

Profile of tobacco growers with green tobacco sickness in Southern Brazil

Perfis de fumicultores da região Sul do Brasil com doença da folha verde do tabaco

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ABSTRACT | Introduction: Green tobacco sickness affects tobacco growers while handling tobacco leaves, regardless of the cultivation stage. **Objectives:** To characterize the sociodemographic and occupational profiles of tobacco growers with green tobacco sickness, as well as their health habits. **Methods:** This was a cross-sectional, descriptive study with information from a database obtained from a previous study conducted in a Southern Brazilian municipality. The data were analyzed using absolute and relative frequency. **Results:** We identified 8 cases of tobacco growers with green tobacco sickness, whose sociodemographic and occupational profiles and health habits were described. **Conclusions:** The data obtained in this study corroborate the existing literature on tobacco growers. The sociodemographic and occupational profiles and the health habits of our study participants have already been described in other studies, as well as of tobacco growers without green tobacco sickness.

Keywords | cotinine; tobacco; occupational risks.

RESUMO | Introdução: A doença da folha verde do tabaco acomete fumicultores durante o manuseio da folha do tabaco, independente da etapa de seu cultivo. **Objetivos:** A pesquisa objetivou caracterizar os perfis sociodemográfico e ocupacional, bem como os hábitos de saúde de fumicultores com a doença da folha verde do tabaco no cultivo do tabaco. **Métodos:** Foi desenvolvido estudo transversal descritivo através da utilização de um banco de dados de uma pesquisa prévia realizada em um município do Sul do Brasil, que foi analisado através de frequência absoluta relativa. **Resultados:** Foram encontrados oito casos de fumicultores com doença da folha verde do tabaco, dos quais foi descrito o perfil sociodemográfico, ocupacional e de hábitos de saúde. **Conclusões:** Os dados encontrados na pesquisa confirmam a literatura já existente sobre fumicultores, sendo que os perfis sociodemográfico e ocupacional e os hábitos de saúde dos fumicultores com a doença da folha verde do tabaco são encontrados na literatura científica, além de também estarem presentes os dos fumicultores sem o quadro da doença.

Palavras-chaves | cotinina; tabaco; riscos ocupacionais.

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INTRODUCTION

Tobacco growers are constantly exposed to health risks when cultivating tobacco, mostly due to the exposure to the nicotine contained in tobacco leaves. Thus, public bodies believe that occupational hazards arising from tobacco cultivation could be considered public health problems.^{1,2} Exposure to nicotine leads to nicotine absorption through the skin. Nicotine is then transformed into cotinine in the liver and excreted by the kidney, possibly resulting in acute intoxication, which is characterized as green tobacco sickness (GTS).^{3,4}

GTS affects tobacco growers when handling tobacco leaves, regardless of the cultivation stage. Diagnosis is based on the triad of abnormal cotinine levels, previous exposure to tobacco, and signs or symptoms of intoxication up to 72 hours after exposure. Most common signs and symptoms include headache, nausea, dizziness, vomiting, pallor, increased salivation, sweating, weakness, chills, and diarrhea.^{5,6}

GTS has been described in tobacco growers in North Carolina (USA), India, Japan, and Poland, as well as in Brazil in 2007. The first clinical diagnosis of GTS was described in 1970 after a few cases were identified in Florida. Only a few epidemiological studies on the subject have been conducted in Brazil. A case-control study was conducted in Arapiraca, state of Alagoas, in 2007 and in Candelária, state of Rio Grande do Sul, in 2008; a cross-sectional study was conducted in São Lourenço, state of Rio Grande do Sul, in 2011; and a cohort study was also conducted in Candelária, in 2015.^{5,7-10}

We became interested in this subject after participating in a previous GTS study with tobacco growers from a municipality in the state of Rio Grande do Sul. The same municipality (Candelária) was also chosen for the present study, further strengthening GTS research in the state. The present study included tobacco growers with GTS, thus being innovative in this field of research, and may contribute to the subject by helping to strengthen the health of tobacco growers.

