



Research Article

Relationship Between Autonomous Motivation for Dietary Self-Care Behaviors and Quality of Life in People with Type 2 Diabetes: A Structural Equation Modeling Approach

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SUMMARY

Purpose: Diabetes has the most detrimental impact on the dietary freedom of people with type 2 diabetes (T2D), and it is important to facilitate dietary self-care behaviors in people with T2D without impairing quality of life (QOL). Autonomous motivation to perform dietary self-care behaviors could lessen their psychological burden and maintain their QOL. Therefore, the purpose of this study was to identify the relationship between autonomous motivation for dietary self-care behaviors and QOL in people with T2D by establishing a hypothetical model using competence and implementation levels of dietary self-care behaviors as mediating variables.

Methods: This cross-sectional study recruited participants and collected data from August 2022 to January 2023 using questionnaires assessing autonomous motivation for dietary self-care behaviors, competence and implementation levels of dietary self-care behaviors, and QOL directed toward people with T2D at the outpatient diabetes department of a university hospital. The authors tested the hypothetical model using structural equation modeling (SEM).

Results: A total of 223 participants completed the questionnaires. The hypothetical model was modified based on testing the model using SEM. The final model showed a good fit, $\chi^2(1) = 0.37$ ($p = .545$); comparative fit index = 1.00; root mean square error of approximation = .00; standardized root mean squared residual = .01. The results showed that autonomous motivation for dietary self-care behaviors was positively associated with overall QOL through competence and implementation levels of dietary self-care behaviors, whereas it was not associated with diabetes-dependent QOL.

Conclusion: Given that the final model was exploratory due to modifications from the hypothetical model, further validation, including cross-validation using independent samples, should assess the replicability and robustness of the model structure. Based on such validation, interventions to increase autonomous motivation for dietary self-care behaviors in people with T2D may need to be developed and evaluated to improve their QOL.

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Introduction

For people with type 2 diabetes (T2D), dietary freedom is the aspect of life most negatively impacted by diabetes and is important for their quality of life (QOL) [1]. Therefore, it is important for nurses to work with them to help them engage in dietary self-care behaviors without impairing their QOL.

When individuals implement health behaviors, autonomous motivation for those behaviors positively affects QOL directly and through competence in those behaviors [2–4]. Autonomous

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motivation refers to the motivation enacted with a full sense of volition and choice [5]. Competence is one of the basic psychological needs and refers to being confident in making or maintaining a change toward a particular behavior [6]. Self-determination theory (SDT) posits these two concepts and suggests that humans need to satisfy their basic psychological needs, including autonomy, competence, and relatedness, to attain psychological development and wellness [7]. Additionally, SDT supports the importance of autonomous motivation and competence as predictors of effective health behavior change based on a review of empirical studies [8]. The meta-analysis of studies adapting SDT concepts to health behaviors by Ng et al. showed a conceptual model in which autonomous motivation for health behaviors positively affects subjective outcomes (e.g., QOL) and objective outcomes (e.g., their implementation levels), directly and through competence in those behaviors [9].

For people with T2D, some studies have shown that autonomous motivation for dietary self-care behaviors positively impacts the implementation of those behaviors [10–14]. However, no studies have examined the relationship between autonomous motivation for dietary self-care behaviors and QOL. Although dietary freedom is the aspect of life most negatively impacted by diabetes and important for their QOL [1], if autonomous motivation motivates dietary self-care behaviors, the psychological burden of dietary self-care behaviors may be reduced.

Therefore, this study aimed to identify the relationship between autonomous motivation for dietary self-care behaviors and QOL in people with T2D. Thus, the following four hypotheses were established using competence and implementation levels of dietary self-care behaviors as mediating variables, which are essential concepts when considering the relationship between autonomous motivation and QOL, and a hypothetical model (Figure 1) was tested based on these hypotheses.

- (1) Autonomous motivation for dietary self-care behaviors positively affects QOL without a mediating role of competence or implementation levels.
- (2) Autonomous motivation for dietary self-care behaviors positively affects QOL through competence without a mediating role of implementation levels.
- (3) Autonomous motivation for dietary self-care behaviors positively affects QOL through implementation levels without a mediating role of competence.

- (4) Autonomous motivation for dietary self-care behaviors positively affects QOL by first enhancing competence and, subsequently, implementation levels.

