

Predicting Tooth Brushing Behavior among Students in Guilan, North of Iran: An Application of the Theory of Planned Behavior

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Abstract

Background

Oral health is one of the key elements of quality of life and welfare. The aim of this study was to investigate the role of the Theory of Planned Behavior (TPB) as predictors of dental brushing behavior among Iranian adolescents.

Materials and Methods: This cross-sectional study was carried out on 791 students in Guilan province, Iran, during the year 2018. The participants were selected through the multi-stage random sampling method. The data collection tool was a self-administered questionnaire designed based on TPB. The validity and reliability of the scale were assessed and confirmed. The data were analyzed using linear and logistic regression models in SPSS software version 21.0.

Results: Nearly half of the assessed students were girls (49.6%, n=392/791). In total, 363 students (45.9%) brushed their teeth once or more daily. The TPB constructs accounted for 28% of the variance of intention to teeth brushing. Multiple logistic regression showed that one-point increase in scores of attitude, perceived behavioral control (PBC), and subjective norms, led to 10%, 12%, and 3% increase in the odds of daily teeth brushing respectively. Moreover, one-point increase in behavioral intention increased the odds of daily teeth brushing 2.24 fold.

Conclusion

Based on the results, the level of oral health practice was unfavorable among most of Guilan high school students compared to similar studies in the world. It seems designing and implementing educational interventions based on TPB constructs especially variables of perceived behavioral control and attitude, could result in optimal activities regarding oral health care among students.

Key Words: Dental Care, Oral Health, Students, Tooth brushing.

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1- INTRODUCTION

Oral health is not limited to dental health. It is one of the most important elements of public health and welfare (1). It also has a notable effect on the quality of life and social relationships (2). Inappropriate oral hygiene can have unsightly consequences for the children (3). For this reasons, many countries have initiated plans to achieve and promote oral health in different social groups. Students in the future of society and human resources are one of the critical social groups and their health is an important issue (4). Oral health might influence the educational performance of students at school and their professional achievements in the future (5). There are reports by studies that more than 66 million school hours are lost due to oral health problems in the world every year. Oral diseases may lead to pain and loss of teeth, which influence appearance, quality of life, nutrition, and growth of children (4, 6).

In addition, the diseases caused by poor oral hygiene create speech and digestive disorders, affect other body organs, and degrade facial beauty. For instance, periodontitis is a potential cause of infection of parathyroid glands, digestive system, and respiratory system, cardiac diseases, and joint rheumatism (7, 8). Tooth decay is one of the most prevalent chronic diseases in children and teenagers all around the world (9, 10). According to the World Health Organization (WHO), about 60-90% of students and around 100% of adults in the world have different levels of tooth decay symptoms (11). The rate of tooth decay in Iranian 15-year teenagers is 74.79%(12), and one of the main reasons for inadequate oral health oral health is poor hygiene and failure to brush the teeth (9, 13). Surveys by the Iran Ministry of Health have shown that 76.9% of Iranian students brush their teeth less than two times a day (10). In the study by Shaghaghian in Shiraz (14), 75% of

children and in the study of Sadeghipour et al. (15), 39.3% of students brushed their teeth once a day or more. Different results were reported from other countries. For example, 39.7% of Chinese children (16), and 52% of Saudi Arabian students brushed their teeth once daily (17). The mechanism of teeth decay and periodontal diseases is highly affected by lifestyle and habits (18). The WHO has warned countries about the load of dental and mouth diseases on health systems and emphasized on the necessity of adopting new approaches towards oral health that are more focused on preventive measures (7, 19). The risk factors of oral health are an unhealthy diet, smoking, alcohol abuse, poor oral hygiene, and economic social conditions (11). Self-care behaviors like teeth brushing are of the main preventive factors of dental decay and periodontal diseases (13, 20). Experts believe that schools can play an important and effective role in the improvement of oral health (13). Through this, the health and welfare of school officials, family members, and members of the society are also improved through school-based programs (5, 18).

With more than a billion population, students play a key role in the promotion and transfer of health concepts. They can achieve the skills to choose a healthier lifestyle. Oral health messages can be created and promoted through school programs (4). Effective improvement of oral health behaviors in those who need it is possible through comprehending the key factors in people's decision to use a toothbrush (20). This can be done using theory to determine the mediatory factors in oral health (21). One of the most acknowledged theories in this regard is the theory of planned behavior (TPB). It gives us a framework to have a disciplined and critical survey of the factors effective in making a decision about a behavior (22). The theory is a social cognitive decision-

making pattern that provides a useful framework to predict and explain health-related behaviors. It can predict the occurrence of behavior provided that the individual intends to perform such behavior (8). Accordingly, the intention to perform a behavior is predicted by attitudes towards the behavior, subjective norms, and perceived behavioral control (8). This study is an attempt to determine the factors effective in teeth brushing behavior in students at public schools of Guilan province (Iran), based on the TPB.