The objective of this study was to characterize the sociodemographic and occupational profiles of tobacco growers with GTS, as well as their health habits.

METHODS

This was a cross-sectional, descriptive study with information from a database originated from the master's thesis "Doença da folha verde do tabaco: uma análise por FT – IR da metabolômica da saúde dos fumicultores".¹¹ The thesis was developed for the Graduate Program in Health Promotion of Universidade de Santa Cruz do Sul (UNISC).

The present study was conducted in the city of Candelária, located in the Vale do Rio Pardo region, in the state of Rio Grande do Sul. The city has an area of 944 km² and a total population of 30,171 inhabitants.¹² Candelária is the fourth largest tobacco producer in Rio Grande do Sul, involving approximately 4,000 families and close to 7,900 hectares of tobacco per year.¹²

The database used in this study, composed of biochemical data and data obtained from a questionnaire, contains information on 52 tobacco growers who live in Candelária and undergo biochemical testing during the stages of tobacco cultivation. However, the questionnaire was only applied after the planting stage, in which 39 tobacco growers participated. Biochemical tests were analyzed to confirm diagnosis, and questionnaire data were used to describe the workers' profiles.

Biochemical data were obtained from the 3 stages of tobacco cultivation: planting, harvesting, and classification. Cotinine levels were evaluated to assist in the diagnosis of tobacco growers with GTS, as well as the data obtained from the questionnaire (divided into sociodemographic, occupational, and health data).

The inclusion criterion was the presence of symptoms suggestive of GTS. Tobacco growers who reported smoking were excluded from the study regardless of the number of consumed cigarettes.

For GTS characterization, cotinine levels were analyzed according to the reference values provided by the laboratory hired for analysis: < 20 ng/dL for non-smokers, 20-50 ng/mL for passive or occasional smokers, and > 50 ng/mL for smokers. Absolute and relative frequency was used for questionnaire evaluation.

The sociodemographic profile was composed by sex, age, marital status, race, and schooling, whereas

the occupational profile was defined by type of tobacco, work duration, duration of tobacco exposure per day, and the relationship between the use of personal protective equipment (PPE) and work activities. Health habits were evaluated by signs and symptoms of GTS in tobacco growers and the use of health services.

GTS diagnosis was defined according to the triad of abnormal cotinine levels, previous exposure to tobacco, and signs or symptoms of intoxication up to 72 hours after exposure, requiring cotinine level assessment. Nine cases of GTS were identified during the harvest and classification stages (4 during harvest and 5 during classification); one case involved the same tobacco grower, who was diagnosed with GTS in both stages.

This study was approved by the Research Ethics Committee of UNISC (approval no. 2,393,086) on November 22, 2017, and conducted in accordance with Resolution no. 466/12 of the National Health Council on research involving humans.

RESULTS

The sex, race, schooling, and marital status of the 8 workers diagnosed with GTS are described in Table 1. These workers reside in five different districts of Candelária and are aged between 31 and 65 years.

Regarding the occupational profile, all tobacco growers cultivated Virginia-type tobacco and performed all cultivation-related activities, such as sowing, transplanting, carrying leaf bundles, pinching, sorting, harvesting, and baling. However, only the men

applied pesticides in addition to the other activities. Seven workers owned the cultivation properties, and one was a day laborer; all of them reported working 8 to 13 hours per day. Six participants reported started working at the ages of 7 to 10, whereas 2 reported working since they were 13 years old.

Although the use of PPE was inadequate among all tobacco growers, they reported using pants, long-sleeved shirts, hat, and shoes, as well as the occasional use of an additional PPE, such as rubber gloves, fabric gloves, or waterproof shirts. All workers reported having received some type of information on the importance of the correct use of PPE from tobacco companies.

Regarding health habits, all participants reported feeling some sign or symptom during or after the workday, such as nausea, vomiting, headache, diarrhea, blurred vision, difficulty sleeping, weakness, dizziness, tremors, or muscle pain. Only 3 workers sought a health service in the municipality to treat these symptoms. Of the 8 participants, 1 was diagnosed with depression and was currently receiving treatment, 1 was diagnosed with hypertension, and 1 was diagnosed with hypercholesterolemia. Among workers, none performed physical activities and 5 reported frequent alcohol consumption.

