The prevalence of dental caries among students of dentistry colleges in holy karbala governorate in Iraq in 2017
Ali Al Mousawi, a Basheer Al Ali, a and Zainab Al Mousawi b

Introduction
Oral health is an integral component of general health and carries a great impact on the quality-of-life.1, 2 Dental caries is the most common preventable oral diseases affecting all age groups all over the world. 3 It was discovered at a prevalence rate of 2–48% in an archaeological populations. 4 The global burden of dental caries I of 187 countries between 1990 and 2010 was estimated in a systematic review which concluded the incidence and prevalence of dental caries remained static during this period. In addition, the most prevalent condition worldwide was untreated caries in permanent teeth affecting 2.4 billion people, while untreated caries in deciduous teeth was the tenth-most prevalent condition, affecting 621 million children, worldwide.5 However, dental decay is preventable and there has been a steady decline in its prevalence since decades in the developed countries. 6 Experts believe, that this decline was primarily due to the introduction of fluoridation therapies after the 1960s that had a huge impact on dental decay rates. 7–9 On the other hand, the prevalence in the developing countries is on rise, because of absence or poor quality of oral public health services. A major part of population in these countries has bad and neglected oral health caused by many different risk factors related to socio-economic and educational levels and difficult or no access to professional dental care. 10–12 While a small part of population, with higher socio-economic state and good home care and better access for professional services since childhood, shows low caries index.13

The tip of the iceberg and the actual size of the problem might be profoundly greater that shown rates. The decayed missing filled surfaces/teeth (DMFT) index is well established and most commonly used measure of caries experience in dental epidemiology. 11 It was developed by Klein et al. 14 The World Health Organization recommended its use for oral health surveys, 15 and had introduced some modification on the index calculation to improve its sensitivity and practical use in epidemiological studies. Larmas 16 counted more than 7000 DMFT index publications in PubMed, which indicated that it is the most commonly used oral health index. The advantages of DMFT index are too many and include: being simple and clear in addition to its high validity and reliability and acceptable sensitivity and specificity. 17 However, DMFT index fails to provide information on the extent and clinical consequences of untreated dental caries, such as pulpal involvement and dental abscess, which may be more serious than the caries lesions themselves. 18 It also describes both past and present caries experience, which is not the same as caries prevalence. The index carries some limitations such as: being not indicating the number of teeth that are at risk; it might be invalid in older patients because some teeth are lost for the reasons other than caries; it might be misleading in children because teeth may be lost for orthodontic reason and finally being not significant in the root caries.17

The targeted population in this study was a sample of individuals with good dental status socio-economical level and access to dental care. The results of this study and similar studies will provide a data base for oral health among a group with lower caries incidence. Gathered information might
Materials and Methods

A cross-sectional descriptive study using self-administered questionnaire about oral health and knowledge and practice about interdental cleaning measures (ICM) was used among a total number of 288 students in two Dentistry Colleges in Holy Karbala in Iraq in April 2017. The University of Kerbala was established since 16 years and include 16 colleges, while Ibn Hayan College was established since 2010. Ethical approval and permission to conduct the survey was obtained before starting the study and the students were informed about the voluntary choice of participation in the study.

The questionnaire consisted of 21 questions designed to evaluate the oral health, knowledge and practice about ICM among the BDS students. The questionnaire was piloted before conducting the definitive study among 10 students and minor changes were introduced. The students were invited from Kerbala Dentistry College (KDC) and Dental Section in Ibn Hayan Private Dentistry College (IHC) in Holy Karbala in Iraq, to participate in this survey using a self-administered structured questionnaire. The voluntary participation and anonymous-confidential nature of the questionnaire was made clear to the students. Introductory talk to all the students and explanation regarding the nature and purpose of the study was given by the researcher.

