Original article

Comparative Assessment of Total Nicotine Content of the Cigarette Brands Available in Peshawar, Pakistan

Tahira Mahmood*, Mukhtiar Zaman**

Abstract

Tobacco use is high around the globe and Pakistan is no exception. Tobacco products have been implicated in inducing injurious effects to its users. It not only kills but also causes many chronic diseases. Keeping in view the toxic effects associated with tobacco use, a study was undertaken to determine the nicotine and moisture content in randomly selected cigarette brands available in Peshawar, Pakistan.

Twenty-three different cigarette brands; ten Pakistani and thirteen foreign were randomly selected from the 48 brands purchased from shops and subjected to analyses using AOAC (Association of Official Analytical Chemists) method at an ISO 17025 accredited laboratory. It was found that only two out of twenty three brands displayed nicotine content on their packs. Overall the total nicotine content per cigarette in the samples analyzed varied from 5.44 to 17.8mg; whereas the percent nicotine content varied from 1.33 to 1.98.However the percent moisture content varied from 7.2 to 13.4. Results showed that the mean nicotine content for national brands is 12.8mg and for international brands it is 10.57mg. Therefore the nicotine content was higher by 21.57% in the national as compared to international brands. It is proposed that the total nicotine content and tobacco quantity per cigarette should be reduced and displayed on all the packs. The values displayed should be the total nicotine content per cigarette rather than percent nicotine in the cigarette smoke.

Authors Affiliation:

* Dr Tahira Mahmood Assistant Professor National Centre of Excellence in Physical Chemistry, University of Peshawar, Peshawar

** Professor Dr Mukhtiar Zaman, Pulmonology Department Khyber Teaching Hospital Peshawar

Corresponding author: Professor Dr Mukhtiar Zaman, Pulmonology Department Khyber Teaching Hospital Peshawar

Tel: 0092-919216340 E-mail: mza38@hotmail.com

Introduction

Tobacco is the single most preventable cause of death in the world today. This year, tobacco will kill more than five million people – more than tuberculosis, HIV/AIDS and malaria combined. By 2030, the death toll will exceed eight million a year. Unless urgent action is taken tobacco could kill one billion people during this century[1]. More than 80% of the world's tobacco-related deaths will be in low and middle-income countries by 2030 [2]

Almost one billion men (35 percent in developed countries and 50 percent in developing countries) and 250 million women (22 percent of women in developed countries and 9 percent in developing countries) smoke cigarettes [3].

Tobacco use is very common in Pakistan and about 32% men and 5.7% women [1] and 12.4% male and 7.5% female youth [4] use some form of tobacco on a regular basis. The tobacco use is on increase in all ages especially in youth and approximately 58000 million sticks were used in 2005 compared to 22000 million in 1970 and to cope with the demand the production has increased from 22000 to 60000 million sticks from 1970 to 2004. The domestic increase in the tobacco use has resulted in the decrease of export to only 9000 compared to 31000 metric ton export in 1970 [1].

Cigarettes, cigars, and spit and pipe tobacco are made from dried tobacco leaves, as well as ingredients added for flavor and other properties. According to American Cancer Society more than 4,000 individual chemicals have been identified in tobacco and tobacco smoke. Among these are more than 60 chemicals that are known carcinogens[5].

According to the society for Neuroscience [6], in tobacco smoke, nicotine "rides" on small particles of tar .The smoke carries this nicotine/tar mixture to lungs where nicotine is absorbed. Nicotine reaches brain about eight seconds after the smoke is inhaled. Much of the nicotine is burned off and a smoker gets about 9% (1mg of nicotine out of 11mg) of nicotine in every cigarette.

Long term exposure to tobacco and nicotine increases the chances of cancer [7, 8] and results in addiction [9] and dependence. Nicotine is one of the most addicting substances known and quitting it is very difficult. Mark Twain said, 'to cease smoking is the easiest thing I ever did. I ought to know because I have done it a thousand times.'

