Effect of Lockdown on Indian Economy

Type of Manuscript: Review Running title: Covid 19

Authors:

KaviyaselviGurumurthy

Saveetha Dental College,

Saveetha Institute of Medical and Technical Sciences [SIMATS]
Saveetha University, Chennai, India
Email ID: 151901002.sdc@saveetha.com

A. Jothi Priya

Assistant professor, Department of Physiology,
Saveetha Dental College,
Saveetha Institute of Medical and Technical Sciences [SIMATS]
Saveetha University, Chennai, India
Email ID: jothipriya.sdc@saveetha.com

K. R. Don

Reader.

Department of Oral and Maxillofacial Pathology,
Saveetha Dental College,
Saveetha Institute of Medical and Technical Sciences [SIMATS]
Saveetha University, Chennai, India
Email ID: donkr.sdc@saveetha.com

Corresponding author: A. Jothi Priya

Assistant professor, Department of Physiology,
Saveetha Dental College,
Saveetha Institute of Medical and Technical Sciences [SIMATS]
Saveetha University, Chennai, India
Email ID: jothipriya.sdc@saveetha.com

ABSTRACT:

The current year, 2020 has witnessed the world wide pandemic of COVID-19 which first originated in the Wuhan district of China. This virus rapidly migrated to the different nations of the globe through close contact of people and actions such as coughing, sneezing and spread of droplet infections. The virus had

not only had a drastic impact on the population of the nation but also affected the Indian economy which is seen as one of the worst hits in the last decade. Various sectors such as the manufacturing sector, agriculture and service suffered a major blow due to the cessation of production of various goods and services which brought a drastic decline in the gross domestic product of the nation and the export and import rates. The present study was conducted to determine the effect of the coronavirus on the Indian economy and how the changes or impact could be overcome by the government and the leaders in each sector or industry.

Keywords: lockdown, pandemic, economy, gross domestic product, e-commerce, impact.

INTRODUCTION:

India which is one of the largest growing economies has the fastest growing technological advancements. Coronavirus is one of the most-deadly diseases that affect both mammals and birds.(1) This virus initially originated in China due to the ingestion of raw uncooked animal meat. The virus rapidly spreads through droplet infections via touch, saliva and nose discharge.(2) To prevent the spread of this virus, maintenance of cleanliness such as sanitizing of hands, use of mask and glove protection can be considered essential.(3) Another major practice that can limit the spread of corona is the practise of social distancing and isolation. To maintain social distancing, a nation-wide lockdown was initiated from March 23 which was also commonly called as the Janta curfew.(4) The lockdown included the closure of all local shops, malls, theatres, schools and colleges also the selective closure of hospitals.(5)

The effect of lockdown had a devastating impact on food delivery sources and other service providers. India's electricity demand reached a five-month low of all times apart from the cessation of manufacture and transport of essential goods.(6) A total of 2257 relief camps were organised which included the free distribution of masks, gloves and other sanitary essentials.(7) On the larger scale, international flights were suspended for a period of 5 months and the foreign exchange students entering the nation were under strict home- isolation for a period of 14 days.(8) The effect of the lockdown had flattened the graph of Covid-19 spread curve.(9) Despite the strict measures undertaken by the government, there was a potential eruption of 92 new cases in certain hotspot regions of the nation which were subsequently. (10) Mass religious gatherings were suspended and devotees involved in such practises were officially suspended.(7) Some of the worldwide researchers suggested that India's lockdown and its stringent rules and norms were the most effective.(11) The Indian economy suffers a major loss approximately 3000 crores or 40 million US dollars.(12) Young start-ups were the most potentially affected and witnessed a 45% decrease in the total growth stage funding as compared to 2019.(13) Automobile industries such as two-wheelers and four wheelers were shut down. E-commerce and legal clarities supposedly focused only on essentials.(14)

The termination of the lockdown is set to witness a change in the Indian economy along with the regular functioning of educational institutions and other service providers. After lockdown, potential stimulus such as relief programs for central banks are to be provided by the government.(15) The purpose of this research is to help understand the importance of the developing economy and the interdependence of each

sector. Without the functioning of each sector the GDP decreases due to the fall in production levels. Our team has rich experience in research and we have collaborated with numerous authors over various topics in the past decade (16–40). The main aim of this study helps further generations in understanding what a pandemic is and how it affects the economy.

