Journal of Contemporary Issues in Business and Government Vol. 26, No. 2, 2020
https://cibg.org.au/

P-ISSN: 2204-1990; E-ISSN: 1323-6903
DOI: 10.47750/cibg.2020.26.02.197

Knowledge on Association of Clinically Proven Allergy with Pets at Home- A Survey

SHARWINI BASKAR[1], N. P. MURALIDHARAN[2*], PREETHA. S[3]

[1]Department of Microbiology, Saveetha Dental College and hospitals, Saveetha Institute of Medical and Technical Sciences (SIMATS), Saveetha University, Chennai.
[2]Associate professor, Department of Microbiology, Saveetha Dental College, Saveetha Institute of Medical and Technical Sciences (SIMATS), Saveetha University, Chennai.
[3]Senior Lecturer, Department of Physiology, Saveetha Dental College, Saveetha Institute of Medical and Technical Sciences (SIMATS), Saveetha University, Chennai.
*Corresponding Author
Email: 151801078.sdc@saveetha.com[1], mugaidar@yahoo.com[2], preeths.sdc@saveetha.com[3]

Abstract: Introduction: Rearing animals and birds at home are in practice in all cultures in the world, many families have a variety of pets. Pets are emotionally connected to family. Many pets have moved from outdoor protectors to indoor family members. When there is a high prevalence of pet keeping, pet allergens are also found relatively in higher concentrations. Humans are exposed to different kinds of allergy at least once in their lifetime. Some studies have shown that the frequency of allergic diseases has increased. Pet keeping was considered to be one of the risk factors for allergy development. Exposure of pet allergens in sensitive people causes diseases.
Materials and method: An online and offline survey was conducted among 53 pet keeping people. The data was collected, analyzed, and results were tabulated.
Results: In this study, the results show 67.9% of the population participating have pets at home. 86.8% of the population have mostly dogs at their home. 52.8% of participant's pets are staying outdoors.
Conclusion: Animal danders are proved to be allergic to many clinical conditions. The study aims to associate allergy and having pets at home.

Keywords: Pets, allergy, allergen, factors, genetics, comorbidity factors.

INTRODUCTION

Allergy is a damaging immune response or exaggerated immune response of the body to a substance such as food, pollen, fur, dust, which becomes hypersensitivity reaction. In most cases, the response is inherited or can be called familial. The allergens which cause allergy can be present both indoor and outdoor. The indoor allergens are house dust, mold spores, pollen, fabrics, dust mites, cockroaches, and mainly due to pets, from animal hair, fur, and feathers. Humans are exposed to different kinds of allergies at least once in their lifetime. Animal allergy is defined as a normal immune reaction to the proteins present in pets. Pet keeping is considered to be a major risk factor for allergy development. Many families in the world have different varieties of pets, especially furry (Podberscek, Paul and Serpell, 2005). Canis lupus familiaris (domestic dog) and Felis catus domesticus (domestic cat) are the two commonly adopted domestic pets in India.

The common allergens derived from them are Can f1 and Fel d1 respectively. The other animal allergens are mite- Der f1 and Der p1. Majority allergens belong to the same protein family (Lodge *et al*., 2012). The proteins are secretoglobin, lipocalins, and kallikreins (Nilsson, van Hage and Grönlund, 2014). Cat allergen Fel d1 belongs to the protein secretoglobin and more than 50% of furry animal's allergens belong to the family lipocalins (Díaz-Perales *et al.*, 2013). The allergens are present in skin, saliva, urine, sebum, perianal gland secretions, dander, and other secretions of the pets. The frequency of allergic diseases has been increased (Platts-Mills, 2015). An allergic reaction occurs after the pet exposure when there is a reaction between the pet allergen and human immune responses (Dharmage *et al.*, 2012). This causes a hypersensitivity reaction. The allergens are aerosolized and suspended in ambient air (Arbes *et al.*, 2004). It also gets transmitted by clothing and with direct contact with pets (Wood *et al.*, 1998).

They also get transmitted from the bedding when the pets are not restricted to one place. The outdoor pet allergens are found in public places such as schools that are considered to be a second-hand exposure, which develops diseases in sensitive children (Almqvist *et al.*, 1999). These types of allergens are seen in an inhabitant of a visibly clean area. Allergens are not just dust, it is mostly a mixture of organic and inorganic substances generated from other living beings. One of the most strongly allergenic components are house dust, often

heavily contaminated with the fecal pellets and cast skins, is house dust mites. House dust mites are tiny creatures related to ticks, chiggers, and spiders who live in close association with humans. The primary food of house dust mites is dander (skin scales) shed from human and pet activity. Home dust mites may be the factor for 50 to 80 percent of asthma, and also in countless cases of eczema, hay fever, and other allergic related ailments.

Symptoms are usually respiratory (sneezing, itching, watery eyes, wheezing, etc. There are reports for a red rash around the neck. Other allergic reactions are headaches, fatigue, and depression. Inhalation of dust mites allergens by hypersensitive individuals can result in acute attacks of bronchial asthma, accompanied by wheezing, shortness of breath, and perhaps even death. Diagnostic tests and clinical studies by allergists have shown that house dust mite is the most common allergy in people with asthma and it is an important "root cause" for the development of asthma in young children. These atopic diseases lead to increased burden of diseases and health care costs, particularly in patients with uncontrolled or poorly controlled diseases, and can also cause chronic infections. Asthma and allergic rhinitis can occur in the same person.

Allergy is also defined in the presence of immunoglobulin class Ig E which binds to the specific antigen. Allergic rhinitis is a nasal disorder induced by immunoglobulin E (Ig E)- mediated immune response and characterized by symptoms including rhinorrhoea, sneezing, nasal obstruction, and itching. It is one of the most common atopic diseases all over the world. Asthma is more severe with allergic rhinitis people compared to those without allergic rhinitis. Immune responses are initiated by antigen-presenting cells such as dendritic cells, which present allergen to the T cells. Interleukin-1β, a potent proinflammatory cytokine, involved in many inflammatory conditions including autoinflammatory and allergic disorders. Detection of cat allergen in dust can be done by demonstrating antibodies and IL by ELISA method using monoclonal antibodies (Briner *et al.*, 1993).

A recent study has found the precise mechanism for cat allergies which is the binding of the cysteine-rich portion through a mannose receptor (Emara *et al.*, 2011). This study includes only dogs and cats because allergic responses to other animals are similar to allergic responses produced by dogs and cats allergens. The relationship of the pet has changed over time from outdoor protectors to indoor family members (Kennedy and McGarvey, 2008). Responding adversely to those agents depends on the genetic makeup of an individual, especially towards the environmental agents. Certain studies have found that new causes of the allergy can be epigenetic changes which means a heritable change in gene expression. Epigenetic change has 3 mechanisms: DNA methylation, histone modification, and non-coding RNA associated gene silencing (Lim *et al.*, 2013). Epigenetic change is also linked to asthma (Breton *et al.*, 2011).

