ORIGINAL RESEARCH

Social Support for Thai Adults with Type 2 Diabetes: A Case–Control Study

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Background: Non-communicable diseases, including type 2 diabetes (T2DM), are the number one cause of death in Thailand. With its well-known social networking and strong kinship, evidence of social support may be a potential of low-cost approach for T2DM self- management. Social support is quite important for T2DM prevention and control but such evidence in Thai setting is still limited. Therefore, we aimed to study social support and associated determinants for T2DM patients compared to non-diabetes people.

Methods: An observational study with a case–control study design was conducted in Chiang Mai, Thailand, in 2019–2020. Using inclusion and exclusion criteria, a total of 300 participants: 150 cases, 150 controls were recruited. Participants were selected based on outcome status of having "T2DM". Cases were defined as newly diagnosed (diagnosis of T2DM within 6 months) adult Thai residents and community controls were non-diabetes participants from the same residential area of cases. Data were analyzed by STATA 17. Descriptive analysis compared the characteristics between case and control group. The relation between social support and T2DM was investigated using multivariable Robust regression analysis.

Results: About 96.7% of T2DM patients had good social support. T2DM had a significant association with social support in all models defined by potential confounders. Social support was significantly positively associated with having family mealtimes in model 2 and model 3 and increasing age in model 2. BMI and T2DM family history had significant negative association in model 2 and model 3.

Conclusion: Social support of Thai T2DM patients is higher than control group. It can either be originated from a newly acquired peer groups network or from the positive social support by family. Future research should focus on behavioral intervention including family and peers to help them understand their role in life-style modification and management of such a prevalent chronic disease.

Keywords: diabetes, family, global health, NCDs, social support, Thailand

Introduction

Diabetes (hereto referred to as Type 2 Diabetes (T2DM)) is a growing chronic disease that can lead to long-term distressing situations with serious complications. Globally, 537 million adults (20–79 years) are living with diabetes, as reported by the International Diabetes Federation in 2021. It has become a major public health challenge affecting 1 in 10 individuals (20–79 years) worldwide. Amongst them, 90 million individuals with diabetes are residing in the South East Asia region.[1] Thailand is regarded as an upper-middle-income country by the World Bank[2] and epidemiological risk factors may change with its growing economy. Non-communicable diseases (NCDs) are the number one cause of death in Thailand, comprising 74% of total deaths.[3] The four major NCDs (cardiovascular diseases, diabetes, cancer, and respiratory diseases) have a significant negative impact on the Thai economy where diabetes constitutes 23% of the economic burden of NCDs and 4% of total deaths among all ages were due to diabetes.[4,5] According to the International Diabetes Federation, the age adjusted comparative prevalence of diabetes (20–79 years of age) in Thailand was 11.6% in

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2021.[6] The Thailand Ministry of Public Health also estimated that 5 million Thai people, or one in every eleven people over 15 years of age, were affected by diabetes in 2020.[7] Local people in the Northern region of Thailand have special cultures such as consumption of sticky rice and oily dishes in their daily lives with increased risk of metabolic syndrome.[8–10] According to the Thai Health Statistics 2021, among 13 regions in Thailand, Northern region is reported as having the top sixth highest prevalence of T2DM among people aged over 15 years and Chiang Mai ranked fifth out of eight provinces in the Northern Region.[11,12]

Individuals living with such a chronic disease condition, T2DM need medical and nursing services which are often costly and limited in community settings both in developing and developed countries.[13] In Thailand, nurses in the primary care unit play a major role in providing health education for people with T2DM. However, nurses cannot meet all demands and only one-third of the primary care units offering diabetes education services can be delivered by nurses.[14] In Thai culture with strong kinship and family ties, family members usually provide support to people with diabetes in terms of physical, mental, economic, and social support. Family support has been evident to influence diabetes self-management by helping the individual prepare healthy food, prompting medication adherence and physical activity, and facilitating access to healthcare professionals.[15] It has been evident that both general social support and diabetes-related support are in positive correlation with the adherence to self-care behaviors of patients with T2DM.[16] According to House JS, Kahn RL (1985),[17] social support refers to several different aspects of social relationships and it can sometimes be defined conceptually or operationally in terms of quantities or existence of general or particular types of social relationships. Schaefer et al, 1981 defined three primary types of social support in the context of interpersonal relationships such as emotional, informational, and tangible. Emotional support is represented by direct behaviors involving empathy and compassion. Informational support involves sharing knowledge of specific social experiences to help other people. Tangible support provides resources such as money, and assisting with tasks.[18] Moderating effects of social support on diabetes outcomes may be exerted via the direct effects of social support to encourage healthy behaviors or indirectly via improving compatibility with the acute and chronic nervous pressure on health.[19]

