



Original Article

The Green Hazards: A Meta-Analysis of Green Tobacco Sickness

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Abstract:

Green Tobacco Sickness (GTS) has been one of the unexplored areas of occupational health safety. The condition mainly affects the tobacco harvesters. The condition is prevalent in Asian and South American tobacco harvesters. Although transient, the condition can affect multiple organ systems. The objective of this review is to extensively discuss the background, epidemiology, clinical features and measures to counter the problem.

A literature search of Medline with terms such as “green”, “tobacco” and “sickness” was done covering years 1970-2007. All studies, reviews and commentaries on health effects of farming green tobacco and preventing the disease were included.

Green Tobacco Sickness is caused by the absorption of nicotine through the skin from wet tobacco plants who have direct contact with tobacco plants during cultivation and harvesting. The early symptoms often include headache and nausea followed by vomiting, weakness, pallor, dizziness, headaches, increased perspiration, chills, abdominal pain, diarrhea, and increased salivation which may also progress to extreme conditions like prostration, shortness of breath, and occasional fluctuations in blood pressure or heart rate. The duration of the illness is usually between one and three days. The use of protective, water-resistant clothing, chemical-resistant gloves, plastic aprons and rainsuits with boots and socks has reduced the chances of contracting GTS.

It is important to educate the tobacco workers and the employers about GTS in order to reduce its incidence. An international level awareness campaign has to be taken up and more stringent workers safety regulations have to be formulated.

Key Words: Green tobacco sickness, harvesters, nicotine, health hazards

Introduction

The health risks associated with smoking tobacco and exposure to second hand smoke are well known, but farming tobacco can also be hazardous to human health. Less well known are the health effects of handling wet tobacco leaves [1]. People who pick the crop can come down with a syndrome called

Green Tobacco Sickness (GTS). GTS is a potential risk to those working with the green tobacco plant. It is a sickness that is not well documented and is often underreported because many of those who experience GTS are not able to interpret their ailment or its cause [2].

GTS is self-limiting and of short duration [3], hence treatment is not always necessary [1]. Despite the relatively short duration of GTS, the illness can be debilitating during its onset and progression. GTS is a form of nicotine poisoning that affects workers who have direct contact with tobacco plants during cultivation

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and harvesting. Symptoms of GTS are similar to those induced by pesticide exposure or heat exhaustion, and to nicotine intoxication experienced by novice smokers [3-6]. Thus, GTS may be misdiagnosed by practitioners unfamiliar with this condition [3-6]. GTS is caused by the absorption of nicotine from wet tobacco plants [3]. It usually occurs several hours after continuous exposure to green tobacco leaves. Nicotine is a water and lipid soluble alkaloid found in tobacco leaves [7] and harvesters who manually collect tobacco leaves absorb nicotine through the skin due to foliar contact [8]. GTS is a threat to those who harvest tobacco because nicotine, being soluble in water [9], can be drawn out of tobacco by rain, dew, or perspiration, and subsequently absorbed through the skin [10,11]. Once nicotine is absorbed, it is distributed throughout the body, including into the brain [1].

The process of cropping tobacco usually consists of pulling and twisting loose green leaves from the plant and collecting them in large bundles that are held either in the hand or underneath the arm and against the body or the entire stalk is removed and the tobacco is typically held in the hand or on the forearm.

The diagnosis of GTS may be made by testing the blood or urine for nicotine (half-life = 3–4 hours) or cotinine (a nicotine metabolite (half-life = 36 hours) that can also be detected in saliva [5]. Studies have reported a substantially higher urinary excretion rate of nicotine and its major metabolite cotinine among different groups of exposed workers, handling all types of tobacco, compared to workers in the control group [12,13]. Although the level of cotinine has been used to distinguish between tobacco users and non-users [10,12,14,15] the level cannot be used to distinguish between heavy tobacco users and persons with GTS, because nicotine/cotinine concentrations that represent toxic levels have not been established [5].

