Factors Predicting Diet Adherence among Type 2 Diabetes Mellitus Patients: A Systematic Review

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Abstract— Type 2 diabetes mellitus (T2DM) is the main contributor to disability and premature death. One of the most critical cornerstones of T2DM therapy is diet adherence. The aim of this systematic review is to synthesize the evidence regarding factors associated with adherence and non-adherence to dietary recommendations among T2DM patients. The databases including Scopus, PubMed, CINAHL complete, Medline were searched for original research of factors related to adherence and non-adherence to diet recommendations for the period from 2010 to 2020. Original research use the correlation statistical study, full text, and written in English language. Studies related to severe diabetes complications such as glycemic crisis that were excluded. In total, 1,121 articles were initially retrieved from the four databases and other sources. 13 published articles were reviewed; 10 met inclusion criteria. Factors including demographic (age, gender, educational level, occupation), self-efficacy; health literacy; social support and other factors significantly affect adherence to diet recommendations. Ten studies were identified as meeting the inclusion criteria. Adherence to diet recommendations remains an important challenge in diabetes management. Health professional's work with individuals with type 2 diabetes mellitus (e.g., diabetes educators) are in a key position to assess predicted factors for non-adherence, to develop strategies to facilitate diet adherence.

Keywords— Adherence, diet, factors, type 2 diabetes mellitus.

I. Introduction

Diabetes mellitus (DM) is a metabolic disease that affects the body's ability to process and use glucose for energy in which type 2 diabetes mellitus (T2DM) is the most common type of diabetes that accounts for about 90% of all diabetes cases in the world [1]. According to International Diabetes Federation (IDF), the prevalence of global diabetes is estimated to be 463 million people (9.3%) in 2019, increasing to 578 million (10.2%) by 2030 and 700 million (10.9%) by 2045 [2]. DM continues to be one of the leading causes of morbidity and mortality among adults worldwide [3]. DM caused 3.96 million deaths in adults aged 20–79 years in 2010 [4]. In 2015, this estimation was increased to 5.0 million deaths due to DM and its complications, equivalent to every six seconds one death [5]. This multitude of interrelated factors increased the prevalence of DM.

DM results is the main contributor to disability and premature death. DM increases risks for many serious health problems that can lead to complications in various parts of the body. Severe micro- and macro-vascular complications are common in T2DM patients, especially in those with poor glycemic control [6]. On the contrary, complications are far less common and less severe in DM patients with well-controlled blood glucose levels. With the proper treatment and adherence to the recommended lifestyle, patients are likely to prevent or delay the onset of T2DM complications [7]. Nowadays, diet adherence is considered the most challenging aspect of diabetes management. The wealth of evidence is available on improving glycemic control, decrease glycosylated hemoglobin (HbA1c) up to 2% and decrease insulin dose in patients with T2DM through diet adherence [8-10]. However, the rate of T2DM patients' non- adherence to diet recommendations is popular in both developed and developing countries [11]. For instance, in a study conducted in New Zealand, only 22% of T2DM patients reported complete diet adherence [12]. In Jordan, as a developing country, it has been reported that about 81.4% of T2DM patients did not adhere to their dietary recommendations [13]. It was found that the level of non- adherence to diet in T2DM patients was relatively low as 74.3% in Ethiopia [11], 41% in Nepal [14]. It was relatively a moderate level in Poland, Indonesia and Vietnam [3, 15, 16].

There are multiple factors influencing diet adherence and non-adherence among diabetes patients. Despite the availability of many primary studies that have investigated the factors associated with diet adherence and non-adherence in T2DM patients, attempts to amalgamate these evidences have been limited. The factors influence diet adherence in T2DM patients are disrupted and inconclusive. According to a preliminary literature review, the predictive factors consist of demographic, health status, barriers, social support, self-efficacy and health literacy were proposed as the influencing factors to diet adherence and non-adherence [15-23]. This systematic literature review sought to provide a robust review of the evidence to explore these influencing factors on diet adherence and non-adherence in patients with T2DM.

