A Review Study on Vaping and Status of Vaping in India

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Abstract: Introduction—Electronic Cigarettes (E-cigarettes) was introduced into the market in 2007 as an alternative method for quitting smoking. Considering the global rise in the use of Electronic cigarettes, the study aims to perform the comprehensive review of literature on E-Cigarettes.

Objectives—To explore the Presence and usage of E-cigarettes in India, to determine the Health-related issues due to the use of E-cigarettes globally, To compare conventional smoking modalities with E-cigarette usage globally, To assess whether use of E-Cigarettes can be helpful in reduction of behavior related to smoking cigarettes

Methods—The Literature Search Strategy was developed using the key words based on the objectives and the electronic based data source for identification of papers was done in PubMed and Research Gate. The Study was Conducted from December 2017 to March 2018.

Results—There are almost 75 companies which are supplying E-Cigarettes through online in India, and there is no brand in India which manufactures its own product except Evolve Vapors. Limited Studies assessing the health effects of E-cigarettes have been performed as most of them are done in the laboratory conditions. The use of E-Cigarettes were more in current smokers as the usage increasing in adolescents because of the modifiability and similarity with the Conventional Cigarettes. Randomized Control Trial (RCT) and Cohort Study were not able to generate enough evidence because of the Smaller no of participants in the study and lack of previous data available Conclusion—Well designed Newer Generation E-cigarettes trials must be monitored and measured for a longer period so that the Safety and efficacy of the device can be generated.

Keywords: electronic cigarette(s), electronic nicotine delivery system, Alternative -nicotine delivery devices, Vaping, Status, Health Hazards, Quit, Smoking Cessation, Smoking Reduction
Introduction

An Electronic cigarette or E-cigarette is a handheld electronic device that tries to create the feeling of tobacco smoking it is a form of an ENDS (Electronic nicotine delivery system). They are battery-powered devices that delivery nicotine in an aerosol to the user. E-cigarettes contain nicotine cartridges with airflow sensors, but do not burn tobacco (SEATCA_E-Cig, 2014). E-cigarette was introduced in the market as an alternative approach /device for quitting smoking. (Heydari et al., 2017). Vaping is the act of inhaling and exhaling the water vapor produced by an electric device (E-Cigarette) called vaporizer (Ernst et al, 2016). E-Cigarettes can be categorized into three groups disposable, rechargeable and modular can be refilled by the user. E-cigarette devices were manufactured mainly in China initially when it was launched into market in 2007 (Grana et al., 2014). There over 466 brands and 7764 unique flavors with about 242 new flavors added per month (Huey, 2018). E-Cigarettes are mostly available online. Dampf, vape stop, Greenvapo and Evolve are the main online stores available in India (Online Shopping India, 2017). A single disposable E-Cigarettes ranges from $Six to $Twelve (Rs.390-782) and Cartridge models are rechargeable and contain pre-filled cartridges Starter kits usually range around $Forty to $Sixty (Rs.2600 -3900) (IEC Vaping Authority, 2018).

The usage of the E-Cigarettes is more in France and UK which represents 6 percent and 3.5 percent of the adult population (SEATCA_E-Cig, 2014). In India, there are almost 75 companies which are supplying E -Cigarettes through online in India according to Association of vapers India and use is more common in adolescents because consumption of E cigarettes occurs through online and there is no authority website protection for E cigarette advertisement and it is available in various flavors. States like Karnataka, Kerala, Punjab, J&K, Mizoram & Maharashtra, have banned E-Cigarettes under the Drugs and Cosmetics Act, 1940, and Food Safety & Standards (Prohibition and Restriction on Sales) Regulation, 2011 (Times of India, 2017).

Conventional Cigarettes (CC) have been used for more than a century and smokers are preferring conventional cigarettes (CC) as compared to E-Cigarettes worldwide, more information about the long term health hazards of the conventional cigarettes is available, whereas E-Cigarettes are newer products which has been implemented 10 years before because of this the data available on the long term health consequences is limited. Some studies are mentioning the benefits of E-
Cigarettes over conventional cigarette and in contrast other studies are mentioning its health hazards equal to Conventional Cigarette (CC) so it is difficult to come to a conclusion that whether the product reduces morbidity and mortality. The present study has been conducted to understand the effects of vaping on health and its efficacy as an alternative product for tobacco cessation.

