

## Assessment of toxic levels of Toxic Heavy-metals.Contaminants in Marketed Molasses (tobacco) at Baghdad

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### ABSTRACT

This a cross-sectional random sample analysis study. The aim of study is to detect the levels of the toxic heavy-metals those commonly found in the samples of Molasses) tobacco) being sold in the local markets of Baghdad city. In the research we have randomly collected 20 sample of molasses (tobacco) from the local markets of Baghdad city to determine the levels of heavy-metals lead, cadmium, chromium, nickel and cobalt (Pb, Cd, Cr, Ni, and Co) in molasses (tobacco) using Atomic Absorption Spectrophotometer (AA7000) Shimadzu, in laboratory of Market Research Center and Consumer Protection/ University, Baghdad. The highest concentration for Pb, Cd, Cr, Ni and Co were 0.75ppm, 0.08ppm, 0.05ppm, 0.06ppm and 0.07ppm respectively; and the lowest concentrations for Pb, Cd, Cr, Ni and Co were 0.11ppm, 0.01ppm, 0.01ppm, 0.02ppm and 0.02ppm respectively. Therefore it can be concluded that, as per the Iraqi Standards No. 1652, 1991 Guidelines, the toxic-levels of heavy-metals found in these randomly collected samples were below the recommended toxic-levels. The limitations of this study is - very small number of samples and the actual health-related outcomes in the molasses (tobacco) consumers have not been included in this study.

**Keywords:** heavy; metals; Pb; Cd; Cr; Ni; Co.

### INTRODUCTION

The use of the water pipe (also known as hubbly bubbly, shisha, narghile or hookah pipe) started as a cultural phenomenon.<sup>1</sup> Today the use of the water pipe has become a social phenomenon on as with cigarette smoking, with hookah bars, cafes and restaurants becoming popular social gathering places for young smokers and their friends.<sup>2</sup> One of the reasons for the popularity of the water pipe is the social availability and accessibility of both the water pipe and the tobacco used<sup>3</sup>. Furthermore, water pipe use is widely viewed as a safer alternative to cigarette smoking rather than a potential health risk.<sup>4</sup> Water pipe smoke contains significantly higher quantities of toxic heavy metals such as arsenic, nickel, cobalt, chromium, lead as compared with cigarette smoke.<sup>5</sup> Research has indicated that the relationship between water pipe use and consumer risk is dose-response related.<sup>6</sup> The health effects of the water pipe are under-studied, but users believe that as smoke is drawn through water, the filtration process removes dangerous particles in the smoke, and users would therefore consider water pipe smoking as a safer alternative to smoking cigarettes.<sup>7,8</sup> The aim of this study

to determine the inorganic contaminants (Pb, Cd, Cr, Co, Ni) in different type of Molasses) tobacco) by atomic absorption spectrophotometer.

### MATERIAL AND METHODS

This a cross-sectional random sample analysis study. The aim of study is to detect the levels of the toxic heavy-metals those commonly found in the samples of Molasses) tobacco) being sold in the local markets of Baghdad city. In the research we have collected 20 sample of molasses being commonly sold in the local markets of Baghdad city to determine the levels of toxic most commonly encountered heavy-metals, e.g. lead, cadmium, chromium, nickel and cobalt (Pb, Cd, Cr, Ni, and Co) in molasses (tobacco). The method used is Atomic absorption spectrophotometer (AA7000), Shimadzu in laboratory of Market Research Center and Consumer Protection/University, Baghdad. The standard solutions were prepared using Pb, Cd, Cr, Ni and Co from standards solution stock 1000 ppm (Merck). Deionizer distilled water was used as control solution. The control

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and the standard solutions were used for the calibration of the Atomic Absorption Spectrophotometer (AA-7000) [10]. The heavy-metals levels detected in the test samples were tabulated systematically and their concentration

was analyzed thereof. For reference, toxic-chemical ingredients, the Consumer information & statutory details of all samples have been enlisted in tabular format as shown in the Table 1 & 2.

