Predicting Dietary Practice Behavior among Type 2 Diabetics Using the Theory of Planned Behavior and Mixed Methods Design

D.O. Omondi, M.K. Walingo, G.M. Mbagaya, and L.O.A. Othuon

Abstract—This study applied the Theory of Planned Behavior model in predicting dietary behavior among Type 2 diabetics in a Kenyan environment. The study was conducted for three months within the diabetic clinic at Kisii Hospital in Nyanza Province in Kenya and adopted sequential mixed methods design combing both qualitative and quantitative phases. Qualitative data was analyzed using grounded theory analysis method. Structural equation modeling using maximum likelihood was used to analyze quantitative data. The results based on the common fit indices revealed that the theory of planned behavior fitted the data acceptably well among the Type 2 diabetes and within dietary behavior {χ^2 = 223.3, *df* = 77, *p* = .02, χ^2/df = 2.9, n=237; *TLI* = .93; *CFI* =.91; *RMSEA (90CI)* = .090(.039, .146)}. This implies that the Theory of Planned Behavior holds and forms a framework for promoting dietary practice among Type 2 diabetics.

Keywords—Dietary practice, Kenya, Theory of Planned Behavior, Type 2 diabetes, Mixed Methods Design.

I. INTRODUCTION

DIETARY management of Type 2 diabetes among patients is one way to prevent or delay the long term effect of the condition. Diabetic individuals worldwide are routinely advised to adopt a healthful eating behavior, which requires modifications in food habits, beliefs and meal patterns on a lifelong basis [1]. However, despite this effort, Kenya is still registering increasing numbers of people being diagnosed with the disease. Dieticians need to be informed on the relationships between psychosocial factors and dietary behavior among these patients. This will improve their capacity to manage the Type 2 diabetes condition better. Diet is a lifestyle behavior that has been reported as a management domain with very little compliance among diabetics [2]-[4]. Low adherence to the dietary recommendations for macronutrient intake and fruit and vegetable consumption has been reported in some cross-sectional studies [4]-[6]. A study among Type 2 diabetic patients in Greek revealed that most patients were less devoted to the Mediterranean diet, which is rich in vegetables, fruits, fish, cereals and olive oil than non-diabetics [7] indicating a possibility of inadequate motivating factors. In addition some evidence from developed countries indicate that diabetic patients are less successful in maintaining long term weight loss than people without diabetes [8], a parameter that predisposes them to poorer metabolic control. It could be that their efforts are not in the appropriate directions or that they receive confusing and contradictory advice from a variety of sources for example, health professionals, media and social contacts. However, even if their diets are far from the official recommendations, self-declared diabetic patients try to modify their dietary habits [9].

Currently most diabetic clinics in Kenya use fact-based approaches to promote healthy diet among the Type 2 diabetes patients [10]. These approaches leave out the patients' perspective and only impose messages to the patients without considering their perceptions and beliefs. However, one concern raised during this study was whether these are good interventional approaches or otherwise. As Anderson and Funnell [11] interestingly pointed out that unlike the treatment of acute illness, the most important choices affecting the health and well-being of people with diabetes are made by themselves and not by their physician or any other health professional. Every day they need to make a series of choices with regards to eating that are very important in regulating their blood glucose levels and overall health. An understanding of their eating habits in addition to their intrinsic and extrinsic factors related to the eating behavior would help to increase the effectiveness of lifestyle education in the management of the disease. Probably an alternative approach is to use theoretical based frameworks from which important factors affecting eating behavior can be drawn, tested and applied in patients' education.

There are several theories that explain behavior, but, the purpose of this study was to apply the Theory of Planned Behavior (TPB) [12] as a framework within which patients'

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perceptions and beliefs regarding dietary behaviors could be measured and empirically tested. According to this theory health related behavior can be predicted by the intention construct. Intention is influenced by attitude, subjective norm and perceived behavioral control towards the behavior. Attitudes are considered as beliefs about the outcome of the health related behavior weighed by the value of the outcome. Subjective norm is the belief an individual has that key people in his or her life may influence them to behave in a certain way, weighed by the level of compliance to such influence. Perceived behavioral control is the belief an individual has that certain factors may facilitate or impede action weighed by the perceived control power he or she has over these factors. Approaches that incorporate social–cognitive theories are shown to be more efficacious than general fact-based approaches [13]. However, theoretical frameworks need to be tested in populations with Type 2 diabetes to identify factors that can be manipulated to achieve optimal behavior change [14]. This study indented to test the efficacy of the Theory of Planned Behavior in understanding dietary practice of Type 2 diabetics in a Kenyan Environment. The study hypothesized that the Theory of Planned Behavior fits the dietary related data acceptably well among Type 2 diabetics.

