

Awareness and attitude on use of nanotechnology among dental and medical professionals in Iraq

Azad M. R. Almuthaffer

Department of Prosthodontic, College of Dentistry, University of Babylon, Hillah, Iraq

Abstract

Objective: Several products such as technological devices, pharmaceutical products, have been developed with nanotechnology applications, in medicine fields. This study aimed to assess dental and medical staff perceptions of nanotechnology in Iraq. **Materials and Methods:** This study was based on an online questionnaires distributed to (736) dental and medical staff in Iraq from different region and different place of work, and the method of selecting the sample was stratified random sampling. The study period was two months (June and July 2020). **Result:** the largest percentage was for the dental staff 76.5% did hear about nanotechnology, and about 23.5% did not, while among medical staff 54.9% answer yes, and about 45.1% answer they did not hear about nanomedicine. Regarding the uses or applications of nanomedicine, largest percentage of the responses was may be 64.7% for the dental staff and 67.1% for medical staff. **Conclusion:** There is an inadequate knowledge of the dental and medical staff about nanotechnology and its applications the in Iraq in field of dentistry and medicine, and it is not effectively used in the dentistry and medical field.

Keyword: Awareness, curriculum, dental staff, dentistry field, medical staff, nanomedicine, nanotechnology

INTRODUCTION

The nanotechnology is a “term that involve a spectrum of technologies, techniques and processes that can deal with a matter at the nanoscale—fall in between 1 nanometer to 100 nanometers in size.” Several products such as technological devices, pharmaceutical products, have been developed with nanotechnology applications, in the field of medicine.^[1,2] New diagnostic modalities and nano-delivery systems introduced in the dental and medical fields due to mechanical and physical properties of materials improvement.^[3]

In Dentistry, the term nano-dentistry used at the first time by R.A. Freitas Jr. in 2000 who discuss “the future of nano in dentistry field, tissue engineering, and dental nanorobots.”^[4]

In prosthodontics, the polymerization shrinkage of heat cure monomer can be decreased by addition of carbon nanotubes and this will improve the mechanical properties, and the flexural strength, antimicrobial property can improved by addition of metal oxide nanoparticles into conventional polymethyl methacrylate (PMMA) by

reducing the porosity.^[5] By addition of nanoparticles as antimicrobial agents to PMMA, the viscoelastic property will increase.^[6] Better flow, improved hydrophilic properties of vinylpolysiloxanes can be obtained by addition of nanofillers, because the voids will reduced at margin and the result will be improved model pouring.^[7]

In orthodontics, nanorobots used to rotate, move and level the teeth with no pain in few minutes or hours.^[4] Also, nano-filled composite materials have consistency more influx to readily adhere to the orthodontics brackets base to teeth.^[4,8,9]

In medicine, the potential advantages of nanobiotechnologies promote great hopes in treatments of cancer, gene therapy, antiviral and antifungal agents,

Address for correspondence: Dr. Azad M. R. Almuthaffer,
Department of Prosthodontic, College of Dentistry,
University of Babylon, Hillah, Iraq.
E-mail: zainab8073@gmail.com

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chronic pulmonary diseases, diabetes mellitus, and gene therapy.^[9]

Physicians can use nanotechnologies as diagnostics assistance for single cell and molecule levels.^[10] The most common nanoparticles used are silver, gold nanoparticles, and quantum dots, while, medicine can progress by the nanotechnologies which offer the restrictions of current molecular diagnostics and also support the point of care diagnostics that leads to the mixture of diagnostics with therapeutics using nanotechnological devices for operation at the nanoscale are nanobio-sensors which are also appreciated for probable clinical applied treatments.^[9,11] The areas of biomarker detection, diagnosis of initial cancer, and infectious germs discovery are the greatest important current applied usages.^[11,12]

In Iraq, there is no study to assess dental and medical staff perceptions of nanotechnology. Therefore, to assess the staff knowledge and concern about nanotechnology, we carry out this study and its aims were as follows : (1) to know the dental and medical staffs' awareness about nanomaterials; (2) to understand dental and medical staffs' risk awareness concerning nanotechnology; and 3) to understand dental and medical staffs' needs for suitable statement, information, and development about the nanotechnology. In particular, we examined differences in their awareness of nanotechnology according to characteristics such as level of education, field of work, and also the differences in work of place if it dental and medical teaching institutions or dental and medical therapeutic institutions.