2- MATERIALS AND METHODS

2-1. Study design

This cross-sectional study was carried out on 791 high school students at Guilan province public urban schools, Iran during the year 2018. The participants were selected through a multi-stage random sampling method. At first, the province was divided into five districts (north, south, east, west, and center). Through simple random sampling, a city was selected in each district (Rasht, Talesh, Fooman, Anzali, and Roudbar). Afterward, a list of public schools was prepared; then, relative to the number of students in each city and through random simple sampling, 12 schools were selected in Rasht city (six girls' and six boys' schools), and eight schools were selected from the remaining cities (four girls' and four boys' schools). At the third stage, a 9th grade classroom was selected from each school through simple random sampling. Given that the distribution of boys and girls population was almost identical, equal numbers of participants from each gender were selected. The required number of participants was determined based the estimation of prevalence of teeth brushing behavior in the population. Based on previous study (6), using a 30% prevalence rate of teeth brushing behavior among adolescents in Guilan province, with a 4% tolerable error, and 0.05 probability of

error type 1 ($\alpha=0.05$), taking into account the risk of losing the information of about 15% of the subjects and with a design effect of 1.2, the final number of participants was set to at least 708.

2-2. Inclusion and exclusion criteria

Inclusion criteria were being a 9th grader in public schools of Guilan province, no history of orthodontics, no progressed oral and dental disease, attending the school during the study, and informed consent to the participant. Exclusion criteria included reluctance to participate, failure to completely fill the questionnaire, and diagnosis of diseases like periodontal disease.

2-2. Measures

A questionnaire was designed based on previous studies (5-7, 9, 13). The validity of the tool was examined using content validity ratio (CVR), content validity index (CVI) (with nine hygiene and health promotion experts, two epidemiologists, and two dentists as reviewers). Face validity was evaluated through interviews with 10 boys and 10 girl students. The questionnaire consists of six sections that are further explained in what follows. **1.** Baseline characteristics (nine statements listed in **Table.1**), and knowledge (eight multi-alternative questions; max and min scores 16 and 0, respectively). **2.** Attitudes; this scale is an 11 item instrument that measures the attitude of students towards oral health care (i.e., if I brush my teeth, I will not have a toothache), and the answers were designed based on Likert's five-point score from 1 (completely disagree) to 5 (completely agree). **3.** Subjective norms; eight items were used to measure the influence of important people (teachers, friends, etc.) on students' opinion about oral health behaviors (i.e. I will brush my teeth if my parents or other family members remind me). The possible response choices range from 1 (completely incorrect) to 5 (completely correct). **4.**

Perceived Behavioral Control; five items were used to measure the students' perceptions about tooth brushing. The students were questioned to show whether it was easy or difficult to brush their teeth (i.e. I am confident that I can brush my teeth even when I am tired). **5.** Intention; three statements were included to measure the students' intention (i.e. in the next 14 days, I am going to brush my teeth every day). In this section, the possible response categories were designed based on Likert's five-point scores from 1 (completely incorrect) to 5 (completely correct). Finally, **6.** Student behavior was evaluated by one question "how many times did you brush in the last seven days?". To evaluate the reliability of the questions, the test-retest method, and intra class correlation (ICC) were used. To this end, 30 students (15 girls and 15 boys) filled out the questionnaire twice with a two week interval. The reliability of the tool was supported in terms of creating knowledge (ICC=0.79) and the constructs of the TBP (ICC ranged from 0.75 to 0.92) (**Table.2**).

2-3. Statistical analysis

The collected data were described using mean and standard deviation for quantitative variables and frequency and percentage for qualitative variables. In the data analyses, frequency of tooth brushing during the last seven days was calculated daily by dividing by 14 and then students were categorized to two groups (students without brushing and students with daily tooth brushing ≥ 1). The Chi-squared test and Mann-Whitney test was used to assess differences between two groups of students, regarding the nominal and ordinal variables. The Spearman correlation coefficient tests were performed to evaluate linear relation among behavior (binary variable 0 and ≥ 1), knowledge and constructs scores. In the multivariable analyses, a multiple linear regression model was performed to examine the relation between constructs of

the theory of planned behavior and intention as the dependent variable. Normality distribution of residuals was checked and met. In addition, a multiple binary logistic regression was used to evaluate the relation between constructs of the TPB and teeth brushing behavior (0 and ≥ 1); while controlling for other variables significantly associated with the behavior. A backward stepwise method was used for identifying demographic variables significantly associated with the behavior in the multivariable model. Hosmer-Lemeshow test is a statistical test for goodness of fit for the logistic regression model and Cox-Snell pseud R² was reported. In all analyses, p-values less than .05 were considered statistically significant. The data were analyzed in SPSS software version 21.0. P-value lower than 0.05 was considered statistically significant.