Smoking causes cancers of lungs, bladder, oral cavity, Pharynx, larynx, esophagus, kidney, pancreas and stomach and causes myeloid leukemia [10].

Cigarette smokers are two to four times more likely to develop coronary heart disease than non smokers [11]. About 90% of all deaths from chronic obstructive lung diseases are attributable to cigarette smoking [10].

Efficacy of Tobacco counseling by health care providers has been analyzed and findings suggest that contact with a health care professional increases cessation [12].

The future of treatment resides in improvement in patient matching to treatment, combination or novel drugs, and viewing nicotine addiction as a chronic disorder that might need long-term treatment [13, 14].

Once the nicotine is determined gravimetrically, it may be reported as

(1) Content (mg) per cigarette,

(2) Nicotine concentration per gram of tobacco, or

(3) Percent nicotine. [15, 16]

To investigate the scope for modifying tobacco products so as to decrease nicotine addiction in Pakistan, we analyzed the nicotine content of manufactured cigarettes and loose cigarette tobacco

Method

Sample Collection

Forty-eight brands of manufactured cigarettes (National and International) were purchased from the markets in Peshawar in March 2006. Out of these twenty-three brands were randomly selected for our study. These included ten national and thirteen international brands. The place of manufacture of the cigarettes was determined from the packs.

Tobacco weights of the cigarettes were based on an average of five cigarettes. For each brand of cigarette tobacco was removed from the wrapping, weighed and pooled for chemical analysis (in triplicate). The reported results are an average of these readings.

Three types of standard reference materials comprising of different blends of tobacco leaves were used as quality control. The nicotine and moisture contents of the reference standards were: I (4-5%, 13-15%); II (1.5-2.5, 9-11%); III (0.5- 1.5%, 7-9%) respectively.

Nicotine content was determined using AOAC Official method for determination of nicotine in tobacco Products [15]. It is a gravimetric method and nicotine was reported as nicotine content (mg) per cigarette as % nicotine concentration.

The nicotine yield of the cigarette smoke was not tested. %Moisture content was also determined using AOAC method [15] The nicotine concentrations in this study are by received or 'wet' weight.

Results

Overall the total nicotine content per cigarette in the samples analyzed varied from 5.44 mg to 17.8 mg. (Tables 1, 2)**.** For national brands the total nicotine content varied from 10.5mg to 17.8mg and for international brands it varied from 5.44mg to 13mg**.** The highest nicotine content was for Cash cigarettes (17.8 mg), which is a plain national cigarette brand. The mean nicotine content for national brands was 12.85mg and for international brands it was 10.57.

The nicotine concentration in manufactured cigarettes was in the range 1.33% to 1.98 % (Tables 1, 2)**.** The highest nicotine concentration was in Cash cigarettes, a local brand (1.98%), whereas Marlboro had the highest nicotine concentration (1.93%) among the international brands. The mean nicotine concentration for national and international bands was almost the same (1.60 and 1.59% respectively).

The effect of moisture content for all the brands studied is shown in figure.

Discussion

The results showed that the nicotine content is higher by 21.57% in the national as compared to the international brands in Pakistan.

The mean nicotine content of the national brands (12.85mg) is much higher than the reported [16] nicotine content of united states manufactured cigarettes (6 to 11mg per

cigarette) and Canadian manufactured cigarettes (9 to 10 mg per cigarette). Among the brands studied the nicotine content of Cash and Press cigarettes is 17.8mg/cigarette and 16mg/cigarette respectively. These are inexpensive brands widely used by the low-income group of the country and their nicotine content is much higher than that of any other brand. One manufacturer's mild cigarette had higher nicotine content than another's hard or regular one. (Pine lights 11.72 mg/cigarette, Morven Gold 11.4mg/cigarette & Gold Flake11.26mg/cigarette). Therefore labeling of cigarettes as mild or extra mild needs to be standardized according to nicotine content and should be same across different brands.

Analysis in one study suggested 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 [17].

