Awareness Regarding the use of Silver Diamine Fluoride in Dentistry- A Survey

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ABSTRACT
Dental caries is a complex progression due to dietary sugars, bacterial metabolism involving demineralization, and organic degradation. Caries are more prevalent among young children which are mostly untreated due to dental anxiety, behavioural changes, and mainly due to expensive treatment. So innovative approaches are needed to treat caries, especially in children. Arresting caries without restoration is possible by silver diamine fluoride (SDF) which is inexpensive topical medication. Silver diamine fluoride (SDF) is used to treat caries and also prevents future caries development. Silver diamine fluoride (SDF) is also used to treat sensitivity. Before silver diamine fluoride (SDF) silver nitrate and silver varnish were used to treat dental caries. Silver diamine fluoride (SDF) consists of silver, fluoride, ammonia, and water. Silver acts as an antimicrobial agent, fluoride as remineralization, and ammonia stabilizes high concentration. The study setting was an online survey. The number of participants involved was 129. A pre-tested questionnaire was circulated. The data was collected and analyzed using SPSS software. 41.9% of the population participated have heard of silver diamine fluoride (SDF), but 34% of the population are not aware of what it is used to treat. 37.2% of the population is also not aware of the method of application. From the studies, the participants are not aware of silver diamine fluoride (SDF), its uses, and its effectiveness. Oral education should be conducted to create awareness among people.

INTRODUCTION
Dental caries is defined as breakdown or damage to the teeth by acids from bacteria. It can also be due to dietary sugars, snacking, which involves demineralization and organic degradation of the teeth. Collagenous organic matrix is exposed when the dentin surface is demineralized and destroyed by native and bacterial proteases which leads to enlargement of the lesion (Featherstone, 2004). The previous study has shown that oxidative stress can also be the reason for the pathogenesis of diseases (Ezhilarasan, 2018). Caries are more prevalent among young children which are mostly in
untreated states (Wong et al., 2001). The reason for ignoring the treatment of caries may be dental anxiety, behavioral aspects, and mainly due to expensive treatment. Fluoridated toothpaste is more expensive than non-fluoridated, which is difficult for people from lower socioeconomic strata to procure. So innovative approaches are needed to resolve the difficulties faced by the patients. A previous study has shown that arresting caries is possible without restoration (Mäkinen et al., 1996).

Silver diamine fluoride (SDF) is an inexpensive topical medication that is used to arrest carious lesions, prevent future development of caries, and used to treat sensitivity. There is a recommended dose for the usage of silver diamine fluoride (SDF). For the effective treatment of caries, 38% of silver diamine fluoride (SDF) solution is recommended by saforide, Toyo seiyaku Kasei co ltd, Osaka, Japan. Before the usage of silver diamine fluoride (SDF), silver nitrate, and fluoride varnish was also used to treat sensitivity. There is a recommendation which makes the tooth harder and resistant to caries is possible without restoration (Mäkinen et al., 1996).

Silver diamine fluoride (SDF) is an inexpensive topical medication that is used to arrest carious lesions, prevent future development of caries, and used to treat sensitivity. There is a recommended dose for the usage of silver diamine fluoride (SDF). For the effective treatment of caries, 38% of silver diamine fluoride (SDF) solution is recommended by saforide, Toyo seiyaku Kasei co ltd, Osaka, Japan. Before the usage of silver diamine fluoride (SDF), silver nitrate, and fluoride varnish was also used to treat sensitivity (Rosenblatt et al., 2009). Silver diamine fluoride (SDF) consists of silver, fluoride, ammonia, and water. Silver, when exposed to the tooth surface, forms silver phosphate (Research and Research, 2019). The topical application of silver forms a squamous layer exposed to dentin and plugs dentinal tubules (Mei et al., 2013). Silver increases resistance to acid dissolution and enzymatic digestion (Mei et al., 2012).

Hydroxyapatite and fluorapatite are formed on the exposed organic matrix, along with the presence of silver chloride and metallic silver. A pathological lesion is characterized by the accumulation of extra-cellular matrices. Silver directly acts against bacteria by breaking the membranes denaturing proteins and also by inhibiting DNA replication (Klasen, 2000). Silver also inhibits biofilm formation and cavity formation (Knight et al., 2007). Silver is also an antibacterial agent. Silver kills the bacteria. When the killed bacteria is added on to the living bacteria, the silver ion in the killed bacteria is reactivated and it kills the living bacteria. This is termed as a "zombie effect" (Wakshlak et al., 2015). Fluoride penetrates deeper into the tooth and forms a fluoride reservoir. Fluoride initiates remineralization. Fluoride causes fluorapatite formation, which makes the tooth harder and resistant to caries (Burgess and Vaghela, 2018).

