

Assessment of Noxious Gases Emission from Herbal and Conventional Cigarettes - A Comparative Study toward Health Promotion

Research Article

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Abstract

Introduction: Smokers, who wish to stop smoking, are introduced to another equally harmful product, herbal cigarette in order to help with their withdrawal symptoms, which are presented as safe alternatives. Herbal and Conventional brands both release noxious gases whose level are not mentioned on the packaging such as carbon monoxide and nitric oxide.

Material and Methods: Smoke of seventeen cigarette brands belonging to conventional and herbal respectively were exposed to the sensor which reports the emission of gases in ppm.

This process is being repeated twice in order to reduce the margin of error and eliminate bias.

The mean CO and NO values were calculated for the conventional, herbal and different length categories of the cigarette.

Results: Herbal cigarettes of 64 mm length emitted 5437 ppm of CO whereas a cigarette of 84 mm length emitted 4042 ppm, and cigarette of 80 mm length produced 5470 ppm of CO.

Conclusion: The authors conclude that considering the deleterious effects reported by CO and NO on the human body the multinational tobacco companies must be directed to mention the levels on the packaging. Herbal cigarettes should be validated by a competent authority prior to their use as an alternative to NRT. This health education approach to sensitise towards noxious gas emission can be of great use among beginners and young crowd, also the law can come into place to mention the CO levels on the packages of all the cigarettes in the market either herbal or conventional.

Introduction

Smoke emitted from Tobacco when burned is a multifaceted, dynamic and reactive combination containing around 5,000 chemicals.[1-3] It has been identified as a potent carcinogenic mixture which is undoubtedly the most substantial source of exposure towards toxic chemical causing diseases among the human race. [4, 5] WHO has estimated, that there are 5.4 million people losing life due to this preventable death caused by tobacco smoking around the world.[6] If this practice continues, it can be predicted that the deaths can reach to as high as, 10 million marks among smokers per year by the end of 2025.[7, 8]

The WHO Framework Convention on Tobacco Control (FCTC) issues a complete outline for global tobacco control efforts. The FCTC is responsible for all facets of tobacco control, including tobacco product regulation, advertising, health warnings, price

and tax issues, illicit trade (smuggling) and programs for smoking cessation.

Due to the efforts of FCTC, in recent time the number of smokers who wish to stop smoking has increased.[9] However, many smokers who wished to stop smoking, use nicotine replacement therapy [10, 11] to help with withdrawal symptoms or are introduced to another equally harmful product herbal cigarette presented as herbal/non-smoking or safe alternatives.

Authors feel that this could be a marketing strategy of Tobacco Giants who are investing a huge amount in marketing their products and increasing their market share by perusing probable quitters back in the business. Herbal cigarette contains herbs, instead of tobacco leaves, as the raw material. However, the safety and chemical composition of herbal cigarette smoke have been scarcely studied.

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Nevertheless, as yet, tobacco products are loosely regulated and largely exempt from any safety standards.

Carbon monoxide (CO) which is a poisonous, colourless and odourless killer gets emitted in tobacco-related smoke. The level of CO [12, 13] have been evaluated to correlate the number of cigarettes smoked per day and levels of CO in breath, which is a reliable indicator [14] and is preferred because of its non-invasive nature, easy procedure and better compliance.[15] The patient can definitely be made aware of the CO levels in the breath and has a high impact towards making people quit the habit.

When nitrogen is released during fuel combustion it combines with oxygen atoms to create nitric oxide (NO), this mainly impacts on respiratory conditions causing inflammation of the airways at high levels. Long term exposure can decrease lung function, increase the risk of respiratory conditions and increases the response to allergens.

However, no attempts till date have been made to find the CO and NO levels of conventional and herbal cigarettes available in the Indian market or even abroad to the best of our knowledge. This health education approach to sensitise towards noxious gas emission of their brand of cigarette can be of great use among beginners and young crowd who are the new targets of the tobacco industry, also the law can come into the place to mention the CO levels on the packages of all the cigarettes in the market either herbal or conventional.

Materials And Methods

In order to analyse the CO and NO content from the smoke of cigarettes, seventeen cigarette brands were shortlisted, these brand of cigarette were reported by the shopkeepers as maintaining maximum sales among conventional cigarette brands. The herbal options were two in number and based on convenience sampling as these brands were available in stores labelled as pure herbal products.

The conventional and herbal cigarettes were further classified on the basis of the length of each cigarette in mm what was mentioned on the packets. Broadly three lengths got to be classified as 84 mm, 80 mm and 64 mm in length.

