A test of theory of planned behavior in type II diabetes adherence: The leading role of perceived behavioral control
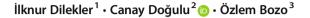
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Abstract

Diabetes mellitus is a health complication that millions of people suffer from all over the world. Type II (non-insulin dependent) diabetes requires many changes in the daily lives of patients, including monitoring blood glucose, following a healthy diet, exercising, and taking medications. Although it is vital for their health, patients generally find it difficult to adhere to their medical regimen. In order to better understand the adherence behaviors of type II diabetes patients, the theory of planned behavior (TPB) was used as the theoretical framework for this study. Ninety type II diabetes patients, who were outpatients of four different hospitals in Ankara, Turkey were administered the TPB tool. The mediation analyses provided support for the mediating role of intention for the attitudes-behavior and subjective norms-behavior relations. The findings did not reveal a mediating role of intention for the PBC-behavior relation but a significant direct effect of PBC on adherence behavior was found. Overall, it seems important that PBC and the multi-faceted nature of adherence behaviors are considered when designing interventions for type II diabetes patients.

Keywords Type II diabetes · Adherence · The theory of planned behavior · Perceived behavioral control · Turkey

Chronic diseases have become an important agenda for health practitioners as they, throughout the world, comprise the major causes of death and disability and there has been an increasing trend in rates of chronic diseases (World Health Organization; WHO 2018). According to worldwide statistics of WHO (2016), the estimated number of people living with diabetes went up from 108 million to 422 million, reflecting a nearly doubled increase in global prevalence. As these statistics indicate, diabetes is a highly prevalent and rapidly increasing chronic disease. In Turkey, diabetes is among the top ten causes of death and has the highest burden of disease along with cardiovascular diseases (WHO 2015). Overall, diabetes is globally considered as a serious public health problem that needs to be prevented by controlling related common biological and behavioral risk factors (WHO 2018).

Diabetes is a serious chronic condition resulting from body's inability to maintain glucose homeostasis. Type II diabetes, comprising a great majority of people with diabetes, occurs when the body is not able to effectively use the insulin it produces (WHO 2016). If not controlled, diabetes causes raised blood glucose and this leads to many physical complications in the body, such as heart attack, stroke, kidney failure, leg amputation, vision loss, and nerve damage (American Diabetes Association 2000; WHO 2016). The physical complications may also be accompanied by psychosocial complications such as negative mood (Adriaanse et al. 2005), depression (Lustman and Clouse 2005), isolation (Whiting et al. 2006), and lower perceived quality of life (Caldwell et al. 1998). Thus, in order to prevent these complications that challenge patients' daily lives, at the individual level, diabetes need to be managed by following medical adherence and adopting healthy lifestyles targeted at improving diet and physical activity (WHO 2016). Diabetes adherence, which is basically the degree of agreement between the health-related behavior of an individual with the recommended action or advice proposed by health care providers, includes glucose monitoring, administration of medication, healthy diet, foot care, and physical activity (Albery and Munafò 2008). However, due to its complex treatment taking place over a

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long period of time and its adherence requiring undesirable lifestyle changes, adherence rates for treatment regimen in diabetes are low. Medication adherence ranges from 36.7% to 67.9% (Polonsky and Henry 2016) in general and is reported to be around 60% in Turkey (IQVIA Institute for Human Data Science 2017). The rates are even as low as 30% for specific behaviors like exercise and diet (Peyrot et al. 2005).

The theory of planned behavior (TPB) provides a socio-cognitive framework for explaining engagement in specific volitional behaviors. It was introduced by Ajzen (1985) as a theoretical extension of the theory of reasoned action (TRA) (Fishbein and Ajzen 1975). The theory assumes that behavior can be predicted from *intention*, which is determined by individual's *attitude towards the behavior, subjective norms,* and *perceived behavioral control (PBC)*. Attitude towards the behavior consists of beliefs about the outcomes of the behavior (outcome expectancy beliefs) and evaluations of the expected outcomes of the behavior (outcome value). Subjective norms involve the person's perception of what others think one should do (normative beliefs) and the value person gives to behaving in line with others' expectations. PBC, which is the major difference between the TPB and the TRA, is defined as the person's beliefs about the amount of control one has on the behavior (control beliefs) (Ajzen 1985). Ajzen (1991) noted that intentions were conceptualized to be central to behavior change in the TRA; however, literature on Atkinson's theory of achievement motivation and Bandura's concept of self-efficacy necessitated such revision. Unlike the other two predictors of intention (attitudes and subjective norms), PBC is proposed to predict behavior directly. As Ajzen (1991) puts forth, this prediction is based on the reasoning that actual control over different behaviors might vary. Specifically, if the behavior is totally volitional, intention is expected to directly and strongly predict the behavior. On the other hand, if additional constraints are required to engage in that behavior – even though the individual has the intention to perform it– the control one perceives on the behavior would be more influential. Hence, PBC was theorized to function as the direct determinant of behavior in case of a weak relation between intention and behavior (Ajzen 1991; Armitage and Conner 2001).

