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Assessment of health-related quality of life of sugarcane cutters in the pre-harvest and harvest periods

ABSTRACT

OBJECTIVE: To assess health-related quality of life in sugarcane cutters.

METHODS: Longitudinal study conducted in a sugar and ethanol plant located in the western region of the State of São Paulo (Southeastern Brazil) from April (pre-harvest) to October (harvest) 2010. A total of 44 sugarcane cutters, smokers and non-smokers, was evaluated in three periods: pre-harvest, at the end of the third month during harvest and at the end of harvest. Health-related quality of life was assessed by the *Medical Outcomes Study 36-Item Short-Form Health Survey* (SF-36). Analysis of variance for repeated measures and the Friedman test were performed to compare quality of life among the periods. To identify the frequency of workers whose score increased in the harvest periods compared to pre-harvest (positive responders), the Goodman test was used, considering the qualitative variables of the SF-36 domains.

RESULTS: At the end of pre-harvest, 23% workers drop out of work; 27% were smokers. There was a significant decrease in the vitality domain at the end of harvest compared to pre-harvest. The dropouts presented higher score in the social aspect domain compared to the group that remained working. There was no difference in health-related quality of life between smokers and non-smokers. However, there was a higher percentage of positive responders among non-smokers in the physical, social and emotional domains in the third month of harvest and in the general health status and social domains at the end of harvest, compared to smokers.

CONCLUSIONS: Health-related quality of life in sugarcane cutters was reduced after the harvest period in the vitality domain. The individuals who remained working during harvest are those with lower scores for social aspects, which demonstrates the need to promote health assistance policies for this specific population, particularly during sugar harvest.

DESCRIPTORS: Quality of Life. Rural Workers. Saccharum. Rural Health. Questionnaires, utilization. Longitudinal Studies.

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INTRODUCTION

Worldwide interest in using renewable energy is growing. Brazil was a pioneer in the large scale production of ethanol with the national (Proalcool) programme created in the 1970s to substitute gasoline consumption.[12] Currently, Brazil is the largest ethanol producer in the world, with the state of São Paulo producing 70% of the world's sugar cane and 17% of the world's ethanol.[a]

The process of cultivating sugar cane has various stages: preparing the land, choosing the type of farming, planting, fertilising and conserving the land. There are also activities to be carried out during the pre-harvest which provide the workers with fixed-rate earnings. The stages of the crop can be described thus: cut the sugar cane, load and transport to the processing units, plants or distilleries where the alcohol, sugar or other products will be produced.[b]

Sugar cane can be harvested mechanically or by hand. In Brazil, in 2005, around 80% of sugar cane was harvested by hand[10] with the crop being burned beforehand to make cutting easier and to increase productivity.[32] This practice is linked to increased levels of carbon monoxide and ozone in sugarcane producing regions,[18] to morbidity due to respiratory disease[3,7] and to the number of hospital admissions, in addition to exploitation of those who work cutting sugar can and are paid according to their yield.[2]

Law nº 11,241, enacted and promulgated in 2002, aims to eradicate the practice of burning the sugar cane crop by 2031.[20] In 2007 the governor of the state of São Paulo and the Union of the Sugar Cane Industry (Unica) signed the Ethanol Sector Environmental Protocol, which brought the deadlines forward. The plants in the state of São Paulo mechanised 70% of areas harvested in 2010/2011. With the protocol, 3.8 million hectares of cane ceased to be burned, avoiding the emission of 14.2 million tonnes of pollutants.[a]

However, in spite of technological developments in the sugar and ethanol sector, the cutters working conditions continue to be precarious. On the whole, the rural workers are migrants from poor areas of the country who travel to find work during the sugar harvest. Cutting sugar cane requires excessive physical effort, incentivised by remuneration by output. The cutters may cut up to 12 tonnes of cane a day, involving bending the spine 3,994 times.[16]

The strenuous role performed by the cane cutters, linked with direct exposure to burning biomass, contributes to their physical and psychological fatigue, together with certain habits specific to this group such as their nutrition, their low intake of liquid and smoking, which can all affect quality of life as far as health is concerned.[21,30]

At the same time as the ethanol industry present the fuel as clean and sustainable, the international community and the authorities complain are demanding them to reduce emissions and humanise working conditions in the sector, as the cane cutters work in critical conditions.[26] Topics related to mechanisation, production models and technological developments should be discussed, as well as migration, work conditions and the quality of life of the workers involved in this activity.