DISCUSSION

In this study, we analyzed cases of tobacco growers diagnosed with GTS during the harvest

Table 1. Sociodemographic profile of participants

Tobacco growers	Sex	Race	Schooling (years)	Marital status
Participant #1	Male	White	1-10	Married
Participant #2	Male	Mixed-race	1-4	Married
Participant #3	Female	White	1-4	Married
Participant #4	Female	White	1-4	Married
Participant #5	Male	Mixed-race	5-10	Married
Participant #6	Female	Black	5-10	Married
Participant #7	Female	White	> 10	Married
Participant #8	Female	White	5-10 years	Widowed

and classification stages, which is in accordance with the results obtained by Martins et al.,⁹ who identified tobacco growers with GTS only during the classification stage. Conversely, some authors have described tobacco growers diagnosed with GTS only during the harvest stage.¹³

In this study, GTS mostly affected female workers. This is in accordance with a study conducted in 2014 in São Lourenço, state of Rio Grande do Sul, in which GTS was prevalent among women.⁸ However, some studies have indicated that male workers have more contact with tobacco because they perform more activities during tobacco cultivation.³

Study participants have worked with tobacco since they were children; in the questionnaire, they reported already being exposed to tobacco at the age of 7 years. Thus, cultivating tobacco at a very young age can be considered child labor and may contribute to the development of health problems in adult life. Kassouf & Santos¹³ reported that the prevalence of rural child labor among children 5 to 9 years old is approximately 75%. Riquinho & Hennington¹⁴ explained that tobacco cultivation involves the worker's entire family, including children, even if working under 18 years old is prohibited. They also explained that children usually start working at the age of 10 and perform the same activities as their parents.

There were low schooling levels among workers, which is characteristic of rural areas. Low levels of education can lead to a lack of understanding of important information about the handling of materials, as well as difficulty in interpreting pesticide labels. This may lead to health hazards, given that workers are exposed to occupational risks and may not have the necessary knowledge to adequately deal with them. Schooling may also impact health habits and access to health care, considering that this population has less access to information and health services.¹⁵

The most common type of tobacco cultivated in Brazil and also in Candelária is Virginia-type tobacco, which adapts more easily to the region's climate and has a good financial return. This type of tobacco is characterized by a tall plant with large, lanceolate leaves and by a mild flavor and aroma. Virginia-type tobacco is cultivated for the manufacture of pipe and

cigarette blends.¹⁶ Cultivation-related activities include sowing, seedbed maintenance, preparing the soil, transplanting the plant from the seedbed to the soil, applying pesticides, harvesting leaf by leaf, leaf sewing, flue-curing, dry leaf separation, making a bundle of dry leaves, baling the bundles, and then selling them in smokehouses. Tobacco growers are exposed to nicotine while performing these activities and may thus develop GTS.^{16,17}

Most tobacco growers own the cultivation land and organize their own activities and schedules; however, concerns about crop supplies and expenditures are restricted to them. Unlike landowners, day laborers follow orders and schedules, work on different properties in a short period of time, and do not have fixed hours. Consequently, they are in contact with tobacco every day and are thus more exposed to risks.^{18,19}

Regarding PPE, none of the participants reported correctly using them. In Goethel et al.,²⁰ none of the participants reported using all PPE, as recommended. In fact, some workers only used some PPE or did not use them at all. PPE are intended to prevent the body from coming into contact with external chemical agents, protecting the worker's health.

Studies have reported that gloves and waterproof clothing help to reduce dermal absorption, preventing nicotine contact with hands and armpits. Incorrect PPE usage results from the fact that PPEs make the harvest process more difficult, as well as from issues related to anthropometric characteristics and thermal sensations; since PPEs are impermeable, they reduce body ventilation and increase the heat when the worker is exposed to the sun.^{21,22}

Most significantly, tobacco growers work long hours daily in tobacco processing activities, thus being more exposed to occupational hazards. There are reports of tobacco growers being possibly exposed to nicotine since intrauterine life during the harvest period. This exposure occurs during tobacco-growing season and decreases off season.

