Evaluation of Quality of Tobacco Cigarette and Implications to Public Health

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ABSTRACT

Introduction: Tobacco cigarette smoking is a serious public health issue, killing more than 8 million people a year around the world. More than 7 million of those deaths are the results of direct tobacco use. The increasing prevalence of tobacco consumption in developing countries is associated with aggressive marketing strategies, employed by the tobacco industry, despite initiatives like the Nigeria ratification of the Framework Convention on Tobacco Control (FCTC) in 2005, and in 2015 signed into law the National Tobacco Control (NTC) Act that regulates all aspects of tobacco control including advertising, packaging, and smoke-free.

Method: The literature search for this scoping review was conducted on Google Scholar, ResearchGate and PubMed web databases using the following phrases and keywords: Quality Assessments of Tobacco cigarettes, Public Health Impact of Cigarette Smoking, Tobacco, Composition of Tobacco Cigarettes and Methods of analysis of Tobacco. Only publications that had full open access for complete manuscript and publication year within the period 1983 to 2022 were included in review.

Results: Understanding the composition of these cigarettes is essential for comprehending the health risks associated with smoking and second-hand smoke exposure. It also enables the development of effective tobacco control measures and policies to protect public health and reduce the impact of tobacco-related diseases on individuals and communities. Findings from this review indicated that most individuals especially the adolescent in Nigeria have knowledge about the health setbacks of cigarette smoking.

Conclusion: To ensure that less attraction to the lifestyle of tobacco product smoking, governments, stakeholders, media, charities, and healthcare providers must work together. The development of more responsive policies and time to time sensitization of the health negative effects of cigarette smoking at institutional levels such as Schools, religious centres, would be a panacea to curving the menace.

1.   Introduction

The prevalent use of tobacco has been the determinant of preventable death and responsible for about 6 million deaths per annum world-wide[1, 2]. However, about 80% of the current 1.3 billion smokers reside in low- and middle-income countries. The tobacco epidemic is one of the biggest public health threats the world has ever faced, killing more than 8million people a year around the world. More than 7 million of those deaths are the results of direct tobacco use while around 1.2 million are the result of non-smokers being exposed to second-hand smoke[3]. The increasing prevalence of tobacco consumption in developing countries is associated with aggressive marketing strategies, employed by the tobacco industry, despite initiatives like the Nigeria ratification of the Framework Convention on Tobacco Control (FCTC) in 2005, and in 2015 signed into law the National Tobacco Control (NTC) Act that regulates all aspects of tobacco control including advertising, packaging, and smoke-free[4] which explicitly target the youth and women. Meanwhile, tobacco consumption, particularly cigarette has declined in developed countries, as a result of successful anti-tobacco campaigns and national tobacco control policies. The increase in tobacco use in developing countries is a cause of

concern, like Nigeria. Nigeria consumes about 20 billion sticks of cigarette which are valued at 200 billion annually. This is in connection to the fact to that Nigeria is no longer just an importer but also a net producer and exporter of tobacco products[5]. The WHO estimated about 13 million smokers in Nigeria in 2012, with over 16,000 deaths attributable to smoking[4].

Before the coming in of transitional tobacco companies, preferences and varied differ from country to country as a result of consumers differences. The reports and claims given of levels of different smoke constituents between available foreign Western style cigarettes and the locally popular ones could serve as an important statistical variable of interpretation solely on public health consequences of smoking[6]. Cigarette contain about 600 ingredients, many of which can also be found in cigars and hookahs. When these ingredients burn, they complex mixture of the smoke generated contains more than 7000 chemicals, according to the American Lung Association. Many of those chemicals are poisonous and at least 69 of them are linked to cancer[2]. Reports shows that altering the retail blend of cigarette by increasing amount of tobacco increases the nitrate content present. Poly-aromatic hydrocarbon content of the smoke can be reduced by an increase in the nitrate content as demonstrated by research of Adams and colleagues; unfortunately, there was an increase in the nitrosamine content proportionally with the nitrate levels[7]. This report aims to Evaluation of Quality of Tobacco Cigarette and Implications to Public Health.

2. Tobacco Cigarettes and their Components

Tobacco cigarettes are the most widely used form of tobacco consumption and consist of a combination of ingredients wrapped in a paper tube. When lit, the tobacco is burned, releasing smoke that is inhaled by the smoker. These cigarettes contain various components, each playing a crucial role in the smoking experience and the potential health effects on both smokers and non-smokers[8].

2.1 Common Components of Tobacco Cigarettes

2.1.1 Tobacco Leaves

The primary component of tobacco cigarettes is the processed tobacco leaves. The leaves are harvested, dried, and cured before being finely cut or shredded to form the tobacco blend found in cigarettes. The type of tobacco used, it's processing, and additives added during production influence the taste, aroma, and nicotine content of the cigarettes[8].