II. Methods

A. Literature Search

The search took place from September to November 2020. According to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement [24], the

researchers systematically identified all potentially relevant articles through 4 electronic databases: Scopus, PubMed, Medline, CINAHL, and other sources such as google, google scholar. Search terms such as type 2 diabetes, diet, adherence, and factors were used in various combinations and permutations. The PRISMA flow chart, as shown in Figure 1, was used to illustrate a comprehensive selection of journal articles [25]. The references and citation lists of the selected articles were examined to identify articles that were excluded from the search.

B. Inclusion and Exclusion Criteria's

This systematic literature review included quantitative studies conducted in adults with T2DM. The peer-reviewed journals published in English from 2010–2020 were included in the review. The literature search included factors related to diet adherence in T2DM patients. Studies were excluded if they did not specify factors related to diet adherence or related to severe diabetes complications.

C. Data Abstraction

Place Items extracted for the characteristics of the trials included the authors, year, country, research design, sample characteristics, data analysis, and major findings (Tables I–III).

D. Quality Appraisal

STROBE guideline (Strengthening the Reporting of Observational Studies in Epidemiology) was used for the quality assessment of the selected studies. The guideline consists of 22 items and scored one point for each item. The score of < 13 was considered a low-quality study, when the study was withdrawn.
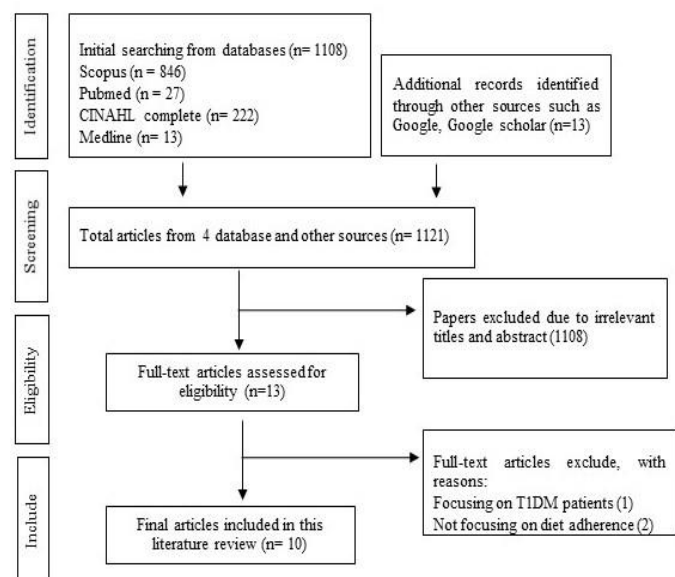

Fig. 1. Flowchart of studies based on PRISMA

III. RESULTS

A total of 1,121 articles were initially retrieved, of which 1,108 were excluded after screening the titles and the abstracts. Subsequently, 13 full-text records were retrieved. Three articles were excluded either because they were not primary research/peer-reviewed journal articles or because they did not focus on diet or T2DM.

Ten articles were selected in this systematic literature review. The articles ascertained that social-demographic characteristics (age, gender, marital status, resident, occupations, monthly income, educational levels); health status (duration of T2DM, obesity, psychological stress, despondency); self-efficacy; health literacy; social support and other factors (facing difficulty to choose foods, non-availability of fruits and vegetables, the high cost of foods, eating out, level of dietary knowledge); influence diet adherence and non-adherence in adults with T2DM

A. Characteristics and quality appraisal of the studies

These articles were assessed quality based on STROBE [26]. Critical appraisal form as illustrated in supplement 1. The quantitative studies were descriptive and descriptive-correlational. The selected articles were synthesized and summarized as shown in Tables I–III.