The authors in the present survey wanted to measure the CO content without considering exhaled human breath content as this study attempts to bring forward the CO levels emitted by various cigarette and use these findings for educating people and bringing the attention of policymakers towards the effect of exposure of the CO from tobacco smoke.

Industrial CO analyser is the method used in the present survey of recording exact measurement of CO and NO among individually selected brands of cigarette, this machine is being used to precisely record and report any accidental leakage of the poisonous gases in industrial settings. The TESTO 350, is a rugged easy-to-use exhaust gas analyser designed to meet the highest demands when it comes to carrying out precise industrial emission measurements and providing proper data administration. The Analysis Box can be operated with up to 6 gas sensors. The measurement

is recorded in ppm and the slightest of the difference can be detected.

Study design

The measurement analysis was done with the highest accuracy which was completely based on the electronic readings given by the gas analyser, all of the findings were retested and the maximum emission and minimum emission were recorded in order to have consistent results and avoid bias. The calibration of the analyser and the entire set up was done before even initiating the survey. The smoke trap apparatus was designed in such a way that the cigarette has to be burned in the chamber which is attached to the smoke collection chamber, the sensor present in this chamber starts to provide the findings on the digital monitor of the TESTO 350 unit. The findings were recorded by a recorder that constantly monitors the readings and is blinded towards the brand of cigarette for which recordings are to be made. This process is being repeated for all 17 samples twice in order to reduce the margin of error and eliminate bias. The apparatus had to be cleaned after every cycle and the glass chambers had to be washed and left for drying.

Statistics

The mean CO and NO values were calculated for the conventional, herbal and different length categories of the cigarette, the p values with the help of Kruskal-Wallis Test Mann-Whitney U Test were calculated using SPSS version 21.

Results And Discussion

The present study is being conducted to identify the CO and NO emission levels from the conventional and herbal cigarettes, further the emission had to be compared according to the length of the cigarettes.

The CO is a poisonous gas, when inhaled from tobacco smoke it gets absorbed through the lungs and enters into the bloodstream and combines with haemoglobin to form carboxy-haemoglobin (COHb), thereby reducing oxygen supply to the body tissues and organs. The CO remains in the blood for about 24 hours after inhalation of tobacco smoke, this CO present in exhaled air can be measured using a portable CO analyser.

The CO emission is clearly reported to be more in herbal brands of a cigarette when compared to conventional ones. CO emission is inversely proportional to the length of the cigarette with longer ones reporting minimum levels of CO. Herbal cigarettes of 64 mm length emitted 5437 ppm of CO whereas a cigarette of 84 mm length emitted 4042 ppm and cigarette of 80 mm length produced 5470 ppm of CO.

There have been studies reporting the levels of exhaled CO among smokers according to the 'pack year' which is calculated on the basis of the number of cigarettes a person smokes (one pack each containing 20 cigarettes smoked per day for one year is one pack-year).[16] This has been made for the convenience of calculation and to have standardisation of all smokers for different duration and quantity. Consumption of tobacco has, therefore, been calculated in terms of "pack years" based on tobacco

Table 1. Comparison of Mean Carbon Monoxide and Nitrous Oxide gas emission among conventional and herbal cigarette brands.

Group	Units in ppm	Carbon Monoxide	Nitrous Oxide
Conventional	Mean	4137.8	103.73
	SD	2250.74	29.31
Herbal	Mean	5256.5	95
	SD	74.24	22.63
Total	Mean	4269.41	102.71
	SD	2137.99	28.14
p value ^b		0.51	0.69

p value^b

Table 1 determines the mean CO emission of cigarettes according to nature, herbal brands reported mean ppm of 5256(74.24) and conventional brands have a mean of 4137 ppm of CO emission. NO gas emission reported mean 103 ppm and mean 95 ppm for conventional and herbal brands respectively.

Table 2. Comparison of Mean Carbon Monoxide and Nitrous Oxide gas emission according to cigarettes with different lengths.

Length	Units in ppm	Carbon Monoxide	Nitrous Oxide
84 mm#	Mean	3774.5	103.42
	SD	1715.15	23.44
80 mm*	Mean	5469	89
	SD	371.79	19.08
64 mm+	Mean	5439.5	119
	SD	5523.21	69.29
p valued		0.36	0.53

Table 2 presents the mean CO and NO emission from cigarettes according to the length in which they are marketed, length of 64 mm reported mean 5437 ppm of CO which reduced to mean 4041 ppm for cigarette of 84 mm of length. NO emission is least reported among cigarette of 80 mm in length.

