Mack, Meldrum, Wilson, & Sabiston, 2013).

In recent years, while much SDT-based physical activity research has investigated how the satisfaction of these three psychological needs predicts autonomous motivation, well-being, and physical activity, very few studies have been conducted on individuals from non-Western countries, such as Japan. Indeed, the relationship between satisfying basic psychological needs when exercising and motivation for exercise in Japanese adults remains unknown. The findings of this study may provide evidence-based interventions to promote physical activity among Japanese adults.

Aim of the Present Study

This study is the first to investigate aspects of psychological need satisfaction and exercise motivation from the perspective of SDT in

Types of motivation	Amotivation	Extrinsic motivation				Intrinsic motivation
Types of regulation	Non-regulation	External regulation	Introjected regulation	Identified regulation	Integrated regulation	Intrinsic regulation
Location on the self-determination continuum						
Perceived locus of causality	Impersonal	External	Somewhat external	Somewhat internal	Internal	Internal
Relevant regulatory processes	Nonintentional, Nonvaluing, Incompetence, Lack of control	Compliance, External rewards and punishments	Self-control, Ego-involvement, Internal rewards and punishments	Personal importance, Conscious valuing	Congruence, Awareness, Synthesis with self	Interest, Enjoyment, Inherent satisfaction

Figure 1 Overview of the self-determination continuum outlining the types of motivation (based on Ryan & Deci, 2000; Standage, Curran, & Rouse, 2019).

Japanese adults. The overarching aim of this study was to shed light on the relationship between satisfying basic psychological needs when exercising and motivation for exercise in Japanese adults. Our hypotheses were drawn from Deci and Ryan's (2002) theorizing within the framework of BPNT and OIT. First, we hypothesized that satisfaction of each basic psychological need would be positively linked with the satisfaction of the other two basic psychological needs. This first hypothesis was based on the premise that satisfying psychological needs for competence, autonomy, and relatedness according to Deci and Ryan (2002, 2012) is a complementary and not mutually exclusive processes within the framework of BPNT. Second, we hypothesized that motivations adjacent to one another (e.g., external-introjected regulations) along the self-determination continuum would be more positively associated with each other than more distal motivations (e.g., external-intrinsic regulations). This second hypothesis was predicated on the argument that motivations within OIT conceptually represent a series of regulations that vary in perceived self-determination (Deci & Ryan, 2002). Such regulations should, according to Deci and Ryan (2002, 2012), display a quasi-simplex pattern of associations with each other when measures assess these constructs in a manner consistent with OIT. Third, we hypothesized that greater satisfaction of each basic psychological need experienced within the exercise domain would be associated with more autonomous than controlled motivations for exercise participation. This last hypothesis was based on the proposition that authentic satisfaction of psychological needs for competence, autonomy, and relatedness theoretically represents the foundation for the internalization process within SDT, resulting in autonomous motivations that are securely integrated with the self (Deci & Ryan, 2002, 2012).

Methods

Participants

Participants ($n = 703$) were Japanese adults recruited at private companies and public fitness

centers in Tokyo, Japan. Of the total sample, 324 were male ($M_{\text{age}} = 45.47$ years, $SD_{\text{age}} = 14.27$ years) and 379 were female ($M_{\text{age}} = 43.77$ years, $SD_{\text{age}} = 14.47$ years). The following occupations were reported: (a) full-time workers (47.2%), (b) part-time workers (11.8%), (c) students (6.4%), (d) retired individuals (6.8%), (e) housewives (17.2%), (f) other (9.2%), and (g) unknown (1.3%). Study participants reported, on average, receiving 14.10 years of education ($SD = 2.22$ years; eight participants omitted this information). The majority (51.2%) reported that they had been engaged in regular exercise for 6 months or more prior to data collection. An additional 9.7% indicated that they had been exercising regularly for up to 6 months prior to data collection while the remainder of the sample (39.1%) indicated they exercised sporadically.²

Instruments

Motivation for exercise. The Self-Determined Motivation Scale for Exercise (SMSE; Matsumoto, Takenaka, & Takaya, 2003) is an 18-item, self-report instrument developed in Japan to assess motivation for exercise, in line with OIT (Deci & Ryan, 2002).³ The SMSE comprises five subscales to assess the following OIT-based exercise motivations: (a) intrinsic motivation (sample item: "Exercise itself is fun"), (b) identified regulation (sample item: "I think it is a good way to improve myself"), (c) introjected regulation (sample item: "I feel guilty if I do not exercise"), (d) external regulation (sample item: "I exercise because other people, such as a family member, friend, or

²These data were collected using an instrument designed to assess stages of change for exercise behavior, in line with the work of Marcus and Simkin (1993).