Development of sensitization to perennial allergens in early life combined with exposure to high allergen levels was used to predict chronic asthma and reduced lung function in children at the age of 13. When there is an exposure to pet associated microbes especially in the neonatal period it alters the child's immune system, reducing the risk of allergic sensitization disease. The study aims to explore areas of health consequences, the prevalence of allergic diseases, people's interactions with pets, and response to the human immune system to pet allergens. Various research studies have been conducted by our team on medicines (Marickar, Geetha and Neelakantan, 2014)(Paramasivam, Vijayashree Priyadharsini and Raghunandhakumar, 2020)(Vaishali and Geetha, 2018)(Girija As and Priyadharsini J, 2019)(Shahzan *et al.*, 2019), in vitro studies (Ashwin and Muralidharan, 2015), in vivo studies (Girija, Jayaseelan and Arumugam, 2018)(Girija, Vijayashree Priyadharsini and Paramasivam, 2019)(Priyadharsini *et al.*, 2018a), surveys (Pratha, Ashwatha Pratha and Geetha, 2017)(Shahana and Muralidharan, 2016), review articles (Selvakumar and Np, 2017), genetic studies (Smiline, Vijayashree and Paramasivam, 2018)(M, Geetha and Thangavelu, 2019)(Priyadharsini *et al.*, 2018b), stemmed for this study on the survey on the association of clinically proven allergy and having pets at home. Our team has rich experience in research and we have collaborated with numerous authors over various topics in the past decade (Deogade, Gupta and Ariga, 2018; Ezhilarasan, 2018; Ezhilarasan, Sokal and Najimi, 2018; Jeevanandan and Govindaraju, 2018; J *et al.*, 2018; Menon *et al.*, 2018; Prabakar *et al.*, 2018; Rajeshkumar *et al.*, 2018, 2019; Vishnu Prasad *et al.*, 2018; Wahab *et al.*, 2018; Dua *et al.*, 2019; Duraisamy *et al.*, 2019; Ezhilarasan, Apoorva and Ashok Vardhan, 2019; Gheena and Ezhilarasan, 2019; Malli Sureshbabu *et al.*, 2019; Mehta *et al.*, 2019; Panchal, Jeevanandan and Subramanian, 2019; Rajendran *et al.*, 2019; Ramakrishnan, Dhanalakshmi and Subramanian, 2019; Sharma *et al.*, 2019; Varghese, Ramesh and Veeraiyan, 2019; Gomathi *et al.*, 2020; Samuel, Acharya and Rao, 2020)

MATERIALS AND METHOD

The study setting conducted was an online and offline survey, which is time-saving and different people can be covered. The number of participants involved in the study was 53 pet keeping owners. The sampling method used was search engines such as Pubmed, google scholar. A set of questionnaires including the parameters of having pets at home and in neighbor's home, taking care of pets, the prevalence of allergy among the family, was included. The data was collected using google docs. The data manipulation was done in excel. The method

of representation of the results is a bar chart. The data were analyzed using SPSS software. The statistical test used is the Chi-square test.

RESULTS AND DISCUSSION

The results are categorized under 4 factors such as awareness, precipitating factors, comorbidity factors, and genetic factors. The responses were collected from 53 pet keeping owners.

In the study, 67.9% of the participants have pets at home (figure 1). 86.8% of participants have dogs than cats 13.2% (figure 2). 73.6% of the population is aware that pets can cause allergy (figure 3). When a question was asked regarding the relationship with pets, 47.2% of the participants chose their pets to stay indoor (figure 4).

Precipitating factors means the factor which is responsible for the onset of allergies.

Question on "Do the participants allow their pets to sleep on the bed?", 73.6% of the population don't allow their pets to sleep on bed even though 26.42% allow their pets to sleep on their bed (figure 5). It is found that 50.9% used to sleep on the floor (figure 6). When the participants were asked about experiencing cough and sneeze in the morning, 43.4% of the participants have experienced coughing and sneezing in the morning even though 56.6% have not experienced it (figure 7).

Comorbidity factor means the co-occurrence of events for example after exposure to the pets some feel difficulty in breathing, continuous exposure might lead to asthma. In this study, 52.8% of the participant's mother is more allergic than father 47.2% (figure 8). In some studies, there is a correlation between allergy and insulin resistance in this study, 32.08% of allergic people are diabetic though 67.92% are non-diabetic (figure 9). The study population with inherited traits for allergy, 18.87% have a family history of asthma (figure 10). Figure 11 represents the comparison between having pets at home and experiencing difficulty in breathing using the Pearson Chi-square. Figure 12 depicts the comparison between having pets at home and experiencing cough and sneezes in the morning using the Pearson chi-square test. Figure 13 depicts the comparison between having pets at home and episodes of respiratory disturbances using the Pearson Chi-square test. Figure 14 represents the comparison between pets at home and allergic responses in children using the Pearson Chi-square test. Figure 15 depicts the comparison between pets at home to the usage of drugs to control wheezing using the Pearson Chi-square test.

In this study, the hygiene of the pet owners was tested. The precipitating factors included are the relationship of the participants with pets, whether the participants allow their pets to sleep on their bed, whether the participants used to sleep on the floor. Pet allergens are found to be present on the floor or clothes which can lead to allergy. Sleeping on the floor results in contact with the dander and saliva of pets. A previous study shows the diagnostic approaches to pet allergies by checking the hygiene of the pet owners (Konradsen *et al.*, 2015). Another study has reported that pet allergens can also be present on the surface of clothes and get transmitted (Enberg *et al.*, 1993). The comorbidity factors included are whether the participants experienced coughing and sneezing, experienced difficulty in breathing, experienced respiratory disturbance. Previous studies report that breathing difficulty after exposure to pets can lead to asthma (Fernández *et al.*, 2007). Another study reported that immunomodulatory protein alters the immune response after exposure to pets which leads to allergy (Herre *et al.*, 2013). The current study shows that mothers are more allergic. Several studies have reported that genetic changes can also be one of the causes of allergies by three mechanisms of epigenetic change (Hollingsworth *et al.*, 2008). In some studies, there is a correlation between allergy and insulin resistance, in this study, there is little evidence of diabetes. Another study has shown that asthma is linked to epigenetic changes (Selgrade *et al.*, 2013).Our institution is passionate about high quality evidence based research and has excelled in various fields ((Pc, Marimuthu and Devadoss, 2018; Ramesh *et al.*, 2018; Vijayashree Priyadharsini, Smiline Girija and Paramasivam, 2018; Ezhilarasan, Apoorva and Ashok Vardhan, 2019; Ramadurai *et al.*, 2019; Sridharan *et al.*, 2019; Vijayashree Priyadharsini, 2019; Chandrasekar *et al.*, 2020; Mathew *et al.*, 2020; R *et al.*, 2020; Samuel, 2021)

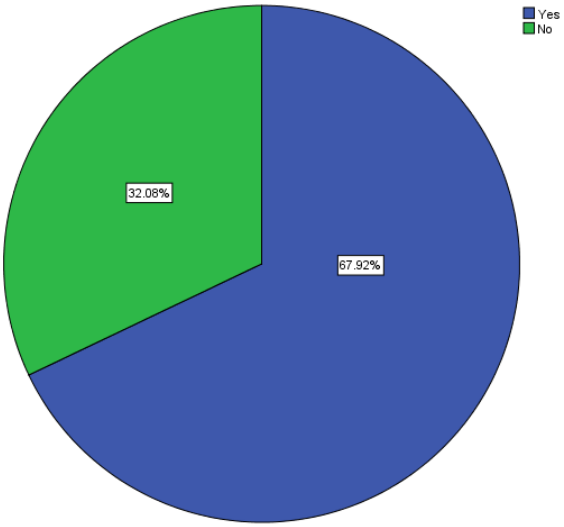

Fig.1: Pie chart depicting responses to the question regarding having pets at home. Blue represents yes and green represents no. 67.9% (blue) of the study participants have pets at home.

