INNSPUB

International Journal of Biosciences | IJB |
ISSN: 2220-6655 (Print), 2222-5234 (Online)
http://www.innspub.net
Vol. 16, No. 4, p. 206-221, 2020

REVIEW PAPER OPEN ACCESS

Occupational Health, Safety and Ergonomic Issues of Sugar Industry- A Review

Muhammad Ehtisham Zafar[1*], Zia-Ul-Haq[1], M. Adnan Islam[2], Hamza Muneer Asam[1], Abdul Qadeer[1], Talha Mehmood[1]

[1]*Faculty of Agricultural Engineering and Technology, PMAS-Arid Agriculture University, Rawalpindi, Pakistan*

[2]*Agricultural Engineering Institute, Pakistan Agricultural Research Council, Pakistan*

Key words: Sugar Industry; Injuries; Safety measures.

http://dx.doi.org/10.12692/ijb/16.4.206-221 Article published on April 29, 2020

Abstract

Sugar industry plays a vital role in country's development. Nowadays, the production and consumption of sugar is significantly increased due to increase in population. A large numbers of people directly and indirectly get employment from this sector. Industry's most outstanding attribute is its crucial connection between the factory and the growers whose interests are interdependent on one another. Sugar is produced mainly from sugar cane in Pakistan. Currently its accounts for approximately 4.5 percent of the total crop area and 11 percent of the total added value. In addition to qualified and semi-skilled workers, the industry contributes over 4 billion rupees to GDP and employs more than 75,000 people directly, including management experts, technologists, engineers, financial experts, lawyers and doctors. Workers in sugar industries are suffering from various kinds of illnesses because of poor working conditions, differ from small injuries to serious and further serious injury. In present work we highlight the practices and environments, risk of discomfort, tension and injury as a result of ergonomic issues. Accidents faced by workers in many developing countries are most common due to hand tools and cutting tools. Additionally, the review also highlights safety measures in sugar industry to avoid injuries and accidents during working.

* **Corresponding Author:** Muhammad Ehtisham Zafar ✉ eehtishamsandhu36@gmail.com

Introduction

Sugar industry is an employment-intensive industry with the highest proportion of the society's population, trying to cover both organized and disorganized human resources. Like any other sector, the sugar industry hires multi-skilled workers at varying leadership levels. From the management point of view, making full use of the workers ' expertise is of paramount importance.

Public relations activities concerns people working in the organizations; they may be in the publicly or privately or collaborative sector. This deals with the process of implementing people according to their desires and to fit the requirements of the organizations. Human capital may be used as a tool for the proper development of other resources. Hence human resource activities influence the organization's performance and human resource plays an important role in the sugar industry. Sugar industry plays a very important part in regional development. The sugar sector is divided into two categories, i.e. the sugar factories are private and cooperative. For successful functioning both categories require trained human resources.

Sugarcane is a significant yield in Pakistan. Pakistan lies in top 10 nations which supply a lot of sugar to the world. In ongoing period, word related sicknesses and mishaps have expanded because of absence of wellbeing and security mindfulness and poor working environment condition. In Pakistan laborers are presented to unsafe synthetic substances on regular routine so word related wellbeing dangers are extremely high in industry. The greater part of the laborers don't know about defensive measures since they are uneducated (Munir *et al.,* 2012).

In Pakistan businesses assume a fundamental job in monetary improvement. Significant issues are making for laborers because of terrible natural conditions in enterprises. The examination was done in Bhalwal sugar plant to watch the effects of that modern condition on laborers wellbeing. Different laborers were chosen to gather polls information. Results demonstrated that physical just as social condition of the business was influencing the laborers wellbeing status. Discouragement and anxiety was found among laborers.

The State Health Interview Survey of 1988 found that a number of musculoskeletal injury risks suffered mostly from employees in the construction industries. A further analysis revealed that, for different individuals working in manufacturing or business, the one-year prevalence of back pain was around one and a half times greater than the average for many other US manufacturing industries (Guo *et al.,* 1999).

Inhaling of particulates produced during burnt cane cutting can impact the top and bottom airways, causing signs and respiratory diseases and also loss of lung function in the workforce (Prado *et al.,* 2012).

Ergonomics and occupational health in sugar industry

A word related peril is typically a circumstance that can possibly hurt laborers. There are two kinds of word related dangers for example wellbeing risks and security perils. On the off chance that any laborer experiences disease because of risks, at that point this peril would be wellbeing danger. On other hand on the off chance that perils physically harm representatives because of any mishaps, at that point it is called wellbeing dangers.

The industry commissioned a review, “Sugar in the Diet of Man,” which it credited with, among other industry tactics, favorably influencing the 1976 US Food and Drug Administration evaluation of the safety of sugar (Taubes *et al,* 2012). These findings, our analysis, and current Sugar Association criticisms of evidence linking sucrose to cardiovascular disease (Sugar Association, 2015) suggest the industry may have a long history of influencing federal policy.

A research has been conducted in India on the ergonomics and occupational health and safety issues of employees at sugar mills. They noted that this study examined more than fifty administrators of

manufacturing units. They also reported that about 48 percent of the workers had low back pain, 38 percent fatigue, 34 percent pain in the upper body, 50 percent tension and 45 percent discomfort. They also indicated that a hot atmosphere was registered by 57 percent of managers, a noisy environment by 37 percent, and a lack of personnel assets and comforts by 42 percent. Likewise, over 60% of employees had no knowledge or understanding of ergonomics problems and 65% of managers did not conduct an ergonomic review of their manufacturing sectors. They found a significant correlation ($p<0.01$) between issues with ergonomics, safety measures and overall injury rates. Lastly, they pointed out the lack of skills in ergonomics, communication and infrastructure as the major factors leading to poor working conditions and consequently rising health and safety issues in sugar mills.

The aim of occupational health and safety (OHS) is to safeguard the illness of employees to detect, evaluate and prevent industrial-level health disorders. Ergonomics is a science of developing devices used in sectors that is ideal for employees to improve job efficiency and also to lower the rate of injury at industry level. In all types of industries the goal of occupational health and safety is to reduce the risk factors during working conditions. The important problems for several industrial nations were the effects of bad health and failure of safety and non-ergonomic factors in various industries, which not only decreased mill capacity and also caused injury (Ahasan, 2002).