³The items comprising the SMSE (and the assessments of psychological needs satisfaction via exercise) were presented to the sample in Japanese, not English. The sample items presented in the Instruments section of this manuscript represent translations of the items used. The SMSE does not include the integrated regulation items, owing to the difficulty to discern clear psychometric support for these items (Li, 1999).

doctor, say I should”), and (e) amotivation (sample item: “I do not know why I exercise”). Participants were asked to rate each SMSE item using a 5-point Likert scale, ranging from 1 = *not at all true* to 5 = *very true*. Previous research using the SMSE in samples of Japanese adults have provided support for the construct validity of score interpretations derived from this instrument (Kuroda, Sato, Ishizaka, Yamakado, & Yamaguchi, 2012; Matsumoto & Takenaka, 2004a).

Basic psychological needs satisfaction via exercise. Three instruments were used to assess basic psychological needs satisfaction during exercise. Competence need satisfaction when exercising was measured using four items derived from the Perceived Competence for Exercise Scale (PCES; Matsumoto & Takenaka, 2004b). Each PCES item (sample item: “I feel confident in my ability to perform exercises”) was assessed on a 4-point Likert scale, ranging from 1 = *not at all true* to 4 = *very true*. Autonomy need satisfaction when exercising was measured using a five-item instrument, namely, the Perceived Exercise Autonomy Scale, developed by Matsumoto and Takenaka (PEAS; 2003b). Each item assessing perceived autonomy when exercising was scored using a 5-point Likert scale ranging from 1 = *not at all true* to 5 = *very true*. A sample item for this measure is as follows: “I feel free to exercise in my own way.” Finally, relatedness need satisfaction when exercising was assessed with four items from the Perceived Exercise Relatedness Scale (PERS; Matsumoto & Takenaka, 2003a). Each PERS item was assessed using a 5-point Likert scale ranging from 1 = *disagree* to 5 = *agree*. A sample PERS item is as follows: “I feel connected to people who exercise together.” Previous studies using these items to assess competence, autonomy, and relatedness experienced during exercise have provided support for the construct validity of these instrument in Japanese adults (Matsumoto & Takenaka, 2003b). Research in the physical activity domain (Wilson, Rogers, Rodgers, & Wild, 2006) has employed the terms “perceived competence,” “perceived autonomy,” and “perceived relatedness” instead of “competence

need satisfaction,” “autonomy need satisfaction,” and “relatedness need satisfaction.” The two constructs have, however, been applied in the same ways from a measurement perspective (Ntoumanis et al., 2020).

Data Collection Procedures and Data Analysis

The principal investigator (all public fitness centers) and a research assistant (all private companies) collected participant data using a non-experimental, cross-sectional design. Standardized instructions were used during data collection to minimize the potential for introducing between-participants effects linked with test administration. Each participant was informed of the study’s purpose and given an opportunity to ask the research team questions, and each participant provided written informed consent before completing the questionnaire. After providing consent, each participant completed paper-and-pencil questionnaires in small group settings before returning them to a research team member. The procedures used in this study were compliant with the ethical requirements for human science at Waseda University (Japan) at the time of data collection.

Data analysis proceeded in the following stages. First, data were screened for missing values. Second, estimates of internal consistency score reliability were calculated using α coefficients (Cronbach, 1951). Third, descriptive statistics (means and standard deviations) were calculated for all study variables. Fourth, correlations (Pearson’s r) were computed to test bivariate associations between study variables. Finally, a series of multiple regression models were tested to determine the predictive ability of each basic psychological need satisfaction variable for each type of motivation assessed by the SMSE. Five multiple regression models were examined, each using a different SMSE subscale as the criterion variable of interest, while scores representing the satisfaction of competence, autonomy, and relatedness when exercising served as predictor variables within each regression model. Predictor variables were entered simultaneously into each multiple regression model. Structure coefficients (r_s)

Table 1 Descriptive statistics and score reliability estimates for male/female subgroups