There is a large body of research that has utilized the TPB to explain behavioral processes taking place in various domains (see Ajzen 2018 for an archive). Health seems to be by far the most frequently studied behavioral domain but the theory has also been used to explain behaviors pertaining to relationships (e.g., Byrne and Arias 2004), marketing (e.g., Hasbullah et al. 2014), environment (e.g., De Leeuw et al. 2015), education (Davis et al. 2002), and traffic (Moan 2013) among many others. Further, the efficacy and utility of the TPB have been demonstrated in a number of systematic reviews and meta-analyses (e.g., Armitage and Conner 2001). Considering its significance to health psychology, a great number of

studies have been conducted to understand health-related behaviors of individuals on the basis of the TPB and based on these studies many intervention strategies were suggested. Similar to the empirical support for the TPB in general, the findings of these studies provided support for the theory in understanding behaviors such as exercising (Blue 1995), breast cancer examination (Godin et al. 2001), smoking cessation (Bledsoe 2006), and condom use (Albarracin et al. 2001). Similarly, in their meta-analysis study examining the prospective prediction of health-related behaviours with the TPB, McEachan et al. (2011) showed that the TPB strongly predicted future-oriented intention and behaviour across a range of health behaviors including physical activity, dietary, safer sex, risk detection, and abstinence behaviors.

Regarding the management of diabetes, the TPB has been applied to adherence behaviors of patients diagnosed with type I and type II diabetes as well as health behaviors of people with diabetes risk. Starting with risk group studies from UK and US, the TPB-related cognitions for physical activity (Hardeman et al. 2011) as well as exercising and healthy eating behaviors (Blue 2007) have been investigated. While both studies mainly investigated intention as a TPB-related cognition, Hardeman et al. (2011) also included assessment of actual physical activity in their study. In both studies, PBC significantly predicted intention to engage in health behaviors, indicating the effectiveness of the TPB for intention. However, Hardeman et al. (2011) pointed out that the theory failed to predict behavior and behavior change in risk groups at baseline, 6-, and 12-month follow-ups. These findings with risk groups seem to be limited due to the fact that the participants were not diagnosed with diabetes, thus they did not need to adhere to a diabetes regimen at that time. Hence, either their behaviors were not investigated or the measured health behaviors (i.e., physical activity) were not directly related to management of diabetes.

In addition to research with risk group samples, research with clinical samples provide insights on the usefulness of the TPB in prediction of diabetes-related behaviors. Study findings vary in the extent to which the TPB is effective, that is, whether the model as a whole or only partially with a few TPB components predict adherence behaviors. For instance, two studies from Canada investigating the TPB in relation to physical activity of diabetes patients showed that attitudes, subjective norms, and PBC explained 60% (Boudreau and Godin 2009) and 40% (Plotnikoff et al. 2010) of the variance in intention to engage in physical activity. Although these findings support the model in general for physical activity, Ferreira and Pereira (2017) provided only partial support for the TPB in that only attitude and PBC predicted intention.

Research with clinical samples providing partial support for the TPB has also included dietary behavior among diabetes patients. In their study, White et al. (2007) investigated

engaging in physical activity along with following low-fat diet in both type II diabetes and cardiovascular disease patients from Australia. They found that physical activity was predicted by attitude and PBC, whereas eating behavior was predicted by attitude and subjective norms. In another study on eating behaviors of type II diabetes patients, White et al. (2010) found that intention was predicted by attitude and subjective norms while intention and PBC were directly related to consumption of food with low saturated fats.

