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Prevalence and Associated Factors of Occupational Stress in the Mining Sector: The Case Study of the Youga Mine at Zabre in Burkina Faso

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Abstract

Introduction: Occupational stress (OS) is a public health issue; it affects all sectors of activity in Burkina Faso. **General objective:** Assess the situation of professional stress and its associated factors among workers at the Youga mine in the municipality of Zabré. **Material and Methods:** This was a descriptive and analytical cross-sectional study. Data collection took place August 15, 2020 to October 10, 2020 from 324 mine workers who met the inclusion criteria using an anonymous questionnaire. Data analysis was done with EpiDATA3.1 software. The Fisher and Chi-squared tests were used to compare the proportions. A binary logistic regression was performed by the stepwise top-down method. The significance level chosen for the tests was $p \leq 0.05$. **Results:** In our study, 324 workers were included. The average age was 35.84 ± 6.56 years with extremes of 23 years and 58 years. The sex ratio was 8. The prevalence of OS was 26.23% and that of iso strain and lack of rewards were 24.38% and 45.06%, respectively. Factors associated with OS were marital status $p = 0.010$; higher education level $p = 0.032$, lack of recognition $p = 0.001$, intention to change jobs $p = 0.009$, job security $p = 0.035$; job satisfaction $p = 0.046$ and the stress felt by the worker at his job $p = 0.003$. **Conclusion:** Occupational stress is a reality in the mining sector in Burkina Faso, our study consisted of evaluating the extent and determining the factors of OS in order to propose preventive measures for the good health of workers.

Keywords

Occupational stress, Prevalence, Mine, Zabré, Burkina Faso

1. Introduction

Rapid globalization and technological advances have transformed the way we work. Workers all over the world are faced with major changes affecting the organization of work in particular; labour relations. Workers are under increased pressure to meet the demands of modern working life characterized by industrialization of companies with the main objective of increasing production [1] [2]. The search for high production has not always been accompanied by a real policy of preserving the health of grassroots players, namely workers [3]. This is how we are witnessing a deterioration in the physical, social and above all mental health of workers. Psychosocial risks such as Occupational Stress (OS), harassment, violence, burnout are among the most important emerging risks in the workplace. Those risks affect all countries, all professions and all workers [3] [4]. Studies in European and other developed countries show that MS is responsible for 50% - 60% of all workdays lost [5]. It was considered the second most common cause of work-related health problems. The OS affected 22% of workers in the European Union in 2005 [2]. Between 1999-2007 almost 28% of those questioned, or around 55.6 million European workers, declared that their mental well-being had been affected by exposure to psychosocial risks. According to the results of the European Business Survey on New and Emerging Risks, 79% of European executives say they are concerned about stress at work [2]. In Africa, a study conducted in Congo in an extractive industry in Katanga showed that 75% of male workers and 68% of female workers were stressed, *i.e.* 74.6% of workers [6]. Other stress studies conducted in Burkina Faso noted that in the railway sector, OS affected 65.86% of male workers and 4.81% of female workers were stressed or 70.67% of workers [7]. And in the banking sector, 19.30% of male workers and 25.76% of female workers were stressed or 22.76% of workers [8]. In Benin, a study on the prevalence of OS in the field of insurance companies showed that 81.8% of the agents of this insurance company felt stressed according to their expression of subjective experience within the company and 54.5% of agents identified high mental demands as stressors in the work environment [9]. In Senegal, a study revealed that 86.2% of workers at the Kolda hospital centre were stressed [10]. In Burkina Faso, as in all countries of the world, stress at work affects all sectors of activity. Burkina has experienced "a mining boom" in recent years and to date has nine mines in production [11]. The mining sector is a very particular sector because of its multiple requirements and its strong work-related constraints. Workers are under multiple pressures to achieve goals. Faced with the magnitude of the problem and the workers' complaints, and having no data concerning this pathology in the mining sector in Burkina Faso,

this study was initiated to assess the situation of professional stress and its associated factors among workers at the Youga mine in the municipality of Zabré.

