Research Paper
Investigating the Microbial Contamination of Unpackaged Cigarettes (Bulk) in Bandar Abbas City, Iran

Valli Alipour1, 2, Somayeh Dehghani1, Leila Rezaei1, Sogand Jabari4, Amin Qanbaranjad5, Farshid Soleimani1*, Gholamali Javdan6, Abdoljabbar Zakeri7
1. Department of Environmental Health Engineering, Faculty of Health, Hormozgan University of Medical Sciences, Bandar Abbas, Iran.
2. Tobacco and Health Research Centre, Hormozgan University of Medical Sciences, Bandar Abbas, Iran.
3. Department of Environmental and Occupational Health, Vice President of Health Hormozgan University of Medical Sciences, Bandar Abbas, Iran.
4. Department of Environmental and Occupational Health, Faculty of Health, Tarbiat Modares University, Tehran, Iran.
5. Department of Public Health, Social Determinants in Health Promotion Research Center, School of Health, Research Institute for Health, Hormozgan University of Medical Sciences, Bandar Abbas, Iran.
6. Food Health Research Center, Hormozgan University of Medical Sciences, Bandar Abbas, Iran.
7. Infectious and Tropical Diseases Research Center, Hormozgan Health Institute, Hormozgan University of Medical Sciences, Bandar Abbas, Iran.
8. Social Determinants in Health Promotion Research Center, Hormozgan Health Institute, Hormozgan, University of Medical Sciences, Bandar Abbas Iran.

Background: Cigarette contamination due to contact with contaminated hands is one of the problems of bulk cigarette distribution. This study was conducted to investigate the microbial contamination of unpackaged cigarettes in Bandar Abbas City, Iran.

Materials and Methods: This study was conducted among various distributors of bulk cigarettes (peddlers, stalls, and supermarkets) in Bandar Abbas City. Cigarette samples were dried, and the microbial quality of their filter was evaluated by Ultrasound U microbial load measuring device. To express the index of microbial contamination, based on the defined scale of the device, RLUs (relative light units) ≤10 indicate cleanliness, 11 to 29 denote the warning level, and ≥30 signify contamination.

Results: Our results showed that 26.9% of cigarettes were sold by vendors, 65.4% by stalls, and 7.7% by supermarkets. The prevalence rates of microbial contamination in standard packaged and unpackaged (bulk) cigarettes were 2.3% and 46.2%, respectively. Among the examined samples, 17.3% were clean, 36.5% were contaminated at the warning level, and 46.2% were contaminated. The percentages of contaminated cigarettes sold by vendors, stalls, and supermarkets were 50%, 47.1%, and 25%, respectively.

Conclusion: The results of this study underscore microbial contamination as another side risk that can be transferred directly from the hands of the supplier to the mouth of the consumer. The intensity of contamination was different based on the place of supply (sales units). Therefore, more attention should be paid to the organization of distribution units of these products.

Article info:
Received: 05 Mar 2023
Accepted: 26 Apr 2023
Available Online: 01 Sep 2023

Keywords:
Microbial contamination,
Unpackaged cigarettes,
Tobacco, Bandar Abbas

* Corresponding Author:
Farshid Soleimani, Assistant Professor.
Address: Department of Environmental Health Engineering, Faculty of Health, Hormozgan University of Medical Sciences, Bandar Abbas, Iran.
Tel: +98 (79)19916753
E-mail: Fsoleimani72@yahoo.com
Introduction

The use of tobacco products is one of the effective factors in the occurrence of deaths and a serious threat to health [1-7]. About one billion smokers worldwide are predicted to reach two billion by 2030 [2]. The prevalence of smoking in the world is about 22%, and in Iran 17.4% [8]. The results of a study on the students of Hormozgan University of Medical Sciences, Bandar Abas City, Iran, showed that 20.5% of students had experienced cigarette and hookah smoking [9].