Silver and fluoride penetrate ~25 microns in enamel and ~50-200 microns in dentin (Aasenden, 1974). Ammonia is used to stabilize the high concentration of the solution in silver diamine fluoride (Rosenblatt et al., 2009). The method of application is staining the carious lesion by SDF. Silver diamine fluoride (SDF) increases mineral density and hardness of the teeth and it causes the death of the lesion (Mei et al., 2013). It also inhibits the proteins that break down the exposed dentin organic matrix (Mei et al., 2014b). The proteins are metalloproteinases, cathepsins, and bacterial collagens. Arrested caries lesions measure 130 microns thick (Mei et al., 2014a). In August 2014, the food and drug administration approved silver diamine fluoride (SDF) usage for sensitivity. The drawbacks of silver diamine fluoride (SDF) are that after treating the caries tooth it turns the lesion darker, from brown to black and the solution has metallic taste (Chu et al., 2002).

The nanoparticle of silver can be used as an alternative for the black lesion. Nanoparticles have specific drug delivery. Nanoparticles are made using less toxic chemicals which reduces toxicity. The advantage is silver diamine (SDF) is a low-cost treatment, and also a large population can be used. There is no need for expensive equipment. It is non-invasive, the spreading of infection is low. It is also a painless treatment for patients with dental anxiety and behavioural aspects. In pharmacokinetics aspects, there is no erythema, bleeding, ulceration, or pigmentation. Previous studies on cancer biology (Perumalsamy et al., 2018; Ashwini et al., 2017; Ezhalrasyan et al., 2017a), medicine (Gheena and Ezhalrasyan, 2019; Anitha and Ashwini, 2017), nanoparticle technology (Ezhalrasyan et al., 2018; Lakshmi et al., 2015; Mehta et al., 2019; Sharma et al., 2019; Ezhalrasyan et al., 2017b), by our team has made a platform for this study on awareness about the use of silver diamine fluoride in dentistry (Karthiga et al., 2018; Rajeshkumar et al., 2018b; Menon et al., 2018; Rajeshkumar et al., 2018a).

MATERIALS AND METHODS

The study setting was an online survey. The number of participants involved in the study was 129. The study is created in such a way to create and evaluate awareness about silver diamine fluoride (SDF). The study design was interventional non-controlled design. A set of pretested questionnaires were prepared and circulated. The sampling method was stratified random sampling. The data were collected using a digital survey. The data collected were manipulated in excel. The number of questions asked was 17. The data were analyzed using SPSS software. The statistical analysis used was the chi-square test. The results were verified and tabulated. The method of representation was a bar graph. The independent variable included is age, occupation,
gender. The dependent variables included are silver diamine fluoride (SDF), caries prevention, treat caries, black lesion formation.

RESULTS AND DISCUSSION

Figure 1 represents the gender of the participants, of which 56.6% of the participants were female than male 43.4%. Figure 2 represents occupation of the participants, 58.1% were ug students, 20.2% were pg, 17.8% were doing other works and very few of 3.9% of the participants were practitioners. Figure 3 depicts the data for the question “Whether the participants were aware of silver diamine fluoride or not?” 41.9% were aware of silver diamine fluoride(SDF), 34.9% were not aware and 23.3% of the population had no idea about silver diamine fluoride(SDF). Figure 4 represents the data for the usage of silver diamine fluoride (SDF), 34% report no idea about the usage of silver diamine fluoride (SDF), 24.8% says it is used to treat sensitivity, 22.5% participants report that silver diamine fluoride (SDF) is used to treat both caries and sensitivity. Figure 5 represents the data for the question “Does silver diamine fluoride (SDF) affect the soft dentin?”, 43.4% of the population choose to be neutral, 17.8% of the participants strongly disagree with the opinion and 15.5% agree to the question.