Studies designed to consider multiple aspects of diabetes management from a TPB perspective are relatively scarce. In a study conducted by Gatt and Sammut (2008), the focus was on adherence behaviors for diet, exercise, blood sugar testing, foot care, and medication habits of Maltese diabetes patients. Thus, a composite dependent variable reflecting different behavioral domains of diabetes was used. Gatt and Sammut (2008) found that attitudes, subjective norms, and PBC were important predictors of intention to carry out expected behaviors among people with type II diabetes, with PBC being the strongest predictor of intention. Another study conducted with women diagnosed with type II diabetes (Didarloo et al. 2012) utilized extended TRA by incorporating the components of TRA and self-efficacy. The findings of Didarloo et al.'s (2012) study highlighted the importance of self-efficacy, as it was the strongest predictor of intention and had a direct relation with behavior in an Iranian sample. However, it should be noted that the interchangeability of the concepts of self-efficacy and PBC is relevant here. Ajzen (2011) reviewed and commented on the issue by suggesting that self-efficacy is just one dimension of PBC.

To date, there have been no empirical studies in Turkey investigating the TPB with diabetes patients. Still, there are a few studies examining the effects of positive health beliefs (Kartal and Özsoy 2014), health perceptions (Küçük and Yapar 2016), and attitudes (Kara and Çınar 2011) on type II diabetes patients' adherence. Additionally, two studies conducted with Turkish immigrants living in Netherlands (Lanting et al. 2008; Uitewaal et al. 2005) suggested that self-efficacy is a crucial factor for adherence. Specifically, Uitewaal et al. (2005) found that Turkish patients with low self-efficacy tend to overcomply to the regimen, while Lanting et al. (2008) stated that decreased adherence is related to low levels of self-efficacy. The latter study also emphasized that, in contrast to Dutch participants, for Turkish participants, increased social support is related to higher levels of adherence.

In view of the abovementioned diabetes-related TPB studies, it seems that this line of research varies in the extent to which studies focus on multiple adherence domains and in the extent to which findings provide full or partial support for the model. This subject matter merits further examination due to following reasons: (a) findings depending on diabetes risk-group studies are inevitably limited in terms of generalizing its findings to adherence behaviors of clinical samples, (b) studies examining specific health behaviors of diabetes patients seem to indicate the relative importance of multiple components of the TPB, (c) studies investigating multiple adherence behaviors are limited in terms of both quantity and actual conceptual correspondence to the TPB, and (d) thus far, studies on the TPB have predominantly been conducted in Western populations. A limited number of studies with Turkish samples also lack consistent and coherent results about regimen adherence. Thus, the question remains as to whether the TPB can explain adherence behaviors of Turkish diabetes patients as a whole in terms of both multiplicity of the TPB components and adherence domains. In an effort to provide an answer to this question, the present study aimed to test the TPB components in relation to adherence behaviors of type II diabetes patients in multiple domains. It was hypothesized that intention would mediate the relations of attitude, subjective norms, and PBC with adherence behaviors.

Method

Participants

The sample consisted of 90 type II diabetes patients recruited through convenient sampling. All participants were outpatients of endocrinology departments of different hospitals in Ankara, Turkey. Their diagnosis was confirmed by the physicians who referred the patients to the study after their regular examination at the hospital. The sample included 54 women (60%; mean age = 53.37, sd = 8.93) and 36 men (40%; mean age = 54.47, sd = 8.97), and their ages ranged between 19 and 72 ($M = 53.81$, $SD = 8.91$). Participants' socioeconomic status was assessed based on their subjective evaluation; they were asked to evaluate their income as low, middle, or high. Majority of the participants ($n = 75$, 83.30%) reported their perceived socioeconomic status as middle, and the remaining participants reported that they were members of either high ($n = 2$, 2.20%) or low ($n = 13$, 14.40%) SES. The participants have had a history of diabetes for a minimum of one month and a maximum of 504 months ($M = 95.67$, $SD = 82.03$). While 24 participants (26.70%) reported using insulin injections, 82 participants (91.10%) reported using medications for their illness. The number of the participants who reported using both insulin injections and medications for their diabetes was 16 (17.80%). Moreover, 26.70% ($n = 24$) of the patients reported that they had difficulty in providing nutrition necessary for their diabetes management. More than half of the sample ($n = 59$, 65.60%) had at least one other physical or psychological illness. Hypertension ($n = 26$,

44%), cardiovascular diseases ($n = 10$, 17%), and hernia ($n = 10$, 17%) were among the most prevalent diseases that the participants were suffering from.