**Table 1:** Shows a Comparative note of the toxic-chemical ingredients found in Hookah smoke and cigarette-smoke<sup>5</sup>

Chemical	Yield from 1gm hookah tobacco	Yield from cigarette smoke 1gm tobacco	Multiple of average cigarette smoke value
Tar/mg	802	Range:1-27 Average:11.2	100-fold
Nicotine/mg	2.96	Range:0.1-2 Average:0.77	4-fold
CO/mg	143	Range:1-22 Average:12.6	11-fold
PAH phenanthrene, µg (co-carcinogen)	0.478	0.2-0.4	2.5-fold
Fluranthracene, µg (co- carcinogen)	0.221	0.009-0.099	4-fold
Chrysene, µg (tumor initiator)	0.112	0.004-0.041	5-fold

## RESULTS

The results obtained by the Atomic absorption spectrophotometer (AA7000) are extrapolated as shown in the Table 3. The results indicated that the highest concentration for Pb 0.75ppm, Cd 0.08ppm, Cr 0.05ppm, Ni 0.06ppm and Co 0.07ppm, however the lowest concentration for Pb 0.11ppm, Cd 0.01ppm, Cr 0.01ppm, Ni 0.02ppm and Co 0.02ppm. And the Iraqi standard No. 1652 for the year 1991 that the sample is free of toxic substances and harmful substances and that this material is of heavy elements.

## DISCUSSION

In the present study, cadmium, lead, Chromium, nickel and cobalt were determined in various brand of molasses. From the results, the toxic metals were present in high quantities. It is feared how-ever that the continuous use of shisha products contaminated with such heavy metals may however cause release of these metals into the human body and cause harmful effects to the consumers over time. However, there are studies

which suggest that the level of the nicotine does not change when the smoke is filtered<sup>9,10</sup>. The water pipe could be considered to be a health risk due to the presence of nicotine and toxic heavy metals in the smoke of the water pipe. Studies suggest that smoking the water pipe has long-term health effects which include cancer<sup>11,12</sup>, respiratory health issues.<sup>13</sup>, acute increased heart rate and systolic and diastolic blood pressure<sup>14</sup>. Besides the smoke of the water pipe being a health risk owing to tobacco use, additional health risks have been noted in studies. Sharing a water pipe is a contributing factor to the spreading of tuberculosis, mononucleosis, viruses and bacteria when an infected individual shares a mouthpiece with non-infected individuals because of the transmission of oral secretions.<sup>15</sup> The humid closed hose may act as a source of tuberculosis infection among water pipe users and the common use of one water pipe amongst a group of users<sup>16</sup>. Poor sanitation, inadequate cleaning of the water pipe and lack of public health oversight contribute to the spread of infectious diseases. In addition, hookah bars are not required to sterilize or replace the water pipe mouthpieces after use<sup>15</sup>. Prevalence studies suggest that water pipe use

amongst school children in Middle Eastern countries and among university student groups of Middle Eastern descent in Western countries have the highest rates<sup>2</sup>. In addition, the use of the water pipe often takes place during social activities between family members and friends, in and out of the home. Smoking the water pipe predicts regular and increased cigarette smoking<sup>15</sup>. Research focusing on the water pipe in South Africa is limited. To our knowledge, only two studies focusing on the water pipe have been conducted in South Africa. The first study focused on secondary school learners in a disadvantaged community in Johannesburg. The results indicated that 60% of participants used the water pipe, which included 20% daily use<sup>17</sup>. The second study focused on university medical students in Pretoria. The prevalence of water pipe use was 18.6%. The results suggested that South African medical students used alternative tobacco products and this could be considered to be part of a pattern of risk-taking behavior<sup>10</sup>. According to the results of the South African Youth Risk Behavior Survey 2008 conducted by the Medical Research Council<sup>7</sup>, the Western Cape Province (36.7%) has a significantly higher prevalence of current tobacco smoking and current frequent tobacco smoking (14.6%) than the national average of 21.0% and 5.8% respectively. Although the South African government has implemented legislative action to discourage tobacco use by increasing taxation and banning advertising, tobacco consumption still remains a public health concern.<sup>18,19</sup> The South African Tobacco Control policy prohibits tobacco smoking in public spaces, but prohibiting water pipe smoking has not been affected. Although, studies provide sufficient evidence that water pipe use is a potential health risk, young people in South Africa may not necessarily be aware of the health risks of smoking the water pipe.

