

ORIGINAL ARTICLE

Assessment of oral hygiene trends among dental patients in relation to chronic medical conditions by dental students. A cross-sectional study

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Keywords

Oral health awareness • General health • Dental education

Summary

Introduction. There is a lack of information about knowledge, attitude and behavior regarding oral hygiene and dietary habits of adult patients attending dental clinical settings. Hypertension, diabetes, obesity and caries are increasing among different populations, resulting in the deterioration of the quality of life related to oral and general health.

Objectives. To involve second year dental students in assessing oral health knowledge, attitude, behavior, dietary habits and general health of dental patients, and screening for blood pressure, blood glucose level and obesity.

Participants and methods. A convenient sample of 652 adult subjects participated in the study. They were screened, and involved in an interviewer - led questionnaire, led by the students over the period of two successive academic years (2013-2014 and 2014-2015).

Introduction

Health is a valuable asset for individuals and nations. Oral and dental health is now recognized as equally important as general health [1]. However, there is a lack of information about knowledge, attitude and behavior regarding oral hygiene and dietary habits in relation to general health among patients attending dental clinical settings. Knowledge, attitude and behavior of individuals are used to evaluate and indicate their understanding [2], reflect their own experiences, cultural perceptions, familial beliefs and they strongly influence the oral health behavior [3, 4]. The precise nature of the relationship between health-related attitudes, beliefs and behaviors is complex [1]. Insufficient oral health knowledge contributes to patients' undergoing low levels of oral self-care practices which increase the risks of oral and dental complications [5]. In fact, misconceptions about oral hygiene may lead to harmful behaviors especially in dental patients suffering from systemic chronic conditions [6]. Chronic diseases such as hypertension, diabetes, obesity and caries are increasing in developing countries like Egypt, resulting in the deterioration of the quality of life related to oral, as well as general health [7]. A strong relationship has been suggested to exist between hypertension, diabetes, obesity and oral health. However, most patients are still un-

Results. Subjects with high blood pressure and/or blood glucose levels were more likely to disagree regarding the presence of a relation between general health and dental health [(correlation coefficient (r) = -0.159, probability value $P < 0.001$) (correlation coefficient (r) = -0.257, probability value $P < 0.001$) respectively]. Subjects with high BMI were less aware of the importance of using the tooth brush in prevention of gingival inflammation. The overall students' satisfaction score was 71.5%. The practical part of the research had the highest satisfaction score (83.7%).

Conclusions. There is scarcity of data regarding dental health-care knowledge and attitudes in dental clinical settings. Additional clinical training for dental students would increase their willingness to play a preventive and educational role in the oral care of patients.

aware that oral health influence general health [8]. The high prevalence of oral diseases reported amongst people with special health needs highlights the need for an increased intervention in providing preventative, emergency, definitive and long-term oral health care. Therefore, it is imperative for dental students and dental professionals to be adequately trained and acquire a strong basis in delivery of care to those patients to alleviate the increased oral disease burden and unmet treatment needs for such patients [9].

Hypertension is a known risk factor for atherosclerotic vascular diseases [10]. A possible pathogenetic mechanism connecting periodontitis with elevated blood pressure has been suggested by several authors [11, 12]. Hence, medical examination is required to prevent complications during dental treatment [13]. The dentist plays a cardinal role in diagnosis of hypertensive patients, and their referral to medical practitioners for further diagnosis and treatment [14, 15].

Diabetes mellitus is a chronic metabolic disease with serious oral health implications [16]. Globally, diabetes is expected to be the 7th leading cause of death in 2030 [17-19]. Oral complications and manifestations are in the form of gingivitis, periodontitis, xerostomia, opportunistic infections, greater accumulation of plaque, oral paresthesia and altered taste. Hence, both patients and dentists should be educated or made aware of the dental consequences of such disease [20-25].

Literature shows that most diabetic patients knew about general health complications of diabetes, but not oral health complications [16, 26]. On the other hand, patients felt they would be more careful about oral hygiene if they were informed [27, 28].

Obesity is an inflammatory condition associated with an increased presence of adipose tissue which is a source of inflammatory mediators [23]. Obesity and in particular abdominal obesity is commonly accompanied by elements of the metabolic syndrome, including insulin resistance, hypertension, and dyslipidemia [29]. In addition, several studies have demonstrated that obesity is associated with oral and dental problems such as chronic periodontitis [30, 31]. It was reported that both dental caries and obesity are diseases with multifactor etiology related to dietary habits that are closely correlated with sociodemographic background of the individuals [29, 32].

Similarly, diet has a direct, local effect on oral health, on the integrity of the teeth, and on the pH and composition of saliva and plaque [33]. Several studies have concluded that particular diets, those highly containing saturated fatty acids, non-milk extrinsic sugars and low in poly saturates, fibers and vitamins represent common risk factors for diseases such as diabetes, coronary heart diseases, obesity, and dental caries [34-36].

It is quite clear that oral health and general health are highly related and that patients may not be aware that they have medical problems that might be reflected on and/or affected by their oral health. Lack of training and experience of dental professionals as early as the undergraduate level are reported barriers to the provision of care for these groups of patients [37, 38]. Accordingly the present study aimed to involve second year dental students in assessing oral health knowledge, attitude, behavior, dietary habits and general health of dental patients, and screening for blood pressure, blood glucose level and obesity. It also aimed to assess the students' perception and satisfaction with education in this field.

Pilot study: three public health professors conducted content validity of the questionnaire before conducting the pilot study. The pilot study was conducted on 163 random attendees of the Misr International University (MIU) in Egypt dental clinics. Face validity was assessed during the pilot study to assess understanding and completion time of the questionnaire. Based upon the results of the pilot study, amendments were done to the questionnaire where some questions were modified. Results of the pilot study were not included in the final results.