II. METHODS

A. Setting

This study was conducted in Kisii Level 5 Hospital. This is the biggest hospital located at the centre of Kisii town. The diabetic clinic in the Hospital is currently hosted within the blood transfusion premises. This clinic is operated by the one consultant doctor, five doctors, six clinical officers, four nurses and one nutritionist. Until the period of data collection diabetic patients attended the clinic every Tuesdays and Fridays.

B. Research Design

This study used a sequential exploratory mixed methods design. Mixed method approaches are now being emphasized in social and human sciences in diverse fields such as occupational therapy [15] and have gained popularity in the field of social science research. This is a three-phase approach where we first gathered qualitative data using Focus Group Discussions and analyzed it using grounded theory approach (phase 1) and then went further to develop an instrument based on the qualitative analysis results (phase 2) subsequently administering the questionnaire to a representative sample of a population (Phase 3) [16].

C. Population and Sampling

The population was made up of all Type 2 diabetes patients who attended the diabetic clinic regularly for a period of at least two months. Based on the monthly reports at Kisii diabetic clinic beginning from June 2008 to June 2009, the population of Type 2 diabetic patients who attended the clinic regularly ranged from 350 to 400 patients. The maximum number (400) of patients ever recorded at the clinic during the past one year was then chosen to represent the population of Type 2 diabetes patients who attend the clinic for a period of one month.

Sampling of the participants was done at two levels. This included sampling during the qualitative phase and sampling during the quantitative phase. Qualitative phase adopted *theoretical sampling* technique where 8 participants (optimal number for an FGD) for each focus group discussion were purposively selected based on the fact that they could help in building the opening and axial coding of the theory. About eight FGDs were conducted until saturation yielding a total of 64 participants. Heterogeneous approach was followed in identifying these patients. In this case half of the patients who strictly followed the recommended diet and the other half who did not were purposively selected for FGDs after initial one-on-one interview with patients who reported to the clinic each clinic day. Quantitative phase recruited participants in this study every Tuesdays and Friday of the week for a period of one month during dietary survey. A sample of 217 participants calculated by the Creative Research Systems [17] formula, when the population is finite was the minimum sample size required to participate in the survey. This formula has been used by a number of authors [18, 19]. This sample size was determined as follows:

$SS= \{Z^2*(P)*(1-P)\} \div C^2$

Where: SS=Sample size; Z=1.96 (for 95 percent level of confidence); P=0.5 (the worst percentage that can ever pick a choice); C=0.045 (confident intervals)

$SS= \{(1.96)^2 *(0.5)*(1-0.5)\} \div (0.045)^2$

SS=474 patients

However, since the population was approximated to be about 400 patients, correction for finite population was made as follows:

New SS=SS÷ {1+ (SS-1) ÷Pop}

New SS= 474÷ {1+ (474-1) ÷400}

New SS=217 patients (Plus 15 percent non-response)

Simple random sampling technique was used to select individual participants. All the Type 2 diabetes patients who were expected to attend the clinic that month were given random numbers ranging from 1 to 400 and a random number table used to select individuals patients to participate in the study. The actual sampled patients engaged in the study were 237, which was more than the required sample size.

D. Data Collection Instruments

Data was collected using Focus Group Discussion (FGD) guides and questionnaires. These tools were developed and written in English language but were translated into *Ekegusi* and Kiswahili and then back-translated into English to ensure that the meaning was not lost during a two day training of research assistants. Expert judgment was used confirm the translation into local language. Two experts used previously as translators in the hospital were given the tools to translate into local language and again back-translate them into English or Kiswahili. No much difference was noted during this process. Translation into local language was only required when a patient could not understand English or Kiswahili.

