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Perception of Static Load as an Ergonomic Factor Associated with Musculoskeletal Disorders among Health and Physical Education Teachers in Secondary Schools in Enugu State

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Abstract
This study focused on the perception of the static load as an ergonomic factor associated with musculoskeletal disorders among health and physical education teachers in secondary schools in Enugu State. Three research questions and two hypotheses guided the study. The study used a survey research design. The population of the study was 323 (male 127, female 196) Health and Physical Education teachers in Government secondary schools in Enugu State, and the entire population was used in the study. Static Load Ergonomic Factors Questionnaire (SLEFQ) (r-0.64), a self-developed structured questionnaire was used to collect data. Statistical mean and standard deviation were used to answer the research questions while a t-test was used to test the hypotheses at a 0.05 level of significance. The study found that health and physical education teachers in Enugu State positively perceived static load as an ergonomic factor associated with musculoskeletal disorders (3.18±0.76), urban teachers (3.36 ±0.37) positively perceived static load as an ergonomic factor associated with musculoskeletal disorders higher than the rural (3.04 ±0.43), both male (3.23 ±0.48) and female (3.14 ±0.38) positively perceived static load as an ergonomic factor associated with musculoskeletal disorder. Furthermore, there was a significant difference in the perception of static load as an ergonomic factor associated with musculoskeletal disorder based on location (t-value of 7.144, p=0.000) but not on gender (t-value of 1.912, p=0.057). The study recommended among others that appropriate intervention strategies like ergonomically designed workplaces, proper equipment and training sessions on the ergonomic guidelines should be provided by school management both in the rural and urban schools to teachers.
Keywords: Static Load, Ergonomic Factor, Musculoskeletal Disorder, Secondary school Teachers

Introduction

The potential consequences of a static load as an ergonomic factor have raised interest among researchers. For example, Cheng, Cheng, and Ju (2013) reported that static load as an ergonomic factor affects the quality of life, resulting in increased sick leaves or early retirement and can impose a major economic burden because of compensation costs and lost wages among teachers. Waldemar (2006) described ergonomics as the scientific discipline concerned with the understanding of interactions among humans and other elements of a system. According to Ismaila (2010) ergonomics is concerned with adjusting the work environment, tools, tasks, and equipment to fit the employees" physical capability and limitations. Ergonomic factors are physical factors of any source or situation with the potential to cause musculoskeletal disorders like an injury in the muscle or lead to the development of a disease as a worker carries out his or her duty in the workplace (Occupational Safety and Health Administration [OSHA], 2007). Therefore, when there is a mismatch between the physical requirements of the job and the physical capacity of the worker, work-related musculoskeletal disorders (MSDs) can result. This is caused by ergonomics risk known as a static load which has unfavourable health consequences when not averted (IEA, 2006).

Static load referred to load that does not change over time in which the same position is held throughout the exertion (Hsin-Yi, Man-Ting, Yu-Chung &Yan-Ying,2016). The static load is any load as on a structure, that does not change in magnitude or position with time (Canadian Center for Occupational Health and Safety, 2006). In this study, static load refers to the situation where the load in the body segments of the teachers are aligned and maintained in a fixed position. Canadian Center for Occupational Health and Safety (2006) found that standing and sitting are the classic positions that most workers in the classroom and office experience. Darcy (2018)

indicated other static loads and its detrimental effects include squatting or crouching, raised arms, bending at a 30-degree angle, and bending at a 45-degree. Squatting or crouching posture occurs when a teacher is trying to make some demonstration while teaching in the class which can strain the knees and lower pain in the leg. Raised arms posture involves elbows being elevated above the shoulder and head without support for more than two hours in the course of writing on the chalkboard which can cause overstretching of arm muscle. Bending at a 30-degree angle and bending at a 45-degree angle include bending forwards at the waist without the support and maintaining un-shifting position unbroken for two hours during classwork activities like teaching, writing and reading.