2. Materials and Methods

2.1. Type of Study and Population

This was a cross-sectional descriptive and analytical study conducted from August 15, 2020 to October 10, 2020 among mine workers.

Workers who met the following criteria were included in this study: Being a permanent mine worker, having at least one year of seniority, and having given consent.

2.2. Sample Size and Sampling

The size of the sample n of workers was calculated using the SCHWARTZ formula:

$$n = (Z\alpha)^2 \, pq / i^2 \, .$$

n: sample size, p: prevalence of SP in the mining sector in the Democratic Republic of Congo in Africa: 74.6%, *q*: (1 − *p*): 25.4%, *α*: risk of the first kind 5%, Zα: confidence level according to the reduced centred normal distribution (for a confidence level of 95%, $z = 1.96$) or standard deviation reduced to risk α (1.96), *i*: desired precision (5%)

$$n : 1.96^2 \times 0.746 \times 0.254 / 0.05^2 : 294, \; n = 294 \text{ workers}$$

with a weight of 10%, due to non-responding subjects or missing data, the sample size is increased to $n = 294 + 10\% \times 294 = 294 + 29.4 = 323.4 = 324$ workers.

Using non-probability sampling, for convenience we have made an exhaustive recruitment of workers meeting our inclusion criteria up to our sample size.

2.3. Data Collection

Data collection was done using two validated questionnaires: The Karasek questionnaire [12] and the Siegrist questionnaire [13]. This data collection involved the following variables: The dependent variable (work stress) and the independent variables (these are factors associated with the onset of OS).

The level of stress at work was assessed using the Karasek questionnaire which takes into account three variables: psychological demand, decision latitude and social support. Karasek's questionnaire includes as follows.

2.3.1. The Karasek Questionnaire or the Job Content Questionnaire [12]

Composed of 26 items, it is interpreted as follows:

- **Decision latitude score**: 4 × [Q4 + (5 − Q6) + Q8] + 2 × [Q1 + (5 − Q2) + Q3 + Q5 + Q7 + Q9]. Decision latitude is low if the score is less than 70.
- **Psychological demand score**: Q10 + Q11 + Q12 + (5 − Q13) + Q14 + Q15 + Q16 + Q17 + Q18; the psychological demand is strong if the score is higher than 21.

- **Overall social support score**: Q19 + Q20 + Q21 + Q22 + Q23 + Q24 + Q25 + Q26.

Overall social support is low if the score is less than 24.

2.3.2. The Siegrist Questionnaire [13]

This is a tool for predicting psychological distress in the workplace, based on the theory developed by Siegrist in its short French version of 23 items subdivided into 3 subscales: the extrinsic effort scale, the scale rewards, and the scale of intrinsic effort.

- The Extrinsic Effort Score is obtained by adding the scores for questions 1 to 6. It varies from 6 to 30 (the more the score tends towards 30, the stronger the efforts).
- The Rewards Score is obtained by adding the scores for questions 7 to 17. It varies from 11 to 55 (the higher the score tends to 11, the stronger the rewards).
- The effort/reward ratio: it is obtained by the formula

$$R = 11/6 \times \frac{\text{Extrinsic effort score}}{66 - \text{Reward score}}.$$

A ratio of "1" is interpreted as a balance between effort and rewards. On the other hand, a ratio greater than "1" indicates an imbalance between high extrinsic efforts and low rewards, since the weight of the efforts is higher than that of the rewards.

- The intrinsic effort score or overinvestment score is obtained by adding the scores for questions 18 to 23. It varies from 6 to 24. This score is then dichotomized at the top tertile of the distribution in the sample. This questionnaire is generally used in addition to that of Karasek, the combination of these two tools allows a wider exploration of psychosocial factors.

The answers given were: Strongly Disagree, Disagree, Agree, Strongly Agree and are rated from 1 to 4 points respectively. The value of the median of each of the scores, the value divides the entire surveyed population into two equal parts: half of the employees being above this score, and the other half below.

Thus, four situations were possible in this model:

- Passive subject: "Low autonomy—Low requirements".
- Active subject: "High autonomy—High demands".
- Relaxed subject: "High autonomy—Low requirements".
- Stressed subject or job train: "Low autonomy—High demands".