Procedure

After obtaining Institutional Review Board approvals, data were collected from two state and two private hospitals in Ankara, Turkey. After the purpose of the study was explained and confidentiality was assured, informed consent was obtained from the participants. Due to reading and visionary difficulties that patients might experience, the questionnaires were applied orally to patients in a meeting room during their hospital visits. Application of each questionnaire took approximately 20 min. Upon administration of the questionnaires, all participants were debriefed.

Measures

The Theory of Planned Behavior (TPB) Tool The only measure used in this study was the 50-item, 7-point Likert-type questionnaire aimed at measuring the domains of the TPB in relation to type II diabetes. It was developed by Gatt and Sammut (2008) to explore the predictors of self-care behaviors in type II diabetes patients. Consistent with the domains of the TPB, the questionnaire included five subscales measuring attitudes, subjective norms, perceived behavioral control (PBC), behavioral intentions, and behaviors of type II diabetes.

The first subscale of the TPB Tool is about the attitudes towards self-care behaviors of diabetes patients. It consists of 5 items rated on a 7-point scale ranging from unpleasant (1) to pleasant (7) (e.g., *For me to eat a healthy diet every day for the next seven days is*). Higher scores on this subscale indicate more positive attitudes towards self-care behaviors of diabetes. The second subscale, subjective norms, consists of 10 items rated on a 7-point scale ranging from strongly disagree (1) to strongly agree (7) (e.g., *Most people who are important to me would think I should eat a healthy diet every day*). Participants, who care more about important people's thoughts about their engagement in diabetes self-care behaviors, score higher on this subscale. The third subscale of TBP Tool measures PBC of the participants. PBC was conceptualized as the patients' perceptions of controllability of and self-efficacy about the illness. The subscale has 15 items (e.g., *How much personal control do you feel you have over whether you can eat healthy everyday*) rated on a 7-point Likert type scale with 3 items for each dimension of adherence behavior. These items ranged from no control (1) to complete control (7), from not at all confident (1) to very confident (7), and from difficult (1) to easy (7). Higher scores on this subscale indicate higher level of control perceived over self-care behaviors of diabetes. The fourth subscale was about behavioral

intentions measured with 10 items rated on a 7-point scale ranging from strongly disagree (1) to strongly agree (7) (e.g., *I will try to eat a healthy diet every day*). Higher scores on this subscale indicate higher level of intentions to engage in self-care behaviors of diabetes. The last subscale of the TPB Tool was about the self-care behaviors of type II diabetes patients. It included 10 items about diet, exercise, blood sugar testing, foot care, and medication habits such as "*How many of the seven days did you test your blood sugar?*". Higher scores on this subscale indicate higher levels of engagement in actual diabetes self-care behaviors. Self-care behaviors in the TPB tool correspond to adherence behaviors in our study. Thus, in the rest of the paper the term *adherence behavior* will be used to refer to the reports of the participants about their actual behavior.

The original tool was developed in a Maltese sample diagnosed with type II diabetes and it was found to have content validity. It had an acceptable level of internal consistency for the subscales of attitudes ($\alpha = .90$), subjective norms ($\alpha = .90$), PBC ($\alpha = .85$), behavioural intentions ($\alpha = .84$), and moderate level of reliability for self-care behaviors ($\alpha = .50$). Moreover, test-retest reliability coefficients were .79 for attitude subscale, .89 for subjective norms subscale, .87 for PBC subscale, and .79 for behavioral intention subscale (Gatt and Sammut 2008).

The original tool was developed in English; thus it was translated into Turkish by the authors of the present study. The translation of the tool from English into Turkish was completed by the first two authors who were fluent in Turkish and English. Then, a back-translation was done by the third author who was also fluent in both languages. This back-translation was compared with the original tool by all three authors. At this stage, these two English versions were evaluated to check if the translated version retains the original meaning, and then inconsistencies were resolved (Brislin 1970). The translated version had acceptable internal consistency ($\alpha = .89$). Subscales of subjective norms ($\alpha = .89$), PBC ($\alpha = .82$), and behavioral intention ($\alpha = .84$) had high reliability values. Cronbach alpha values were relatively lower for attitude ($\alpha = .53$) and self-care behaviors ($\alpha = .60$), indicating moderate levels of reliability (Hinton et al. 2004). These subscales were included into the analysis not to disrupt the unity of the tool and the TPB model. In addition, Hair et al. (2014) put forth that Cronbach alpha levels around .60 are acceptable if research is exploratory and/or if other constructs have good reliability values, which is also the case in this study.

