International Journal of Psychosocial Rehabilitation, Vol. 24, Issue 02, 2020
ISSN: 1475-7192

Awareness of tumor suppressor genes among dental students

Type of manuscript: Original research
Running title: Tumor suppressor genes awareness

Kiruthika Patturaja[1], Dhanraj Ganapathy[2], Revathi Duraisamy[3]

ABSTRACT: *Tumor formation arises as a consequence of alterations in the control of cell proliferation and disorders in the interactions between cells and their surroundings that result in invasion and metastasis. Tumor-suppressor genes activate a multitude of genes encoding proteins with functions in cell-cycle control, DNA repair, senescence, and apoptosis. The present study aims to find the awareness of tumor suppressor genes among dental students. An online questionnaire was formulated and distributed among 215 dental students in Saveetha Dental College, Chennai pursuing undergraduate and postgraduate courses. Of 215 students, 200 students responded. A total of 10 multiple choice questions were formulated and distributed. Datas were collected from the filled questionnaire and analysed. Descriptive statistics was done using SPSS statistical analysis. The results of the present study findings show that there was no significant association between undergraduate and postgraduate dental students on awareness of tumour suppressor genes p=0.174. The overall awareness level of tumour suppressor genes among dental students was moderate. This study showed that the awareness of tumor suppressor genes was moderate among the dental students. Increased importance should be given to education in this aspect of tumor suppressor genes.*

Keywords*: Awareness; Tumour suppressor genes; Dental students; Cancer*

1. INTRODUCTION:

Cancer is thought to arise from the accumulation of several genetic mutations in a single cell. The last two decades have led to a greater understanding of the genetic basis of human malignancy. Although numerous genetic alterations have been detected in cancer, activation of oncogenes and inactivation of cell cycle regulators (e.g., tumor suppressor genes) are now known to play a critical role in the progression of the disease (Nielsen and Maneval, 1998). Tumor suppressor genes function by one of the following mechanisms: protect the genome from mutagenic events, impede dysregulated progression through the cell cycle, induce apoptosis in cells that escape normal cell cycle controls, and inhibit cellular migration and metastasis preventing malignant transformation (Kersh and Fitzpatrick, 2006) . Loss of function or

[1]*Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical sciences, Saveetha University, Chennai, Email: 151501048.sdc@saveetha.com*
[2]*Professor and Head of Department, Department of Prosthodontics, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical sciences, Saveetha University, Chennai, Email: dhanraj@saveetha.com*
[3]*Senior Lecturer, Department of Prosthodontics, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical sciences, Saveetha University, Chennai, Email: revathid.sdc@saveetha.com*
Corresponding Author: Dhanraj Ganapathy
Professor and Head of Department, Department of Prosthodontics, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical sciences, Saveetha University, 162, P.H. Road, Chennai -600077, TamilNadu, India, Email: dhanraj@saveetha.com

Received: 10 Dec 2019 | Revised: 20 Jan 2020 | Accepted: 02 Feb 2020

mutagenesis of tumor suppressor genes has caused a variety of cancers, including ovarian, lung, colorectal, head and neck, pancreatic, uterine, breast, and bladder cancer. There are even familial cancer syndromes like Li-Fraumeni syndrome (Varley et al., 1997).

There are various tumor suppressor genes studied, the mechanisms of each tumor suppressor gene and its protein products are complex and interrelated to other cell signaling pathways .Some important tumor suppressor genes are P53 , retinoblastoma, PTEN, BRCA 1, BRCA 2, PARP-1, NF 2 , APC (Lipsick, 2020). BRCA 1 and BRCA 2 are two genes , the mutation of which have been recognized as possessing the firm relationship with breast cancer (Nkondjock and Ghadirian, 2004) . P53 also known as guardian of genomes has been associated with transcription, cell cycle arrest and apoptosis (Vogelstein and Kinzler, 1992). Retinoblastoma prevents excessive cell growth by inhibiting cell cycle progression until a cell is ready to divide , mutation of retinoblastoma is associated with osteosarcoma , parathyroid and other malignant carcinomas (Sakai et al., 1991) . PTEN gene encodes a dual-specificity phosphatase mutated in a variety of human cancers and embryonic development (Di Cristofano et al., 1998) . NF2 has been associated with development of Schwann cell tumors such as neurofibromas, schwannoma , mesothelioma of lungs (McClatchey et al., 1997). APC gene are linked to familial adenomatous polyposis and to the progression of sporadic colorectal , adenomatous polyposis and gastric tumors (Rubinfeld et al., 1993).