Social support has been studied and is an independent factor in improving medication adherence and self-care management for T2DM patients.[20–23] The evidence of the importance of social support and social networks for chronic disease management is growing; however, excessive control from family members can negatively influence T2DM self-care.[24] A research on the quality of life of T2DM patients in a suburban tertiary hospital, near Bangkok, Thailand showed that overall social support was significantly and positively associated with quality of life of study participants.[25] Regarding social support in Thai contexts, studies of social support for cancer patients, elderly people, and people living with HIV have been reported; however, social support for T2DM patients as well as in comparison with persons without T2DM are still limited.[26–28] Thailand is well known for its strong social networking and assessment of social support and associated impacts on the health status of diabetes patients would be useful for consideration of public health strategies. Evidence of social support may be a potential for low-cost approach to promote health in the primary care setting and T2DM self- management.[29] Therefore, we aimed to study social support and associated determinants for T2DM patients compared to non-diabetes people in the community of Northern Thailand.

Materials and Methods
Study Setting and Participants
This study was conducted following the guidelines in the Declaration of Helsinki.[30] Ethical approval was obtained from the Review Committee for Research on Human Participants, Chiang Mai Provincial Health Office and the Ethical Review Board of the Juntendo University, Tokyo, Japan (authorization number 2017141). An observational study with a case–control study design was conducted in 2019–2020. The main research project included three different components: nutrition characteristics, physical activity, and social support among T2DM patients and non-diabetes persons in Thailand and Myanmar. We used different cross-culturally translated research instruments, research variables, analysis, findings and implications for each component. Findings about the nutrition characteristics, physical activity of Thai and Myanmar participants, and social support for Myanmar participants from the same study have been published.[31–35] The current study is about the social support and associated determinants for Thai T2DM patients compared to non-diabetes

participants in the Northern Thailand setting. The sample size of this study was calculated using STATA version 15.1 (Stata Corporation, College Station, TX). A precision level with a *P* value of 0.05 and a 95% confidence interval was applied and a total of 300 participants,150 participants were recruited in each case and control group. The study site was in Sanpatong district, Chiang Mai, Northern Thailand, and the eligible criteria to define the study population consisted of Thai citizens aged 25 to 74 years of both genders residing there for more than 6 months. The exclusion criteria were as follows: those who were not willing to participate, seriously ill people (eg, hospitalized patients, kidney diseases), long-term modification of diet due to any reason such as meditation, pregnant women, institutionalized individuals, and temporary residents (those living in Chiang Mai region for less than 6 months).

Selection Criteria for Case and Control Groups

Both case and control groups met the eligible criteria and participants in each group were defined to have a clear difference of outcome status "T2DM" between the case and control groups.

Case group definition: "Cases" were defined as newly diagnosed T2DM patients between 25 and 74 years of age (diagnosis of T2DM within 6 months before data collection) who were attending the diabetes clinic of the Sanpatong District Hospital, Chiang Mai. Diagnostic criteria for T2DM are according to the Thailand National Guideline for Diabetes, fasting plasma glucose level ≥126 mg/dL and/or 2 hours Oral Glucose Tolerance Test (OGTT) ≥200 mg/dL.

Control group definition: "Controls" in this study were defined as 'Community controls" who were non-diabetes participants from the same residential area of the case. Non-diabetes status was verified by negative result from a plasma glucose test.