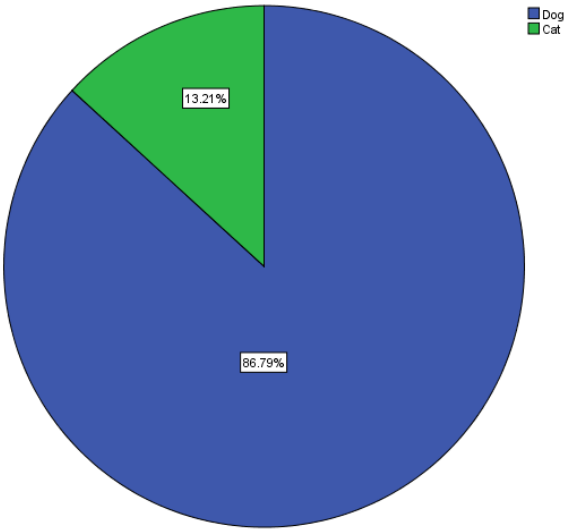

Fig.2: The pie chart shows responses to the question regarding the type of pet at home either dogs or cats, where blue color denotes 'dog', green denotes 'cat', 86.8% of the population have dogs (blue) than cats 13.2% (green).

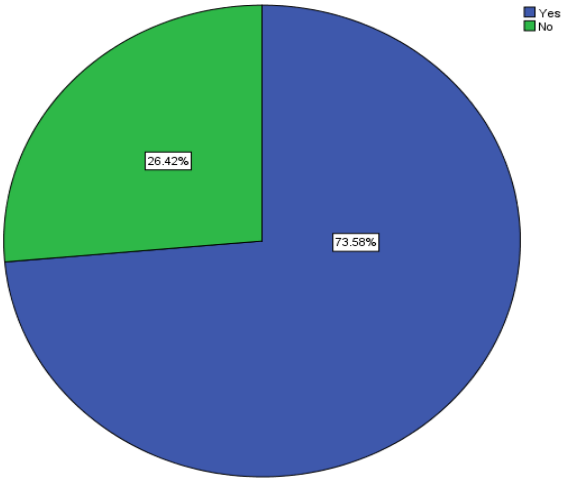

Fig.3: The pie chart showing responses to the question if having pets at home can cause allergy, where blue color denotes 'yes', and green denotes 'no', 73.6% of the pet owners are aware that pets can cause allergies (Blue).

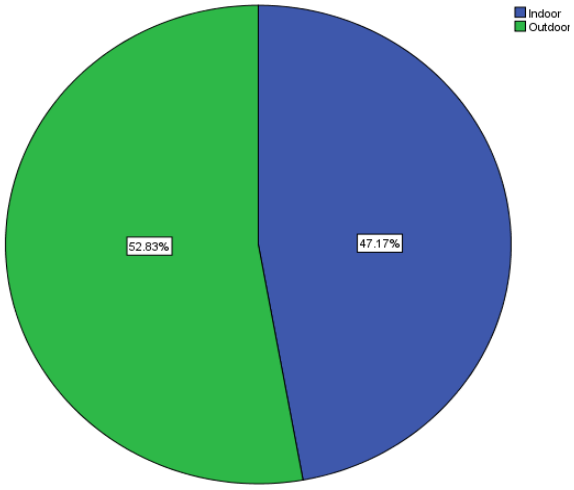

Fig.4: Pie chart depicts the response to the question on the relationship of the participants with pets, where blue color denotes 'indoor', green denotes 'outdoor', 52.8% of the pet owners chose their pets to stay outdoors (green)

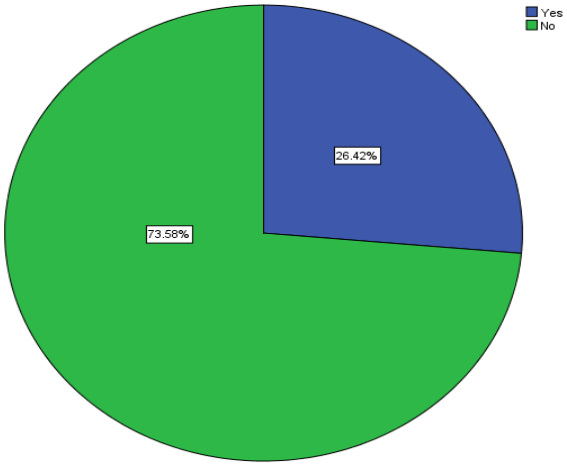

Fig.5: Pie chart represents the response to the question on whether the participants allow their pets to sleep on the bed, where blue color denotes 'yes', green denotes 'no', 73.58% of the pet owners don't allow their pets to sleep on the bed (green) though 26.42% allow their pets to sleep on the bed (blue).

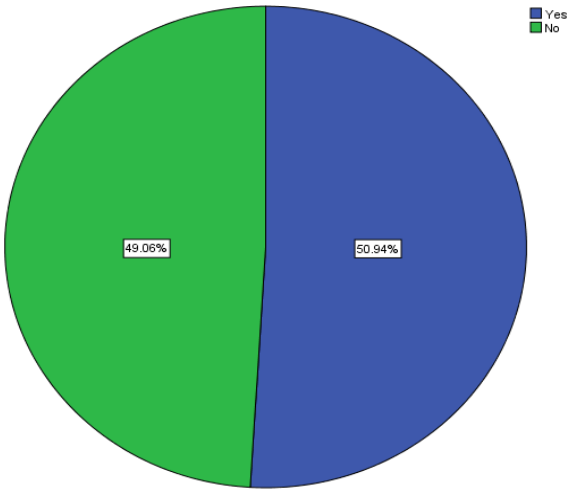

Fig.6: Pie chart showing responses to the question regarding whether the participants sleep on the floor, where blue color denotes 'yes', green denotes 'no', 50.94% of the participants used to sleep on the floor (blue).