Figure 6 depicts the data for the question “Does silver diamine fluoride (SDF) reduce the risk of general anesthesia?”, 35.7% choose to be neutral and 24% disagree with the question and 17.1% agree with the opinion. Figure 7 represents the data for components of silver diamine fluoride (SDF), 41.1% of the population says silver diamine fluoride(SDF) consists of silver, fluoride, and water; 34.1% choose silver, fluoride, water, and ammonia. Figure 8 depicts the data for the role of silver in SDF, 51.9% of the population chose silver as antibacterial, 24% choose they have no idea about the role of silver, 24% report antifungal. Figure 9 represents the recommended usage of silver diamine fluoride (SDF), 46.5% of the population report they have no idea, 24.8% report as 19%, 20.9% report as 38%. Figure 10 represents the data for the question “Does silver diamine fluoride (SDF) be used only for primary dentin?”, 39.5% of the population chosen neutral, 20.9% agree to the question, 16.3% strongly disagree with the question.
Figure 4: Pie chart representing the percentage distribution for the usage of silver diamine fluoride.

Figure 5: Pie chart representing the percentage distribution for the question “Does SDF affect the soft dentin?”.

Figure 6: Pie chart depicting the percentage distribution for the question “Whether SDF reduces the risk of general anesthesia?”.

Figure 7: Pie chart representing the percentage distribution for the components of silver diamine fluoride (SDF).

Figure 8: Pie chart depicting the percentage distribution for the role of silver in SDF.

Figure 11 depicts the data for silver diamine fluoride (SDF) causing black lesion, 41.9% chose no idea, 34.1% said ‘yes’, and 24% not aware. Figure 12 represents data for “Does silver diamine fluoride (SDF) provide a good alternative to other treatments for caries prevention?”, 31.8% of the population choose to be neutral, 20.2% agree to the question, 19.4% disagree with the opinion. Figure 13 represents the association data between gender and awareness of SDF using the Chi-square test. Figure 14 represents the association data between gender and the usage of SDF using the Chi-square test. Figure 15 represents the association data between gender and about the role of silver in SDF using the Chi-square test. Figure 16 represents the association data between gender and “whether SDF reduces the risk of general anesthesia?” using the Chi-square test.
In the current study, 41.9% of the population who participated in the study have heard of the silver diamine fluoride (SDF) which is in correlation to the previous study done by (Antonioni et al., 2019). In this study, 34.1% of the participants were not aware of the usage of silver diamine fluoride (SDF) which means there is a lack of awareness. A previous study also shows that silver diamine fluoride (SDF) is used to treat caries (Zhi et al., 2012). Another study also shows that silver diamine fluoride (SDF) is used to treat sensitivity and prevent caries (Castillo et al., 2011). Previous literature says that the caries teeth are stained by silver diamine fluoride (SDF) (Gao et al., 2016). In this study, 43.4% of the population choose to be neutral for silver diamine fluoride (SDF) which doesn’t affect soft dentin. The study reported that silver diamine fluoride (SDF) prevents caries without harming the soft dentin in children (Kawasaki et al., 2005). In this study, 35.7% of the participants chose to be neutral for SDF reduces the risk of general anesthesia. The previous study has shown that silver diamine fluoride (SDF) reduces the risk of general anesthesia (Nelson et al., 2016). In this current study, people are not aware of their risk factors. In this current study, 46.5% of the population is not aware...
of the recommended level of SDF. In the previous study recommended usage of silver diamine fluoride (SDF) is 38%, 12% is less effective (Lo et al., 2001). In this current study, 39.5% of the population chose neutral for SDF is used only for primary dentin. But several studies have shown that silver diamine fluoride (SDF) is used across age, both for deciduous and permanent dentin (Yee et al., 2009). In this study, 41.9% of participants chose no idea about the black lesion caused by SDF after treating the caries teeth.

In Figure 1, 56.6% of the participants were female (green) than male 43.4% (blue). In Figure 2, 58.14% were UG (blue), 20.2% were pg (green), 17.8% were doing other works (purple). In Figure 3, 41.9% were aware of SDF (blue), 34.9% were not aware (green) and 23.3% of the population had no idea (grey) about SDF. In Figure 4, 34.11% report no

Figure 13: The graph depicts the association between gender and awareness of SDF.

Figure 14: The graph depicts the association between gender and awareness on the usage of SDF.

Figure 15: The graph depicts the association between gender and awareness of the role of silver in SDF.

Figure 16: The graph depicts the association between gender and awareness on SDF reduces the risk of general anesthesia.