Figure 1. Carbon Monoxide Emission Level of all 15 conventional and 2 herbal cigarette brands individually.

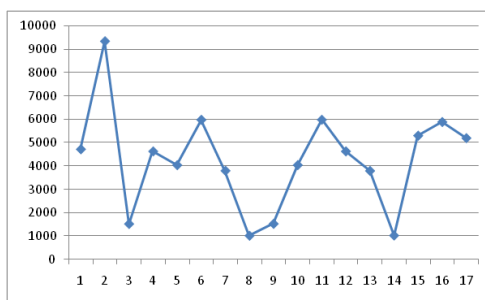


Figure 1 represents the individual emission level reported among every cigarette brand of Carbon Monoxide gas, the last two brand number 16 and 17 represent the herbal products.

Among the 17 brands used, 15 belong to the conventional category and 2 were herbal brands.

weight. Logically, “pack-years” cannot be calculated on the basis of the weight of tobacco; otherwise, “pack-years” would vary according to the brand of cigarettes as different brands have different weights. Thus, there appears to be no scientific basis for equating cigarette on the basis of tobacco weight. In addition to this, most of the brands in India has ten cigarettes in one pack which compromises the “pack year” calculation and its validity. The health-related concern is also arising in such experiments where the sample is being selected on the basis of merit towards continuing the habit for such a long time and at high frequency. These experiments are dependent on the responses of the subject where the subject can have difficulty in remembering the events and incorporate recall bias which is another issue arising. Hence the authors selected a new process to check the emission levels from different brands of cigarettes.

Unfortunately, the tobacco brands are not liable to inform the emission levels of cigarettes although they emit noxious gases despite being labelled as “herbal”.

The present study results can be used to educate the general people regarding the content of noxious gases present in the smoke of the concerned brand; they must be made aware that the alternative products proposed are not to be considered healthy alternatives at any cost.

In an interesting research conducted by university students of Alaska [17], it was revealed that cigarette smoke has a much higher CO concentration than does the exhaust from a clean, well-maintained vehicle. In fact, all of the cigarette measurements which were made gave CO mixing ratios of greater than 1.0%, which is the usual “passing” value for cars that must have annual emission tests. Of the cars tested in this experiment, none exceeded the 1.0% level.

The exposure of CO concentrations can be well understood with the results of a study conducted to evaluate the impact of the smoking ban law in the city of Sao Paulo, Brazil, [18] on the CO concentration in restaurants, bars, night clubs and similar venues and in their workers. The average CO concentration measured in

the city was lower than 1 ppm during both pre-ban and post-ban periods. Smoking-free legislation reduced significantly the CO concentration in hospitality venues and in their workers, whether they smoke or not. These results clearly indicate the effect of CO levels in the atmosphere due to smoking.

This issue will raise the concern towards the second-hand smoke (SHS) or people who are exposed to cigarette smoke unwantedly. The results of the study where CO levels were monitored in 22 Polish pubs [19] also showed, that passive smoker can be exposed to very high CO concentration exceeding the WHO. The results presented in this article prove that passive smoking in public places like pubs might be a potential health risk because of breathing air with elevated levels of CO. Moreover, pubs' patrons and staff are a special group occupationally exposed to higher levels of CO for a long time.

The results from present survey indicate that NO emission from a conventional cigarette (103.7) is more than that of herbal brands with (95) mean ppm of emission.

Amount of NO in the cigarette smoke is of prime importance as it has been proposed by a literature review that inhaled NO from smoke may be able to increase nicotine absorption, which is responsible for smoking addiction. Since it has been shown that NO from smoke dilates pulmonary vessels in humans and animals [20, 21] the dilated pulmonary vessels allow the smoker to breathe deep and comfortably allowing the nicotine to reach in high concentration. In view of smoking addiction, animal studies have reported that NO contribute to nicotine dependence among rodents. [22, 23]

CO when emitted in public places with closed surroundings can have a serious effect on human beings, the attraction of haemoglobin towards CO is well understood and the reduction in oxygen-carrying capacity has been documented. Regarding NO it still remains unclear whether reducing the NO content in cigarette smoke may reduce nicotine absorption but its role in tobacco smoke addiction has been documented.

Conclusion

The findings of the current research can be used to draft the guidelines towards strict law implementation towards CO/NO levels to be disclosed by the tobacco companies.

The authors conclude that considering the effects reported by CO and NO on the human body the multinational tobacco companies must be directed to mention the levels on the packaging. Herbal cigarettes should be validated by a competent authority prior to their use as an alternative to NRT.

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