EFFECTS ON INDIAN ECONOMY

ORIGIN:

To prevent the spread of the corona virus in the Indian nation, the nation-wide lockdown initiated on the 23rd of March, 2020 for a period of 21 days. The extension of the lockdown was subsequently divided into five different phases along with the classification of the cities into different zones depending on the number of people affected by the coronavirus. The red zones or hotspot areas represented districts with a high number of active cases, orange zones or non-hotspots represented districts with fewer cases and green zones represented the districts with no new cases or the least number of cases (41). All individuals of the nation excluding the essential services' such as police, medical services, media, home delivery professionals and firefighters were asked to be a part of this mandatory curfew. The closure began with the shutting down of some of the most widely occupied or crowded places such as schools, colleges, theatres, shopping malls and gyms. Despite the strict lockdown measures initiated, the number of people suffering from this virus continued to increase. The reopening of educational institutions is set to commence only when a decrease in the effect of the coronavirus is observed.

MANUFACTURING SECTOR:

Manufacturing production in the Indian economy generally measures the output of businesses operating in the current year. This industry along with the automobile industry contributes to almost 20% of the country's gross domestic product. Apart from the regular automobile services, the country also provides a base for establishment of mobile phones, luxury and other automobile brands. The introduction of Goods and Service Tax assisted in making India a common market all across the globe. Despite the cessation of this industry, the production order cut off 5 to 10% of the total production sales which decreased the output by 15%. Some of the leading companies such as Larsen and Toubro, Bharat Forge, UltraTech Cement have temporarily suspended the production of all goods. In comparison to the high maintenance brands which include the I-phone, Hindustan Unilever and ITC have suffered huge blows and the restricted production and services on government orders [(42). The lack of workforce, the production of goods by major companies such as Aditya Birla Group, Tata Motors and Thermax had significantly reduced the number of manufacturing facilities and factory outlets across the country. Many companies decided to cease production upto the 31st of March, 2020 which included the iphone, ITC and Hindustan Unilever. By the upcoming years, Indian manufacturing services are estimated to be 5.6% post Covid. (43)

E- COMMERCE SECTOR:

The e-commerce sector provides a means of financing, technology and training and shows an interlinking and interdependence to all the other sectors. The Indian e-commerce has one of the largest user bases adding to a total of 475 million and some of the leading e-commerce companies included Amazon, Flipkart, Ebay, Myntra and Pepper-fry and the increase in e-commerce sector is due to the internet and smartphone penetration. With the corona virus out of the picture, the Indian e-commerce was set to visualisea growth of US\$ 200 billion by launching various plans and 4G networks to increase the consumer output. With the foreign direct investment set at a high peak by the Indian government, the activity and investments of foreign players and companies has expanded. By the termination of 2021, a total of 100 billion US dollars was expected as a retail revenue. This industry was supported by various online platforms such as digital payments, net bankings and hyperlocal logistics. (44) The post Covid period shall witness the reopening of delivery of various goods and services, some of which include the delivery of packages ordered before the initiation of the lockdown from various online sites such as Amazon, Flipkart, Myntra and Pepper Fry. The delivery of food from functioning restaurants through Swiggy or Zomato could function from May 3rd. (45) By the third week of March, 2020 the Amazon service agreed to cease the production and sales of all non-essential goods. Delivery and grocery services such as Big Basket restricted its services and completely ceased delivery in the hotspot regions of the country. A majority of the e-commerce companies also started seeking clarity on the definition of essential goods to reduce conflict among service providers and the police officials.

