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# The impact of stress on the health of sugar cane cutters

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## ABSTRACT

**OBJECTIVE:** Evaluate the impact of stress on sugar cane cutters and the prevalence of physical and psychological symptoms before and after harvest.

**METHODS:** We studied 114 sugarcane cutters and 109 urban workers in the pre-harvest and 102 sugar cane cutters and 81 urban workers in the post-harvest period in the city of Mendonça, SP, Southeastern Brazil, in 2009. Data analysis was based on the frequency and percentage of the assessed symptoms of stress, using the Lipp-ISSL test (Symptoms of Stress for Adults). The data were analyzed using descriptive statistics. The Fisher Test was used to compare the variable of stress between pre- and post-harvest within the sugar cane cutter and urban worker groups. P values below 0.05 were considered significant.

**RESULTS:** Stress in sugar cane cutters increased after harvesting (34.2% pre-harvest and 46.1% post-harvest); in urban workers, stress decreased from 44.0% pre-harvest to 42.0% post-harvest. There was prevalence of the phase of resistance to stress for both groups with signs more apparent from the near-exhaustion and exhaustion phases for sugar cane cutters. After harvest, there was a tendency for the number of sugar cane cutters with symptoms of near-exhaustion (6.4%) and exhaustion (10.6%) to increase. After harvest there was a trend for the number of sugar cane cutters with physical symptoms (pre-harvest = 20.5%, post-harvest = 25.5%) and psychological symptoms (pre-harvest = 64.1%; post-harvest = 70.2%) to increase. For both groups, predominantly psychological symptoms occurred in both phases (70.2% versus 64.7%).

**CONCLUSIONS:** The work process of cutting cane can cause stress. Individual factors such as cognitive perception of the experience, self-efficacy beliefs and expectations of the employee regarding their performance can influence the understanding of the reactions in their body in face of the work.

**DESCRIPTORS:** Rural Workers. Agricultural Workers' Diseases, epidemiology. Stress, Physiological. Heat Stress Disorders. Burnout, Professional.

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## INTRODUCTION

Sugar cane cutters' health is conditioned by social, economic, technological and organizational factors related to the profile of production and consumption, as well as by physical, biological, mechanical and ergonomic risk factors existing in the work processes.<sup>9</sup> In Brazil, the relationship between work and the workers' health-disease is a mosaic in which different stages of technical incorporation and forms of organization coexist, as well as the management of production activities which impact on the life, sickness and deaths of the workers.

Sugar cane cutters live with modern work methods but in slavery-like conditions, which can affect their health.<sup>2-4,18</sup> A series of sudden deaths among sugar cane cutters was attributed to overwork.<sup>2,17,22</sup>

The restructuring of the country's production processes from the 1990s onwards, due to the globalization of the economy, had repercussions for rural activities, exacerbating historically constructed situations of exploitation and inequality. Thus, technological innovation enabled work to be intensified, expressed in physiological and psycho-cognitive diseases among the workers. This transformation in the world of work led to social exclusion and deteriorating health conditions.<sup>1,2,20</sup>

The migration process undergone by sugar cane cutters should also be considered as a risk factor for health. Studies have shown that the migration phenomenon can trigger illness, as it requires the organism to adapt to changes in the environment,<sup>10,12,20,23,a</sup> obliging the organism to use its reserves of energy, which can, in certain circumstances, lead to weakened physical and mental resistance, and this can result in psycho-physiological diseases originating in excessive stress.<sup>8,10,12,20,23,a</sup>