3-RESULTS

There was an almost identical gender distribution in the participants (50.4% boys and 49.6% girls, total participants n=791). The mothers (37.9%, n=300), and fathers (31.9%, n=253) with a high school diploma were in the majority. The majority of fathers (56.2%, n=445) were freelancers and the majority of mothers were homemakers (79.5%, n=629). In total, 363 students (45.9%) brushed their teeth once or more daily. As listed in **Table.2**, gender, parents' education, and fathers' job were significantly related to teeth brushing behavior ($P < 0.05$). The frequency of teeth brushing was significantly higher in girls, students whose fathers had a college degree, and students whose fathers were office employees. Moreover, teeth brushing behavior was significantly lower in the students whose mothers had elementary education ($P < 0.05$). As listed in **Table.2**, the students obtained the highest mean score in behavioral intention followed by attitudes, perceived behavioral control, and

subjective norms, respectively. As showed in **Table.3** there was a linear relation between all the constructs and teeth brushing behavior. According to the results of Spearman correlation analyses, intention ($r = 0.59, p=0.002$), Perceived behavior control [PBC] ($r = 0.29, p=0.001$), attitude ($r = 0.18, p=0.009$), SN ($r = 0.14, p=0.005$), and knowledge ($r = 0.08, p=0.03$) were positively related to the

tooth brushing behavior. In addition, there was no significant relationship between knowledge and the constructs of intention, PBC, attitude and SN ($P>0.05$ for all). The relationship between behavioral intention and behavior was strong, between control and behavior was moderate, and between subjective norms, attitudes, and behavior was weak (**Table.3**).

Table.1: Distribution of daily tooth brushing amongst students according to selected background characteristics (n=791).

Variables	Sub-group	Number	Tooth brushing daily		P-value
			≥1	0	
			Number (%)	Number (%)	
Gender	Girl	392	226(57.7%)	166(42.3%)	0.001
	Boy	399	137(34.3%)	262(65.7%)	
Age	14	199	98(49.2%)	101(50.7%)	0.059
	15	482	226(46.9%)	256(53.1%)	
	16	110	39(35.5%)	71(64.5%)	
Number of siblings	1	141	75(53.2%)	66(46.8%)	0.205
	2	439	200(45.6%)	239(54.4%)	
	3	159	67(42.1%)	92(57.9%)	
	4	37	16(43.2%)	21(56.8%)	
	≥5	15	5(33.3%)	10(66.6%)	
Birth rank	1	414	199(48.1%)	215(51.9%)	0.594
	2	259	115(44.4%)	144(55.6%)	
	3	88	36(40.9%)	52(59.1%)	
	4	18	9(59.1%)	9(50%)	
	≥5	12	4(33.3%)	8(66.7%)	
Father's job	Employee	196	108(55.1%)	88(44.9%)	0.039
	worker	67	28(41.8%)	39(58.2%)	
	Free	442	194(43.9%)	248(56.1%)	
	Farmer	28	11(39.3%)	17(63%)	
	Retired	54	20(37%)	426(54.1%)	
Mother's job	housewife	627	282(45%)	345(55%)	0.646
	Employee	91	49(53.8%)	42(46.2%)	
	worker	7	3(42.9%)	4(57.1%)	
	Free	53	32(41.5%)	31(58.5%)	
	Farmer	4	2(50%)	2(50%)	
	Retired	7	4(57.1%)	3(52.9%)	
Father's education	illiterate	14	7(50%)	7(50%)	0.006
	Elementary	91	36(39.6%)	55(60.4%)	
	High school	243	98(40.3%)	145(59.7%)	
	Diploma	252	112(44.4%)	140(55.6%)	
	University	189	108(57.1%)	81(42.9%)	
Mother's education	illiterate	31	14(45.2%)	17(54.8%)	0.001
	Elementary	116	34(29.3%)	82(70.7%)	
	High school	180	79(43.9%)	101(56.1%)	
	Diploma	299	143(47.8%)	156(52.2%)	
	University	163	91(55.8%)	72(44.2%)	
Socioeconomic status	Good	387	183(47.3%)	204(52.7%)	0.479
	Medium or bad	402	180(44.7%)	222(55.2%)	

Table-2: Description statistics for knowledge and TPB constructs scores.