Variables	Male subsample			Female subsample		
	<i>M</i>	<i>SD</i>	α	<i>M</i>	<i>SD</i>	α
Intrinsic motivation	4.01	0.70	.66	4.00	0.85	.80
Identified regulation	4.06	0.76	.78	4.16	0.78	.79
Introjected regulation	2.20	0.91	.78	2.14	1.00	.85
External regulation	2.17	0.97	.76	2.06	0.96	.74
Amotivation	1.50	0.74	.84	1.46	0.83	.90
Competence	2.83	0.61	.82	2.64	0.69	.84
Autonomy	4.10	0.61	.75	3.98	0.72	.78
Relatedness	3.47	1.26	.91	3.81	1.18	.89

Note. *M* = mean; *SD* = standard deviation; α = coefficient alpha (Cronbach, 1951) estimate of internal consistency reliability.

were used in addition to standardized beta-coefficients (β) to aid in the interpretation of predictor–criterion relationships, as r_s 's are less susceptible to distortion from multicollinearity compared with β 's (Courville & Thompson, 2001). Each r_s was calculated using the formula, $r_s = r_{yx1}/R$, where r_{yx1} is the bivariate correlation between a solitary predictor variable and the criterion variable (*Y*) per multiple regression model and *R* is the multiple correlation coefficient estimated per multiple regression model in the analysis.

Results

Preliminary Analyses

Data analysis indicated that 10.13% ($n_{\text{missing}} = 114$) of participants ($N = 1,125$) chose not to respond to all questionnaire items, and were removed from subsequent analyses. Further inspection of the remaining participants ($n_{\text{complete data}} = 1,011$) revealed that 30.47% ($n_{\text{non-exerciser}} = 308$) indicated that they did not participate in any form of exercise at the time of data collection. These participants were also removed from subsequent analyses ($n = 703$).

Estimates of Score Reliability

Internal consistency score reliability estimates for each SMSE subscale and each assessment of basic psychological needs satisfaction via exercise are presented in Table 1. Within the male subsample, average coefficient α 's for

items comprising basic psychological needs satisfaction via exercise ($M_\alpha = 0.83$; $SD_\alpha = 0.08$) were higher than that for SMSE items ($M_\alpha = 0.76$; $SD_\alpha = 0.07$). Less marked differences were noted in the score reliability estimates for items assessing basic psychological needs satisfaction via exercise ($M_\alpha = 0.84$; $SD_\alpha = 0.06$) and exercise motivation ($M_\alpha = 0.82$; $SD_\alpha = 0.06$) in the female subsample.

Descriptive Statistics and Bivariate Correlations

Descriptive statistics are presented in Table 1. Irrespective of participant gender, identified regulation was the most strongly endorsed form of exercise motivation, followed closely by intrinsic motivation. Autonomous exercise motivations were endorsed more strongly than controlling forms of exercise motivation in both the male and female subsamples. Amotivation was the least endorsed SMSE subscale. Further analysis of descriptive statistics indicated that both men and women reported experiencing greater autonomy need satisfaction than relatedness need satisfaction when exercising, although the difference was more pronounced in the male subsample. Men and woman both indicated they experienced competence need satisfaction to some degree as a function of exercise.

Table 2 presents Pearson *r* coefficients for male and female subsamples, depicting the bivariate associations between study variables.

Table 2 Bivariate correlations between psychological needs satisfaction via exercise and exercise motivations

Variables	1.	2.	3.	4.	5.	6.	7.	8.
1. Intrinsic motivation	—	.63**	.12*	-.17**	-.42**	.39**	.47**	.31**
2. Identified regulation	.49**	—	.27**	-.09	-.48**	.27**	.35**	.23**
3. Introjected regulation	.14*	.33**	—	.28**	.17**	.07	.09	-.11*
4. External regulation	-.08	.20**	.37**	—	.50**	.05	-.06	.10
5. Amotivation	-.19**	-.32**	.19**	.27**	—	-.07	-.16**	-.10
6. Competence	.47**	.31**	.10	.00	-.12*	—	.43**	.31**
7. Autonomy	.45**	.35**	.07	-.09	-.22**	.45**	—	.32**
8. Relatedness	.34**	.13*	-.03	.09	-.05	.24**	.18**	—

Note. The correlations for the male subsample are presented in the lower diagonal of the matrix. The correlations for the female subsample are presented in the upper diagonal of the matrix.