Methods

Research design

This cross-sectional study recruited participants and collected data between August 2022 and January 2023 using questionnaires directed toward people with T2D at the outpatient diabetes department of a university hospital. The Kyoto University Graduate School and Faculty of Medicine Ethics Committee approved this study on August 12, 2022 (approval number: R3365). All procedures were performed in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. This study follows the strengthening the reporting of observational studies in epidemiology statement.

Participants and procedure

The inclusion criteria were Japanese people with T2D, aged 18+, who could read and write in Japanese. Exclusion criteria were a diagnosis less than three months earlier, diagnosis of cognitive impairment or psychiatric disorder, or being regarded as inappropriate by a doctor. The authors orally provided the study details and an explanatory document to those who met the inclusion criteria. Written informed consent was obtained from all individual participants included in the study. After obtaining their consent, the first author asked participants to complete the questionnaires, which were collected that day. If participants required additional time, they were asked to complete them at home on that day and return them by mail. The first author collected participants' demographic and medical data from their electronic medical records.

Variables and measures

Demographics and medical history

Information on age, sex, age at diabetes diagnosis, latest HbA1c level, body mass index, medication regimen for diabetes, and diagnosed diabetes complications was obtained from participants'

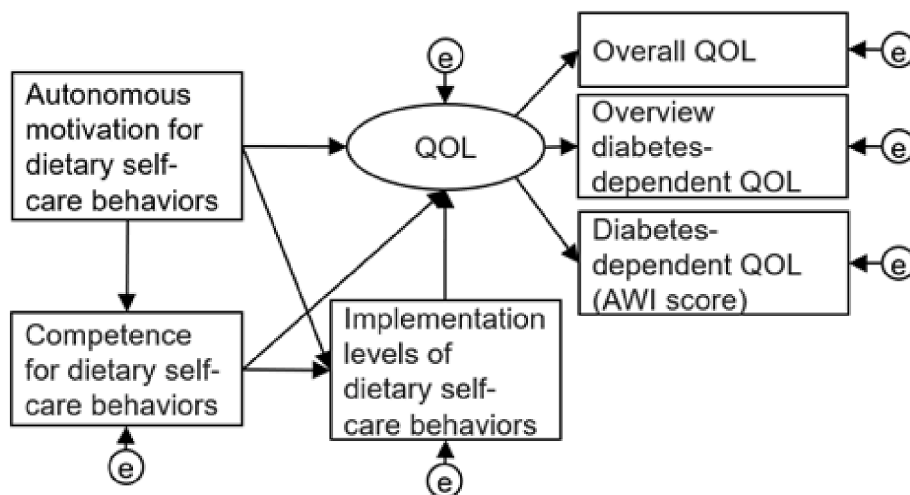


Figure 1. Hypothetical Model.

Note. Squares indicate the observed variables; circles indicate the latent variables; circles with "e" indicate the error term of each indicator. AWI = average weighted impact; QOL = quality of life.

electronic medical records. Additionally, information on marital status, education level, employment status, annual income, and history of nutritional guidance was obtained via a self-administered questionnaire.

Autonomous motivation for dietary self-care behaviors

This study adopted a subscale of the treatment self-regulation questionnaire [15], translated into Japanese by Yamamoto et al. [16], to assess dietary self-care behaviors for diabetes [6] with permission from the Center for Self-Determination Theory, which administers the scale. This scale assesses the degree to which a person's motivation for a particular behavior or set of behaviors is relatively autonomous or self-determined. It has 15 items with three subscales: autonomous motivation, controlled motivation, and amotivation (which refers to being unmotivated). Confirmatory factor analysis verified that the structure found in this study was the same as that of the Japanese version presented by Yamamoto et al. [16], and seven items were used as autonomous motivation items. Items included "I would perform dietary self-care behaviors because it is an important choice I really want to make." Items were scored on a 7-point Likert scale ranging from 1 (not at all true) to 7 (very true). Each participant's average response score on autonomous motivation items was used in the primary analyses, that is, structural equation modeling (SEM).

Competence for dietary self-care behaviors

This study also adopted the perceived competence scale [17], translated into Japanese by Yamamoto et al. [16], to assess dietary self-care behaviors for diabetes [6], with permission from the Center for Self-Determination Theory. This scale assesses the degree to which participants feel confident about making or maintaining a change in a particular behavior. It has four items, with one item being "I feel confident in my ability to maintain dietary self-care behaviors." Items were scored on a 7-point Likert scale ranging from 1 (not at all true) to 7 (very true). Each participant's average score was used in the SEM.