MATERIALS AND METHODS

Online questionnaires distributed to (736) dental and medical staff in Iraq from different region and different place of work. The study period was two months (June and July 2020). Their age range from (20) to (60 years old), and the questions were multiple options subdivided into four categories: general information (questions from 1st to 3rd), the evaluation of general nanomedicine knowledge (questions from 4th to 6th), the responses of participants on nanomedicine safety and ethics (questions 7th and 9th), and finely assessment of attitude toward nanotechnology (question 10th) [Table 1].

Statistical analysis

Data were analyzed by using Statistical Package for Social Studies (SPSS 22; IBM Corp., New York, NY,USA), percentages, frequencies and Chi square test were used for categorical variables. A $P < 0.05$ value was considered statistically significant.

Ethical approval

The study was conducted in accordance with the ethical principles that have their origin in the Declaration of

Table 1: Questionnaire: nanotechnology knowledge and attitude among dentists and physician in Iraq (2–3 min)

1-What is your gender?
• Male
• Female
2-What is your scientific degree?
• Bachelor
• Diploma
• Master
• PhD
3-Place of work :
• Medical Educational Institutions.
• Governmental Health Institutions.
• Private medical field
4-Do you hear about nanomedicine?
• Yes
• No
5-Where did you hear about nanomedicine?
• University, college, seminars and conferences
• Scientific programs and reports, cultural magazines, science journals.
• Television, movie.
• Books.
• I do not know about it.
6-Isnanomedicine effectively used at present in the field of (dentistry/medicine)?
• Yes
• No
• May be
7-According to your information does treatment by nanotechnology cause any long-standing side effect?
• Yes
• No
• I do not know
8-Do you know about risk–benefit analysis in nanomedicine?
• A little.
• Some.
• A lot.
• I do not know
9- In respect to ethics, do you know what nanomedicine does?
• In future, there is no problem with ethical issues.
• Risk management needs to be assessed in clinical studies.
• Educating members in the society minimizes the backlash.
• It affects the public health and environment domain.
• I not willing to answer this question.
10-Do you think the introduction and inclusion of nanotechnology topics in education system are necessary? (yes, no)

Helsinki. It was carried out with patients verbal and analytical approval before sample was taken. The study protocol and the subject information and consent form were reviewed and approved by a local ethics committee according to the document number 6761 (including the number and the date in 22/05/2022) to get this approval. This study was reviewed and approved by the Central Committee for Scientific Research Ethics.

RESULTS

[Table 2] shows the characteristics of the dental and medical staff who participate in the questionnaire, about 736 participants, 408 dental staff (294 female and 114

male) with different scientific degree and 328 medical staff (148 female and 180 male) with different scientific degree. Pearson Chi-Square for all the questions was significant p value less 0.05.

Regarding the question if they hear about nanomedicine, the largest percentage was for the dental staff 76.5% answer yes, and about 23.5% answer no, while among medical staff 54.9% answer yes, and about 45.1% answer they did not hear about nanomedicine [Table 3].

When analyze the responses about this question according to the scientific degree, among the dental staff, the scientific degree PhD, master, diploma answer 100% yes, among the bachelor, largest percentage 61.9% answer yes, on the other hand, among the medical staff, the largest percentage was for PhD scientific degree 71.43%, then 61.54% for master, 50% for diploma, and the least percentage was for the bachelor 43.33% [Figure 1].

According to the place of work, among the dental staff, the largest percentage answer yes (100%) was for the Medical Educational Institutions and Private Dental Field, while among dentist of Governmental Health Institutions 61.90% answer yes, they hear about nanomedicine and 38.10% answer no they did not hear about it. In contrast,

among the medical staff, the largest percentage answer yes (80%) was for the Private Medical Field, then 75% for Medical Educational Institutions, and the least percentage 39.60% was for medical staff of the Governmental Health Institutions [Figure 2].