Sample size: based upon the pilot study results, the predicted minimum sample size (n) was 450 subjects. The sample size was increased to 652 subjects to ensure participation of every second year dental student in the study. Sample size calculation was performed using IBM® SPSS® Sample Power® Release 3.0.1

Methods

The present non-randomized cross sectional study was performed by second year dental students and targeted

a convenient sample of 652 adult subjects; 399 females and 253 males, attending the (MIU) dental clinics for dental examination and diagnosis over the period of two successive academic years (2013-2014 and 2014-2015). The participants participated in a detailed interviewer - led questionnaire and were screened for blood pressure, blood glucose level and obesity.

Inclusion criteria: all patients aged eighteen and above were included in the study.

Exclusion criteria: pregnant females were excluded as they might have increased blood glucose level, blood pressure and body mass index that are related to pregnancy.

ETHICAL APPROVAL

The present study was approved by the Institutional Review Board. (IRB number: 1617-032).

Before leading the questionnaire, the students received a training session to ensure the standardization of the questionnaire interviews. Each student provided each participant with a detailed verbal explanation of the different parts of the study, explaining the aim of performing the study, as well as informing the participants that they will be screened for blood pressure, blood glucose level and obesity; verbal approval, followed by signing a written approval for participation, was taken before proceeding with the study. Subjects who refused to participate in the study, or those who desired to quit at any point of the study were excluded, and were referred to the University clinics to receive their regular treatment. An interviewer-led, structured questionnaire was prepared by the main investigators. The questionnaire included six sections each of them was concerned with one of the main items of the study.

Demographic data

This part included data about the participants' age, gender, education, residence, occupation and social conditions.

General health

This part included eight questions scored on a nominal scale about health conditions including hypertension and/or diabetes, intake of medications, previous history of surgical operations, as well as attitudes towards regular measurement of blood pressure and blood glucose level.

Oral health knowledge and attitude

This part included eleven questions scored on a 5-Point Likert scale about the importance of tooth brushing to gingival health, effect of fluorides in tooth pastes on teeth, knowledge about the effect of diet on general health, whether or not patients believed that teeth loss is a normal part of growing old, the importance of dental treatment, and the impact of oral health on general health.

Dietary habits

This part included two questions scored on a nominal scale about the number of daily consumption of sugary food, type of daily consumed food in different meals.

Oral health behavior

This part included seven questions scored on a nominal scale on the frequency and time of tooth brushing, brushing method, and the use of other oral hygiene aids, as well as reasons for visiting a dentist, and frequency of dental visits.

For screening and measurements

Training of the students was done by six resident physicians who were calibrated, in orientation sessions before beginning the research. Examiners' reliability was statistically assessed using Kappa scores that were (Cronbach's alpha = 0.746, ICC = 0.595) for systolic blood pressure, and (Cronbach's alpha = 0.692, ICC = 0.529) for diastolic blood pressure.

Recorded measurements

All measurements were done by the students, under complete supervision of the main investigators, and in the presence of the resident physicians who were available for any emergencies and/ or complications.

Blood pressure

Blood pressure was measured from the right upper arm using a blood pressure monitor with mercurial sphygmomanometers and stethoscope set (Shanghai Medical Instruments impt.& expt. Co. Limited). The subject was asked to sit down for at least five minutes before blood pressure was measured. A person was screened as a possible suspect for hypertension if blood pressure level is $\geq 140/90$ mmHg. The measurement was repeated after two minutes by the resident physicians to confirm the previous recorded reading [10].

Blood glucose screening

The finger-tip blood sample Accu-Chek Performa Blood Glucose meter (Roche Diabetes Care, Inc. Switzerland) was used for assessing blood glucose levels. The reference range was a random plasma glucose ≥ 200 mg/dl (at any time of the day regardless of last meal time). Nurses were assigned to do the needle prick using disposable needles, while students were assigned to record the reading [23].

Body Mass Index

The height and weight of the participants were measured by the students. The subjects were weighed to the nearest 0.1 kg and height was measured in centimeters using digital weight and height floor type balance (MC, China). Body Mass Index (BMI) was calculated by dividing the body weight (in kilograms) by the square of the height (in meters). The BMI was divided into 4 groups according to the BMI ranges for adults related to standard weight status categories [31].

Waist circumference

Waist circumference was measured in cm with plastic measuring tapes, above the level of the iliac crest while the subject was at minimal respiration. According to the American Heart Association, women with more than

88 cm or men with more than 102 cm waist measurement are considered to have abdominal obesity [29].

Dealing with critical blood pressure and blood glucose levels

Dental treatment was postponed for patients with suspected problems in their blood pressure level, and/or uncontrolled blood glucose level. The patients were informed about the condition, and referred to the resident physicians who then referred them to receive the required medical care. Those patients were asked to bring a written medical report before proceeding with their dental treatment.

Students' satisfaction

A specially designed self-administered 5-Point Likert Scale questionnaire was prepared by the main investigators. The questionnaire aimed at assessing the degree of students' satisfaction with the usefulness of the practical part, and the effect of participation in such a study on motivating them to participate in upcoming researches. Finally, they were asked about their suggestions to improve future dental students' research projects.