Implementation levels of dietary self-care behaviors

This study used the dietary self-care subscale of the Japanese-translated summary of diabetes self-care activities measure [18] originally developed by Toobert, Hampson, and Glasgow [19], to assess the levels of dietary self-care behaviors. Five items confirmed the number of days in the last week that respondents implemented each dietary self-care behavior. Items included "How many of the last seven days have you followed a healthful eating plan?" Each participant's total score was used in the SEM. The possible range of total scores is 0 to 35.

Quality of life

This study used the Japanese version of the Audit of Diabetes-Dependent Quality of Life (ADDQoL) [20], originally developed by Bradley et al. [21], and included the same number of items as the version modified by Wee et al. [22]. It measures individuals' perceptions of the impact of diabetes on their QOL [21]. This scale contains two overview items and a series of items asking about the impact of diabetes on 19 specific domains of life. The first overview item measures the individual's overall QOL by asking them to respond to the statement, "In general, my present quality of life is ..." on a 7-point Likert scale (–3: as bad as it could possibly be to 3: as good as it could possibly be). The second overview item measures overview diabetes-dependent QOL by asking individuals to respond to, "If I did not have diabetes, my quality of life would be ..." on a 5-point Likert scale (–3: a great deal better to 1: worse). For both overview items, higher scores indicate a less negative or

better impact on QOL. The 19 items that follow measures diabetes-dependent QOL; that is, the individual's perception of the impact of diabetes on specific domains of life and their importance for QOL. A 5-point Likert scale (e.g. –3: very much better to 1: worse) measures the impact on QOL (how each aspect would change if the individual did not have diabetes) for each item that is relevant to the individual's QOL, while a 4-point Likert scale (3: very important to 0: not at all important) measures the importance of a specific item for the individual's QOL. Respondents can choose "non-applicable" if required. Weighted impact (WI) scores for each applicable domain are calculated by multiplying impact by importance scores for each domain (range –9 to +3; more negative scores indicate a greater negative impact of diabetes on QOL, while positive scores [rarely seen] indicate a positive impact of diabetes on QOL). The average weighted impact (AWI) score is calculated by summing the WI scores for all applicable domains and dividing them by the number of applicable domains for each respondent. Each participant's AWI score, measuring their diabetes-dependent QOL, was used in the SEM.

Data analysis

For each variable, the mean and SD or number and percentage were calculated. Additionally, Spearman's correlations among the variables in the hypothetical model were computed.

The model was tested using SEM for the primary analysis. SEM is used to analyze complex relationships among multiple variables to test the validity of a theory using empirical models [23]. It also estimates latent (unobserved) variables from observed variables and examines the relationship between multiple variables [23]. In the hypothesized model, the latent variable of QOL was planned to be estimated using the following three indicators: overall QOL, overview diabetes-dependent QOL, and diabetes-dependent QOL (AWI score). Previous studies have reported significant positive correlations between the AWI score and both overall QOL and overview diabetes-dependent QOL [21,22]. In addition, since the AWI score is calculated by aggregating and averaging scores across various life domains, it can be considered to reflect the same conceptual dimension of QOL as overall QOL and overview diabetes-dependent QOL, which ask about general aspects of life. Furthermore, overall QOL is considered to reflect aspects of life affected by factors other than diabetes, while overview diabetes-dependent QOL is considered to reflect aspects of life impacted by diabetes that are not fully represented by the 19 specific domains used to calculate the AWI score. Based on these considerations, it was inferred that the three indicators capture complementary yet conceptually related aspects of diabetes-related QOL, and the authors considered all three indicators essential for a comprehensive assessment of QOL. Despite this rationale, overall QOL and overview diabetes-dependent QOL are single-item measures and thus potentially subject to greater measurement error—which could reduce the reliability of the latent construct and negatively affect the estimation and overall model fit. However, both indicators were designed to measure clearly defined, unidimensional constructs. Under such conditions, single-item measures can show validity comparable to that of multi-item scales [24,25]. Therefore, the authors initially planned to use these three indicators to estimate the latent variable of QOL.

