Assessment of a Dietary Consultation Model for Effective Diabetes Care in Saudi Population using Partial Least Squares Estimation

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Abstract

The relationship between dietary habits and diabetes has not been studied efficiently in Saudi Arabia and the available diabetes risk models does not focus much on diet, nor do they capture the overall dietary behaviors. The purpose of this research was to test empirically the hypothesised dietary consultation model that has been proposed for more effective diabetes care. This exploratory study was conducted on type 2 diabetic Saudi patients visiting the Primary Health Care Centres in Almajmaah city. The data comprising 350 patients were collected from 5th February – 24th April, 2017 through systematic sampling technique using direct investigation method. Data was collected through four questionnaires. Composite scores were extracted for all variables under study and analysed by Partial Least Squares-Structural Equation Modelling approach using SmartPLS 3.2.6 software. Evaluation of formative outer and inner model relationships validated the hypothesised dietary consultation model. Power of study, coefficient of determination, effect size, total effects, and model fit index further validated the findings. The validated dietary consultation model facilitates a new healthcare paradigm which can give a better understanding of diabetes management at stakeholder and individual level. Healthcare givers should pay special emphasis on diabetics' diabetes mellitus knowledge, dietary knowledge, and dietary attitude, as these factors influence each other, dietary practices and HbA1c. Healthcare givers can use this model alone or by integrating it with available diabetes risk models to carry out the dietary assessment of type 2 diabetics.

Keywords: Dietary Assessment, Type 2 Diabetes Mellitus, Saudi Arabia, Dietary Consultation Model, Structural Equation Modelling.

1. Introduction

According to 2016 estimates, the population of Kingdom of Saudi Arabia (KSA) is over 18 million and is rapidly growing. The prevalence of Type 2 Diabetes Mellitus (T2DM) in KSA is increasing at an alarming level, every other adult, aged above 30, is prone to

diabetes (Wild et al., 2004). Several studies consider the Saudi prevalence of T2DM as an epidemic, average ranging from 16%-35%. It has many serious microvascular and macrovascular complications. Factors like poor dietary habits, sedentary lifestyle, increasing age, obesity and a person's genetic profile, all are well known to be associated with diabetes and its complications (Akram et al., 2011; Caballero, 2005). A report published in Arab news by Irfan (2012) stated that the cost of treating diabetes in KSA had been reported as high as about 30 billion Saudi Riyals (SAR). The annual cost of treating an uncomplicated case of diabetes comes to around SAR 5,000, while it soars up to 38 times (SAR 180,000) with the addition of any one diabetes complication.

There is lack of literature regarding the dietary assessment of type 2 diabetics in KSA. According to World Health Organization (WHO, 2005), the prevalence data on physical inactivity and dietary patterns in the Saudi population are scarce, with no reliable published study. The relation between dietary habits and diabetes has not been studied efficiently in KSA as literature related to diet-diabetes is very limited (Mohamed et al., 2013; Ng et al., 2011; Amini, 2012). The current gap in dietary evidence in KSA urges for further studies to be conducted to understand diet-diabetes relation in more detail (Al-Khudairy et al., 2013). An intensive literature review was conducted to initiate this research. Five domains namely diabetes mellitus knowledge (DMK), dietary knowledge (DK), dietary attitude (DA), dietary practices (DP) and haemoglobin A1c (HbA1c) were identified as influential factors in the dietary assessment of type 2 diabetics (Sami, Ansari, Butt & Hamid, 2017, 2016).

1.1 Development of Hypothesis

Studies have documented knowledge as a requirement for people and societies for inhibition, handling, and control of chronic diseases like diabetes (Saleh et al., 2012; Raj & Angadi, 2010). Mufunda et al. (2012), recommended addressing the knowledge gaps between DMK and diet in diabetes education programmes with sheer emphasis, as not addressing these gaps can influence the development of diabetes complications. Ntaate (2015), also reported a gap between disease and DK. It has been stated in another study that dietary pattern and food selection is influenced by patient's knowledge related to recommended diet (Tesfaye et al., 1996). Literature addressing the relationship between DMK and DP is non-existent, our study is the first to analyze this relationship. Thus we hypothesised that:

H1: Diabetes mellitus knowledge has an influence on dietary knowledge.

H2: Diabetes mellitus knowledge has an influence on dietary practices.