B. Socio-demographic characteristics factors

Studies showed that age, gender, marital status, resident, occupations, monthly income, educational levels were factors influencing diet adherence among adults with T2DM.

a) Age

Previous literature reported that independent predictors of non-adherence to dietary recommendations were age > 60 years (p = 0.001) [27]. Similar results were reported from a descriptive and logistic regression study in Iran, a reduction in adherence to diet as the age increased for 50–64 years (p < 0.011), ≥ 65 years of age (p = 0.046) [19]. The results of this study conclude that older age (>60 years) affect non-adherence to dietary recommendations in T2DM patients.

b) Gender

One study indicated that male respondents were more likely to be non-adherent to dietary recommendations (AOR = 2.8, 95% CI: [1.35–5.65]) [27]; however, another study did not find any relationship between gender and diet adherence [19].

c) Martial Status

Finding related to marital status showed a significant association with adherence to diet, indicating participants who were single/ever married were three times more likely to adhere than married [18]. Contrary to this finding, previous studies did not find a statistically significant association between dietary practice and marital status [19, 23].

d) Residence

Alhariri et al. (2017) revealed that urban residents were two times more likely to adhere to the diet than rural residents [COR (95% CI) =2.2 (1.2-4.2), *P*-value=0.012] [17]. This difference may be due to the lack of DM health care services and education in rural areas. This finding was in line with a recent research in Northwest Ethiopia, which showed that living in rural areas were 3.75 times more likely

to have dietary non-adherence than living in urban areas (AOR ¼ 3.75; 95% CI: 2.12–6.63) [21].

TABLE I. Characteristic of the included studies.

S. No.	Source	N	Design	Data analysis	Participants					
					Mean Age	Gender	Marital status	Duration of DM	Educational level	Occupation
1	ALhariri, Daud, Almaiman, & Saghir, 2017 Yemen	210	A cross-sectional study	Logistic regression	47.6 ± 12.6	54.8% Males	79% Married	51.0% ≤5 years	32.4% Illiterate	37.6% Employed
2	Thuy, Keeratiyutawong, & Deoisres, 2016 Vietnam	82	Predictive correlational study	Multiple regression	49.51	64.2% Female	82.7% Married	5 years	Secondary school (40.7%)	77.8% Employed
3	Om, Deenan, & Pathumarak, 2013 Bhutan	82	A cross-sectional study	Stepwise multiple regressions	49.8	52.4 % Female	85.4% Married	56.1% 1-5 years	42.7% High school	57.3% Employed
4	Putra, Toonsiri, & Junprasert, 2015 Indonesia	117	A predictive correlation research	Stepwise multiple regression	47.07	64.1% Female	76.92% Married	n.a	55.56% High school	n.a
5	Worku, Abebe, & Wassie, 2015, Ethiopia	422	A cross-sectional quantitative study	Bivariate and multivariate logistic regression	55.19	50.9% Male	55.2 % Married	n.a	56.6% Formal education	n.a
6	Mirahmadizadeh, Khorshidsavar, Seif, & Sharifi, 2020 Iran	500	A Cross-sectional study	Ordinal logistic univariate and multivariate regression	56.92 ± 0.52	58.8 % Female	82.4% Married	n.a	38.6% High school	n.a
7	Wahome, Makau, & Kiboi, 2018 Kenya	123	A Cross-sectional study	Bivariate and multivariate logistic regression	51-70	75.8% Female	67.4% Married	n.a	37.9% Secondary school	68.6% Self-employed
8	Jadawala et al., 2017 Surat	290	A Cross Sectional Study	Logistic regression	55	50.7 % Male	88.6% Married	88.7 % ≤ 10 years	n.a	n.a
9	Negera & Epiphanio, 2020 Ethiopia	322	A Cross Sectional Study	Multivariate logistic regression	44.2 (±1.3)	50.9% Male	56.2% Married	63.7 % ≤ 5 years	34.8% Primary school	77% Employed
10	Tirfie et al., 2020 Ethiopia	404	A Cross Sectional Study	Logistic regression	42.5 years (15. 13)	56.4% Male	62.6% Married	54.3% < 5 years	29.1% Unable to read and write	35.3% Civil servants

e) Occupatios

According to a previous study, employees [COR (95% CI) =3.3 (1.4-7.9), P-value=0.006] adhered to the diet compared with unemployed individuals [17]. Similar findings were found in study done by Wahome et al. (2018) [22]. This finding is in contrast to that concluded among diabetics from Ethiopia, Worku et al. (2015), indicated that there was no statistically significant association between poor dietary practice and occupation in diabetic patients [23].