The staff who answered that they hear about the nanomedicine, then proceed to the source of information from where did you heard about it [Figure 3], the largest percentage 32.8% where from scientific programs and reports, cultural magazines, and science journals, then 25% from university, college, seminars and conferences, 11.9% from television and movie and 6.8% from book for dental staff. For the medical staff the largest percentage 22% for university, college, seminars and conferences, 17.5% form scientific programs and reports, cultural magazines, and science journals, 8.3% from television and movie and 7.1% from book.

Regarding the uses or applications of nanomedicine if it was used in your field [Table 3], largest percentage of the responses was may be 64.7% for the dental staff and 67.1% for medical staff.

Concerning the side effects, if the treatment by nanotechnology cause any long-standing side effect [Table 3], largest percentage of the responses was maybe 70.6% for the dental staff and 86.6% for medical staff.

Concerning the risk–benefit [Table 3], if they know about risk–benefit analysis in nanomedicine, 55.9% do not know and 25% had a little awareness about it among dental staff, and 54.9% do not know and 28% had a little awareness about it among medical staff.

Relating to ethics [Figure 4], largest percentage answer was I not willing to answer this question about 50% for the dental staff and 58% for medical staff.

Table 2: Sample distribution

Scientific degree	No.	%	No.	%
Dental staff		Medical staff		
Bachelor	252	61.8	120	36.6
Diploma	42	10.3	16	4.88
Master	96	23.5	52	15.9
PhD	18	4.41	140	42.7
Total	408	100	328	100

Table 3: Responses of dental and medical staff to some questions

Do you hear about nanomedicine?				
	Yes %	No %		
Dental staff	76.5	23.5		
Medical staff	54.9	45.1		
Is nanomedicine effectively used at present in the field of (dentistry/medicine)?				
	Yes %	No %	May be %	
Dental staff	32.4	2.9	64.7	
Medical staff	12.2	20.7	67.1	
According to your information does treatment by nanotechnology cause any long-standing side effect?				
	Yes %	No %	May be %	
Dental staff	11.8	17.6	70.6	
Medical staff	3.6	9.8	86.6	
Do you know about risk–benefit analysis in nanomedicine?				
	A little %	Some %	A lot of %	I do not know %
Dental staff	25	17.6	1.5	55.9
Medical staff	28	15.9	1.2	54.9

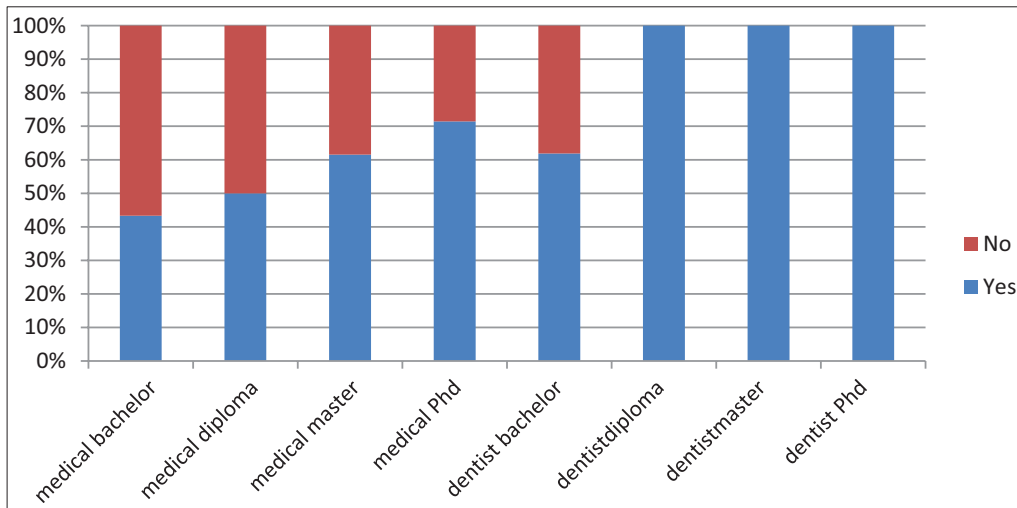


Figure 1: Answer of the question “Do you hear about the nanomedicine” for dental and medical staff regarding the scientific degree