Measurements

Assessment of Social Support by the ENRICHD Social Support Inventory (ESSI)

Social support was assessed by using the 7-item ESSI questionnaires.[36] It measures social support concerning emotional, instrumental, informational, and appraisal domains. Each item of ESSI except Q7 was responded to scores ranging from "1 (none of the time) to 5 (all of the time)". Q7: "Are you currently married or living with a partner?" is a Yes/No type of question. A total score of ≤18 and a score of ≤3 in at least 2 items, excluding items 4 and 7 was defined as low social support by the criteria of the ENRICHD protocol (Version 7.0).

Following the WHO process of research instruments translation and adaptation,[37] all questionnaires were forward and backward translated by independent language experts and edited by a panel of bilingual researchers. The readability and comprehensiveness of the questionnaires were tested in a pilot study including 30 Thais, and several revisions and editions were done by the research team to produce the final version of the questionnaires. The internal consistency (Cronbach's alpha) of the Thai version of the 7-item ESSI was 0.89 and that of the International Physical Activity Questionnaire–short form (IPAQ-SF) was 0.92 from the pilot study which approved the feasibility, reliability, and validity of the proposed study design.

Data Collection

This study was conducted in the Sanpatong district hospital which covers healthcare for residents via twenty primary care units (PCUs). A free routine health check-up for the residents above the age of 40 years is conducted at the community level (PCUs) once a year. Those suspected of T2DM are referred to the diabetes clinic of Sanpatong district hospital for further treatment and stable T2DM patients continue regular follow-up visits at the local PCUs. The potential participant lists for the eligible case and control groups were initially screened from the PCU registers. We used eligible criteria to recruit the study participants for both case and control groups. The participants were selected based on outcome status of having "T2DM" which was the clear contrast between case and control group. An appointment for an individual in-person interview was made when the eligible participants were explained about the study and agreed to take part in.

Data collection was done using face-to-face interviews by well-trained research assistants until the required sample size was reached. All eligible participants were recruited with their written informed consent. Structured questionnaires included sociodemographic characteristics (age, gender (male, female), marital status (single, divorced, currently married), educational level (no formal education, the primary school completed, the secondary school completed and above), estimated monthly household income (below average or average and above), current employment status

(currently employed or unemployed), and living condition (living alone or live with someone), having a family history of diabetes or not, health behaviors (smoking behavior, alcohol consumption, and physical activity by the IPAQ-SF). It is a common tool to measure physical activity (PA) with seven questions.[38] The frequencies of mealtime with family and dining out over the past week were assessed by using the questionnaires with five response options such as "Never/very rarely", "rarely", "1–2 times/week", "3–4 times/week", "5–6 times/week", or "everyday/week". The social support status of the study participants was assessed using a validated transcultural translated version of the ENRICHD Social Support Instrument. After the interview, anthropometric measurements (weight, height, BMI) and blood pressure measurements were done.

Data Analysis

Final analysis included a total of 300 participants: 150 case group and 150 control group. All statistical analyses were performed using the STATA version 17 SE (Stata Corporation, College Station, TX, USA). Descriptive analysis was applied to express continuous variables as a mean with standard deviation, and categorical variables as a percentage. Some continuous variables were categorized using suitable standard cut-offs such as categories of blood pressure measurements into two groups, normal BP (<140/90 mmHg) and high BP (≥140/90 mmHg). Physical activities are categorized into three groups: 1, "low" (some activity is reported but not enough to meet categories 2 or 3); 2, "moderate" (meets any of the following three criteria: (a) 3 days of vigorous activity for at least 20 min/day; (b) 5 days of moderate-intensity activity or walking for >30 min/day for >10 min at a time; or (c) 5 days of any combination of walking, moderate-intensity or vigorous-intensity activities achieving at least 600 METs min/week); and 3, "high" (meets either of two criteria: (a) vigorous-intensity activity >3 days/week, collecting at least 1500 METs min/week; or (b) >5 days of any combination of walking, moderate-intensity, or vigorous-intensity activities achieving at least 3000 METs min/week). These moderate, vigorous physical activities and walking are then categorized into dichotomous scales of "no activity" and "at least 1 day/ week". The "*T*-test" or "Mann–Whitney *U*-test" and "Chi-square test" were used to make the comparison of continuous and categorical variables between the case and control groups (Tables 1 and 2). Six items of ESSI were compared between case and control groups in a single analysis using Multivariate analysis of variance (MANOVA) (Table 3). The association between social support for T2DM patients and non-diabetes participants was investigated using multivariable Robust regression analysis (Table 4). Social support, in the form of a continuous variable, was analyzed as a dependent variable and three models of model 1, model 2, and model 3 were applied to test the association between the dependent and independent variables adjusting various confounders. Covariates in model 1 were case/control, age, gender, level of education, marital status, household income, and living condition; family history of diabetes and mealtimes with family were variables in model 2, in addition to model 1; variables in model 3 were those in the model 2 plus physical activity; walking and BMI.