The first step of the SEM was to validate the model that constitutes the latent variable, QOL. Regarding the model that constitutes the latent variable, positive correlations were required between observed variables that were indicators of the same latent variable [26]. Thus, the correlations between the three observed variables of QOL were checked. Subsequently, the causal relationships among the variables in the overall model, that is, the

structural model, were tested. To evaluate the model fit of the structural model, this study used fit indices: χ^2 , comparative fit index (CFI), root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR). The model was considered a good fit with $\chi^2 p$ value $\geq .05$, CFI $>.95$, RMSEA $<.06$, and SRMR $<.08$ [27]. It was also evaluated by the direction, magnitude, and statistical significance of each path coefficient as well as R^2 , which indicated the degree to which the variable was explained by other factors in the model. In the SEM, because the data structure should be explained using a simpler model [28], parameters determined to be unnecessary were removed based on the results of testing the structural model, and clinical and theoretical significance. Finally, the results of testing the final model, which was reduced to non-significant paths, were reported. The parameters were estimated using maximum likelihood.

For all the analyses, $p < .05$ was considered statistically significant. All statistical analyses were conducted using IBM SPSS Statistics for Windows, version 23.0 (IBM Corp., Armonk, N.Y., USA) and IBM SPSS Amos for Windows, version 27.0 (IBM Corp., Armonk, N.Y., USA).

Sample size

Regarding the sample size for SEM, some recommend $N = 100$ – 150 [29], whereas others recommend at least 10 times the number of free parameters [30,31]. Considering the number of free parameters in the hypothetical model was 15, we set the required minimum sample size to 200 to account for missing data.

Results

Participants' characteristics

A total of 236 individuals agreed to participate. Of these, 235 responded to the questionnaires (response rate: 99.6%). Four respondents with inappropriate response styles and eight respondents with incomplete questionnaire were excluded from the analysis because the missing values were regarded as missing completely at random. Finally, data from 223 individuals were analyzed (effective response rate: 94.5%). Table 1 shows the demographic and clinical characteristics of the participants ($N = 223$). The mean HbA1c was 7.5% (58.7 mmol/mol), and 73.1% of the participants did not receive insulin therapy.

Participants' quality of life

Supplementary Table 1 shows the participants' QOL ($N = 223$). Among the WI scores, "freedom to eat" had the lowest score (-2.92 ± 2.89), followed by "freedom to drink" (-2.32 ± 2.61). Diabetes-dependent QOL (measured by the AWI score) showed a high mean score of -1.46 and a small SD of 1.57, despite a potential range of -9 to $+3$.

SEM variables

Table 2 shows the descriptive statistics of the SEM variables and the Spearman's correlations between them. The mean and SD for autonomous motivation, competence, implementation levels, overall QOL, overview diabetes-dependent QOL, and diabetes-dependent QOL were 5.41 ± 1.01 , 4.79 ± 1.22 , 20.40 ± 6.72 , 0.45 ± 0.88 , -1.07 ± 1.03 , and -1.46 ± 1.57 , respectively. The correlation coefficients of autonomous motivation, competence, implementation levels, and overall QOL were .30 or above, and all were significant. However, overview diabetes-dependent QOL had weak, insignificant correlation coefficients of $-.11$ or less with the

Table 1 Participants' Characteristics ($N = 223$).

Characteristics	Mean (SD)	n (%)
Age, y	66.9 (11.0)	
Sex		
Male		161 (72.2)
Female		62 (27.8)
Diabetes duration, y	15.9 (9.3)	
HbA1c, %	7.5 (1.1)	
HbA1c, mmol/mol	58.7 (11.5)	
BMI, kg/m ²	25.4 (4.1)	
Medication regimen for diabetes		
None		11 (4.9)
Orals only		142 (63.7)
Orals + injection		55 (24.7)
Injection only		15 (6.7)
Insulin therapy		
Yes		60 (26.9)
No		163 (73.1)
Diagnosed diabetes complications		
Yes		161 (72.2)
No		62 (27.8)
History of nutritional guidance		
Yes		208 (93.3)
No		15 (6.7)
Marital status		
Not married		24 (10.8)
Married		171 (76.7)
Divorced/widowed		28 (12.5)
Education level		
Up to junior high school		21 (9.4)
High school		68 (30.5)
Vocational schools, junior colleges, technical colleges, universities		134 (60.1)
Employment status		
Employed		118 (52.9)
No income		105 (47.1)
Annual income		
Less than 4 million yen (\$30,000)		154 (69.1)
4–8 million yen		35 (15.7)
8 million yen (\$60,000) or above		30 (13.4)
No answer		4 (1.8)

Note. BMI = body mass index; SD = standard deviation.

other variables in the model, except for diabetes-dependent QOL. Additionally, diabetes-dependent QOL (AWI score) showed a weak, significant negative correlation with competence ($r = -.16$, $p = .019$).