#### *What are Water-pipes?*

Water pipes, also known as shish, hookahs, narghiles, or hubble-bubble pipes have long been used for smoking tobacco in the Middle East and parts of Africa and Asia, and are now increasingly used in Western countries. Water pipes can be used to smoke a number of substances. Whilst they are largely used to smoke tobacco, which may be flavored with fruits or sugar syrup, herbal mixtures are also commonly used. Although the latter do not

contain tobacco or nicotine, the negative health effects of smoking herbal shisha are similar to smoking tobacco shisha, as both involve burning charcoal and inhaling the smoke. Water pipes generally consist of a head, body, water bowl and a hose. A tobacco or herbal mixture is placed on top of the head and this is often covered with perforated aluminum foil. Burning charcoal is placed on top of the foil. On breathing in through the hose, a mixture of the coal and smoke is drawn down through the body of the apparatus and into the bowl of water. This causes a vacuum in the air space above the water, resulting in smoke passing through the water, producing bubbles and into the hose and finally the mouth of the user. Disposable mouthpieces may be attached to the end of the hose to reduce the risk of infection. The size of the water pipe, number of hoses and other features may vary<sup>20</sup>. Tobacco smoke contains over 4000 chemicals in the form of particles and gases<sup>21</sup>. Many potentially toxic gases are present in higher concentrations in side stream smoke than in mainstream smoke and nearly 85% of the smoke in a room results from side stream smoke<sup>22</sup>. The particulate phase includes tar (itself composed of many chemicals), nicotine, benzene and benzo (a) pyrene. The gas phase includes carbon monoxide, ammonia, dimethylnitrosamine, formaldehyde, hydrogen cyanide and acrolein. Some of these have marked irritant properties and some 60 are known or suspected carcinogens (cancer causing substances).

#### *What is in Hookah Smoke?*

During the last 40 years of research, nearly 4,800 chemical compounds have been identified in cigarette smoke, including 69 carcinogens<sup>23</sup>. In contrast, only five studies have been published in English on the chemical composition of hookah smoke, and those focused on only a relatively small number of chemical compounds<sup>24,25</sup>. Combustion chemistries involved in the production of mainstream cigarette smoke and mainstream hookah smoke differ due to widely different combustion temperatures and the dry or humid characteristics of tobacco. In both cases, plant-derived organic matter undergoes pyrolysis or volatilization, producing addictive nicotine as well as a number of the same toxicants from combustion. These include carbon monoxide, tar and myriad carcinogenic polycyclic

aromatic hydrocarbons .also hookah smoke contains significantly higher quantities of toxic heavy metals like arsenic, nickel, cobalt, chromium, lead<sup>26</sup> and cadmium<sup>27</sup>. As compared with cigarette smoke<sup>28</sup>. These facts about hookah smoke are a screaming warning that hookah smoking is harmful. In a carefully designed recent study, researchers used a smoking machine that replicated the puffing mechanics derived from precise measurements of 52 hookah smokers in Lebanon<sup>25</sup>. It carried out stringently controlled quantitative chemical analyses of hookah smoke. They found that hookah smoke produced nearly two orders of magnitude greater amount of tar from a single smoking session than that produced from a single cigarette. Simply put, hookah smoke produces nearly 100 times more tar than cigarette smoke, for each gram of the respective tobaccos. (Table 1) shows that hookah smoke contains several-fold greater quantities of harmful chemicals thus far studied than found in cigarette smoke. In light of these recent chemical data on selected constituents of hookah smoke as compared with those of mainstream cigarette smoke, hookah smoke of various fruity flavors, tastes, and aromas may be even more harmful than disease-causing cigarette tobacco smoke.