f) Monthly income

According to the result of a recent study, monthly income of family was significant predictors of eating behaviors (β = 0.24, P–value < 0.001) [16]. Further, Wahome et al. (2018) reported that T2DM people with higher incomes are better placed to practice better dietary diversity than those with limited incomes (p=0.048) [22]. Contrary of these findings, study done by Thuy et al. (2016) showed that income (ß = 0.05, p > 0.05) was not a significant predictor of eating behavior [15].

g) Educational levels

According to a previous study in Kenya, Wahome et al. (2018) found that T2DM patients with postsecondary education were 4.72 times more likely to diet practice than those who had no formal education [22]. This could be due to their level of exposure to nutritional information at different levels of educational attainment. This study concludes that educational level is the predictors of the patients' dietary practices. Dietary practices constitute an important factor in diabetes control since individual eating habits have been shown to either increase or reduce the risk of the disease. Contrary this results, a qualitative study by Putra et al. (2015) showed that educational level was not a significant predictor of eating behaviors from a study Indonesia [16].

Generally, there was an absence of authoritative research reconciling the conflicting perspectives of these studies. Due to these inconsistent findings, a conclusive relationship between gender, marital status, occupation, monthly income, educational level and diet adherence could not be generated. Thus, further investigation is warranted.

h) Health status

Previous studies have consistently reported that duration of DM, psychological stress, despondency, overweight and obesity lead to poorer diet adherence among adults with T2DM.

i) Duration of DM

According to Alhariri et al. (2017), patients who had DM for less than 5 years adhered to diet about two times higher than those who had DM for more than 5 years [COR=1.8 (1.0 -3.3), *P*-value=0.040] [17]. Similarly, another study indicated that participants who had lived with diabetes for less than 5 years were 2.81 times more likely to have dietary non-adherence than those who had lived with diabetes for more than 10 years (AOR ¼ 2.81; 95% CI: 1.22–6.50) [21].

j) Psychological stress and despondency

Findings from the literature indicated that psychological stress were significant predictors of eating behaviors (β = -0.18, P–value < 0.01) [16]. In addition, patients who had despondency were 2.15 times more likely to follow poor dietary practice than those who did not have despondency (AOR = 2.15; 95% CI: 1.14, 4.02) [23].

k) Overweight and obesity

Previous studies suggested that there was a significant difference in overweight (OR = 0.44, 95% CI 0.26–0.74), obese (OR = 0.29, 95% CI 0.15–0.56). The results of this study indicated a reduction in adherence to diet with an increase in weight [19].

l) Self-efficacy

Self-efficacy is defined as individual confidence in carrying out a specific task or behavior in a given situation. Studies have shown that higher levels of self-efficacy predict better diet adherence. A cross-sectional study by Om et al. (2013) revealed that there was significant correlation between eating behavior and perceived self-efficacy (r = 0.720, p < 0.001) [20]. Consistent with another study, stepwise multiple regressions showed that perceived self-efficacy significantly predicted eating behavior (β = 0.36, P–value < 0.001) [16]. Hence, these studies concluded that self-efficacy affected diet adherence among adults with type 2 DM.

m) Health literacy

The functional health literacy refers to the ability to read and understand adequate fundamental skills to act effectively based on health information [28]. According to a recent study found that health literacy of T2DM patients was positively significant correlated with diet adherence (ß = 0.18, p< 0.05) [15]. People with high functional health literacy are more likely to engage in appropriate diet adherence.