Tobacco products can contain various chemicals, including heavy metals [10], pesticides [11], polycyclic aromatic hydrocarbons (PAHs) [12], and nicotine [13, 14]. The microbiological content of tobacco products has also been investigated in limited studies [15]. Cigarette tobacco may contain bacteria, fungal spores, and microbial toxins [16]. Larsson et al. reported that the amount of endotoxin in tobacco is comparable to other agricultural products [15]. Also, mesophilic bacteria were dominant in fresh and processed tobacco [15]. The Eaton et al. study identified Mycobacterium avium in tobacco, cigarette paper, and cigarette filters [17]. These bacteria were also observed in cigarette filters after smoking, which shows that microorganisms can survive exposure to gas and high temperatures caused by cigarette combustion [17]. Cigarette filters are neither sterile nor resistant to small organisms such as bacteria [18]. Approximately 95% of cigarette filters are made of cellulose acetate, a suitable substrate for microbial colonization [19].

Smoking and distribution of tobacco products are major risk factors in contracting oral and dental diseases such as oral cancer and periodontitis (serious gum infection). Various factors, including economic, cultural, and social conditions, can impact bulk distribution of cigarettes. One of the problems in this process is the contamination of cigarettes due to contact with infected hands during delivery to the customer. The cigarette filter is the most exposed part of the cigarette. Hence, the contamination of the filter is high, leading to the transfer of contamination to the mouth of the consumer. To the best of our knowledge, no study has been conducted on evaluating microbial contamination of bulk cigarettes sold in local markets. This study is the first to investigate cigarette filters’ microbial load. In particular, we evaluated the microbial contamination of cigarettes sold in bulk in Bandar Abbas City in 2022.

Materials and Methods

This descriptive-analytical study was conducted in Bandar Abbas City in 2022. The block sampling method consisted of three blocks (peddlers, stalls, and supermarkets), and different neighborhoods of Bandar Abbas City formed the clusters of this sampling. For sampling, Bandar Abbas City was divided into distinct neighborhoods: the upper part of the city, the lower part of the city, and the center of the city. Then, the cigarette samples were collected from different cigarette distribution centers (peddlers, stalls, and supermarkets). Microbial load was measured by Ultersnap U device. The measuring unit of this device is RLU (relative light unit), indicating the amount of microbial load. To measure the microbial load, the swab was drawn on the cigarette filter in a circular manner. Next, the swab was activated by breaking the capsule and combining the luciferase enzyme inside with adenosine triphosphate molecules of the microorganism and putting it in the device immediately to read the microbial load. In addition, the results from bulk cigarettes were compared with cigarettes packaged under sterile conditions to ensure the source of contamination. The microbial load levels were divided into three parts based on the instructions in the device purchase catalog: the RLUs ≤10 indicate cleanliness, 11 to 29 denote the warning level, and the values ≥30 indicate contamination. Data analysis was done using SPSS software, version 26.

Results

The demographic characteristics of the participants are presented in Table 1. The Mean±SD age of the participants was 37.09±12.77 years. Among the participants, 18(10.59%) were women and 154(89.41%) were men. Also, most participants (41.87%) had less than a diploma education level. Among the participants, 33.73% distributed cigarettes in supermarkets, 31.39% in stalls, and 37.88% in peddlers.

The contamination load of cigarettes by distribution units is presented in Table 2. In supermarkets, 38.41% of samples were clean, 46.55% contaminated at the warning level, and 12.07% contaminated. Regarding stalls, 31.48% were clean, 33.33% at the warning level and 35.19% contaminated. In peddlers’ samples, 33.33% of cigarettes were clean, 46.67% at the warning level, and 12% contaminated. Among all the examined samples, 35.46% were clean, 42.44% at the warning level, and 22.10% contaminated (Figure 1).
Discussion

To the best of our knowledge, this is the first study conducted on the microbial contamination of unpackaged (bulk) cigarettes. Our study focused on the microbial contamination of unpackaged cigarettes in Bandar Abbas City, Iran. Microbial contamination of cigarette filters, which are placed in the oral cavity for a long time, can threaten consumers’ health, especially for people with immune deficiencies. Microbial contamination of tobacco products in the processing and post-processing may affect consumers’ health due to their pathogenic potential. Developing microbial metabolic by-products, including microbial toxins and carcinogens, maybe an extra potential risk related to microbial contamination [20].