The four-stage model conceives stress as the organism's reaction to psychological, physical, mental and hormonal components occurring when the need for a significant adaptation to an event or situation appears. This event could be perceived as positive or negative. Positive stress is that of the initial phase of alert, when the organism produces adrenaline, providing energy and making the individual both more productive and more creative. Negative stress is produced by excess, occurring when the individual exceeds their limits and exhausts their capacity to adapt. In this phase, resistance, the organism seeks to resist the stressors and total exhaustion of energy. Cortisol is produced and productivity falls drastically. When the tension exceeds manageable limits, this is the near exhaustion phase; physical and emotional resistance begin to breakdown; in this phase, there is great anxiety as the individual

experiences moments of discomfort interspersed with moments of lucidity and decision making. Finally, in the fourth phase, exhaustion, the most negative, pathological, stress leads to significant internal imbalance, which can lead to serious illness.<sup>16</sup>

Going beyond this psycho-physical concept of stress, Rodrigues & Gasparini<sup>19</sup> state that stress is related to the subject's interpretation of their experience of living, control of which is closely related to the subject's ability to perceive their own body and emotional reactions. Thus, depending on their self-perception, an individual can be capable of identifying, more or less accurately, their physical and emotional reactions stemming from a stressful situation.

The aim of this study was to analyze stress levels and prevalence of physical and psychological symptoms in sugar cane cutters in the pre- and post-harvest periods.

## METHODS

In 2009, it was estimated that there were around 400 individuals from the Northeast of Brazil, from the states of Paraíba and Pernambuco, working in sugar and alcohol plants in the rural area of Novo Horizonte, SP, Southeastern Brazil, of which 183 migrated annually to the city of Mendonça, SP, to work cutting sugar cane. In the pre-harvest period, 114 rural sugar cane cutters and 102 urban residents in Mendonça participated in the study. In the post-harvest period, 109 sugar cane cutters and 81 urban workers participated.

Sugar cane cutters meeting the following inclusion criteria were selected: males aged between 20 and 40, non-smokers and with no reported cardiorespiratory disease.

The urban workers, residents in the city, were selected according to the same criteria established for the sugar cane cutters, provided they did not work in this crop.

Stress levels were evaluated in the groups of cane cutters and in the group of urban workers in both stages (1 and 2) using Lipp's Inventory of Symptoms of Stress for Adults (ISSL).<sup>14</sup>

The Lipp-ISSL aims to answer three basic questions: whether the individual is stressed; if so, in which phase (alert, resistance, near exhaustion or exhaustion); and whether physical or psychological symptoms are prevalent. The instrument is composed of three sessions, the first referring to symptoms the individual has experienced in the preceding 24 hours, the second concerning symptoms from the preceding week and the third symptoms from the preceding month.

<sup>a</sup> Silva MAM. Migração e adoecimento: a cultura e o espaço de simbolização da doença [doctoral thesis]. Campinas (SP): Faculdade de Ciências Médicas da Universidade de Campinas; 2004.

**Table 1.** Distribution of urban workers and sugar cane cutters in the pre- and post-harvest periods according to presence of stress.<sup>a</sup>

Period	Population	Sample (n)	With stress (n)	With stress (%)
Pre-harvest	Urban workers	109	48	44.0
	Sugar cane cutters	114	39	34.2
Post-harvest	Urban workers	81	34	41.9
	Sugar cane cutters	102	47	46.1

<sup>a</sup> p of Fisher test for urban workers = 1.00 and p of Fisher test for sugar cane cutters = 0.25.

The ISSL lists physical (e.g., dry mouth, tense muscles, tingling extremities) and psychological (e.g., self-doubt, sudden surges in motivation, lost sense of humor) symptoms, divided into three areas. It is based on Selye's<sup>21</sup> three stage model, in which each area corresponds to a phase of stress. First, the respondent indicates which of the symptoms in the first area had been experienced in the preceding 24 hours. Next, they indicate symptoms from the second area which they had noted in the preceding week, and then those which had affected them in the preceding month, from the physical and psychological symptoms presented in the third area. The ISSL can diagnose whether the individual is stressed, at which stage of the process (alert, resistance, near exhaustion or exhaustion) and whether physical or psychological symptoms are prevalent. The Lipp-ISSL is a four-stage model of stress that introduces a new phase between those of resistance and exhaustion, namely the "near exhaustion phase".<sup>13</sup>

The results were analyzed according to criteria of the sugar cane cutters and urban workers having participated in either of the two periods, i.e., in the pre- or in the post-harvest period, or in both. As the participants were not paired, no individuals were eliminated, and there were therefore no losses. In total, 114 sugar cane cutters were evaluated in the pre-harvest and 102 in the post-harvest period; and 109 urban workers in the pre-harvest and 81 in the post-harvest period.