Results

Characteristics of Study Participants

The final analysis included 300 Thai citizens (150 T2DM patients and 150 non-diabetes participants). When making a comparison between the characteristics of participants in the case group (n=150) and the control group (n=150), there was no significant difference in the mean age of study participants (58.8 ± 8.4 years vs 56.5 ± 9.9 years). The proportion of male participants was significantly higher in the case group than in the control group (42.0% vs 27.3%). The participants in the case group had significantly higher average monthly household income (22.8% vs 13.3%) and a family history of diabetes (36.7% vs 14.7%) compared to the controls. There was no significant difference in marital status, level of education, current employment status, or living conditions between the two groups. (Table 1).

Health Assessments of Study Participants

Health assessments included the assessment of tobacco smoking, alcohol drinking, physical activity, BMI, and blood pressure measurements. More than half of the study participants (54.3%) never drink alcohol and the proportion of participants in the case group who never drink alcohol was significantly higher than that of the control group (70.0% vs 38.7%). When assessing physical activity, the participants in the case group had significantly higher vigorous activity and

Table 1 Characteristics of Study Participants

	Case (n=150) n (%)	Control (n=150) n (%)	Total (n=300) n (%)	p-value
Age mean±SD	58.8 ± 8.4	56.5 ± 9.9	58.8 ± 9.1	0.09
Sex				
Male	63 (42.0)	41 (27.3)	104 (34.7)	0.01
Female	87 (58.0)	109 (72.7)	196 (65.3)	
Education				
No formal schooling	13 (8.7)	19 (12.7)	32 (10.7)	0.08
Primary school	94 (62.7)	75 (50.0)	169 (56.3)	
Secondary school and above	43 (28.6)	56 (37.3)	99 (33.0)	
Employment				
Currently employed	108 (72.0)	98 (65.3)	206 (68.7)	0.21
Unemployed or elderly	42 (28.0)	52 (34.7)	94 (31.3)	
Marital status				
Single	16 (10.7)	13 (8.7)	29 (9.7)	0.68
Divorce	25 (16.7)	30 (20.0)	55 (18.3)	
Currently married	109 (72.6)	107 (71.3)	216 (72.0)	
Living condition				
Living alone	7 (4.7)	11 (7.3)	18 (6.0)	0.34
Live with someone	142 (95.3)	139 (92.7)	281 (94.0)	
Household income				
Below average	115 (77.2)	130 (86.7)	245 (81.9)	0.03
Average and above	34 (22.8)	20 (13.3)	54 (18.1)	
Family history of diabetes				
Yes	55 (36.7)	22 (14.7)	77 (25.7)	<0.01
No	95 (63.3)	128 (85.3)	223 (74.3)	

Notes: A simple *t*-test or Mann–Whitney *U*-test was used to compare continuous variables, and the chi-square test was used to compare categorical variables between case and control. p-value < 0.05 statistically significant, p-value < 0.01 statistically strongly significant.
Abbreviation: SD, Standard Deviation.

walking than the control group (72.0% vs 37.3%) and (92.0% vs 65.3%), respectively. No significant differences in moderate physical activity, tobacco smoking, blood pressure, and BMI between the case and control groups were noted (Table 2).