Only two out of twenty-three brands in our study displayed nicotine and tar content on their packs. Of these "More" had 0.9mg nicotine and "Esse Menthol" had 0.5 mg nicotine. The values displayed are the percent nicotine in the cigarette smoke rather than the total nicotine content per cigarette. Measurement of nicotine yields using FTC method does not offer smokers meaningful information on the amount of nicotine they will receive from a cigarette [18]. Regular hard pack version of Marlboro has nicotine content of 13.5 mg whereas FTC nicotine rating is 1.1 mg, while 'light' hard pack version has a nicotine content of 13 mg and FTC rating of 0.8 mg[19]. Smokers should not believe that the nicotine levels listed on a pack of cigarettes is what they are actually inhaling.

The nicotine content of a cigarette is an important element in its design[20]. Nicotine content is the amount of nicotine contained in the tobacco before it is burned and inhaled. A smoker extracts the nicotine contained within the tobacco by inhaling nicotine, which is released into the smoke when the tobacco is burned. A cigarette with higher nicotine content has a greater amount of nicotine, which may potentially be extracted by the smoker and inhaled during smoking. Consumers may believe that 'light' and 'ultra-light' cigarettes contain less nicotine than full flavor cigarettes. However, such classifications do not reflect the amount of nicotine in the cigarette; they are based solely on FTC ratings

of nicotine yield, which are based on the amount of nicotine “inhaled” by a smoking machine.

According to 1997 data[20], there were no significant differences in the nicotine content of full flavor, 'light', or 'ultra-light' cigarettes. Whether a cigarette is classified as full flavor, 'light', or 'ultra-light', it is likely to contain similar amounts of nicotine in the unsmoked tobacco.

Perceptions and responses of employees regarding the effects of a Health Warning Label (HWL) on their decision to encourage quitting and stages of change in smoking behavior showed that New-HWL significantly increased attitudes about smoking cessation [21].

Compensation techniques such as vent blocking or taking longer and deeper puffs on a cigarette are used by smokers as means of extracting a greater amount of nicotine than nicotine yield ratings suggest. When a cigarette has a high level of nicotine content, the smoker may be able to extract high levels of nicotine even though smoking cigarettes labeled with lower nicotine yields.

Smokers, who switch to 'lower yield' cigarettes in order to reduce their intake of nicotine, are faced with similar levels of nicotine content in the 'low yield' cigarettes. Rather than reducing their amount of nicotine, they may simply smoke harder and longer on 'light'/'ultra-light' cigarettes in order to achieve the same impact and the same level of nicotine they obtained with 'higher' nicotine yield cigarettes.

The mean nicotine concentration of Pakistani manufactured cigarettes and international brands in our study was almost the same (1.6%). There was little difference in the % nicotine concentration of mild, regular and hard brands.
Depending on their method of smoking, smokers absorb 3 to 40 percent of a cigarette’s nicotine content [16] Much of the nicotine is burned off and a smoker gets about 11% (~1mg of nicotine out of 11 mg) in every cigarette[6] Smokers probably need 5mg of nicotine per day to maintain their addiction, therefore Pakistani smokers can fulfill their

need even if they smoke 5 to 6 cigarettes per day instead of the 15 to 20 cigarettes that they smoke at an average per day currently.

It is believed that if the amount of nicotine in cigarettes were reduced, it would facilitate people smoking less and finding it easier to quit smoking, with little evidence of compensation. Rather than make a dramatic change at once, by providing cigarettes with a nicotine content that was gradually reduced, people had a much easier time quitting smoking. This study supports the idea that if tobacco companies were required to reduce the levels of nicotine in cigarette tobacco, young people who start could avoid becoming addicted, and long-time smokers could reduce or end their smoking. This could spare millions of people from the severe health effects of long-term smoking [22, 23]

Currently the high nicotine content in the available brands is one of the key factors for sustaining the addiction and making it difficult for people to quit. The nicotine content per cigarette should be reduced and consequently exposure of Pakistani smokers to higher levels of addictive and cancer causing substances reduced.

Table 1 Nicotine Content of Pakistani manufactured Cigarettes.