The concept of quality of life with regards to health is both wide and complex and does not have a global definition. But there is an understanding that this should be evaluated in a subjective, multi-dimensional way, including physical and psychological health and social relationships.[8,11] Quality of life and state of health may be linked, but they are distinct concepts. The first is determined not only by health problems. But also by the emotional response to these problems.[6]

Evaluating quality of life with regards to health is highly relevant in populations of sick individuals and today it is recognised as an important indicator of health in healthy populations including workers.[25]

Studies have addressed the arduous and exhausting working conditions of sugar cane cutter,[1,23] however, there is no research which analyses the quality of life with regard to the health of these individuals. The aim of this study was to evaluate health-related quality of life (HRQL) of sugar cane cutter.

METHODS

This is a longitudinal study carried out at a sugar and ethanol plant in the east of the state of São Paulo (the city is not named so as to protect the sugar and ethanol producer in which the research was carried out). There were three evaluation periods: at the end of the pre-harvest (April), at the end of the third month of harvesting (July) and at the end of harvesting (October) in 2010. During the pre-harvest the workers planted the sugar cane and cut the burnt cane during the harvest.

[a] Campagna L. Metas para o fim da queima da cana-de-açúcar são alcançadas em SP. São Paulo: Governo do Estado de São Paulo. Secretaria do meio ambiente; 2011 [cited 2011 Apr 29]. Available from: http://www.ambiente.sp.gov.br/acontece/noticias/metas-para-o-fimdaqueima-da-cana-de-acucar-sao-alcancadas-em-sp

[b] Ferreira LL, Gonzaga MC, Donatelli, Bussacos, MA. Análise coletiva do trabalho dos cortadores de cana da região de Araraquara, São Paulo. 2.ed. São Paulo: FUNDACENTRO; 2008. Available from: http://www.observatoriosocial.org.br/arquivos_biblioteca/conteudo/Cortadores%20de%20cana%20edi%C3%A7%C3%A3o%202008.pdf

Around 340 workers travelled to the site of the work camp during the pre-harvest and the harvest in a bus with capacity for 44. We carried out randomisation of the participants in the study on the bus which transported the workers to the camp. There were no female workers as, at the company in which the data were collected, women do not work as sugar cane cutters.

The workers were approached in the work camp and the objectives and proceedings of the study were explained to them.

The population was made up of rural workers (n = 44), males, migrants from the north east and, for the period of this study, living in accommodation provided by the employer. We collected data on: age, weight, height, number of seasons previously worked, education and smoking. Smoking was classified by the number of cigarettes per day and by the packs-year index in which the number of cigarettes smoked per day is divided by the number of cigarettes in a pack and multiplied by the number of years the smoker has smoked for.[28]

In order to evaluate (HRQL) we used the Medical Outcomes Study 36-Item Short Form Health Survey (SF-36),[29] translated into Portuguese and validated, which is easy to understand and use.[9] It contains 36 items which cover eight areas: functional capacity (FC), physical aspects (PA), pain (P), general health (GSH), vitality (VIT), Social Aspects (SA), emotional aspects (EA) and mental health (MH). The score ranges from 0-100 (0 = worst HRQL; 100 = best HRQL).[9,29]

The workers answered the SF-36 questionnaire in the off season and during the harvest at the above mentioned periods. 33 of the 44 workers participated, as 24% left the job at the end of the pre-harvest. Therefore, we divided the workers into two groups: dropouts and non-dropouts, with the aim of understanding the impact of HRQL on abandoning the job.