* $p < .05$, ** $p < .01$.

Weak-to-moderate correlations were evident between perceptions of basic psychological needs satisfaction, irrespective of participant gender, although greater variability in bivariate associations was evident in the male ($Mr_{12} = 0.29$; $SDr_{12} = 0.14$), compared to the female ($Mr_{12} = 0.35$; $SDr_{12} = 0.07$), subsample. SMSE subscales representing adjacent constructs along the self-determination continuum were all positively correlated within each subsample (see Table 2). In addition, while both competence need satisfaction and autonomy need satisfaction were negatively correlated with amotivation in the male subsample, in the female subsample, only the autonomy need satisfaction–amotivation link was statistically significant and negative. Most r values linking basic psychological needs satisfaction via exercise with either external or introjected regulation were trivial in magnitude; however, relatedness need satisfaction in the female subsample was negatively correlated with introjected regulation for exercise. Finally, greater satisfaction of each basic psychological need was positively correlated with greater endorsement of each autonomous motivation for exercise assessed with the SMSE, irrespective of participant gender (see Table 2).

Multiple Regression Analyses

In Table 3, the results of simultaneous multiple regression analyses for both the male and female subsamples are displayed. Greater variance

was predicted for autonomous motivations ($M_R^2 = 0.23$) compared to controlled motivations ($M_R^2 = 0.02$) or amotivation ($M_R^2 = 0.04$), irrespective of participant gender. Joint consideration of β and r_s coefficients across male and female subsamples indicated that competence need satisfaction and autonomy need satisfaction were more salient predictors of intrinsic and identified regulations for exercise than relatedness need satisfaction. While lower relatedness need satisfaction significantly predicted greater introjected regulation, lower autonomy need satisfaction predicted external regulation in the female subsample only. Lower scores for autonomy need satisfaction predicted amotivation in both the male and female subsamples.

Discussion

This study aimed to test the link between satisfaction of the basic psychological needs of competence, autonomy, and relatedness via participation in exercise with motivations regulating exercise behavior, as reported in a sample of Japanese adults. The study represents a first attempt to investigate aspects of psychological need satisfaction and exercise motivation from the perspective of SDT in Japanese adults. Overall, this study's key findings were mostly in line with previous research conducted in Western countries, in which stronger basic psychological needs satisfaction were linked to

Table 3 Multiple regression analyses predicting exercise motivations from psychological needs satisfaction via exercise

Male subsample															
	Intrinsic motivation			Identified regulation			Introjected regulation			External regulation			Amotivation		
Predictors	β	r_s	R^2	β	r_s	R^2	β	r_s	R^2	β	r_s	R^2	β	r_s	R^2
			.34**			.15**			.01			.02			.05**
Competence	.28**	.80		.19**	.80		.10	.85		.03	.01		-.02		-.54
Autonomy	.29**	.78		.26**	.89		.04	.60		-.12	-.63		-.20**		-1.0
Relatedness	.22**	.58		.04	.33		-.06	-.22		.10	.63		-.01		-.25
Female Subsample															
	Intrinsic motivation			Identified regulation			Introjected regulation			External regulation			Amotivation		
Predictors	β	r_s	R^2	β	r_s	R^2	β	r_s	R^2	β	r_s	R^2	β	r_s	R^2
			.28**			.15**			.03**			.02*			.03*
Competence	.20**	.74		.13**	.71		.08	.41		.07	.34		.01		-.40
Autonomy	.34**	.88		.26**	.90		.11	.49		-.13*	-.42		-.15*		-.95
Relatedness	.14**	.58		.10*	.59		-.16**	-.60		.11*	.64		-.05		-.58

Note. β = standardized beta-coefficients; r_s = structure coefficients (Courville & Thompson, 2001).

* $p < .05$, ** $p < .01$.

greater endorsement of autonomous motivations for exercise behavior, compared to controlled motivations.

First, as predicted by BPNT, satisfaction of each psychological need was found to be positively linked with satisfaction of the other two psychological needs. Bivariate correlation analysis results supported our hypothesis and were in line with BPNT. Particularly, the correlation between competence need satisfaction and autonomy need satisfaction was greater than the correlations between these two variables and relatedness need satisfaction, irrespective of gender.