The questionnaire was written in Arabic and organized into four parts: The first part elicited information on the demographic attributes of students including age, gender, college, and study year. The second part assessed students’ oral health by asking about possessing filled tooth, extracted tooth or filled tooth due to dental decay and also asked about the number of these teeth. The third and fourth parts assessed the participant’s oral health knowledge about ICM and one closed and one open question, while the last part explored the use of these measures. The second part was used to elicit their DMFT index oral while the next two parts were used to determine students’ knowledge and practice scores through summation of positive answers. The students were asked to respond to each item according to the response provided in the questionnaire. Responses included multiple-choice (closed end) questions, in which the students were instructed to choose only one appropriate response from a provided list of options.

Results

The students in the public college (KDC) formed three quarters (213 students, 74%) of the sample and the remaining were from the private college (IHC, 75 students, 26%). Females formed about two-thirds of the sample (176 students, 61.1%). The main bulk (44%) of the students was from the third study year (Table 1).

Females formed a significantly higher proportion in KDC compared with IHC (Fig. 1).

Table 1. The demographic characteristics of the undergraduate Dentistry College students in Holy Karbala Governorate in Iraq in 2017 (n = 288)

| Variable | Category | Frequency | Percentage (%) |
|----------|----------|-----------|----------------|
| College  | Holy Kerbala Dentistry College | 213 | 73.96 |
|          | Ibn Hayan Dentistry College | 75  | 26.04 |
| Study year | Third | 127 | 44.10 |
|          | Fourth | 81 | 28.13 |
|          | Fifth | 66 | 22.92 |
| Gender   | Male | 112 | 38.89 |
|          | Female | 176 | 61.11 |
| Total    | | 288 | 100.00 |

Fig. 1. The gender distribution of undergraduate Dentistry College students in Holy Karbala in Iraq in 2017 (n = 288).
The mean age of the students was 21.42 ± 1.36 years and males had a significantly (P = 0.008) higher mean age than females (21.68 ± 1.48 years and 21.26 ± 1.25 years, respectively). Similarly, the mean age of students in the private college (IHC) was significantly higher than the mean age of students at the public college (22.24 ± 1.39 years, 21.14 ± 1.22 years, respectively, P < 0.001). The proportion of students with caries, filling and extracted tooth among the total sample were 48.0%, 54.1% and 31.7%, respectively (Table 2). The prevalence of dental caries among the total sample was 69.9%, while the proportion of the students free from lifetime caries was 30.1%. Gender differences in these proportions were not significant.

No significant gender difference was discovered in the prevalence of tooth caries, filling or extraction (Table 3).

Comparison of the prevalence of tooth caries, filling or extraction between the two colleges showed no significant differences between the students in the two colleges (Table 4).

The mean numbers of teeth with caries, filling and extracted tooth among the total sample were 1.19 ± 1.41, 1.74 ± 1.99 and 0.4860 ± 0.96 teeth, respectively. Comparison of the detailed numbers of these pathological findings among males and females showed no significant differences (Table 2). On the other hand, comparison of these indices between the two colleges showed highly significant differences (Table 5).

The mean DMFT value for the total sample was 2.65 ± 2.70 and there was a highly significant difference between KDC and IHC (2.74 vs. 2.27, P < 0.001). However, no statistically significant gender difference was discovered (2.71 vs. 2.93 for males and females, respectively, P = 0.587). While a significant difference was discovered between the study years through ANOVA test (P = 0.004). The mean DMFT value for the second, third, fourth and fifth study years were 0.50, 1.48, 2.36 and 2.40, respectively.

Further analysis tried to assess the situation of the mostly affected proportion of the students using the Significant Caries (SiC) index which is concerned with the worst third of the total population. The mean SiC was 4.69 ± 2.41 tooth and there was no significant difference between KDC and IHC (4.4056 vs. 6.00, P = 0.072). Additionally, no significant gender difference was found (4.56 vs. 4.84, P = 0.413); nor there was any significant difference between the study years (P = 0.104).