The "job strain" or "tension at work" is the combination of low latitude and high psychological demand. In practice, if the psychological demand score is greater than 20 and the decisional latitude score less than 71, the employee is in the "tense" dial and therefore considered in a "job strain" situation. Iso strain is the combination of a job strain situation and low social support, a social support score below 24.

The calculation and analysis of the different scores of the occupational stress parameters were done using the "Job Strain measure: Karasek questionnaire".

The joint use of the 2 questionnaires of Siegrist and Karasek makes it possible to take into account the limits which were opposed to the model of Karasek which defines a notion of too restricted control and does not address the control over career prospects and security employment. In addition, the notion of effort of the Siegrist model being close to the psychological demand developed by Karasek, and in order to avoid any redundancy, we will only consider the recognition part (rewards). The employee above the median of the reward factor and its sub scores is considered to perceive a low reward or lack of recognition [14].

Rewards: score varying from 11 to 55.

Score = Q7 + Q8 + Q9 + Q10 + Q11 + Q12 + Q13 + Q14 + Q15 + Q17.

2.4. Statistical Analysis

The data collected were processed by the EPI data version 3.1 software. The data analysis was carried out with the STATA version 15 software. The qualitative variables were described as proportions and the quantitative variables were expressed as median, Mean ± Standard Deviation. In univariate analysis, the proportions were compared using Pearson's Chi-square (χ^2) test, and the means with the student's t test. All the variables with a p-value less than 0.25 were retained in the initial model of the multivariate analysis by logistic regression. The binary logistic regression was done by the top-down stepwise method. The association between the studied factors and the SP was determined by the raw and adjusted Odds Ratio (OR) along with their 95% confidence intervals (CI). The significance level chosen for the tests was $p \leq 0.05$.

2.5. Deontological and Ethical Considerations

The collection authorization was obtained in advance from the general management of the mine. A general management briefing note informed all staff of the objectives of our study, respect for anonymity, the rights of workers to participate or not. All the workers who were interviewed were informed and received oral explanations in order to obtain their free and informed consent. The study was conducted within this mining company with respect for confidentiality and respect for ethical values.

3. Results

Our study sample consisted of 324 mine workers.

3.1. Socio-Demographic and Socio-Professional Characteristics

The average age of the workers was 35.84 years ± 6.56 with extremes of 23 years and 58 years and the male/female sex ratio is 8. Workers living in couples were the most numerous: 66.67 %. The employees were mostly enforcement officers (56.79%), working at least 11.34 ± 1.26 hours per day and approximately 4.59 days ± 0.52 per week. Table 1 shows the Sociodemographic and professional characteristics.

Table 1. Sociodemographic and professional characteristics of the workers surveyed at the Youga mine in the municipality of Zabré (N = 324).

	Effective	Percentages (%)
Age		
<40	229	70.68
≥40	95	29.32
Sex		
Women	36	11.11
Men	288	88.89
Level of study		
Primary	83	25.62
Secondary	135	41.67
University	106	32.72
Marital status		
Single	108	33.33
Couple	216	66.67
Dependent children		
Yes	265	81.79
No	59	18.21
Seniority working life		
<10 years	159	49.07
≥10 years	165	50.93
Seniority Mine		
<5years	189	58.33
≥5 years	135	41.67
Seniority at the post		
≤5years	256	79.01
>5 years	68	20.99
Number of days worked		
≤5 days	319	98.46
>5 days	5	1.54
Number of working hours/days		
≤8 h	14	4.32
>8 h	310	95.68
Socio-professional category		
Enforcement agent	184	56.79
Petty Officer	75	23.15
Executive Officer	65	20.06

3.2. Prevalence of Occupational Stress

3.2.1. Karasek Model

The prevalence of occupational stress according to Karasek's model is 26.23%.

Table 2 shows the prevalence according to Karasek.

79 workers suffered from iso strain or 24.38%; 95% CI [19.70; 29.05] (Table 3).