Previously our department has published extensive research on various aspects of dentistry (Anbu et al., 2019; Ariga et al., 2018; Ashok and Ganapathy, 2019; Duraisamy et al., 2019; Ganapathy et al., 2017; Gupta et al., 2018; Jain, 2017a, 2017b; Ranganathan et al., 2017; Varghese et al., 2019; World Journal of Dentistry, 2017), this vast research experience has inspired us to research about the awareness of tumor suppressor genes was moderate among the undergraduate dental students .

2. MATERIALS AND METHODS:

An online questionnaire based study was conducted among dental students pursuing undergraduate and postgraduate courses . The Questionnaire (annexure 1) was circulated among 215 undergraduate and postgraduate dental students in Saveetha Dental College Chennai, India through e-mail , of which 200 students accepted to participate in the study . The medium of answering the questionnaires was English. This study was conducted between 1st December 2019 to 15 January 2019. Convenient sampling methodology was followed to select the study samples. Participation was voluntary and anonymous and no personal data were collected. The questionnaire consisted of 10 multiple choice type questions related to tumor suppressor genes .There was no time limitation for the questions.The questionnaire collected information about the knowledge on tumor suppressor genes . The responses were tabulated , the returned questionnaire containing unanswered questions were excluded.

Descriptive statistics like mean and percentages were used to interpret the data with SPSS statistical analyser 22.0 by IBM .

3. RESULTS AND DISCUSSION:

A cross sectional study was conducted among 200 dental students at Saveetha Dental College, Chennai and it presented an overall view about the awareness level on tumour suppressor genes . The awareness level of tumor suppressor genes among undergraduate students was 31.50% and postgraduate students was 36%. There was no

statistically significant association between the year of study and awareness level p=0.174 (figure 1) . The responses based on awareness of various tumour suppressor genes and their various roles had been tabulated (table 1) . The response for awareness of diagnosis of tumour suppressor genes mutation through immunohistochemistry was about 44.9% (figure 2) .The response based on awareness on the role of tumour suppressor genes in cell cycle was 60% (figure 3) . The response to awareness of environmental stimulus such as hypoxia , radiation role in tumour suppressor mutation was 50% (figure 4) . The response on awareness of tumour suppressor genes presence in various cell structures was about 44.5% (figure 5) .

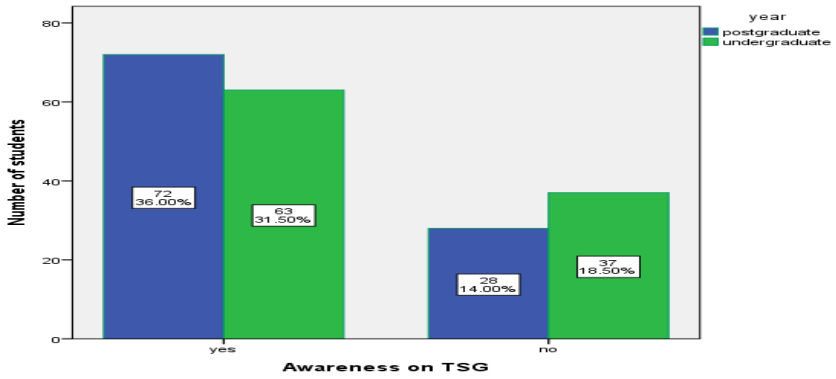


Figure 1: Bar chart showing awareness of tumour suppressor genes among students X axis represents the awareness and y axis represents the number of students. Majority of postgraduate students were aware of tumour suppressor genes. There was no statistically significant association. (chi square, p=0.174 (>0.05))