Social Support Status of the Study Participants

Seventy percent of total participants had mealtimes with family every day and the case group had significantly higher everyday mealtimes with family than the control group (70.6% vs 66.9%). There was no significant difference in the frequency of dining out between the two groups. The social support status of the study participants in the case and control

Table 2 Health Assessment of Study Participants

	Case (n=150) n (%)	Control (n=150) n (%)	Total (n=300) n (%)	p-value
Vigorous PA per week				
No activity	42 (28.0)	94 (62.7)	164 (54.7)	<0.01
At least 1 day/ week	108 (72.0)	56 (37.3)	136 (45.3)	
Moderate PA per week				
No activity	68 (45.3)	60 (40.0)	128 (42.7)	0.35
At least 1 day/ week	82 (54.7)	90 (60.0)	172 (57.3)	
Walking days per week				
No activity	12 (8.0)	52 (34.7)	64 (21.3)	<0.01
At least 1 day/ week	138 (92.0)	98 (65.3)	236 (78.7)	
Smoking tobacco				
Never smoke	112 (74.7)	110 (73.4)	222 (74.0)	0.78
Former smoker	19 (12.7)	23 (15.3)	42 (14.0)	
Current smoker	19 (12.6)	17 (11.3)	36 (12.0)	
Alcohol				
Never drink	105 (70.0)	58 (38.7)	163 (54.3)	<0.01
Quit drinking	10 (6.7)	34 (22.7)	44 (14.7)	
Current drinker	35 (38.7)	58 (38.6)	93 (31.0)	
BMI (kg/m2) mean ± SD	24.82±4.81	24.01±3.68	24.41±4.29	0.32
Blood pressure (mmHg)				
Normal BP (<140/ 90)	110 (73.3)	119 (79.3)	229 (76.3)	0.22
High BP (≥140/90)	40 (26.7)	31 (20.7)	71 (23.7)	

Notes: A simple *t*-test or Mann–Whitney *U*-test was used to compare continuous variables, and a chi-square test was used to compare categorical variables between case and control. p value < 0.05 statistically significant, p value < 0.01 statistically strongly significant.
Abbreviations: SD, Standard Deviation, PA, Physical Activity, BMI, Body Mass Index, BP, Blood Pressure.

group was determined by the ENRICHD Social Support Inventory (ESSI). The mean scores of all six items (Q1 to Q6) were compared in a single analysis by using the MANOVA test, and means of all items were significantly higher among the T2DM patients compared to the control group participants. The highest mean score of ESSI item for T2DM patients was for Q3 "Is there someone available to you who shows you love and affection? (4.8±0.45). For the Q7 "Are you currently married or living with a partner?", about 77.3% of study participants from the case group lived together with their spouse or other relatives whereas 66.0% of control group participants lived with their spouse or other relatives (p-value <0.01, chi-squared). There was a significant difference in the mean total score of social support between the participants of the case and control group (23.6±2.16 vs 22.1±3.72). Regarding the level of perceived social support, T2DM patients had a significantly greater proportion of high levels of social support when compared to the persons without T2DM (96.7% vs 80.0%). (Table 3) The presence of type 2 diabetes had a strongly significant association with the level of social support in all models of the multivariable Robust regression analysis defined by potential confounders. (p-value <0.01) Age had a significant positive association with total social support in model 2. Having a family history of

Table 3 Social Support Status of Study Participants

		Case (n=150)	Control (n=150)	p-value
Mealtime with family				<0.01
Never or hardly	10 (6.7)	30 (20.3)	40 (13.4)	
1–2 times/week	4 (2.7)	9 (6.1)	13 (4.4)	
3–4 times/week	29 (19.3)	7 (4.7)	36 (12.1)	
5–6 times/week	1 (0.7)	3 (2.0)	4 (1.3)	
Everyday	106 (70.6)	99 (66.9)	205 (68.8)	
Eating out				0.69
Never or hardly	21 (14.1)	29 (19.6)	50 (16.8)	
1–2 times/week	54 (36.2)	46 (31.1)	100 (33.7)	
3–4 times/week	55 (36.9)	52 (35.1)	107 (36.0)	
5–6 times/week	7 (4.7)	9 (6.1)	16 (5.4)	
Everyday	12 (8.1)	12 (8.1)	24 (8.1)	
Social support assessment by ESSI				
Q 1. Is there someone available to you whom you can count on to listen to you when you need to talk?	Mean ± SD	4.7±0.53	4.3±0.92	<0.05
Q 2. Is there someone available to give you good advice about a problem?	Mean ± SD	4.7±0.58	4.4±0.82	<0.05
Q 3. Is there someone available to you who shows you love and affection?	Mean ± SD	4.8±0.45	4.5±0.78	<0.01
Q 4. Is there someone available to help you with daily chores?	Mean ± SD	4.6±0.66	4.2±1.08	<0.01
Q 5. Can you count on anyone to provide you with emotional support (talking over a problem or helping you make a difficult decision)?	MEAN ± SD	4.7±0.53	4.4±0.82	<0.01
Q 6. Do you have as much contact as you would like with someone you feel close to, someone with whom you can trust and confidence?	Mean ± SD	4.7±0.59	4.4±0.84	<0.01
Q 7. Are you currently married or living with a partner?	N (%)			
Yes		116 (77.3)	99 (66.0)	<0.05
No		34 (22.7)	51 (34.00)	
Total social support scores (Q 1–7)	Mean ± SD	23.6±2.16	22.1±3.72	<0.05
Perceived social support	N (%)			
High		145 (96.7)	120 (80.0)	<0.01
Low		5 (3.3)	30 (20.0)	