2. Methods

Study Characteristics

<table>
<thead>
<tr>
<th>Population</th>
<th>Intervention</th>
<th>Control</th>
<th>Outcome</th>
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<tbody>
<tr>
<td>1. Adult smokers</td>
<td>Electronic cigarettes</td>
<td>Non-smokers</td>
<td>1. Smoking cessation</td>
</tr>
<tr>
<td>(age limit ≥18 years)</td>
<td></td>
<td></td>
<td>2. Health Hazards</td>
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<td>3. Former smokers</td>
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<td>4. Benefits of E-Cigarette use</td>
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<td>4. Dual Users</td>
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Data sources and searches

Literature search strategies was developed using medical subject headings (Mesh) based on the terms “electronic cigarette(s)” OR “e-cig” OR “electronic nicotine delivery system(s)” OR “Alternative -nicotine delivery devices” OR “Vaping” AND “Status “AND “Health Hazards” AND “Quit” OR “Smoking Cessation” OR “Smoking Reduction”. This electronic based search strategy was used for identification of published papers in PubMed, Research gate and Google scholar. Search results were not limited by language, but all identified studies were in English. There was no limitation on publication dates. This strategy for the date bases was run or conducted from December 2017 to March 2018.

A total of 27 unique articles met the inclusion criteria. Articles titles and abstracts were screened based on the status of vaping, health effects of using the E-Cigarettes and its role on tobacco cessation in addition relevant reports, articles, Journals were referred from Electronic Cigarette Research website. The authors of these articles/papers were conducted through Email as well as phone calls.
Criteria for considering studies for the review

Inclusion criteria:
Eligible study designs included (a) Systematic Reviews and Meta-Analysis (b) analytical study designs (case-control studies, cohort studies, analytical cross-sectional studies) (c) descriptive studies (case report, case series, cross-sectional studies), (d) Qualitative Research and outcome studies on the status, health hazards and the reasons for its usage, efficacy, or smoking cessation of E-cigarettes were included. We considered all study populations that were defined as “adult” by the study authors. The studies that defined adult smokers, Current smokers, Former smokers, and Dual Users were used for further analysis.

Exclusion Criteria
Editorials, conference papers, studies which were unrelated to topic concerned and studies were excluded. At the end articles relevant will be reviewed.

Data extraction
A standardized data extraction form was developed to collect information from the selected studies done on E-Cigarettes and vaping. Standard data describing each study was extracted, this includes general Information of the study (Author, year of publication), Study characteristics (Study design, Study Location), primary and secondary outcome measures and end points, study strengths and limitations.

Selection of Studies
Studies were reviewed based on the exclusion and inclusion criteria, in three stages.

- During the first stage of title screening, titles of the studies identified from the search were assessed for inclusion.
- If the study was related to the objectives of the current study, then it was moved to abstract screening. In the next stage of abstract screening, abstracts of these selected titles that were approved and included for the final stage of full text screening.
  In the third stage of full text screening, full texts of abstracts selected in the previous stage were screened for eligibility.
**Flow chart of Search Strategy**

Initial search yielded 537 titles

188 relevant abstracts were shortlisted using inclusion criteria

20 full text articles were available from the PubMed and 4 full text articles were selected from the Research gate after hand searching using inclusion criteria

24 articles or reports selected to be included in the results selection of present review

* 11 Reviews, 1 commentaries, 1 Letter
* 3 Qualitative research
* 3 Systematic Review and 1 Meta-analysis
* 4 Cross-sectional

**Inclusion criteria**

Eligible study designs will include

(a) Systematic Reviews and meta-analysis
(b) analytic study designs (case-control studies, cohort studies, analytical cross-sectional studies)
(c) descriptive studies (case report, case series, cross-sectional studies),
(d) Qualitative Research, outcome studies, and fact sheets on the status, health hazards and the reasons for its usage, efficacy, or smoking cessation of E-cigarettes will be included.
(e) Study populations that were defined as “adult” by the study authors age ≥ 18 in the studies that defined adult smokers, Current smokers, and Former smokers.

