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Pre-intention Mediators within the Theory of Planned Behaviour Applied to Dietary Practices among Type II diabetics: What is the Position of Perceived Dietary Knowledge?

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Abstract: In this study we formulated and applied planned behaviour knowledge theory in predicting dietary behavior among Type 2 diabetics. 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. The initial data collection process began with Focus Group Discussions and ended with structured questionnaire interviews among of 237 Type 2 diabetic patients. Qualitative data was analyzed using constant comparative approach in grounded theory analysis and specific used to develop structures questionnaire. Structural equation modeling using maximum likelihood was used to analyze quantitative data. The results based on the common fit indices revealed that the planned behaviour knowledge theory fits the data acceptably well among the Type 2 diabetes and within dietary behavior {χ^2= 256.7, df = 121, p = 0.07, χ^2/df = 2.12; TLI = 0.95; CFI = 0.93; RMSEA (90CI) = 0.075 (0.003, 0.077)} and was superior within dietary behaviour (PBK: χ^2/df = 2.12; p = 0.07 against TPB: χ^2/df = 2.53, p = 0.02) compared to the traditional theory of planned behaviour. This implies that perceived knowledge is an important preliminary locus of control when considering use of the theory of planned behaviour as a reference framework for promoting healthy dietary practice among Type 2 diabetics.

Key words: Dietary practice, psychosocial factors, theory, mixed methods design, type 2 diabetes, perceived knowledge

INTRODUCTION

Type II diabetics in Kenya and other developing countries continue meet dietary challenges due to poor perceived knowledge on appropriate diet. Health professionals need to identify patients' related factors influencing dietary adherence and understand how these factors relate to perceived knowledge and dietary intentions of the patients. Dieticians need to put emphasis on patients related factors during counseling sessions and the relationship between psychosocial factors and dietary practice should be prioritized. This will make them understand dietary related behaviour factors of the patients better and strengthen their efforts in attempting to manage the disease by promoting healthy eating among these patients. Factors related to their decision making process (dietary intentions) need to be understood carefully for proper dietary management of their condition. 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 (Anderson and Funnell, 2000). Every day they need to make a series of healthy food choices with sugar regulation in mind. An understanding of their eating behaviour, in addition to their intrinsic and extrinsic factors related to the dietary practices would help to increase the effectiveness of dietary management of the disease.

Probably one of the most innovative approaches is to use theoretical based frameworks from which important factors affecting eating behaviours can be drawn, tested and applied in patients' education. Approaches that incorporate social-cognitive theories such as the Theory of Planned Behaviour are known to be more powerful in changing behaviour (Norris *et al.*, 2001). However, theoretical frameworks need to be tested in populations with Type II diabetes to identify factors that can be manipulated to achieve optimal behaviour change (Anderson and Funnell, 1999). There appears to be a growing empirical evidence to support addition of variables such as past behaviour, self efficacy, moral norms, self-identity, social support and affective beliefs

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(Armitage and Conner, 1998; Nejad *et al.*, 2004) among others to the TPB in order to come up with improved motivation model. Fishbein and Ajzen (1975) argued the TPB model stands on its own and that variables besides attitude, subjective norm and perceived behavioural control could only influence behaviour if they influence attitude and subjective norm, however, in this study we examined the power of perceived knowledge in the original model by considering the knowledge concept as a mediator and the immediate determinant of dietary intention. We hypothesized that the Theory of Planned Behaviour (TPB) model with perceived knowledge as a mediator fits the data on dietary behaviour acceptably among Type II diabetic patients.

MATERIALS AND METHODS

Setting: The study was conducted in Kenya between the months of June and November of the year 2009. The actual setting was within diabetic clinic at Kisii provincial referral hospital in Nyanza Province. The 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. During each clinic day, the patients arrive at 8.30 am and are tagged with numbers as they come in. As they wait to begin the clinical processes, a session of education is conducted by a chosen health professional for the day. The patients then go through the normal processes beginning with screening of blood to determine sugar level. This is followed by medical prescription made by the doctor or clinical officer in charge. After medical prescription, the patients undergo counseling process conducted by the nurse in charge then proceed to collect drug supplies from the pharmacy.