2.1.2 Additives

Manufacturers often add various additives to enhance the flavour, burn rate, and overall smoking experience. These additives can include sweeteners, flavourings, and other chemicals designed to increase the appeal of cigarettes to consumers[9].

2.1.3 Paper

The tobacco blend is encased in a thin, porous paper wrapper. The paper is designed to maintain the structure of the cigarette, allow for a controlled burn, and facilitate the delivery of smoke to the smoker when lit[10].

2.1.4 Filters

Many cigarettes have filters at one end to reduce the intake of some harmful constituents of smoke. Filters are made of cellulose acetate and can trap larger particles, but they do not eliminate the health risks associated with smoking[10].

2.2 Understanding the Composition of Tobacco Cigarettes in Relation to Public Health Implications

Understanding the composition of tobacco cigarettes is of paramount importance for public health implications due to several reasons:

2.2.1 Health Risks for Smokers

The chemicals present in tobacco cigarettes, particularly nicotine, tar, and various toxicants, are associated with a wide range of health risks for smokers. Smoking is a significant risk factor for various diseases, including lung cancer, chronic obstructive pulmonary disease (COPD), heart disease, stroke, and other respiratory disorders[10].

2.2.2 Second hand Smoke Exposure

Second hand smoke, also known as passive smoke or environmental tobacco smoke, is the smoke emitted by the burning end of a cigarette and the smoke exhaled by the smoker. Non-smokers exposed to second hand smoke are at increased risk of health problems, including respiratory infections, asthma, and cardiovascular diseases[9].

2.2.3 Influence on Smoking Behaviour

The additives and flavourings in tobacco cigarettes can make them more appealing, especially to younger individuals and new smokers. Understanding the role of these components can aid in developing effective tobacco control strategies and regulations to discourage smoking initiation and promote smoking cessation[8].

2.2.4   Regulation and Policy Development

Understanding the components of tobacco cigarettes is crucial for policymakers to develop evidence-based regulations and policies to reduce the harm caused by smoking. This includes measures such as restricting the use of certain additives, imposing health warnings on cigarette packages, and implementing smoke-free environments[10].

Tobacco cigarettes consist of a blend of processed tobacco leaves, additives, paper, and filters. Understanding the composition of these cigarettes is essential for comprehending the health risks associated with smoking and second hand smoke exposure. It also enables the development of effective tobacco control measures and policies to protect public health and reduce the impact of tobacco-related diseases on individuals and communities.

3.   Methods of Quality Evaluation

3.1 Methods Used to Assess the Quality of Tobacco Cigarettes

The evaluation of tobacco cigarettes' quality involves a range of methods to analyse their chemical composition, nicotine and tar content, and potential presence of harmful substances. Some of the commonly used evaluation methods include:

3.1.1   Chemical Analysis

Chemical analysis is a fundamental method used to assess the components present in tobacco cigarettes. This involves the identification and quantification of various compounds, such as nicotine, tar, volatile organic compounds (VOCs), and carcinogens. High-performance liquid chromatography (HPLC) and gas chromatography-mass spectrometry (GC-MS) are commonly employed techniques for chemical analysis[11].

3.1.2.   Nicotine and Tar Content Analysis

Nicotine and tar are key constituents of tobacco cigarettes that significantly impact the smoking experience and health risks. Standardized methods are used to determine the nicotine and tar levels in cigarettes. The International Organization for Standardization (ISO) and the Federal Trade Commission (FTC) has established protocols for testing nicotine and tar content, respectively[12].

3.1.3   Heavy Metal Analysis

Tobacco leaves have the potential to absorb heavy metals from the soil, which may find their way into tobacco cigarettes. Inductively coupled plasma mass spectrometry (ICP-MS) is commonly used for heavy metal analysis in tobacco products to identify harmful elements such as lead, cadmium, and arsenic[13].

3.1.4   Analysis of Harmful Additives

Many tobacco cigarettes contain additives that may enhance the flavour, burning rate, or overall smoking experience. Analysing the presence of these additives is crucial to assess potential health risks. Liquid chromatography-tandem mass spectrometry (LC-MS/MS) and nuclear magnetic resonance (NMR) are employed for this purpose[13].

3.2 Strengths and Limitations of the Evaluation Methods

3.2.1   Strengths

Many of the evaluation methods used for tobacco cigarettes offer high precision and accuracy in identifying and quantifying various components, providing reliable data for quality assessment[14]. The use of standardized protocols, such as ISO and FTC methods for nicotine and tar content analysis, ensures consistency and comparability of results across different studies[12] These evaluation methods allow for a comprehensive analysis of the tobacco cigarettes' chemical composition, nicotine and tar levels, heavy metal content, and harmful additives, providing a holistic view of their quality[11].