DK and DA have been identified as potential mediators in any diet-related behaviors, these factors should be addressed in any diabetes diet-focused intervention (Contento, 2007). DK has been specified to be a significant factor that influences dietary behaviors (Backman et al., 2002). More studies have documented nutritional knowledge as an important factor to achieve positive attitude towards healthy eating (Mirmiran,

Azadbakht & Azizi, 2007; Brown & Ogden, 2004). Findings of another study reported DK and DA as essential factors in making healthy food choices (Coon, 2001). DP fall in the domain of self-management of disease. Diabetics who have a deficiency in knowledge related to the diet cannot develop a dynamic and reliable role in disease self-management (Saleh, Ara & Afnan, 2016). Various studies have documented knowledge as an essential resource that can guide diabetics about their practices (Kigaru et al., 2015; Sindhu, 2014). Nutritional education although is necessary to perceive dietary practices, however, still a big gap exists between these two factors (Girosis et al., 2001). Thus we hypothesised that:

H3: Dietary knowledge has an influence on dietary attitude.

H4: Dietary knowledge has an influence on dietary practices.

DA can help in measuring the effects of dietary outcomes in non-communicable diseases (Worsley, 2002). DA can be influenced by intrinsic and extrinsic factors like food restraint, healthy choices, and hunger, etc. Positive DA with good nutritional knowledge is likely to display long-term beneficial effect on DP. Aesthetic or scientific values of food can be related to observing dietary patterns of individuals, these values can significantly influence one's dietary choices (Yaktine & Stallings, 2007). Poor control of diabetes among type 2 diabetics is related to inappropriate DA and unhealthy DP (Amorim et al., 2014). Attention should be given to diabetics' nutrition status as this has an overall impact on the attitude that can be translated into healthy practices (Waithaka, 2011). Thus we hypothesised that:

H5: Dietary attitude has an influence on dietary practices.

To improve the risk profile of diabetic patients and delay the onset of diabetes complications, a primary and essential measure is to have appropriate DP. Controlling diet can reduce HbA1c by 1-2%. However, this improvement in HbA1c is related to limiting caloric intake and reducing weight (Monnier et al., 2004; Pastors et al., 2002). Importance of diet in diabetes management is well accredited, however, practically, deficiency in dietary compliance in T2DM is a main restrictive factor in achieving good glycemic control (Pi-Sunyer et al., 1999). A study conducted on DP of type 2 diabetics in KSA reported overall inadequate DP (Mohamed et al., 2013). Studies conducted internationally and in Gulf Cooperation Council (GCC) countries reported that a significant association exists between DP and HbA1c (Al-Kaabi et al., 2008; Lanting et al., 2008; Nasser, 2007; Hearnshaw & Lindenmeyer, 2006). Thus we hypothesised that:

H6: Dietary practices have a direct influence on HbA1c.

The prime purpose of this research is to empirically validate the dietary consultation model. This was carried out by 1) describing the effect of DP on HbA1c which is considered as a contributing factor for developing both microvascular and macrovascular diabetes complications. The hypothesized factors that can influence DP are "DMK, DK, and DA." In addition, the interrelationship of DMK, DK, and DA was also studied as shown in Figure 1 and Figure 2.