Maintaining these postures for a long time increases discomfort and pain and if prolonged, it will eventually affect tissue and cause nerve injury and it has accounted for 42 per cent of all lost-time claims and costs and 50% of all lost-time days among teachers (Ontario Ministry of Labour, 2006). A teacher is a person who helps to educate children and imparting knowledge to them at their vulnerable age in the school. The teacher plays a significant role in transforming young children into productive adults. Teachers are undoubtedly the role models for their students. They have a moral responsibility in the overall physical and mental development of their students. Teacher's tasks involve teaching students, construction of lessons, evaluating students' work and being involved in other works such as innovative art and games and take part in many school committees (Chong & Chan, 2010). Mesaria and Jaiswal (2015) maintained that in a single day, a teacher has to perform tasks like teach a specific subject to children, check the note-books of students, maintain class discipline, write on the blackboard, dictate notes to students and take attendance. Performing these tasks posed psychological and bodily health problems to teachers but the severity depends on the individual variables like location and gender (Chong & Chan, 2010)

A study conducted by Thomsen, Mikkelsen, Andersen, Follentin, loft, Frost, Koergoard and Bonde (2007) found that location was related to hand wrist pain and possible tendonitis in the analyses. Chiu et al. (2002) indicated that rural teachers had high static load than urban, especially on neck pain and leg as a result of standing in the classroom teaching because of lack of equipment and other reading materials. Chiu and Ku (2010) found that teachers in the urban schools had higher musculoskeletal disorders because they often make use of computers in their daily work that involves repetitive movements such as reading, writing and prolonged static posture. Solis-Soto, Schön, Solis-Soto, Parra, and Radon (2017) carried out a study to determine the prevalence of MSD among school teachers from urban and rural areas in Chuquisaca, Bolivia. The findings revealed that MSD was most common in the neck and least common in the wrist/hands and teachers working in rural areas had significantly higher odds than teachers from urban schools for work-limiting pain.

Studies from Norway found that school teachers represent an occupational group among which there appears to be a high prevalence of MSD especially among the female ones (Erick & Smith, 2011). Chong and Chan (2010) conducted a study in China and confirmed that Hong Kong teachers showed a high prevalence for the neck (68.9%), shoulder (73.4%) and low back pain (59.2%). The study further showed a significantly higher prevalence in all musculoskeletal complaints among the teachers in Hong Kong based on gender. A study in India found a significant difference in the static load among teachers as regards gender (Yue & Liu, 2012). Samad, Abdullah, Moin, Shamsul, Tamrin, and Hashim (2010) found both male and female teachers experienced a high impact on workplace risk factors of static load.

A study showed that around 175 million were lost of the UK economy due to sick leave with one in eight patients detected with Musculoskeletal disorder signs like the neck, back and shoulder pain (Health and Safety Executive, 1996). The researchers observed that the teachers in Enugu State are often forced to adjust to their existing work environment. The poorly designed work environment of the classroom might have a direct impact on the productivity of the teachers resulting in poor health and quality of teaching. Hence, teaching as a profession required that the teacher might stand and sit in static (non-moving) positions for an extended period. Such restriction of movement places an unnatural mode on teachers which often lead to complaining of pain, fatigue, stiff legs, chronic neck and back pain, stiff neck and shoulders, precipitation of rheumatic diseases of the tendons and ligaments, deep vein thrombosis and sore and tired arms and hands. If this situation lingered for a longer time, it might have serious consequences for the teachers as well as the students too. There are tendencies for the teachers to experience the impact of musculoskeletal disorders specifically within the teaching profession since it has not been given sufficient attention in the literature. No study known to the researchers in Enugu State has been carried out to ascertain the perception of static load as an ergonomic factor associated with musculoskeletal disorders among health and physical education teachers in secondary schools in Enugu State, hence the need for the study.

Purpose of the Study

The main purpose of this study was to determine the perception of static load as an ergonomic factor associated with musculoskeletal disorders among Health and Physical Education Teachers in secondary schools in Enugu State. Specifically, the study determined:

1. perceptions of static load as an ergonomic factor associated with musculoskeletal disorders among Health and Physical Education Teachers in secondary schools in Enugu State;
2. perceptions of static load as an ergonomic factor associated with musculoskeletal disorders among Health and Physical Education Teachers in secondary schools in Enugu State by location; and
3. perceptions of static load as an ergonomic factor associated with musculoskeletal disorders among Health and Physical Education Teachers in secondary schools in Enugu State by gender.

Research Questions

The following research questions guided this study:

1. What is the perception of static load as an ergonomic factor associated with musculoskeletal disorders among Health and Physical Education Teachers in secondary schools in Enugu State?
2. What is the perception of static load as an ergonomic factor associated with musculoskeletal disorders among Health and Physical Education Teachers in secondary schools in Enugu State by location?
3. What is the perception of static load as an ergonomic factor associated with musculoskeletal disorders among Health and Physical Education Teachers in secondary schools in Enugu State by gender?