Smoking habits influenced HRQL.[21,30] Therefore, the non-dropouts were subdivided into smokers and non-smokers. Those who experienced a worsening in the quality of life scores between the pre-harvest, middle and end of harvest were termed negative responders; those who had increased scores were termed positive responders.

The statistical analysis was carried out using Sigma Stat10 software (Systat Software, Inc. San Jose, CA, EUA).[27] Comparisons of quality of life between the different periods were carried out using the Friedman test. The Student t test was used to compare quality of life in the pre-harvest between the dropouts and non-dropouts. The comparison of quality of life of the smokers and non-smokers was carried out using the repeated measures ANOVA test. The Goodman test was used to identify the frequency of workers in relation to: level of education, number of seasons previously worked and the frequency of positive and negative responders. The eight areas of the SF-36 questionnaire were deemed to be qualitative variables between smoking and non-smoking workers. Differences were deemed to be significant when $p < 0.05$.

The participants all gave their written consent to taking part in the study, in accordance with the WMA Helsinki Declaration. The study was approved by the Committee on Ethics and Research of the Universidade Estadual Paulista (nº 15/2010).

RESULTS

The average age was 25 years old (SD = 5 years), 27% were smokers, the majority were participating in this activity for the first or second time and most had not completed elementary education ($p \geq 0.05$) (Table 1).

The participants' (n = 44) average score for general state of health (80.0) was lowest during the pre-harvest, whereas their functional capacity got the highest score (95.0).

During the pre-harvest, the dropout group had a higher social relationships score than the non-dropout group ($p = 0.02$) (Table 2).

Vitality was the area of the SF-36 which showed the lowest average score at three months (79.5) and six months (72.5) into the harvest among the non-dropout group; functional capacity was the area which obtained the highest scores at all the periods studied (Table 3).

Table 1. Characteristics of sugar cane cutters. Eastern São Paulo state, 2010.

Characteristics [mean (standard deviation)]	
Age (years)	25.4 (4.7)
BMI (kg/m^2)	24.3 (3.4)
Packs-year	5.4 (5.2)
Cigarettes-day	7.4 (6.5)
Harvests worked (%)	
1 to 2	52.3[a]
3 to 4	34.1
≥ 5	13.6
Education (%)	
Illiterate	6.8
Incomplete elementary education	63.6[b]
Completed elementary education	11.3
Incomplete high school education	11.3
Completed high school education	6.8

[a] $p \geq 0.05$ in relation to the group ≥ 5 harvests worked
[b] $p \geq 0.05$ in relation to other levels of education

Table 2. Scores for dropout and non-dropout sugar cane cutters for areas of the SF-36 during the pre-harvest. Eastern São Paulo state, 2010.

Areas of the SF-36	Non-dropout (n = 34)			Dropout (n = 10)		
	Mean (SD)	Median	Percentile 25-75	Mean (SD)	Median	Percentile 25-75
Functional capacity	94.6 (9.5)	100	90-100	99.4 (1.6)	100	98.75-100
Physical aspect	85.8 (24.2)	100	75-100	86.1 (33.3)	100	62.50-100
Pain	86.9 (16.3)	100	72-100	89.5 (15.9)	100	72-100
General state of health	78.8 (15.5)	80	70.75-100	88.2 (16.0)	92	75.75-100
Vitality	80.6 (16.5)	85	70-100	79.4 (13.0)	80	70-100
Social aspect	87.5 (20.5)	100	75-100	100 (0)[a]	100	100-100
Emotional aspect	83.3 (27.3)	100	0-100	100 (0)[b]	100	100-100
Mental health	81.4 (11.1)	84	75-100	88.0 (12.6)	90	83-97

[a] p = 0.02
[b] p = 0.056

Table 3. Scores for the areas of the SF-36 of sugar cane cutters in the pre-harvest, mid-harvest and end of harvest. Eastern São Paulo state, 2010.