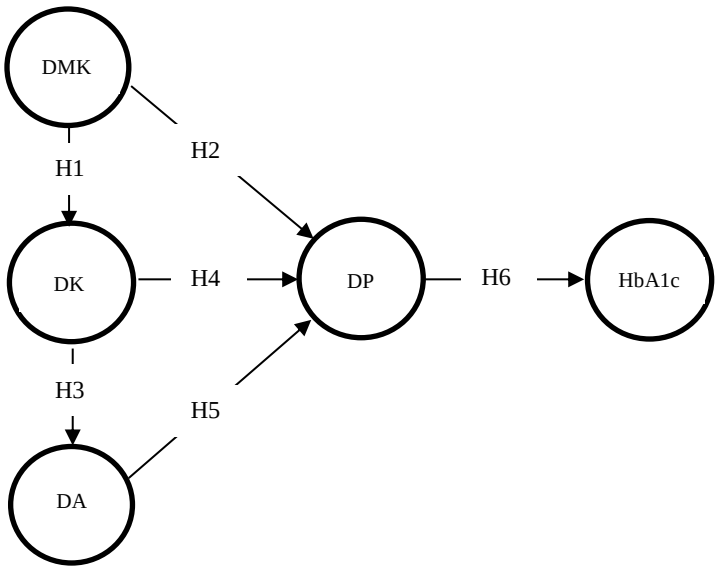

Figure 1: Hypothesised Dietary Consultation Model

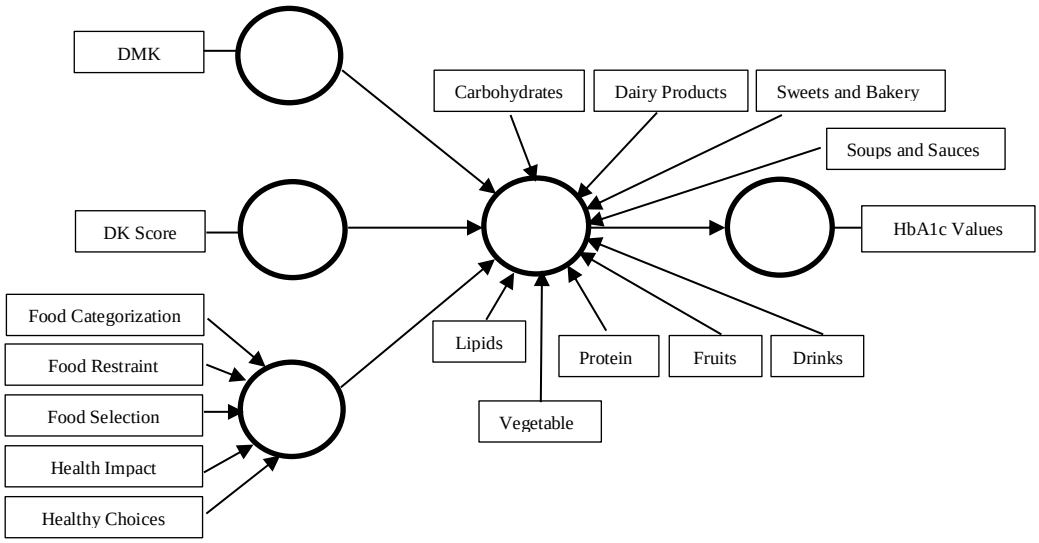

Figure 2: Full Research Model with Indicators

2. Material and Methods

This exploratory study was conducted on type 2 diabetic Saudi patients visiting the Primary Health Care Centres (PHC's) in Almajmaah city. The data was collected from 5th February – 24th April, 2017 through systematic random sampling technique using direct investigation method. G*Power 3.1.9.2 for windows was used to calculate the sample

size. A maximum number of arrows pointing to the formative constructs were 9, to achieve a statistical power of 80% at 5% level of significance with a minimum R^2 of 0.10, the required sample size was 181 subjects (Cohen, 1992). However, keeping in view the precision, generalizability, missing values, patients withdrawing from the study and presence of outliers, the sample size was increased to 350. The latest value of HbA1c was taken from patient's record present in the PHC's. Inclusion criteria were 1) known type 2 diabetics since five years, 2) aged between 35-55 years, 3) both gender, i.e., males and females and 4) having no other co-morbidities. Exclusion criteria were, 1) patients with type 1 diabetes and other chronic diseases, 2) patients with age less than 35 years and more than 55 years and 3) other co-morbidities. Written informed consent was taken from the patients prior to data collection and anonymity was maintained. This research was approved by the ethical review committee of Majmaah University, KSA vides reference no: MURECApril.02/COM-2016.

2.1 Instruments for Data Collection

There is a scarcity of literature in KSA about the availability of standardized questionnaires for carrying out a dietary assessment of type 2 diabetics. As dietary habits vary from country to country, therefore, we attempted to develop questionnaires that can serve as a baseline for carrying out the dietary assessment. Through rigorous literature review, four questionnaires assessing/evaluating DMK, DK, DA, and DP were developed/modified and subsequently tested for psychometric properties (Sami, Ansari, Butt & Hamid, 2017). Composite scores obtained from each questionnaire were used in Structural Equation Modeling (SEM) analysis (Henseler, 2017).