INFORMAL SECTOR:

The informal sector in India, generally comprises of daily wage workers and labourers who are employed outside the modern industrial world. Across the country, 93% of the workforce belongs to the informal sector but only 85% are considered to be employed informal workers.(46) These include various domestic vendors, street workers, home based workers, rickshaw drivers and waste collectors. This sector is also responsible for performing most of the intensive and low-skill required work. The lockdown in India showed a huge impact on the workers of the informal sector. Over 400 million workers proved to be at a risk of unemployment along with a reduction in working hours by 6.7%. Due to the negligence of primary health of informal workers, over 8.9% of these workers suffered from the coronavirus.(47) Following the lockdown, the Indian government is set to reskill unemployed migrants and informal workers apart from providing rehabilitation to the workers who had lost their jobs during the lockdown.

STOCK MARKETS:

Right at the onset of the corona pandemic, the Indian stock market reached a five year low with a rising Sensex of about 14.4%. Leading investors continued to support and favour the Indian stock markets for 10,800 Nifty points. As of 2019, the Nifty stocked a gain of 12 points while the Sensex further advanced by 14.4%. Following the day the lockdown was announced, the Sensex had seen its largest gain in a span of 11 years which estimated to about \square 4.7 lakh crore or roughly US\$66 billion for the primary investors.

Researchers have estimated a loss of about 32,000 crore Indian rupees following every day of the lockdown period. In addition to this the tourism sector is expected to suffer an additional loss of about 15,000 crore Indian rupees.(48) The effect of the lockdown had witnessed a fall of 4000 points in the Sensex which estimates to about 13.15%. The NSE NIFTY showed a decline of 1150 points. All these effects together had a drastic impact on the Wall street that led to a major loss for all the primary investors involved in the stock market and the major shareholders of all the companies.(49) After the 21- day lockdown, the Sensex posted its biggest gain in a span of 11 years which added a value of about 66 billion US dollars or 4.7 lakh crore Indian rupees for the investors. Despite this pandemic, the stock market in India rose steeply after receiving a positive indication from Wall Street in the US.

SERVICE SECTOR:

The goods and service sector provides an exceptional employment opportunity which estimates to 27% of the Indian population and 25% of the country's export. In India, the goods and service sector covers a large ground by including insurance, storage, transport, communication, financing and business. (50) The service sector is directly and indirectly influenced by both global and domestic factors and at the onset of the coronavirus, this sector had shown a growth expectancy of 17%. The government initiative to introduce the Goods and Service Tax [GST] had however caused a decline in the tax burden on essential goods. In association to the rules and guidelines issued by the government of India, only the production of essential goods and emergency services were under operation. Despite these guidelines, the variation in meanings of the term "essential goods" has created a puzzling confusion among the social workers and policemen thereby causing further deterioration in the number of labour workers. By the first week of April, essential industries such as growing, harvesting and food deliveries were allowed to operate. (51) Despite the advancing technology, the number of products and services initiated during the lockdown had reached a minimum low in all the years. The smartphone companies suffered a decline of 55% and a return shipment of 300 products every day. In addition to this, the retail sales suffered a major dip that is expected to rise in the post lockdown period. (52) Following the lockdown period, various supply chains broke down. However, some of the major food companies pressured the government to ensure movement of raw materials between the states. Essentials such as the milk and newspaper services were allowed to function on a regular basis but keeping in mind the idea of social distancing. The lockdown had also put a stop to the functioning of local buses, trains as well as international flights. Due to this, foreign exchange students were unable to enter the country. In addition, the migrant workers and daily wage labourers were left with no source of livelihood and income. Our institution is passionate about high quality evidence based research and has excelled in various fields ((53-63)

CONCLUSION:

The nationwide lockdown had not only affected the various companies but also the Indian economy as a whole. The present study helped in understanding the effect of the pandemic and the vast changes and losses both positive and negative that it had laid down on the Indian nation and its economy. The COVID pandemic has also helped in understanding the importance of each sector and their interdependence on each other.

ACKNOWLEDGEMENT

The author extends gratitude to their institution for their support.

CONFLICT OF INTEREST

The author declares that there were no conflicts of interest.