n) Social support

Findings from the literature indicated that there was significant correlation between eating behavior and social support (r = 0.54, p < 0.05) [20]; participants who had poor social support were 3.84 times more likely to have dietary nonadherence than those who had strong social support (AOR ¼ 3.84;95% CI: 1.74–8.46) [21]; family support (β = 0.31, P–value < 0.001) was significant predictors of eating behaviors [16]. Consistent with other studies, the multivariable logistic regression analysis showed that those who did not get diabetic nutrition education were 4.47 times more likely to have poor dietary practice than those who got (AOR = 4.47; 95% CI: 1.92, 10.40) [23]. Those who had not received nutritional education at the hospital were 5.88 times more likely to have dietary non-adherence than those who had received nutritional education (AOR ¼ 5.88; 95% CI: 3.30–10.48) [21]. Therefore, consistent evidence showed that social support was associated with diet adherence among T2DM patients in this review.

o) Other factors

Worku et al. (2015) revealed that patients who had difficulty to choose foods were 9.66 times more likely to have a poor practice than patients who did not (AOR = 9.66; 95% CI: 5.12, 18.24) [23]. In addition, patients who had less access to fruits and vegetables were 2.79 times more likely to have poor dietary practice than those who did not (AOR = 2.79; 95% CI: 1.03, 7.54). Likewise, patients who thought of cost of foods were 2.36 times more likely to have poor dietary practice than those who did not think about cost of foods (AOR = 2.36; 95% CI: 1.18, 4.70). Other factors are seen in a study done by Om et al. (2013), there was significant correlation between eating behaviors and perceived barrier such as time and effort for food preparation and eating out (r = 0.24, p < 0.001) [20]. Participants who did not make good choice on food during eating out were 3.49 times more likely to have dietary non-adherence than their counterparts (AOR ¼ 3.49; 95% CI: 2.09–5.81) [21]. Although these findings seem to suggest there is an association between above factors and diet adherence in adults with T2DM, these studies were limited in low-income countries.

Besides, the result of a study done by Wahome et al. (2018) in Kenya indicated that participants who had higher dietary knowledge were found to have a higher dietary practice (p=0.036) [22]. In contrast, the result of another study in Indonesia showed that dietary knowledge was not significant predictors of eating behaviors [16]. Although the dietary knowledge had been consistently implicated in Type 2 diabetes-related studies, there were conflicting findings that rendered the presumed relationships inconclusive. In fact, health literacy goes beyond knowledge and is the end goal of vital patient education. Hence, future research should focus on investigating the effects of health literacy on diet adherence worldwide.

TABLEL II. Factors related to adherence to dietary recommendations.

S. No.	Sources	Social-Demographic	Health status	Health literacy	Self-efficacy	Social support	Other factors
1	ALhariri, Daud, Almaiman, & Saghir, 2017 Yemen	+ Urban residents (P=0.012) + Employees (P=0.006)	+ Duration of DM ≤5 years (P=0.040)	-	-	-	-
2	Thuy, Keeratiyutawong, & Deoisres, 2016 Vietnam	-	-	+ Health literacy (β = .18, p< .05)	-	-	+ Knowledge of diabetes diet (β= .30, p< .05) + Patients' Awareness for diet control (β = .46, p< .001)
3	Om, Deenan, & Pathumarak, 2013 Bhutan	-	-		Perceived self-efficacy (r = 0.720, p < 0.001),	Social support (r = 0.54, p < 0.05)	
4	Putra, Toonsiri, & Junprasert, 2015 Indonesia	+ Monthly income of family (β = 0.24, P < 0.001),	+ Psychological stress (β = -0.18, P < 0.01)	-	Self-efficacy (β = 0.36, P < .001),	family support (β = 0.31, P < .001),	-
5	Worku, Abebe, & Wassie, 2015, Ethiopia		+ Despondency [AOR = 2.15, 95%CI:(1.14,4.02)]		-	+ Not getting nutrition education [AOR = 4.47, 95% CI: (1.92,10.40)]	+ Facing difficulty to choose foods [AOR = 9.66, 95% CI: (5.12,18.24)] + Non- availability of fruits and vegetables [AOR = 2.78,95% CI: (1.03,7.54)] + the high cost of foods [AOR = 2.36,95% CI: (1.18, 4.70)]
6	Mirahmadizadeh, Khorshidsavar, Seif, & Sharifi, 2020 Iran	+ Age: 50–64 years of age (P = 0.011) ≥65 years (P = 0.046) + Singer (OR = 2.84, 95% CI 1.79–3.84)	+ Overweight (P = 0.002) + Obese (P= 0.001)	-	-	-	-
7	Wahome, Makau, & Kiboi, 2018	+ Education level (p = 0.034) + Occupation (p=0.047), + Monthly income (p<0.001)	-	+ Level of dietary knowledge (p=0.026)	-	-	-