Second, as predicted by OIT, correlations among motivations mainly showed a simplex-like pattern, with stronger positive correlations between motivations adjacent on the self-determination continuum and stronger negative correlations between more distal motivations. Generally, these results support our hypothesis. However, the correlation between amotivation and identified regulation had a stronger negative relationship than between amotivation

and intrinsic motivation. A meta-analysis review of the self-determination continuum structure revealed similar results in exercise domain (Howard, Gagné, & Bureau, 2017). As noted by Markland & Tobin (2004), "This is perhaps not surprising because the identification (identified regulation) items concern the personal importance or value placed on exercising, whereas the amotivation items reflect a lack of such importance or value" (p. 195).

Third, we identified which three basic psychological need satisfactions were significant predictors of motivational regulations for exercise among men and women in Japan. Multiple regression analyses indicated that greater perception of all basic psychological need satisfaction was related to autonomous motivations. These findings were mostly in support of our hypothesis. Specifically, autonomy need satisfaction was the dominant predictor of motivations for exercise in both genders. Thus, autonomy need satisfaction was positively related to two of the autonomous forms of motivation (i.e., intrinsic motivation and identified

regulation) while negatively related to amotivation. Edmunds, Duda, and Ntoumanis (2010) revealed that autonomy need satisfaction among Asian/Asian British women did not predict any forms of autonomous exercise motivation. Edmunds et al. (2010) explained their results from the perspective of the collectivism/individualism orientation in Western and non-Western countries. Our results were incompatible with those of Edmunds et al. (2010). However, the common viewpoint that the “national character” of the Japanese is more collective than that of individuals who have grown up in Western countries (e.g., Americans) has not been supported by empirical data (Takano & Osaka, 1997, 2018). Therefore, our findings indicated that autonomy need satisfaction could be equally important for individuals from both Japan and Western countries who exercise. Competence need satisfaction also predicted autonomous motivations for exercise irrespective of gender but was not related to controlled motivations. Relatedness need satisfaction emerged as a significantly more important predictor of motivations for women than men. Among men, a significant relationship was only found between relatedness need satisfaction and intrinsic motivation. However, relatedness need satisfaction among women predicted autonomous motivations and controlled motivations. Relatedness need satisfaction emerged as a significantly more important predictor of motivational regulations for women, compared to men. Darlow and Xu (2011) found that the association between the perceived exercise habits of friends and one’s own exercise habits was stronger in women than in men. Wilson and Rogers (2008) indicated that enhancing relatedness need satisfaction could promote both autonomous and controlled forms of extrinsic motivations as individuals appear more likely to regulate their behaviors in accordance with those they perceive to share connections with than those from whom they feel isolated in social contexts. This implication could be useful in encouraging Japanese women to maintain their exercise habits.

Furthermore, previous studies indicated that competence need satisfaction, more than autonomy need satisfaction, showed stronger

associations with autonomous motivation for exercise (Wilson & Rogers, 2008). In the results of this study, however, autonomy need satisfaction was the dominant predictor of motivations for exercise in both genders. Kinnafick, Thøgersen-Ntoumani, and Duda (2014) suggested that satisfaction of competence and relatedness needs is critical to exercise adoption stages, whereas satisfaction of autonomy need can become more important in the adherence phase. Recent research conducted by Kang, Lee, and Kwon (2019) showed that autonomy need satisfaction was the strongest predictor of adherence to a 6-month exercise program among Korean sports center members. Most of the participants in the present study (60.9%) reported that they engaged in regular exercise; therefore, participants’ exercise habits may have been relevant to these findings.

The findings of the present study revealed that stronger satisfactions of the basic psychological needs of competence, autonomy, and relatedness were linked to greater endorsement of autonomous exercise motivations, and associated with decreased endorsement of controlled motivations and amotivation among Japanese adults. Our study provides health professionals with some evidence of whether SDT-based approaches can motivate Japanese exercisers, and how. Deci and Ryan (2011) pointed out that:

By understanding the functioning of these three needs, interventionists (e.g., parents, teachers, managers, physicians) will be able to evaluate what aspects of a social context will significantly enhance versus undermine individuals’ engagement and effectiveness within the context, whether the context is an immediate proximal context, a developmental context that exists over time, or a more distal context such as culture. (p. 19)

