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Prevalence and Factors Associated with Musculoskeletal Disorders among Biomedical Analysis Laboratory Staff in Hospitals in Cotonou

Rose Mikponhoué[1,2*], Simon Azonbakin[3], Mênonli Adjobimey[1], Nadia Godjoa[4], Etienne Alagnide[5], Paul Ayél[1], Antoine Vikkey Hinson[1]

[1]Occupational and Environmental Health Research Unit, Faculty of Health Sciences of Cotonou, University of Abomey-Calavi, Cotonou, Benin
[2]Department of Occupational Medicine, Suru-Lere Zone University Hospital Center, Cotonou, Benin
[3]University Hospital Center for Mother and Child of Cotonou, Cotonou, Benin
[4]School of Physiotherapy, Faculty of Health Sciences of Cotonou, Cotonou, Benin
[5]University Clinic of Physical Medicine and Rehabilitation, National University Hospital Center Hubert Koutoukou Maga, Cotonou, Benin
Email: *nayetoon@yahoo.fr, azandeg@yahoo.fr, menoladjobi@yahoo.fr, godjoanadia90@gmail.com, paulayelo@yahoo.fr, hinsvikkey@yahoo.fr

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Abstract

Introduction: Musculoskeletal disorders (MSDs) are a real occupational health problem. Laboratory technicians appear to be among those most affected. **Objective:** To assess the prevalence and factors associated with MSDs among laboratory technicians in Cotonou. **Study Method:** A descriptive and analytical cross-sectional study was carried out on laboratory technicians at university hospitals and area hospitals in Cotonou. It took place over a three-month period from August 10 to November 10, 2021. The data collected were analyzed using SPSS version 25.0 software. Frequencies were compared using the chi^2 test for qualitative variables and the ANOVA test for quantitative parametric variables. The significance level was 5%. **Results:** A total of 156 technicians were included in the study, 83 of them male, *i.e.* a M/F sex ratio of 1.14. The mean age was 36.70 ± 6.69 years. The overall prevalence of MSD was 91.03%. For back, neck, shoulder, elbow, wrist-hand, the prevalence was 83.56%, 50.68%, 08.21%, 14.38% and 20.54% respectively. Factors associated with MSD were the non-adjustable nature of the seats ($p = 0.03$), job strain ($p < 0.0001$), overweight and obesity ($p = 0.046$). **Conclusion:** The prevalence of MSD is high among laboratory technicians. The study confirms the multifactorial etiology of MSDs. The preventive approach must be comprehensive, including all risk factors.

Keywords

MSDs, Laboratory Technicians, Hospital, Cotonou

1. Introduction

Musculoskeletal disorders (MSDs) are one of the top occupational health concerns [1]. According to France's Institut National pour la Sécurité et la Santé (INRS), "MSDs are injuries that affect the musculoskeletal system of the human body, in particular bones, vertebral discs, ligaments, tendons, joints, cartilage, nerves and blood vessels" [2]. The World Health Organization (WHO) states that MSDs were one of the leading causes of disability in 2017 (ranked 2nd in the Eastern Mediterranean region and 3rd in the African region [3]).

All socio-professional categories are affected by MSDs. The medical profession is also affected. In Portugal, 89% of nurses suffer from MSDs [4]. In France, 76.4% of hospital workers reported at least one painful episode during the year, with 55.8% reporting two separate locations and 20.6% three or more. The prevalence of MSDs was significantly higher among caregivers than in other occupational groups [5].

In Senegal, 85.2% of caregivers at the Grand Yoff Health Center and all surgeons at the Saint Louis Regional Hospital complained of MSDs [6] [7]. In Côte d'Ivoire, 79.7% of staff at Bouaké University Hospital were concerned [8]. Most of the data available concerned staff in contact with patients and directly involved in care. However, quality care requires the involvement of biomedical laboratory staff. In addition to biological and chemical risks, which are of primary concern to these staff, the job of biomedical analysis technician also exposes them to other occupational constraints and nuisances, such as atypical working hours, biomechanical postural constraints and time pressure when delivering results. Laboratory technicians accumulate numerous risk factors for MSDs. But few data in the literature have focused on the study of MSDs in this population of workers.

The aim of the present study was to determine the prevalence and factors associated with MSDs among laboratory staff in Cotonou, Benin.