REFERENCES:

- 1. Samuel AR, Devi MG. Geographical distribution and occurrence of Endemic Goitre. J Pharm Res [Internet]. 2015; Available from: http://www.indianjournals.com/ijor.aspx?target=ijor:rjpt&volume=8&issue=8&article=001
- 2. Baheerati MM, Devi RG. Obesity in relation to Infertility. J Pharm Res [Internet]. 2018; Available from: http://www.indianjournals.com/ijor.aspx?target=ijor:rjpt&volume=11&issue=7&article=084
- 3. Fathima F. Preetha. Evaluation of Thyroid Function Test in Obese Patients. Asian J Pharm Clin Res. 2016;
- 4. Timothy CN, Devi RG, Priya AJ. Evaluation of Peak Expiratory Flow Rate (PEFR) in Pet Owners. Indian J Public Health [Internet]. 2019; Available from: http://www.indianjournals.com/ijor.aspx?target=ijor:ijphrd&volume=10&issue=8&article=148
- 5. Kavya S. A Study on The Impact of Covid--19 on Indian Economy. Purakala with ISSN 0971-2143 is an UGC CARE Journal. 2020;31(17):506–12.
- 6. Rj I, Devi G. Role of environmental factors on sleep patterns of different age groups: A survey-based study. Asian J Pharm Clin Res [Internet]. 2016; Available from: https://innovareacademics.org/journals/index.php/ajpcr/article/download/13832/8065
- 7. Harsha L, Priya J, Shah KK. Systemic approach to management of neonatal jaundice and prevention of kernicterus. Research Journal of [Internet]. 2015; Available from: http://www.indianjournals.com/ijor.aspx?target=ijor:rjpt&volume=8&issue=8&article=028

- 8. Dave PH. Pathogenesis and Novel Drug for Treatment of Asthma-A Review. Research Journal of Pharmacy and technology [Internet]. 2016; Available from: http://www.indianjournals.com/ijor.aspx?target=ijor:rjpt&volume=9&issue=9&article=049
- 9. Swathy S, Sethu VG. Acupuncture and lower back pain. J Pharm Res [Internet]. 2015; Available from: http://www.indianjournals.com/ijor.aspx?target=ijor:rjpt&volume=8&issue=8&article=004
- 10. Priya J, Devi G. Evaluation of Muscular Endurance among Dentists. Indian Journal of Public Health Research [Internet]. 2019; Available from: http://search.ebscohost.com/login.aspx?direct=true&profile=ehost&scope=site&authtype=crawler&jr nl=09760245&AN=140756206&h=G4SC%2FJ8z%2BUHFuuTbV4UFDCYnk6MKUTskQkH7kGxL d3EgnLZ4lb%2FVDEMrZPtKML9s6AouBNijcz%2BNcfv3UaNBkw%3D%3D&crl=c
- 11. Renuka S, Sethu G. Regeneration after Myocardial Infarction. J Pharm Res [Internet]. 2015; Available from: http://www.indianjournals.com/ijor.aspx?target=ijor:rjpt&volume=8&issue=6&article=014
- 12. Priya AJ, Devi G. Physical Fitness among the Dental Physician, Dental Undergraduates and Postgraduates Students. Indian Journal of Public Health Research & [Internet]. 2019; Available from: http://www.indianjournals.com/ijor.aspx?target=ijor:ijphrd&volume=10&issue=10&article=045
- 13. Shruthi M, Preetha S. Effect of Simple Tongue Exercises in Habitual Snorers. J Pharm Res [Internet]. 2018; Available from: http://www.indianjournals.com/ijor.aspx?target=ijor:rjpt&volume=11&issue=8&article=070&type=p df
- 14. Virmani A, Bhasin K. Growth Implications of Pandemic: Indian Economy. 2020 Apr 20 [cited 2020 Jun 22]; Available from: http://dx.doi.org/
- 15. Choudhari S, Jothipriya MA. Non-alcoholic fatty liver disease. J Pharm Res [Internet]. 2016; Available from: http://www.indianjournals.com/ijor.aspx?target=ijor:rjpt&volume=9&issue=10&article=059
- 16. Duraisamy R, Krishnan CS, Ramasubramanian H, Sampathkumar J, Mariappan S, NavarasampattiSivaprakasam A. Compatibility of Nonoriginal Abutments With Implants: Evaluation of Microgap at the Implant-Abutment Interface, With Original and Nonoriginal Abutments. Implant Dent. 2019 Jun;28(3):289–95.
- 17. Ariga P, Nallaswamy D, Jain AR, Ganapathy DM. Determination of correlation of width of Maxillary Anterior Teeth using Extraoral and Intraoral Factors in Indian Population: A systematic review. World J Dent. 2018 Feb;9(1):68–75.
- 18. Kannan A, Venugopalan S. A systematic review on the effect of use of impregnated retraction cords on gingiva. J Adv Pharm Technol Res. 2018;11(5):2121.