Regarding the three observed variables that constitute the latent variable of QOL, the authors determined that removing overview diabetes-dependent QOL from the model was appropriate because it had weak insignificant correlations with the other variables in the model, except for diabetes-dependent QOL (AWI score). Additionally, because the correlations between the remaining QOL observables, overall QOL and diabetes-dependent QOL (AWI score), were weak and insignificant ($r = -.04$, $p = .533$), the authors determined that these observables should not be combined as common factors for the latent variable of QOL. In summary, as the hypothesized model was found to lack sufficient validity, the authors revised the model and proceeded with the analyses in an exploratory manner.

Structural model testing

Based on the results of the correlation analysis, the latent variable of QOL and overview diabetes-dependent QOL were removed from the hypothetical model, which was then used as the primary analysis model for subsequent exploratory analysis. Although the model fit of the original hypothesized model was initially assessed, the fit indices indicated a poor fit ($\chi^2(6) = 70.58$ ($p < .001$); CFI =

Table 2 Descriptive Statistics and Correlations for Structural Equation Modeling Variables.

Variable	Mean	SD	Correlation (p value)					
			1	2	3	4	5	6
1. Autonomous motivation	5.41	1.01	—					
2. Competence	4.79	1.22	.65 (< .001)	—				
3. Implementation levels	20.40	6.72	.45 (< .001)	.53 (< .001)	—			
4. Overall QOL	0.45	0.88	.30 (< .001)	.42 (< .001)	.42 (< .001)	—		
5. Overview diabetes-dependent QOL	−1.07	1.03	−.04 (.533)	−.09 (.202)	−.04 (.563)	−.11 (.116)	—	
6. Diabetes-dependent QOL (AWI score)	−1.46	1.57	−.10 (.133)	−.16 (.019)	−.06 (.418)	−.04 (.530)	.54 (< .001)	—

Note. AWI = average weighted impact; QOL = quality of life; SD = standard deviation.

.79; RMSEA = .22; SRMR = .11), which did not meet the thresholds for good model fit (χ^2 p value $\geq .05$, CFI $> .95$, RMSEA $< .06$, and SRMR $< .08$). Figure 2 presents the results of testing the primary analysis model. The fit indices of the model were $\chi^2(1) = 0.71$ ($p = .399$), CFI = 1.00, RMSEA = .00, and SRMR = .01. This model thus showed a good fit to the data. Of the paths in the primary analysis model, all the paths to diabetes-dependent QOL and the direct path from autonomous motivation to overall QOL were insignificant. To simplify the model, the final model, which removed the insignificant paths, was established and tested (Figure 3). The fit indices of the final model showed a good fit ($\chi^2(1) = .37$ ($p = .545$), CFI = 1.00, RMSEA = .00, and SRMR = .01). In the final model, the path coefficients ranged from .23 to .60.

Discussion

Through exploratory analysis, this study showed that autonomous motivation for dietary self-care behaviors was positively associated with overall QOL in people with T2D. Regarding the mechanism by which autonomous motivation enhances overall QOL, the results showed that competence and implementation levels were mediators. This suggests that increased autonomous motivation increases competence—a positive psychological sense of being able to engage in diet therapy based on one's own initiative. This will lead to improved psychological aspects of QOL, regardless of the implementation levels of dietary self-care behaviors. Furthermore, in addition to the existing outcome that higher autonomous motivation influences higher implementation levels of dietary self-care behaviors [10–14], engaging in

autonomously motivated dietary self-care behaviors may also improve QOL, an essential goal of self-care behaviors. Interventions to increase autonomous motivation for dietary self-care behaviors in people with T2D could improve their QOL.

Based on the WI scores, regarding the impact of T2D on the participants' QOL, “freedom to eat” was most negatively impacted by T2D and important for QOL. This result was consistent with previous studies [22,32]. For the participants in this study as well as other populations with T2D, it is essential that they are supported to engage in dietary self-care behaviors without impairing their QOL.