2. Study Methods

This was a descriptive and analytical cross-sectional study covering a period of three (03) months from August 10 to November 10, 2021. Exhaustive recruitment of all laboratory technicians from 08 hospitals, including six university hospitals and two Cotonou zone hospitals, with at least one year's seniority and present at their post during the study period. The study variables were related to the existence of MSD, characterized by pain or discomfort in a body segment without any notion of trauma, and to socio-demographic, occupational and psychosocial factors.

Data were collected using a survey form that included the participants' general,

socio-demographic, occupational and clinical characteristics. Psychosocial stress factors were assessed using the Karasek questionnaire [9]. Statistical analysis was performed using SPSS version 25.0. The relationship between variables was tested using Pearson's chi² test and Anova. The chosen significance level was 5%.

3. Results

- Socio-demographic characteristics, work habits

A total of 156 technicians were included in the study, 83 of them male, giving an M/F sex ratio of 1.14. The mean age was 36.70 ± 6.69 years; the majority were married (64.74%).

Just under a quarter (23.70%) were obese, and 35.90% were overweight. In addition, 58.97% took part in sporting activities (Table 1).

Table 1. Socio-demographic characteristics and lifestyles of laboratory technicians in Cotonou's teaching hospitals and zone hospitals in 2021, n = 156.

Age (years)	n	(%)
<30	50	32.05
]30 - 40]	56	35.89
]41 - 50]	31	19.87
>50	19	12.19
Gender		
M	83	53.21
F	73	46.79
Marital status		
Married/partnered	101	64.74
Divorced	54	34.61
Single	1	0.10
BMI*		
Normal	55	35.30
Overweight	56	35.90
Obese	37	23.90
Lean	8	05.10
Sporting activity		
Yes	92	58.97
No	64	41.03

BMI: Body mass index.

- Professional characteristics

The average length of service as a laboratory technician was 10.47 ± 6.53 years. Just over 2/3 (68.59%) worked 40 hours a week. Half (50%) said they adopted a standing posture during working hours, 42 (26.92%) remained seated most of the time and 36 (23.08%) alternated sitting and standing postures. Three quarters of the seats used (75%) were non-adjustable (Table 2).

Table 2. Occupational characteristics of laboratory technicians in Cotonou's teaching hospitals and zone hospitals in 2021, n = 156.

Length of service (years)	n	(%)
<10	50	58.33
]10 - 25]	56	31.42
> 25	31	10.25
Weekly working hours (H)		
40	107	68.59
>40	49	31.41
Usual working posture		
Prolonged standing	78	50
Alternating standing and sitting	42	26.92
Prolonged sitting	36	23.08
Seat type		
Non-adjustable seats	117	75
Adjustable seats	39	25

Description of laboratory technician activities

The actual work involves a succession of tasks, as described below:

- Taking samples;
- Checking that samples comply with requests;
- Recording data on computer;
- Labeling tubes;
- Depositing tubes in automated racks;
- Technical and biological validation of results;
- Microscopic reading of blood smears;
- Communication of results with the biologist;
- Reagent management and equipment maintenance.

Work equipment includes:

- On-screen workstation;
- Manual labeling device;
- Electron microscope;
- Programmable hematology and biochemistry machines;
- Personal protective equipment: latex gloves and surgical mask.

All these tasks involve awkward postures, such as standing for long periods, bending over, lowering the head during microscope reading or venipuncture, and repetitive movements during labeling.

They work a 2*8 shift schedule from Monday to Saturday, and are also on call for an average of 12 hours a month on Sundays and public holidays, followed by a one-day recovery period.

- Psycho-social characteristics

The prevalence of job strain was 78.80%, *i.e.* those with low decision latitude and high psychological demand. Only 1.30% were in iso-strain, *i.e.* combining job-strain with low social support (**Figure 1**).