2.2 Structural Equation Modelling

SEM is a powerful second-generation multivariate tool for studying interrelationships simultaneously among multiple observed and latent variables (Hair, Ringle & Sarstedt, 2011). Partial Least Square-Structural Equation Modeling (PLS-SEM) is an Ordinary Least Square (OLS) regression-based estimation technique. In this research, a formative model was used. The selection of formative model was based on 1) its definition, 2) discussion with experts, 3) keeping in view the model selection criteria's and 4) nature of study variables. In the formative model, indicators are not interchangeable, if an indicator is deleted, the underlying construct can be meaningless as a part of it is omitted (Hair et al., 2006). However, the indicators may have no, low, medium or high correlations among them. After selecting the type of model, next step was to carry out the evaluation of formative measurement model (outer model) and assessment of structural model (inner model) that is explained in Table 1.

Table 1: Assessment criteria for outer formative and inner model

Outer Model	Description
Convergent Validity	The magnitude of 0.70 and above is recommended for the construct to meet convergent validity (Hair et al., 2016).
Collinearity	A Variance Inflation Factor (VIF) value $\geq$ 5 indicates a potential problem of collinearity between indicators and constructs (Hair et al., 2016).
Significance & relevance of formative indicators	Running bootstrapping procedure with 5000 replicates selected with-replacement. Indicator weight's significance was evaluated by t-values and p-values (Hair et al., 2016; Jahner, Leimeister, Kenebel & Krcmar, 2008).
Inner Model	**Description**
Collinearity	A VIF value $\geq$ 5 indicates a potential problem of collinearity between constructs (Hair et al., 2016).
Assessing the significance and relevance of structural model relationships	Running bootstrapping procedure with 5000 replicates selected with-replacement. Path coefficients significance was evaluated by t-values and p-values (Chin, 1998).
Coefficient of Determination (R^2)	< 0.19: no effect; 0.20-0.33: weak; 0.34-0.67: moderate and > 0.67: substantial (Chin, 1998).
Effect Size (f^2)	$0.02 \leq f^2 < 0.15$: weak effect; $0.15 \leq f^2 < 0.35$: moderate effect and $f^2 \geq 0.35$: strong effect (Hair et al., 2016).
Model Fit	Standardized Root Mean Square Residual (SRMR) with a cutoff criterion < 0.08 was used as a model fit measure (Hair et al., 2016; Hu & Bentler, 1999).

2.3 Data Analysis

Preceding to data analysis, the data were screened for typographically wrong entries and missing values by using IBM SPSS 23.0 (IBM Corp., Armonk, N.Y., USA). Median (25th quartile – 75th quartile) is reported for non-normally distributed quantitative variables. Frequencies and percentages are reported for qualitative variables. Mahalanobis distance, a multivariate technique was used to identify the outliers before running the SEM analysis. Any value < 0.001 should be considered as an outlier (Peat & Barton, 2008). The data was then screened for normality, collinearity and common method bias (Pallant, 2011; Tabachnick & Fidell, 2007). PLS-SEM was used to test the hypothesized model using exploratory modelling analysis via SmartPLS 3.2.6. A p-value of < 0.05 was considered as statistically significant.

3. Results

The median age of the patients was 45 (40-51) years. Majority of the patients were males as compared to females (57.7% vs 42.3%). The family history of diabetes was positive in 40% of the patients. Almost 50% of the patients were overweight, followed by obese

32.9%, normal weight were 16%, and only 3.4% patients were underweight. Based on HbA1c, majority of the patients 50% had poorly controlled diabetes (> 58 mmol/mol), one-quarter of patients had partially controlled diabetes (47-58 mmol/mol), and only 18.6% had good diabetes control (37-46 mmol/mol).

Mahalanobis distance showed the presence of outliers, 14 cases had p-value less than 0.001. The final dataset for SEM analysis contained 336 cases. Normality of data was checked through an online freely available software to assess multivariate skewness and kurtosis (Ramayah et al., 2017). Results of skewness and kurtosis obtained from https://webpower.psychstat.org/models/kurtosis/results.php?url=955cb020081037157f4087e130ca059b showed that data was multivariate non-normal. Mardia's multivariate skewness ($\beta = 42.88$, $p < 0.001$) and Mardia's multivariate kurtosis ($\beta = 350.02$, $p < 0.001$). Multicollinearity was evaluated through bivariate correlations and regression analysis. Results showed that all bivariate correlations were < 0.90 cutoffs, whereas, all tolerance values were above 0.20 and VIF for each independent variable was < 5. Hence, no multicollinearity problem existed among the variables. Common method bias was evaluated through Harman's one-factor test. Ideally, no single factor should explain more than 50% of the variation. Exploratory Factor Analysis (EFA) showed that maximum variance explained by one factor was 34.23% that had Eigenvalue of 5.819. Hence it was confirmed that common method bias was not an issue in this study.