Results

Preliminary analyses were conducted to examine the relations between the demographic and main study variables (i.e., the TPB model variables). Particularly, significant

correlations and group differences for the TPB variable *adherence behavior* were inspected to use as covariates later for testing the TPB model with mediation analyses. Based on correlational analyses (see Table 1), duration of diabetes was significantly and positively related to adherence behavior ($r = .25$, $p < .05$), indicating that the longer the duration of diabetes, the higher their actual adherence behaviors were. As for group differences, it was found that participants who reported difficulty in food supply ($m = 47.50$, $sd = 12.75$) were found to adhere to their regimen more than the participants who did not report any difficulty ($m = 41.30$, $sd = 9.10$), $t(88) = -2.55$, $p < .05$. Accordingly, diabetes duration and food supply difficulty were included as covariates in the mediation analyses.

Considering our small sample size and the resulting potential for increased type I error, a bootstrapping approach was preferred for the main analyses. Accordingly, the TPB model was tested by PROCESS (Preacher and Hayes 2004), an analytic tool which is based on bootstrapping and also allows for controlling for covariates in mediation analyses. For the mediation analyses, the indirect effects of the TPB variables *attitudes, subjective norms,* and *PBC* on *adherence behavior* through *intention* was tested using bias-corrected bootstrapping derived from 5000 resampling. Each mediation was tested separately so that the effects of the predictors and the covariates on each other are not cancelled out (Hayes 2018; Preacher and Hayes 2004). As Hayes (2018) recommended, Sobel test was used to examine the significance of the mediations. Specifically, an indirect effect is considered as significant when the range of the 95% confidence interval (CI) derived from 5000 bootstrap resamples excludes zero. Both preliminary and mediation analyses were performed using IBM SPSS (Version 20). An interactive online calculation tool was used to conduct the Sobel test (Preacher and Leonardelli 2001).

Firstly, the indirect effect of attitudes on adherence behavior through intention was examined with diabetes duration and food supply difficulty as covariates. It was found that the indirect effect of attitudes was statistically different from zero (CI [.17, .86]) and the Sobel test yielded significant results ($z = 2.65$, $SE = .19$, $p < .01$). Thus, intention mediated the relation between attitudes and adherence behavior. In other words, when participants had high levels of intention to adhere to the medical regimen, having positive attitudes toward adherence increased their actual behavioral engagement.

Secondly, the indirect effect of subjective norms on adherence behavior through intention was tested with diabetes duration and food supply difficulty as covariates. The mediation analysis revealed that subjective norms influences adherence behavior indirectly through intention (CI [.06, .37]). The Sobel test also showed that this indirect effect was statistically significant ($z = 2.97$, $SE = .06$, $p < .01$). Thus, when participants had high levels of intention to adhere to the medical regimen, endorsing subjective norms regarding adherence increased their actual behavioral engagement.

Lastly, the indirect effect of PBC on adherence behavior through intention was tested after controlling for the two covariates. For this indirect effect, the range of the 95% confidence interval included zero (CI [−.15, .19]). That is, intention failed to mediate the PBC-behavior relationship. The significant direct effect, however, suggested that higher levels of PBC is positively related to engagement in adherence behaviors. The direct effects tested for all the mediation analyses can be seen in Table 2.