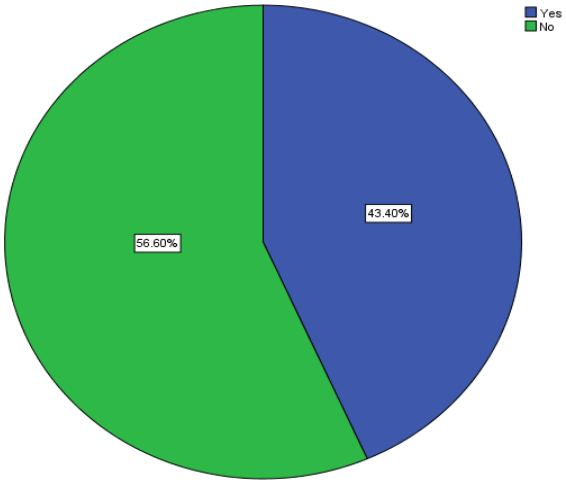

Fig.7: The pie chart depicts the response to the question on study participants experiencing cough and sneezes in the morning, where blue color denotes 'yes', green denotes 'no', 43.4% of the participants have experienced coughing and sneezing in the morning (green)

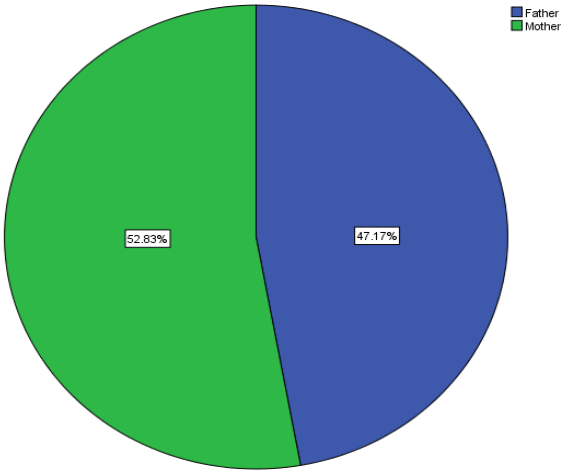

Fig.8: Pie chart showing the responses to the question regarding "among parents who are allergic?", where blue color denotes 'father', green denotes 'mother', 52.83% (green) of the participants responded that mothers are allergic than father

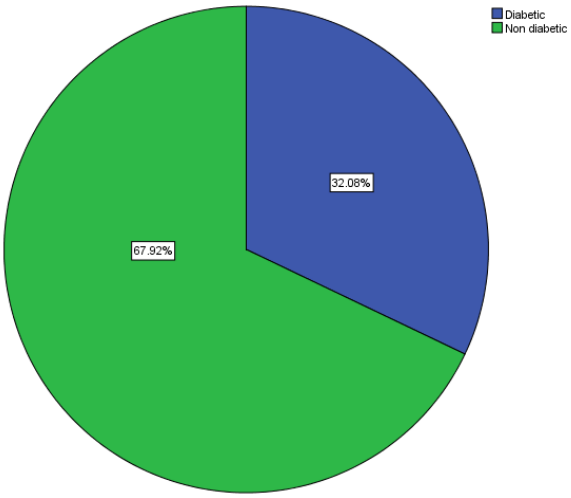

Fig.9: Pie chart represents the response to the question of whether the allergic person is diabetic or not, where blue color denotes 'diabetic', green denotes 'non-diabetic', 67.92% of the people allergic is non-diabetic (green).

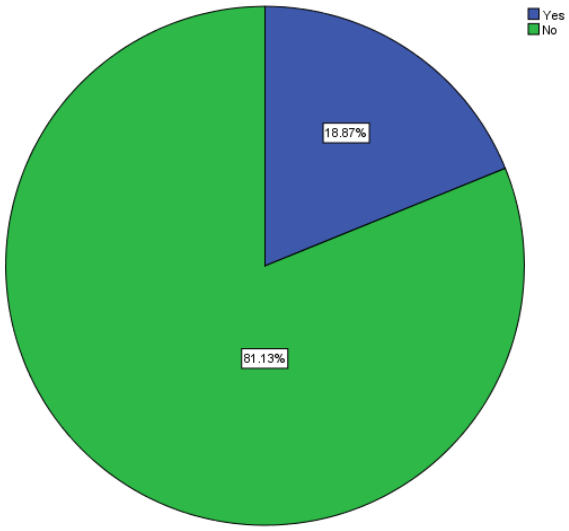

Fig.10: The pie chart depicts the response to the question of family history of asthma, where blue color denotes 'yes', green denotes 'no', 18.87% participants have a family history of asthma (green) even though 81.13% have no records of family history of asthma (blue).

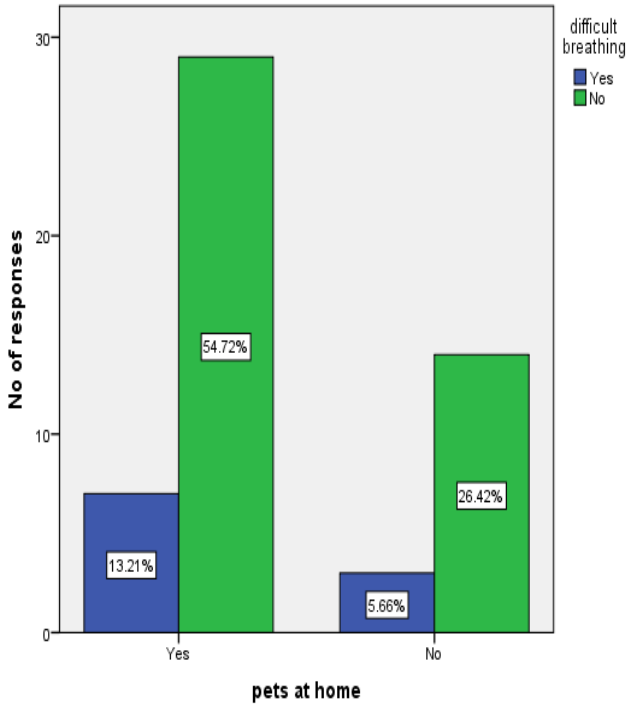

Fig.11: The bar graph depicts the comparison between having pets at home and experiencing difficulty in breathing using the Pearson Chi-square where blue color denotes 'yes' and green denotes 'no'. The x-axis represents pets at participants' homes and the y-axis represents the number of participants who had difficulty breathing. The graph shows that 54.72% of participants who had pets at home did not experience difficulty in breathing. The Pearson chi-square value is (p)= 0.87 which is statistically not significant (p>0.05). Susceptibility to pet allergy varies and genetically predisposed.