The most studied socio-contextual component of the SDT framework in an exercise setting is autonomy support (Wilson, Mack, & Grattan, 2008). This refers to authority figures listening with empathy, providing meaningful

rationales for change without pressuring compliance, offering choice, and acknowledging that behavioral change is demanding and challenging from participants' perspectives (Deci & Ryan, 2002). For example, Ng, Ntoumanis, Thøgersen-Ntoumani, Stott, and Hindle (2013) found that when participants who engaged in weight management perceived more autonomy support from important others (e.g., spouse, close friends), their psychological needs were satisfied. In support of SDT, a meta-analysis of 73 studies conducted by Ntoumanis et al. (2020) demonstrated that SDT-based interventions' increases in perceived need support and autonomous motivation were associated with positive changes in health behavior, including exercise and physical activity. Perceived autonomy support remains an important research initiative to consider within future applications of SDT for exercise (Wilson et al., 2008). Future studies should involve assessments of the social environment within the exercise domain to better understand how different environments are associated with basic psychological needs satisfaction in the Japanese setting.

Study Limitations and Future Directions

Although this study offered preliminary information regarding the applicability of BPNT and OIT to the study of exercise motivation in Japanese adults, some limitations should be acknowledged, and future research directions outlined. First, this study used a cross-sectional design with non-probability sampling procedures to collect data that limited causal inferences and restricted generalizability. Future studies using longitudinal designs and random sampling procedures from well-defined populations would be a useful next step in this line of research. Second, this study relied exclusively on self-report data to assess focal constructs within BPNT and OIT. Future studies may choose to include additional instruments to gauge the degree to which recall and social desirability biases may have affected data collection in this study. Furthermore, linking self-report data measuring constructs central to BPNT and OIT with other variables assessed

with different methods (e.g., markers of well-being assessed with biological protocols) may be a useful approach for future research. Finally, this study did not include an assessment of integrated regulation for exercise, as this construct was not included within the SMSE's development. Future research may wish to expand the SMSE to explore whether integrated regulation for exercise is experienced by Japanese adults in a manner consistent with samples from other countries (Wilson, Rodgers, Loitz, & Scime, 2006).

Conflict of Interest

The authors have no conflicts of interest directly relevant to the content of this article.

References

- Bauman, A., Bull, F., Chey, T., Craig, C. L., Ainsworth, B. E., Sallis, J. F., ... the IPS Group (2009). The international prevalence study on physical activity: Results from 20 countries. *International Journal of Behavioral Nutrition and Physical Activity*, 6, 21. <https://doi.org/10.1186/1479-5868-6-21>
- Baumeister, R. F., & Leary, M. R. (1995). The need to belong: Desire for interpersonal attachments as a fundamental human motivation. *Psychological Bulletin*, 117, 497–526.
- de Charms, R. (1968). *Personal causation: The internal affective determinants of behavior*. New York, NY: Academic Press.
- Courville, T., & Thompson, B. (2001). Use of structure coefficients in published multiple regression articles: β is not enough. *Educational and Psychological Measurement*, 61, 229–248.
- Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, 16, 297–334.
- Darlow, S. D., & Xu, X. (2011). The influence of close others' exercise habits and perceived social support on exercise. *Psychology of Sport and Exercise*, 12, 575–578.
- Deci, E. L., & Ryan, R. M. (2002). *Handbook of self-determination research*. Rochester, NY: University of Rochester Press.
- Deci, E. L., & Ryan, R. M. (2011). Levels of analysis, regnant causes of behavior, and well-being: The