Discussion

The aim of the current study was to test the Theory of Planned Behavior (TPB) in an attempt to better understand the

Table 1 Descriptive statistics for and intercorrelations among variables: age, duration, attitudes, subjective norms, perceived behavioral control (PBC), intention, and adherence behavior

Variable	Correlations							M	SD	Range	
	1	2	3	4	5	6	7			Min.	Max.
1. Age	–							53.81	8.91	19	72
2. Duration	.43**	–						95.67	82.03	1	504
3. Attitudes	−2.36*	.12	(.53)					31.73	2.97	17	35
4. Subjective Norms	−.52	.21	.13	(.89)				58.70	10.89	24	70
5. PBC	.06	.26*	.36**	.37**	(.82)			86.52	10.79	55	105
6. Intention	.02	.22*	.36**	.47**	.72**	(.84)		61.02	7.60	39	70
7. Adherence Behavior	.14	.25*	.02	.14	.55**	.42**	(.60)	42.96	10.49	19	69

* Correlation is significant at $p < .05$, ** Correlation is significant at $p < .01$

Scores shown in parentheses on diagonal are alpha internal consistency reliabilities

Table 2 Direct effects observed in the mediation analyses

Antecedent		Consequent							
		Intention				Adherence behavior			
		Coefficient	SE	p			Coefficient	SE	p
Attitudes	a	.86	.25	< .01	c'		−.60	.35	.09
Intention		–	–	–	b		.59	.14	< .001
Diabetes duration		.02	.00	.09			.02	.01	.10
Food supply difficulty		.76	1.70	.66			5.18	2.20	< .05
Constant	i_1	31.97	8.04	< .001	i_2		22.70	11.32	< .05
		$R^2 = .16$					$R^2 = .27$		
		$F(3, 86) = 5.53, p < .01$					$F(4, 85) = 7.93, p < .001$		
Subjective norms	a	.31	.07	< .001	c'		−.12	.10	.27
Intention		–	–	–	b		.58	.15	< .001
Diabetes duration		.01	.01	.21			.03	.01	< .05
Food supply difficulty		.32	1.63	.85			5.45	2.41	< .05
Constant	i_1	41.70	3.93	< .001	i_2		11.00	8.17	.18
		$R^2 = .24$					$R^2 = .26$		
		$F(3, 86) = 8.85, p < .001$					$F(4, 85) = 7.39, p < .001$		
PBC	a	.51	.06	< .001	c'		.43	.13	< .01
Intention		–	–	–	b		.09	.18	.63
Diabetes duration		.00	.01	.67			.01	.01	.25
Food supply difficulty		−.94	1.30	.47			3.83	2.13	.08
Constant	i_1	16.91	4.63	< .001	i_2		−1.73	8.15	.83
		$R^2 = .52$					$R^2 = .34$		
		$F(3, 86) = 31.57, p < .001$					$F(4, 85) = 10.75, p < .001$		

adherence behaviors of type II diabetes patients. Particularly, the indirect effects of the TPB components attitudes, subjective norms, and PBC on adherence behavior through intention was tested with separate mediation analyses. The findings provided support for the mediating role of intention for the attitudes-behavior and subjective norms-behavior relations. Mediation findings obtained for attitudes and subjective norms provided support for the TPB model. Specifically, when type II diabetes patients have high levels of intention to adhere to the medical regimen and more positive attitudes toward diabetes-related self-care behaviors, and endorse subjective norms (i.e., caring about important people's thoughts about one's engagement in diabetes-related self-care behaviors), then they become more likely to perform actual adherence behaviors.

Our findings did not reveal a mediating role of intention for the PBC-behavior relation, indicating that one's level of intention to adhere to medical regimen is not influential in determining the extent to which PBC is positively related with adherence behavior. Still, a significant direct effect of PBC on adherence behavior was found. That is, adherence to medical regimen was directly explained by how much control the participants felt over their diabetes-related self-

care behaviors, which was not the case for attitudes and subjective norms. From a cultural perspective, the observed influence of PBC on adherence behavior without the mediating role of intention, as well as the mediating role of intention for attitudes-behavior and subjective norms-behavior relations, seem to provide support for the cross-cultural validity of the TPB in type II diabetes context.

An important finding of this study, thus, is that intention did not function as a mediator for the PBC-behavior relation. This was similar to findings of Zomahoun et al.'s (2016) study which focused on adherence to drug use in diabetes as the behavioral element of the TPB. It seems to be important to reflect on why intention failed to mediate the relation between PBC and adherence behavior. Firstly, as Ajzen (1991) and Armitage and Conner (2001) pointed out, all behaviors may not be equally volitional or the relative importance of predictors might have been influenced by the nature of the particular behavior. For instance, taking pills might require less effort and motivation than exercising or patients might not consider unfavorable consequences of poor foot care as much as blood monitoring. In fact, factors that have been found to be influential in diabetes-related adherence behaviors might have a hindering effect for the translation of intention into actual