#### *Addictive Hookah smoking*

Hookah smoking is an efficient nicotine delivery system. After a 45-minute hookah smoking session, the concentrations of nicotine and its longer-lived metabolic product, nicotine, become significantly elevated in saliva, plasma, and urine<sup>29</sup>. Comparison of urinary levels of nicotine between hookah smokers and cigarette smokers suggests that in a single hookah smoking session using 20 grams of hookah tobacco, the hookah smoker is exposed to several-fold greater quantities of the addictive stimulant nicotine for up to 45 to 60 minutes. That is equivalent to chain-smoking 15 cigarettes.<sup>30</sup> A cross sectional study on hookah smokers from 112 restaurants and cafes in Aleppo, Syria, reported that 96% of weekly hookah smokers and 50% of daily hookah smokers did not smoke cigarettes<sup>31</sup>. This survey found that 91% of weekly hookah smokers and 51% of daily hookah smokers did not have the will to quit, which highlights the addictive nature of hookah smoking<sup>2</sup> among myriad factors<sup>32</sup>.

#### *Heavy-metals*

Considering, not only active smoking but even passive smoking, it was early recalled that WHO warned that second-hand smoke from water pipes poses a serious risk for non-smokers<sup>33</sup>. Interestingly, the underpinning reference states that the higher content of heavy metals in water pipe smoke compared to cigarettes may also have adverse health effects on exposed non-smokers<sup>34</sup>. However, no study on heavy metals in hookah ETS has been identified so far, at least for those for which concern was raised: namely lead, chromium, cobalt, nickel, beryllium and arsenic. As for the source of heavy metals that could be found in hookah MSSS, it is doubtful and results from different studies are contradictory<sup>35</sup>. Indeed, in Saudi Arabia, researchers determined by atomic absorption that out of 14.685 mg (heavy) metals present in 1 g of the jurak paste, only 3.075 µg were transferred to the smoker<sup>36</sup>. In an unpublished report about an experiment conducted in Russia, arsenic was not detected. As for the potential intake by exposed non-smokers, the case of cadmium is more documented. Scherer et al. measured an active/passive ratio of cadmium varying between 110 and 1,500 (1.5 µg / 0.001 µg-0.014 µg) [Table 3]<sup>37</sup>. In India, an association was found between tobacco smoking habits of male and female rural subjects using hookah and increased Cd levels in hair and nails<sup>38</sup>. However, possible confounding factors (simultaneous use of cigarettes or bides, pollution, diet, etc.) have not been excluded.<sup>39,40</sup>

#### **CONCLUSION**

On comparing and analysis with the Iraqi Standards No. 1652, 1991 Guidelines for the toxic-levels of common heavy-metals in the marketed samples of molasses/tobacco are below the recommended toxic-levels. As the actual health-related issues of smoking piped molasses (tobacco) by the consumers have not been included in this study, further studies may be done having sufficient number of samples along with considering the actual health-outcomes of the consumers.