3.2.2. Siegrist Model

The prevalence of the effort/reward imbalance according to the Siegrist model: (E/R score > 1) was found in 82.72% of the workers questioned. Table 4 shows the prevalence according to Siegrist model.

3.3. Stress and Associated Factors

In multivariate analysis, after logistic regression, the factors associated with occupational stress were:

- Risk factors: lack of job security (ORa = 2.47; $CI_{95\%}$ [1.07; 5.72]; p = 0.035); stress felt by the worker at his job (ORa = 5.82; $CI_{95\%}$ [1.79; 18.96]; p = 0.003).
- Protective factors: higher education level (ORa = 0.36 $CI_{95\%}$ [0.14; 0.92]; p = 0.032); marital status as a couple (ORa = 0.34 $CI_{95\%}$ [0.15; 0.77] p = 0.010); good job satisfaction (ORa = 0.35; $CI_{95\%}$ [0.12; 0.98]; p = 0.046), intention to change job (ORa = 0.37; $CI_{95\%}$ [0.18; 0.77]; p = 0.009), and High recognition (ORa = 0.31; $CI_{95\%}$ [0.15; 0.63]; p = 0.001). Table 5 shows the associated factors to stress.

Table 2. Prevalence of occupational stress among the workers surveyed at the Youga mine in the municipality of Zabré (N = 324).

Psychological Demand	Decision latitude			
	High		Low	
	n	%	n	%
High	45	13.89	85	**26.23**
Low	101	31.17	93	28.7

Table 3. Prevalence of iso strain among the workers surveyed at the Youga mine in the municipality of Zabré (N = 324).

Social support	Occupational Stress			
	No		Yes	
	n	%	n	%
High	83	25.62	6	1.85
Low	156	48.15	79	**24.38**

Table 4. Prevalence of effort/reward imbalance among surveyed workers at the Youga mine in the municipality of Zabré (N = 324).

	Effective (n)	Percentage (%)
Effort/Reward Report		
Normal (score E/R ≤ 1)	56	17.28
Imbalance (score E/R > 1)	268	**82.72**

Table 5. Associated factors of occupational stress.

	Factors	ORa	$CI_{95\%}$ [ORa]	p
Risk factors	Job Security: No	2.47	[1.07; 5.70]	0.035
	Stress experienced by the worker at his/her job: yes	5.82	[1.79; 18.96]	0.003
Protective factors	Recognition: High	0.31	[0.15; 0.63]	0.001
	Marital status: in couple	0.34	[0.15; 0.77]	0.010
	Level of study: higher	0.36	[0.14; 0. 92]	0.032
	Intention to Change workstations: No	0.37	[0.18; 0.77]	0.009
	Job Satisfaction: Yes	0.35	[0.12; 0.98]	0.046

4. Discussion

4.1. Prevalence of Occupational Stress

At the end of our study, the prevalence of OS represented by the job strain was 26.23%. This prevalence is lower than that found by Kalumba *et al.* [6] in Katanga in the Democratic Republic of Congo, which found a prevalence of 74.6% of occupational stress among workers in a mineral extraction company in Haut Katanga. Results superior to ours were noted by Manga [14] in Cameroon among pharmacy workers in Douala, Traore I [7] in Burkina Faso in the rail sector, by Aka *et al.* in the port sector in Abidjan [15] and Dia *et al.* in Senegal in the service of asylum seekers in Dakar [16] with respective prevalence of professional stress of 71.80%; 70.67%; 54.6% and 40.38%. This difference could be explained by the fact that workers in the mining sector are already conditioned to perform the tasks assigned to them without being involved in the decision-making process regarding the organization of work.

Our data corroborate those of Hinson *et al.* in Benin, who found a prevalence of 27.3% of OS among workers in an insurance company [9] and Ouedraogo A [8] in Burkina Faso who found a prevalence of stress at work of 22.76%, and Nadja M in Tunisia [17] who obtained a prevalence of job strain of 28.2% in the mass distribution sector (chain stores). This prevalence was close to that found by Niedhammer [18] who noted respectively a prevalence of 24.4%.

4.2. Prevalence of Iso Strain

This is the prevalence of stressed workers with low social support. The prevalence of iso strain in our study was 24.38%.