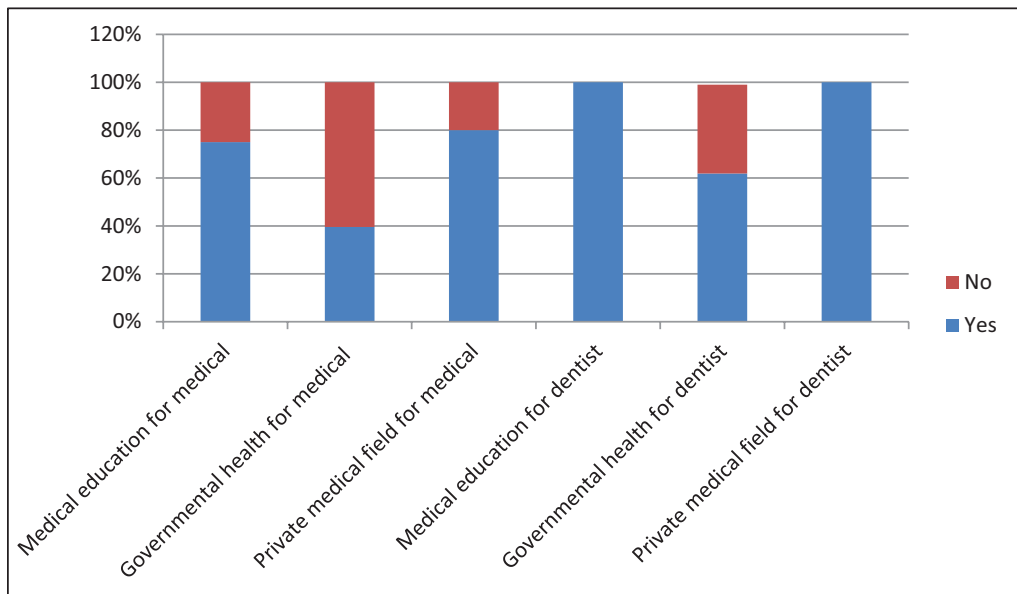


Figure 2: Answer of the question “Do you hear about the nanomedicine” for dental and medical staff regarding place of work

Finely regarding the attitude toward nanotechnology [Figure 5], about 95.6% of dental staff and 98.8% of medical staff recommended the introduction and inclusion of nanotechnology topics in education system of dental and medical colleges.

DISCUSSION

Nanotechnology is an emerging technology science field, and it's very important for the development of country. Nearby, concerning our study, in Iraq, there is no study to assess dental and medical staff perceptions of nanotechnology. Usage of online questionnaire gave the respondents a chance to answer questions in their own time.^[13] Despite that, the method of using questionnaire rather than face to face questioning method to get information depend on honesty of respondents in their answers.

This search based on questioning different category of doctors and dentists to know their knowledge about application and effect of nanoparticles. Regarding the answer of question (do you hear about nanomedicine) for dental staff the answer was 76.5% yes while for medical was 54.9% yes, this is probably due to the dental staff with higher degree more than medical staff or the percentage of dental staff who involved to answer these questions in this search are already more than medical staff.

In this search had found most staff of Medical Educational Institutions who carrying higher degree (PhD and master) were know about (nanomedicine), this may due to their search requirement doing original search or advance search that push them to take such interesting topic. In addition, they are more awareness than those in Governmental Health Institutions, this probably due to their jobs which include teaching the update information