Much of the research on GTS has focused on American tobacco harvesters. Internationally, the effects and prevalence of GTS are not well known. Foreign production of tobacco, however, has increased rapidly in recent years [1]. The largest plantations are located in China, Brazil, India, USA and Malawi. These countries together account for ⅔ of worldwide tobacco production [16].

The objective of this review is to describe the health effects of farming and harvesting tobacco and also to suggest the prevention and risk reduction strategies to avoid contracting Green Tobacco Sickness.

Methods

All population based studies, review articles and commentaries regarding GTS, its health effects and steps in prevention of the disease were included. A comprehensive literature search of Medline with terms “green”, “tobacco” and “sickness” was done covering years 1970-2007. The bibliographies of identified articles were also reviewed for additional studies and commentaries.

Results

Study characteristics

Studies from several countries have confirmed the entity of GTS, which occurs when tobacco workers hand harvest, cut, or load tobacco plants, usually in the early morning or after rainfall when tobacco leaves are covered with moisture [1,5]. The incidence and prevalence of GTS has been described in the United States, India, Japan, Malaysia and Italy [17-19].

Epidemiological data

Using United States and Kentucky Department of Agriculture data, the incidence of GTS was estimated to be 10/1000 workers (or 1%) [5] (Table 1). In 1973, a study in North Carolina estimated a 9% prevalence of GTS, i.e. 5400 of 60 000 workers [3] (Table 1). Younger workers are at higher risk, which means that the prevalence may be even higher in developing economies, where children play a substantial role in harvesting and processing tobacco [1]. In one study, 58% of those suffering GTS were under age 29 and 32% were between 14 and 19 years of age [20] (Table 1). Likewise, it was found that younger people (under age 30) were 3.1 times more likely to develop GTS than older people [5] (Table1). Differences by gender have also been found. Nearly all of those affected by GTS are male (3,12,20). Sex differences are probably due to the fact that women are largely under-represented among tobacco croppers [4].

India is the third country to have reported GTS among tobacco harvesters (10). The beedi industry remains the largest manufacturer of tobacco products in India. Beedis are Indian cigarettes, wrapped in tendu or temburini leaf and secured with a string at one end of the cigarette. Beedis are hand-rolled by more than 4 million poor people who work out of their homes (21). Cross-sectional studies were carried out to assess the prevalence of GTS among tobacco harvesters in four villages of Gujarat, where tobacco is cultivated mainly for making beedis,

Table I Showing study, study population and results

Sl.no.	Name	Place	Findings
1	Ballard T et al	United States and Kentucky	Incidence of GTS was estimated to be 10/1000 workers (or 1%). Younger people (under age 30) were 3.1 times more likely to develop GTS than older people.
2	Gehlbach SH et al	North Carolina	A survey among 53 harvesters who had had green-tobacco sickness and 49 control harvesters was undertaken to define and quantify the symptom complex. 9% prevalence of GTS, i.e. 5400 of 60 000 workers was estimated.
3	McKnight R et al	Kentucky	The search identified 104 exposure reports, which were examined, of these, 78 represented GTS cases. Of the 78 persons with suspected GTS, 78% were male, 1/2 were aged 22 or younger, 1/4 were 17 or younger, and dermal contact was the usual reported route of exposure.
4	National Institute of Occupational Health studies	Gujarat and Andhra Pradesh (India)	Prevalence of GTS was higher (86.2%) among beedi tobacco cultivators compared to cigarette tobacco cultivators (60.6%), and in chewing tobacco and snuff tobacco cultivators (47.0%).

chewing tobacco and snuff, as well as in a research farm of the Central Tobacco Research Institute (CTRI) at Andhra Pradesh, where mainly cigarette tobacco is grown. The most common symptoms observed in all tobacco workers were headache, giddiness, nausea and vomiting. The overall prevalence of GTS was higher (86.2%) among beedi tobacco cultivators compared to cigarette tobacco cultivators (60.6%), and in chewing tobacco and snuff tobacco cultivators (47.0%). Among men, the proportion of workers with GTS was higher in the chewing tobacco and snuff tobacco-growing areas of Anand, Gujarat than in the cigarette tobacco-growing area of Andhra Pradesh (22-24) (Table 1).