Questions	**Responses**
1. Do you know tumor suppressor genes play an important role in prevention of malignant tumors? A. Yes B. No	 80% 20%
2. Are you aware that mutation of tumour suppressor genes causes carcinogenesis? A. Yes B. No	 67% 33%
3. Are you aware of tumour suppressor gene - p53 / guardian of genome? A. Yes B. No	 70% 30%
4. Are you aware of tumour suppressor genes Retinoblastoma (Rb) ? A. Yes B. No	 55% 45%
5. Are you aware of tumour suppressor genes BRCA 1, BRCA 2 role in causing breast/ovarian cancer? A. Yes B. No	 49% 51%

Table 1: Table depicting knowledge and awareness of students regarding Tumour Suppressor Genes and their role .

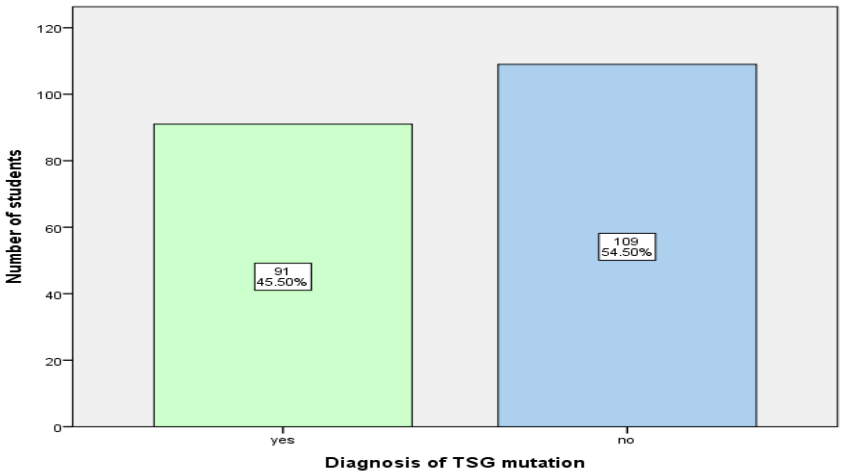


Figure 2: Bar chart showing awareness on diagnosis of tumour suppressor genes mutation among students through immunohistochemistry. X axis represents the awareness of diagnosis of tumour suppressor genes mutation and y axis represents the number of students. Majority of the students were not aware of diagnosis of tumour suppressor genes mutation .

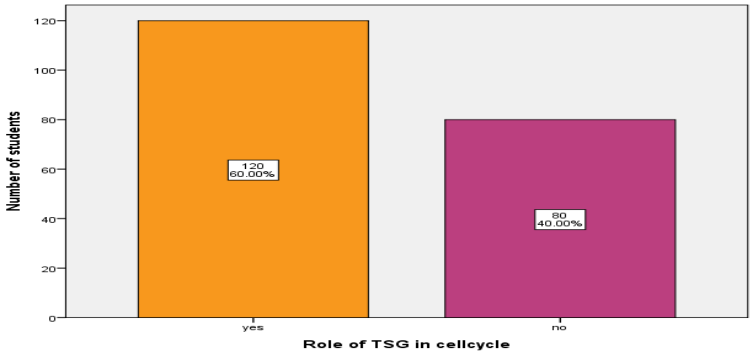
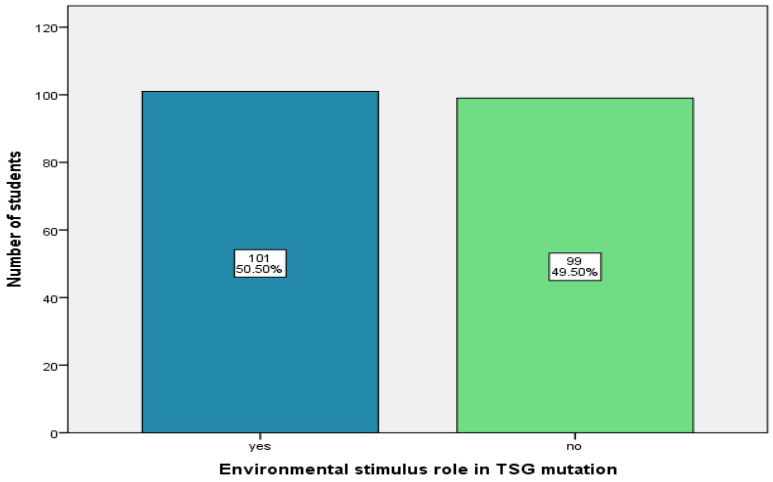