behavioural engagement. Though these factors are not the focus of the TPB, it is known that mindfulness, awareness of attention, environmental cues, and inner experiences (Chatzisarantis and Hagger 2007), individual differences in executive functioning (Hall et al. 2008), coping planning (Scholz et al. 2008), and problem solving (Hill-Briggs 2003) may influence adherence levels to diabetes regimen. Compared to behaviors that require less effort and planning (such as drug usage), behaviors that require more effort (such as exercising) might depend more on factors such as coping planning and problem solving. These possibilities seem to be good candidates for further investigation in the TPB research.

The findings of the present study further provide support for the TPB reasoning in understanding adherence behaviors of type II diabetes patients in Turkey. Particularly, our findings point out that diabetes-related self-care behaviors comprising treatment adherence are not totally volitional; instead, they require additional constraints which render intention ineffective (Ajzen 1991; Armitage and Conner 2001). Further, in the present study, we found that participants who had difficulty in food supply reported higher levels of adherence. This finding can be interpreted as further supporting the view that it might be the extent to which patients perceive control over their adherence behavior, rather than their actual resources, that is important for adherence when it is potentially hindered by extraneous factors such as food supply difficulty. In this sense, the emergence of PBC as a key predictor of adherence behavior can be considered as the most important contribution of this study to the field.

Our findings are also similar to Gatt and Sammut's findings (Gatt and Sammut 2008) in that both studies revealed that PBC directly predicted adherence behaviors of individuals with type II diabetes. Supporting these findings, in a review study investigating the applications of the TPB to health-related behaviors (Godin and Kok 1996), PBC was found to be a strong and also the only direct predictor of behavior in half of the studies reviewed on health behaviors. Furthermore, it explained additional 13% and 12% of variance in intention and behaviors over and above attitudes and subjective norms. Though this review study is based on peer-reviewed publications during 1985–1996, research evidence has also been accumulating in recent years to support the distinctive role of PBC in predicting health behaviors of individuals with diabetes (e.g., Ajzen 2011; Blue 2007; Didarloo et al. 2012; Taylor et al. 2006; White et al. 2007, 2010).

Abovementioned factors can be regarded as being related to individual's intrapersonal processing about adherence to diabetes regimen. However, research has revealed that interpersonal interactions and social conditions also play a role. Studies have shown that perceptual differences between patients and physicians in terms of diabetes seriousness (Clark and Hampson 2003), obstacles (Vermeire et al. 2007) and perceived barriers to adherence (Nagelkerk et al. 2006) as well

as health-related quality of life (Maddigan et al. 2005) influence adherence behaviors of type II diabetes patients. Such difference between patients' and health care professionals' beliefs about diabetes might also be complicating the mediating role of intention for PBC-behavior relation. Furthermore, as related to health care professionals' and patients' interaction, the extent to which patients view their physicians competent in addition to their own perceived self-efficacy has been found to be related to behavior modification (Imai et al. 2017). As have been discussed by Perwitasari and Urbayatun (2016), institution characteristics might also be influential in supporting patients on ways of coping with the disease and adhering to its medical regimen.

Although more than one health institution was visited for this study in order to overcome the possible effects of organizational factors, as researchers we did not have in-depth information about patients-health care system interaction in the four hospitals where data collection took place. Particularly, it might be that the four hospitals differ with respect to health care professionals' characteristics as well as health care politics, patient preferences, and quality of relationship between professionals and patients. For instance, some of the participants mentioned that they attended the hospital's educational meetings about diabetes management while some others did not. Such differences might have influenced our findings. Further studies which take these organizational differences into account are therefore recommended to better understand the role of the TPB dynamics in adherence to type II diabetes regimen.

Pointing out the importance of social context, Ajzen (2011) did propose that investigation of background factors is enriching especially for habit formation as it is the case for major lifestyle changes diabetes requires. Jones et al. (2014) identified several factors as barriers and facilitators at broader levels for type II diabetes management, which would guide future studies in extending their scope. These factors included intrapersonal (illness denial, motivation, knowledge and skills, and lack of time), interpersonal (stress and relationships), organisational (access to recommended foods, transport, health professionals, and exercise options), and societal (engagement and societal attitudes; e.g., disengagement from community, unemployment, lack of meaningful roles in society, isolation, and negative attitudes of society) conditions (Jones et al. 2014). Thus, to develop a full psychological picture of adherence to type II diabetes regimen, further studies focusing on contextual and interpersonal factors in addition to factors accounted by the TPB model are suggested.