- 19. Basha FYS, Ganapathy D, Venugopalan S. Oral hygiene status among pregnant women. J Adv Pharm Technol Res. 2018;11(7):3099.
- 20. Rajakeerthi, Ms N. Natural Product as the Storage medium for an avulsed tooth A Systematic Review. CumhurÜnivDişHekimFakderg. 2019 Jun 11;22(2):249–56.
- 21. Teja KV, Ramesh S, Priya V. Regulation of matrix metalloproteinase-3 gene expression in inflammation: A molecular study. J Conserv Dent. 2018 Nov;21(6):592–6.
- 22. Menon S, Ks SD, R S, S R, S VK. Selenium nanoparticles: A potent chemotherapeutic agent and an elucidation of its mechanism. Colloids Surf B Biointerfaces. 2018 Oct 1;170:280–92.
- 23. Siddique R, Sureshbabu NM, Somasundaram J, Jacob B, Selvam D. Qualitative and quantitative analysis of precipitate formation following interaction of chlorhexidine with sodium hypochlorite, neem, and tulsi. J Conserv Dent. 2019 Jan;22(1):40–7.
- 24. Nandakumar M, Nasim I. Comparative evaluation of grape seed and cranberry extracts in preventing enamel erosion: An optical emission spectrometric analysis. J Conserv Dent. 2018 Sep;21(5):516–20.
- 25. Manohar MP, Sharma S. A survey of the knowledge, attitude, and awareness about the principal choice of intracanal medicaments among the general dental practitioners and nonendodontic specialists. Indian J Dent Res. 2018 Nov;29(6):716–20.
- 26. Hema Shree K, Ramani P, Sherlin H, Sukumaran G, Jeyaraj G, Don KR, et al. Saliva as a Diagnostic Tool in Oral Squamous Cell Carcinoma a Systematic Review with Meta Analysis. Pathol Oncol Res. 2019 Apr;25(2):447–53.
- 27. Rajendran R, Kunjusankaran RN, Sandhya R, Anilkumar A, Santhosh R, Patil SR. 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. Pesqui Bras Odontopediatria Clin Integr. 2019;19(1):1–10.
- 28. Gheena S, Ezhilarasan D. Syringic acid triggers reactive oxygen species-mediated cytotoxicity in HepG2 cells. Hum Exp Toxicol. 2019 Jun;38(6):694–702.
- 29. Hussainy SN, Nasim I, Thomas T, Ranjan M. Clinical performance of resin-modified glass ionomer cement, flowable composite, and polyacid-modified resin composite in noncarious cervical lesions: One-year follow-up. J Conserv Dent. 2018 Sep;21(5):510–5.
- 30. Hannah R, Ramani P, Herald. J. Sherlin, Ranjith G, Ramasubramanian A, Jayaraj G, et al. Awareness about the use, ethics and scope of dental photography among undergraduate dental students dentist behind the lens. J Adv Pharm Technol Res. 2018;11(3):1012.