Research design: This study used a sequential exploratory mixed methods design. 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) (Creswell and Plano Clark, 2007). Mixed method approaches are now being emphasized in social and human sciences in diverse fields such as occupational therapy (Lysack and Krefting, 1994) and have gained popularity in the field of social science research. However, we have only presented the quantitative phase of the results.

Population and sampling: A sample of 217 participants calculated by the Creative Research Systems (2003) 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 (Ibironke, 2002; Mugnaini *et al.*, 2008). 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% level of confidence); p = 0.5 (the worst percentage that can ever pick a choice); C = 0.045 (confident intervals). $SS = \{(1.96)^2 *(0.5)*(1-0.5)\} \div (0.045)^2 = 474$ 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} = 474÷ {1+ (474-1) ÷ 400} = 217 patients (Plus 15% 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.

Data collection instruments: The study begun by first collecting qualitative information using Focus Group Discussion guide and the results obtained were used to develop dietary questionnaire during the second phase of the study. Dietary questionnaire was then used 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 (1991). A seven point likert scale was used to measure operational zed variables related to 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 towards “high fat diet” (attitude-1), “high sugar diet” (attitude-) and “recommended diet” (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 towards "high fat diet" (subjective norm-1), "high sugar diet" (subjective norm-2) and "recommended diet" (subjective norm-3). Perceived behavior control was computed by finding the product between control belief strength and control power weight, for perceived behavioral towards "high sugar diet" (Perceived behavioural control-1), "high sugar diet" (perceived behavioral control-2) and "recommended diet" (perceived behavioral control-3). Intention was measured by the degree of willingness to reduce fat and sugar intake and increase consumption of recommended diet. Dietary knowledge focused on perceived knowledge on dietary fat, sugar and recommended diet intakes as identified during qualitative phase. Knowledge on fat intake was labeled knowledge-1, sugar intake was labeled knowledge-2 and recommended diet intake was labeled knowledge-3. Varied responses emerged during the discussions and we selected five best areas of concern to test under each sub-theme. The five areas for each category were developed into five statement form questions where participants were expected to choose whether such statements were true or false based on their perceived knowledge and overall score computer out of the total as a denominator.

Questionnaire reliability and validity: 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. Cronbach's alpha was 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 $\alpha = 0.5$ to $\alpha = 0.87$ (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. 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 (Field, 2005).

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 (Institutional Review Board (IBA) of 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.

Data analysis: 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. CFI and TLI values greater than 0.90 was considered satisfactory (Garson, 2009). RMSEA less than 0.08 was also be considered satisfactory (Schumacker and Richard, 2004). Relative chi-square was considered fit when within 3:1 range (Kline, 1998). Hoelter's critical N was considered low below 75 cases and bootsrap samples were set at 200 (Garson, 2009).

RESULTS

Planned behaviour knowledge theory: Based on our hypothesis perceived knowledge was positioned to mediate the relationship between attitude, subjective norm and perceived behavioural control and intention within the theory of planned behavior through selective coding process to develop and confirm a new theory. This new theory postulates that dietary behaviour can be predicted by the dietary intention. Dietary intention depends on perceived knowledge of an individual weighed by the level of understanding of dietary behaviour outcomes. Perceived knowledge is shaped up by attitude, subjective norm and perceived control. Attitude is the belief an individual has about the outcome of the dietary behaviour weighed by the value attached to the outcome. Subjective norm is the belief of an individual that people important in their life can influence them to follow a specific dietary pattern weighed by their motivation to comply. Perceived behavioural control is the belief an individual has that some factors influence their dietary practice weighed by the control power they have over such factors.