In the correlation analysis between the observed variables for the SEM, overview diabetes-dependent QOL showed no significant correlations with the other variables except for diabetes-dependent QOL, and there was no significant correlation between overall QOL and diabetes-dependent QOL (Table 2). Hence, the latent variable of QOL and overview diabetes-dependent QOL were removed from the hypothetical model. The lack of a correlation between overall QOL and diabetes-dependent QOL could be because the participants were only those with T2D, most (73.1%) did not receive insulin therapy, and diabetes-dependent QOL had a high mean score of −1.46 and a small SD of 1.57 (Supplementary Table 1), despite a potential score range of −9 to +3. Given that diabetes-dependent QOL is significantly worse for those taking insulin than those not [21], a population with fewer individuals taking insulin may have a smaller range of diabetes-dependent QOL scores than a larger population such as those with type 1 diabetes. A study using ADDQoL for Asian people with diabetes, including type 1, found that, unlike in the present study, diabetes-

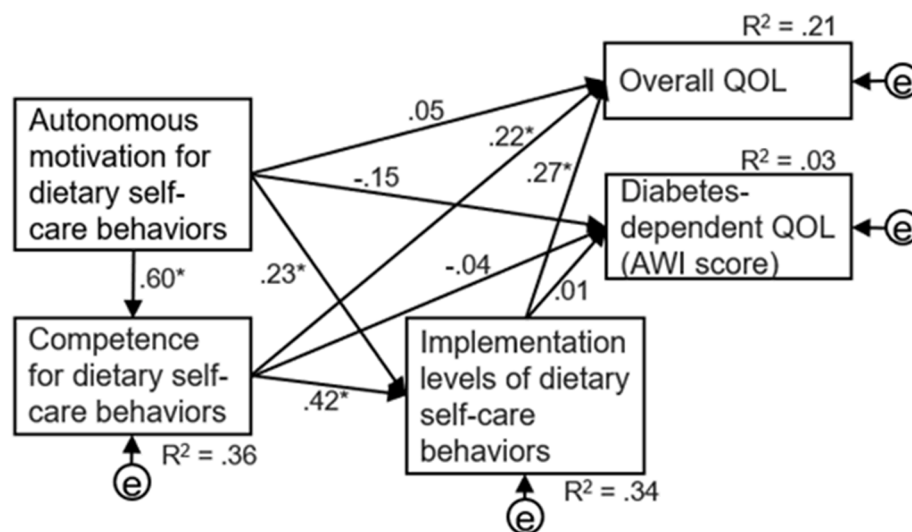


Figure 2. Test of the Primary Analysis Model.

Note. Squares indicate the observed variables; circles with “e” indicate the error terms of each indicator; numerical values near the arrows indicate each path coefficient (* $p < .05$). The fit indices are $\chi^2(1) = 0.71$ ($p = .399$), comparative fit index (CFI) = 1.00, root mean square error of approximation (RMSEA) = .00, and standardized root mean square residual (SRMR) = .01. AWI = average weighted impact; QOL = quality of life.

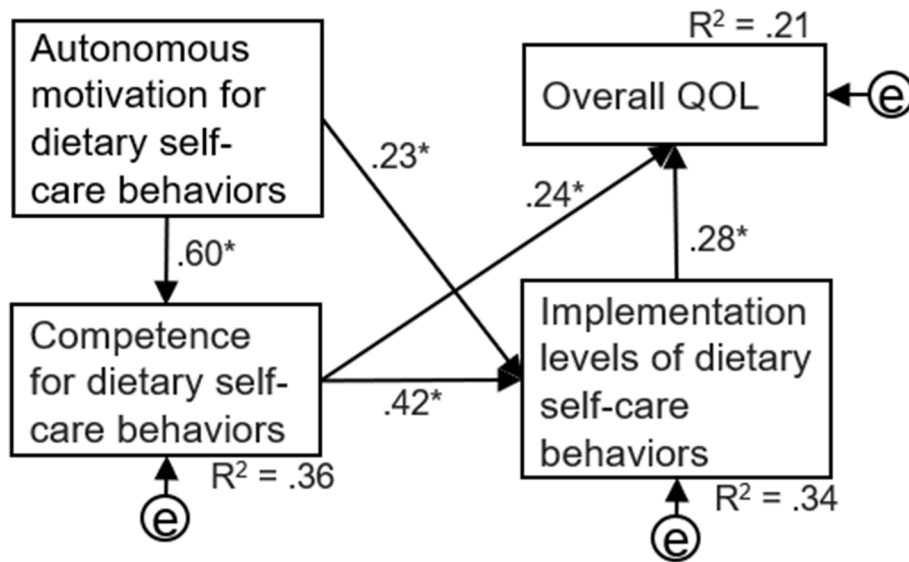


Figure 3. Test of the Final Model.