Areas of the SF-36	Pre-harvest			Mid-harvest[a]			End of harvest[a]			
	Mean (SD)	Median	Percentile 25-75	Mean (SD)	Median	Percentile 25-75	Mean (SD)	Median	Percentile 25-75	p
Functional capacity	95.0 (9.3)	100	90-100	99.2 (2.5)	100	100-100	99.2 (2.2)	100	100-100	0.055
Physical aspect	85.9 (23.7)	100	75-100	92.9 (14.5)	100	100-100	93.7 (16.8)	100	100-100	0.105
Pain	86.8 (16.1)	100	72-100	85.2 (19.2)	100	72-100	82.6 (17.7)	84	62-100	0.288
General state of health	80.0 (15.7)	81	68-92	80.0 (11.7)	82	68-92	75.9 (17.1)	77	59-92	0.938
Vitality	81.5 (16.3)	87.5	70-95	79.5 (14.8)	82.5	70-100	72.5 (14.5)[b]	70	61-83	0.002
Social aspect	87.5 (20.0)	100	78-100	95.7 (8.1)	100	75-100	88.6 (16.3)	100	75-100	0.150
Emotional aspect	84.3 (26.7)	100	66-100	95.7 (11.4)	100	100-100	93.6 (13.4)	100	100-100	0.195
Mental health	81.8 (11.8)	82	76-92	82.7 (16.0)	86	73-96	79.5 (12.6)	84	72-88	0.163

[a] Pre-harvest lasts 3 months: starting in February and ending in April. The harvest lasts six months: staring in April and ending in October. We deemed 'mid-harvest' to be the end of the third month of harvest
[b] $p \leq 0.05$ in relation to the pre-harvest period

No statistically significant differences in the quality of life scores were observed between the off season and the third month of the harvest; however, there was a significant reduction in vitality when comparing the pre-harvest with the sixth month of harvest ($p < 0.05$).

There were no significant differences in HRQL of the smokers and non-smokers in the three periods. No difference was observed between the smokers and non-smokers for the negative responders.

The non-smoking workers showed a significantly greater percentage of positive responders in physical social and emotional aspects three months after the harvest and in social aspects six months after the harvest (Table 4, $p < 0.05$).

DISCUSSION

Evaluating the HRQL of sugar cane cutters during the pre-harvest showed lower scores in the area of general state of health; at the end of the third month of the harvest scores for vitality were lower. The

Table 4. Percentage of sugar cane cutters smokers and non-smokers who improved their scores for quality of life (positive responders) in the mid and end of harvest compared to the pre-harvest in the areas of the SF-36. Eastern São Paulo state, 2010.

Areas of the SF-36	Non smokers (n = 26)		Smokers (n = 8)	
	Mid harvest[a] (%)	End of harvest[a] (%)	Mid harvest[a] (%)	End of harvest[a] (%)
Functional capacity	34.6 (9)	34.6 (9)	12.5 (1)	12.5 (1)
Physical aspect	42.3 (11)[b]	38.4 (10)	0 (0)	25 (2)
Pain	26.9 (7)	23.0 (6)	12.5 (1)	25 (2)
General state of health	50.0 (13)	53.8 (14)[c]	25.0 (2)	12.5 (1)
Vitality	38.4 (10)	26.9 (7)	12.5 (1)	12.5 (1)
Social aspect	50.0 (13)[b]	34.6 (9)[c]	0 (0)	0 (0)
Emotional aspect	34.6 (9)[b]	30.7 (8)	0 (0)	12.5 (1)
Mental health	57.7 (15)	46.1 (12)	50.0 (4)	25 (2)

[a] Pre-harvest lasts three months: starting in February and ending in April. The harvest lasts six months: staring in April and ending in October. We deemed 'mid-harvest' to be the end of the third month of harvest
[b] $p \leq 0.05$ in relation to smokers mid-harvest
[c] $p \leq 0.05$ in relation to smokers end of harvest

area of vitality showed a reduction at the end of the harvest when compared to the pre-harvest. There were no significant differences encountered between the smokers and non-smokers.