With a normal development pace of 2.5% per annum, the number of inhabitants in the nation will develop year to year. The per capita utilization of sugar in Pakistan is around 22 kg. The assessed residential utilization is given in table I and chart IA. Remembering the equalization generation of horticultural segment and curious issues the sugar business face due to being its status of political industry, and its occasional nature the base creation of 3.3 million tons for every season will be sufficiently adequate to meet the residential interest as well as make surplus sugar accessible during the following three years.

Injuries of workers in sugar industry

Keeping in see the significance of the laborers as the genuine spine of industry, it was wanted to direct eye to eye meetings of harmed unfortunate casualties to record their wounds looked during working in sugar businesses.

The Poor rustic individuals are legitimately occupied with the generation work under different unpleasant conditions. Commonness of a few lethal word related and working environment wellbeing perils is seen in these sugarcane industry laborers. The study on various agents are checked on to feature issues of sugarcane laborers for future extents of work (Arkajit *et al.,* 2016).

In developed and urban developing countries, the leading cause of workplace injury and illness is musculoskeletal disorders (MSDs).The economic loss incurred by these disorders has an impact not only on patient but also on company and the community as a whole. Low wages and lack of an efficient system for preventing work injury in developing industrial countries have resulting in very strong MSD level. Risk factors for WMSD provide workplace behaviors, like heavy load holding, repetitive activities and uncomfortable working stances. In sugar-producing factory workers are directly involved in the production process. In these mills, physical activities like physical processing of products (e.g. lift heavy loads, falling, holding, pulling and push) and uncomfortable working stances were quite usual. In that situation a high rate of WMSD is predicted (Vanwonterghem, 1996).

Poor quality of drinking water and dusty environment in the sugar sector had adversely affected the safety of the employees. This was also observed that approximately half of the employees in the sugar industy in Pakistan were not equipped with safety precautions that were the main leading cause in different parts of the sugar industry. At last

conclusions showed that accidents can be minimized in Pakistan's Sugar Industry by coordinating the industry's proper training programme. Preventing job-related injuries, health and deaths was critical for a company and considered when designing a management system (Munir *et al.,* 2012).

Mechanical harvester operators are much more vulnerable to mental burdens associated with study than that of the manual cutters. The work requires routine and repetitive tasks that require continuous concentration and focus, lead to mental issues like stress and fatigue (Scopinho, 1995).

Job remuneration is a further factor affecting staff sickness. The cutters, charged on the basis of their quality, try to raise their speed of work with a view to ensuring payments as well as the survival for theirs employment in future harvests, ignoring the limitations for their own bodies and exposing themselves to constant work overloads and health risks. In the case of ten sugarcane cutters that died in São Paulo state in 2005, the correlation between form of compensation and the rate of work intensification is believed to become the leading cause of death (Alves, 2006).

Goto *et al.* (2011) conducted a study including 30 sugarcane cutters whose primary objective was to check nasal mucociliar movement, contrasting the harvesting period the time to before harvest. Writers have not noticed variations between the times of lung function. Prado *et al.* (2012), however, established a research involving a greater number of employees and a control group that assessed breathing and lung function. In the harvest season, increased number of respiratory problems and reduced lung function among many sugar cane cutters linked with before harvest, reduced forced expiratory quantities during the first sec, forced expiratory quantities during the first second / forced critical efficiency and forced expiratory circulation (FEF25-75 per cent),classifying an organism of obstructive patterns of ventilatory dysfunction. Ferreira-Ceccato *et al.* (2011) measured the severe impactsin the first day of burnt cane harvest, i.e. 4 hours after work begins, and did not seeany indication of nasal signs in one of the assessed staff. Nevertheless, the occurrence of symptoms is not an indicator that is immune to the study's measured acute effect, and thus restricts its viewpoint.

Barbosa *et al.* (2012) determined that, throughout harvest and pre-harvest, 28 people involved in sugar cane cutting observed a substantial increase in blood pressure levels during harvest season. Systemic blood pressure monitoring during 24 hours harvest has shown a rise in systolic blood pressure of 3.7 mmHg. The research also demonstrated the impact of greater sympathetic behavior correlated with elevated blood pressure, which is directly reported in the fibular nerve. This indicates the outcome of a nervous autonomous System failure like one of those pathways potentially involved in high blood pressure. On edge of effect on blood pressure. During the harvest he often noted a significant reduction throughout the time of thrombin and prothrombin. It indicates higher blood coagulation that raises the risk of thromboembolic effects, changes that can be correlated with both cane burn and dehydration inhalation of pollutants.

Vilela *et al.* (2015), evaluated cardiovascular load (CVL) in a group of 40 cane cutters. This index is used to measure the work's physiological effect as it refers to the percentage of occupational heart rate compared to highest heart rate allowed. They found a positive impact between productivity gains and CVL. The increasing of approximately 0.81 per cent in CVL was associated with each rise in 1 ton of sugar cane cut. This discovery demonstrates the effect of higher production on heart stress, i.e. work paid through efficiency which imposes higher risk of cardiovascular disease.

Prado *et al.* (2012) reported a decline in antioxidant enzymes in sugar cane cutters: catalase, glutathione S-transferase (GST), glutathione reductase (GR) and glutathione peroxidase (GPx) at the end of the harvest period relative to the pre-harvest period. Malondialdehyde amount (MDA), a component of

lipid peroxidation in the cell wall, has raised. This result, together with both the reduction of enzymatic antioxidant activity, confirms a chronic condition of oxidant stress between cutters. Nevertheless, in the burned sugarcane harvest season, Barbosa *et al.* (2012) noticed an increase of antioxidant enzymes GST, GPx, presumably as a reaction to hostility, even though it reported a rise in MDA levels. The researchers suggested that both procedures could be coincidental, an attempt to justify aginst oxidizing agents to enhance sensitive enzymes, and damage by membrane oxidation to the cell wall. The different conclusions in the antioxidant markers may be explained by variations in individual characteristics, genetic polymorphism, working conditions, dietary and living conditions. Barbosa *et al.* (2012) research cutters in the São Paulo area of Sorocaba-Piracicaba, SP, and those interested in Prado *et al.* (2012) research were Paraíba and Pernambuco refugees who served in the São José do Rio Preto district, SP during the growing seasons.