Note. Squares indicate the observed variables; circles with “e” indicate the error terms of each indicator; numerical values near the arrows indicate each path coefficient ($*p < .05$). The fit indices are $\chi^2(1) = .37$ ($p = .545$), comparative fit index (CFI) = 1.00, root mean square error of approximation (RMSEA) = .00, and standardized root mean square residual (SRMR) = .01. QOL = quality of life.

dependent QOL was significantly positively correlated with both overview diabetes-dependent QOL and overall QOL (correlation coefficients $r = .61$, $p < .001$; $r = .22$, $p < .001$, respectively) [22]. Because most participants in the present study did not receive insulin therapy, there may have been no correlation between overall QOL, which can vary from influences other than diabetes, and diabetes-dependent QOL. These results suggest that in people with T2D, diabetes-dependent QOL, which is “the impact of diabetes on specific domains of life and their importance for QOL,” and overall QOL, which is “the present quality of life in general,” [20–22] are different concepts.

Based on the correlation analysis results, a primary analysis model, which removed the latent variable of QOL and overview diabetes-dependent QOL, was established and tested in an exploratory manner. Although this model showed a good fit, all the paths to diabetes-dependent QOL and the direct path from autonomous motivation to overall QOL were insignificant (Figure 2). A possible reason is that the variability of diabetes-dependent QOL scores was small, resulting in minimal correlations with the other observed variables (Table 2). That is, in people with T2D, diabetes-dependent QOL, “the impact of diabetes on specific domains of life and their importance for QOL” may not be influenced by autonomous motivation, competence, or implementation levels of dietary self-care behaviors. Regarding the lack of a significant direct path from autonomous motivation to overall QOL, the study by Ng et al. also showed that its impact on subjective outcomes, including QOL, was small (path coefficient of .04) [9]. Therefore, competence and implementation levels of dietary self-care behaviors could mediate the effect of autonomous motivation on overall QOL in people with T2D.

To create a simpler model, a final model that removed insignificant paths and diabetes-dependent QOL from the primary analysis model was established and tested. The fit indices of the final model showed a good fit (Figure 3) and were similar to those of the primary analysis model. Although the model did not show a substantial improvement in fit indices, caution is warranted regarding the potential risk of overfitting due to the removal of non-significant paths. In the final model, the three pathways through which autonomous motivation increased overall QOL

through competence and implementation levels were significant. The first pathway was that autonomous motivation positively influenced overall QOL through competence alone. The second pathway was that autonomous motivation positively influenced overall QOL through implementation levels alone. The third pathway was that autonomous motivation positively influenced overall QOL by first enhancing competence and, subsequently, implementation levels.

First, the finding that autonomous motivation had a significant pathway to increasing overall QOL through competence only, not through implementation levels, aligns with findings regarding medication behaviors in people with diabetes [2]. As stated in SDT, competence is a basic psychological need, and satisfying this need facilitates well-being [7]. Increased autonomous motivation may create positive feelings of engaging in dietary self-care behaviors on one’s own initiative, leading to better psychological aspects of QOL regardless of the implementation levels of dietary self-care behaviors.

Second, the finding that autonomous motivation had a significant pathway to increase overall QOL through implementation levels adds to the previous finding that autonomous motivation for dietary self-care behaviors positively affects the implementation levels of those behaviors in people with T2D [10–14]. Since self-care behaviors in people with diabetes are recommended for their optimal health and QOL [33], it was important that this study identified the potential impact of autonomous motivation on QOL. This is supported by the need to “be able to engage in dietary modifications on my own” for people with T2D [34]. Based on SDT [5], motivation based on the need to act according to one’s own values is autonomous motivation. Implementing dietary self-care behaviors based on autonomous motivation may satisfy this need and lead to a higher perception of the psychological aspects of QOL in people with T2D.

Third, regarding the pathway through which autonomous motivation increased overall QOL through both competence and implementation levels, the path coefficient from competence to implementation levels was significant at .42, indicating a moderate effect. Given that competence is a concept similar to self-efficacy, a significant predictor of behavior [35], it showed larger

effects than those of the paths between the other variables. The second and third pathways through implementation levels provide preliminary evidence with potential clinical relevance that people with T2D could improve their QOL, which is an important outcome, if they engage in autonomously motivated dietary self-care behaviors.