Notes: The test used in the analysis of ESSI items was the MANOVA test. p-value < 0.05 statistically significant, p-value < 0.01 statistically strongly significant. ESSI items are adapted with permission from Mitchell PH, Powell L, Blumenthal J, et al. A short social support measure for patients recovering from myocardial infarction: the ENRICHD Social Support Inventory. *J Cardio Rehabil Prev*. 2003;23(6):398–403. Available from: https://journals.lww.com/jcrjournal/citation/2003/11000/a_short_social_support_measure_for_patients.1.aspx.[36]

diabetes had a significant negative association with social support whereas mealtimes with family had a significant positive association both in model 2 and model 3. BMI had a negative association with social support significantly in model 3 (Table 4).

Table 4 Multivariable Robust Regression Analysis, Indicating the Relation Between Diabetes and Social Support Defined by the Potential Confounders

	Univariate		Model 1		Model 2		Model 3	
	Coef. (95% CI)	p-value	Coef. (95% CI)	p-value	Coef. (95% CI)	p-value	Coef. (95% CI)	p-value
Case-control								
Control (ref:)								
Case	1.55 (0.86 to 2.02)	<0.01	1.60 (0.83 to 2.37)	<0.01	1.56 (0.78 to 2.34)	<0.01	1.66 (0.81 to 2.51)	<0.01
Age	0.03 (−0.01 to 0.06)	0.02	0.03 (−0.01 to 0.08)	0.14	0.04 (−0.01 to 0.08)	0.01	0.03 (−0.01 to 0.08)	0.15
Sex								
Male (ref:)								
Female	−0.24 (−0.99 to 0.51)	0.53	0.32 (−0.54 to 1.18)	0.47	0.46 (−0.39 to 1.30)	0.11	0.03 (−0.01 to 0.08)	0.23
Household income								
Below average (ref:)								
Above average	0.90 (−0.02 to 1.82)	0.06	0.61 (−0.29 to 1.52)	0.18	0.59 (−0.28 to 1.47)	0.29	0.51 (−0.33 to 1.36)	0.10
Education								
No formal schooling (ref:)								
Primary school	−0.26 (−1.45 to 0.93)	0.67	−0.57 (−1.74 to 0.61)	0.34	−0.53 (−1.67 to 0.61)	0.36	−0.58 (−1.71 to 0.55)	0.32
Secondary school and above	−0.35 (−1.61 to 0.91)		−0.28 (−1.60 to 1.04))	0.68	−0.21 (−1.47 to 1.06)	0.75	−0.18 (−1.44 to 1.08)	0.78
Marital status								
Single (ref:)								
Divorce	−0.43 (−1.82 to 0.97)	0.55	−0.60 (−2.07 to 0.87)	0.42	−1.15 (−2.59 to 0.28)	0.12	−1.33 (−2.77 to 0.11)	0.07
Currently married	1.02 (−0.18 to 2.22)	0.10	0.66 (−0.58 to 1.89)	0.30	−0.10 (−1.33 to 1.13)	0.87	−0.26 (−1.50 to 0.97)	0.68
Alcohol								
Never drink (ref:)								
Quit drinking	−0.55 (−1.60 to 0.50)	0.30	0.22 (−0.91 to 1.34)	0.71	0.32 (−0.75 to 1.40)	0.56	0.38 (−0.70 to 1.46)	0.49
Still drinking	0.02 (−0.78 to 0.82)	0.96	0.62 (−0.30 to 1.55)	0.19	0.78 (−0.11 to 1.66)	0.09	0.83 (−0.05 to 1.72)	0.07