In addition to the contributions explained above, the present study stands out in several respects. Particularly, this study is the first in Turkey to test the TPB with type II diabetes patients, a clinical sample. In order to be able to control for possible confounding variables, various diabetes-related demographic variables were also included in our study. In this

sense, delineating the influence of various diabetes-related (e.g., food supply, difficulty in food supply) socio-demographic variables was rendered possible to some extent. Furthermore, the current study attempted to understand a broad range of behaviors involved in diabetes regimen. Previous research on the application of the TPB to diabetes-related health behaviors mainly relied on specific behaviors, such as physical activity and dietary behaviors. As a matter of fact, the decision of which behaviors of diabetes regimen should be included while testing the TPB seems to be a challenging one. Assessment of the TPB components with a more holistic approach in terms of medical regimen seems to be important, as the daily activities of patients include them all. Yet, different dimensions of diabetes regimen might yield more specific findings, since in that case each individual behavior is evaluated in terms of its own individual (e.g., level of individual effort) and environmental (e.g., physical and economic conditions) requirements as discussed earlier. Likewise, Gatt and Sammut (2008) found that although PBC was the strongest predictor of the model, blood-monitoring was relatively more strongly predicted by PBC compared to other domains of diabetes regimen. Therefore, in future studies or meta-analyses, the differences between these two research approaches can be addressed.

The current study is not without its limitations. Due to the retrospective nature of adherence measurement, participants might have filled the TPB tool under the influence of recall bias. In other words, they might have unintentionally or intentionally distorted their reports of adherence behaviors in the previous week. Also, since the TPB tool was administered orally by the researchers, the probability of obtaining socially desirable responses by the participants might have increased. Cultural characteristics might have also played a role in this increase in social desirability. Our participants, as members of a relatively collectivistic culture (Hofstede 2001), might have experienced the need to maintain positive and harmonious relations with the interviewer (Johnson and Van de Vijver 2003). Still, as Armitage and Conner (2001) have suggested, social desirability in the TPB studies is trivial.

A further limitation of the present research is that the two subscales of the Turkish version of the TPB tool (i.e., attitudes and adherence behavior) were moderately reliable. These subscales were included in the study due to reasons explained in the Method section. Still, there seems to be substantial need for a thorough adaptation of the tool or development of a robust measurement. Moreover, although the sample size of the study was statistically acceptable, some limitations can arise when the diversity of the participants is considered. The sample of the study did only include patients visiting their physicians regularly, but not those who do not or cannot go to hospital. In other words, our sample might not be representative of type II diabetes patients who do not or cannot attend to their regular visits and this might have confounded the generalizability of our findings. In addition to problems in reaching to patients with diverse characteristics, difficulty in contacting patients multiple times led to a cross-sectional study design, which enabled us to reveal just a snapshot of their adherence behaviors and related factors. Thus, it is crucial that future studies take the diversity of patients into account and employ longitudinal designs in order to increase the validity of findings and their predictive power in this field of research.

In conclusion, despite its limitations, the present study contributes to health psychology literature by examining the implementation of the TPB to adherence behaviors of type II diabetes patients in a non-Western culture. Our findings demonstrated the mediating role of intention for the attitudes-behavior and subjective norms-behavior relations, but not for PBC-behavior relation. Still, PBC was found to directly predict adherence behaviors of type II diabetes patients. Although the findings should be interpreted with caution, the need to consider PBC as a crucial aspect of diabetes management is well pointed out, as consistent with theory and previous research. As an implication, it might be that for patients similar to our sample characteristics, professionals should make an effort to facilitate the feeling of control their patients feel over different domains of adherence including glucose monitoring, medication, diet, physical activity, and foot care practices. While doing this, it is also important to keep in mind that the individual patient is embedded in a larger context consisting of social, cultural, and economic dynamics. Hence, there is a need for adopting a more comprehensive approach to behavioral management of type II diabetes adherence, taking into account these socio-cultural dynamics as it is the case for many medical conditions.

Compliance with Ethical Standards

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