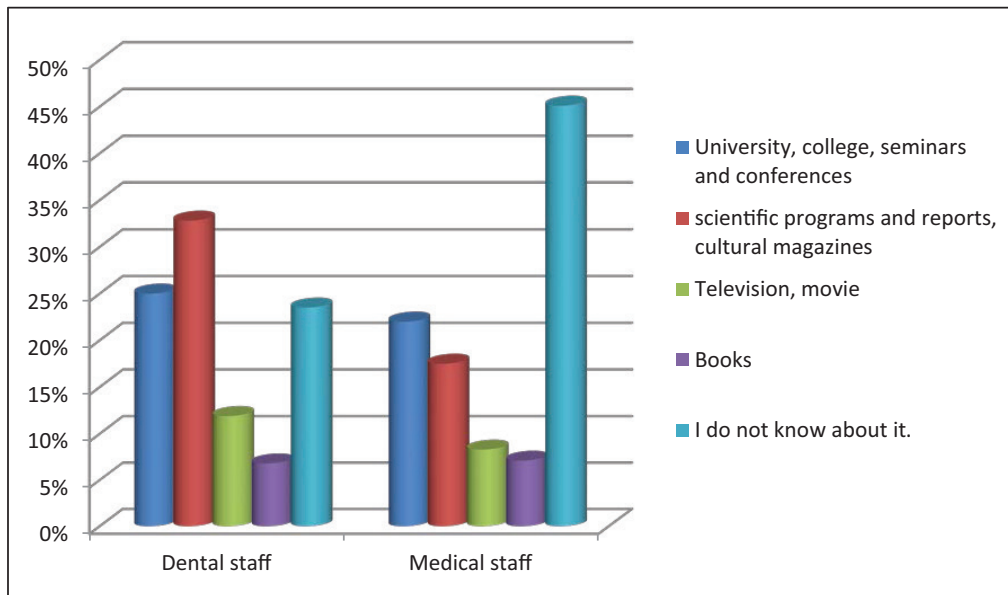


Figure 3: Where did you hear about nanomedicine?

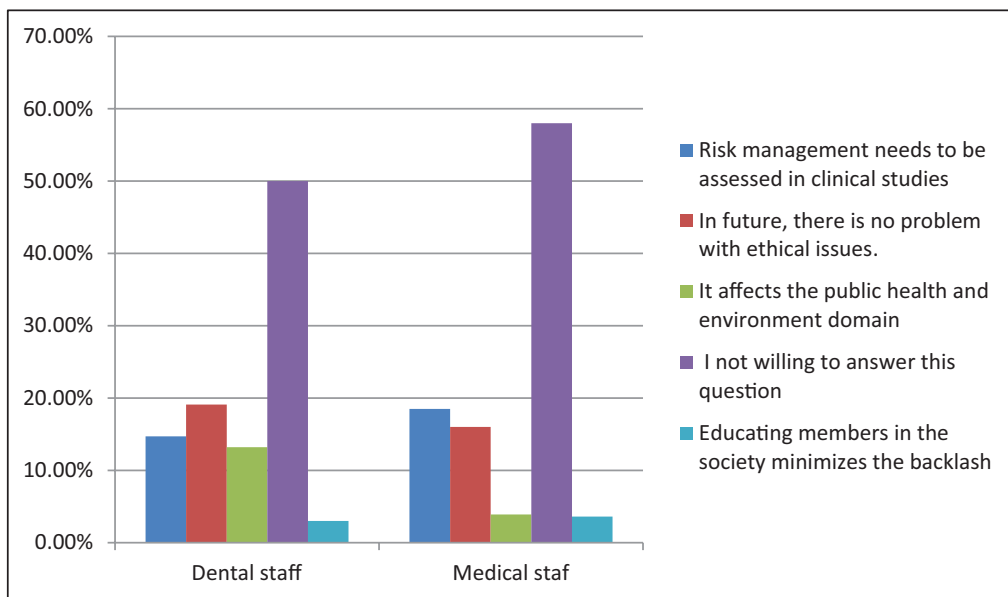


Figure 4: Dental/medical. In respect to ethics, do you know what nanomedicine does?

and materials to students, doing researches each year, supervision on under and post graduate students) made them more knowing. Also as increase in age of human, awareness increase.