Variable (no. of items)	Median	Mean± SD	Scales range	Mean ± SD per item
Knowledge (8)	8	8.13±2.41	0-16	--
Attitude (11)	42	41.91±5.99	11-55	3.81±0.55
Subjective norm (8)	30	29.52±6.10	8-40	3.69±0.76
PBC (5)	19	18.86±2.81	5-25	3.80±0.79
Intention (3)	13	12.14±3.21	3-15	4.04±0.99

SD: Standard deviation, TPB: Theory of Planned Behavior.

Table-3: TPB variables with brushing behavior correlation matrix.

Variables	Knowledge	Attitude	Subjective norm	PBC	Intention	Behavior
Knowledge	1					
Attitude	0.019	1				
Subjective norm	0.004	0.339**	1			
PBC	0.061	0.302**	0.304**	1		
Intention	-0.003	0.245**	0.267**	0.390**	1	
Behavior	0.084*	0.180**	0.139**	0.288**	0.587**	1

* P<0.05, **P<0.01, PBC: Perceived behavior control.

Based on the multiple linear regression result, PBC had a stronger significant relation with behavioral intention followed by subjective norms and attitudes. These three constructs describe 28% of the variance of behavioral intention (**Table.4**). Multiple binary logistic regression to assess adjusted relation between TPB constructs and behavior showed that controlling for other variables, one-point increase in attitude, led to a 10% increase in the odds of teeth brushing. In the same manner, one point increase in perceived behavioral control, led to a 12% increase

in the odds of teeth brushing. One point increase in subjective norms score, led to a 3% decrease in the odds of teeth brushing. Moreover, one point increase in behavioral intention increased the odds of teeth brushing by 2.24 times. The regression model also demonstrated daily teeth brushing in girls was 2.18 times more than boys. P-value of the Hosmer-Lemesow test shows goodness of fit test with statistics equals 9.64 and degree of freedom of 8 was 0.291. Cox and Snell determination coefficient of the logistic regression model was equal to 0.42 (**Table.5**).

Table-4: Regression coefficient and its 95% confidence interval of TPB constructs as predictors of behavioral intention using a multiple linear regression model.

Variables	Unstandardized Coefficients		Standardized Coefficients (Beta)	T	P-value	95% CI for B		R2
	B	S.E.				Lower	Upper	
Constant	1.887	.709		2.663	.008	.496	3.279	0.28
PBC	.310	.025	.407	12.274	.000	.260	.360	
Attitude	.046	.017	.092	2.675	.008	.012	.080	
Subjective norm	.082	.017	.167	4.968	.000	.050	.115	

SE: Standard error, 95% CI: 95% Confidence Interval, PBC: Perceived behavior control.

Table-5: Odds ratios and its 95% confidence interval of TPB constructs related to daily tooth brushing (<1 and ≥1 times) as dependent variable using a multiple logistic regression model.

Variables	B	S.E.	Wald	df	P-value	Exp(B)	95% CI for EXP (B)	
							Lower	Upper
Knowledge	.095	.041	5.263	1	.022	1.099	1.014	1.192
PBC	.111	.030	13.394	1	.000	1.117	1.053	1.186
Attitude	-.005	.019	.073	1	.787	.995	.958	1.033
Subjective norm	-.032	.019	2.987	1	.084	.968	.933	1.004
Intention	.808	.069	135.083	1	.000	2.242	1.957	2.570
Gender	.782	.198	15.534	1	.000	2.186	1.482	3.225

SE: Standard error, 95% CI: 95% Confidence Interval, TPB: Theory of Planned Behavior, df; degrees of freedom, PBC: Perceived behavior control.

4- DISCUSSION

The good oral health is vital to good quality of life. It is vital to examine this important matter to develop more effective oral health prevention programs (22). The aim of this study was to evaluate the role of the Theory of Planned Behaviour (TPB) as predictors of dental brushing behavior among Iranian adolescents. Our results showed that less than half of the students (45.9%) brushed their teeth once or more per day. Similarly, study of Habibi et al. (6) in Qom (Iran) was 35%, and 39.3% in Sadeghipour et al. (23), in Tehran, Iran. Al Subait et al. (24) in Saudi Arabia reported that 67% of the participants brushed their teeth once or more a day. Contrary to the results of our study, Taniguchi-Tabata et al. (25) found 86.6% for Japanese students.