3.2.2   Limitations

The composition of tobacco cigarettes can vary significantly between different brands and batches, making it challenging to capture the full range of product diversity through standardized testing[11].

The methods used for evaluation may not fully represent the variations in smoking behaviour among individuals, such as puff volume and frequency, which can influence the amount of toxicants inhaled[14].

While the evaluation methods cover many harmful substances, there may be other constituents or potential new additives not yet included in the analysis[15].

The evaluation methods may not always align with the specific regulations in different countries, which can pose challenges for international trade and product standardization[15].

The evaluation of tobacco cigarettes' quality involves a range of methods, including chemical analysis, nicotine and tar content assessment, heavy metal analysis, and evaluation of harmful additives. These methods provide

valuable insights into the composition of tobacco cigarettes and their potential health implications. While these evaluation methods have strengths in precision, standardization, and comprehensiveness, they also have limitations, such as the dynamic nature of tobacco products and incomplete analysis of harmful substances. Understanding these strengths and limitations is critical for interpreting and utilizing the data effectively in public health policy development and tobacco control efforts.

4. Review of Publicly Available Studies on Yield Assessment of Tar, Nicotine and Carbon monoxide in Tobacco Cigarette

The prevalence of smoking according to the Nigerian Global Adult Tobacco Survey (GATS) in 2012 was 4.4%[16]. According to Awotedu et al,[17] of the 14 brand of cigarettes brand analysed for tar nicotine and carbon monoxide in Nigeria, 5 brands belonged to high and middle to high tar category (>22 mg/cigarette) and 9 brands belonged to middle category (17-22 mg/cigarette). None belonged to the low to middle and low tar category (<17 mg/cigarette). They further concluded that Tobacco companies in the third world countries need to manufacture low tar cigarettes has it is being practised in the economically developed worlds.

Also, a study by Calafat et al,[6] showed that the smoke deliveries varied with region with as the mainstream smoke deliveries varied from 6.8 to 21.6 mg tar/cigarette, 0.5 to 1.6 mg nicotine/cigarette, and 5.9 to 17.4 mg CO/cigarette. Other physical parameters were examined. On conclusion, it is indicated that cigarettes from the Eastern Mediterranean, Southeast Asia, and Western Pacific WHO regions tended to have higher tar, nicotine, and CO smoke deliveries than did brands from the European, American, or African WHO regions surveyed.

A study by Rickert et al,[18] indicated that developed countries such as Canada sponsor routine monitoring of cigarette tar, nicotine, and carbon monoxide yields which are evaluated by cigarette-smoking machines according to a standard protocol. This yield continues to decline as most tobacco companies modify their product to meet consumers demand for "light" products. Thirty-six brands of Canadian cigarettes, including 28 with ventilated filters, were tested under standard conditions and 2 others indicated most smokers manipulate cigarette in order to increase smoke intake. While the rank order yields of the three major substances are more than doubled when cigarette is intensively smoked.

Baumung et al[1] compare the health risk assessment of nicotine for smokers of cigarette with margin of exposure (MOE). The findings indicated that MOE ranged from 1 to 7.6 indicating a considerable consumer risk. The study concluded that all MOEs of nicotine in this study are less than 10 and within the range of very high risk. Owing to the lack of toxicological data particularly relating to cancer[19], long term animal bioassay studies for nicotine are urgently necessary. In this context all kinds of possible nicotine exposures as well as certain co-exposures (tobacco smoke toxicants) and different nicotine concentrations related to a potential threshold of addiction need to be considered.

Rickert et al,[20] compared the yield of tar, nicotine and carbon monoxide in some selected Canadian Brands of manufactured and hand rolled cigarette of small and large cigars. To control the volume of smoke delivery per cigarette The mean deliveries per litre of smoke and tar, nicotine, and carbon monoxide were highest for small cigars, followed by hand-rolled and manufactured cigarettes; large cigars had the lowest deliveries, standardized comparison in milligrams of toxic substance per litre of smoke were made. In conclusion, 5 out of 6 brands of cigarettes handmade from fine-cut tobacco delivered significantly more tar, nicotine, and carbon monoxide per cigarette or per litre than did the identically named manufactured brand.

Another study by Rickert et al,[21] worked on Side stream smoke yields for 15 brands of cigarettes which were determined under conditions where mainstream yields were approximately equal to those used for determining the values which appear on packages of Canadian cigarettes. The study indicated that side stream yields of tar, nicotine, and carbon monoxide were much higher than mainstream yields for all brands tested. The average side stream-to-mainstream ratios for the 15 brands were 3.5, 6.6, and 6.8 for tar, nicotine, and carbon monoxide, respectively. The highest yields of side stream were obtained from the brands with the lowest mainstream yields.