- 31. Sharma P, Mehta M, Dhanjal DS, Kaur S, Gupta G, Singh H, et al. Emerging trends in the novel drug delivery approaches for the treatment of lung cancer. Chem Biol Interact. 2019 Aug 25;309:108720.
- 32. Ravinthar K, Jayalakshmi. Recent advancements in laminates and veneers in dentistry. J Adv Pharm Technol Res. 2018;11(2):785.
- 33. Jose J, Ajitha, Subbaiyan H. Different treatment modalities followed by dental practitioners for Ellis class 2 fracture A questionnaire-based survey. Open Dent J. 2020 Feb 18;14(1):59–65.
- 34. Sekar D, Lakshmanan G, Mani P, Biruntha M. Methylation-dependent circulating microRNA 510 in preeclampsia patients. Hypertens Res. 2019 Oct;42(10):1647–8.
- 35. Kumar D, Antony SDP. Calcified canal and negotiation-A review. J Adv Pharm Technol Res. 2018;11(8):3727.
- 36. Johnson J, Lakshmanan G, M B, R M V, Kalimuthu K, Sekar D. Computational identification of MiRNA-7110 from pulmonary arterial hypertension (PAH) ESTs: a new microRNA that links diabetes and PAH. Hypertens Res. 2020 Apr;43(4):360–2.
- 37. Janani K, Palanivelu A, Sandhya R. Diagnostic accuracy of dental pulse oximeter with customized sensor holder, thermal test and electric pulp test for the evaluation of pulp vitality: an in vivo study. Braz Dent Sci [Internet]. 2020 Jan 31;23(1). Available from: https://bds.ict.unesp.br/index.php/cob/article/view/1805
- 38. Seppan P, Muhammed I, Mohanraj KG, Lakshmanan G, Premavathy D, Muthu SJ, et al. Therapeutic potential of Mucuna pruriens (Linn.) on ageing induced damage in dorsal nerve of the penis and its implication on erectile function: an experimental study using albino rats. Aging Male. 2018 Feb 15;1–14.
- 39. Jeevanandan G, Govindaraju L. Clinical comparison of Kedo-S paediatric rotary files vs manual instrumentation for root canal preparation in primary molars: a double blinded randomised clinical trial. Eur Arch Paediatr Dent. 2018 Aug;19(4):273–8.
- 40. Nandhini JST, Babu KY, Mohanraj KG. Size, shape, prominence and localization of gerdy's tubercle in dry human tibial bones. J Adv Pharm Technol Res. 2018;11(8):3604.
- 41. Roy R, Agarwal V. India's Food Supply Chain Frays as People Stay Home. WSJ Online [Internet]. 2020 Apr 8 [cited 2020 Jun 2]; Available from: https://www.wsj.com/articles/indias-food-supply-chain-frays-as-people-stay-home-11586343607
- 42. Dev S. Mahendra (2020), "Addressing COVID-19 impacts on agriculture, food security, and livelihoods in India", IFPRI Blog, April 8.