Obviously, Iranian students are not in the desired level in terms of teeth brushing; while many authors have shown that brushing is one of the main behaviors to prevent oral and dental diseases (5, 9). In addition, there was a strong relationship between brushing with fluoride-enriched toothpaste and oral health (5, 8). The present study also indicated that the behavioral intention was the most related factor of the teeth brushing behavior so that there was a strong correlation between behavior and intention. This finding is not surprising as the direct and main determinant of behavior in the TPB is the behavioral intention. This construct covers thinking about demonstrating a behavior, which is the direct determinant of behavior. The strong relationship between

intention and behavior has been supported in many of the behavioral fields such as Soltani et al. (8), Fai et al. (26), and Polk et al. (27). A meta-analysis by Sheerman et al. (19), also found a positive and significant correlation between intention and teeth brushing behavior. In a study by Ebrahimi Pour et al. (28) in pregnant women, there was a positive but weak correlation between behavioral intention and behavior. According to the present study, there seems to be a strong relationship between intention and behavior in adolescents, so affecting intention can play an effective role in proper behavior in adolescents.

The results of current study showed that perceived behavioral control, attitude, and subjective norms explained 28% of changes in brushing intention. Studies have shown that the predictive capability of the TPB for intention and behavior is higher than other motivational models. According to meta-analysis studies, the TPB explained 39% of intention and 27% of behavior on average (29, 30). A similar study by Karimi-Shahanjarini showed that the elements of the TPB predicted 25% of the variance of the intention of flossing (31). Van den Branden et al. showed that the TPB can predict 27-37% of oral health behavioral intention in Belgian children (32). At any rate, the variables that explain brushing intention and or behavior can be used as motivation factors in designing oral health programs.

The finding revealed that PBC was the most related factor of intention. This construct represents students' perception of easiness or hardship of teeth brushing behavior. Several studies have emphasized on perceived behavioral control as a critical construct effective in behavioral intention and behavior itself (22, 23). Studies on oral health have shown that perceived behavioral control is one of the most powerful determinants of behavioral intention and behavior itself (31, 32, 34).

According to the TPB, higher perceived behavioral control increases positive feelings about the intended behavior and decreases the perceived barriers. In the study of Buunk-Werkhoven et al. (35), all constructs except perceived behavioral control had a positive and significant relationship with behavioral intention. Given that the study population was in the study referred to dental clinics and in the present study adolescent students, it seems that younger people are more likely to believe they can control their behavior, and this sense of ability can be a strong point and it should be considered in educational interventions. Authors have emphasized a deep and accurate understanding of behaviors and attitudes about oral health as the key and important variables for the success of dental and oral health improvement programs (36).

Here, the attitude was also a significant predictor of teeth brushing. This finding is consistent with Buunk-Werkhoven et al. (35), and Breine et al. (33), who argued that oral health, was positively and significantly related to attitude and perceived behavior control. Health personnel and parents need to know that teenagers develop their attitudes by observing others' attitudes about behavior. Therefore, after experiencing a healthy behavior, positive or negative attitudes about the outcomes of behavior are reinforced and then function as a motivation to continue or stop a behavior. With regard to baseline characteristics, the results of this study showed that gender was an effective factor in teeth brushing behavior so that girl students had a better performance in this regard. This finding is consistent with other studies in this field (33, 37). One probable reason can be the higher sensitivity in girls about health and hygiene so that they tend to be more sensitive about oral health as a factor effective in their beauty and appearance. Moreover, and comparing with men,

women's self-assessment about oral health tends to be more negative, which increases their intention to perform oral health behaviors like brushing (38). The findings showed that there was a relationship between teeth brushing behaviors in students and the parents' education level. That is, students with highly educated parents had better performance. Karimy et al. (39) showed in a study that the parents' literacy was more effective than income and wealth in healthy behaviors in children. Hooley et al. (40) maintained that education level was one of the most social-economic indices that affects attitudes and skills needed to adopt health-related behaviors.

4-1. Limitations of the study

Limitations of our study should also be noted. An important limitation of our research is that it could not infer the causal association due to the cross-sectional study. In addition, our data were based on questionnaire and was self-report; so these may be subject to social desirability bias.

5- CONCLUSION

Our finding showed that the level of oral health practice was unfavorable among most Guilan high school students. The TPB constructs (attitude, subjective norms, and PBC) were all significantly associated with tooth brushing behavioral intention. In addition, the TPB constructs describe 28% of the variance of intention. It seems designing and implementing educational interventions by using TPB constructs, especially variables of perceived behavioral control and attitude, could result in optimal activities regarding oral health care among students.

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7- CONFLICT OF INTEREST: None.

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