According to Oliveira et al.⁵ and Bartholomay,¹⁶ the most common symptoms of GTS are dizziness, headache, vomiting, nausea, and weakness. These signs and symptoms characterize chronic intoxication and

may appear within or after 72 hours of contact with tobacco.

However, health care among tobacco growers is considered precarious due to the difficult access to health services, just as health services cannot easily access rural areas. Because this population lacks important information, tobacco growers do not seek health services when presenting symptoms, thus delaying care and, if necessary, treatment. In addition to a lack of exercise, frequent alcohol consumption, and off-label use of medication, tobacco growers get sick and only seek medical assistance after they are severely ill.²³

CONCLUSIONS

Analyzing cases of tobacco growers with GTS allowed us to know the reality of rural work and understand the sociodemographic and occupational profiles of these workers. Tobacco cultivation is performed manually and requires an intensive workforce, family assistance, long working hours, physical exhaustion, and exposure to pesticides and nicotine. Consequently, workers may become intoxicated or develop diseases that affect the entire body.

Our study revealed that the health of tobacco growers is compromised due to the nature of tobacco cultivation. This is worrying because GTS can be considered a public health problem. Tobacco cultivation is known to be a source of income for many families; however, health prevention and promotion actions such as the use of PPEs are needed to avoid

exposure to toxic agents. Awareness should be raised among tobacco growers regarding prevention of occupational diseases, and public policies are needed to further assist these workers. Our research also contributes to the scientific knowledge of GTS and rural workers' health, given that there are few published studies on this subject.

This study has some limitations, such as a lack of scientific studies on rural workers' health, especially tobacco growers with GTS, as well as a lack of GTS knowledge by health care professionals. Tobacco growers also revealed to have little knowledge of the health hazards to which they are exposed. We also observed a cultural bias regarding tobacco cultivation, as health problems and diseases are seen as a normal part of the tobacco production process, thus interfering with the reliability of some important information for the study.

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Author contributions

MP was responsible for study conceptualization, formal analysis, methodology, and writing - original draft. VAM was involved in data curation, investigation, and writing - original draft. JDPR, CPR, and SBFK were responsible for supervision, validation, and writing - revision & editing. All authors have read and approved the final version submitted and take public responsibility for all aspects of the work.

REFERENCES

1. Moreira JPL, Oliveira BLCA, Muzi CD, Cunha CLF, Brito AS, Luiz RR. A saúde dos trabalhadores da atividade rural no Brasil. *Cad Saúde Pública*. 2015;31(8):1698-708.
2. Castro LSP, Monteiro JK. Saúde no trabalho de fumicultores do RS: não adocece somente quem fuma, mas também quem planta. *Rev CEFAC* 2016;22(3):790-813.
3. McBride JS, Altman DG, Klein M, White W. Green tobacco sickness. *Tob Control*. 2008;7(3):294-8.
4. Arcury TA, Vallejos QM, Schulz MR, Feldman SR, Fleischer AB, Verma A, et al. Green tobacco sickness and skin conditions among migrant latino farmworkers. *Am J Prev Med*. 1988;4:96-101. 2008;51(3):195-203.
5. Oliveira PPV, Sihler CB, Moura L, Malta DC, Torres MCA, Lima SMCP, et al. First reported outbreak of green tobacco sickness in Brazil. *Cad Saúde Pública*. 2010;26(12):2263-9.