Figure 17: The graph depicts the association between gender and awareness of SDF causes black lesion.
idea (grey), 24.8% says it is used to treat sensitivity (green). 22.5% report that silver diamine fluoride (SDF) is used to treat both caries and sensitivity (purple). In Figure 5, 43.4% of the population choose to be neutral (yellow), 17.8% of the participants strongly disagree (purple) with the opinion and 15.5% agree (grey) to the question. In Figure 6, 35.7% choose to be neutral (yellow) and 24% disagree (green) with the question and 17.1% agree (grey) to the opinion. In Figure 7, 41.1% of the population says silver diamine fluoride (SDF) consists of silver, fluoride, and water (green), 34.1% choose silver, fluoride, water, and ammonia (blue). In Figure 8, 51.9% of the population choose antibacterial (green), 24% choose they have no idea (grey) about the role, 24% report antifungal (green). In Figure 9, 46.5% of the population report they have no idea (grey), 24.8% report as 19% (green), 20.9% report as 38% (blue). In Figure 10, 39.5% of the population chose neutral (yellow), 20.9% agree (grey) to the question, 16.3% strongly disagree (green).

In Figure 11, 41.9% chose no idea (grey), 34.1% said ‘yes’ (blue), and 24% not aware (green) that SDF can cause a black lesion. In Figure 12, 31.8% of the population choose to be neutral (yellow) for SDF is a good alternative treatment, 20.2% agree to the question (grey), 19.4% disagree (green) with the opinion. In Figure 13, the X-axis represents the gender of the participants and the Y-axis represents the number of responses. Blue color denotes ‘yes’, green denotes ‘no’, grey denotes ‘no idea’. Females had better awareness of SDF than males. A Chi-square test was done to find the association between gender and awareness of SDF and was found to be statistically not significant. Pearson chi-square value 4.15 $p=0.12 (>0.05)$ hence statistically not significant.

In Figure 14, X-axis represents the gender of the participants and the Y-axis represents the number of responses. Blue color denotes ‘caries in primary teeth’, green denotes ‘sensitivity’, grey denotes ‘no idea’, purple denotes ‘Both caries in primary teeth and sensitivity’. Females had better awareness of the usage of SDF than males. A Chi-square test was done to find the association between gender and awareness of SDF and was found to be statistically not significant. Pearson chi-square value 5.17 $p=0.15 (>0.05)$ hence statistically not significant.

In Figure 15, X-axis represents the gender of the population and the Y-axis represents the number of responses. Blue colors denote ‘antifungal’, green denotes ‘antibacterial’ and grey denotes ‘no idea’. Females had better awareness of the role of silver than males. A Chi-square test was done to find the association between gender and awareness of the role of silver and was found to be statistically significant. Pearson chi-square value 6.60 $p=0.03 (<0.05)$ hence statistically significant.

In Figure 16, X-axis represents the gender of the participants and the Y-axis represents the number of responses. Blue color denotes ‘strongly disagree’, green denotes ‘disagree’, grey denotes ‘agree’, purple denotes ‘strongly agree’ and yellow denotes ‘neutral’. Males had better awareness of SDF reducing the risk of general anesthesia than females. A Chi-square test was done to find the association between gender and awareness on SDF reduces the risk of anesthesia and was found to be statistically significant. Pearson chi-square value 12.04 $p=0.01 (<0.05)$ hence statistically significant.

**Limitations**

Since it is a cross-sectional study and it is an online survey it is reliable. Quantitative data is decreased. The sample size of this study is less and the data are less reliable.

**CONCLUSIONS**

This study concludes that the majority of the population who participated in the study are not aware of silver diamine fluoride (SDF). Despite the disadvantage of turning the carious lesion into black. The advantages are silver diamine fluoride (SDF) is an inexpensive, good alternative treatment without involving expensive equipment, where a large population can be covered. Further studies can be done to overcome the disadvantage. This survey helps to assess oral education to the people who are not aware of silver diamine fluoride.

**Conflict of interest**

The authors declare that they have no conflict of interest for this study.

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REFERENCES

Aasenden, R. 1974. Fluoride concentrations in the surface tooth enamel of young men and women. *Archives of Oral Biology*, 19(8):697–701.

Anitha, R., Ashwini, S. 2017. Antihyperglycemic activity of Caralluma fimbriata: An In vitro approach. *Pharmacognosy Magazine*, 13(51):499–499.

Antonioni, M. B., Fontana, M., Salzmann, L. B., Inglehart, M. R. 2019. Pediatric Dentists’ Silver Diamine Fluoride Education, Knowledge, Attitudes, and Professional Behavior: A National Survey. *Journal of Dental Education*, 83(2):173–182.

Ashwini, S., Ezhilarasan, D., Anitha, R. 2017. Cytotoxic Effect of Caralluma fimbriata Against Human Colon Cancer Cells. *Pharmacognosy Journal*, 9(2):204–207.