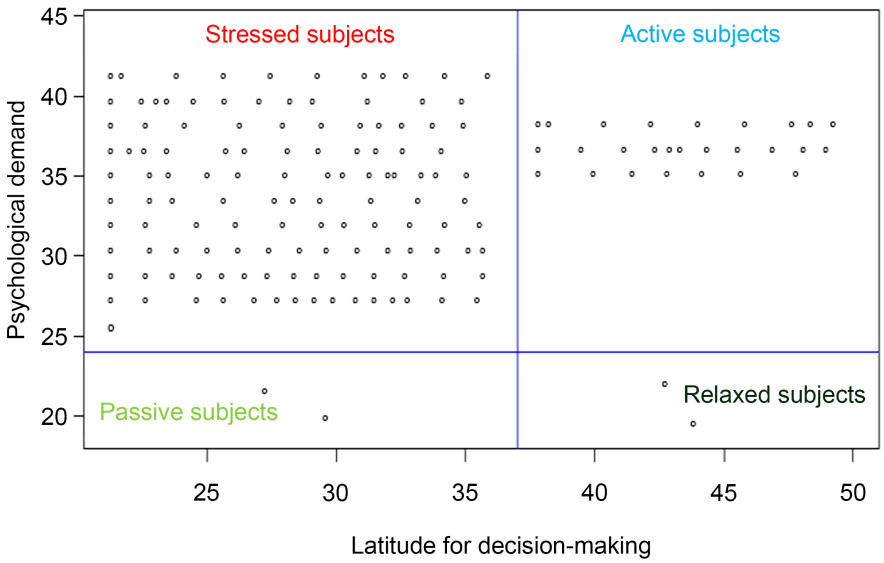

Figure 1. Prevalence of stress among laboratory technicians in Cotonou hospitals in 2021, n = 156.

- Prevalence of MSDs

The prevalence of MSDs was 91.59%. Low back pain was predominant at 83.56%, followed by neck pain at 50.68%. In the upper limb, wrists, elbows and shoulders were affected in proportions of 20.54%, 14.38% and 8.21% respectively (**Figure 2**).

- Factors associated with MSDs

The presence of spinal MSDs was statistically associated with the non-adjustability of work chairs ($p = 0.03$), as was overweight ($p = 0.046$). Job strain technicians suffered more MSD than others ($p < 0.0001$) (**Table 3**).

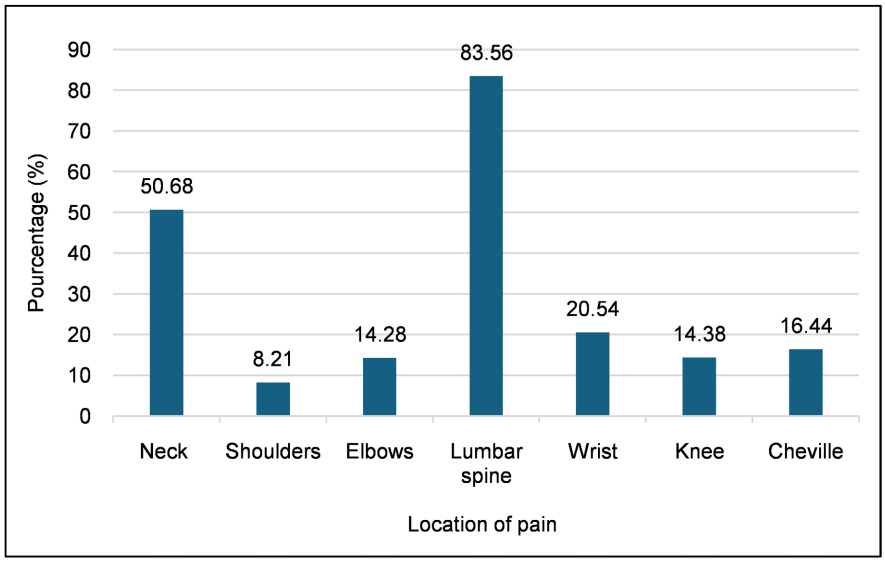

Figure 2. Prevalence of MSDs depending on location among laboratory technicians in Cotonou hospital centers in 2021, n = 156.

Table 3. Factors associated with MSDs among laboratory technicians in Cotonou's teaching hospitals and zone hospitals in 2021, n = 156.

	MSDs		OR [$CI_{95\%}$]	p
	Yes	No		
Seat type				0.05
Adjustable	34	5	1	
Non-adjustable	112	5	3 [0.89 - 12.06]	
Psychosocial state				<0.001
Relaxed	2	154	1	
Subject in job strain	123	33	27.02 [16.56 - 45.01]	
Active subject	2	154	8.47 [5.27 - 13.82]	
Subject in iso-strain	2	154	8.47 [5.27 - 13.82]	
Passive subject	27	29	17.86 [10.07 - 30.45]	
BMI				0.029
Normal	29	26	1	
Lean	1	7	4.63 [2.22 - 9.65]	
Overweight	21	35	1.63 [0.93 - 2.85]	
Obese	21	16	3.11 [1.66 - 5.85]	

4. Discussion

This study focuses on MSDs and associated factors among laboratory assistants in Cotonou's teaching hospitals and zone hospitals. Without affecting the validity of our results, our study has a number of limitations. These relate to the sampling method used and the collection technique. As the sampling was non-random, our results cannot be extrapolated to all laboratory technicians in Benin. In addition, the workload of laboratory technicians in Cotonou's major hospitals is much heavier, which could explain a higher prevalence of MSDs than that of laboratory technicians in private clinics or smaller hospitals. Nevertheless, the use of validated data collection tools is a strength of our study.