Certain work-induced manifestations (Prado *et al.*, 2012) are correlated with the elevation of muscular damage biological markers such as lactate dehydrogenase (LDH) and creatine kinase (CK) and employment-compatible electrolyte modifications in physical condition stress and hydro electrolyte equilibrium.CK and LDH are biological markers which may develop when the cell membranes become porous and release various compounds, such as myoglobin, in to the blood (Brancaccio, Lippi & Maffulli, 2010). There was a severe rise in CK serum concentrations in the study by Paula *et al.* (2015) that rose from 120 IU / l before the start of the workday to 360 IU / l at the end of the work day.In the research by Barbosa *et al.* (Barbosa *et al.,* 2012), though low in degree, heights were observed in the CK and DHL serum levels in connection to the time before harvest during harvest, which indicates chronic injury to the muscle.

Their etiology was not explained, following many reports. One theory is that it would be triggered by frequent moments of acute kidney damage caused by chronic rhabdomyolysis-related dehydration, structural inflammation, genetic diversity, oxidative stress and attention to uncharacterized pesticides (Trabanino *et al.*, 2002).In Nicaragua, Wesseling *et al.* (2016) tested 29 sugar cane cutters and observed a substantial reduced renal function over the course of nine weeks job of cutting sugar cane. The measured mean levels of glomerular filtration declined significantly (9%, 10 mL / min), serum creatinine (20%), serum urea (41%), and neutrophil-related lipocalin (NGAL), a biological marker for early diagnosis of kidney problems. There was a substantial rise in uranial density, low serum sodium rate and nominal sodium excretion (FeNa) in the Paula *et al.* (2015) research concerning 28 sugarcane cutters assessed during a work day after the harvest period ends, including a significant increase in hematocrit at the end of a working day, which implies dehydration of the sugarcane cutters.

Dehydration, heat stress, and loss of size, are established risk factors for renal disease formation. The high incidence of decreased glomerular filtration rate was consistent with dehydration in hot and humid environments caused by strenuous working. The cause can be attributed to reduced renal blood circulation, increased tubular reabsorption demand and increased uric acid levels (García-Trabanino *et al.*, 2015).

Tompa *et al* (2016) made, in an earlier study, one of the first attempts to article the effectiveness of preventive measures by healthcare and clauses. The writers discussed difficulties in establishing unique criteria for composition and efficiency, and using best evidence-based synthesis. Researchers found that the implementation of legislation on workplace Health and safety (OHS) also has no direct effect on the rates of workplace injuries, and that charges for violations of regulations. Tompa *et al* updated the knowledge base by examining the efficacy of the enforcement of workplace health and safety regulations. They stated that there was solid evidence from real penalty inspection and reasonable to limited evidence that there was no effect on inspections without sanctions.

There was moderate evidence that somehow the implementation of OHS regulations affected injuries and deaths. The implementation of smoking-free occupational regulations enhanced proximal results such as exposure to smoke and intake of tobacco (strong proof) and proximal results of respiratory and sensory effects (reasonable evidence).Protests for awareness generally demonstrated weak proofs. In a 2013 Cochrane collaborative checking on workplace resources for ensuring health and safety to prevent injuries and workplace illnesses. (Mischke *et al.*, 2013) proved that there is proof that investigations are continuing to reduce long-term but not short-term injuries with unclear degree of impact. Therefore, the results of intensified inspections may be stronger than total investigations and the impact of fine and sanctions is uncertain.

The consistency of the proof was considered small to a very small, thus findings are provisional and might easily be altered by future research. A review of the partnership with Cochrane on strategies for minimizing injuries between laborers. In 2018 only, the law stated in Van Der Molen *et al.* is not effective at reducing serious and anti-fatal injuries. Ongoing industry-oriented initiatives between managers and workers, such as a focused protection initiative or a drug-free workplaces policy, tend to affect the prevention of long-term injuries. The study also found that legislation and prevention programs have really poor quality proof, and practices in building companies to reduce serious and non-fatal injuries.

Several industries are sponsoring research to affect risk and benefit assessments for their products. Enhanced consideration is being given over the impact of industry sponsorship on nutritional science. Exposure to information not intended for public consumption has given unparalleled insight into business motivations, plans, techniques, and evidence intended to protect businesses from lawsuits and enforcement by the population health community. The insight was a key factor behind positive strategies on global tobacco control. Studies using data from the sugar industry has the ability to educate the health world of how to combat the tactics and strategies of this industry to control the flow of information about the negative health effects of sugar (WHO, 2014).

Occupational health and safety is posited as an environment dealing with workers ' fitness, security and wellbeing. It is also claimed that one of the goals of health and safety services at work is to promote a fair and friendly climate of work. The terms listed above may be aimed at protecting other contractors in the sector inquired (Fanning, 2003). Health and security in the workplace are argued critical from the social, financial and legal viewpoints. Example is that workers have an ethical obligation to treat their workers with reasonable care. In addition, the administration is formulating new rules to regulate occupational health and security. In the same way, effective workplace protection and wellbeing services a long way to go reduce costs related to injury and illness to workers, health care, excuse for sickness and even cost of disability benefits.

Manual and mechanized sugar cane cutting workers confront various health hazard, which due to occupational practices will jointly assess worker's illness. Laborers in traditional sugarcane cutting are vulnerable to the chance of musculoskeletal disorders (particularly in the lower region and upper limbs), assessed because of a sudden and repetitive series of physical movements, irregular working style and extreme physical exertion. The repeated motions and constancy arising from manual sugar cane cutting intensify the concentration and focusing needed for such a task which increases the likelihood of resulting workplace injuries. Machet holding and biting of venomous animals are, as seen by research, the most popular workplace injuries for manual cutters, while mechanical cutter accidents resulted from crashes and dropping during machine maintenance (Alessi and Navarro, 1997).

It is claimed (EU-OSHA, 2007) that employers in most OECD nations have aduty not only to defend the physical illness of their workers and also their mental

health. The metal health risks are seen to be linked to the way in which they are conceived, structured and controlled and also to the background of economic and social research.n In short, workers safety is believed being related to mental hazards as job stress, and workplace lawlessness. These are recognized worldwide as serious health and safety challenges for the work force. The study conducted by European Agency for Safety and Health at Work (EASHW) found highest mental threats on the rise included insecure working undertake, increased vulnerability of employees, job insecurity and intensification of work (EU-OSHA, 2007).