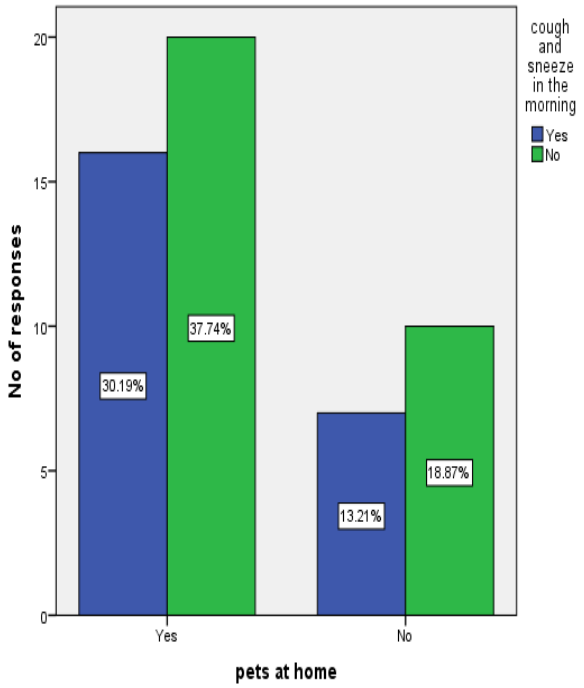

Fig.12: The bar graph depicts the comparison between having pets at home and experiencing cough and sneezes in the morning using the Pearson chi-square test, where blue color denotes 'yes' and green denotes 'no'. The x-axis represents pets at participants' homes and the y-axis represents the number of participants who had coughs and sneezes in the morning. The graph shows that 30.19% of the participants who had pets at home experienced cough and sneeze in the morning. The Pearson chi-square value is p=0.82 which is statistically not significant (p>0.05).

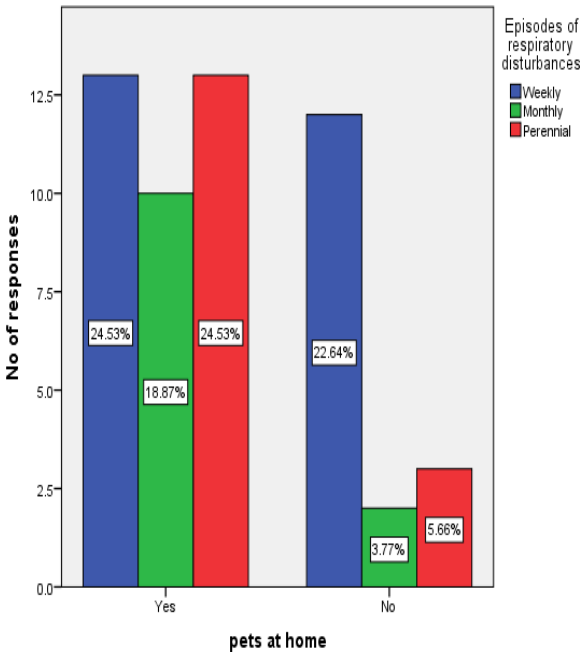

Fig.13: The bar graph depicts the comparison between having pets at home and episodes of respiratory disturbances using the Pearson Chi-square test, where blue color denotes 'weekly', green color denotes 'monthly' and red denotes 'perennial'. The x-axis represents pets at participants' homes and the y-axis denotes the number of participants who had episodes of respiratory disturbances. The graph shows 24.53% of the participants experiencing breathing difficulty weekly have pets at their homes. The Pearson chi-square value is (p)=0.06 which is statistically not significant (p>0.05).

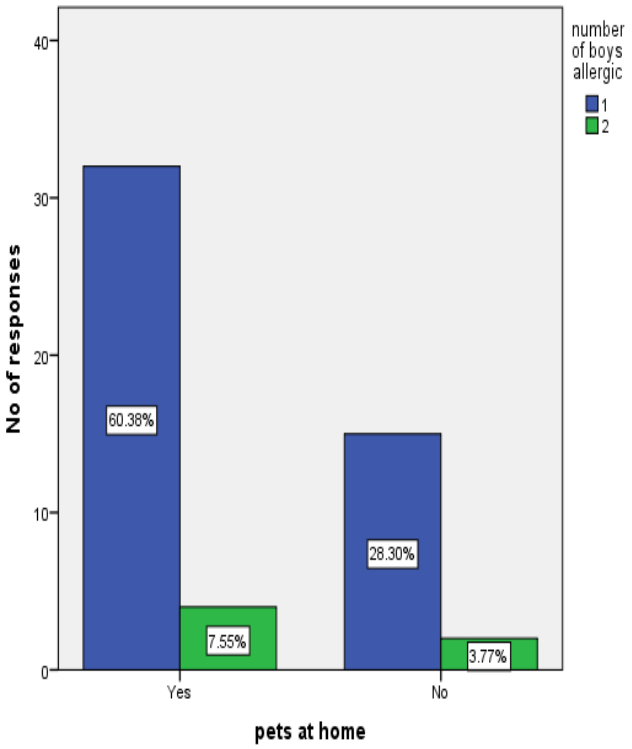

Fig.14: The bar graph depicts the comparison between pets at home and allergic responses in children using the Pearson Chi-square test, where blue color denotes '1 i.e boys' and green denotes '2 i.e girls'. The x-axis represents pets at home and the y-axis represents the number of allergic children. The graph shows that 60.38% of boys with pets at home are more allergic. The Pearson chi-square value is (p)= 0.94 which is statistically not significant (p>0.05).

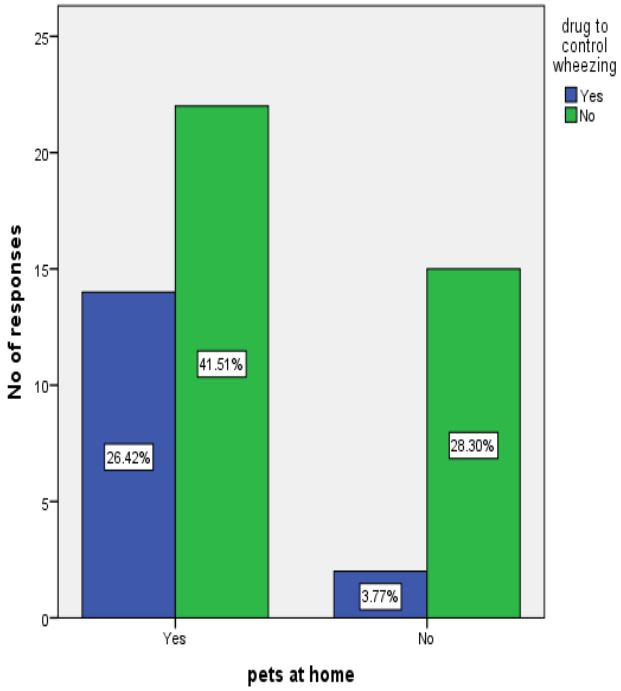

Fig.15: The bar graph depicts the comparison between pets at home to the usage of drugs to control wheezing using the Pearson Chi-square test, where blue color denotes 'yes' and green denotes 'no'. The x-axis represents pets at participant's homes and the y-axis represents drugs to control wheezing. The graph shows that 26.42% of the population who are undergoing drugs to control wheezing have pets at their homes. The Pearson chi-square value is (p)= 0.04 which is statistically significant (p<0.05).