Regarding answering the question (the source of knowing about nanomedicine), the highest percentage was from programs, reports and journals and the least percentage from books, for the highest result may be due to the fluently of getting the information from these sources as most of them can get from internet, the same result get by Retzbach *et al.*^[14] and Ola M. Sakr and Alhablain E.A.^[15] While for lowest one, this mean the books need to be more updated, the same result get by Ola M. Sakr and Alhablain E.A.^[15]

Despite almost all category of medical and dental staff had knowledge in nanomedicine but still they do not have the same knowledge about risk benefit of nanomedicine, this may be due to its expensiveness, difficulty of techniques to in cooperate it in dental materials and medical field. There were conflict of opinions about effectiveness of nanotechnology in dentistry, also may be the same reasons for knowing it risk benefit. Our results supported by the results obtained by Ola M. Sakr and Alhablain E.A. 2018.^[15] In other search were 73.8% of participants not quite sure about the effect of nanotechnology on environmental.^[16] While for, Sahin N.s' their responses thought that the benefits of nanotechnology more to the risks.^[17]

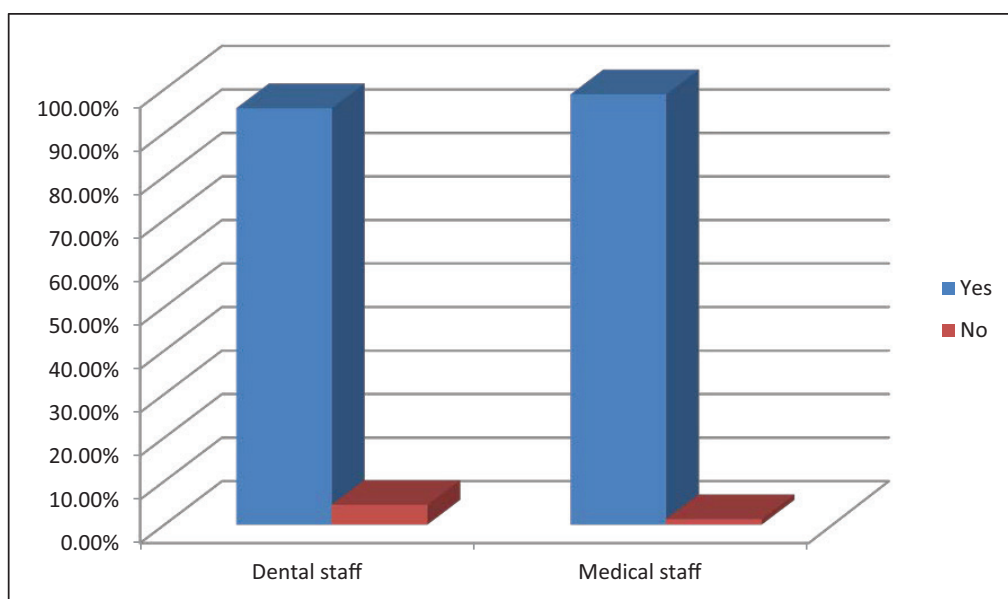


Figure 5: Dental/medical. Do you think the introduction and inclusion of nanotechnology topics in education system are necessary?

After questioning different category of medical and dental staff about nanotechnology, we tried to know if they are interesting of nanotechnology to be as educated material in under graduated classes and for marketing them, it had been found a high percentage of them agree despite a lot of them didn't know about nanotechnology before this questionnaire. Chow L and Chia Sung^[18] support our result which state that nanotechnology curriculums was considered for the high school level and should put into practiced in all education stages. The same wishes also obtained by Daoutsali E.^[19] and Ola M. Sakr and Alhablain E.A.^[15]

CONCLUSION

The findings of this study can be understood as, the dental and medical staff of Iraq have inadequate knowledge about the technology of nano and its uses in field of dentistry and medicine. As well as, the technology of nano is not efficiently used in the dentistry and medical field. so the inclusion of the technology of nano in the colleges of dentistry and medicine program in Iraq was obligatory to raise the knowledge and attitude. So the first step to organize the input for the development of nanotechnology within the country, was this research data.

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Conflicts of interest

There are no conflicts of interest.

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