Preceding the annual report of the International Labor Organization (ILO, 2012), regardless of the age of the workers, agriculture is among the three most sought after hazardous in occupational health and safety industries. ILO Agricultural Safety and Health Recommendation, No. 192 recommends that children should not participate in dangerous behaviors and, where appropriate measures on welfare monitoring for young workers. This has been caused in the recent past by over use of agricultural chemicals and motorized farming machinery, in particular, farmers in developing countries, who have resulted in superior levels of injury and worker poisoning. It is further discussed that particularly nations are lacking the necessary resources to track the importation and using the above-mentioned chemicals are vulnerable.

The extent of conformity with the same is alleged not to be motivating in South Africa, despite excellent regulations regarding occupational health and safety (Joubert, 2002). There are other forms of government intervention, in line with the above, that are argued to improve working conditions indirectly. These include restrictions on workers ' compensation and stipulations that employers of certain types must hire health and safety practitioners such as nurses. Workplace safety and health in Africa is also reported to have brought partners on board across different ministries and across Africa and beyond the goal to collaborate to help nations, workers in both the formal and informal fields (ILO, 2012).

In Kenya's scenario, Mbakaya *et al* (1999) concluded that among those working in the country there is a general impression that regulatory level and implementation of occupational illness and security regulations is greatly inadequate, especially in comparison with developed nations. Chullen in 2012 put much thought into workplace illness and security of the kenya's sugar industry. He acknowledged that Occupational Health and Safety (OHS) is a key area of many aspects of trade union labor. It says it is a worker's right to work in a clean, hazard-free environment and productivity benefit. In addition, creating a healthier workplace is asserted to be a continuous task that requires the involvement of both management and workers in a collaborative process based on knowledge and proactive efforts to eradicate hazardous and reduce risks.

Bandura (2001) claimed the above description had been commonly used in a multitude of environments related to health. It's also suggested that self-effectiveness is preferred in cultural psychological theory because it has many implications in a variety of contexts and also because of the substantial overlap of factors between social cognitive theories and similar theories health related. The theory of social cognition has two principles. The first explains how psychology has to include the cultural context in the study of human activity, because people are fundamentally of a nature. The second tenet explains how people use their intellect to respond to social contexts for ways of thought and communication. In other words, as part of the social acts, this theory construes cognition.

It's argued that people are trying to regulate the different aspects that characterize their climate. Each individual seeks controlling the required results and get controlling the unrequired things. Bandura (2001) has noted that people are exposed from a social psychological point of view on a daily basis to different continuous situations, identify the best approach to these circumstances, study their presumed competency (self-effectiveness) in achieving their objectives, decide whether the

activities they carry out can produce the required result (expected outcomes) and ultimately determine the effectiveness of achieving the outcome.

Peterson's research (1996) found that the education related to safety happens almost reflexively in industrial conditions. The researcher argued that from a socially experimental viewpoint, the above results can be different in nature. For example, traditional safety education sessions are either focused on providing workers with knowledge about risky conditions or using fearful tactics to alert workers about hazardous health related circumstances. Bandura (2001) said that a change in focus is needed to have the most effect on self-efficacy of employees. On the place of trying to threaten workers into health, safety, the required instruments for exercising personal control over their health habits should be given. Therefore, in order to have an effect on the health and workers ' Self-efficacy, awareness about health must emphasis on getting people to work with the necessary skills to execute their work tasks safely.

It hypothesized while that is a traditional defense training session may not have an effect on the self-efficacy of workers, it may have an impact on the expectations of their result. Example of that if workers watch a video about safety showing a amputation to the finger that occurs because of the failure of a worker who switches power off to a machine; a change in the general public interpretation of the result can adapt to that specific type of injury. The seriousness was argued about the injury that would make the result in perceptions of physical deficiency (physical outcome expectation) through amputation, relatives, colleagues, aversive social reactions and coworkers (social outcome expectation), and a negative self-assessment where the individual considered protection a key value (Rotich and Kwasira, 2015).

As such, it is deduced that the safety training and health education could be merged to enhance the efficiency of workers from a social cognitive perspective and thus form their result perceptions unless they did have good training and feel they could get suggestions into the system protection. Security initiatives concentrates on delivering realistic ways and techniques to improve safety will increase the self-efficacy of participants (employees) when it comes to injury prevention (Rotich & Kwasira, 2015).

Safety climate theory

Psychosocial security climate (PSC) as common views of organizational policies, processes, and procedures for the defense of employee psychological health and safety arising primarily from management practices, according to Law *et al.* (2011).The PSC hypothesis implies that the structure of the job needs resources and indicates that the PSC level of the company affects working conditions and consequently psychological health issues and work participation. The empirical theory of psychological security environment, according to Dollard (2007), draws on insights to the study of Stress, psychological vulnerability and the literature on the organizational environment.

Dollard and Bakker (2010) mentioned in their study that PSC is a common aspect of the organizational environment associated with liberation from workplace psychological harm. It is also suggested how this shows administration attention to the mental health of the employees and the importance they bring to protecting mental health as compared to the needs of production. PSC is linked to the administrative environment which is constructed like an organization's property, composed of distributed opinions in that administration on the management's obligation to protect its mental health and safety.

As shown by James *et al.* (2008), the idea of the PSC derives primarily from notion that people attach importance to the work conditions, i.e. their working environments, systems of administration, benefits, worker relationships and fairness of care. Hence, where PSC can be obvious to employees, it includes excellently-developed communications networks such as documenting poor mental health during employment and engaging all aspects of the

organization in managing stress related to work. (Dollard and Bakker, 2010).PSC is obvious in the background of such a research both at the factory and also in ranches in which the workers work. It really is, of course, that tea-sector employees are due to mental problems. Because the theory says that the mental safety and health of employees derives primarily from administrative practices, then the tea sector managers should ensure that the psychosocial health and safety of employees is maintained.

Effective implementation of occupational health and safety

Ultimate research shows that one of an employer's main tasks is to make it clear that employees are fully overseen when performing the responsibilities. Worker are also encouraged to collaborate with managers to assist in promoting good aspects to safety among employees. In the safe performance of their duties, supervisors should monitor employees and also ensure that they are safe to work. It is also assumed that it is essential that preparation is considered, expertise and interactions with the staff who carry out the task when assessing the risk of an accident at work (Rotich and Kwasira, 2015).