This prevalence was higher than those of Kalumba *et al.* in the Demographic Republic of Congo [11], of Ouedraogo A in Burkina Faso [8] and of Magroun in Tunisia [19] who found respectively in their research a prevalence of iso strain 14.4%; 14.63% and 10%. Our results were lower than those of Traore I which was 35.09% among SITARAIL workers [7]. This difference could be explained by the diversity of business sectors and localities.

4.3. Prevalence of Recognition of the Effort/Reward Imbalance (Siegrist Model)

The prevalence of lack of recognition was 45.06% and that of effort/reward imbalance calculated according to the Siegrist model was 82.72%.

Our results were lower than those of Hinson *et al.* in Benin, who found a prevalence of lack of recognition of 63.6% among workers in an insurance company. The prevalence of the effort/reward imbalance in our study was close to that of Aroui *et al.* in Tunisia [20] who found a prevalence of 72.9% among workers in pre-hospital emergency mobile teams and also close to work. The same observations were made by Rugulies who noted a 65% prevalence of the effort/reward imbalance among public transport operators in San Francisco in the United States [21].

However, different results were found by Kacem I *et al.* in Tunisia in the telephony sector [22], Colleville in France in the large distribution sector [23]; and Lubanzadio in Belgium among physiotherapists [24] who respectively obtained the prevalence of effort/reward imbalance of 16.7%, 9.14% and 3.8% among workers during their respective research.

4.4. Factors Associated with Occupational Stress

4.4.1. Marital Status

In our study, 216 workers, or 66.67% of all employees, were living as a couple. We noted a statistically significant relationship between work stress and marital status: being in a couple is associated with a lower risk of work stress occurring (**ORa = 0.34; $CI_{95\%}$: [0.15 - 0.77], p = 0.010**) compared to workers who are not in a relationship. This risk of occurrence of occupational stress was reduced by 66% ([1 − ORa = 0.66] × 100) among workers who are in a couple compared to other workers. Observations similar to ours have been made in several studies on work stress. In fact, the prevalence of occupational stress during studies was higher among single workers than among those living in a couple. This is the case of Honda A. *et al.* in Japan [25] and Sorghum D A in Burkina Faso [26] who found a higher proportion of stressed single people than married ones.

4.4.2. Level of Education

We found a statistically significant association between higher level of education and professional stress (p = 0.032): having a higher level of education is associated with a lower risk of occurrence of professional stress (**ORa = 0.36; $CI_{95\%}$: [0.14 - 0.92] p = 0.032**) compared to other workers. This risk of occurrence of occupational stress was reduced by 64% ([1 − ORa = 0.64] × 100) among workers with a higher level of education compared to other workers. In fact, the more educated the worker, the less stressed he is. Other studies in the field of stress have noted that the prevalence of stress decreases with increasing level of education. Indeed, the work of Ouédraogo A [7] and Traore I [8] reached the same conclusion.

4.4.3. Job Security

Two hundred and nineteen workers or 67.59% said their job security was at risk.

The prevalence of stress increases with the threat of job security. Lack of job security is associated with a higher risk of job stress (**OR = 2.47; $CI_{95\%}$: [1.07 - 5.70]; p = 0.035**) compared to other workers. This risk of occurrence of occupational stress increased by 51.0% ([1 − 1/ORa = 0.51] × 100) among workers who did not have job security compared to other workers (p = 0. 035).

Our data corroborate those of Ouedraogo A who found a significant relationship between job security and the occurrence of MS among bank workers, p = 0.020 [7]. Job security refers to the stability of employment. In a difficult socio-economic context characterized by poverty, unemployment and job insecurity, the fear of losing one's job can become a source of stress.