STATISTICAL ANALYSIS

Numerical data were presented as mean, median, standard deviation (SD), minimum, maximum and 95% Confidence Interval (95% CI) for the mean values. Numerical data were explored for normality by checking the distribution of data and using tests of normality (Kolmogorov-Smirnov and Shapiro-Wilk tests). Multiple Linear Regression analysis was performed to study the association between oral hygiene knowledge score, blood pressure, blood glucose level, BMI and waist circumference as well as to determine the possible confounding effect of socio-demographic variables on the relationship of obesity, hypertension and diabetes with dietary and oral hygiene habits. The significance level was set at $P \leq 0.05$. Statistical analysis was performed with IBM SPSS Statistics Version 20 for Windows.

Results

DEMOGRAPHICS

The present study was conducted on 652 subjects; 399 females (61.2%) and 253 males (38.8%). The mean \pm standard deviation values for age were 42.4 ± 11.9 years with a minimum of 18 and a maximum of 76 years old with a 95% CI (41.5-43.3) years old. Education and occupation distribution is presented in Figure 1.

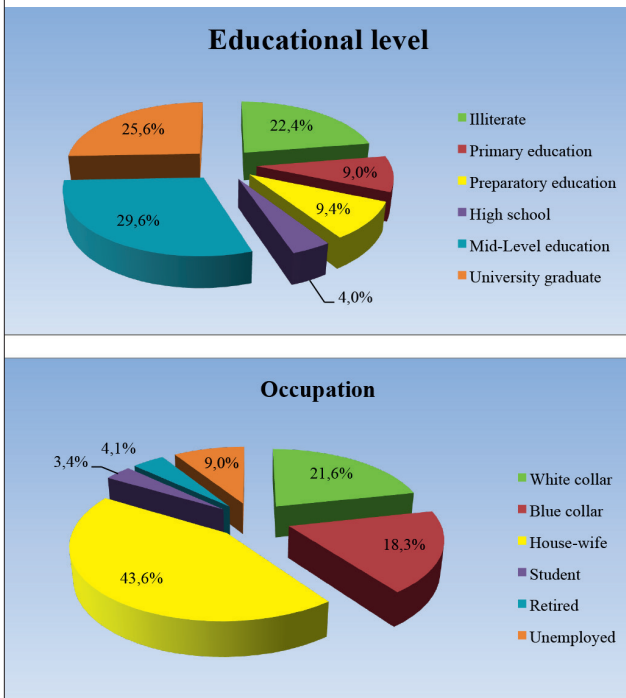
MEASUREMENTS

Measurements are presented in Table I.

RELIABILITY OF MEASUREMENTS

There was good agreement between blood pressure measurements done by dental students and the medi-

Fig. 1. Pie charts representing distribution of educational levels and occupations.



cal seniors (Cronbach’s alpha = 0.746, ICC = 0.595 for systolic blood pressure) and (Cronbach’s alpha = 0.692, ICC = 0.529 for diastolic blood pressure).

GENERAL HEALTH

Responses to questions regarding general health are presented in Table II. The results showed that 85.4% and 77.8% of the participants reported they don’t suffer from diabetes and blood pressure problems, respectively. Only 31.4% of the participants assessed their blood glucose level and/or blood pressure regularly. However, it was found that 3.7% of those who reported being non-diabetics had elevated blood glucose levels [Mean (SD) = 201.5 (75.2) g/dL] and 11.7% of those who reported not having blood pressure problems have elevated blood pressure measurements [Mean (SD) = 163.2/94.2 (10.6/12.8) mmHg].

ORAL HEALTH KNOWLEDGE, ATTITUDES AND BEHAVIORS

Responses to questions regarding oral health knowledge, attitudes and behaviors are presented in Table III. The results showed that 31.4% of the participants strongly disagreed that general health is correlated to oral health. Only 6.9% of the subjects strongly agreed that fluoridated toothpaste prevents tooth decay, 20.1% strongly agreed that eating sweets frequently lead to tooth decay, 44.3% of participants strongly disagreed that dental treatment is equally important to other body parts. As regards tooth brushing, 79.1% of the subjects mentioned that they use tooth brush to clean their teeth, and 76.9% reported that they use fluoridated tooth paste besides the tooth brush to clean their teeth. However, 77.8% of the subjects go to the dentist only when they feel pain.

GENERAL HEALTH KNOWLEDGE AND DIETARY HABITS

Responses to questions regarding general health knowledge and dietary habits are presented in Table IV. The results showed that 70.9% of participants reported that the patient is responsible for preventing and/or caring with diabetes, 87.9% of participants don’t eat sweets daily. The most prevalent nature of daily food was home food (84.7%) followed by fruits and vegetables (39.3%) while only 14.9% of the participants reported fast food as their daily food nature and finally 43.4% of the participants don’t care about their daily food nature.

ASSOCIATION BETWEEN ORAL HEALTH KNOWLEDGE, ATTITUDE AND BEHAVIOR OF THE PARTICIPANTS AND THE RECORDED MEASUREMENTS

Multiple Linear Regression analysis models were constructed to find out the relation between blood pressure, blood glucose level and BMI, and oral health knowledge, attitude and behavior. The models also assessed the effect of socio-demographic variables as confounders. Education was found to be a confounder in the relation between oral health knowledge, blood pressure, blood glucose and BMI. The adjusted results revealed that subjects with recorded high blood pressure and/or blood glucose levels were more likely to disagree with or have a neutral opinion regarding the presence of a relation between general health and dental health

Tab. I. Descriptive statistics for the different measurements done by second year dental students for a group of patients attending MIU dental clinics.