The lowest scores were to be found in the area of vitality at the middle and end of the harvest. The period six months into the harvest showed a significant decline in the score for vitality compared with the pre-harvest. This shows that the workers experience a decrease in energy levels and an increase in fatigue. Although this was to be expected, given the intense workload, this result has never before been quantitatively presented.

The daily average amount of sugar cane cut was eight tonnes per worker. The workload was eight hours/day with two break periods of 15 minutes, six days a week. However, the workers did not always respect the break times due to the system of remuneration by output imposed on them.

The cutters were monitored to ensure they cut as close to the ground level as possible, as it is in the lower part of the plant where a large amount of the sucrose is concentrated. This means a greater flexion of the spinal column and contributes to the worker's physical fatigue.[2]

Together, these factors lead the workers to exceed their physical limits, which explains the reduction in vitality found in this study.

Fatigue in the workplace has been approached in studies of diverse types of tasks.[4,14,17] The correlation between workload and fatigue has been described by Yamazaki et al.[31] According to the authors, when the worker moves to a task which requires more intense activity, the level of fatigue increases. This data is similar to that found in this study, as the harvest period is extremely intense and more exhausting than the pre-harvest period. In contrast, general state of health obtained lower points in the pre-harvest. The workers' main complaints referred to their health conditions during the period in which the sugar cane was planted. This may suggest poor working conditions and insufficient medical care for this population.[2]

The area of the SF-36 which had the highest score was functional capacity, which corroborates the results of a study evaluating HRQL in migrant workers.[33] If the worker has any type of limitation to their physical capacity, it may make it impossible for them to perform the task.

At the end of the pre-harvest, 23% of the workers left the job, and the group of dropouts had a higher score in the area of social aspects ($p = 0.02$) stressful working conditions may cause harm to the workers' physical and mental health.[15] Job satisfaction may be related to remaining in a position or leaving it. Dissatisfaction and stress at work may be explained by factors such as hard work associated with low pay.[24]

Smoking may negatively affect HRQL;[19,21,22,30] thus, it was expected that the scores of cane cutters who smoked would be lower than those of the non-smokers. However, this was not found to be the result.

No difference was observed in the HRQL between negative responders, probably because the exhausting task and direct exposure to burnt biomass had a stronger negative effect than smoking.

On examining the scores of individuals who had higher scores after the harvest than for the pre-harvest, the percentage of non-smokers was greater than of smokers. However, the number of non-smokers was three times higher than the number of smokers, which shows that smoking was not a prominent feature in the population of cane cutters. Future studies which evaluate greater samples and with variables such as

smoking, age groups, amount of time doing the activity, occupational history, among others, will be important in understanding the health of these workers.

In spite of the 2002 Law nº 11,241, which will eliminate burning the sugar cane crop by 2013,[20] and the increasing mechanisation of the plants of the State of São Paulo, the health and working conditions of individuals in the sugar and ethanol sector is still a subject of discussion for the coming years. Data on the HRQL of sugar cane cutters are scarce in the literature. The results found in this study suggest that the remuneration by output and the heavy workload are responsible for the decrease in the vitality of this population.

Among the limitations of this study was the difficulty in understanding and the low level of education of the population studied (63% had not completed elementary education). However, completing the questionnaire in the workplace was important so that the workers' perceptions and impressions occurred at the moment in which he was working at planting in the pre-harvest and at cutting during the harvest. It was not possible to evaluate the HRQL at the moment in which the workers who dropped out left, nor the relationship between the number of years they had been working doing this activity, as the participants were in their first or second year cutting sugar cane.

In spite of these limitations, this study shows a reduction in the HRQL, in the area of the sugar cane cutters' vitality, in the period of the harvest. Thus, the study will be able to contribute in guiding preventative policies and health interventions.

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