This study included a section exploring student knowledge and use of interdental cleaning measures (IDM) which showed significant differences across the genders, colleges and study years. The mean knowledge score for KDC students was significantly higher than IHC students (0.47 ± 0.89 point vs. 0.91 ± 1.12 point, P = 0.003). The gender difference was also significant toward female students vs. male students (0.92 ± 1.11 point vs. 0.60 ± 1.00 point, P = 0.013). However, the correlation between the knowledge score and DMFT was very weak and not significant (r = 0.046, P = 0.437).

On the other hand, other indicators were included to determine the use of IDM where the mean use score was 0.41 ± 0.65. On comparing the use score between the colleges and genders, no significant differences were discovered. The mean use score for KDC students was significantly higher than IHC students (0.42 ± 0.63 point vs. 0.36 ± 0.71 point, P = 0.513), while mean male use score was 0.35 ± 0.60 point vs. 0.45 ± 0.68 for females, P = 0.217. Similarly very weak correlation was found between the use score and DMFT and was not significant (r = 0.065, P = 0.271).

A further step was undertaken in the analysis to determine the instantaneous impact of knowledge and use of IDM on DMFT through the use of Structural Equation Model (SEM) by Amos software. The model showed that the highest impact as shown by the highest regression coefficient, was for the use of IDM (0.94), while knowledge imposed a minor effect of less than one half of use effect (0.41). The impact of gender and age were almost similar top knowledge, while the colleges impact was very small (Fig. 2).

### Table 2. The prevalence of tooth caries, filling or extraction among undergraduate students in Holy Karbala Governorate in Iraq in 2017 (n = 288)

| Variable          | Frequency | Percentage (%) |
|-------------------|-----------|----------------|
| Have carried tooth| 135       | 48.0           |
| Have filled tooth | 146       | 54.1           |
| Have extracted tooth | 91       | 31.7           |

### Table 3. The gender distribution of the prevalence of tooth extraction, caries and filling of undergraduate Dentistry College students in Holy Karbala in Iraq in 2017 (n = 288 frequency and percentage -in brackets-)

| Gender      | Have extracted tooth | Have carried tooth | Have filled tooth |
|-------------|----------------------|--------------------|-------------------|
| Male        | 34 (30.4)            | 55 (51.4)          | 59 (54.6)         | 285 |
| Female      | 57 (32.6)            | 80 (46.0)          | 86 (53.8)         | 86 |
| Total       | 91 (31.7)            | 135 (48.0)         | 145 (54.1)        | 371 |
| Significance| 0.694                | 0.377              | 0.887             |

### Table 4. The prevalence of tooth extraction, caries and filling of undergraduate Dentistry College students in Holy Karbala in Iraq in 2017 (n = 28, frequency and percentage -in brackets-)

| College                  | Have extracted tooth | Have carried tooth | Have filled tooth | Total |
|--------------------------|----------------------|--------------------|-------------------|-------|
| Holy Kerbala Dentistry College | 68 (31.9)           | 105 (51.0)         | 112 (57.1)        | 285   |
| Ibin Hayan Dentistry College | 23 (31.5)           | 30 (40.5)          | 33 (45.8)         | 86    |
| Total                    | 91 (31.7)            | 135 (48.0)         | 145 (54.1)        | 371   |
| Significance             | 0.974                | 0.142              | 0.199             |
This has led to a change in the behavior patterns to their patients in their practices in the future. The gender difference found in this study was significant, and knowledge of etiology and prevention of dental caries must be learned and practiced throughout their undergraduate training in the dental college. For this reason, a study of how dental students adopt this knowledge and convert it to their own oral health care during their study could, in fact, be of great importance.

However, when the use score was removed, the SEM model showed a greater impact (2.23) in the difference between college students in the sample (Fig. 3).

Discussion

The problem of tooth decay is not a local oral health problem but is a systemic disease with impact on physical build self-esteem and mental health. It carries a heavy burden on human beings, health, and a great economic and sociocultural impact.