3.1 Assessment and Evaluation of Outer Model Relationships

3.1.1 Assessing Convergent Validity (Redundancy Analysis)

To assess Convergent Validity (CV), a reflective global scale item (measuring the essence of rest of the formatively measured items) was included in each questionnaire. In addition, DP questionnaire had 9 food groups, a reflective global scale item was included for each subgroup as all foods groups were independent of each other. Redundancy analysis results presented in Table 2 showed that all questionnaires displayed evidence of CV as all path coefficients were ≥ 0.70.

3.1.2 Assessing Collinearity among Indicators and Constructs

VIF values for outer model presented in Table 2 are uniformly less than the cutoff value 5. Hence, we conclude that multicollinearity is not an issue for estimation of PLS path model.

3.1.3 Significance and Relevance of Formative Measurement Model Outer Weights

Significance and relevance of outer weights were assessed by means of bootstrapping procedure. Results presented in Table 2 showed that outer weights of all formative indicators are significant. Moreover, outer weights of all indicators are more than 0.10. Therefore, we can conclude that each indicator of the related formative construct is considered important in explaining the construct's domain.

Table 2: Formative outer model evaluation

Construct	CV	VIF	Indicators	Outer Weights	t-value	p-value
DMK	0.839	1.000	DMK Score	Single item quantitative		< 0.001*
DK	0.935	1.000	DK Score	Single item quantitative		< 0.001*
		1.659	Food Selection	0.228	3.411	< 0.001*
		1.258	Health Impact	0.368	6.453	< 0.001*
DA	0.853	1.274	Healthy Choices	0.139	2.552	0.012ǂ
		1.292	Food Restraint	0.151	2.340	0.015ǂ
		2.007	Food Categorization	0.500	6.523	< 0.001*
	0.932	1.543	Proteins	0.195	3.723	< 0.001*
	0.878	2.162	Carbohydrates	0.445	7.575	< 0.001*
	0.887	1.432	Lipids and Fats	0.305	5.762	< 0.001*
	0.974	1.081	Dairy Products	0.157	3.768	< 0.001*
DP	0.916	2.378	Sweets and Bakery	0.207	4.174	< 0.001*
	0.806	1.254	Drinks	0.123	2.755	0.002ǂ
	0.790	1.049	Fruits	0.125	3.086	0.008ǂ
	0.853	1.062	Vegetables	0.120	3.404	0.002ǂ
	0.822	1.025	Soup and Sauces	0.113	2.649	0.005ǂ
HbA1c	---	1.000	HbA1c	Single item quantitative		< 0.001*

*significant at 1% level of significance

ǂsignificant at 5% level of significance

3.2 Assessment and Evaluation of Inner Model Relationships

Before formal assessment of structural model also known as an inner model, power (1-β) was calculated to validate the empirical findings of the study by using G*Power 3.1.9.2. Results showed that this study achieved a power of 100% with a significance level of 0.05 (two-tailed), a sample size of 336 and effect size of 0.30 (medium effect). Power achieved in this study exceeds the cutoff value 0.80 (Cohen, 1992).

3.2.1 Examining Structural Model (Inner Model) for Collinearity Issues

To assess a structural model for collinearity issues, same diagnostic measure, i.e., VIF was used. VIF values were examined for all set of predictor variables. Results presented in Table 4 showed that collinearity is not a problem among the predictor variables as all values were less than the cutoff value 5.

3.2.2 Assessment of Significance and Relevance of Inner Model Relationships

The same bootstrapping procedure was used to assess the significance and relevance of inner model relationships. The significance of paths was determined by examining path loadings, t-values, and p-values. Results showed that all path coefficients were significant at $p < 0.001$. Moreover, the magnitude of all path coefficients was > 0.20 (Chin, 1998). Hence, significance and magnitude of inner model path coefficients confirm that the research model has adequately established nomological validity as shown in Table 3.

