

## Special Article - Dental Public Health

## Green Tobacco Sickness - A Brief Review

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Green Tobacco Sickness (GTS) has been one of the unexplored areas of occupational health safety. 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 present review was carried out to discuss the etiology, symptoms, diagnosis, treatment and prevention of GTS. It is caused by the absorption of nicotine through the skin while the workers are engaged in handling the uncured tobacco leaves. The symptoms include nausea, vomiting, pallor, dizziness, headaches, increased perspiration, chills, abdominal pain, diarrhea, increased salivation, prostration, weakness, breathlessness, and occasional lowering of blood pressure. The use of personal protective equipment like water-resistant clothing, chemical resistant gloves, plastic aprons, and rain suits with boots should be used by the tobacco farmers to prevent its occurrence. An international level awareness campaign has to be taken up and more stringent workers safety regulations have to be formulated.

**Keywords:** Green Tobacco Sickness; Health Hazards; Nicotine; Tobacco; Occupational Exposure

**Introduction**

Tobacco (*Nicotiana tabacum*) is cultivated in more than 100 countries [1]. 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 [2]. Although some of these hazards, such as pesticide exposure and musculoskeletal trauma, are faced by workers in other types of agricultural production, tobacco production presents some unique hazards, most notably acute nicotine poisoning, a condition also known as Green Tobacco Sickness (GTS) [1].

GTS is a form of nicotine poisoning that affects tobacco workers who have direct contact with tobacco plants during cultivation and harvesting. Nicotine poisoning has been reported in tobacco workers as well as in persons who intentionally or accidentally ingested tobacco or nicotine containing solutions or who had dermal contact with nicotine-based insecticide [3]. Nicotine, as a low-molecular weight substance with good lipid and water solubility, can easily be absorbed from skin [4]. 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.

India is the third country to have reported GTS among tobacco harvesters. The beedi industry remains the largest manufacturer of tobacco products in India [2]. Rolling beedi, an indigenous, handmade cigarette, has provided employment for millions of Indians [5]. Although GTS has not been associated with mortality or long-term morbidity, it causes significant discomfort and lost productivity among tobacco workers [6].

**Etiology and Physiology of GTS**

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 [2]. It was hypothesized that an unknown emetic substance contained in the tobacco sap was absorbed through the harvesters' skins. Illness has been attributed principally to dermal absorption of the pesticide residues on the tobacco leaves, although heat exhaustion, malingering, and a variety of other causes have also been suggested [7]. The skin acts both as a barrier and as the primary route into systemic circulation for chemicals. There is also evidence that the skin acts as a reservoir [8].

GTS is a threat to those who harvest tobacco because nicotine, being soluble in water, can be drawn out of tobacco by rain, dew, or perspiration, and subsequently absorbed through the skin. As much as 9mg nicotine may be contained in 100ml of dew. Once nicotine is absorbed, it is distributed throughout the body, including into the brain. The nausea and vomiting characteristic of GTS is mediated by the direct action of nicotine on the emetic chemoreceptor trigger zone in the medulla oblongata leading to reflex vomiting. Nicotine also excites sensory nerves from the gut and parasympathetic nerves in the gastrointestinal tract, which lead to an overall increase in gastrointestinal secretion and motility [6].

Laborers working in hot, wet conditions are more likely to develop GTS because the wetness and high humidity causes nicotine to reside on the surfaces of the leaves, while the high ambient temperature increases skin absorption, thereby increasing plasma nicotine concentrations by 30-45% [9].

**Symptoms**

Symptoms include parasympathetic and sympathetic manifestations. Symptoms that are ascribed to nicotine intoxication in novice smokers mimic green-tobacco sickness [7]. Illness associated with the harvest of tobacco is characterized by nausea, vomiting, dizziness, prostration, and weakness, i.e., "green symptoms," which recur during or after each workshift [10]. Other symptoms, like a

cough with or without expectoration and breathlessness, are regarded as respiratory complaints [11].

It has been reported that nausea and faintness can occur within 15 minutes of skin contact, although the US Centers for Disease Control and Prevention (CDC) reported that the median time from exposure to onset of GTS was 10 hours (ranging from three to 17 hours) [6].

## Diagnosis

Symptoms of GTS are similar to those induced by pesticide exposure or heat exhaustion, and to nicotine intoxication experienced by novice smokers. Thus, GTS may be misdiagnosed by practitioners unfamiliar with this condition. Some of the symptoms of GTS are similar to those of organophosphate poisoning and heat exhaustion. However, many of the symptoms of organophosphate poisoning (including increased lacrimation, pulmonary oedema, and miosis) have not been associated with GTS.