Dental health professionals have an important role in the improvement of the public’s health education level. For this reason, the acquisition of knowledge and attitudes relating to dental health and the prevention, control, and treatment of dental problems during the future dentists’ training period is very important. At present, it is assumed that the decrease in the prevalence of dental caries in many population groups is also related to a reduction in the activity and the speed of progression of the carious lesions. This has led to a change in the dentists’ approach to dental care, which is more oriented toward prevention rather than restoration to avoid or postpone invasive treatment.

This study has indicated a serious finding regarding the high lifetime prevalence of caries (69%) among dental students in Holy Karbala Governorate. The important issue is that these students represent a group characterized by good dental status and knowledge of etiology and prevention of dental caries. However, knowledge alone is not enough unless it is adopted as a behavior. The process of adopting any change in dental care attitudes about personal dental care must be learned and practiced throughout study years in the dentists’ learning process, especially during their undergraduate training in the dental college. For this reason, a study of how dental students adopt this knowledge and convert it to their own oral health care during their study could, in fact, be of great importance since the students are the ones who will apply these same behavior patterns to their patients in their practices in the future.

On the other hand, the findings in this study might indicate that the problem is much worse among students in other colleges and this might need to explore in further studies in the future.

Another noteworthy finding was the difference between the private and public college, in the benefit of the later. The students in the private colleges in Iraq are usually from families of higher socioeconomic level as they could offer payment of around 10000 US$/year to these colleges. From these results, one can conclude that the worthy people might be worse than lower social class population in protecting their children’s oral health.

Similar four previous studies among dental students were published previously. In the first and most recent, the oral health indices were compared between fifth and first study year students in the dental college in Mustansiria University. The sample included 50 students in the first and 60 students in the sixth study year (55 males and 55 females). The DMFT means were significantly higher among females than males (6.48 for males and 7.08 for females) in first year. While in the fifth year students the means were 8.73 for males and 9.16 for females. The prevalence of tooth brushing, mouthwash, dental floss, and tooth picks using for the fifth year students were higher than first year students. Whilst a previous similar study in the same college examined 30 students from each of the five study year students (75 males and 75 males) and reported almost similar findings. Dental caries prevalence was 100% (none of the examined students were caries free). However, DMFS value was decreasing with advancing study year and was attributed by the researcher for better knowledge and awareness about dental health among senior students in comparison with freshmen. There was no significant difference between all the study years, and increased in filling score values with a significant difference between females in all study years. The gender difference found in this study was not significant and is consistent with most reviewed findings; however, the above two mentioned results reported two contradictory findings.

The third study year showed reversed gender prevalence among 250 dental students (150 females and 100 males) in the College of Dentistry in Baghdad University in 2011. The students answered a self-administered questionnaire; where 75 students (30%) reported having dental caries and 70 students (25%) reported having tooth filling. The study found that females had better oral hygiene practices, significantly less
self-reported oral bad breath (40%/vs. 70%). It was found that smoking and presence of dental caries had statistically highly significant correlation with halitosis. The fourth study year surveyed 450 students from nine colleges in Mosul University (50 students from each college) in 2004. The study concluded that the students have acceptable dental health knowledge. However, more than half of the students (54.6%) had gingival bleeding but they did not know the cause of bleeding (75.1%) and how to avoid it (75.5%). A large percent of them had no ideas about the causes of dental caries (75.5%), and how to avoid it (76%). Their knowledge was poor regarding the age at which the primary and permanent teeth erupted (23.8%, 22.8%) and completed (18.6%, 27.3%).

Few other studies reported adult dental caries indices from outpatient clinics in Iraq. A study at Mustansiriya University outpatient clinic showed that dental caries was the main cause behind teeth loss among 584 adult patients visiting the outpatient clinic in the dental college in Al-Mustansiriya University in Baghdad in 2013. Teeth loss was more prevalent among males, however, no significant gender difference was found but significant association with age was discovered. A survey among 300 dental outpatient clinic visitors in Najaf city (central part of Iraq) showed that two thirds of them have acceptable dental health knowledge, and a great majority (91%) have good dental behavior as teeth brushing of at least once a week. A study in Tikrit city found that the mean DMFT scores were 7.5 (8.3 for female and 6.7 for male). Mean DMFT for both sex increases with age. The percentage of decayed teeth DMFT percentage was the highest among younger age group (60.7% for female and 63.1% for male). There was statistically a highly significant difference between age, sex, dental visit type and brushing behavior and DMFT.