Burgess, J. O., Vaghela, P. M. 2018. Silver Diamine Fluoride: A Successful Anticarious Solution with Limits. *Advances in Dental Research*, 29(1):131–134.

Castillo, J. L., Rivera, S., Aparicio, T., Lazo, R., Aw, T. C., Mancl, L. L., Milgrom, P. 2011. The Short-term Effects of Diammine Silver Fluoride on Tooth Sensitivity. *Journal of Dental Research*, 90(2):203–208.

Chu, C. H., Lo, E. C. M., Lin, H. C. 2002. Effectiveness of Silver Diamine Fluoride and Sodium Fluoride Varnish in Arresting Dentin Caries in Chinese Pre-school Children. *Journal of Dental Research*, 81(11):767–770.

Ezhilarasan, D. 2018. Oxidative stress is bane in chronic liver diseases: Clinical and experimental perspective. *Arab Journal of Gastroenterology*, 19(2):56–64.

Ezhilarasan, D., Lakshmi, T., Nagaich, U., Vijayaragavan, R. 2017a. Acacia catechu ethanolic seed extract triggers apoptosis of SCC-25 cells. *Pharmacognosy Magazine*, 13(51):405–405.

Ezhilarasan, D., Lakshmi, T., Vijayaragavan, R., Bhullar, S., Rajendran, R. 2017b. Acacia catechu ethanolic bark extract induces apoptosis in human oral squamous carcinoma cells. *Journal of Advanced Pharmaceutical Technology & Research*, 8(4):143–143.

Ezhilarasan, D., Sokal, E., Najimi, M. 2018. Hepatic fibrosis: It is time to go with hepatic stellate cell-specific therapeutic targets. *Hepatobiliary & Pancreatic Diseases International*, 17(3):192–197.

Featherstone, J. D. B. 2004. The Continuum of Dental Caries-Evidence for a Dynamic Disease Process. *Journal of Dental Research*, 83[1_suppl]:39–42.

Gao, S. S., Zhao, I. S., Hiraishi, N., Duangthip, D., Mei, M. L., Lo, E. C. M., Chu, C. H. 2016. Clinical Trials of Silver Diamine Fluoride in Arresting Caries among Children. *JDR Clinical & Translational Research*, 1(3):201–210.

Gheena, S., Ezhilarasan, D. 2019. Syringic acid triggers reactive oxygen species-mediated cytotoxicity in HepG2 cells. *Human & Experimental Toxicology*, 38(6):694–702.

Karthiga, P., Rajeshkumar, S., Annadurai, G. 2018. Mechanism of Larvicidal Activity of Antimicrobial Silver Nanoparticles Synthesized Using Garcinia mangostana Bark Extract. *Journal of Cluster Science*, 29(6):1233–1241.

Kawasaki, A., Suge, T., Ishikawa, K., Ozaki, K., Matsumo, T., Ebisu, S. 2005. Ammonium hexafluorosilicate increased acid resistance of bovine enamel and dentine. *Journal of Materials Science: Materials in Medicine*, 16(5):461–466.

Klasen, H. J. 2000. A historical review of the use of silver in the treatment of burns. II. Renewed interest for silver. *Burns*, 26(2):131–138.

Knight, G. M., McIntyre, J. M., Craig, G. G., Zilm, P. S., Gully, N. J. 2007. Differences between normal and demineralized dentine pretreated with silver fluoride and potassium iodide after an in vitro challenge by Streptococcus mutans. *Australian Dental Journal*, 52(1):16–21.

Lo, E. C. M., Chu, C. H., Lin, H. C. 2001. A Community-based Caries Control Program for Pre-school Children Using Topical Fluorides: 18-month Results. *Journal of Dental Research*, 80(12):2071–2074.

Mäkinen, K. K., Hujoel, P. P., Bennett, C. A., Isotupa, K. P., Mäkinen, P. L., Allen, P. 1996. Polyol Chewing Gums and Caries Rates in Primary Dentition: A 24-Month Cohort Study. *Caries Research*, 30(6):408–417.

Mehta, M., Deeksha, Tewari, D., Gupta, G., Awasthi, R., Singh, H., Pandey, P., Chellappan, D. K., Wadhwa, R., Collet, T., Hansbro, P. M., Kumar, S. R., Thangavelu, L., Negi, P., Dua, K., Satija, S. 2019. Oligonucleotide therapy: An emerging focus area for drug delivery in chronic inflammatory respiratory diseases. *Chemico-Biological Interactions*, 308:206–215.