OHS includes investment in and security of an organization's human capital (employees) with report mentioned from the European Agency for Safety and Health at Work (EU-OSHA, 2011).Consideration should therefore be given to behavioral aspects, social and cultural processes with a view to achieving a more secure and healthier working environment and improving overall organization. The study of OHS management in administrations shows that whereas many management environments are concerned with, inter alia, explaining the relationship between progress or effectiveness in a particular managerial domain and some dimension of organizational efficiency, systematic work on how OHS management contributes to organizational performance is somewhat equivocal, even in terms of OHS outcomes (Zanko and Dawson, 2012). The risk management approach has been correlated in the recent past with a demand for the implementation of prescriptive technical rules for organizational decision-making in dangerous industries where good industry practices are decided upon, where higher performance standards are often required by regulations and in which no danger is appropriate.

The value of standard operating procedures (SOPs), as mentioned by Gustin (2007), indicates that except having four main elements, namely administrative participation and workers involvement, workplace review, hazard prevention and control and training, a reported health and safety plan also includes the core components of effective safety and health programs. A Kenya study of the OHS administration (Okelloh *et al.*, 2013) claims the SOP form a part of the reported safety plan. It's also suggested that existence of the given program represents the staff's commitment to security issues.

In the mountainous region including in the Terai region, sugar cane was grown regardless of geographical variation. The climate friendly and topographical circumstances must make Nepal's Terai region adapted for sugarcane cultivation. Community from nearby mills have commercial sugar cane farming. Most small scale sugarcane farms have been seen for income generation with many individual farmers. Mostly these small-scale farms sell sugar cane directly in the local juice-making market and chew. For that, instead, many farmers manually harvest sugar cane without using any private security appliances. Sugarcane harvester is an individual engaged in vehicle sugar cane cutting, tie-up and packing. While most farmers harvest, minor fractures, cuttings, burns, lacerations and often serious injuries of cut or amputation of the fingers are frequently affected. Excessive physical effort is needed to harvest sugar cane. The cutters can cut to 12 tons of cane a day, including 3,994 spinal bending (Juttel, 2008).

Farmers are facing lots of health issues throughout sugar cane cutting due to lack of sufficient equipment awareness and correct use of protection. Most are poor farmers who are therefore unable to afford these

tools, using local cutting knives and sickles for cutting the sugar cane. Such local equipment is unsafe which contributes to small injury and multiple cuts. The fields have various conditions which lead to ergonomic problems. Such employees often face musculoskeletal dysfunction, excessive pressure on work, and injuries. For the sugarcane workers who perform manual loading and carrying activities, musculoskeletal pain in the lower back and knee was found to be maximum. Ergonomic involvement in the sugarcane cutting process shows less cutting force and tension to the sugarcane harvester's body muscles (Clementson and Hansen, 2008).

Brazil is the world's biggest sugarcane manufacturer, followed by India, China and Thailand. The sugar industry is one of the major agro-based industries not in India but in the world that contributes directly to job creation, income and social development in the country's rural areas.This sector employs both skilled and unskilled rural workers (Rocha, Marziale and Robazzi, 2007).

Many sugar mills have insufficient steps in terms of occupational health and safety, inadequate policies and facilities to tackle health hazards. Workers are therefore vulnerable to injuries in the workplace, repetitive strain injury (RSI) and musculoskeletal disorders (MSDs) in the spine, upper back, lower back and arms due to continuous motion.There has been a devastating chronic kidney disease in the coastal lowlands of El Salvador since 1999, but the cause was unclear until 2014 when Correa- Rotter *et al* found that cane cutters suffered mainly from CKD (Trabanino at al., 2002; Correa-Rotter *et al.,* 2014).

Researches on sugarcane workers

In India, sugar and related industries support the family of about 50 million farmers and thus contribute largely to the economic development (KPMG, 2007). In addition, the world's energy generation potential from bagasse is around 105GWatt per annum (Morand, Brown & Casten, 2004).The first sugar mill was established on the island of Lanai in 1802. This stepped up as farming in Hawii in 1840, but planting decline started in the 1980s due to various hazards (Alexander, 1937; Steger, 2017).

Another community of health concerns for sugar cane workers are respiratory diseases due to the constant exposures to soil dust and soot from the burning sugar cane. Mechanical operators were less susceptible to respiratory problems, however, as they spend most of their time in the harvesters ' enclosed cabins (Ribeiro, 2008).

For workers, especially the sugar cane cutters, agrochemicals represent another type of environmental risk. These chemicals contribute to various problems in public health, such as respiratory illnesses, allergic problems and cancer (Siqueira and Kruse, 2008).

Poverty is another social factor that can decide a sugar cane cutter's health condition (Rocha, Marziale & Robazzi 2007). Such workers are small, living in houses often lacking basic sanitation and tap water, in poor hygienic conditions; their food requirements do not meet their individual organic needs; and the public health system offers pure curative medical care.

The lack of proper sanitation and hygiene in the areas where the sugar cane cutters stay, and also changes in individuals ' nutrition status, can affect their immunological state and encourage infections and transmission of disease.In addition, poverty represents their precarious life, threats, insecurity and deprivation of health, education, employment, suitable living conditions, meaningful work, freedoms, social engagement and status, and also in specific human dignity.