The data collected were analyzed using descriptive statistics. Fisher's Exact test (GraphPad Prisma 4.0 software) was used to compare the categorical variable, represented by pre- and post-harvest stress in the

groups of cane cutters and urban workers (Table 1). P values below 0.05 were considered significant.

The study was approved by the Research Ethics Commission of the Hospital das Clínicas of the *Faculdade de Medicina* of the *Universidade de São Paulo* (Protocol 0282/09). All participants signed an informed consent form.

## RESULTS

Table 1 shows the symptoms of stress which manifested themselves in both the sugar cane cutter (pre-harvest period = 34.2%; post-harvest = 46.1%) and the urban worker population (pre-harvest period = 44.0%; post-harvest = 41.1%). However, in sugar cane cutters, stress was more prevalent in the post-harvest period, whereas it remained constant for the urban workers, irrespective of the period (p of the Fisher test 0.25 and 1.00, respectively).

The data show (Table 2), that the sugar cane cutter population with stress were predominantly in the resistance phase, both before (84.6%) and after (83.0%) the harvest. However, in the post-harvest period, there was a trend for the number of individuals with symptoms of near exhaustion (6.4%) and exhaustion (10.7%) to increase. On the other hand, in the urban worker group, although the predominant phase was that of resistance, in both the pre- (93.8%) and post-harvest (97.1%) periods, there was less exhaustion (4.2% in the pre-harvest period, versus 0.0% in the post-harvest period) (Table 2).

When comparing the pre- and post-harvest data, a tendency for the proportion of sugar cane cutters with

**Table 2.** Distribution of urban workers and sugar cane cutters in the pre- and post-harvest periods according to phase of stress.

Period	Phase of stress Population	Alert		Resistance		Near exhaustion		Exhaustion	
		Frequency	%	Frequency	%	Frequency	%	Frequency	%
Pre-harvest	Urban workers (N = 48)	1	2.0	45	93.75	0	0.0	2	4.1
	Sugar cane cutters (N = 39)	2	5.1	33	84.6	2	5.1	2	5.1
Post-harvest	Urban workers (N = 34)	1	2.9	33	97.0	0	0.0	0	0.0
	Sugar cane cutters (N = 47)	0	0.0	39	82.9	3	6.3	5	10.6

physical (20.5% to 25.5%) and psychological (from 64.1% to 70.2%) symptoms to increase was observed, whereas for the urban workers (Table 3) the trend was for physical symptoms to decrease (from 29.2% to 23.5%) and psychological symptoms to increase (from 62.5% to 64.7%) in the post-harvest period. In both groups, psychological symptoms were less frequent in both periods, with this being more evident in the sugar cane cutters.

Regarding specific symptoms of stress (Table 4), in the post-harvest period, it was noted that sugar cane cutters had: increased dermatological problems (from 10.1% to 25.3%), constant fatigue (from 20.3% to 30.3%), excessive irritability (from 11.3% to 29.3%), prolonged dermatological problems (from 11.3% to 23.6%) and excessive fatigue (from 19.2% to 37.3%).

In the group of urban workers, the frequency of symptoms of stress decreased in the post-harvest period, with the exception of "changes in appetite" (Table 4).