Table 1: Measurement level descriptive statistics, univariate and multivariate normality for the model (n = 237)

Variable	Min	Max	Mean	S.D.	Skew	c.r.	Kurtosis	c.r.
D3	1.000	7.000	7.27	0.051	- 3.242	- 20.378	9.942	31.242
D2	4.000	8.000	7.74	0.037	- 2.799	- 17.594	10.447	32.829
D1	4.000	8.000	7.27	0.051	- 0.970	- 6.093	0.815	2.562
IN1	3.000	7.000	6.72	0.044	- 3.097	- 19.467	10.696	33.613
IN2	3.000	7.000	6.84	0.032	- 4.636	- 29.136	28.659	90.058
IN3	4.000	7.000	6.84	0.027	- 3.071	- 19.298	11.485	36.091
KN3	1.000	5.000	4.05	0.056	- 0.303	- 1.905	- 0.030	- 0.093
KN2	1.000	5.000	4.19	0.050	- 1.239	- 7.790	2.663	8.370
KN1	1.000	5.000	4.05	0.056	- 0.667	- 4.193	0.197	0.618
PC1	1.000	49.000	24.75	1.164	0.279	1.754	- 1.617	- 5.082
PC2	1.000	49.000	27.08	1.234	0.045	0.285	- 1.777	- 5.583
PC3	1.000	49.000	16.68	1.064	1.070	6.722	- 0.489	- 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	- 0.847	- 5.324	0.365	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							204.112	58.553