Figure 3: Bar chart showing awareness on role of tumour suppressor genes in cell cycle . X axis represents the awareness of the role of tumour suppressor genes in the cell cycle and y axis represents the number of students. Majority of the students were aware of role of tumour suppressor genes in cell cycle



Received: 10 Dec 2019 | Revised: 20 Jan 2020 | Accepted: 02 Feb 2020

Figure 4: Bar chart showing awareness on environmental stimulus role in tumour suppressor mutation . X axis represents the awareness of the environmental stimulus role of tumour suppressor genes mutation and y axis represents the number of students . About 50% were aware of the environmental stimulus role in tumour suppressor mutation .

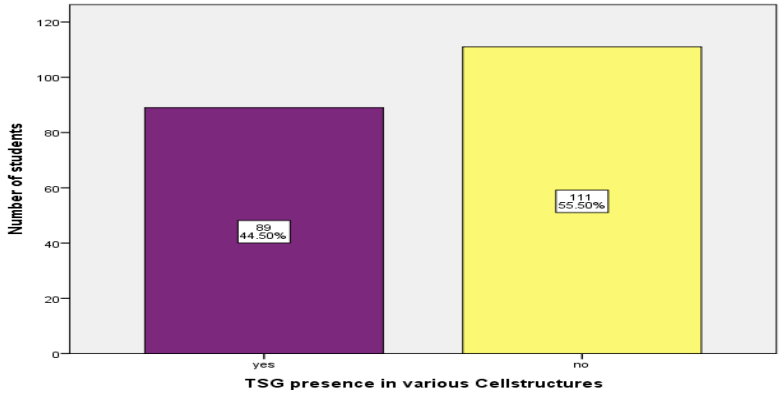


Figure 5: Bar chart showing awareness of tumour suppressor genes presence in various cell structures . X axis represents the awareness of tumour suppressor genes presence in various cell structure and y axis represents the number of students . Most of the students were not aware of tumour suppressor genes presence in various cell structures .

The present study findings show that the awareness on tumour suppressor genes p53 was moderate among dental students .The p53 gene encompasses 16 to 20 kb of DNA chromosome 17 encodes for a 393-amino acid nuclear phosphoprotein involved in cell-cycle control. Loss of normal p53 function is associated with cell transformation in vitro and development of neoplasms in vivo (Chang et al., 1995) .A number of signals, notably DNA damage and activation of oncogenes, activate p53 (Adams and Kaelin, 1998) . P53 gene deletion has been associated with poor prognosis and response to treatment in B-cell leukemia (Döhner et al., 1995). An history of tobacco and alcohol use was associated with a high frequency of p53 mutations in patients with squamous-cell carcinoma of the head and neck (Brennan et al., 1995) .