The prevalence of MSDs was 91.03%. This prevalence is higher than those reported in Iran, Ireland and France, *i.e.* 72.4% 75% and 75.5% respectively among biomedical analysis technicians [10]-[12]. In our study, low back pain was predominant, followed by neck pain. In a comparative study of MSDs in healthcare professionals conducted in Taiwan region, laboratory technicians had more spinal pathologies OR = 1.22 (CI: 1.25 - 3.64) and especially cervical OR = 1.57 (CI: 1.10 - 2.25) compared to other trades [13]. According to Flavin *et al.* in Ireland, the predominance of spinal injuries in the latter group is linked to the use of microscopes [11].

In addition to spinal injuries, the shoulders, wrists/hands/fingers and elbows were affected in proportions of 8.21%, 14.38% and 20.54% respectively. Our results are lower than those of Maumet *et al.* in France, who reported 24.5% shoulder and wrist involvement, and of Bjorksten in Sweden, where 44% of technicians reported MSD of the hand and 58% of the shoulder [12] [14]. Handling solvents can also promote finger injuries, as demonstrated by studies by Purdie *et al.* in New Zealand [15].

The presence of spinal MSDs is associated with the non-adjustable nature of technicians' work chairs. Sitting for long hours in a static position, especially on a non-ergonomic seat, can cause pain. This observation has been made in Iran and India among laboratory technicians, where uncomfortable postures are associated with MSDs [16] [17]. Our study confirms the importance of biomechanical factors such as postural constraints in the onset of musculoskeletal disorders.

In addition to biomechanical factors, technicians in tense work situations were more prone to MSDs. The study corroborates most of the data in the literature; the link between stress and MSDs has been widely described by several authors [18]-[20]. This association is underpinned by physiological factors. Stress activates the central nervous system which, via the hypothalamus, in turn activates the pituitary gland, which triggers, among other things, the release of corticoids by the adrenal gland, the most visible consequence of which is edema. Edema can trigger "ductal syndromes" through local compression of nerves by adjacent edematized tissues (tendons). Stress also activates the production/release of cytokines (substances secreted by various immune system cells). Some of these cytokines, such as interleukins (IL-1, IL-2, IL-10…), are pro-inflammatory and may

promote or even provoke TMS (tendon inflammation) [21].

Finally, overweight and obesity are associated with spinal RSI. This observation is supported by other authors [22] [23]. Fat distribution, which differs according to gender, modifies gait patterns in obese individuals, leading to different neuromuscular adaptations during the single phases of stance and propulsion. Obesity and fat distribution may be causes of muscular injury and MSD [23].

5. Conclusion

The prevalence of MSDs is high among laboratory technicians. The origin of MSDs is multifactorial. The preventive approach must be comprehensive, including all risk factors. For example, it will involve health promotion initiatives such as raising awareness of obesity and stress, introducing sports activities and nutritional education. Training in gestures and postures and the provision of ergonomic seating are also necessary, and more frequent job rotation.

Conflicts of Interest

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

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Questionnaire

1. General specifications		
1.1. Sociodemographic characteristics		
1.1.1. Age (years)		|___| |___|
1.1.2. Gender	1. Male 2. Female	|___|
1.1.3. Height (cm)		|___| |___| |___|
1.1.4. Weight (Kg)		|___| |___| |___|
1.1.5. Marital status	1. Single 2. Married 3. Divorced 4. Widow	|___|
1.1.6. Dominant hand	1. Right-hand 2. Left-hand	|___|
1.1.7. Sports activity	1. Yes 2. No	|___|
1.1.8. If so, weekly frequency		|___|
1.2. Professional characteristics		
1.2.1. Seniority (years)		|___|
1.2.2. Average working time per week (hours)		|___| |___|
1.2.3. Usual working posture	1. Sitting 2. Standing	|___|
1.2.4. Type of seat	1. Adjustable 2. Non Adjustable	|___|
1.2.5. Taking a break	1. Yes 2. No	|___|
1.2.6. Number of daily breaks		|___|
2. Clinical features		
2.1. Musculoskeletal disorders - Have you had any problems (aches, pains, discomfort) with your upper back in the last 12 months?	1. Yes 2. No	|___|