**Exclusion criteria**

conference papers which are unrelated to topic concerned, studies that did not satisfy the review purpose

3 articles were included by contacting with the author

Total 27 articles/reports used in the Present Descriptive review
3. Results

Initial searches conducted via PubMed using the key words electronic cigarette, E-Cigarette, Vaping, and Electronic nicotine delivery systems, yielded a total of 537 records were retrieved through the Search Strategy, of which 188 articles were Screened for Eligibility after Full text Screening. At last, 27 articles were included for the final review.

According to Royal College of Physicians, E-Cigarettes were considered 95 percent safe as compared to Traditional Cigarettes (Public Health England, 2015). The aerosol exposure from the E-cigarettes risk assessment was done using Gas chromatography (Used in analytical chemistry for separating and analyzing compounds) in one study. The study found that there was release of Acrolein, Acetaldehyde and Formaldehyde which was classified as carcinogens by IARC and the risk was less compared to Traditional Cigarettes (Farsalinos et al., 2016b). Standardized method for assessing the E-Cigarettes exposure were not used in monitoring the risk assessment.

There are short term health effects due to use of E-Cigarettes like nausea and vomiting, headache, urinary Tract Infection, dizziness, dryness of eyes, allergic inflammation of airway and mucus membrane (Meo et al, 2014) and Long term effects like elevation in Blood Pressure and heart rate in E-Cigarettes users as compared to the smokers (Polosa et al., 2016b). Most of the effects were found during in-vitro and in-vivo laboratory test.

E-Cigarettes was marketed to the Current Smokers because of the following reasons:- i) enjoyment ii) to smoke in all places iii) Professional use iv) Health benefits (Kistler et al., 2017). According to a study causation model analysis conducted showed that Never-Cigarette Smoking Adolescents aged 12-17 years and Young adults aged 18-29 years would initiate Cigarette Smoking by the age of 35-39 years, but this model was unable to conclude Causation or fully control the confounders (Soneji et al, 2018). Most of the studies had participants or over sampled satisfied users or Long-term users of the product which may generate results favorable to defend E-Cigarettes and the studies were not able to discuss the results across different races, income levels and educational levels.
Of the two RCT’s conducted suggested a possible increase in Tobacco smoking cessation with ENDS(Electronic Nicotine Delivery System) in Comparison with ENNDS(Electronic Non-Nicotine Delivery System) with Relative Risk=2.03 and P value=0.07 as the study was conducted for a period of 6-12 months, the study could not generate much evidence as information like when did the participants start using the E-Cigarettes before the intervention the data about this were not available(Dib et al., 2017).

4. Discussion

1. To know the presence and usage of E-cigarettes in India

The data on E-Cigarettes in India both in offline outlets, as well as online retail websites, is still not available. A Study conducted in India to check for the online ENDS availability reported that findings out of 65 models (34 brands) which include 45 models of electronic cigarettes, 12 e-shisha, 2e-hookah and 6 e-cigar. In these products information regarding the Ingredients, Flavours, Nicotine Strength and claims such as “Health related-No Tar No Harm, Environmental friendly” were mentioned(Mohanty et al., 2017). But studies on E-Cigarettes are claiming it as not an eco-friendly product as it contains substances like Formaldehyde, Acetaldehyde and Acrolein that are released into the environment which are classified as carcinogens by International Agency for Cancer Research(IARC). Apart from that multiple studies have reported both acute and long-term effects on health so long-term studies on Humans must be done on this topic in order to generate an evidence. Few states in India, such as Punjab, Karnataka, and Maharashtra have taken steps to cease the sale of ENDS in areas under their jurisdictions(Zee Media Bureau, 2016).