CONCLUSION

It is a general belief and opinion that cough and sneeze is the influence of the environment. The environment is everything around us, composed of gaseous and particulate matter generated from the materials around us. Animal danders are proven to be allergic to many clinically proven allergic patients. The main aim of the study is to associate allergy and having pets at home. From the survey, it is obvious that the changing of the relationship of the pets from outdoor to indoor is the onset of the cause of allergy. Prevention can be done by avoiding exposure to pets allergen by keeping them clean when at home whether indoor or outdoor.

REFERENCES

1. Almqvist, C. et al. (1999) 'School as a risk environment for children allergic to cats and a site for transfer of cat allergen to homes', Journal of Allergy and Clinical Immunology, pp. 1012–1017. doi: 10.1016/s0091-6749(99)70172-7.
2. Arbes, S. J. et al. (2004) 'Dog allergen (Can f 1) and cat allergen (Fel d 1) in US homes: Results from the National Survey of Lead and Allergens in Housing', Journal of Allergy and Clinical Immunology, pp. 111–117. doi: 10.1016/j.jaci.2004.04.036.
3. Ashwin, K. S. and Muralidharan, N. P. (2015) 'Vancomycin-resistant enterococcus (VRE) vs Methicillin-resistant Staphylococcus Aureus (MRSA)', Indian journal of medical microbiology, 33 Suppl, pp. 166–167. doi: 10.4103/0255-0857.150976.
4. Breton, C. V. et al. (2011) 'DNA Methylation in the Arginase–Nitric Oxide Synthase Pathway Is Associated with Exhaled Nitric Oxide in Children with Asthma', American Journal of Respiratory and Critical Care Medicine, pp. 191–197. doi: 10.1164/rccm.201012-2029oc.
5. Briner, T. J. et al. (1993) 'Peripheral T-cell tolerance induced in naive and primed mice by subcutaneous injection of peptides from the major cat allergen Fel d I', Proceedings of the National Academy of Sciences, pp. 7608–7612. doi: 10.1073/pnas.90.16.7608.
6. Chandrasekar, R. et al. (2020) 'Development and validation of a formula for objective assessment of cervical vertebral bone age', Progress in orthodontics, 21(1), p. 38. doi: 10.1186/s40510-020-00338-0.
7. Deogade, S., Gupta, P. and Ariga, P. (2018) 'Effect of monopoly-coating agent on the surface roughness of a tissue conditioner subjected to cleansing and disinfection: A Contact Profilometric In vitro study', Contemporary Clinical Dentistry, p. 122. doi: 10.4103/ccd.ccd_112_18.
8. Dharmage, S. C. et al. (2012) 'Exposure to cats: update on risks for sensitization and allergic diseases', Current allergy and asthma reports, 12(5), pp. 413–423. doi: 10.1007/s11882-012-0288-x.
9. Díaz-Perales, A. et al. (2013) 'Allergy to uncommon pets: new allergies but the same allergens', Frontiers in immunology, 4, p. 492. doi: 10.3389/fimmu.2013.00492.
10. Dua, K. et al. (2019) 'The potential of siRNA based drug delivery in respiratory disorders: Recent advances and progress', Drug development research, 80(6), pp. 714–730. doi: 10.1002/ddr.21571.
11. Duraisamy, R. 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), pp. 289–295. doi: 10.1097/ID.0000000000000885.
12. Emara, M. et al. (2011) 'Recognition of the Major Cat Allergen Fel d 1 through the Cysteine-rich Domain of the Mannose Receptor Determines Its Allergenicity', Journal of Biological Chemistry, pp. 13033–13040. doi: 10.1074/jbc.m111.220657.
13. Enberg, R. N. et al. (1993) 'Ubiquitous presence of cat allergen in cat-free buildings: probable dispersal from human clothing', Annals of allergy, 70(6), pp. 471–474. Available at: https://www.ncbi.nlm.nih.gov/pubmed/8507041.
14. Ezhilarasan, D. (2018) 'Oxidative stress is bane in chronic liver diseases: Clinical and experimental perspective', Arab journal of gastroenterology: the official publication of the Pan-Arab Association of Gastroenterology, 19(2), pp. 56–64. doi: 10.1016/j.ajg.2018.03.002.
15. Ezhilarasan, D., Apoorva, V. S. and Ashok Vardhan, N. (2019) 'Syzygium cumini extract induced reactive oxygen species-mediated apoptosis in human oral squamous carcinoma cells', Journal of oral pathology & medicine: official publication of the International Association of Oral Pathologists and the American Academy of Oral Pathology, 48(2), pp. 115–121. doi: 10.1111/jop.12806.
16. Ezhilarasan, D., Sokal, E. and Najimi, M. (2018) 'Hepatic fibrosis: It is time to go with hepatic stellate cell-specific therapeutic targets', Hepatobiliary & pancreatic diseases international: HBPD INT, 17(3), pp. 192–197. doi: 10.1016/j.hbpd.2018.04.003.
17. Fernández, C. et al. (2007) 'Analysis of skin testing and serum-specific immunoglobulin E to predict airway reactivity to cat allergens', Clinical & Experimental Allergy, pp. 391–399. doi: 10.1111/j.1365-2222.2007.02659.x.
18. Gheena, S. and Ezhilarasan, D. (2019) 'Syringic acid triggers reactive oxygen species-mediated cytotoxicity in HepG2 cells', Human & experimental toxicology, 38(6), pp. 694–702. doi: 10.1177/0960327119839173.
19. Girija As, S. and Priyadharsini J, V. (2019) 'CLSI based antibiogram profile and the detection of MDR and