4.4.4. Job Satisfaction

Two hundred and forty-six workers (75.9 3%) were unhappy with their jobs. We found a statistically significant relationship between work stress and job satisfaction (p = 0.046), the prevalence of stress decreasing with job satisfaction: having job satisfaction is associated with a lower risk of occupational stress (**ORa = 0.35; $CI_{95\%}$: [0.12 - 0.98] p = 0.045**) compared to other workers. This risk of occurrence of occupational stress decreased by 65% ([1 − ORa = 0.65] × 100) among workers who had job satisfaction compared to other workers. Our results corroborate those of Ouedraogo A [7] and Fournel [27], who noted that the prevalence of stress increased with job dissatisfaction. Henrotin [28] found that good work life satisfaction is associated with lower levels of stress. Laraqui [29] found a statistically significant relationship between stress and job satisfaction (p = 0.0001), job satisfaction being lower among stressed workers.

4.4.5. Stress Felt by Worker in His Workplace

We noted a statistically significant relationship between the subjective feeling of stress at work and objective professional stress (based on the assessment of scores): Also, the stress felt by the worker at his post is associated with a higher risk of stress, professional (**OR = 5.82; $CI_{95\%}$: [1.79 - 18.76] p = 0.003**) compared to other workers. This risk of occurrence of occupational stress increased by 82.8% ([1 − 1/ORa = 0.51] × 100) among workers who experienced a feeling of stress at their post compared to other workers (p = 0.003).

4.4.6. Rewards

Recognition at work was significantly associated with work stress. Workers who are subject to low recognition at work, have an approximately 2 times higher risk of developing occupational stress than those who are not subject to low recognition at work (p < 0.001): Having high recognition is associated at a lower risk of occurrence of occupational stress (**ORa = 0.31; $CI_{95\%}$: [0.15 - 0.63]; p = 0.031**) compared to workers who have low recognition. This risk of occurrence of occupational stress was reduced by 69% ([1 − ORa = 0.69] × 100) among workers with high recognition compared to workers with low recognition (p < 0.001). Our results corroborate those of Hinson *et al.* who found that the lower the recognition at work, the higher the stress level (p = 0.04) and that low recognition

at work could therefore be an additional reason for stress at work. [9].

4.4.7. Intention to Change Job Positions

We noted in our study that 159 workers or 49.07% intended to change jobs because of the work organization or the work environment. Lack of intention to change jobs is associated with a lower risk of occupational stress (**ORa = 0.37; $CI_{95\%}$: [0.18 - 0.77] p = 0.009**) compared to other workers. This risk of work-related stress was reduced by 63% ([1 − ORa = 0.63] × 100) among workers who did not intend to change jobs compared to other workers (p = 0.009). Our results were similar to those of Ouedraogo A in Burkina Faso [7] and Niedhammer in France who reported that the prevalence of stress increases with the intention to change jobs for reasons related to the organization or the work environment [18]. Workers accept jobs below their qualification. Those who express their intention to change jobs see in this a prospect of promotion or training because they believe that they can be better paid according to their skills.

4.5. Limitations of the Study

The limitations of our study are that information bias is possible (the worker may not answer the questions truthfully, and our study is not exhaustive) and that timing is not taken into account in the onset of stress (no estimate of impact). Moreover, the exclusion of workers absent at the time of the survey could be problematic if the fact of being absent on the day of the survey is linked to the phenomenon studied. We were unable to analyse the data according to the type of position because of the multitude, diversity and specificity of the positions, hence the need to group them by department. Each department has several sub-departments and each sub-department has several workstations (administrative, field or mixed). Workers were classified by department and then divided into two main groups for convenience.

5. Conclusion

At the end of our study entitled "Occupational stress in the mining sector: case study of an open-pit mine in the Centre East region of Burkina Faso", we ended with the following conclusions:

- The prevalence of work stress was 26.23%.
- The study population was predominantly male and the sex ratio was 8.
- The factors associated with the occurrence of occupational stress among workers were: higher education level (p = 0.032), marital status (p = 0.010), intention to change jobs (p = 0.009), felt stress (p = 0.003) and lack of recognition (p = 0.001).
- In view of the high prevalence of work stress at this mining site, it is imperative to take corrective and preventive measures to reduce work stress in order to preserve the physical, mental and social well-being of workers and the proper functioning of the company's business.

Authors' Contributions

All the authors contributed to the conception, the field work to the data analysis and to the writing of this manuscript.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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