| Measurement | Mean | SD | Median | Range | 95% CI | |
|----------------------------|----------|-----------|--------|---------------|-------------|-------------|
| | | | | | Lower bound | Upper bound |
| Height (cm) | 166.2 | 9.9 | 166 | 143-195 | 165.4 | 167 |
| Weight (Kg) | 82.7 | 15.5 | 81.9 | 42.3-144 | 81.4 | 83.9 |
| BMI (Kg/m ²) | 30.1 | 5.8 | 29.6 | 14.3-51.7 | 29.6 | 30.5 |
| Waist circumference (cm) | 105 | 13.6 | 105 | 73-138 | 103.9 | 106.1 |
| Blood pressure (mmHg) | 123.4/81 | 13.5/10.9 | 120/80 | 90/40-182/120 | 122.3/80.2 | 124.5/81.9 |
| Blood glucose level (g/dL) | 112.6 | 43.9 | 101 | 45-406 | 109.2 | 116 |

Tab. II. Frequencies (n) and percentages (%) of responses to general health questions.

| Question | n | % |
|--|---------|------|
| Are you diabetic? | | |
| • Yes | 78/652 | 12 |
| • No | 557/652 | 85.4 |
| • Don't know | 17/652 | 2.6 |
| If yes; what is the type of medication you use? | | |
| • Tablets | 20/78 | 25.6 |
| • Insulin injection | 11/78 | 14.1 |
| • Others | 33/78 | 42.3 |
| • Don't know | 14/78 | 17.9 |
| If yes; do you use your medication regularly? | | |
| 41/78 | | 52.6 |
| Do you suffer from any blood pressure problems? | | |
| • Hypertension | 124/652 | 19 |
| • Hypotension | 3/652 | 0.5 |
| • No | 507/652 | 77.8 |
| • Don't know | 18/652 | 2.8 |
| If yes; do you use your medication regularly? | | |
| 31/127 | | 24.4 |
| Do you assess your blood pressure and/or blood glucose level regularly? | | |
| • Yes | 205/652 | 31.4 |
| • No | 447/652 | 68.6 |
| Do you use any regular medication? | | |
| • Yes | 42/652 | 6.4 |
| • No | 610/652 | 93.6 |
| Do you suffer any kidney or liver problems? | | |
| • Yes | 57/652 | 8.7 |
| • No | 558/652 | 85.7 |
| • Don't know | 37/652 | 5.6 |
| Have you undergone any surgery before? | | |
| • Yes | 347/652 | 53.2 |
| • No | 305/652 | 46.8 |

[($r = -0.159$, $P\text{-value} < 0.001$) and ($r = -0.257$, $P\text{-value} < 0.001$) for blood pressure and blood glucose level, respectively]. They also strongly agreed that losing teeth is a natural aging process [($r = 0.123$, $P\text{-value} = 0.005$) and ($r = 0.165$, $P\text{-value} < 0.001$) for blood pressure and blood glucose level, respectively]. Those participants visit the dentist more frequently when feeling pain than others with normal blood pressure levels [($r = 0.215$, $P\text{-value} < 0.001$) and ($r = 0.224$, $P\text{-value} < 0.001$) for blood pressure and blood glucose level, respectively].

Subjects with high BMI were less aware of the importance of using the tooth brush in prevention of gingival inflammation ($r = -0.198$, $P\text{-value} < 0.001$). Subjects with small waist circumference were more aware about the relation between eating sweets and its relation to being diabetic ($r = -0.318$, $P\text{-value} < 0.001$). They also showed a higher prevalence of using tooth brush regularly than subjects with larger waist circumference records ($r = -0.177$, $P\text{-value} < 0.001$).

Subjects who believe that eating sweets lead to caries and that food type might prevent diabetes, hypertension and obesity showed lower frequency of eating sweets [($r = -0.182$, $P\text{-value} < 0.001$) and ($r = -0.210$, $P\text{-value} < 0.001$) for eating sweets question and food type question, respectively]. They were more likely to eat homemade food than those who believed that the type of food is not related to general and oral health ($r = 0.125$, $P\text{-value} = 0.005$).

STUDENTS' SATISFACTION WITH THE RESEARCH

Results are presented in Figure 2. The practical part of the research had the highest satisfaction (83.7%). The overall satisfaction score was 71.5%.

Discussion

There is scarcity of data regarding oral hygiene trends in relation to chronic medical conditions among patients in clinical dental settings. To develop a sound strategy for improving dental and oral health of any population, more representative data base should be made available. The current study sought to involve dental students in their early academic years in data collection and screening of patients as a main part of their under graduate curriculum in order to not only help in their clinical training and valuable educational experiences, but also to help in developing such missing data base which can consequently contribute to fulfill the basic dental care needs of the patients.

Regarding the responses to the general health questions, although the majority of the subjects reported that they were not suffering from blood pressure problems or elevated blood glucose level, respectively. However, the findings of the present study showed that 11.7%, and 3.7% of these subjects had blood pressure problems and high blood glucose level, respectively. Of all the exam-

ined subjects, only 31.4% assessed their blood pressure and/ or blood glucose level regularly. The previous findings confirm that several dental patients are unaware of their general health condition, and that the dentist might be the one who discovers that a patient is diabetic or suspected hypertensive patient. Several authors reported similar results and correlated patients' general condition to their oral health [13-17]. Accordingly, the authors of the present study recommend that it should be a routine in governmental and private dental practice to screen

dental patients for blood pressure and blood glucose level.