2. Health Related issues due to the use of E-Cigarettes

The main contents in the E-cigarettes are 1,2-propylene glycol and glycerol with the content ranging between 75% and 95%(Zhang et al., 2017). Studies states that glycerol which is present in the E-Cigarettes will converted into acrolein which cause stimulation of upper respiratory tract. Resulting in Respiratory distress(Logan and Marlatt, 2010). Propylene glycol is also converted to Propylene Oxide on heating which is considered to be a carcinogen(Laugesen, 2008). Studies on short-term exposure of Propylene glycol in animals and humans did not find any significant adverse health effects (Suber et al., 1989; Wieslander et al., 2001). Nicotine is the addictive component of tobacco it functions as a “tumor promoter”(Blasi et al, 2015). Nicotine causes endothelial dysfunction, inhibit apoptosis, and enhance angiogenesis. This effect raises concerns about nicotine promoting cancer development and accelerating atherosclerosis.(Balakumar et al,
The chemistry profile of E-Cigarette liquid and aerosol is substantially less harmful compared to tobacco cigarettes such as tobacco-specific nitrosamines, polycyclic aromatic hydrocarbons and carbon monoxide (Farsalinos et al., 2015; Goniewicz et al., 2013; Margham et al., 2016; Tayyarah et al., 2014; Varlet et al., 2015). A major sensory parameter of E-cigarettes is that liquid overheating creates a strong unpleasant taste that users avoid. This phenomenon is called dry puffs (Farsalinos et al., 2015). None of the studies has checked for the generation of dry puffs because the laboratory testing setup could have represented unrealistic conditions and be irrelevant to true human exposure as further research is needed to understand inter- and intra-individual differences in detecting the unpleasant taste. There are limited clinical studies assessing the effects of E-cigarettes and they have found the acute effects of elevated blood pressure and aortic stiffness which are related to the sympathetic effects of nicotine (Carnevale et al., 2016; Vlachopoulos et al., 2016) leading to cardiovascular disease (Adamopoulos et al., 2009). These observations are also found after short- or long-term use of caffeine (Adamopoulos et al., 2009; Mahmoud et al., 2001) or after exercise (Mutter et al., 2017) but these do not have any long-term adverse health effects. The adverse health effect when compared between Smoker and a E-Cigarette user there was an improvement in Blood pressure after Switching from Smoking to E-Cigarette when sustained for 2 years (Farsalinos et al., 2016; Polosa et al., 2016). Studies done by Scripp et al. 2013 gave evidence that traditional Cigarette smoke was more hazardous than the Electronic Cigarette smoke but according to Czogala et al. 2014 the risk of Second Hand Smoke generated by E-Cigarette is higher than the traditional Cigarettes. The benefits of the E-cigarettes over Traditional Cigarettes includes they can be used it in the work place, car and does not smell in the clothing and they offer greater customization in females and young adults as it is available in various flavors like chocolate chunky flavor, etc. they are available in different varying levels of nicotine (High/Low). The disadvantages of E-Cigarette use was they did not relieved stress in previous smokers which they used to get during smoking traditional cigarettes as a study conducted by Vansick et al. dose of exposure may influence quit rate and Newer Models may be more effective, but there is insufficient data to provide in these issues. Manufacturer of E-Cigarettes claimed that they are produced to aid in smoking-cessation (Dawkins et al., 2013; Farsalinos et al., 2014, 2013; Gucht et al., 2017). Many Cohort studies have shown mixed results with some showing the odds of quitting while others showing the opposite effect (Biener, 2014; Brose, 2015 use; Vickerman, 2013). Meta-Analysis has also shown mixed results and Systematic Review
have reported that the E-cigarettes help in quitting smoking (Hartmann-Boyce et al., 2016; McRobbie et al., 2014). The systematic reviews were of good quality, but there were major problems in the studies that were included to the analyses and were rated ‘low’ by GRADE standards due to the small number of trials, low event rates and wide confidence intervals around the estimated means. Two randomized controlled trials was done for 6-12 months period with follow-up and used outdated and poor-quality products that were already withdrawn and replaced by more advanced products at the time of the studies’ publication (Manzoli et al., 2015; Bullen et al, 2013).

**Strength**

This Study performs the comprehensive review of Literature to Know the Status and Presence of E cigarettes in India and to determine the health hazards and the efficacy of the E -cigarettes as a smoking cessation device globally

**Limitations**

1. Articles related to the topic were scarce and access to those data sources were limited
2. Review studies were considered mainly for data analysis as the systematic review and meta-analysis were limited in number
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