## DISCUSSION

This study reveals that stress manifested itself in almost half of assessed sugar cane cutters in the municipality of Mendonça, SP, in the pre- and post-harvest periods of 2009. Both cane cutters and urban workers suffered from stress, as confirmed in previous studies.<sup>b,c</sup> These results lead us to reflect on the impact of the organization of work processes on the health of these workers. Concerning the sugar cane cutters, the data show that this group are more vulnerable to stress manifesting itself after the intense and continuous work of cutting sugar cane over an eight-month period. Regarding the intensity of the stress suffered, there was an increase in the post-harvest period (Table 2). This means that in both groups, our participants showed signs of stress, the organism presenting generalized attrition with problems with memory and vulnerability to infection by microorganisms, cortisol production and falls in productivity denoting attempts to re-establish internal balance.<sup>20</sup> However, the two groups differed in that a higher proportion of sugar cane cutters were in the near exhaustion and exhaustion phases in the post-harvest period, indicating that their work may produce increased physical and mental attrition, which was not the case for the urban workers, exercising functions which required cognitive abilities rather than physical effort. The consequences of excessive stress range from gastritis (risk factor in developing gastric ulcers), dermatological problems (herpes, dermatitis, urticaria psoriasis and vitiligo), arterial hypertension, early ageing, depression anxiety and, in rare cases, sudden death.<sup>2,4,17</sup> In this sense,

these results indicate the relationship between stress and cases of sudden death in sugar cane cutters.<sup>2,20</sup>

Although the majority of workers with stress in the pre- and post-harvest periods were in the resistance phase, more cases of workers with unacceptable levels of stress (near exhaustion and exhaustion) were noted after the harvest. These results show a potential association between reports of sudden, unexplained deaths in this group of workers.<sup>2,18</sup> The results also show the predominance of psychological symptoms over physical symptoms on the groups of sugar cane cutters and urban workers (Table 3). This is characterized by emotional reactions such as excessive irritability, fixed thinking and self-doubt. They also show evidence of the damage the production process in this sector causes to the health of sugar cane cutters, such as symptoms of excessive fatigue, excessive irritability and prolonged dermatological problems, among others (Table 4). Monitoring sugar cane workers' health and preventing health problems should take into account bio-psycho-social factors implicated in the production processes of the work.

This study raises important issues beyond that of the perception of symptoms of stress suffered by sugar cane cutters in their intense day-to-day work. For those who opt for this kind of life, it is important that our analysis is aimed at the worker's perception of their capacity to deal with events exceeding their limits, which are the stressors in their daily work. This refers to what psychologists call self-efficacy beliefs.

According to Bandura,<sup>6</sup> these beliefs have diverse effects on the way humans function: they regulate aspirations, influence the course of action to choose from, the effort put into attempts, thought patterns (self-help and self-impeding), as the stress or depression experienced when dealing with demands that exceed capability. Perceiving oneself as capable, or otherwise, of dealing with stressful situations appears to be a critical aspect in facing them. Self-efficacy beliefs affect the impact of organizational stressors on the health and emotional life of employees. What is experienced as a stressor partly depends on the level of self-efficacy. Workers with a poor sense of self-efficacy become stressed with overwork and the responsibilities inherent to their role. Those with high sense of self-efficacy are frustrated and stressed by limited opportunities to make use of their talents.

This study shows that it is important not only to interpret the sugar cane cutters' working conditions as threatening or otherwise, but to assess self-perception of capacity to effectively control them, especially in work of a dangerous nature, such as cutting sugar cane. This self-perception is a critical factor in preventing stress.

<sup>b</sup> Fontes AP. O enfrentamento do estresse no trabalho na idade adulta [Mater's dissertation]. Campinas (SP): Faculdade de Educação da Universidade de Campinas; 2006.

<sup>c</sup> Guimarães LAM, Mac Fadden MAJ. Validação para o Brasil do SWS Survey: questionário sobre estresse, saúde mental e trabalho. In: Guimarães LAM, Grubits S, organizadores. *Série Saúde mental e trabalho*. São Paulo: Casa do Psicólogo; 1999. v.1, p.153-169.