6. Silva KL, Sena RR, Belga SMMF, Silva PM, Rodrigues AT. Health promotion: challenges revealed in successful practices. *Rev Saúde Pública*. 2014;48(1):76-85.
7. Bartholomay P, Iser BPM, Oliveira PPV, Santos TEHH, Malta DC, Sobel J, et al. Epidemiologic investigation of an occupational illness of tobacco harvesters in southern Brazil, a worldwide leader in tobacco production. *Occup Environ Med*. 2012;69(7):514-8.
8. Fassa AG, Faria NM, Meucci RD, Fiori NS, Miranda VI, Facchini LA. Green tobacco sickness among tobacco farmers in southern Brazil. *Am J Ind Med*. 2014;57(6):726-35.
9. Martins VA, Renner JDP, Corbelini VA, Pappen M, Krug SBF. Doença da Folha Verde do Tabaco no período da classificação do tabaco: perfil sociodemográfico e ocupacional de fumicultores de um município do interior do Rio Grande do Sul. *Rev Epidemiol Control Infect*. 2016;6(4):206-10.
10. Fotedar S, Fotedar V. Green tobacco sickness: a brief review. *Indian J Occup Environ Med*. 2017;21(3):101-4.
11. Martins, VA. Doença da folha verde do tabaco: uma análise por FT-IR da metabólômica da saúde dos fumicultores [Dissertação - Mestrado em Promoção da Saúde]. Santa Cruz do Sul: Universidade de Santa Cruz do Sul; 2016. 122 f.
12. Brazilian Institute of Geography and Statistics (Instituto Brasileiro de Geografia e Estatística) Cidades@ [Internet]. Rio de Janeiro: IBGE; 2010 [citado em 7 out. 2018]. Disponível em: <http://cidades.ibge.gov.br/xtras/home.php>
13. Kassouf AL, Santos MJ. Trabalho infantil no meio rural brasileiro: evidências sobre o “paradoxo da riqueza”. *Econ Apl*. 2010;14(3):339-53.
14. Riquinho DL, Hennington EA. Cultivo do tabaco no sul do Brasil: doença da folha verde e outros agravos à saúde. *Cienc Saude Colet*. 2014;19(12):4797-808.
15. Santana CM, Costa AR, Nunes RMP, Nunes NMF, Peron AP, Cavalcante AACM, et al. Exposição ocupacional de trabalhadores rurais a agrotóxicos. *Cad Saúde Colet*. 2016;24(3):301-7.
16. Bartholomay P. Doença da folha verde do tabaco na região fumageira de Candelária/RS. Relatório preliminar: investigação epidemiológica de intoxicações agudas na região fumageira de Candelária/RS [Dissertação de Mestrado]. Brasília: Universidade de Brasília - UnB
17. Heemann F. Cultivo do fumo e condições de saúde e segurança dos trabalhadores rurais [Dissertação de Mestrado]. Porto Alegre: Universidade Federal do Rio Grande do Sul; 2009.
18. Oliveira F, Costa MCF. Dossiê técnico - cultivo de fumo (*Nicotiana tabacum L*) [Internet]. São Paulo: Serviço Brasileiro de Respostas Técnicas; 2012 [citado em 23 jun. 2022]. Disponível em: <http://www.respostatecnica.org.br/dossie-tecnico/downloadsDT/NTcwMg==>
19. Hartwing M. As relações de trabalho no sistema integrado de produção da indústria do fumo [Tese de doutorado]. Florianópolis: Universidade Federal de Santa Catarina.
20. Goethel G, Nascimento F, Dani C, Mascarenhas M, Sebben V, Funcha C. Avaliação de parâmetros bioquímicos e toxicológicos de fumicultores do município de Venâncio Aires/RS. *Rev Bras Pesq Saude*. 2013;15(1):105-12.
21. Carginin MCS, Teixeira CC, Mantovani VM, Lucena AF, Echer IC. Cultura do tabaco versus saúde dos fumicultores. *Texto Contexto Enferm*. 2016;25(2):e2940014.
22. Faria NMX, Fassa AG, Meucci RD, Fiori NS, Miranda VI. Occupational exposure to pesticides, nicotine and minor psychiatric disorders among tobacco farmers in Southern Brazil. *Neurotoxicology*. 2014;45:347-54.
23. Fiori NS, Faria NMX, Meucci RD, Fassa AG. Prevalência e fatores associados ao tabagismo em fumicultores do Sul do Brasil. *Cad Saúde Pública*. 2016;32(7):e00123115.

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