TABLE III. Factors related to non-adherence to dietary recommendations

S. No	Sources	Social-Demographic	Health status	Self-efficacy	Social support	Others factors
1	Jadawala et al., 2017 India	+ Occupation (p= 0.018) + Marital status (p= 0.03) + Lived in nuclear family (p= 0.001)	+Duration of DM (p<0.001) + Insulin treatment (p=0.0001)	-	-	-
2	Negera & Epiphanio, 2020 Ethiopia	+ Age>60 years (AOR = 6.3, 95% CI: [2.21–18.17]) + Male (AOR = 2.8, 95% CI: [1.35–5.65])	-	-	+ Lack of social support (AOR = 15.26, 95% CI = [7.45–32.8]) + doctor's instructions or advice regarding diet (AOR = 8.9, 95% CI = [4.26–18.9])	-
3	Tirfie et al., 2020 Ethiopia	+ Living rurally (AOR ¼ 3. 75; 95% CI: 2.12–6.63)	+ Duration of diabetes less than 5 years (AOR ¼ 2.81; 95% CI: 1.22–6.50)	-	+ Lack of social support (AOR ¼ 3. 84; 95% CI: 1.74–8.46) +Did not receive nutritional education (AOR ¼ 5. 88; 95% CI: 3.30–10.48),	+ Eating out (AOR ¼ 3. 49; 95% CI: 2.09–5.81)

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IV. DISCUSSION

This systematic literature review examined the literature on the factors associated with diet adherence in T2DM patients. According to current research, there is evidence to support a significant association between various factors and diet adherence among adults with T2DM. These factors include social-demographic, health status, self-efficacy, health literacy, social support and other factors.

Socio-demographic characteristics has been reported to have an association with diet adherence as it handle the stressors of life; hence, they are more likely to perceive lower barriers in diet adherence [17, 27]. However, this discrepancy could be attributed to differences in the characteristics of the study population or different sociocultural differences. This can be explained by the reason that self-employment would offer more flexibility in time schedule and the likelihood of healthier dietary practices

In different studies, various domains of health status were explored and assessed, such as duration of DM, psychological stress, despondency, overweight and obesity. Alhariri et al., 2017 found out that shorter duration (≤5 years) of diabetes was related to tighter diet adherence (>5 years) [17]. This able to results problems about psychological such as stress and despondency, which were other factors identified for poor dietary practice. Accordingly, those who were stress or despondency for most of the times were twice highly at risk of forgetting and not giving value to food planning and therefore consume whatever is edible. In addition, Mirahmadizadeh et al., 2020 found a reduction in adherence to diet with an increase in weight [19].

According to the theory of self-efficacy by Bandura (1997), self-efficacy is the belief in one's capability to predict and accomplish certain behaviours [29]. Low self-efficacy predicts poor diet adherence in diabetes management. The literature has justified the relationship between self-efficacy and diet adherence, in which high self-efficacy leads to the possibility of embracing a new behaviour [16, 20]. This review proposes self-efficacy as a medically essential constituent that can be incorporated as a part of the health assessment hereafter to encourage a more forward-looking and adaptive appraisal among T2DM patients.

Individuals with a high level of health literacy were better at making effective to fulfill their healthy diet goals. Individuals who are well-equipped with dietary health literacy have a greater tendency to recognize their self-regulatory capability to deal with dietary barriers. Second, health literacy able individuals tend to make informed decisions that are appropriate to their chronic disease self-management. Self-management is essential to produce optimum diet adherence for diabetes mellitus through the healthy lifestyle behaviour approach.