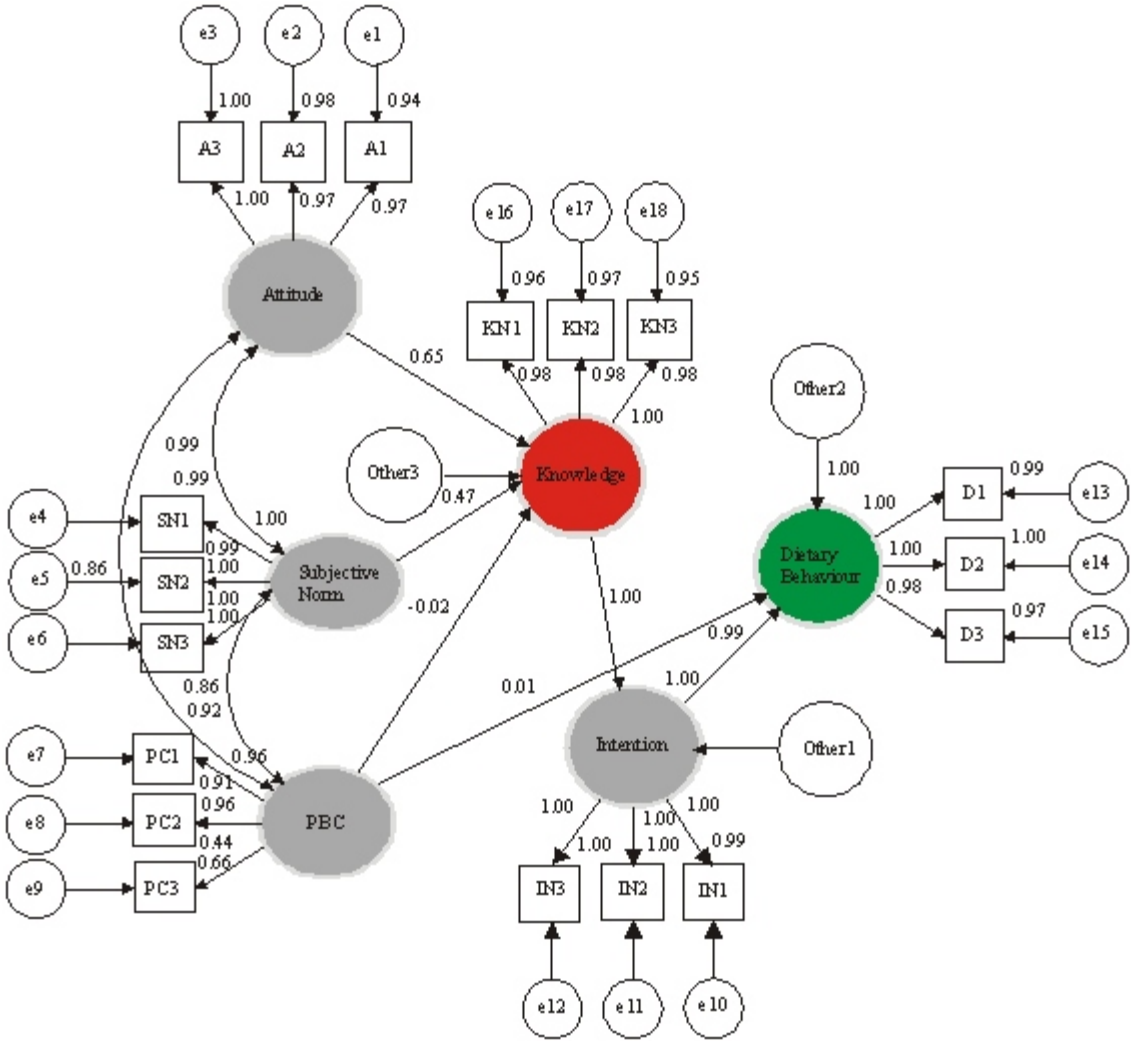

Fig. 1: Planned behaviour knowledge measurement model applied to dietary practice

Exploring theory using structural equation modeling: In order to build and confirmed the proposed planned behaviour knowledge theory, we first specified a measurement model based on the formulated concepts of planned behaviour knowledge theory. Both item measurements analysis and measurement model analysis were performed using observed/unobserved endogenous and unobserved exogenous variables. 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. The means and standard deviations for all the measures within Model are presented (Table 1). All the measures were subjected to skewness test based on the recommended ±2 range for normal distribution. Measures of dietary behaviour were negatively skewed except for diet class-1 which appeared to be normally distributed. Measures of intention were all negatively skewed. All measures of knowledge and perceived behavioural control were normally distributed, while subjective norm measures appeared to be negatively skewed except for subjective norm-1 which was normally distributed. Attitude measures were all normally distributed. On the overall data violated normality assumption based on skewness. Kurtosis also indicated that all measures were outside the ±2 range for normal distribution except for diet class-1, knowledge-3, knowledge-1 and perceived behavioural control measures. Attitude-1 also registered normality.

Item level measurements (Fig. 1) were performed due to the difference in the measurement scales. The model was recursive with a df = 121. It appears items defining attitude, subjective norm, perceived behavioural control, intention, knowledge and dietary behaviour had very high regression weights close to 1.00. The squared multiple correlation indicated that predictors of subscales accounted for >90% except for Perceived Behavioural Control (PBC3) for the recommended diet where the predictors accounted for 44% of the variance of PBC3 itself. Predictors of knowledge accounted for 100% of the variance of knowledge itself. Correlations between observed variables in the model were strong ($p<0.001$) and positive except PBC3 which registered lower but significant positive correlation coefficient ($p<0.01$). Modification indices suggested specifying relationships among items within and between the scales, which suggest multicollinearity.

The goodness of fit statistics were statistically non-significant at the 0.05 level ($\chi^2 = 256.7$, df = 121, $p = 0.07$, $\chi^2/df = 2.12$). However, the relative chi-square was within the recommended 3:1 range indicating acceptable fit after significant modification indices were uncorrelated. Other fit indices {TLI = 0.95; CFI = 0.93; RMSEA (90CI) = 0.075 (0.003, 0.077)} also demonstrated a good model fit. Hoelter's critical N values suggest that the model would have been accepted at the