FGD guides focused on the theoretical concepts in the TPB model applied to dietary behavior. It was useful during the qualitative phase (phase1) of this study. The construction of the guide was guided by the concepts of the grounded theory of planned behavior [12]. Four (4) FGDs were conducted within dietary behavior domain until a saturation point (the point at which no more additional information could be generated during the discussions) was reached. Results from FGDs were used to develop dietary questionnaire during the second phase of the study to explore the results generated within dietary domain during qualitative phase. Measurement of key concepts drawn from the Theory of Planned Behavior adopted the techniques initially developed by Ajzen [12]. A seven point likert scale was used to measure attitude, subjective norm, perceived behavioral control and intention in a continuum ranging from *totally disagree/not all/extremely unlikely=1; Moderately disagree/not all/extremely unlikely =2; Slightly disagree/not all/extremely unlikely =3; Undecided=4; Slightly agree/very much/extremely likely =5; Moderately agree/ very much /extremely likely=6; to Totally agree/ very much /extremely likely=7.* Dietary practice was measured on the frequency of use of foods in "high fat diet" (Beef, chicken with skin, egg yolk, fried potato chips, roast meat, fatty meats, chapatti, and cream) , "high sugar diet" (Sweet potato, Irish potato, white rice, white rice, white sugar, soda and sweet soft drinks, cakes, ice cream, chocolate, sugared beverage, jam, glucose, honey, arrow roots and boiled maize) and "recommended diet" (Whole grain rice, green vegetables, low fat milk, chicken without skin, fish, beans, green grams, carrots, minnow fish (*omena*), sweet banana, pineapple and mangoes) categories as identified during FGDs. Attitude was computed by summing up the product of salient belief strengths and corresponding evaluation weights for attitude-1, attitude-2 and attitude-3. Subjective norm was computed by summing up of the product of normative belief strengths and corresponding motivation to comply weights for subjective norm-1, subjective norm-2 and subjective norm-3. Perceived behavior control was computed by finding the product between control belief strength and control power weight, for perceived behavioral control-1, perceived behavioral control-2 and perceived behavioral control-3. Intention was measured by the degree of willingness to reduce fat and sugar intake and increase consumption of recommended diet.

In order to determine the effectiveness of the survey questionnaires, pretesting was conducted at Kisii Hospital. Pretesting was useful in determining the strengths and weaknesses of the survey concerning question format, wording and order. It was also necessary to pretest for the reliability and validity of the questionnaires. Two methodologies were followed during this pretesting exercise. The first pretest method was *participating pretests* where the respondents were informed that the pretest is a practice run. They were asked to explain reactions to question form, wording and order. This kind of pretest was useful to determine whether the questionnaire was understandable. The second pretest method was an *undeclared pretest*, where the respondents were not informed that the exercise was a pretest. The survey was given just the same way as it would happen for the real survey. This type of pretest was useful in checking choice of analysis and the standardization of the survey. A part from participating or undeclared pretest, we also pretested specifically for question variation, meaning, task difficulty, and respondent interest and attention. All questions were pretested including those borrowed from past studies. Also included during this exercise were the flow, order, timing, and overall respondent well-being.

Finally the questionnaire was subjected into pretest for *reliability* and *validity*. In the case of *reliability*, we intended to find out if all questions measuring the same factor could be answered the same way using Conbach's alpha. Twenty (20) percent of the intended sample size was randomly selected to be involved in this pilot. The questionnaires were fully administered to the respondents. Data from each set were entered into SPSS version 15 data spread sheet and Cronbach's alpha generated to determine how closely or distantly grouped measures for each factor appeared. Cronbach's alpha for all the items measuring each concept ranged between α=0.5 to α=.87 (n=44), which indicated an acceptable internal consistency. Validity of the questionnaires was determined by how well they measured the concept (s) they intended to measure. Both convergent validity and divergent validity were determined by comparing answers to each question measuring the same concept, then by measuring this answer to the participant's response to a question that asks for the exact opposite answer. Factor analysis was used to determine construct validity where all the measurement items for each concept in the dietary practice questionnaire were subjected to *KMO and Bartlett's test of sphericity* which process Kaiser-Meyer-Olkin measure of sampling adequacy and Bartlett's test. The value of KMO was greater than 0.5 for all the measurement items and Bartlett's test was also significant ($p<0.0001$) indicating adequate sample size [20]. The average communalities that each factor could explain (variance explained) for concept measurement items ranged from 0.5 to 0.8 (n=237) which was acceptable [20].

E. Ethical Considerations

This study was presented and approved by Maseno University School of Graduate Studies board and the National Council for Science and Technology (NCST). NCST is a national body in Kenya in-charge of research authorization. Permission was also granted by the institution within which the research was conducted. All the participants signed informed consent forms before participating in the research process. They were also assured that the information obtained from them will be treated with confidence. All documents related to the patients and intended to be used in the study remained under the custody of the principal researcher and could not be accessed by any unauthorized person except supervisors. To ensure minimal disruption of the usual diabetic activity at the centre within the setting, the research assistants were advised to interview patients and allow them to continue with other processes whenever they were called upon. The interview process would then continue after patients had gone through all the processes.