	Univariate		Model 1		Model 2		Model 3	
Living condition								
Alone (ref:)								
Live with someone	1.87 (0.39 to 3.36)	0.01	1.07 (−0.48 to 2.63)	0.18	0.66 (−0.89 to 2.21)	0.41	0.75 (−0.81 to 2.31)	0.34
Family history of diabetes								
No (ref:)								
Yes	−0.57 (−1.38 to 0.25)	0.17			−0.99 (−1.79 to −0.19)	0.02	−0.93 (−1.73 to −0.14)	0.02
Mealtime with family								
Never or hardly (ref:)								
1–2 times/week	2.23 (0.38 to 4.08)	0.02			2.12 (0.28 to 3.96)	0.02	2.10 (0.26 to 3.94)	0.03
3–4 times/week	2.23 (0.98 to 3.64)	0.01			1.50 (0.10 to 2.90)	0.03	1.42 (0.01 to 2.83)	0.05
5–6 times/week	1.18 (−1.87 to 4.28)	0.45			1.00 (−2.03 to 4.03)	0.52	1.06 (−1.96 to 4.08)	0.49
Everyday	2.13 (1.13 to 3.13)	<0.01			1.53 (0.43 to 2.62)	0.01	1.46 (0.36 to 2.56)	0.01
Walking days per week								
No activity								
At least 1 day/ week	0.90 (0.03 to 1.76)	0.04					−0.03 (−0.90 to 0.85)	0.95
Vigorous activity days per week								
No activity								
At least 1 day/ week	0.54 (−0.17 to 1.26)	0.01					0.01 (−0.73 to 0.74)	0.99
BMI (kg/m2)	−0.09 (−0.17 to −0.1)	0.03					−0.12 (−0.19 to −0.02)	0.02

Notes: Univariate represents univariable robust regression, and models represent multivariable Robust regression analysis model. p-value < 0.05 statistically significant, p-value < 0.01 statistically strongly significant. The powers of model 2 and model 3 were 80% with a sample of 300. Model 1: Adjustment for age, gender, marital status, education, household income, alcohol drinking, and living condition, model 2: model 1+ family history of T2DM, and mealtime with family, model 3: model 2 + walking, vigorous physical activity, and BMI.
Abbreviations: CI, Confidence Interval, T2DM, Type 2 Diabetes Mellitus, BMI, Body Mass Index.

Discussion

About 96.7% of study participants with T2DM had good social support. We also noted social support status of Thai diabetes patients was significantly higher than that of non-diabetes participants (Table 3). The prevalence of good social support among our study participants is higher than in other studies where 22.9% of diabetes patients at the sub-urban tertiary hospital near Bangkok had good social support, 51.3% of study participants in Malaysia public primary care clinic, and 71.3% of diabetes patients in Myanmar private clinics.[25,33,39] The differences in the extent of social support among diabetes patients may result from different research instruments used to measure social support. The warmth and love from family and friends had a positive effect on health behaviors and medication adherence of diabetes cases. Self-management activities of T2DM were strongly associated with better clinical outcomes and social support had a significant moderating effect on self-management activities and HbA1C outcomes in another study in Thailand.[22] According to Thai culture, older adults still have other possible active social roles within their local communities[40] which could support our findings of a positive association of social support with increasing age in the multi-variable Robust regression analysis model 2 (Table 4).