Interesting and surprising results were reported in responses to questions regarding oral health knowledge, attitude and behavior. The highest percentage of subjects 33.1% strongly disagreed that tooth brushing helps prevent gingivitis. Similarly, the majority of the subjects 31.4% strongly disagreed that general health is correlated to oral health. The majority of respondents were not aware of the benefits of fluorides for prevention of

Tab. III. Frequencies (n) and percentages (%) of responses to oral health knowledge, attitude and behavior questions.

| Knowledge and attitude questions | Strongly agree | | Agree | | Neutral | | Disagree | | Strongly disagree | | No answer | |
|--|----------------|------|---------|------|---------|------|----------|---------|-------------------|--------|-----------|-----|
| | n | % | n | % | n | % | n | % | n | % | n | % |
| Tooth brushing helps preventing gingival inflammation | 110/652 | 16.9 | 103/652 | 15.8 | 59/652 | 9 | 149/652 | 22.9 | 216/652 | 33.1 | 15/652 | 2.3 |
| General health is correlated with oral health | 121/652 | 18.6 | 110/652 | 16.9 | 66/652 | 10.1 | 134/652 | 20.6 | 205/652 | 31.4 | 16/652 | 2.5 |
| Fluoridated toothpaste prevents tooth decay | 45/652 | 6.9 | 86/652 | 13.2 | 256/652 | 39.3 | 137/652 | 21 | 109/652 | 16.7 | 19/652 | 2.9 |
| Eating sweets is related with diabetes | 107/652 | 16.4 | 107/652 | 16.4 | 72/652 | 11 | 145/652 | 22.2 | 193/652 | 29.6 | 28/652 | 4.3 |
| Eating sweets lead to tooth decay | 131/652 | 20.1 | 81/652 | 12.4 | 20/652 | 3.1 | 105/652 | 16.1 | 299/652 | 45.9 | 16/652 | 2.5 |
| Loss of teeth is a normal aging process | 92/652 | 14.1 | 174/652 | 26.7 | 45/652 | 6.9 | 184/652 | 28.2 | 141/652 | 21.6 | 16/652 | 2.5 |
| Natural teeth problems are more prevalent than artificial teeth problems | 91/652 | 14 | 123/652 | 18.9 | 169/652 | 25.9 | 142/652 | 21.8 | 100/652 | 15.3 | 27/652 | 4.1 |
| There are people with good health regardless of what they do and people with bad health regardless of what they do | 95/652 | 14.6 | 143/652 | 21.9 | 87/652 | 13.3 | 159/652 | 24.4 | 139/652 | 21.3 | 29/652 | 4.4 |
| Do you believe that dental treatment is equally important to other body parts? | 136/652 | 20.9 | 91/652 | 14 | 16/652 | 2.5 | 101/652 | 15.5 | 289/652 | 44.3 | 19/652 | 2.9 |
| Do you believe that reducing salt intake prevents hypertension? | 88/652 | 13.5 | 115/652 | 17.6 | 98/652 | 15 | 126/652 | 19.3 | 210/652 | 32.2 | 15/652 | 2.3 |
| Taking care of food type prevents against diabetes, hypertension or obesity | 117/652 | 17.9 | 86/652 | 13.2 | 42/652 | 6.4 | 150/652 | 242/652 | 37.1 | 15/652 | 2.3 | |

continues

Tab. III. *follows.*

| Behavior questions | n | % |
|---|---------|------|
| How do you clean your teeth? | | |
| • Tooth brush | 516/652 | 79.1 |
| • Dental floss or tooth picks | 63/652 | 9.7 |
| • Miswak | 80/652 | 12.3 |
| • Mouth wash | 114/652 | 17.5 |
| • I don't brush my teeth | 64/652 | 9.8 |
| What is the type of your tooth brush? | | |
| • Hard | 69/516 | 13.4 |
| • Medium | 217/516 | 42.1 |
| • Soft | 70/516 | 13.6 |
| • I don't know | 160/516 | 31 |
| How often do you brush your teeth? | | |
| • Less than one time/month | 9/588 | 1.5 |
| • One-two times/month | 27/588 | 4.6 |
| • One-two times/week | 98/588 | 16.7 |
| • Once daily | 214/588 | 36.4 |
| • Two or more times/day | 200/588 | 34 |
| • Never use the brush | 40/588 | 6.8 |
| How do you clean your partial or complete denture? | | |
| • I don't have a denture | 457/652 | 70.1 |
| • Water | 41/652 | 6.3 |
| • Cleansing tablets | 1/652 | 0.2 |
| • Water and salt | 21/652 | 3.2 |
| • Using tooth brush | 61/652 | 9.4 |
| • I don't clean it | 30/652 | 4.6 |
| • I don't know it needs cleaning | 41/652 | 6.3 |
| What do you use to clean your teeth besides the tooth brush? | | |
| • Fluoridated tooth paste | 452/588 | 76.9 |
| • Cleansing powder | 25/588 | 4.2 |
| • Sodium Bicarbonate | 17/588 | 2.9 |
| • I don't use any cleanser | 94/588 | 16 |
| When do you visit the dentist? | | |
| • Once/Year | 24/652 | 3.7 |
| • Twice/Year | 33/652 | 5.1 |
| • When I feel pain | 507/652 | 77.8 |
| • I don't visit the dentist | 88/652 | 13.5 |
| What is the cause of your current dental visit? | | |
| • Pain | 243/652 | 37.3 |
| • Continuing treatment | 228/652 | 35 |
| • Regular check-up | 9/652 | 1.4 |
| • Advice from physician | 0/652 | 0 |
| • Diagnosis | 49/652 | 7.5 |
| • Other | 123/652 | 18.9 |

dental caries, only 6.9% of the subjects strongly agreed that fluoridated toothpaste prevents tooth decay, and only 20.1% strongly agreed that eating sweets frequently leads to tooth decay. Unfortunately, 44.3% of the subjects strongly disagreed that dental treatment is equally important to other body parts.