Brand	Av. wt of Tobacco per cigarette (g)	% Nicotine concentration	Nicotine content mg/cigarette
Press	0.94	1.74	16
Red & White	0.727	1.45	10.5
Morven Gold	0.832	1.38	11.4
Capstan International	0.738	1.49	10.99
Park Lane	0.684	1.56	10.7
Wills Gold Flake	0.75	1.50	11.26
Cash	0.899	1.98	17.8
Diplomat	0.863	1.61	13.89
John Player Gold Leaf	0.685	1.95	13.35
Wills	0.836	1.51	12.62

Table 2 Nicotine Content of International Brands.

Brand(Manufacture)	Manufacture/ Make	Av. wt of Tobacco per cigarette (g)	% Nicotine concentration	Nicotine content mg/cigarette
Marlboro	USA	0.688	1.93	13
More	EU	0.7	1.68	11.76
Bensen & Hedges	England	0.696	1.83	12.73
Seven Stars	Japan	0.612	1.55	9.4
555	British American Tobacco	0.675	1.86	12.55
USA Gold Lights	USA	0.681	1.59	10.83
Camel	USA	0.729	1.58	11.51
Mild 88	Korea	0.66	1.35	8.96
Hi Lite Special Mild	USA	0.648	1.38	8.94
Pleasure Lights	Korea	0.681	1.33	9.05
Captain Black Light Cigars	USA	0.819	1.42	11.63
Esse Menthol	Korea	0.363	1.5	5.44
Pine Lights	USA	0.689	1.68	11.72

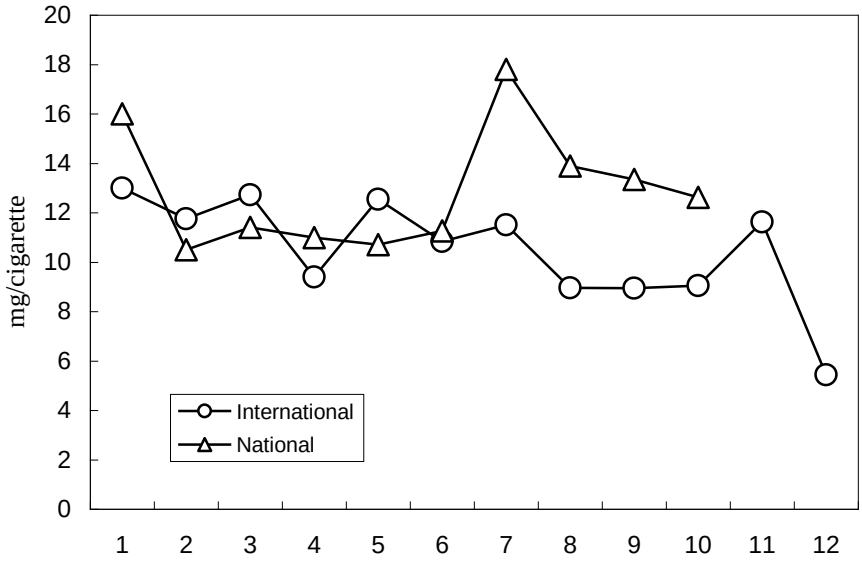

Figure. Comparison of the total nicotine content of national and international manufactured cigarette brands available in Peshawar, Pakistan.