F. Data Analysis

Grounded theory analysis was used to analyse qualitative data obtained from FGDs. During this analysis three phases of coding including open, axial and selective coding [21] were followed. Structural Equation Modelling (SEM) in AMOS 7 using Maximum Likelihood (ML) estimation was used to test the hypothesis during the quantitative phase. Presentations were made in tables and figures. Cronbach' s alpha was used to for internal consistency of questions measuring the same concept. Exploratory factor analysis in SPSS version 15.0 was applied in testing for the dimensionality of the questions measuring the same concepts. Means and standard deviations were used to assess any irregularites in the answering of questions. Skew and kurtosis tests were used to assess for the normality of data obtained. Pearson correlations were used to assess the associations between observed variables for each model. The overall model fit was evaluated using chi-squaire (CMIN) and relative chi-square (CMIN/df), comparative fit index (CFI), the standardized root-mean-square error of approximation (RMSEA), Hoelter's critical N, the Tucker-Lewis-Index (TLI) and Bollestine-stine bootsrap. During analysis model categories were presented. The first model category was measurement model meant to reveal the actual measurements based on variances and standardized regression weights. The second model was structural model meant to advance the theory under investigation. CFI and TLI values greater than 0.90 was considered satisfactory [22]. RMSEA less than 0.08 was also be considered satisfactory [23]. Relative chi-square was considered fit when within 3:1 range [24]. Hoelter's critical N was considered low below 75 cases and bootsrap samples were set at 200 [22].

III. RESULTS

A. Patients' Characteristics

Analysis first dwelt on the patients characteristics in order to describe the population of patients engaged during this survey (Table II). About 237(Female; 144:60.8 percent and Male 93:39.2 percent) of Type 2 diabetic patients participated in the study during dietary survey. Among the participants involved in the survey, 51(21.5 percent) did not go to school at, 77(32.5 percent) completed primary level education, 84(35.4 percent) completed secondary level education, 18(7.6 percent) went to tertiary college while only 7(3.0 percent) completed University education. This implied that more than 60 percent of the participants went through formal education. Concerning family diabetic history, 166 (70.0 percent) did not have any of the family members who was living with the condition, while 71(30.0 percent) had at least one member living with the condition among patients who participated in dietary survey. The mean age 55.73 ±12.25 years and the minimum age for onset of diabetes was above 35 years, implying that most participants suffered from Type 2 diabetes; not Type 1 diabetes. The most frequent cadre attending to patients the doctor/clinical officers 156 (65.8 percent) followed by nurse 21 (8.9 percent), nurse and nutritionists 19 (8.0 percent) and nutritionists alone 1 (0.4 percent).

TABLE I
PATIENTS' CHARACTERISTICS

Descriptive Characteristics	***(N=231)***
	Frequency
Sex	
Male	144 (60.8 %)
Female	93 (39.2 %)
Level of Education	
Never	51(21.5 %)
Primary	77 (32.5 %)
Secondary	84 (35.4 %)
Tertiary	18 (7.6 %)
University	7 (3.0 %)
Family diabetic history	
No	166 (70.0 %)
Yes	71 (30.0 %)
Frequent cadre attending to patients	
Doctor/clinical officer	156 (65.8 %)
Nurse	21 (8.9 %)
Nutritionist	1 (.4 %)
Nurse and nutritionist	19 (8.0 %)
All the cadres	40 (16.9 %)
Current age in years (mean)	55.73 ±12.25
Age at onset in years (minimum)	35

B. Structural Equation Modeling

Measurement model was specified based on the relationships of the concepts in the traditional Theory of Planned Behavior. Both item measurements analysis and measurement model analysis were performed using observed endogenous and unobserved exogenous variables. These variables are presented in Table II and displayed in a measurement model (Fig. 1).