To working communities, the numerous heat diseases that can arise from heat exposure (often in combination with dehydration) are of great concern. The terms with each disorder differ more through various academics rules and regulations, but continuum increase in diseases typically starts with relatively rare medical emergency heat migraines and

sometimes fatal heat strokes.As reported in the Technical Bulletin of the US Air Force, “The diagnostic categories of heat exhaustion, exertional heat illness and heat stroke have overlapping features that should be thought of as different regions on a continuum rather than discrete disorders” (Sawka *et al.*, 2003). However, patients often do not experience problems "in sequence" or even at the same rate of growth-that is, an individual may experience severe dehydration without experiencing muscle cramps or an individual with a heat stroke might not even have clear signs of heatstroke hours until entering serious condition. (Binkley *et al.*, 2002; Sawka *et al.*, 2003).
Heat disease' is a general term for heat-related health effects, so categorizing results as' slight heat disease' and' massive heat disease' may be beneficial. Common heat diseases contain edema (swelling of the extremities), hypotension (fainting in blood pooling throughout the extremes), and aches. Dehydration seems to be more extreme and results from heart disease to concurrently deal with the needs of thermoregulation and workout, also classified as moderate heat disease because no significant organ damage occurs. Sometimes it happens in combination of fatigue and signs like weakness, headaches, muscle pain, exhaustion, Ataxia, dizziness, nausea, vomiting, tachycardia, hyperventilation, anxiety, hypotence and temporary altering of the mental state (Sawka *et al.* 2003).Work under heat stress may occur in either one of the preceding effects if organized correctly, and may also tend to reduced mental capacity (Ramsey, 1995) and heightened injury threat (Ramsey, 1983). In addition, heat stress and fatigue also result in reduced physical capacity to work (Kerslake, 1972).

More than ten years ago, the World Health Organization (WHO) identified a correlation inchange in climate and public health, but significantly, the community medical care system has been somewhat weak in reacting to what used to be a fairly excellently-documented fact: climatic change affects public health and the poor would be hardest hit (Frumkin and McMichael, 2008; Field, 2014). Appropriately, climatic change was branded as a "amplification" of current health threats (Kjellstrom & McMichael 2013). That is, in areas that have traditionally been important, public health professionals still need to act. Heat stress can cause harmful effects of climate change on health; vector-borne and other serious diseases; environmental pollution, water and food security; hunger and severe weather.

The poor health effects concerning climate change capacity to accentuate already broad cultural-economic inequalities contributing to unwarranted national health factors (WHO, 2008; IWGCCH, 2010), as those with fewer resources are disproportionately affected to recover from disasters.In addition to significant or serious events of climate change, the everyday threats faced by some people will also change. Heat exposure and seasonal workers are a good example of this (Kjellstrom, 2013). Sugar cane is cultivated in various countries with warm climates and is a relatively excellently-developed Central American sectors where about 520,000 hectares were harvested constitute a market for $1.3 billion. Industrial workplace hazards are significant and harvester hazards involve bites of insects and animals; particulate matter inhalation; chemical exposure; threats of physical violence; dangerous positions and physical lots; repeated moves; slow movement working administrations; machinery and equipment risks; heat and Sunlight. Another factor that contributed to the very high frequency of accidents is the severe existence of the Spanish-language harvest season(' zafra') which takes about 5-6 months (November–April in Central America) to what manufacture and work changes take place 24 hrs, 7 days a week. Therefore, it does not stop till the harvest finishes after the start of the production plant (FAOSTAT, 2013).

In Central America, for the harvest season, many countries rely on migrant labor, a situation that increases job vulnerabilities and risks, particularly as workers are often subcontracted. Migrant workers typically live in labour camps with very limited amenities, and often unacceptable situations. Such circumstances are combined with the difficulty of

being away from the family from a 5-6 month harvest season.Harvesters are generally paid according to the sum they cut, a situation that constantly undermines workers ' health, particularly in relation to dehydration and heat stress (Hansen and Donohoe, 2003).

Production of sugarcane in Costa Rica continues to rise, partially because of its potential as a biofuel. Although processed worldwide, more than 50 percent of the harvest and storage are held in Guanacaste Province in the nations northwest. Some of the region is small, as well as the area records the hottest temperature in the country, making it perfect for sugar cane production but difficult with workers, especially harvesters since planting season (zafra) occurs during hottest months of this year (late November to mid-April) with average peak temperature changes of close to 36^{o}C.

Heat exposure represents a significant occupational safety hazard in sugar cane sector. For seasons, field and factory, heat-exposed laborers were formed. Caldera workers and the sugarcane harvesters were the most notable examples of heat-exposed workers. This study was based on harvesters of sugar cane as they face significant difficulties found to increase the risks of workers: they are contracted, seasonal and sometimes migrants.

Most sugarcane harvesters suffer significant adverse side effects, most of which tend to be directly related to exposure to heat: 20 per cent of harvesters experience headache each day, and at least once a week a fourth of harvesters have signs such as tachycardia and muscle pain. Most of the population (82 percent) have at minimum one heat-related condition at least once per week 59 percent had at least once a week at a maximum of two heat-related symptoms. Health issues such as fainting (syncope), vomiting, and dizziness were reported to be less common but far more intense. Such a workforce cannot function to its maximum potential and must clearly be covered against negative health consequences.

For sugarcane harvesters to create safe working conditions, a coordinated numerous factor response will be required: government officials, scholars, workers, supervisors and harvesters of their own. The growing of sugarcane is an example of the logistical problems of protecting against stress at sun in tropical agricultural ecosystems. There is presently enough experience in IT, infrastructure, and regulation achieving a safe working environment. Nevertheless, the factors usually feel overwhelmed by the current issues. Here are some responses to some of the most frequent questions raised by others in a situation to claim action.

It is also critical for harvesters to ensure timely in-field food consumption that prevents exertional hypernatremia as well as increases thirst and drive to consume sufficient liquids. In normal diets, salt levels are generally sufficient but further work must be done to improve hydration. In some cases, salt hydration alternatives for athletes are suggested, but much more study is needed to evaluate whether it can be done without raising the intake of fructose that has not been removed as a contributing factor (Casa *et al.*, 2000).

The harvesting of sugarcane is by no means the only workplace where innovative and dedicated security is needed to protect the workers. In addition, in few of the world's most arduous situations, military forces have resolved much greater challenges (and perhaps much greater economic costs).For instance, the U.S. Army still records unbearably high levels of hospital treatment caused by heat stroke, but was relatively effective in lowering heat exhaust, demonstrating that alterations are feasible (Carter *et al.*, 2005).

Conclusion

All the above ergonomic research studies, curriculum components and the extension activities were functioning with inter-disciplinary orientations. There is a need for paradigm shift from single discipline orientation to multi-disciplinary approach. Thus, the teaching, research and extension activities should include ergonomic components which are of

multi-dimensional in nature focusing the individual. Such agricultural education will meet the needs of the stakeholders involved in agriculture.