References

1. WHO report on the global tobacco epidemic, 2008; The MPOWER package, 128-131.
2. Mathers CD, Loncar D. Projections of global mortality and burden of disease from 2002 to 2030. PLoS Medicine, 2006; 3(11):e442.
3. Judith Mackay, Michael Erikson. The Tobacco Atlas, World Health Organization, Myriad Editions Limited, UK, 2006. http://www.who.int/tobacco/en/atlas5.pdf).
4. WHO Report on the Global Tobacco Epidemic, implementing smoke-free environments 2009; Page 374.
5. Centers for Disease Control and Prevention (CDC), National Center for Chronic Disease Prevention and Health Promotion. Toxic chemicals in tobacco products. Available at: http://www.cancer.org/docroot/ipg.asp?sitename=Centers+for+Disease+Control+and+Prevention+%28CDC%29&url=http://www.cdc.gov/tobacco/research_data/product/objective21-20.htm**.**
6. Neuroscience for kids. http://faculty.washington.edu/chudler/nic.html
7. Mitsutomi, T. Bunshi kokyukibyo, (Japanese language, ISSN 1342-436X) 1999; 3(5), 313-317.
8. Kassai, H.; Bunshi Kokyukibyo, (Japanese language, ISSN 1342-436X) 1999; 3(5), 318-323.
9. Benowitz, N. L.; Nicotine saf. toxic. 1998; 3-16. Edited by Benowitz, Neal L. Oxford university Press: New York
10. U.S. Department of Health and Human Services. The Health Consequences of Smoking: A Report of the Surgeon General. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, 2004 [cited 2006 Dec 5]. Available from: http://www.cdc.gov/tobacco/data_statistics/sgr/sgr_2004/index.htm.

11. U.S. Department of Health and Human Services. Reducing the Health Consequences of Smoking—25 Years of Progress: A Report of the Surgeon General, Atlanta, GA: U.S. Department of Health and Human Services, CDC; 1989. DHHS Pub. No. (CDC) 89–8411 [cited 2006 Dec 5] http://profiles.nlm.nih.gov/NN/B/B/X/S/.
12. Gorin, S S, Heck J E. Meta analysis of the efficacy of tobacco counseling health care providers. Cancer Epidemiol Biomarkers Prev. 2004; 13(12), 2012-2022.
13. Hatsukami DK, Stead LF, Gupta PC. Tobacco addiction. Lancet. 2008; 371 (9629): 2027-38.
14. Mitrouska I, Bouloukaki I, Siafakas N M. Pharmacological approaches to smoking cessation. Pulm Pharmacol Ther**.**2007; 20(3):220-32.
15. Official Methods of Analysis of AOAC (Association of Official Analytical Chemists) International,2000, volume I, 17th Edition; Editor Dr. William Horwitz, Published by AOAC International, Suite 500, 481 North Frederick Avenue, Gaithersburg, Maryland 20877-2417, USA
16. New Zealand Public Health Report on Nicotine, 1997; 4:34-35.ISSN 11/3-0250.
17. Calafat A. M, Polzin G.M, Saylor J, Richter P, Ashley D.L, Watson C. H. Determination of tar, nicotine, and carbon monoxide yields in the mainstream smoke of selected international cigarettes. Tobacco Control 2004; 13: 45-51.
18. Risks Associated with Smoking Cigarettes with Low Machine Measured Yields of Tar and Nicotine. Monograph on Smoking and Tobacco Control, National cancer Institute (NCI), volume 13.
19. http://archives.drugabuse.gov/meetings/Nicotine/slade.html

20. Keithly L, Cullen D, Land T. Massachusetts Department of Public Health. Change in nicotine yields 1998 – 2004. Chapter 94: Section 307B, 105 CMR 660.000. Available at: http://www.mass.gov/Eeohhs2/docs/dph/tobacco_control/nicotine_yields_1998_2004_report.pdf

21. Silpasuwan P, Yaowaluk N, Viwatwongkasem C, Satitvipawee P, Sirichotiratana N, Sujirarat D. Potential effectiveness of health warning labels among employees in Thailand. J Med Assoc Thai. 2008; 91(4): 551-8.
22. Benowitz NL, Hall SM, Stewart S, Wilson M, Dempsey D, Jacob P 3rd. Nicotine and carcinogen exposure with smoking of progressively reduced nicotine content cigarette. Cancer Epidemiol Biomarkers Prev. 2007, 16(11): 2479-85.
23. Benowitz NL, Dains KM, Hall SM, Stewart S, Wilson M, Dempsey D, Jacob P 3rd. Progressive commercial cigarette yield reduction: biochemical exposure and behavioral assessment. Cancer Epidemiol Biomarkers Prev. 2009, 18(3): 876-83.