TABLE II
ENDOGENOUS AND EXOGENOUS VARIABLES IN THE TPB MODEL

Endogenous Variables (Observed)	*Exogenous Variables (Unobserved)*
Attitude towards high fat diet [Attitude-1 (A1)]	Attitude
Attitude Towards high sugar diet [Attitude-2 (A2)]	e1
Attitude towards recommended diet [Attitude-3 (A3)]	e2
Subjective norm towards high fat diet [Subjective norm-1 (SN1)]	e3
Subjective norm towards high sugar diet [Subjective norm-2 (SN2)]	Subjective norm
Subjective norm towards recommended diet [Subjective norm-3(SN3)]	e4
Perceived Behavioral Control towards high fat diet [PCB-1 (PC1)]	e5
Perceived Behavioral Control towards high sugar diet [PCB-2 (PC2)]	e6
Perceived Behavioral Control towards recommended diet [PCB-3 (PC3)]	Perceived Behavioral Control (PCB)
Intention to reduce fat intake [Intention (IN1)]	e7
Intention to reduce sugar intake [Intention (IN2)]	e8
Intention to increase recommended diet intake [Intention (IN3)]	e9
High fat diet [Diet class-1(D1)]	Intention
High sugar diet [Diet class-2 (D2)]	e10
Recommended diet [Diet class-3 (D3)]	e11
	e12
	Dietary Behavior
	e13
	e14
	e15
	Other 1
	Other 2

e= error; other=other factors

Table II shows all the variables included in the specified measurement model in attempt to test the extent to which the model fits the data. Cases were subjected to both univariate and multivariate screening to test for the normality of the data for each variable observed before fitting the model (Table III). The means and standard deviations for all the measures are presented in the table. Values indicate that no measurement was done outside the expected range. All the measures were subjected to skewness test based on the recommended ±2 range for normal distribution. Measures of dietary behavior were negatively skewed except for diet class-1 which appeared to be normally distributed. Measures of intention were all negatively skewed. Measures of perceived behavioral control were normally distributed, while subjective norm measures were negatively skewed except for subjective norm-1 which appeared to be normally distributed. Attitude measures were all normally distributed. On the overall data violated normality assumption based on skewness. Kurtosis also indicated that most measures were outside the ±2 range for normal distribution except for diet class-1 and perceived behavioral control measures. Attitude-1 also registered normality.

TABLE III
MEASUREMENT LEVEL DESCRIPTIVE STATISTICS, UNIVARIATE AND MULTIVARIATE NORMALITY FOR THE TPB MODEL

n=237 *Variable*	*min*	*max*	*mean*	*s.d.*	*skew*	*c.r.*	*kurtosis*	*c.r.*
D3	1.000	7.000	7.27	.051	-3.242	-20.378	9.942	31.242
D2	4.000	8.000	7.74	.037	-2.799	-17.594	10.447	32.829
D1	4.000	8.000	7.27	.051	-.970	-6.093	.815	2.562
IN1	3.000	7.000	6.72	.044	-3.097	-19.467	10.696	33.613
IN2	3.000	7.000	6.84	.032	-4.636	-29.136	28.659	90.058
IN3	4.000	7.000	6.84	.027	-3.071	-19.298	11.485	36.091
PC1	1.000	49.000	24.75	1.164	.279	1.754	-1.617	-5.082
PC2	1.000	49.000	27.08	1.234	.045	.285	-1.777	-5.583
PC3	1.000	49.000	16.68	1.064	1.070	6.722	-.489	-1.537
SN1	56.000	294.000	256.98	3.419	-1.728	-10.859	2.637	8.286
SN2	35.000	294.000	261.29	3.323	-2.079	-13.064	4.348	13.663
SN3	56.000	294.000	265.00	2.895	-2.098	-13.184	4.978	15.642
A1	29.000	245.000	184.33	3.278	-.847	-5.324	.365	1.147
A2	35.000	294.000	221.95	2.013	-1.837	-11.548	5.800	18.225
A3	113.000	245.000	198.72	1.030	-1.688	-10.612	8.288	26.045
Multivariate							195.123	66.507

Item level measurements were performed due to the difference in the measurement scales. The model was recursive with a *df*=77. Standardized regression weights for the endogenous variables are displayed in the measurement model (Fig. 1). It appears items defining attitude, subjective norm, perceived behavioral control, intention and dietary behavior had very high regression weights close to 1.00. The squared multiple correlation indicated that predictors of subscales accounted for >90 percent except for perceived behavioral control (PCB-3) for the recommended diet where the predictors accounted for 43.9 percent of the variance of PCB-3 itself. Correlations between observed variables in the model were strong (p<0.001) and positive except PCB-3 which registered lower but significant positive correlation coefficient (p<0.01; Table IV). Modification indices suggested specifying relationships among items within and between the scales, which suggest multicollinearity.