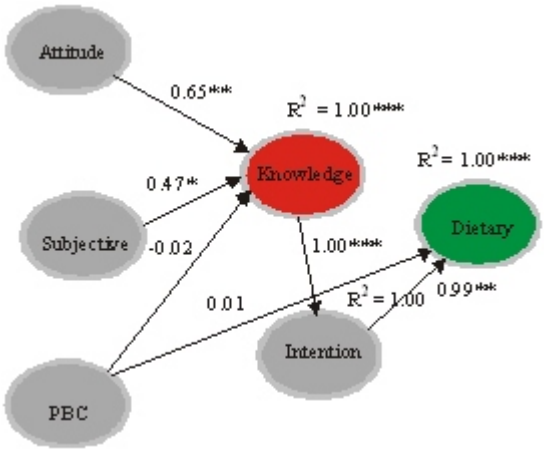

Fig. 2: Planned behaviour knowledge structural model applied to dietary practice

0.05 significance level with 165 cases and the upper limit of *N* for the 0.01 significance level is 199. 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 = 0.075 provided further reassurance about the model fit. Based on the goodness of fit statistics an attempt was made to advance the planned behaviour knowledge theory using structural model (Fig. 2). Standardized regression weights indicates that attitude was a better predictor of knowledge ($\beta = 0.65$, $p<0.01$, n = 237), followed subjective norm ($\beta = 0.43$ $p<0.05$, n = 237) while perceived behavioural control poorly ($\beta = -0.02$ $p>0.05$, n = 237) predicted intention and dietary behaviour ($\beta = 0.01$, $p>0.05$, n = 237). Knowledge strongly predicted intention ($\beta = 1.00$, $p<0.001$, n = 237) while intention still had a strong prediction for dietary behaviour ($\beta = 1.00$ $p<0.001$, n = 237). This implies that when attitude goes up 1 standard deviation, knowledge goes up by 0.65 standard deviations. In addition when subjective norm goes up by 1 standard deviation, knowledge goes up by 0.43 standard deviations. However, when perceived behavioural control goes up by 1 standard deviation, knowledge goes down by 0.02 standard deviations. Again, when knowledge goes up by 1 standard deviation, intention also goes up by 1standard deviations. Finally, when intention goes up by 1 standard deviation, dietary behaviour goes up by 0.99 standard deviations. Knowledge predictors put together accounted for 100% of the variance on knowledge. Finally, intention and perceived behavioural control also explained 100% of the variance on dietary behaviour.

Fitness comparisons between the planned behaviour knowledge theory and the traditional theory of planned behaviour revealed that the new theory was superior

within dietary behaviour (PBK: χ^2/df = 2.12; p = 0.07 against TPB: χ^2/df = 2.53, p = 0.02). The study revealed that attitude (β = 0.65, p<0.01) was the best predictor of knowledge and in descending order followed by subjective norm (β = 0.45, p<0.05), while perceived behavioural control (β = -0.02, p>0.01) only had a small impact on knowledge (Fig. 1) within dietary behaviour model.

DISCUSSION

Attitude, subjective norm, perceived and intention in relation to knowledge: The study used the key concepts identified by Ajzen (1991) including attitude, subjective norm, perceived behavioural control and intention, which were all linked up to dietary behaviour. This research sought to identify the motivational factors underlying dietary behaviour in a sample of Type II diabetic patients. This section of the study was performed because there was need to develop superior models that include patients' perspectives in the dietary promotion and health education and the original theory of planned behaviour was the beginning point. This study revealed that Type II diabetic patients held fairly favourable attitudes toward dietary behaviour, perceived positive social pressure to do so and poorly felt in control of the behaviour. The prediction of each of these factors for knowledge varied significantly. Attitude (β = 0.65, p<0.01) was the best predictor of perceived knowledge followed by subjective norm (β = 0.45, p<0.05), while perceived behavioural control (β = -0.02, p>0.01) only had a small impact on knowledge (Fig. 1) within dietary behaviour model.