In sugar industry policy controlling for health safety at the workplace are urgently needed. Such a framework should also be extended to cover other vulnerable workers. The literature studies show that inter and multidisciplinary approaches are needed for this purpose that could be a useful tool to provide a sound scientific framework for the sugar industry worker's health and safety measures.

References

Ahasan M. 2002. Occupational Health, Safety and Ergonomic issues in small and medium-sized.

Alessi NP, Navarro VL. 1997. Health and rural work: the case of sugarcane workers in Ribeirão Preto region, São Paulo, Brazil. Public Health Notebooks, **13,** S111-S121.

Alexander AC. 1937. Koloa Plantation, 1835-1935: A History of the Oldest Hawaiian Sugar Plantation. Honolulu Star-Bulletin.

Alves F. 2006. Why do sugarcane cutters die? Health and Society, **15,** 90-98.

Anonymous, 2016. Environmental, Health and Safety Guidelines for Perennial Crop Production.

Arkajit B, Rina B, Gourab B. 2016 International Journal of Biomedical Research .com 568-570.

Bandura A. 2001. Social cognitive theory: An agentive perspective. Annual Review of Psychology, **52,** 1-26.

Barbosa CMG, Terra-Filho M, Albuquerque ALP, Di Giorgi D, Grupi C, Negrao CE, Braga ALF. 2012. Burnt sugarcane harvesting–cardiovascular effects on a group of healthy workers, Brazil. Brancaccio P, Maffulli N, Limongelli FM. Creatine kinase monitoring in sport medicine. British Medical Bulletin **(1),** 209–230.

Binkley HM, Beckett J, Casa DJ, Kleiner DM, Plummer PE. 2002. National Athletic Trainers' Association position statement: exertional heat illnesses. Journal of Athletic Training **37(3),** 329.

Brancaccio P, Lippi G, Maffulli N. 2010. Biochemical markers of muscular damage. Clinical Chemistry and Laboratory Medicine **48(6),** 757-767.

Carter III R, Cheuvront SN, Williams JO, Kolka MA, Stephenson LA, Sawka MN, Amoroso PJ. 2005. Epidemiology of hospitalizations and deaths from heat illness in soldiers (No. M04-24). Army research inst of environmental medicine Natick ma thermal and mountain medicine division.

Casa DJ, Armstrong LE, Hillman SK, Montain SJ, Reiff RV, Rich BS, Stone JA. 2000. National Athletic Trainers' Association position statement: fluid replacement for athletes. Journal of athletic training **35(2),** 212.

Chullen J. 2012. Occupational health and safety in the sugar industry of Kenya. Petit Lancy, Switzerland; the International Union of Food.

Clementson CL, Hansen AC. 2008. Pilot study of manual sugarcane harvesting using biomechanical analysis. Journal of agricultural safety and health **14(3),** 309-320.

Correa-Rotter R, Wesseling C, Johnson RJ. 2014. CKD of unknown origin in Central America: the case for a Mesoamerican nephropathy. American Journal of Kidney Diseases **63(3),** 506-520.

Dollard M. 2007. Psychosocial safety culture and climate; definition of a new construct. Adelaide; Work and Stress Research Group, University of South Australia.

Dollard M, Bakker A. 2010. Psychosocial safety

climate as a precursor to conducive work environments, psychological health problems, and employee engagement. Journal of Occupational and Organizational Psychology **83,** 579-599.

EU-OSHA 2007. Expert forecast on emerging psychosocial risks related to occupational.safety and health. Luxembourg; Office for Official Publications of the European Communities.

Fanning F. 2003. Basic Safety Administration: A Handbook for the New Safety Specialist. Chicago: American Society of Safety Engineers.

FAOSTAT. 2013. Food and Agriculture Organization of the United Nations; Available from: http://faostat3.fao.org/faostatgateway/go/to/home/E

Ferreira AD, Ramos EMC, Carvalho LCS, Xavier RF, DeSouza Teixeira, MF, Raymundo PA, Ramos D. 2011. Short terms effects of air pollution from biomass burning in mucociliary clearance of Brazilian sugarcane cutters. Respiratory medicine **105(11),** 1766-1768.

Field CB. 2014. Climate change 2014–Impacts, adaptation and vulnerability: Regional aspects. Cambridge University Press.

Frumkin H, McMichael AJ. 2008. Climate change and public health: thinking, communicating, acting. American journal of preventive medicine **35(5),** 403-410.

García R, Jarquín E, Wesseling C, Johnson RJ, González M, Weiss I, Harra T. 2015. Heat stress, dehydration, and kidney function in sugarcane cutters in El Salvador–A cross-shift study of workers at risk of Mesoamerican nephropathy. Environmental research **142,** 746-755.

Goto DM, Lança M, Obuti CA, Barbosa CMG, Saldiva PHN, Zanetta DMT, Nakagawa NK. 2011. Effects of biomass burning on nasal mucociliary clearance and mucus properties after sugarcane harvesting. Environmental research, **111(5),** 664-669.

Guo Tanaka, Halperin W, Cameron L. 1999. Back prevalence in US industry Gustin, J. 2007. Safety Management: A Guide for Facility Managers. New York: Fairmont Press.

Hansen E, Donohoe M. 2003. Health issues of migrant and seasonal farmworkers. Journal of Health care for the Poor and Underserved **14(2),** 153-164. http://apps.who.int/iris/bitstream/10665/42811/1/9241591013.pdf

International Labour Organization. 2012. Occupational Safety and Health (OSH) and hazardous work of children in agriculture. Geneva: ILO.

IWGCCH. 2010. A human health perspective on climate change: A report outlining the research needs on the human health effects of climate change [Internet]. Research Triangle Park, NC; p. 70. Available from: www.niehs.nih.gov/climatereport.

James L, Choi C, Ko C, McNeil K, Minton K, Wright A, Kim, K. 2008. Organizational and psychological climate: A review of theory and research. European Journal of Work and Organizational Psychology **17,** 5–32.

Juttel LP. 2008. Excessive physical effort seeks increased income. Science and Culture **60(4),** 6-7.

Kerslake DM. 1972. The stress of hot environments (Vol. 29). CUP Archive.

Kjellstrom T, McMichael AJ. 2013. Climate change threats to population health and well-being: the imperative of protective solutions that will last. Global health action **6(1),** 20816.