Mei, M. L., Ito, L., Cao, Y., Li, Q. L., Chu, C. H., Lo, E. C. 2014a. The inhibitory effects of silver diamine fluorides on cysteine cathepsins. *Journal of Dentistry*, 42(3):329–335.

Mei, M. L., Ito, L., Cao, Y., Li, Q. L., Lo, E. C., Chu, C. H.
2013. Inhibitory effect of silver diamine fluoride on dentine demineralisation and collagen degradation. *Journal of Dentistry*, 41(9):809–817.
Mei, M. L., Ito, L., Cao, Y., Lo, E. C., Li, Q. L., Chu, C. H. 2014b. An ex vivo study of arrested primary tooth caries with silver diamine fluoride therapy. *Journal of Dentistry*, 42(4):395–402.
Mei, M. L., Li, Q. L., Chu, C. H., Yiu, C. K. Y., Lo, E. C. M. 2012. The inhibitory effects of silver diamine fluoride at different concentrations on matrix metalloproteinases. *Dental Materials*, 28(8):903–908.
Menon, S., KS, S. D., R. S., R. S., V., K. 2018. Selenium nanoparticles: A potent chemotherapeutic agent and an elucidation of its mechanism. *Colloids and Surfaces B: Biointerfaces*, 170:280–292.
Nelson, T., Scott, J. M., Crystal, Y. O., Berg, J. H., Milgrom, P. 2016. Silver Diamine Fluoride in Pediatric Dentistry Training Programs: Survey of Graduate Program Directors. *Pediatric Dentistry*, 38(3):212–217.
Perumalsamy, H., Sankarapandian, K., Veerappan, K., Natarajan, S., Kandaswamy, N., Thangavelu, L., Balusamy, S. R. 2018. In silico and in vitro analysis of coumarin derivative induced anticancer effects by undergoing intrinsic pathway mediated apoptosis in human stomach cancer. *Phytochemistry*, 46:119–130.
Rajeshkumar, S., Agarwal, H., Kumar, S. V., Lakshmi, T. 2018a. Brassica oleracea Mediated Synthesis of Zinc Oxide Nanoparticles and its Antibacterial Activity against Pathogenic Bacteria. *Asian Journal of Chemistry*, 30(12):2711–2715.
Rajeshkumar, S., Kumar, S. V., Ramaiah, A., Agarwal, H., Lakshmi, T., Roopan, S. M. 2018b. Biosynthesis of zinc oxide nanoparticles using Mangifera indica leaves and evaluation of their antioxidant and cytotoxic properties in lung cancer (A549) cells. *Enzyme and Microbial Technology*, 117:91–95.
Research, C. M., Research, C. M. 2019. Staining Potential and Caries Arresting Effect of Silver Diamine Fluoride/Potassium Iodide and Silver Diamine Fluoride. *Case Medical Research*.
Rosenblatt, A., Stamford, T. C. M., Niederman, R. 2009. Silver Diamine Fluoride: A Caries “Silver-Fluoride Bullet”. *Journal of Dental Research*, 88(2):116–125.
Sharma, P., Mehta, M., Dhanjal, D. S., Kaur, S., Gupta, G., Singh, H., Thangavelu, L., Rajeshkumar, S., Tambuwala, M., Bakshi, H. A., Chellapan, D. K., Dua, K., Satija, S. 2019. Emerging trends in the novel drug delivery approaches for the treatment of lung cancer. *Chemico-Biological Interactions*, 309:108720–108720.
Wakshlak, R. B.-K., Pedahzur, R., Avnir, D. 2015. Antibacterial activity of silver-killed bacteria: the “zombies” effect. *Scientific Reports*, 5(1).
Wong, M. C. M., Lo, E. C. M., Schwarz, E., Zhang, H. G. 2001. Oral Health Status and Oral Health Behaviors in Chinese Children. *Journal of Dental Research*, 80(5):1459–1465.
Yee, R., Holmgren, C., Mulder, J., Lama, D., Walker, D., van Palenstein Helderman, W. 2009. Efficacy of Silver Diamine Fluoride for Arresting Caries Treatment. *Journal of Dental Research*, 88(7):644–647.
Zhi, Q. H., Lo, E. C. M., Lin, H. C. 2012. Randomized clinical trial on effectiveness of silver diamine fluoride and glass ionomer in arresting dentine caries in preschool children. *Journal of Dentistry*, 40(11):962–967.