Table 3: Significance of hypothesized relationships

Path	Beta	t-value	p-value	Result
DMK→DK	0.660	20.853	< 0.001*	Supported
DMK→DP	0.263	5.304	< 0.001*	Supported
DK→DA	0.686	21.236	< 0.001*	Supported
DK→DP	0.365	5.606	< 0.001*	Supported
DA→DP	0.324	4.950	< 0.001*	Supported
DP→ HbA1c	0.739	28.325	< 0.001*	Supported

*significant at 1% level of significance (two-tailed)

3.2.3 Coefficient of Determination (R^2)

In this research, there were four endogenous (DK, DA, DP, and HbA1c) and one exogenous variable (DMK). R^2 values of DK, DA, and HbA1c were moderate, whereas, DP had a substantial R^2 value. DMK significantly explained 43.5% variation in DK construct. Whereas, DK significantly explained 47.1% variation in DA construct. Moreover, DMK, DK, and DA significantly and substantially explained 68.1% variation in DP construct. Nevertheless, DP significantly predicts HbA1c with a healthy R^2 of 54.7% as shown in Table 4.

3.2.4 Effect Size (f^2)

DMK had a large significant effect (0.77) on DK and a small but significant effect (0.12) on DP. Whereas, DK had a large significant effect (0.88) on DA and a medium significant effect on DP (0.16). Moreover, DA had a medium significant effect (0.17) on DP. Lastly, DP had a large significant effect (1.20) on HbA1c as shown in Table 4.

3.2.5 Model Fit Index (SRMR)

Model fit indices enable researchers to judge how well the hypothesized model fits the empirical data. As this research is exploratory and a formative model was tested, the recommended model fit measure is SRMR. Results presented in Table 4 showed that the obtained SRMR value (0.057) is less than 0.08. Thus, the study concludes that the dietary consultation model which has been proposed in this research for more effective diabetes care has a considerable predictive power.

3.2.6 Total Effects

An interesting finding of this study was revealed by examining the total effects. Influence of DMK, DK, and DA on HbA1c was seen through mediating variable DP. DMK has the strongest significant total effect (0.481) on HbA1c, followed by DK (0.434) and DA (0.240) $p < 0.001$ respectively. Therefore, healthcare givers should pay special emphasis on patients' DMK, DK and DA as these factors can also significantly influence HbA1c. Results are presented in Table 4.

Table 4: Significance and relevance of formative inner model relationships

Path	VIF	R^2	p-value	f^2	p-value	Total Effects	Beta	p-value
DMK→DK	1.00	0.435	< 0.001*	0.77	< 0.001*	**DMK – HbA1c**	0.481	< 0.001*
DMK→DP	1.78	0.471	< 0.001*	0.12	0.013ł			
DK→DA	1.00			0.88	< 0.001*	**DK→ HbA1c**	0.434	< 0.001*
DK→DP	2.54	0.681	< 0.001*	0.16	0.013ł			
DA→DP	1.89			0.17	0.017ł	**DA→ HbA1c**	0.240	< 0.001*
DP→ HbA1c	1.00	0.547	< 0.001*	1.20	< 0.001*			
Model Fit (SRMR) = 0.057 (p < 0.001)								

*significant at 1% level of significance

łsignificant at 5% level of significance

4. Discussions

The findings of this study provide important implications for healthcare stakeholders that includes healthcare organizations, healthcare givers and, healthcare managers, etc. As reported in the literature, diabetes risk models do not fully capture the essence of diet and dietary behaviours which are considered as a foundation for self-management of diabetes. Moreover, it is evident that diet and related habits and practices have not been studied efficiently in developed and developing countries. Therefore, dietary consultation model proposed in this research can be considered as a significant contribution to diabetic society.