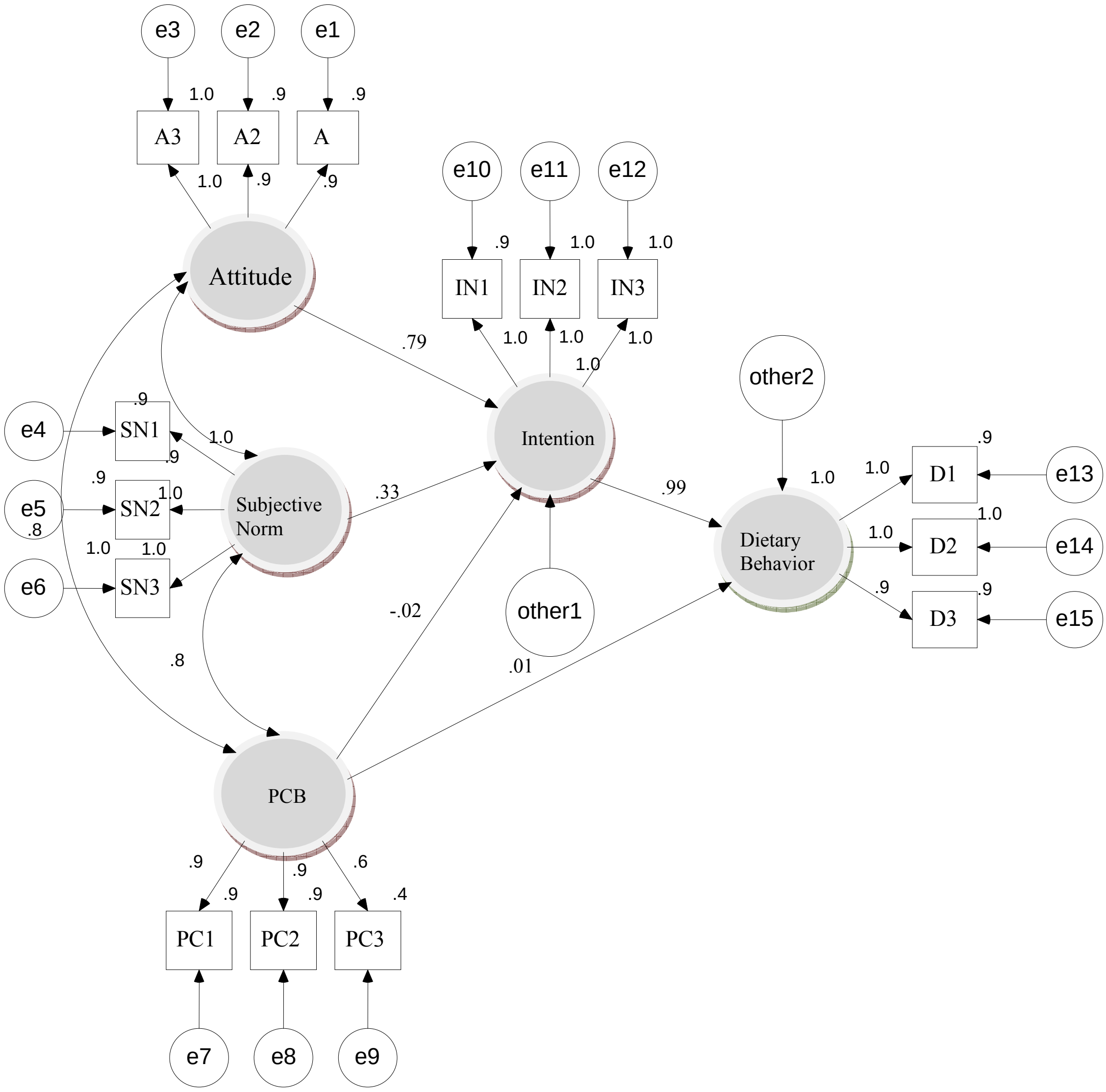

Fig. 1 Theory of planned behavior measurement model applied to dietary practice

Overall the goodness of fit statistics were statistically non-significant at the .01 level but the model should be rejected at the .05 level (χ^2= 223.3, *df* = 77, *p* = .02, χ^2/df = 2.9). However, the relative chi-square was under the recommended 3:1 range indicating acceptable fit after significant modification indices were uncorrelated. Other fit indices (*TLI* = .93; *CFI* =.91; *RMSEA (90CI)* = .090(.039, .146) also demonstrated a good model fit. Hoelter's critical N values suggest that the model would have been accepted at the .05 significance level with 194 cases and the upper limit of *N* for the .01 significance level is 200. No Modification Index was above the customary cutoff value of 4.00. Because the data violated the normality assumption, bootstrapped chi-square values were also calculated and the model fits better in 200 bootstrapped samples. The Bollen-Stine *p* = 0.025 provided further reassurance about the model fit. It was then necessary to advance the theory of planned behavior using structural model (Fig. 2). Standardized regression weights, indicates that attitude was a better predictor of intention (β=0.79, p<0.01, n=237), followed subjective norm (β=0.33 p<0.05, n=237) while perceived behavioral control poorly (β=-0.02, p>0.05, n=237) predicted intention. Intention in turn strongly predicted dietary behavior (β=0.99 p<0.001, n=237). This implies that when attitude goes up 1 standard deviation, intention goes up by 0.79 standard deviations. In addition when subjective norm goes up by 1 standard deviation, intention goes up by 0.33 standard deviations. However, when perceived behavioral control goes up by 1 standard deviation, intention goes down by 0.02 standard deviations. Finally, when