Yet positive attitudes towards the importance of tooth brushing were widespread, as 79.1% of the subjects mentioned that they use toothbrush to clean their teeth, and 76.9% reported that they use fluoridated tooth paste besides the toothbrush to clean their teeth. However, 77.8% of the subjects did not visit the dentist except when they felt pain.

Highly positive trends were recorded in the responses to the dietary habits questions, where 87.9% of the subjects revealed that they do not eat sweets daily, and 84.7% reported that their daily food nature is homemade food.

The reported agreement level between measurements recorded by the students and that recorded by the resident physicians was considered of a good level because Cronbach's alpha values greater than 0.6 are indicative for good agreement [39]. Additionally, this agreement helped in the evaluation of the students and gave an indication about the efficient training the students had before proceeding with the practical part of the study.

Out of all the measured socio-demographic variables, only educational levels of the participants were found to affect the relation between general and oral health, where participants of higher educational levels showed higher levels of general and oral health knowledge which goes in agreement with several previous studies that recorded similar findings [7].

Surprisingly, subjects with recorded high blood pressure and/or blood glucose levels were more likely to disagree

Tab. IV. Frequencies (n) and percentages (%) of responses to general health knowledge and dietary habits Questions.

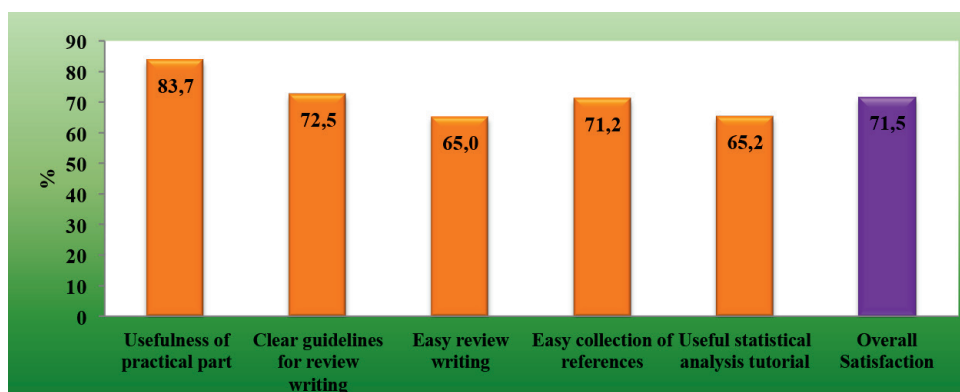
| General health knowledge and dietary habits Questions | n | % |
|--|---------|------|
| Who is responsible for preventing diabetes and/or caring with diabetic patient? | | |
| • The patient | 462/652 | 70.9 |
| • The physician | 112/652 | 17.2 |
| • Family members | 89/652 | 13.7 |
| • I don't know | 59/652 | 9 |
| Factors associated with blood pressure are: | | |
| • Heredity | 176/652 | 27 |
| • Nervous tension | 500/652 | 76.7 |
| • Obesity | 205/652 | 31.4 |
| • Smoking | 154/652 | 23.6 |
| • Food type | 143/652 | 21.9 |
| • Aging | 100/652 | 15.3 |
| • I don't know | 36/652 | 5.5 |
| How many times do you eat sweets per day? | | |
| • Once/daily | 35/652 | 5.4 |
| • Twice/daily | 16/652 | 2.5 |
| • More than two times/day | 28/652 | 4.3 |
| • I don't eat sweets daily | 573/652 | 87.9 |
| What is your daily food nature? | | |
| • Home food | 552/652 | 84.7 |
| • Fruits and/or vegetables | 256/652 | 39.3 |
| • Fast food | 97/652 | 14.9 |
| • I don't care | 283/652 | 43.4 |

with or have a neutral opinion regarding the presence of a relation between general health and dental health. They also strongly agreed that losing teeth is a natural aging process. These results confirm the extreme lack of health literacy among such group of patients and emphasize the importance of raising the awareness and health education level of such groups of people. Similar low levels of dental and general health literacy were reported by other authors who suggested that the link between general health and oral health is not well known to patients, and that the financial obstacles to care are higher because of lower income and because dental care is given a low priority in expenditures [16, 17, 20]. On the other hand, our results showed that subjects with diagnosed high blood pressure levels visit the dentist more frequently when feeling pain than others with normal blood pressure levels.

As for BMI and its relation to knowledge, attitude and behavior, it was found that subjects with high BMI are less aware of the importance of using the toothbrush in prevention of gingival inflammation. Conversely, subjects with low waist circumference records were more aware about the relation between eating sweets and being diabetic. They also showed a higher prevalence of using toothbrush regularly than subjects with higher waist circumference records.

Regarding dietary habits, beliefs and their impact on type and amount of food intake, the current study reported that subjects with the belief that eating sweets leads to caries and that food type might prevent being diabetic, hypertensive and obese, showed lower frequency of eating sweets, and were more likely to eat homemade food than those who believed that the type of food has nothing to do with general and oral health.

Fig. 2. Bar chart representing students' satisfaction scores with different parts of the research.



One of the most important findings of the present study was the 71.5% students' satisfaction score, and the students' suggestions to have more opportunities to make contact and receive training to deal with patients in their early academic years. This conveys the benefits for the students to make contact with real-life patients, and get exposed to a greater variety of conditions and procedures. Many students valued the opportunity of accurately measuring blood pressure and glucose level. Usefulness of the practical part of the research was found satisfactory by 83.7% of the students. This goes in agreement with several previous studies [9, 37, 38] that reported the importance of undergraduate students training and the high level of satisfaction the students report when they receive such educational experiences during their early academic years. Furthermore, early contact with the patients might aid dental students developing their practical and team working skills.