Symptoms

During GTS onset, early symptoms often include headache and nausea followed by vomiting, weakness, pallor, dizziness, headaches, increased perspiration, chills, abdominal pain, diarrhoea, and increased salivation [3-6,10-14,20,25-27]. These effects can be rather extreme, and may also include severe prostration [5,27,28] shortness of breath, and occasional fluctuations in blood pressure or heart rate [3,5,11]. The average length of the illness is usually between one and three days (median = 2.4 days) [4,26]. Although GTS has not been associated with mortality or long-term morbidity, it causes significant discomfort and lost productivity among tobacco workers [3,6,10,20,25,26].

Hand harvesting can lead to skin abrasions, further increasing risk of contracting GTS [1]. In the process of cropping tobacco, leaves and stalks are often cracked, emitting a gummy substance that coats workers' hands, skin, and clothing [29].

However, symptoms associated with severe nicotine poisoning, such as convulsions, dyspnoea, and vascular collapse, are not

typically seen in GTS cases [3]. Symptoms that are ascribed to nicotine intoxication in novice smokers mimic green tobacco sickness—for example, nausea, vomiting, increased heart rate, chills [1].

Measures taken to reduce GTS risks

Based upon both the presence of symptoms described above and a history of harvesting tobacco, a clinical diagnosis of GTS is made [1].

Very little widespread action has been taken to reduce the risks associated with harvesting tobacco [1]. Protective measures to prevent green tobacco sickness should be aimed at reducing dermal absorption of nicotine and therefore nicotine dose. Washing hands has a large and significant effect on the amount of nicotine residues remaining on the hands. Washing with soap and water reduced the residues on average 96%. Therefore, using hand washing facilities can substantially reduce nicotine residues on hands [8]. The use of protective, water-resistant clothing and chemical-resistant gloves would reduce the amount of nicotine absorbed by workers in contact with green tobacco [4,5,10,12,13,15,26,27,30]. In an intervention study among tobacco harvesters in India, it was found that nicotine and cotinine in urine were reduced significantly when wearing gloves during harvesting [14]. Plastic aprons and rainsuits, in addition to boots and socks, have been used to reduce exposure to nicotine [12,15]. Dimenhydrinate is useful in treating GTS once onset has occurred and as a prophylactic measure before harvesting tobacco [28].

Discussion

GTS can be avoided with the proper precaution. But, first one must know that the crop they are working with can cause them harm. This knowledge is the best means of prevention.

Harvesters can be exposed over large portions of their body despite wearing work clothing due to substantial contact with tobacco that may be wet with dew. Contact with wet tobacco and wearing work clothes, that have become wet from dew or perspiration, may increase exposure and absorption of nicotine through the skin [8]. It has been suggested that croppers should avoid harvesting in the rain or should begin harvesting after the dew evaporates [3].

Incidence of GTS is likely to be underestimated. This problem arises partly due to poor financial status of most workers and thus the costs of the treatment act as a barrier to them. Hence, those most in need are not able to obtain treatment.

Conclusion

GTS is usually underreported. A very little regulatory effort is undertaken, hence addressing the potential hazards of GTS has become difficult, also, discussions involving treatment modalities are rare.

Public awareness campaign on GTS at the international level should be taken up and more aggressive workers health regulations should be formulated. Greater numbers of workers will be exposed to GTS as the tobacco manufacturing industry expands production, hence more international studies are required to understand the magnitude of GTS. The greatest challenge for public health professionals is to monitor and reduce the problems associated with GTS.

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