**Table 2:** This study was about 20 type of molasses

No	Name/made	Flavor	Warning	Tar/mg	Nicotine/mg	Expiry/year	Contents
1	Alamasi/Jordan	Orange fusion	Smoking is the main cause of lung cancer, disease of heart and arteries	0.00	0.05	2	Tobacco, honey, glycerine, flavor
2	Alamasi/Jordan	(sultani) lemon & mint	Smoking is the main cause of lung cancer, disease of heart and arteries	0.00	0.05	2	Tobacco, honey, glycerine, flavor
3	Alamasi/Jordan	Apple ice	Smoking is the main cause of lung cancer, disease of heart and arteries	0.00	0.05	2	Tobacco, honey, glycerine, flavor
4	Alfakher/ajman-U.A.E	Strawberry with cream	Smoking is the main cause of lung cancer, disease of heart and arteries	0.00	0.05	2	Tobacco, molasses, glycerine, natural flavor
5	Alfakher/ajman-U.A.E	Two apples	Smoking is the main cause of lung cancer, disease of heart and arteries	0.00	0.05	2	Tobacco, molasses, glycerine, natural flavor
6	Alfakher/ajman-U.A.E	Gum	Smoking is the main cause of lung cancer, disease of heart and arteries	0.00	0.05	2	Tobacco, molasses, glycerine, natural flavor
7	Alfakher/ajman-U.A.E	Cocktail	Smoking is the main cause of lung cancer, disease of heart and arteries	0.00	0.05	2	Tobacco, molasses, glycerine, natural flavor
8	Mazaya / French tobacco / jordan	Natural cool lemon	Smoking is the main cause of lung cancer, disease of heart and arteries	0.00	0.05	2	Tobacco, molasses, glycerine, natural flavor
9	Mazaya / French tobacco / jordan	Natural gum with mint	Smoking is the main cause of lung cancer, disease of heart and arteries	0.00	0.05	2	Tobacco, molasses, glycerine, natural flavor
10	Mazaya / French tobacco / jordan	Natural black grape	Smoking is the main cause of lung cancer, disease of heart and arteries	0.00	0.05	2	Tobacco, honey, glycerine, flavor
11	Mazaya / French tobacco / jordan	Natural grape with mint	Smoking is the main cause of lung cancer, disease of heart and arteries	0.00	0.05	2	Tobacco, honey, glycerine, flavor
12	Mazaya / French tobacco / jordan	Natural four seasons	Smoking is the main cause of lung cancer, disease of heart and arteries	0.00	0.05	2	Tobacco, honey, glycerine, flavour
13	Mazaya / French tobacco / jordan	Natural choco coco	Smoking is the main cause of lung cancer, disease of heart and arteries	0.00	0.05	2	Tobacco, molasses, glycerine, natural flavor
14	Mazaya / French tobacco / jordan	Natural kiwi lemon	Smoking is the main cause of lung cancer, disease of heart and arteries	0.00	0.05	2	Tobacco, molasses, glycerine, natural flavor
15	Mazaya / French tobacco / jordan	Natural gum	Smoking is the main cause of lung cancer, disease of heart and arteries	0.00	0.05	2	Tobacco, molasses, glycerine, natural flavor
16	Mazaya / French tobacco / jordan	Natural gum with cherry	Smoking is the main cause of lung cancer, disease of heart and arteries	0.00	0.05	2	Tobacco, molasses, glycerine, natural flavor
17	Alamasi/Jordan	Watermelon & mint (code 51)	Smoking is the main cause of lung cancer, disease of heart and arteries	0.00	0.05	2	Tobacco, molasses, glycerine, natural flavor
18	Alfakher/ajman-U.A.E	Orange	Smoking is the main cause of lung cancer, disease of heart and arteries	0.00	0.05	2	Tobacco, molasses, glycerine, natural flavor
19	Alfakher/ajman-U.A.E	Strawberry	Smoking is the main cause of lung cancer, disease of heart and arteries	0.00	0.05	2	Tobacco, molasses, glycerine, natural flavor
20	Mazaya / French tobacco / jordan	Natural lemon with mint	Smoking is the main cause of lung cancer, disease of heart and arteries	0.00	0.05	2	Tobacco, molasses, glycerine, natural flavor

**Table 3 :** Shows various Concentrations of the heavy-metals in the samples (n=20)

No	Pb/ppm	Cd/ppm	Cr/ppm	Ni/ppm	Co/ppm
1	0.075	0.025	0.050	0.015	0.030
2	0.100	0.020	0.010	0.020	0.035
3	0.055	0.030	0.010	0.025	0.025
4	0.070	0.025	0.050	0.020	0.030
5	0.105	0.015	0.010	0.015	0.020
6	0.115	0.010	0.015	0.010	0.015
7	0.085	0.010	0.010	0.020	0.020
8	0.090	0.015	0.015	0.020	0.025
9	0.100	0.020	0.010	0.015	0.030
10	0.110	0.015	0.050	0.010	0.015

No	Pb/ppm	Cd/ppm	Cr/ppm	Ni/ppm	Co/ppm
11	0.380	0.040	0.020	0.025	0.030
12	0.170	0.030	0.015	0.030	0.035
13	0.135	0.020	0.010	0.020	0.015
14	0.095	0.010	0.015	0.025	0.020
15	0.105	0.015	0.020	0.020	0.025
16	0.150	0.050	0.010	0.030	0.030
17	0.350	0.040	0.025	0.030	0.035
18	0.175	0.015	0.010	0.020	0.025
19	0.125	0.010	0.015	0.015	0.010
20	0.100	0.015	0.010	0.020	0.020

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