The present study findings shows that awareness of BRCA mutation involved in causing breast/ovarian cancer was less among the students . BRCA gene mutation has been associated with familial breast and ovarian cancer. BRCA1 and BRCA2 genes belong to the family of ataxia-tel- angiectasia-mutated-mediated DNA repair genes that play a critical role in the DNA double-strand break repair (Miki et al., 1994). heterogenous mutation of BRCA genes could lead to decreased reproductive potential, including reduced ovarian reserve and advanced natural menopause (Lambertini et al., 2017) . The Prevalence of breast cancer is high for women who carry germline mutations in BRCA1 and/or BRCA2 (Rebbeck et al., 2015). The identification of deleterious BRCA genes mutations plays an im- portant role in oncology diagnosis, treatment, and prevention of breast and ovarian cancer .

The present study findings show that awareness of tumour suppressor gene retinoblastoma was less among the students . Mutational inactivation of Rb1 causes the cancer of retina , while deregulation of the pathway in which it functions is common in most types of human cancer (Goodrich, 2006). The RB-1 gene was analyzed in several studies by RNA and DNA-techniques in acute lymphoblastic leukemia as well as in acute myelogenous leukemia (Sauerbrey et al., 1998). Inactivation of retinoblastoma gene appears to have a fundamental role in causing retinoblastoma, osteosarcoma, and other malignant tumors (Sakai et al., 1991) .

No literature studies on tumour suppressor genes awareness among students have been reported.Henceforth, more surveysshould be done on tumour suppressor genes to promote awareness .Therefore, it is acknowledged that

interpretation of any survey data must consider the possibility of incorrect answers because of factors related to questionnaire design, question wording, and respondent factors. Generalizability of this study may be limited due to small sample size.

4. CONCLUSION:

It can be concluded that the awareness of tumor suppressor genes among dental students was moderate . Hence, continuing dental education programs can be conducted to promote awareness among dental students.

5. REFERENCES:

1. Adams PD and Kaelin WG Jr (1998) Negative control elements of the cell cycle in human tumors. Current opinion in cell biology 10(6): 791–797.
2. Anbu RT, Suresh V, Gounder R, et al. (2019) Comparison of the Efficacy of Three Different Bone Regeneration Materials: An Animal Study. European journal of dentistry 13(1): 22–28.
3. Ariga P, Nallaswamy D, Jain AR, et al. (2018) Determination of Correlation of Width of Maxillary Anterior Teeth using Extraoral and Intraoral Factors in Indian Population: A Systematic Review. World Journal of Dentistry 9(1): 68–75.
4. Ashok V and Ganapathy D (2019) A geometrical method to classify face forms. Journal of oral biology and craniofacial research 9(3): 232–235.
5. Brennan JA, Boyle JO, Koch WM, et al. (1995) Association between cigarette smoking and mutation of the p53 gene in squamous-cell carcinoma of the head and neck. The New England journal of medicine 332(11): 712–717.
6. Chang F, Syrjänen S and Syrjänen K (1995) Implications of the p53 tumor-suppressor gene in clinical oncology. Journal of clinical oncology: official journal of the American Society of Clinical Oncology 13(4): 1009–1022.
7. Di Cristofano A, Pesce B, Cordon-Cardo C, et al. (1998) Pten is essential for embryonic development and tumour suppression. Nature genetics 19(4): 348–355.
8. Döhner H, Fischer K, Bentz M, et al. (1995) p53 gene deletion predicts for poor survival and non-response to therapy with purine analogs in chronic B-cell leukemias. Blood 85(6): 1580–1589.
9. Duraisamy R, Krishnan CS, Ramasubramanian H, et al. (2019) Compatibility of Nonoriginal Abutments With Implants: Evaluation of Microgap at the Implant-Abutment Interface, With Original and Nonoriginal Abutments. Implant dentistry 28(3): 289–295.
10. Ganapathy DM, Kannan A and Venugopalan S (2017) Effect of Coated Surfaces influencing Screw Loosening in Implants: A Systematic Review and Meta-analysis. World Journal of Dentistry 8(6): 496–502.
11. Goodrich DW (2006) The retinoblastoma tumor-suppressor gene, the exception that proves the rule. Oncogene 25(38): 5233–5243.
12. Gupta P, Ariga P and Deogade SC (2018) Effect of Monopoly-coating Agent on the Surface Roughness of a Tissue Conditioner Subjected to Cleansing and Disinfection: A Contact Profilometric Study. Contemporary clinical dentistry 9(Suppl 1): S122–S126.
13. Jain AR (2017a) Clinical and Functional Outcomes of Implant Prostheses in Fibula Free Flaps. World Journal of Dentistry 8(3): 171–176.
14. Jain AR (2017b) Prevalence of Partial Edentulousness and Treatment needs in Rural Population of South India. World Journal of Dentistry 8(3): 213–217.
15. Kersh EN and Fitzpatrick DR (2006) Rapid demethylation of the IFN-γ gene occurs in memory but not naive CD8 T cells. The Journal of. Am Assoc Immnol. Available at: https://www.jimmunol.org/content/176/7/4083.short.
16. Lambertini M, Goldrat O, Toss A, et al. (2017) Fertility and pregnancy issues in BRCA-mutated breast cancer patients. Cancer treatment reviews 59: 61–70.
17. Lipsick J (2020) A History of Cancer Research: Tumor Suppressor Genes. Cold Spring Harbor Perspectives in Biology. DOI: 10.1101/cshperspect.a035907.
18. McClatchey AI, Saotome I, Ramesh V, et al. (1997) The Nf2 tumor suppressor gene product is essential for extraembryonic development immediately prior to gastrulation. Genes & development 11(10): 1253–1265.