Finally, Stephens,[22] estimated the extent to which tar, nicotine and carbon monoxide (TNCO) yields are dependent on cigarette design features such as burn rate, filter ventilation and paper porosity, and to consider the implications for human exposure and the regulation of TNCO emissions. Findings from this study indicated that Filter ventilation is the dominant control on measured TNCO emissions, but other factors including burn rate, amount of tobacco and paper porosity also contribute. Yields are predictable with reasonable accuracy and precision using only measured physical parameters. The study also concluded that Surrogate exposure indicators suggest that filter ventilation does not lead to any reduction

in exposure and that highly ventilated (low-yield) brands may actually increase exposure to the more volatile toxins.

5. Public Health Implications of Tobacco Cigarette Use in Nigeria

The public health impacts of tobacco cigarette use are well-documented. The World Health Organization (WHO) estimates that there will be more than 8 million tobacco-related deaths a year by 2030, amounting to 10% of annual deaths worldwide[23]. The impact that tobacco has on health & environment is less well recognized. The WHO Framework Convention on Tobacco Control (FCTC) addresses the health & environmental concerns regarding tobacco in Article 18, which states that:

"In carrying out their obligations under this Convention, the Parties agree to have due regard to the protection of the environment and the health of persons in relation to the environment in respect of tobacco cultivation and manufacture within their respective territories."

In response, a series of policy options and recommendations were agreed at the sixth Conference of the Parties to the FCTC in 2014[24]. The meeting identified key sources of environmental concern and recommended health & environmental impact studies on tobacco usage & growing[24]. Given the environmental and health concerns associated with tobacco cigarette, the FCTC also addresses the need for alternative livelihoods for tobacco users.

The health impacts of tobacco smoke exposure include lung cancer, cardiovascular disease and pulmonary disease[25]. Exposure to residual chemicals in environments where smoking takes place may also have human health impacts, though these impacts have not yet been quantified[26]. Cigarettes smoking remain an important cause of accidental fires and resulting deaths. In the United Kingdom of Great Britain and Northern Ireland, cigarettes caused 7% of fires in 2013-2014, making them the single most important cause of deaths related to fires (34 deaths/1000 fires)[27]. In the United States of America, cigarettes have been responsible for 8-10% of all fires over the past 10 years (on average 90 000 fires per year); they also remain the single most important cause of deaths related to fires (540 of 2855 total deaths in 2011)[28]. These fires were responsible for 621 million United States dollars in direct property damage and 1640 civilian injuries. Regulations requiring cigarettes to self-extinguish in Canada and the USA were associated with a 30% decline in fire-related deaths from 2003 to 2011[29].

Tobacco smoking is a growing public health problem in Nigeria and other developing countries. The health hazards of smoking are well documented, and prevention of smoking has been described as the single greatest opportunity for preventing non-communicable disease in the world today[30]. A report by Ebirim et al,[31] indicated the increasing prevalence of cigarette smoking among Nigeria adolescents and in future will translate to increase in morbidity and mortality if nothing is done to curb it. They also indicated that Health problems have proved to be a good reason for not smoking by never smoked adolescents which means that health education in schools will to a reasonable extent reduce the prevalence of cigarette smoking among adolescents. Another study by Adeniyi et al,[32] indicated that the level of awareness of the adverse effects of tobacco smoking in Nigeria was low and varied by region and socioeconomic development. This presents a potential point of intervention through targeted health educational campaigns to change behaviour among smokers. They concluded that among smokers in Nigeria, there is a gross lack of knowledge of the health consequences of smoking, particularly of cancers other than that affecting the lungs. A 2009 study by Hussain et al,[5] reported a negative relationship between smoking and military performance. It also indicated the high level of smoking among soldiers despite their knowledge of its health hazards. Further findings revealed the need for continuous anti-smoking programmes to be established by the medical authority in the Nigerian Army to sensitize personnel on the dangers of cigarette smoking.

6. Conclusion

Findings from this review indicated that most individuals especially the adolescent in Nigeria have knowledge about the health setback of cigarette smoking. The development of more responsive policies and time to time sensitization of the health negative effects of cigarette smoking at institutional levels would be a panacea to curving the menace.

Given the public health importance, further studies can be undertaken so as to enable more robust and comprehensive exploration in order to deepen some of these emergent findings as well as to determine specific barriers preventing the implementation of existing policies which have the potential stop the use of tobacco cigarette. Also, it is critical to have strong, appropriately empowered, and well-funded national drug regulatory agencies and Nigeria.

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