intention goes up by 1 standard deviation, dietary behavior goes up by 0.99 standard deviations. Intention predictors put together accounted for 100 percent of the variance on intention. Finally, intention and perceived behavioral control also explained 100 percent of the variance on dietary behavior.

TABLE IV
IMPLIED CORRELATIONS MATRIX FOR THE OBSERVED ENDOGENOUS VARIABLES [a b]

n=237 Variables	IN3	IN2	IN1	D3	D2	D1	PC1	PC2	PC3	SN1	SN2	SN3	A1	A2	A3
IN3	1.000														
IN2	.997	1.000													
IN1	.995	.995	1.000												
D3	.981	.981	.979	1.000											
D2	.995	.995	.993	.983	1.000										
D1	.992	.992	.990	.980	.994	1.000									
PC1	.817	.817	.816	.808	.820	.817	1.000								
PC2	.817	.817	.816	.808	.819	.817	.916	1.000							
PC3	.566	.566	.565	.559	.567	.566	.635	.634	1.000						
SN1	.982	.982	.980	.967	.981	.978	.820	.820	.568	1.000					
SN2	.982	.982	.980	.967	.981	.978	.821	.820	.568	.992	1.000				
SN3	.985	.985	.983	.970	.984	.981	.823	.823	.570	.995	.995	1.000			
A1	.965	.965	.963	.950	.964	.961	.798	.798	.553	.953	.953	.956	1.000		
A2	.989	.989	.987	.974	.988	.985	.818	.818	.567	.977	.977	.980	.960	1.000	
A3	.995	.995	.993	.980	.994	.991	.823	.823	.570	.982	.982	.985	.966	.990	1.000

[a] Significant at α=0.001
[b]A1= Attitude towards high fat diet, A2=Attitude towards high sugar diet, A3=Attitude towards recommended diet, SN1=Subjective norm towards high fat diet; SN2=Subjective norm towards high sugar diet, SN3=Subjective norm towards recommended diet, PC1=Perceived Behavioral Control towards high fat diet, PC2=Perceived Behavioral Control towards high sugar diet, PC3=Perceived Behavioral Control towards recommended diet, IN1=Intention to reduce fat intake, IN2=Intention to reduce sugar intake, IN3=Intention to increase recommended diet intake, D1=High fat diet, D2=High sugar diet, D3=Recommended diet