Perceived knowledge having been proposed to be a powerful mediator between the underlying TPB concepts (attitude, subjective norm and perceived behavioural control) and intention proved its worth through modeling. Based on this proposition a new theory was advanced and labeled planned behaviour knowledge theory (PBK) for the purpose of this investigation. This study attempted to fit a model based on this theoretical postulation and the proposed model fitted acceptably well within dietary behaviour {χ^2 = 256.7, df = 121, p = .07, χ^2/df = 2.12; TLI = 0.95; CFI = 0.93; RMSEA (90CI) = 0.075(0.003, 0.077)}. Fitness comparisons between the planned behaviour knowledge theory and the traditional theory of planned behaviour revealed that the new theory was superior within dietary behaviour (PBK: χ^2/df = 2.12; p=0.07 against TPB: χ^2/df = 2.53, p = 0.02). Fishbein and Ajzen (1975) argued that variables besides attitude and subjective norm could only influence behaviour if they influence attitude and subjective norm. Although this argument seemed to be true at the time of this theoretical advancement, the situation so far changed when the perceived behavioural control was added as a direct predictor of intention and behaviour (Ajzen, 1991). This study has also demonstrated that knowledge is a direct predictor of intention and that attitude, subjective norm and perceived behavioural control predict knowledge and opens a new area of debate.

The level of a patients' knowledge may affect his/her information and decision-making process (Brucks, 1985; Park *et al*., 1994) with regard to following healthy dietary practices. There appears to be two knowledge constructs within patients' dietary practice domain. The first knowledge construct focus on accurate information about the dietary behaviour stored in the long term memory. The second one dwells on patients' perceptions of what or how much they know about different diet categories. Although the two knowledge spheres appeared to have been related in this study, their distinct nature may be explained. For example, when patients do not accurately perceive how much or how little they actually know, subjective knowledge may over or under estimate patients' actual dietary knowledge. Additionally, measures of subjective knowledge can indicate self-confidence levels as well as knowledge levels (Alba and Hutchinson, 1987; Brucks, 1985). That is, subjective knowledge can be thought of as including patients' degree of confidence in his/her knowledge, while objective knowledge only refer to what patients actually know (Chiou, 1998).

Attitude of Type II diabetes patients may play a major role on the knowledge about behaviour. Negative attitude on the positive outcome of dietary behaviour may interfere with the correct knowledge of a patient and subsequently decision making. Subjective norm or social pressure may also enhance or interfere with the objective knowledge. The pressure from significant others (doctor/clinical officer/spouse/siblings/friend/children/ neighbor) may impact heavily on the knowledge of a patient. As discussed in the previous section, one component of perceived behavioural control in the theory of planned behaviour reflects a patient's self-confidence in the ability to conduct the behaviour through control of barriers. If the patient has strong subjective dietary knowledge, s/he will have higher confidence in the ability to follow appropriate dietary behaviour. His/her attitude toward the act already shows this confidence. The attitude toward the behaviour can overshadow the effect of perceived behavioural control. Therefore, the effect of perceived behavioural control on behavioural intention will be weaker when patients have high subjective dietary knowledge (Chiou, 1998).

Conclusion and significance of the study: Perceived knowledge played a critical role in mediating the relationship between psychosocial factors (attitude, subjective norm and perceived behavioural control) and intention and formed basis for advancing a new theory which we labeled planned behaviour knowledge theory.

This theory past fitness test among the Type II diabetes and within dietary practice {χ^2= 256.7, df = 121, p = 0.07, χ^2/df = 2.12; TLI = 0.95; CFI = 0.93; RMSEA (90CI) = 0.075(0.003, 0.077} domain based on the fit indices used during analysis. The results also revealed that the *planned behaviour knowledge theory* is superior within dietary behaviour (PBK: χ^2/df = 2.12; p = 0.07 against TPB: χ^2/df = 2.53, p = 0.02) based relative chi-square ratios. The new framework can now be used by primary care providers when promoting healthy dietary practices among Type 2 diabetics. When using this individual based theory, two categories of locus of control need to be put into consideration when designing a teaching model. The initial focus should be on both subjective and objective knowledge, and then focus should again be directed toward dietary intention. Knowledge improvement need to consider patients' attitude, social norm and perceived behavioural control for effective learning to take place.

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