The bacteriological examination of smokeless tobacco products in Delhi showed microbial load compared to established guidelines for microbiological food safety given for various food products, and the most common bacteria isolated were Pseudomonas aeruginosa and Streptococcus faecalis [20]. In another study, mesophilic bacteria dominated in both fresh and cured tobacco leaves [15]. Microbial constituents of the cigarette may be inhaled during smoking and settle in the lung and or oral cavity, directly impacting the health of the smokers [21]. Today, there is concern about the potential health risks associated with the presence of different microbial communities in cigarettes and other tobacco products available in the market. The national tobacco control policy or regulatory authorities have not addressed this critical issue. In this study, the microbial content was only evaluated, and the presence of bacteria was not differentially evaluated. Future studies with more brands and samples and advanced techniques for specific/differential identification of microbial content are highly suggested.

Table 1. Demographic characteristics of participants (n=172)

<table>
<thead>
<tr>
<th>Variables</th>
<th>No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Women</td>
<td>18(10.59)</td>
</tr>
<tr>
<td>Men</td>
<td>154(89.41)</td>
</tr>
<tr>
<td>Illiterate</td>
<td>12(6.97)</td>
</tr>
<tr>
<td>Less than a diploma</td>
<td>72(41.87)</td>
</tr>
<tr>
<td>Diploma</td>
<td>52(30.24)</td>
</tr>
<tr>
<td>Associate degree</td>
<td>18(10.46)</td>
</tr>
<tr>
<td>Bachelor</td>
<td>18(10.46)</td>
</tr>
<tr>
<td>Supermarkets</td>
<td>58(33.73)</td>
</tr>
<tr>
<td>Stalls</td>
<td>54(31.39)</td>
</tr>
<tr>
<td>Peddlers</td>
<td>60(34.88)</td>
</tr>
</tbody>
</table>

Table 2. Microbial contamination levels of cigarette samples according to the units of distribution

<table>
<thead>
<tr>
<th>Units of Distribution</th>
<th>Clean</th>
<th>Warning Level</th>
<th>Contaminated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supermarkets</td>
<td>24(41.38)</td>
<td>27(46.55)</td>
<td>7(12.07)</td>
</tr>
<tr>
<td>Stalls</td>
<td>17(31.48)</td>
<td>18(33.33)</td>
<td>19(35.19)</td>
</tr>
<tr>
<td>Peddlers</td>
<td>20(33.33)</td>
<td>28(46.67)</td>
<td>12(20)</td>
</tr>
<tr>
<td>Total</td>
<td>61(35.46)</td>
<td>73(42.44)</td>
<td>38(22.10)</td>
</tr>
</tbody>
</table>
Conclusion

This study was conducted to understand the microbial communities of unpackaged (bulk) cigarettes. Among all examined samples, 35.46% were clean, 42.44% at the warning level, and 22.10% contaminated. One of the potential risks for consumers is the microbial contamination of cigarettes with pathogenic or opportunistic microorganisms and the exacerbation of infectious diseases. Cigarette products are usually in bulk and come in direct contact with the hands of suppliers/smokers. This condition is hazardous because microbial-contaminated cigarette users could also be exposed to biological pathogens in addition to inhaling harmful chemicals. However, this study was conducted for the first time in Iran without a research background. Therefore, many factors in this topic may have been overlooked. Due to the lack of regulation for the distribution of cigarettes in the market, users, especially those with immune deficiencies, may be exposed to more health risk factors. Finally, differential diagnosis tests and even molecular diagnosis of microbial communities are strongly suggested in future studies.

Ethical Considerations

Compliance with ethical guidelines

This research was approved by Hormozgan University of Medical Sciences (Code: IR.HUMS.REC.1401.345).

Funding

This research was supported by the research project, funded by the Hormozgan University of Medical Sciences.

Authors' contributions

Conceptualization and supervision: Vali Alipour and Farshid Soleimani; Methodology: Vali Alipour, Somayyeh Dehghani, Ghomamali Javdan and Abdoljabbar Zakeri; Data collection: Leila Rezaei and Sogand Jabari; Data analysis: Amin Qanbaranjad and Sogand Jabari; Funding acquisition and resources: Vali Alipour; Investigation and writing: All authors.

Conflict of interest

The authors declared no conflict of interest.

Acknowledgments

The authors thank the Hormozgan University of Medical Sciences for their financial support.

References