The possibility that GTS symptoms are due to pesticide poisoning is lessened because the last application of pesticides normally occurs several weeks before harvest and because GTS is known to occur among workers on farms that do not use pesticides. Furthermore, cases of GTS were documented before widespread pesticide use. Symptoms of heat exhaustion have been ruled out in many cases of GTS. Although tobacco is typically harvested during hot weather, GTS symptoms have also appeared during cool conditions when harvesters reported feeling chilled rather than overheated [6].

Clinical diagnosis of GTS is based on the presence of symptoms consistent with the condition and on a history of working with tobacco plants. The diagnosis of green tobacco sickness may be achieved by a test for urinary or serum nicotine (half-life = 3-4 h) or, in the case of nontobacco users, cotinine (a nicotine metabolite with a half-life of 36h) may be useful diagnostically [3].

## Treatment

Traditionally, taking of tea and jaggery (a sugar-like product), followed by rest, was the only way the workers could rid themselves of these symptoms [11]. Because GTS is self-limiting and of short duration, treatment is not always necessary.

Exposed workers are encouraged to increase fluid intake, ingest dimenhydrinate (Dramamine), and rest. The therapeutic effects of H1 blockers such as dimenhydrinate, however, are not mediated through an antagonistic action on the nicotinic cholinergic receptors. Dimenhydrinate is useful in treating GTS once onset has occurred and as a prophylactic measure before harvesting tobacco. When symptoms are serious, physicians can administer intravenous hydration, anti-emetics, and H1 blockers (dimenhydrinate) [6].

## Cost

Because nearly a quarter of those stricken with GTS who sought medical treatment required hospitalisation, significant hospital expenditures are associated with the condition. In the US, on an average, fees were \$250 for outpatient treatment, \$566 for hospital admission, and \$2,041 for intensive-care treatment.<sup>3</sup> However, no such estimate has been reported in India [9].

## Prevention of GTS

Prevention strategies to reduce the incidence of GTS include avoiding the handling of wet tobacco. Workers should avoid working in tobacco fields during or immediately after a rainfall; delay work hours until dew has dried; wear protective clothing (e.g., chemical-resistant gloves or waterproof rain gear) when working with wet tobacco plants; and change into dry clothing as soon as possible if clothing becomes wet [3].

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 [2].

Tobacco farm owners should inform their employees of the hazards associated with harvesting wet tobacco and the importance of safe work practices in preventing GTS; discuss routes of exposure and symptoms associated with the disease; advise workers to change into clean, dry clothing and boots during the work day if these become wet; and allow flexible work hours to avoid work during or immediately after a rainfall [12]. Employers must provide handwashing facilities to workers and, if housed in a temporary labor camp, showering facilities in that camp [9].

Health-care providers in areas where tobacco is harvested should consider GTS in workers who present with symptoms similar to those reported [12]. Mechanization of tobacco harvesting reduces dermal contact with wet tobacco leaves and represents a potential method for prevention [3].

Nonetheless, these prevention strategies may not be practical for many reasons. Because of a tight schedule for harvesting tobacco, workers are often in the field 10-12 h/d, and growers may not be able to postpone work until plants are dry or allow frequent breaks for changing clothes. Use of personal protective equipment (e.g., impermeable clothing, gloves, rubber boots) may increase the risk of heat stress in hot weather [3].

## Public Health Response

Very little regulatory effort has been undertaken to address the potential hazards of GTS. Currently, there is no legal requirement that workers be informed about the hazards of nicotine exposure. In Kentucky in 1992, for example, an Occupational Health Nurses in Agricultural Communities study of GTS was undertaken to educate tobacco workers and healthcare providers about the dangers inherent in tobacco harvesting. The educational effort included targeted informational mailings and news stories in the local media, coinciding with the tobacco harvest. Following a public awareness campaign, the 1993 incidence of hospital-treated GTS increased from the previous year, probably due to the heightened awareness about GTS on the part of tobacco workers and healthcare providers [6].

In India, 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, 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 magnitude of GTS has not been

assessed in sufficient detail and most published research on GTS is descriptive studies [9].

## Conclusion

Tobacco 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. GTS can be avoided with the proper precaution. So, one must know that the crop they are working with can cause them harm. Public awareness campaign on GTS at the national and international level should be taken up regarding workers health regulations. A strong regulatory effort must be undertaken to address the potential hazards of GTS.

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