For similar studies in other parts of the world, a meta-analysis study in Saudi Arabia estimated DMFT in Saudi Arabia at 3.34 and the prevalence of dental caries was reported to be rising with age (91% for age group 12–19 years; and DMFT of 7.35 while, it was 98% for age group 30–45 years; and DMFT of 14.5). While, a study among 320 medical and dental students in Serbia in 2007 reported a mean DMFT value of 12.8 ± 4.7 with only one student with a value of zero. A second study in northern Brazil city said to be not served by restorative dental services, among 889 students aged 15–19 years showed that the DMFT index was 4.65 ± 0.12, and the prevalence of dental caries was 87.4%.

Conclusion

This study revealed high dental caries prevalence among dental students in Karbala Governorate with no gender difference. However, the private college students showed higher prevalence rates and indices. As these students represent important dental health care providers in the near future; at most attention need to be given to improve future dentist knowledge and practice in Iraq.

Conflict of Interest

None.

References

1. Kassebaum NJ, Bernabei D, Dahya M, Bhandari B, Murray CJ, Marcenes W. Global burden of untreated caries: a systematic review and metatregression. J Dent Res. 2015;94:650–658.
2. Li DW, Wong HM, Gandhi A, McGrath CP. Caries-related risk factors of obesity among 18-year-old adolescents in Hong Kong: a cross-sectional study nested in a cohort study. BMC Oral Health. 2018;18:188.
3. Freckenk J, Sharma P, Stenhous L, Green D, Laverty D, Dietrich T. Global epidemiology of dental caries and severe periodontitis - a comprehensive review. J Clin Periodontol. 2017;44:594–5105.
4. Humphrey LT, De Grooto I, Morales J, Barton N, Collicutt S, Ramsey CB, et al. Earliest evidence for caries and exploitation of starchy plant foods in Pleistocene hunter-gatherers from Morocco. Proc Natl Acad Sci U S A. 2014;111:954–9590.
5. Manthaler TM. Changes in dental caries 1953-2003. Caries Res. 2004;38:173–181.
6. Curby JA, Tenuta LM, Ribeiro CC, Paes Leme AF. The importance of fluoride dentifrices to the current dental caries prevalence in Brazil. Braz Dent J. 2004;15:167–174.
7. Bratthall D, Hassel-Petersson G, Sundberg H. Reasons for the caries decline: what do the experts believe? Eur J Oral Sci. 1996;104:416–422.
8. Petersen PE, Lennon MA. Effective use of fluorides for the prevention of dental caries in the 21st century: the WHO approach. Community Dent Oral Epidemiol. 2004;32:319–321.
9. Cortes FJ, Nevo C, Ramon JM, Cuenca E. The evolution of dental health in dental students at the University of Barcelona. J Dent Educ. 2002;66:1203–1208.
10. Pavlovia E, Vesela S, Stanko P. Prevalence of dental caries in dentists. Bratisl Lek Listy. 2015;116:93–95.
11. Birkeland JM, Haugejorden O. Caries decline before fluoride toothpaste was available: earlier and greater decline in the northern Norway. Acta Odontol Scand. 2001;59:7–15.
12. Selwitz RH, Ismail AI, Pitts NB. Dental caries. Lancet. 2007;369:51–59.
13. Broadbent JM, Thomson WM. For debate: Problems with the DMF index pertinent to dental caries data analysis. Community Dent Oral Epidemiol. 2005;33:400–409.
14. Klein H, Palmer CE, Knutson JW. Studies on dental caries: I. Dental status and dental needs of elementary school children. Public Health Rep. (1896–1970). 1938;53:751–765.