STUDY LIMITATIONS

The study is a cross-sectional study which has the limitation of not providing causal relationship. Convenient sampling method was chosen for easier enrollment of participants; however, it doesn't reflect the entire population. Accordingly, generalization of results is limited. It is also worth noting that as the results of the present study related to oral health knowledge, attitude and behavior rely on self-reported data, the rates of oral health behavior may be biased through over- and under-reporting due to social desirability.

Conclusions

Within the limitations of the present study it could be concluded that there is an urgent need for developing educational programs and establishing primary oral health services in order to meet the basic dental care needs of people with chronic health conditions.

It is also worth noting that earlier exposure of dental students to clinical training will provide them with valuable educational experiences which can subsequently contribute to teaching and training of the future generation of dentists.

Acknowledgements

Funding sources: this research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Conflict of interest statement

None declared.

Authors' contributions

MF developed the idea, organized the settings and participated in manuscript writing. KK analyzed the data

and reported it. AB participated in data collection and wrote the initial manuscript.

References

- [1] Archana J, Sharda, Srinath S. A comparative study of oral health knowledge, attitude and behaviour of non-medical, para-medical and medical students in Udaipur city, Rajasthan, India. *Int J Dent Hygiene* 2010;8:101-9. doi: 10.1111/j.1601-5037.2009.00393.x.
- [2] AlYousef Y, Damiano P, Weber-Gasparoni K, Qian F, Murph J, Nothwehr F. Medical students' child oral-health-related knowledge, practices and attitudes. *Eur J Dent Educ* 2013;17:218-24. doi: 10.1111/eje.12041. Epub 2013 Mar 27.
- [3] Benoît V, Poul Erik P, Seydou O. Oral health behaviour of children and adults in urban and rural areas of Burkina Faso, Africa. *International Dental Journal* 2006;56(2). doi: org/10.1111/j.1875-595X.2004.tb00260.x.
- [4] Woelber J, Bienas H, Fabry G, Silbernagel W, Giesler M, Tennert C, Stampf S, Ratka-Krueger P, Hellwig E. Oral hygiene-related self-efficacy as a predictor of oral hygiene behaviour: a prospective cohort study. *J Clin Periodontol* 2015;42:142-9. doi: 10.1111/jcpe.12348.
- [5] Slaughter A, Evans L. Culturally sensitive oral health educational materials for older African Americans. *J Health Care Poor Underserved* 2007;18. doi: 10.1353/hpu.2007.0108.
- [6] Yuen H, Wiegand R, Slate E, Magruder K, Salinas C, London S. Dental health knowledge in a group of Black adolescents living in rural South Carolina. *J Allied Health* 2008;37:15-21.
- [7] Sheiham A. Oral health, general health and quality of life. *Bulletin of the World Health Organization* 2005;83:644. Available at: www.ncbi.nlm.nih.gov/pmc/articles/PMC2626333/pdf/16211151.
- [8] Petersen P. The World Oral Health Report 2003: continuous improvement of oral health in the 21st century - the approach of the WHO Global Oral Health Programme. *Comm Dent Oral Epidemiol* 2003;32:3-24. Available at: www.who.int/oral_health/media/en/orh_report03_en.pdf.
- [9] Borromeo G, Ahmad M, Buckley S, Bozanic M, Cao A, Al-Dabbagh M, Athale A. Perception of special needs dentistry education and practice amongst Australian dental auxiliary students. *Eur J Dent Educ* 2017;1-6. doi: 10.1111/eje.12296.
- [10] Ollikainen E, Saxlin T, Tervonen T, Suominen AL, Knuutila M, Jula A, Ylöstalo P. Association between periodontal condition and hypertension in a non-smoking population aged 30-49 years: results of the Health 2000 Survey in Finland. *J Clin Periodontol* 2014;41:1132-8. doi: 10.1111/jcpe.12316.
- [11] Montebugnoli L, Servidio D, Miaton R, Prati C, Tricoci P, Melloni C. Poor oral health is associated with coronary heart disease and elevated systemic inflammatory and haemostatic factors. *J Clin Periodontol* 2004;31:25-9. doi: org/10.1111/j.0303-6979.2004.00432.x.
- [12] Buhlin K, Mäntylä P, Paju S, Peltola JS, Nieminen MS, Sinisalo J, Pussinen PJ. Periodontitis is associated with angiographically verified coronary artery disease. *J Clin Periodontol* 2011;38:1007-14. doi: https://doi.org/10.1111/j.1600-051X.2011.01775.x.
- [13] C Sproat, Behesti S, Harwood AN, Crossbie D. Should we screen for hypertension in general dental practice? *Br Dent J* 2009;207:257-77. doi: 10.1038/sj.bdj.2009.815.
- [14] Sikkerimath SB, Ramesh DNSV. Study on the prevalence of hypertension in dental out-patient population. *Journal of Indian Academy of Oral Medicine and Radiology* 2010;22:77-80.
- [15] Ramasamy C. Protocol for hypertensive patient management in dental office- short communication. *International Journal of Medical Dentistry* 2013;3:67-269.
- [16] Yuen HK, Mountford WK, Magruder KM, Bandyopadhyay D, Hudson PL, Summerlin LM, Salinas CF. Adequacy of oral