19. Miki Y, Swensen J, Shattuck-Eidens D, et al. (1994) A strong candidate for the breast and ovarian cancer susceptibility gene BRCA1. Science 266(5182): 66–71.
20. Nielsen LL and Maneval DC (1998) P53 tumor suppressor gene therapy for cancer. Cancer gene therapy 5(1): 52–63.
21. Nkondjock A and Ghadirian P (2004) Epidemiology of breast cancer among BRCA mutation carriers: an overview. Cancer letters 205(1): 1–8.
22. Ranganathan H, Ganapathy DM and Jain AR (2017) Cervical and Incisal Marginal Discrepancy in Ceramic Laminate Veneering Materials: A SEM Analysis. Contemporary clinical dentistry 8(2): 272–278.
23. Rebbeck TR, Mitra N, Wan F, et al. (2015) Association of type and location of BRCA1 and BRCA2 mutations with risk of breast and ovarian cancer. JAMA: the journal of the American Medical Association 313(13): 1347–1361.
24. Rubinfeld B, Souza B, Albert I, et al. (1993) Association of the APC gene product with beta-catenin. Science 262(5140): 1731–1734.
25. Sakai T, Toguchida J, Ohtani N, et al. (1991) Allele-specific hypermethylation of the retinoblastoma tumor-suppressor gene. American journal of human genetics 48(5): 880–888.
26. Sauerbrey A, Stammler G, Zintl F, et al. (1998) Expression of the retinoblastoma tumor suppressor gene (RB-1) in acute leukemia. Leukemia & lymphoma 28(3-4): 275–283.
27. Varghese SS, Ramesh A and Veeraiyan DN (2019) Blended Module-Based Teaching in Biostatistics and Research Methodology: A Retrospective Study with Postgraduate Dental Students. Journal of dental education 83(4): 445–450.
28. Varley JM, Evans DG and Birch JM (1997) Li-Fraumeni syndrome--a molecular and clinical review. British journal of cancer 76(1): 1–14.
29. Vogelstein B and Kinzler KW (1992) p53 function and dysfunction. Cell 70(4): 523–526.
30. World Journal of Dentistry (2017) Evaluation of Corrosive Behavior of Four Nickel–chromium Alloys in Artificial Saliva by Cyclic Polarization Test:An in vitro Study. 8(6): 477–482.