This study has three limitations. First, the hypothetical model was modified because the subscales of the ADDQoL used to estimate the latent variable of QOL showed no significant correlations. As the observed variable for overall QOL in the final model used the score of a single Likert scale, future studies must investigate whether similar results can be obtained using a reliable and valid general QOL scale such as the “schedule for the evaluation of individual quality of life,” which allows respondents to nominate, weight, and rate dimensions of life areas considered important from their perspective [36]. Second, the final model should be regarded as exploratory in nature, as it was based on a modified version of the initial hypothetical model rather than a strictly theory-driven model. Further validation, including cross-validation using independent samples, is warranted to assess the replicability and robustness of the model structure. Third, because participants were from a single university hospital in Japan, their severity of diabetes may be higher than the average for people with T2D (for this study vs. a Japanese multicenter study; A1c: 7.5% vs. 7.1%, insulin therapy: 26.9% vs. 19.3%) [37]. Hence, our participants' QOL may be lower than the average for people with T2D, whereas autonomous motivation for and implementation levels of dietary self-care behaviors may be higher. Therefore, caution should be exercised when generalizing the results.

Practical implications

Although the final model was exploratory in nature due to modifications from the initial hypothetical model, this study showed an association between autonomous motivation for dietary self-care behaviors and QOL in people with T2D attending an outpatient diabetes department at a university hospital considered to provide care in accordance with guidelines. Although dietary self-care behaviors in people with T2D may interfere with their QOL, this study suggests that enhancing autonomous motivation for dietary self-care behaviors in people with T2D by nurses may increase both their competence for and their implementation levels of dietary self-care behaviors, improving their QOL in medical institutions with diabetes specialists, such as the participants in this study. Autonomous motivational support in the healthcare setting includes listening and understanding patients' perspectives, providing meaningful information when appropriate, accepting their needs and anxieties, and allowing them to make their own choices without criticizing or judging them [38]. For people with type 1 diabetes, guided self-determination (GSD) has been developed to increase autonomous motivation for self-care behaviors [39,40]. In the GSD intervention, participants complete a worksheet to provide information on their goals and experiences related to self-care behaviors, the perceived advantages and disadvantages of such behaviors, and the reasons for engaging in them before the interview [39]. Using this GSD intervention as a reference, future research might develop useful interventions to increase autonomous motivation for dietary self-care behaviors in people with T2D. Additionally, given that this study showed that competence and implementation levels are mediating variables between autonomous motivation and QOL in people with T2D, nurses could effectively improve QOL by continuing the intervention

while confirming increased competence and implementation levels of dietary self-care behaviors.

Conclusion

This study investigated the relationship between autonomous motivation for dietary self-care behaviors and QOL in people with T2D. The results showed that autonomous motivation for dietary self-care behaviors positively associated with overall QOL through competence and implementation levels of dietary self-care behaviors. Although the final model was exploratory due to modifications from the initial hypothetical model, the findings highlight the central role of autonomous motivation in enhancing QOL. This suggests that QOL can be improved if autonomous motivation motivates dietary self-care behaviors in people with T2D. Further validation, including cross-validation using independent samples, is warranted to assess the replicability and robustness of the model structure. Based on such validation, developing and evaluating future interventions to increase autonomous motivation for dietary self-care behaviors in people with T2D is recommended to foster positive psychological and behavioral changes and improve their QOL.

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Conflict of interest

The authors declare that they have no conflict of interest.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.anr.2025.08.001>.

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Supplementary table

Supplementary Table 1. Participants' Quality of Life.

Variable		Number of applicable participants	Mean	SD
Overall QOL		223	0.45	0.88
Overview diabetes-dependent QOL		223	-1.07	1.03
Diabetes-dependent QOL (AWI score)		223	-1.46	1.57
WI_1	Leisure activities	223	-1.89	2.52
WI_2	Working life	130	-1.87	2.46
WI_3	Local or long-distance journeys	223	-1.26	2.16
WI_4	Holidays	186	-1.66	2.38
WI_5	Physical health	223	-1.40	2.11
WI_6	Family life	211	-1.64	2.49
WI_7	Friendship and social life	223	-1.36	2.35
WI_8	Having close personal relationships	188	-2.07	2.85
WI_9	Sex life	88	-1.50	2.02
WI_10	Physical appearance	223	-0.98	1.91
WI_11	Self-confidence	223	-1.40	2.12
WI_12	Motivation	223	-1.45	2.25
WI_13	People's reaction	223	-0.70	1.65
WI_14	Feelings about the future	223	-1.80	2.36
WI_15	Financial situation	223	-0.89	1.79
WI_16	Living conditions	223	-0.56	1.56
WI_17	Dependence on others	223	-0.75	1.61
WI_18	Freedom to eat	223	-2.92	2.89
WI_19	Freedom to drink	223	-2.32	2.61

Note. AWI = average weighted impact; QOL = quality of life; SD = standard deviation; WI = weighted impact.