15. World Health Organization. Oral Health Surveys: Basic Methods. World Health Organization, Geneva, Switzerland, 2013.
16. Larmas M. Has dental caries prevalence some connection with caries index values in adults? Caries Res. 2010;44:81–84.
17. Jakobsen JR, Hunt RJ. Validation of oral status indicators. Community Dent Health. 1990;7:279–284.
18. Annual Statistical Report, Iraq Ministry of Health. Ministry of Health, Iraq, Baghdad, 2017.
19. Abdullah AI. Experience of dental caries of adult patients in relation to the characteristic of dental visit and brushing behavior in Tikrit City. Mustansiria Dent J. 2013;10:17–27.
20. Al-Ghalebi SN, El-Samarrat SK. Oral health status and treatment needs in relation to nutritional status among 9–10-year-old school children in Nassiryia City/Iraq. J Baghdad Coll Dent. 2012;24:133–137.
21. Aljoujairi TS, Rabee MK, Alvan AM. Evaluation of DMF in Baghdad after years 2003. Mustansiria Dent J. 2009;6:129–133.
22. Rebelo MA, Lopes MC, Veira JM, Parente RC. Dental caries and gingivitis among 15 to 19-year-old students in Manaus, AM, Brazil. Braz Oral Res. 2009;23:248–254.
23. Al-Naaimy KMT. Dental Health Status Among Adult Population in Mosul City. Tikrit J Dent Sci. 2015;3:105–111.
24. Khamis MH, Al-Huwaizi R. Severity and prevalence of caries experience in 18-year-old adolescents in Hong Kong: a cross-sectional study. Public Health Rep. (1896–1970). 2003;118:63–69.
25. Al-Attiyah MA, Smiley RL, Al-Ahmad H. Dental health and life status in Iraq. J Al-Ahwar Med J. 2010;4:129–132.
26. Al-Ani RS. Tooth loss in adult urban population in Ramadi City, Iraq. Al- Anbar Med J. 2009;7:118–123.
27. Ibnsheem SA-R. Dental health knowledge and behavior in Al –Najaf city. kufa J Nurs Sci. 2012;2:116–122.
28. Al Kotobe MF. Tooth loss, prosthodontic treatment need and association factors in a sample of adults attending College of Dentistry,Al Mustansiria University. Al-Rafidain Univ Coll Sci. 2013:125–136.
29. Jazrawi KH. Evaluation of the sequelae of untreated dental caries using PUFA index. Al-Rafidain Dent J. 2014;14:101–110.
29. Almas K, Al-Hawish A, Al-Khamis W. Oral hygiene practices, smoking habit, and self-perceived oral malodor among dental students. J Contemp Dent Pract. 2003;4:77–90.
30. Mahmood AA. Comparison of oral health status and behavior between first and fifth years of Al-Mustansiyah dental students. J Baghdad Coll Dent. 2017;29:71–77.
31. Hasan GA. Oral hygiene practices and self-perceived halitosis among dental students. J Baghdad Coll Dent. 2014;26:58–62.
32. Al Mousawi A. War-related trauma and post-traumatic stress disorder prevalence among undergraduate students in Iraq in 2010. Iraqi J Public Health. 2017;1:35–41.
33. Mahmoud MK, Al-Ubaidi RS. Dental caries severity between students in Al-Mustansia University / College of Dentistry. Mustansia Dent J. 2011;8:24–28.
34. Gasgoosi SS, Jazrawi KH, Al-Ajrab MG. Dental health knowledge, attitude and behavior among first year university students, Mosul. Al-Rafidain Dent J. 2007;7:138–152.
35. Al Agili DE. A systematic review of population-based dental caries studies among children in Saudi Arabia. Saudi Dent J. 2013;25:3–11.
36. Stojanović N, Krunic J. Caries prevalence in medical and dental students in Foca municipality. Stomatol Glas Srb. 2007;54:89–96.