- role of psychological needs. *Psychological Inquiry*, 22, 17–22.
- Deci, E. L., & Ryan, R. M. (2012). Motivation, personality and development within embedded contexts: An overview of self-determination theory. In R. M. Ryan (Ed.), *The Oxford handbook of human motivation* (pp. 85–107). New York, NY: Oxford University Press.
- Edmunds, J., Duda, J. L., & Ntoumanis, N. (2010). Psychological needs as the prediction of exercise-related cognitions and affect among an ethnically diverse cohort of adult women. *International Journal of Sport and Exercise Psychology*, 8, 446–463.
- Gunnell, K. E., Crocker, P. R. E., Mack, D. E., Wilson, P. M., & Zumbo, B. D. (2014). Goal contents, motivation, psychological need satisfaction, well-being, and physical activity: A test of self-determination theory over 6 months. *Psychology of Sport and Exercise*, 15, 19–29.
- Gunnell, K. E., Mack, D. E., Wilson, P. M., & Adachi, J. D. (2011). Psychological needs as mediators? The relationship between leisure-time physical activity and well being in people diagnosed with osteoporosis. *Research Quarterly for Exercise and Sport*, 82, 794–798.
- Heath, G. W., Parra, D. C., Sarmiento, O. L., Andersen, L. B., Owen, N., Goenka, S., ... Brownson, R. C. (2012). Evidence-based intervention in physical activity: Lessons from around the world. *Lancet*, 380, 272–281.
- Howard, J. L., Gagné, M., & Bureau, J. S. (2017). Testing a continuum structure of self-determined motivation: A meta-analysis. *Psychological Bulletin*, 143, 1346–1377.
- Jenkins, M., Hargreaves, E. A., & Hodge, K. (2020). Examining the relationships among cognitive acceptance, behavioral commitment, autonomous extrinsic motivation, and physical activity. *Journal of Sport and Exercise Psychology*, 42, 177–184.
- Kang, S., Lee, K., & Kwon, S. (2019). Basic psychological needs, exercise intention and sport commitment as predictors of recreational sport participants' exercise adherence. *Psychology and Health*, 35, 916–932. <https://doi.org/10.1080/08870446.2019.1699089>
- Kim, J., Tanabe, K., Yokoyama, N., Zempo, H., & Kuno, S. (2013). Objectively measured light intensity lifestyle activity and sedentary time are independently associated with metabolic syndrome: A cross-sectional study of Japanese adults. *International Journal of Behavioural Nutrition and Physical Activity*, 10, 30. <https://doi.org/10.1186/1479-5868-10-30>
- Kinnafick, F. E., Thøgersen-Ntoumani, C., & Duda, J. L. (2014). Physical activity adoption to adherence, lapse, and dropout: A self-determination theory perspective. *Qualitative Health Research*, 24, 706–718.
- Koba, S., Tanaka, H., Maruyama, C., Tada, N., Birou, S., Teramoto, T., & Sasaki, J. (2011). Physical activity in the Japan population: Association with blood lipid levels and effects in reducing cardiovascular and all-cause mortality. *Journal of Atherosclerosis and Thrombosis*, 18, 833–845.
- Kuroda, Y., Sato, Y., Ishizaka, Y., Yamakado, M., & Yamaguchi, N. (2012). Exercise motivation, self-efficacy, and enjoyment as indicators of adult exercise behavior among the transtheoretical model stages. *Global Health Promotion*, 19, 14–22.
- Li, F. (1999). The Exercise Motivation Scale: Its multifaceted structure and construct validity. *Journal of Applied Sport Psychology*, 11, 97–115.
- Mack, D. E., Meldrum, L. S., Wilson, P. M., & Sabiston, C. M. (2013). Physical activity and psychological health in breast cancer survivors: An application of basic psychological needs theory. *Applied Psychology: Health and Well-Being*, 5, 369–388.
- Marcus, B. H., & Simkin, L. R. (1993). The stages of exercise behavior. *Journal of Sports Medicine and Physical Fitness*, 33, 83–88.
- Markland, D., & Tobin, V. (2004). A modification of the Behavioral Regulation in Exercise Questionnaire to include an assessment of amotivation. *Journal of Sport and Exercise Psychology*, 26, 191–196.
- Matsumoto, H., & Takenaka, K. (2003a). The relationship between perceived exercise relatedness and exercise motivation, with mental health. *Human Science Research*, 11, 147–160. (In Japanese with English abstract.)
- Matsumoto, H., & Takenaka, K. (2003b). The relationship between the perceived exercise autonomy and the intention of exercise adherence. *Japanese Journal of Health Promotion*, 5, 114–119. (In Japanese with English abstract.)
- Matsumoto, H., & Takenaka, K. (2004a). Motivational profiles and stages of exercise behavior change. *International Journal of Sport and Health Science*, 2, 89–96.
- Matsumoto, H., & Takenaka, K. (2004b). The relationship between perceived exercise competence and regular exercise behavior. *Japanese Journal of Health Promotion*, 6, 1–7. (In Japanese with English abstract.)
- Matsumoto, H., Takenaka, K., & Takaya, N. (2003). Development of the Exercise Motivation Scale for Exercise Adherence based on self-determination theory: The reliability and validity. *Japanese Journal of Health Promotion*, 5, 120–129. (In Japanese with English abstract.)