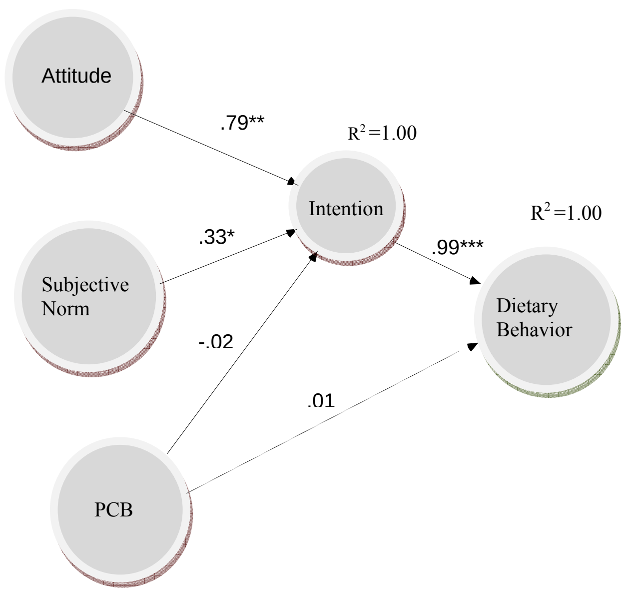

Fig. 2 Theory of planned behavior structural model applied to dietary practice

IV. DISCUSSION

A. Role of TPB Model in Predicting Dietary Behavior

The Theory of Planned Behavior laid the foundation upon which the hypothesis was stated. The study used the key concepts identified by Ajzen [12] including attitude, subjective norm, perceived behavioral control and intention, which were all linked up to dietary behavior. This research sought to identify the motivational factors underlying dietary behavior in a sample of Type 2 diabetic patients. It was found that Type 2 diabetic patients held fairly favorable attitudes toward dietary behavior, perceived positive social pressure to do so and poorly felt in control of the two behaviors. The prediction of each of these factors to intention varied (Fig. 2). Attitude was the most powerful determinant of intention (dietary behavior, β=0.79, p<0.01); subjective norm/social pressure (dietary behavior, β=0.33, p<0.05); while perceived behavioral control (dietary behavior, β=-0.02, p>0.05) insignificantly predicted intention indicating less control over behavior (dietary behavior, β=0.01, p>0.05). Intention highly predicted both dietary behaviors (dietary behavior, β=-0.99, p<0.001).

High prediction power of intention is consisted with the finding of other authors where a person's intention to perform a particular behavior was both the immediate determinant and the single best predictor of that behavior [25]. An intention to perform behavior is influenced by attitudes towards the action, including the individual's positive or negative beliefs and evaluations of the outcome of the behavior [26]. It is also influenced by subjective norms, including the perceived expectations of important others (e.g. family or work colleagues) with regard to a person's behavior; and the motivation for a person to comply with others' wishes [12]. Behavioral intention then results in action. The authors argue that other variables besides those described above can only influence the behavior if such variables influence attitudes or subjective norms [27]. The three factors explained 100 percent of the variability of intention when other factors including demographic characteristics were held constant and this was excellent. Nested model for dietary behavior domain fitted the data acceptably well based on the recommended fit indices.

This research has highlighted the relative importance of the TPB constructs upon behavioral intention and subsequent behavior. These relationships should be considered when designing educational programs to promote dietary practice among diabetic patients. For instance, in order to increase Type 2 diabetic patients' motivation/intention to follow recommended diet, their attitude is the most important followed by subjective norm or social pressure and then perceived behavioral control. In the behavior model, intentions had a strong prediction for dietary behavior calling for both a motivational and a structural educational approach [28]. Furthermore, because perceived control was not statistically a strong predictor intention, its effect might reflect lack of confidence in patience ability to follow recommended diet, and might call for reduction in structural barriers as a focus for intervention.

B. Study Limitations

Individual contributions of demographic, cultural and economic factors were not established, other than being controlled during the analysis although there were indications that these factors grouped together significantly varied among subjects. Many studies have indicated that age and gender are powerful predictors of health related behavior just the same way as psychosocial factors [29]. The contribution of these two demographic factors may have been established by comparing the models fitness indices across gender and different age categories. However, the sample size could not allow for smaller groupings of participants by gender and age category. Doing this would mean that we deal with a sample size less than 200 for either males or females, the minimum required to accept structural equation model [30]. Additional factors which needed attention but left out during this study include economic status and religion. Health related behaviors such as dietary practice may be influenced by individuals' economic status and their religious culture. More than 90 percent of items within dietary practice questionnaire met the minimum criteria recommended by Field [18] which requires adequate sample size with communalities after extraction above 0.5 for a factor to be accepted and internal consistency reliability above 0.5 based on George and Mallery's [31] recommendation. However, factor loading for items in the questionnaire that did not meet these criteria need to be improved by refocusing the measurement items.

V. Conclusion

The theory of planned behavior fitted that data acceptably well among the Type 2 diabetes and within dietary behavior {χ^2 = 223.3, df = 77, p = .02, χ^2/df = 2.9, n=237; TLI = .93; CFI =.91; $RMSEA$ $(90CI)$ = .090(.039, .146)} based on the fit indices used during analysis. This indicates a better prediction power of dietary behavior among the patients. However, results indicated that both attitude and subjective norms turned to be the most powerful predictor of intention to follow recommended diet. Although perceived behavioral control accounted for some percentage of the variance in intention the variance was insignificantly different from zero.

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