- health information for patients with diabetes. *J Public Health Dent* 2009;69. doi: 10.1111/j.1752-7325.2008.00111.x.
- [17] Ayse B, Ruth F, Lone S. A new complementary approach for oral health and diabetes management: health coaching. 2017 FDI World Dental Federation International Dental Journal doi: <https://doi.org/10.1111/idj.12334>.
- [18] Winning L, Patterson C, Neville C, Kee F, Linden G. Periodontitis and incident type 2 diabetes: a prospective cohort study. *J Clin Periodontol* 2017;44:266-74. doi: 10.1111/jcpe.12691.
- [19] Hegazi R, El-Gamal M, Abdel Hady N, Hamdy O. Epidemiology of and risk factors for type 2 diabetes in Egypt. *Ann Glob Health* 2015;81:814-20. doi: 10.1016/j.aogh.2015.12.011.
- [20] Bangash R, Khan A, Rasheed D, Manzoor M. Diabetic patients: level of awareness about oral health knowledge, attitude and practices. *Pakistan Oral & Dental Journal* 2011;31.
- [21] Simpson T, Weldon J, Worthington H, Needleman I, Wild S, Moles D, Stevenson B, Furness S, Iheozor-Ejiofor Z. Treatment of periodontal disease for glycaemic control in people with diabetes mellitus. *Cochrane Database Syst Rev* 2015;11:CD004714. doi: 10.1002/14651858.CD004714.pub3.
- [22] George W, Dana T, Ira B. Diabetes mellitus and oral health: an interprofessional approach, first edition. Lamster: John Wiley & Sons 2014, pp. 121-41.
- [23] Garton B, Ford P. Root caries and diabetes: risk assessing to improve oral and systemic health outcomes. *Aust Dent J* 2012;57:114-22. doi: 10.1111/j.1834-7819.2012.01690.x.
- [24] Taylor J, Preshaw P, Lalla E. A review of the evidence for pathogenic mechanisms that may link periodontitis and diabetes. *J Clin Periodontol* 2013;40:S113-134. doi: 10.1111/jcpe.12059.
- [25] Sandberg G, Sundberg H, Wikblad, K. A controlled study of oral self-care and self-perceived oral health in type 2 diabetic patients. *Acta Odontologica* 2001;59:28-33. Available at: www.ncbi.nlm.nih.gov/pubmed/11318042.
- [26] Morgan R, Tsang J, Harrington N, Fook L. Survey of hospital doctors' attitudes and knowledge of oral conditions in older patients. *Postgrad Med Journal* 2001;77:392-4. <http://dx.doi.org/10.1136/pmj.77.908.392>.
- [27] Sylvie A, Rosemary D. Sociodemographic factors associated with the dental health of persons with diabetes in France *Spec Care Dentist* 2012;32:142-9. doi: 10.1111/j.1754-4505.2012.00257.x.
- [28] Mirza K, Khan A, Ali M, Chaudhry S. Oral health knowledge, attitude, and practices and sources of information for diabetic patients in Lahore, Pakistan. *Diabetes Care* 2007;30:3046-7. doi: 10.2337/dc07-0502.
- [29] Thomas M, Cecilia C. Blomberg, Biniyam W, Annika J, Claude M. Association between obesity, flow rate of whole saliva, and dental caries in adolescents obesity. *Epidemiology* 2010;18(12). doi: 10.1038/oby.2010.63.
- [30] Nascimento G, Seerig L, Vargas F, Correa F, Leite F, Demarco F. Are obesity and overweight associated with gingivitis occurrence in Brazilian schoolchildren? *J Clin Periodontol* 2013;40:1072-8. doi: 10.1111/jcpe.12163.
- [31] Dejan M, Danijel A, Vesna V, Goran M, Jelena N, Tamara P, Ivana K. Association between being overweight and oral health in Serbian school children. *Int J Paediatr Dent* 2015;25:409-17. doi: 10.1111/ipd.12147.Epub 2014 Dec 15.
- [32] Honne T, Pentapati K, Kumar N. Relationship between obesity/overweight status, sugar consumption and dental caries among adolescents in South India. *Int J Dent Hyg* 2012;10:240-4. doi: [org/10.1111/j.1601-5037.2011.00534.x](http://dx.doi.org/10.1111/j.1601-5037.2011.00534.x).
- [33] Rebecca H, Ana G, Yvonne D, Angela A. One-to-one dietary interventions undertaken in a dental setting to change dietary behaviour. *Cochrane Database Syst Rev* 2012;3. doi: 10.1002/14651858.CD006540.pub2.
- [34] Department of Health. Dietary reference values for food energy and nutrients for the United Kingdom. Report on Health and Social Subjects 1991;97:30-2.
- [35] World Health Organization. Diet, nutrition and the prevention of chronic diseases. WHO Technical report series 2003;916. Available at: [/www.who.int/dietphysicalactivity/publications/trs916/en](http://www.who.int/dietphysicalactivity/publications/trs916/en).
- [36] Sheiham A, Watt R. A rational basis for promoting oral health. *Comm Dent Oral Epidemiol* 2000;28:399-406. doi: <https://doi.org/10.1034/j.1600-0528.2000.028006399.x>.
- [37] Ahmad M, Razak I, Borrromeo G. Special needs dentistry: perception, attitudes and educational experience of Malaysian dental students. *Eur J Dent Educ* 2015;19:44-52. doi: 10.1111/eje.1.
- [38] Goswami S, Karaharju T, Kaila M, Tseveenjav B. Community Health Centre-Based Outreach Clinic for undergraduate dental education: experience in Helsinki over 8 years. *Eur J Dent Educ* 2017;1-9. doi: 10.1111/eje.12295.
- [39] Hair J, Anderson R, Tatham R and Black W. Multivariate data analysis. NJ: Pearson/Prentice Hall 2006.

■ Received on November 12, 2018. Accepted on April 5, 2019.

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