Kjellstrom T, Sawada SI, Bernard TE, Parsons K, Rintamäki H, Holmér I. 2013 Climate change and occupational heat problems. Ind Health **51(1),** 1–

2.

KPMG I. 2007. The Indian sugar industry sector roadmap 2017.

Law R, Dollard M, Tuckey R, Dormann C. 2011. Psychosocial safety climate as a lead indicator of workplace bullying and harassment, job resources, psychological health and employee engagement. Accident analysis and prevention 1-12.

Mbakaya F, Onyoyo A, Lwaki A, Omondi J. 1999. A Survey of Management Perspectives of the State of Workplace Health and Safety Practices in Kenya. Accident Analysis Prevention. PubMed, **31(4),** 305–12.

Mischke C, Verbeek JH, Job J, Morata TC, Alvesalo A, Neuvonen K, Pedlow RI. 2013. Occupational safety and health enforcement tools for preventing occupational diseases and injuries. Cochrane database of systematic reviews, **(8).**

Morand A, Brown M, Casten T. 2004. Bagasse cogeneration–global review and potential. World Alliance for decentralized energy (WADE).

Munir A, Ashraf MA, Nasir A, Hensel O, Iqbal M. 2012. Ergonomics and occupational health in sugar industry of Pakistan. Pakistan Journal of Life and Social Sciences **10,** 74-9.

Okelloh O, Ogonda A, Ogolla S, Tonui K, Onyango R. 2013. Quality assurance for occupational health and safety administration (OSHA) in the morgue. Journal of Biology, Agriculture and Healthcare **3(19),** 1-11.

OSHA E. 2011. European Agency for Safety and Health at Work, 2008. Work-related musculoskeletal disorders: prevention report.

Paula U, Zanetta DM, Terra-Filho M, Burdmann EA. 2015. Burnt sugarcane harvesting is associated with acute renal dysfunction. **87(4),** 792–799. http://dx.doi.org/10.1038/ki.2014.306.

Petersen D. 1996. Safety by Objectives. (2ed.). New York: John Wiley press.

Prado GF, Zanetta DMT, Arbex MA, Braga AL, Pereira LAA, Marchi MRR, Gonçalves FT. 2012. Burnt sugarcane harvesting: particulate matter exposure and the effects on lung function, oxidative stress, and urinary 1-hydroxypyrene. Science of the Total Environment **437,** 200-208.

Ramsey JD. 1995. Task performance in heat: a review. Ergonomics **38(1),** 154-165.

Ramsey JD, Burford CL, Beshir MY, Jensen RC. 1983. Effects of workplace thermal conditions on safe work behavior. Journal of safety Research **14(3),** 105-114.

Ribeiro H. 2008.Sugarcane burns in Brazil: effects on respiratory health.Journal of Public Health **42,** 370-376.

Rocha FLR, Marziale MHP, Robazzi MLDCC. 2007. Poverty as a predisposing factor of illness tendencies in sugar cane workers. Latin American Journal of Nursing **15,** 736-741.

Rotich L, Kwasira J. 2015. Assessment of success factors in the implementation of occupational health and safety programs in tea firms in Kenya: a case of Kaisugu tea factory. Int J Econ Commer Manag **3,** 797-812.

Sawka MN, Wenger CB, Montain SJ, Kolka MA, Bettencourt B, Flin S, Scott C. 2003. Heat stress control and heat casualty management (No. MISC-04-13).

Scopinho RA. 1995. Business pedagogy of work control and worker health: the case of a distillery plant in Ribeirão Preto region. Sao Carlos: UFSCar.

Siqueira SLD, Kruse MHL. 2008. Agrochemicals and human health: contributions of healthcare professionals. USP School of Nursing Journal **42(3),** 584-590.

Steger MB. 2017. Globalization: A very short introduction **86,** Oxford University Press.

Sugar Association. 2015. Sugar and heart health: what are the facts? [Accessed August 11, 2015 [Google Scholar]
https://www.sugar.org/sugar-heart-health-facts/

Taubes G, Couzens CK. 2012. Big sugar's sweet little lies. Mother Jones.

Tompa E, Kalcevich C, Foley M, McLeod C, Hogg-Johnson S, Cullen K, Irvin E. 2016. A systematic literature review of the effectiveness of occupational health and safety regulatory enforcement. American journal of industrial medicine **59(11),** 919-933.

Trabanino RG, Aguilar R, Silva CR, Mercado MO, Merino RL. 2002. End-stage renal disease among patients in a referral hospital in El Salvador. Revista panamericana de salud publica= Pan American journal of public health **12(3),** 202-206.

Trabanino RG, Aguilar R, Silva CR, Mercado MO, Merino RL. 2002. Terminal nephropathy in patients of a referral hospital in El Salvador. Pan American Journal of Public Health, **12,** 202-206.

Vander HF, Basnet P, Hoonakker PL, Lehtola MM, Lappalainen J, Frings MH, Verbeek JH. 2018. Interventions to prevent injuries in construction workers. Cochrane database of systematic reviews **(2).**

Vanwonterghem K. 1996. Work-related musculoskeletal problems among workers in Iranian Sugar Production Industry: some ergonomics considerations. Journal of Human Ergology **25(1),** 5-13.

Vilela RADG, Laat EFD, Luz VG, Silva AJND, Takahashi MAC. 2015. Pressure for production and risks production: the dangerous athon marathon'of sugar cane manual cutting. Brazilian Journal of Occupational Health **40(131),** 30-48.

Wesseling C, Aragón A, González M, Weiss I, Glaser J, Bobadilla NA. 2016. Kidney function in sugarcane cutters in Nicaragua: a longitudinal study of workers at risk of Mesoamerican nephropathy. Environmental Research **147,** 125–132.

WHO. 2008. Closing the gap in a generation: Health equity through action on the social determinants of health. Final Report of the Commission on Social Determinants of Health. [Internet].

Wijkström J, González M, Hernandez M, Trujillo Z, Hultenby K, Ring A, Wernerson A. 2017. Renal morphology, clinical findings, and progression rate in Mesoamerican nephropathy. American journal of kidney diseases **69(5),** 626-636.

World Health Organization. WHO. 2014. Framework Convention on Tobacco Control. [Accessed October 20 2014];

Zanko M, Dawson P. 2012. Occupational health and safety management in organizations: A review. International Journal of Management Review, and estimates.