**Table 3.** Distribution of urban workers and sugar cane cutters in the pre- and post-harvest periods according to predominance of symptoms.

Period	Phase of stress Population	Physical		Psychological		Physical and Psychological	
		Frequency	%	Frequency	%	Frequency	%
Pre-harvest	Urban workers (N = 48)	14	29.1	30	62.5	4	8.3
	Sugar cane cutters (N = 39)	8	20.5	25	64.1	6	15.3
Post-harvest	Urban workers (N = 34)	8	23.5	22	64.7	4	11.7
	Sugar cane cutters (N = 47)	12	25.5	33	70.2	2	4.2

We suggest that, in future research, evaluation of stress include questions evaluating the degree of control the worker judges he has over the event, as he determines his capacity to deal with stress, or otherwise.

Believing oneself capable of carrying out the work throughout the entire harvest period, receive a salary, acquire spending power and guarantee a new contract for the next harvest enables the worker to believe they will manage to balance worrying stimuli at work and decrease anxiety and stress.<sup>15</sup> According to Bandura,<sup>5,7</sup> self-efficacy beliefs have adaptive power not only for emotional well-being, but also for action and motivation. Thus, cognitive social theory attributes crucial value to determining human behavior, deducing from this that success, or lack of, it depends much more on the beliefs held concerning it than on the effective result. Regarding sugar cane cutters, self-perception of their capacity to bear the harvest time workload is more important to meeting the demands of the work than the final result. According to Bandura,<sup>6</sup> this is because individuals self-motivate themselves and guide their performance through anticipatory thinking, i.e., their capacity to foresee positive situations for the forces which will be expended. It can be concluded that monitoring the health of sugar cane cutters is permeated by subjective issues concerning the cognitive perception they have of their state of health, as well as by a wide range of social, environmental, economic, political and cultural factors. Iglesias & Araújo<sup>11</sup> state

that health is no longer seen as an exact concept, standardized for everyone, but rather, as something linked to many other factors, such as those mentioned above. This is demonstrated by Medeiros Neto et al<sup>14</sup> in their analysis of perceptions of fatigue, stress and anxiety in workers in the shoe industry. These authors state that the physical workload, the lack of control and the demanding work to which professionals in this sector are exposed do not lead to higher scores for anxiety, fatigue or stress compared with administrative workers. However, the study observed a strong positive correlation between the presence of anxiety, perception of fatigue and stress at work, suggesting that the impact of these variables may be modified through individual, social and cultural characteristics.

It is not only the heavy physical work of cane cutting which can cause stress, as the researchers of this study expected. There is a web of individual and subjective implications, involving the cognitive perception of experience, the worker's life history with self-efficacy beliefs and their expectations of their own performance which will make up the fabric that will permeate their understanding of their bodily reactions to the challenges of work.<sup>16</sup>

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**Table 4.** Distribution of urban workers and sugar cane cutters in the pre- and post-harvest periods according to presence of symptoms of stress (p of Fisher test).

Symptoms	Pre-harvest (Phase 1)		Post-harvest (Phase 2)	
	Sugar cane cutters (%)	Urban workers (%)	Sugar cane cutters (%)	Urban workers (%)
Changes in appetite	55.2	17.7	52.5	23.3
Surge of motivation	55.2	35.4	42.4	19.2
Dermatological problems	10.1	23.2	25.2	10.1
Constant fatigue	20.2	21.8	30.2	20.2
Excessive emotional sensitivity	30.4	47.7	29.2	31.4
Thinking about only one subject	51.8	47.7	49.4	37.5
Excessive irritability	11.2	23.2	29.2	17.2
Extreme changes in appetite	36.1	19.0	40.3	18.2
Prolonged dermatological problems	11.2	25.9	23.5	12.1
Self-doubt	57.5	39.5	39.3	24.3
Excessive fatigue	19.1	25.9	37.3	20.2

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