- Ng, J. Y., Ntoumanis, N., Thøgersen-Ntoumani, C., Stott, K., & Hindle, L. (2013). Predicting psychological needs and well-being of individuals engaging in weight management: The role of important others. *Applied Psychology: Health and Well-Being*, 5, 291–310.
- Ntoumanis, N., Ng, J. Y. Y., Prestwich, A., Quested, E., Hancox, J. E., Thøgersen-Ntoumani, C., ... Williams, G. C. (2020). A meta-analysis of self-determination theory informed intervention studies in the health domain: Effects on motivation, health behavior, physical, and psychological health. *Health Psychology Review*. <https://doi.org/10.1080/17437199.2020.1718529>
- Owen, K. B., Smith, J., Lubans, D. R., Ng, J. Y. Y., & Lonsdale, C. (2014). Self-determined motivation and physical activity in children and adolescents: A systematic review and meta-analysis. *Preventive Medicine*, 67, 270–279.
- Puklek Levpušček, M., & Podlesek, A. (2019). Links between academic motivation, psychological need satisfaction in education, and university students' satisfaction with their study. *Psihologijske Teme*, 28, 567–587.
- Rodrigues, F., Teixeira, D. S., Cid, L., Machado, S., & Monteiro, D. (2019). The role of dark-side of motivation and intention to continue in exercise: A self-determination theory approach. *Scandinavian Journal of Psychology*, 60, 585–595.
- Ryan, R. M., & Deci, E. L. (2000). Intrinsic and extrinsic motivations: Classic definitions and new directions. *Contemporary Educational Psychology*, 25, 54–67.
- Ryan, R. M., & Deci, E. L. (2017). *Self-determination theory: Basic psychological needs in motivation, development, and wellness*. New York, NY: Guilford Press.
- Standage, M., Curran, T., & Rouse, P. C. (2019). Self-determination-based theories of sport, exercise, and physical activity motivation. In T. S. Horn & A. L. Smith (Eds.), *Advances in Sport and Exercise Psychology: Self-determination-based theories of sport, exercise, and physical activity motivation* (pp. 289–311). Champaign, IL: Human Kinetics.
- Takano, Y., & Osaka, E. (1997). “Japanese collectivism” and “American individualism”: Reexamining the dominant view. *Japanese Journal of Psychology*, 68, 312–327. (In Japanese with English abstract.)
- Takano, Y., & Osaka, E. (2018). Comparing Japan and the United States on individualism/collectivism: A follow-up review. *Asian Journal of Social Psychology*, 21, 301–316.
- Teixeira, P., Carraça, E. V., Markland, D., Silva, M. N., & Ryan, R. M. (2012). Exercise, physical activity, and self-determination theory: A systematic review. *International Journal of Behavioral Nutrition and Physical Activity*, 9, 78. <https://doi.org/10.1186/1479-5868-9-78>
- White, R. W. (1959). Motivation reconsidered: The concept of competence. *Psychological Review*, 66, 297–333.
- Wilson, P. M., & Bengoechea, E. G. (2010). The Relatedness to Others in Physical Activity Scale: Evidence for structural and criterion validity. *Journal of Applied Biobehavioral Research*, 15, 61–87.
- Wilson, P. M., Mack, D. E., & Grattan, K. P. (2008). Understanding motivation for exercise: A self-determination theory perspective. *Canadian Psychology*, 49, 250–256.
- Wilson, P. M., Rodgers, W. M., Loitz, C. C., & Scime, G. (2006). “It’s who I am...really!” The importance of integrated regulation in exercise contexts. *Journal of Applied Biobehavioral Research*, 11, 79–104.
- Wilson, P. M., & Rogers, W. T. (2008). Examining relationships between perceived psychological need satisfaction and behavioral regulations in exercise. *Journal of Applied Biobehavioral Research*, 13, 119–142.
- Wilson, P. M., Rogers, W. T., Rodgers, W. M., & Wild, T. C. (2006). The Psychological Need Satisfaction in Exercise Scale. *Journal of Sport & Exercise Psychology*, 28, 231–251.

(Received April 18, 2020; accepted January 29, 2021)