Our study is the first to empirically validate the influence of DMK on DK and DP using SEM approach. Results of our study helped in answering the gaps empirically that have been pointed out by previously published studies between DMK, DK and DP (Ntaate, 2015; Mufunda et al., 2012; Tesfaye et al., 1996). There is a scarcity of empirical evidence in the literature addressing the influence of DK on DA and DP among diabetics. Our study is the first to address this issue in detail. Odenigbo and Inya-Osuu (2012) from their study identified DK as an important factor that influenced DA. Our study findings also validated these findings by concluding that DK significantly influences DA. A study conducted by Ntaate (2015) on type 2 diabetics reported that DK was not significantly predicting DP, although, score of DK was good. Our study contradicts with this study as DK was significantly positively predicting DP. A recently conducted study found a moderate but significant association between knowledge and dietary behavior (Tavakoli et al., 2016). This result is almost similar to our study findings, where DK is significantly predicting DP. A study conducted by Primanda et al. (2011) also found a significant positive relationship between DK and dietary behaviors. Our study results are again consistent with this by findings a significant positive relationship between DK and DP.

Empirical evidence about the relationship between DA and DP among type 2 diabetics is limited. Ntaate (2015) conducted a study on type 2 diabetics reported that DA was not significantly predicting DP. Our study results contradict with this study as DA and DP are significantly positively related. Results of a study conducted on type 2 diabetics by Omondi et al. (2011) showed that attitude and norms followed by behavior control were

the most significant predictors to follow the recommended diet. Our study results are consistent with this study, SEM analysis showed that DA was significantly related to DP.

Carbohydrates have the highest effect on blood glucose as compared to other macronutrients like lipids, fats, and protein (Sheard et al., 2004). This result is similar to our study findings, carbohydrates had the highest effect on HbA1c, followed by lipids and fats and proteins. A study conducted by Al-Kaabi et al. (2008) described a significant relationship between carbonated drinks and HbA1c. This finding is also congruent to our study, as drinks had a significant relationship with HbA1c. Franz et al. (2002) reported a significant decrease in HbA1c level with the increase of total vegetable and fruit intake. In our study, fruits and vegetables had a significant positive relationship with HbA1c; the reason is consuming fruits and vegetables having a high glycemic index (GI). Lee et al. (2012) studied the relationship between dairy products and HbA1c, results revealed a non-significant relationship. Our study results contradict with this finding by observing a significant positive relationship between dairy products and HbA1c. Midhet et al. (2010) conveyed that consumption of bakery items routinely can increase the risk of T2DM by 5.5 times. Results of our research also indicated sweets and bakery products have a significant positive effect on HbA1c. Harding et al. (2001) studied the relationship between fat consumption and HbA1c level. A significant positive relationship was reported between total fat intake and HbA1c. Our study results are similar to this by finding a significant positive relationship between lipids and fats and HbA1c.

4.1 Contribution of study

The study discusses its contribution in terms of theory and practice. Theoretically, the study extends management of DM by proposing a validated and integrated dietary consultation model for more effective diabetes care. Practically, the study proves that before guiding diabetics' about "what to eat and what to avoid," patients DMK, DK, and DA should be assessed first as these factors are interrelated and directly influence DP and HbA1c. Overall, the study makes a significant contribution to knowledge, better health outcomes for patients with diabetes, thus improving their quality of life.

4.2 Limitations

The research model used in this study may not be as comprehensive as it could have been. The identified influential factors were able to explain a portion of variances between them. There may be other factors that can influence studied parameters but were not included in the research model. For example, duration of diabetes, socioeconomic status, gender, occupation, marital status and education level can influence diabetes mellitus knowledge, dietary knowledge, dietary attitude and dietary practices. The HbA1c level can also be under and overestimated by some factors like having any blood disorder, HIV, kidney disease, etc. To rule out these, a more stringent inclusion criteria is required.

5. Conclusions

There is a great unawareness of healthy diet, poor eating habits, and void of exercise-culture in Arab society. It demands a three-dimensional programme of promoting early

age exercise and nutrition education irrespective of region, gender and stratum of society without damaging their cultural norms and conventions. Overall, the findings of dietary consultation model facilitate a new healthcare paradigm which can give a better understanding of diabetes management at stakeholder level as well as at individual level. Healthcare givers can use this model alone or by integrating it with available diabetes risk models to carry out the dietary assessment of type 2 diabetics in a more effective way. Healthcare givers should pay special emphasis on diabetics diabetes mellitus knowledge, dietary knowledge and dietary attitude, as these factors influence each other onto dietary practices and HbA1c. Conducting the dietary assessment of diabetics at the initial stage and periodically can help in overall reduction in diabetes complications, thus improving the quality of life of patients.

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