Continued

2.1.1. If yes, specify type (check)	1. Low back pain	|___|
	2. Neck pain	|___|
	3. Shoulder pain	|___|
	4. Wrist pain	|___|
	5. Knee pain	|___|
	6. Ankle pain	|___|
2.1.2. How often has this problem occurred?	Low = 1 Moderate = 2 Strong = 3 Unbearable = 4 Not concerned = 9	|___|
Clinical examination		|___|
3. Psychosocial factors		
3.1. My job requires me to learn new things	Strongly disagree = 1 Disagree = 2 Agree = 3 Strongly agree = 4	|___|
3.2. My job requires me to work hard	Strongly disagree = 1 Disagree = 2 Agree = 3 Strongly agree = 4	|___|
3.3. I'm required to do excessive work	Strongly disagree = 1 Disagree = 2 Agree = 3 Strongly agree = 4	|___|
3.4. In my job I perform repetitive tasks	Strongly disagree = 1 Disagree = 2 Agree = 3 Strongly agree = 4	|___|
3.5. My job requires me to be creative	Strongly disagree = 1 Disagree = 2 Agree = 3 Strongly agree = 4	|___|

Continued

3.6. My job often allows me to make decisions myself	Strongly disagree = 1 Disagree = 2 Agree = 3 Strongly agree = 4	|___|
3.7. My job requires a high level of skills	Strongly disagree = 1 Disagree = 2 Agree = 3 Strongly agree = 4	|___|
3.8. In my job, I have very little freedom to decide how I do my work	Strongly disagree = 1 Disagree = 2 Agree = 3 Strongly agree = 4	|___| |___|
3.9. In my job, I have a variety of activities	Strongly disagree = 1 Disagree = 2 Agree = 3 Strongly agree = 4	|___| |___|
3.10. I can influence the course of my work	Strongly disagree = 1 Disagree = 2 Agree = 3 Strongly agree = 4	|___| |___|
3.11. I have the opportunity to develop my professional skills	Strongly disagree = 1 Disagree = 2 Agree = 3 Strongly agree = 4	|___|
3.12. I'm asked to do an excessive amount of work	Strongly disagree = 1 Disagree = 2 Agree = 3 Strongly agree = 4	|___|
3.13. I have the time I need to do my job	Strongly disagree = 1 Disagree = 2 Agree = 3 Strongly agree = 4	|___|

Continued

3.14. I receive contradictory orders from other people	Strongly disagree = 1 Disagree = 2 Agree = 3 Strongly agree = 4	|___|
3.15. My work requires long periods of intense concentration	Strongly disagree = 1 Disagree = 2 Agree = 3 Strongly agree = 4	|___|
3.16. My tasks are often interrupted before they are completed, requiring me to resume them later	Strongly disagree = 1 Disagree = 2 Agree = 3 Strongly agree = 4	|___|
3.17. My work is very hectic	Strongly disagree = 1 Disagree = 2 Agree = 3 Strongly agree = 4	|___|
3.18. Waiting for work from colleagues or other departments often slows down my own work.	Strongly disagree = 1 Disagree = 2 Agree = 3 Strongly agree = 4	|___|
3.19. My superior is concerned about the well-being of his subordinates	Strongly disagree = 1 Disagree = 2 Agree = 3 Strongly agree = 4	|___|
3.20. My superior pays attention to what I say	Strongly disagree = 1 Disagree = 2 Agree = 3 Strongly agree = 4	|___|
3.21. My superior helps me complete my task	Strongly disagree = 1 Disagree = 2 Agree = 3 Strongly agree = 4	|___|

Continued

3.22. My superior easily gets subordinates to work together	Strongly disagree = 1 Disagree = 2 Agree = 3 Strongly agree = 4	|___|
3.23. The colleagues I work with are professionally competent	Strongly disagree = 1 Disagree = 2 Agree = 3 Strongly agree = 4	|___|
3.24. The colleagues I work with show interest in me	Strongly disagree = 1 Disagree = 2 Agree = 3 Strongly agree = 4	|___|
3.25. The colleagues I work with are friendly	Disagree = 2 Agree = 3 Strongly agree = 4	|___|
3.26. The colleagues I work with help me get the job done.	Strongly disagree = 1 Disagree = 2 Agree = 3 Strongly agree = 4	|___|