XDR strains of isolated from urine samples', Medical journal of the Islamic Republic of Iran, 33, p. 3. doi: 10.34171/mjiri.33.3.
20. Girija, A. S. S., Vijayashree Priyadharsini, J. and Paramasivam, A. (2019) 'Plasmid-encoded resistance to trimethoprim/sulfamethoxazole mediated by dfrA1, dfrA5, sul1 and sul2 among Acinetobacter baumannii isolated from urine samples of patients with severe urinary tract infection', Journal of global antimicrobial resistance, 17, pp. 145–146. doi: 10.1016/j.jgar.2019.04.001.
21. Girija, S. A., Jayaseelan, V. P. and Arumugam, P. (2018) 'Prevalence of VIM- and GIM-producing Acinetobacter baumannii from patients with severe urinary tract infection', Acta microbiologica et immunologica Hungarica, 65(4), pp. 539–550. doi: 10.1556/030.65.2018.038.
22. Gomathi, A. C. et al. (2020) 'Anticancer activity of silver nanoparticles synthesized using aqueous fruit shell extract of Tamarindus indica on MCF-7 human breast cancer cell line', Journal of Drug Delivery Science and Technology, p. 101376. doi: 10.1016/j.jddst.2019.101376.
23. Herre, J. et al. (2013) 'Allergens as Immunomodulatory Proteins: The Cat Dander Protein Fel d 1 Enhances TLR Activation by Lipid Ligands', The Journal of Immunology, pp. 1529–1535. doi: 10.4049/jimmunol.1300284.
24. Hollingsworth, J. W. et al. (2008) 'In utero supplementation with methyl donors enhances allergic airway disease in mice', Journal of Clinical Investigation. doi: 10.1172/jci34378.
25. Jeevanandan, G. and Govindaraju, L. (2018) 'Clinical comparison of Kedo-S paediatric rotary files vs manual instrumentation for root canal preparation in primary molars: a double blinded randomised clinical trial', European Archives of Paediatric Dentistry, pp. 273–278. doi: 10.1007/s40368-018-0356-6.
26. J, P. C. et al. (2018) 'Prevalence and measurement of anterior loop of the mandibular canal using CBCT: A cross sectional study', Clinical implant dentistry and related research, 20(4), pp. 531–534. doi: 10.1111/cid.12609.
27. Kennedy, P. F. and McGarvey, M. G. (2008) 'Animal-companion depictions in women's magazine advertising', Journal of Business Research, pp. 424–430. doi: 10.1016/j.jbusres.2007.07.013.
28. Konradsen, J. R. et al. (2015) 'Allergy to furry animals: New insights, diagnostic approaches, and challenges', Journal of Allergy and Clinical Immunology, pp. 616–625. doi: 10.1016/j.jaci.2014.08.026.
29. Lim, P. S. et al. (2013) 'Epigenetic regulation of inducible gene expression in the immune system', Immunology, 139(3), pp. 285–293. doi: 10.1111/imm.12100.
30. Lodge, C. J. et al. (2012) 'Perinatal Cat and Dog Exposure and the Risk of Asthma and Allergy in the Urban Environment: A Systematic Review of Longitudinal Studies', Clinical and Developmental Immunology, pp. 1–10. doi: 10.1155/2012/176484.
31. Malli Sureshbabu, N. et al. (2019) 'Concentrated Growth Factors as an Ingenious Biomaterial in Regeneration of Bony Defects after Periapical Surgery: A Report of Two Cases', Case reports in dentistry, 2019, p. 7046203. doi: 10.1155/2019/7046203.
32. Marickar, R. F., Geetha, R. V. and Neelakantan, P. (2014) 'Efficacy of contemporary and novel Intracanal medicaments against enterococcus faecalis', The Journal of clinical pediatric dentistry, 39(1), pp. 47–50. doi: 10.17796/jcpd.39.1.wmw9768314h56666.
33. Mathew, M. G. et al. (2020) 'Evaluation of adhesion of Streptococcus mutans, plaque accumulation on zirconia and stainless steel crowns, and surrounding gingival inflammation in primary molars: Randomized controlled trial', Clinical oral investigations, pp. 1–6. Available at: https://link.springer.com/article/10.1007/s00784-020-03204-9.
34. Mehta, M. et al. (2019) 'Oligonucleotide therapy: An emerging focus area for drug delivery in chronic inflammatory respiratory diseases', Chemico-biological interactions, 308, pp. 206–215. doi: 10.1016/j.cbi.2019.05.028.
35. Menon, S. et al. (2018) 'Selenium nanoparticles: A potent chemotherapeutic agent and an elucidation of its mechanism', Colloids and Surfaces B: Biointerfaces, pp. 280–292. doi: 10.1016/j.colsurfb.2018.06.006.
36. M, M. A., Geetha, R. V. and Thangavelu, L. (2019) 'Evaluation oEvaluation of anti-inflammatory action of Laurus nobilis-an in vitro studyf anti-inflammatory action of Laurus nobilis-an in vitro study', International Journal of Research in Pharmaceutical Sciences, pp. 1209–1213. doi: 10.26452/ijrps.v10i2.408.
37. Nilsson, O. B., van Hage, M. and Grönlund, H. (2014) 'Mammalian-derived respiratory allergens – Implications for diagnosis and therapy of individuals allergic to furry animals', Methods, pp. 86–95. doi: 10.1016/j.ymeth.2013.09.002.
38. Panchal, V., Jeevanandan, G. and Subramanian, E. M. G. (2019) 'Comparison of post-operative pain after root canal instrumentation with hand K-files, H-files and rotary Kedo-S files in primary teeth: a randomised clinical trial', European archives of paediatric dentistry: official journal of the European Academy of Paediatric Dentistry, 20(5), pp. 467–472. doi: 10.1007/s40368-019-00429-5.
39. Paramasivam, A., Vijayashree Priyadharsini, J. and Raghunandhakumar, S. (2020) 'N6-adenosine methylation (m6A): a promising new molecular target in hypertension and cardiovascular diseases', Hypertension research: official journal of the Japanese Society of Hypertension, 43(2), pp. 153–154. doi:

10.1038/s41440-019-0338-z.
40. Pc, J., Marimuthu, T. and Devadoss, P. (2018) 'Prevalence and measurement of anterior loop of the mandibular canal using CBCT: A cross sectional study', Clinical implant dentistry and related research. Available at: https://europepmc.org/article/med/29624863.
41. Platts-Mills, T. A. E. (2015) 'The allergy epidemics: 1870-2010', The Journal of allergy and clinical immunology, 136(1), pp. 3–13. doi: 10.1016/j.jaci.2015.03.048.
42. Podberscek, A. L., Paul, E. S. and Serpell, J. A. (2005) Companion Animals and Us: Exploring the Relationships Between People and Pets. Cambridge University Press. Available at: https://books.google.com/books/about/Companion_Animals_and_Us.html?hl=&id=tSs2yV_F4n0C.
43. Prabakar, J. et al. (2018) 'Comparative Evaluation of Retention, Cariostatic Effect and Discoloration of Conventional and Hydrophilic Sealants - A Single Blinded Randomized Split Mouth Clinical Trial', Contemporary clinical dentistry, 9(Suppl 2), pp. S233–S239. doi: 10.4103/ccd.ccd_132_18.
44. Pratha, A. A., Ashwatha Pratha, A. and Geetha, R. V. (2017) 'Awareness on Hepatitis-B vaccination among dental students-A Questionnaire Survey', Research Journal of Pharmacy and Technology, p. 1360. doi: 10.5958/0974-360x.2017.00240.2.
45. Priyadharsini, J. V. et al. (2018a) 'An insight into the emergence of Acinetobacter baumannii as an oro-dental pathogen and its drug resistance gene profile – An in silico approach', Heliyon, p. e01051. doi: 10.1016/j.heliyon.2018.e01051.
46. Priyadharsini, J. V. et al. (2018b) 'In silico analysis of virulence genes in an emerging dental pathogen A. baumannii and related species', Archives of Oral Biology, pp. 93–98. doi: 10.1016/j.archoralbio.2018.07.001.
47. Rajendran, R. et al. (2019) 'Comparative Evaluation of Remineralizing Potential of a Paste Containing Bioactive Glass and a Topical Cream Containing Casein Phosphopeptide-Amorphous Calcium Phosphate: An in Vitro Study', Pesquisa Brasileira em Odontopediatria e Clínica Integrada, pp. 1–10. doi: 10.4034/pboci.2019.191.61.
48. Rajeshkumar, S. et al. (2018) 'Biosynthesis of zinc oxide nanoparticles usingMangifera indica leaves and evaluation of their antioxidant and cytotoxic properties in lung cancer (A549) cells', Enzyme and microbial technology, 117, pp. 91–95. doi: 10.1016/j.enzmictec.2018.06.009.
49. Rajeshkumar, S. et al. (2019) 'Antibacterial and antioxidant potential of biosynthesized copper nanoparticles mediated through Cissus arnotiana plant extract', Journal of photochemistry and photobiology. B, Biology, 197, p. 111531. doi: 10.1016/j.jphotobiol.2019.111531.
50. Ramadurai, N. et al. (2019) 'Effectiveness of 2% Articaine as an anesthetic agent in children: randomized controlled trial', Clinical oral investigations, 23(9), pp. 3543–3550. doi: 10.1007/s00784-018-2775-5.
51. Ramakrishnan, M., Dhanalakshmi, R. and Subramanian, E. M. G. (2019) 'Survival rate of different fixed posterior space maintainers used in Paediatric Dentistry - A systematic review', The Saudi dental journal, 31(2), pp. 165–172. doi: 10.1016/j.sdentj.2019.02.037.
52. Ramesh, A. et al. (2018) 'Comparative estimation of sulfiredoxin levels between chronic periodontitis and healthy patients - A case-control study', Journal of periodontology, 89(10), pp. 1241–1248. doi: 10.1002/JPER.17-0445.
53. R, H. et al. (2020) 'CYP2 C9 polymorphism among patients with oral squamous cell carcinoma and its role in altering the metabolism of benzo[a]pyrene', Oral Surgery, Oral Medicine, Oral Pathology and Oral Radiology, pp. 306–312. doi: 10.1016/j.oooo.2020.06.021.
54. Samuel, S. R. (2021) 'Can 5-year-olds sensibly self-report the impact of developmental enamel defects on their quality of life?', International journal of paediatric dentistry / the British Paedodontic Society [and] the International Association of Dentistry for Children, 31(2), pp. 285–286. doi: 10.1111/ipd.12662.
55. Samuel, S. R., Acharya, S. and Rao, J. C. (2020) 'School Interventions-based Prevention of Early-Childhood Caries among 3-5-year-old children from very low socioeconomic status: Two-year randomized trial', Journal of public health dentistry, 80(1), pp. 51–60. doi: 10.1111/jphd.12348.
56. Selgrade, M. K. et al. (2013) 'Potential risk of asthma associated with in utero exposure to xenobiotics', Birth Defects Research Part C: Embryo Today: Reviews, pp. 1–13. doi: 10.1002/bdrc.21028.
57. Selvakumar, R. and Np, M. (2017) 'COMPARISON IN BENEFITS OF HERBAL MOUTHWASHES WITH CHLORHEXIDINE MOUTHWASH: A REVIEW', Asian Journal of Pharmaceutical and Clinical Research, p. 3. doi: 10.22159/ajpcr.2017.v10i2.13304.
58. Shahana, R. Y. and Muralidharan, N. P. (2016) 'Efficacy of mouth rinse in maintaining oral health of patients attending orthodontic clinics', Research Journal of Pharmacy and Technology, p. 1991. doi: 10.5958/0974-360x.2016.00406.6.
59. Shahzan, M. S. et al. (2019) 'A computational study targeting the mutated L321F of ERG11 gene in C. albicans, associated with fluconazole resistance with bioactive compounds from Acacia nilotica', Journal de Mycologie Médicale, pp. 303–309. doi: 10.1016/j.mycmed.2019.100899.
60. Sharma, P. et al. (2019) 'Emerging trends in the novel drug delivery approaches for the treatment of lung

cancer', Chemico-biological interactions, 309, p. 108720. doi: 10.1016/j.cbi.2019.06.033.
61. Smiline, A., Vijayashree, J. P. and Paramasivam, A. (2018) 'Molecular characterization of plasmid-encoded blaTEM, blaSHV and blaCTX-M among extended spectrum β-lactamases [ESBLs] producing Acinetobacter baumannii', British journal of biomedical science, 75(4), pp. 200–202. doi: 10.1080/09674845.2018.1492207.
62. Sridharan, G. et al. (2019) 'Evaluation of salivary metabolomics in oral leukoplakia and oral squamous cell carcinoma', Journal of oral pathology & medicine: official publication of the International Association of Oral Pathologists and the American Academy of Oral Pathology, 48(4), pp. 299–306. doi: 10.1111/jop.12835.
63. Vaishali, M. and Geetha, R. V. (2018) 'Antibacterial activity of Orange peel oil on Streptococcus mutans and Enterococcus-An In-vitro study', Research Journal of Pharmacy and Technology, p. 513. doi: 10.5958/0974-360x.2018.00094.x.
64. Varghese, S. S., Ramesh, A. and Veeraiyan, D. N. (2019) 'Blended Module-Based Teaching in Biostatistics and Research Methodology: A Retrospective Study with Postgraduate Dental Students', Journal of dental education, 83(4), pp. 445–450. doi: 10.21815/JDE.019.054.
65. Vijayashree Priyadharsini, J. (2019) 'In silico validation of the non-antibiotic drugs acetaminophen and ibuprofen as antibacterial agents against red complex pathogens', Journal of periodontology, 90(12), pp. 1441–1448. doi: 10.1002/JPER.18-0673.
66. Vijayashree Priyadharsini, J., Smiline Girija, A. S. and Paramasivam, A. (2018) 'In silico analysis of virulence genes in an emerging dental pathogen A. baumannii and related species', Archives of oral biology, 94, pp. 93–98. doi: 10.1016/j.archoralbio.2018.07.001.
67. Vishnu Prasad, S. et al. (2018) 'Report on oral health status and treatment needs of 5-15 years old children with sensory deficits in Chennai, India', Special care in dentistry: official publication of the American Association of Hospital Dentists, the Academy of Dentistry for the Handicapped, and the American Society for Geriatric Dentistry, 38(1), pp. 58–59. doi: 10.1111/scd.12267.
68. Wahab, P. U. A. et al. (2018) 'Scalpel Versus Diathermy in Wound Healing After Mucosal Incisions: A Split-Mouth Study', Journal of oral and maxillofacial surgery: official journal of the American Association of Oral and Maxillofacial Surgeons, 76(6), pp. 1160–1164. doi: 10.1016/j.joms.2017.12.020.
69. Wood, R. A. et al. (1998) 'A Placebo-controlled Trial of a HEPA Air Cleaner in the Treatment of Cat Allergy', American Journal of Respiratory and Critical Care Medicine, pp. 115–120. doi: 10.1164/ajrccm.158.1.9712110.