When exploring the factors associated with better social support for case groups, our study noted the importance of family involvement in addition to the other common supporting factors for social support in the Thai context. Having mealtimes with family and the frequency of eating outside can assess how close patients and their family members are and how much time patients spend with their family in a single day. Having mealtime with family had a positive significant association with social support among case participants compared to control participants. This finding is consistent with other studies, eating meals together with family was advantageous to the health of patients with diabetes. In a study conducted in Myanmar, the score of perceived social support had a positive association with frequent meal times with family among diabetes patients when compared to non-diabetes participants.[33] Another study among Korean immigrants noted that family support, specific to diet had a significant positive association with clinical outcomes like blood glucose control.[41] Active family nutritional support was significantly associated with improved metabolic outcomes for individuals with T2DM in a study conducted in India.[42] As social support can predict health-promoting behavior, getting the family members involved in self-care behavior can be important for the provision of healthcare to patients with T2DM.[43] A qualitative study conducted among Thai diabetes patients in Chiang Mai also approved that families are crucial for managing chronic disease. Family interactions are important for high medication adherence, encouraging and supportive communication, and practical considerations such as managing diet, and self-monitoring of blood glucose at home.[44]

As social support can predict health-promoting behavior, this concept can also be useful in predicting the exercise behavior of diabetes patients. Physical activities in terms of walking and vigorous exercise activity were significantly higher among the case group than the control group in the univariate analysis of this study. Although physical activity was not significantly related to social support in the multivariable Robust regression analysis model, we noted a significant negative association of BMI with social support among patients with T2DM. Social networks, described in terms of close social contacts such as families and close friends, may impact an individual's health behaviors with consequent effects on physical activity and tendencies to obesity.[45] Social support may enable physical activity uptake and maintenance via encouragement, resources, and companionship.[46] Our finding of lower social support associated with higher BMI supports this concept. It is assumed that those who have a family history of diabetes, and the social support they received may have more experience, knowledge, and confidence to follow a self-management plan which is more likely to be sustained.[47] However, our finding revealed that having a family history of diabetes was negatively associated with social support which was opposed to the findings of other studies conducted in Ethiopia, and Iran where a family history of diabetes had a positive association with social support.[48,49]

Strengths and Limitations of the study

The strengths of this study were the eligible criteria to select the case and control groups; the selection of community control comparable to the parameters of the targeted population; usage of ENRICHD social support inventory to investigate the recent event of social support which could minimize the possible recall bias, and exploration of factors

associated with social support using multivariable Robust regression analysis to adjust several possible confounders. Moreover, our findings of social support may be a potential for low-cost approach to support the burdened healthcare workers for health education sessions on T2DM patients in the primary care setting and promotion of T2DM self-management. Several potential limitations in this study should also be considered. First of all, it is a cross-sectional study, and the causation between social support and its association factors cannot be determined. All study participants were living in the Chiang Mai Province, Northern Thailand which may reflect the traditional culture and society unique to Northern Thailand and the generalizability of our findings is limited. Despite these shortcomings, it is hoped that public health interventions including family members and peers getting involved in diabetes care will benefit from the findings of the present study.

Conclusion

Our study noted that perceived social support of T2DM patients was higher than that of non-diabetes persons. Such higher social support among T2DM patients can either be originated from a newly acquired peer groups network or from the positive social support provided by the family members and their existing social networks in the Northern Thailand setting. Since the high level of perceived social support of type 2 diabetes patients has a positive association with mealtime with family, future research should focus on the intervention on a family or household level to improve healthy lifestyle modification for not only T2DM patients but also for high-risk individuals such as obese persons, physically inactive people, or those with T2DM family history. Longitudinal studies exploring the need for social support and improving social support for patients with diabetes are advised. Delivery of family-based health promotion interventions to share helpful health information is recommended as it may reduce the negative psychosocial impact of a family history of diabetes and subsequent improvement in diabetes control and self-management of such a prevalent chronic noncommunicable disease.

Data Sharing Statement

The data presented in this study are available on request from the corresponding author.

Ethical Approval and Informed Consent Statement

The study was conducted following the guidelines in the Declaration of Helsinki. Ethical approval was obtained from the Review Committee for Research on Human Participants, Chiang Mai Provincial Health Office, and the Ethical Review Board of the Juntendo University, Tokyo (authorization number 2017141). Written informed consent was obtained from all subjects involved in the study.

Disclosure

The authors report no conflicts of interest in this work.

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