Social support has been reported to have a significant association with diet adherence in which family can be primary sources of social support, as well as provide personal hands-on care during the times of illness [16, 20, 23]. In addition, healthcare worker communication able to convey enough information needed by patients. Giving the right information will have higher effectiveness in improving patient empowerment in terms of their diet self-management and lifestyle modification.

Other factors influencing diet adherence are facing difficulty to choose foods, non-availability of fruits and vegetables, the high cost of foods, eating out, and level of dietary knowledge. Difficulty to choose foods was also identified as a factor for poor dietary practice. This may be due to cultural and personal food choice, economic reasons, the unavailability of food guide prepared for diabetic patients. Non availability of fruits and vegetables was another factor affecting the dietary practice of diabetic patients. This may be due to the seasonality of fruits and vegetables which make the patients suffer from difficulty to take the recommended type and amount of fruits and vegetables, leading to poor dietary practice. In addition, cost of foods as the most frequent barrier to the dietary practice among T2DM patients. Worku et al., 2015 indicated that those who have economic constraints cannot have enough money to buy different types of foods to fulfill their daily requirements [23]. Therefore, patients will be forced to consume only some specific foods without choice and get exposed to poor self-dietary management.

Not making good food choices when eating out was identified as a another factor linked to poor dietary practice due to the recommend foodstuff may not be available or affordable when they eat out in places or at events such as restaurants, social gatherings, and the homes of extended families and friends. Thuy et al., 2016 indicated that knowledge of diabetic diet may predict eating [15]. The results of this review indicated that seven sociodemographic factors, namely age, gender, marital status, resident, occupations, monthly income, educational levels, in which older age and living in rural areas affect non-adherence to dietary recommendations in Type 2 diabetes patients. A possible explanation for this could be awareness amongst old patients more difficult than young patients and the lack of DM health care services and education in rural areas. In addition, there are relationships conflicting gender [19, 27], marital status [18, 19, 23], occupation [17, 22, 23], monthly income [16], educational level in relation to diet adherence. This discrepancy could be attributed to differences in the characteristics of the study population or different sociocultural differences. In fact, differences in knowledge level and economic status are usually better among employees. In addition, because cooking in society is exclusively done by housewives, it may explain their better adherence to the dietary regimen. Moreover, those with higher education levels

generally have better awareness of diabetic complications and higher-income individuals have more health.

V. CONCLUSIONS

The current findings showed that reduced levels of adherence to diet recommendations were associated with various factors. Adherence to diet recommendations remains an important challenge in diabetes management. Health professionals working with individuals with type 2 diabetes mellitus (e.g., diabetes educators) are in a key position to assess predicted factors for non-adherence, to develop strategies to facilitate diet adherence. On the basis of the associated factors, an educational package for T2DM patients in primary care centers should be developed and tailored to convey an appropriate message for promoting adherence to diet recommendations among patients with T2DM.

APPENDIX

APPENDIX I. Articles quality assessment based on STROBE.

Study	Title & abstract	Background/rationale	Objectives	Study design	Setting	Participants	Variables	Data sources/measurement	Bias	Study size	Quantitative variables	Statistical methods	Participants	Descriptive data	Outcome data	Main results	Other analyses	Key results	Limitations	Interpretation	Generalizability	Funding	Total score
							Introduction								Results				Discussion			Other	
1st	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	20
2nd	0	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	20
3rd	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	0	1	1	0	19
4th	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	0	1	1	1	20
5th	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	21
6th	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	21
7th	1	1	1	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	19
8th	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	0	1	1	0	19
9th	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	21
10th	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	21

1st: ALhariri, Daud, Almaiman, & Saghir, 2017
2nd: Thuy, Keeratiyutawong, & Deoisres, 2016
3rd: Om, Deenan, & Pathumarak, 2013
4th: Putra, Toonsiri, & Junprasert, 2015
5th: Worku, Abebe, & Wassie, 2015
6th: Mirahmadizadeh, Khorshidsavar, Seif, & Sharifi, 2020
7th: Wahome, Makau, & Kiboi, 2018
8th: Jadawala et al., 2017
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