- 43. Gayatri DR, Sethu G. EVALUATION OF ADENOIDS BY ORONASAL AND NASAL SPIROMETRY. Evaluation [Internet]. 2018; Available from: https://innovareacademics.org/journals/index.php/ajpcr/article/download/27365/15808
- 44. Pallavi E. Impact of COVID--19 on Indian Economy--An Analysis. Purakala with ISSN 0971-2143 is an UGC CARE Journal. 2020;31(21):747–61.
- 45. Reardon T, Mishra A, Nuthalapati CSR, Bellemare MF, Zilberman D. Covid-19's disruption of india's transformed food supply chains. Econ Polit Wkly. 2020;55(18):18–22.
- 46. Naik AK. Informal sector and informal workers in India. In: Special IARIW-SAIM Conference on "Measuring the Informal Economy in Developing Countries" September. iariw.org; 2009. p. 23–6.
- 47. Dhingra S. Protecting informal workers in India: the need for a universal job guarantee. LSE COVID-19 Blog [Internet]. 2020 May 18 [cited 2020 Jun 22]; Available from: http://eprints.lse.ac.uk/104579/
- 48. Shaikh A, Mishra K. The Impact of the Lockdown on India's Informal Sector. Studies in Indian Place Names. 2020;40(68):519–23.
- 49. Dev SM, Sengupta R, Others. Covid-19: Impact on the Indian economy. Indira Gandhi Institute of Development Research, Mumbai April [Internet]. 2020; Available from: http://www.igidr.ac.in/pdf/publication/WP-2020-013.pdf
- 50. Iyer PK, Devi RG, Priya AJ. A Survey Study on Causes, Treatment and Prevention of Onychocryptosis. Indian Journal of Public Health Research & Development. 2019;10(8):807–11.
- 51. Shah A. Sensex posts biggest gain in 11 years: Investors richer by Rs 4.7 lakh crore [Internet]. The Economic Times. Economic Times; 2020 [cited 2020 Jun 2]. Available from: https://economictimes.indiatimes.com/markets/stocks/news/sensex-logs-biggest-one-day-gain-in-11-years-investors-richer-by-rs-4-7-lakh-crore/articleshow/74810933.cms
- 52. Nakhate SB, Jain N. The Effect of Coronavirus on E Commerce. Studies in Indian Place Names. 2020;40(68):516–8.
- 53. VijayashreePriyadharsini J. In silico validation of the non-antibiotic drugs acetaminophen and ibuprofen as antibacterial agents against red complex pathogens. J Periodontol. 2019 Dec;90(12):1441–8.
- 54. Pc J, Marimuthu T, Devadoss P. Prevalence and measurement of anterior loop of the mandibular canal using CBCT: A cross sectional study. Clin Implant Dent Relat Res [Internet]. 2018; Available from: https://europepmc.org/article/med/29624863
- 55. Ramesh A, Varghese S, Jayakumar ND, Malaiappan S. Comparative estimation of sulfiredoxin levels

- between chronic periodontitis and healthy patients A case-control study. J Periodontol. 2018 Oct;89(10):1241-8.
- 56. Ramadurai N, Gurunathan D, Samuel AV, Subramanian E, Rodrigues SJL. Effectiveness of 2% Articaine as an anesthetic agent in children: randomized controlled trial. Clin Oral Investig. 2019 Sep;23(9):3543–50.
- 57. Sridharan G, Ramani P, Patankar S, Vijayaraghavan R. Evaluation of salivary metabolomics in oral leukoplakia and oral squamous cell carcinoma. J Oral Pathol Med. 2019 Apr;48(4):299–306.
- 58. Ezhilarasan D, Apoorva VS, Ashok Vardhan N. Syzygiumcumini extract induced reactive oxygen species-mediated apoptosis in human oral squamous carcinoma cells. J Oral Pathol Med. 2019 Feb;48(2):115–21.
- 59. Mathew MG, Samuel SR, Soni AJ, Roopa KB. Evaluation of adhesion of Streptococcus mutans, plaque accumulation on zirconia and stainless steel crowns, and surrounding gingival inflammation in primary molars: Randomized controlled trial. Clin Oral Investig. 2020;1–6.
- 60. Samuel SR. Can 5-year-olds sensibly self-report the impact of developmental enamel defects on their quality of life? Int J Paediatr Dent. 2021 Mar;31(2):285–6.
- 61. Coulter, I., Ryan, G., Kraus, L., Xenakis, L., Hilton, L.A Method for Deconstructing the Health Encounter in Complementary and Alternative Medicine: The Social Context(2019) Journal of Complementary Medicine Research, 10 (2), pp. 81-88.
- 62. Chandrasekar R, Chandrasekhar S, Sundari KKS, Ravi P. Development and validation of a formula for objective assessment of cervical vertebral bone age. Prog Orthod. 2020 Oct 12;21(1):38.
- 63. VijayashreePriyadharsini J, SmilineGirija AS, Paramasivam A. In silico analysis of virulence genes in an emerging dental pathogen A. baumannii and related species. Arch Oral Biol. 2018 Oct;94:93–8.