Hypotheses

The study tested the following research hypotheses at a 0.05 level of significance

1. There is no significant difference in the perception of static load as an ergonomic factor associated with musculoskeletal disorders among Health and Physical Education Teachers in secondary schools in Enugu State by location.
2. There is no significant difference in the perception of static load as an ergonomic factor associated with musculoskeletal disorders among Health and Physical Education Teachers in secondary schools in Enugu State by gender.

Methods

The study used a survey research design. The study was conducted in Enugu State using government secondary schools. The population of the study was 323 (male 127, female 196) Health and Physical Education teachers in Government secondary schools in Enugu State, and the entire population was used in the study. Hence, there was no sampling of the population. The instrument for data collection was a self-developed structured questionnaire known as Static Load Ergonomic Factors Questionnaire (SLEFQ) which had 20 items. The questionnaire had two sections: A and B. Section A elicited information on demographic data of the respondents, while section B elicited information on static load with 18 items. The response columns of the questionnaire were arranged as follows: Always = 4, occasionally=3 Rarely = 2, and never=1. The instrument was validated by three experts in the Department of Human Kinetics and Health Education, University of Nigeria Nsukka, Enugu State. Internal consistency of the instrument was determined using Cronbach alpha co-efficient and the reliability coefficient was r= 0.642, which is higher than a coefficient of 0.60 for a good instrument (Ogbazi & Okpala, 1994). To establish the level of agreement on the perception of static load among the participants; the criterion mean was set at 2.50. Hence, any means up to 2.50 and above indicated that static load was perceived as an ergonomic factor associated with musculoskeletal disorders while below 2.50 was not perceived as an ergonomic factor associated with musculoskeletal disorders.

To have access to the respondents, an introductory letter was attached to the instrument and given to each of the Principal of the study schools and the respondents. The researchers and their research assistants administered the questionnaire to the respondents in their respective schools. The respondents filled and returned the questionnaire immediately after completion. Copies of the questionnaire were cross-checked for its completeness. Statistical mean and standard deviation were used to answer the entire research questions while t-test was used to test the 2 null hypotheses at a 0.05 level of significance.

Results

Table 1: Mean and Standard Deviation of Respondents' Perception of Static Load as Ergonomic Factors Associated with Musculoskeletal Disorders among Health and Physical Education Teachers in Secondary Schools in Enugu State

SN	Item	$\bar{X}$	SD	Decision
3.	Contact stress results from occasional, repeated or continuous contact between soft body tissue and a hard or sharp object and leads to MSD.	3.30	0.80	Positive
4.	Contact stress commonly affects the soft tissue on the fingers, palms, forearms, thighs, shins and feet resulting in MSD.	3.07	0.79	Positive
5.	This contact may create pressure over a small area of the body, such as the wrist or forearm, that can inhibit blood flow, tendon and muscle movement, and nerve function.	3.24	0.80	Positive
6.	Contact stress can occur when working surfaces with sharp edges are too high or too low which create contact points resulting in MSD.	3.12	0.69	Positive
7.	Poor tool design can often result in contact stress which leads to MSD.	3.20	0.76	Positive
8.	Gripping handles that are too small may press the handle or handle edge into the skin causing MSD.	3.03	0.76	Positive
9.	Neutral postures can result in MSD if one posture or position is maintained for a prolonged period.	3.06	0.93	Positive
10.	Avoid tight and static grip and use padded non-slip handles to prevent MSD.	3.15	0.74	Positive
11.	Use knee pads when kneeling to avoid MSD	3.26	0.63	Positive
12.	In MSD caused by static load, the muscles tire after a time and begin to hurt.	3.30	0.65	Positive
13.	In the workplace, having to hold parts and tools continually causes MSD as a result of static load.	3.10	0.72	Positive
14.	Using a fixture eliminates the need to hold onto a part, thereby eliminating and reducing MSD.	3.12	0.62	Positive
15.	Having to hold the arms overhead for a few minutes causes MSD due to static load, this time affecting the shoulder muscles.	3.28	0.76	Positive
16.	Having to stand for a long time creates a static load on the legs which leads to MSD.	3.14	0.75	Positive
17.	The legs can be repositioned while standing with the use of footrest which makes standing easier and avoids MSD.	3.07	0.82	Positive
18.	Standing on a hard surface, like concrete creates pressure point that makes the heels and feet to begin to hurt and the whole legs can begin to tire.	3.23	0.74	Positive
19.	There is a need to shift postures after sitting for long periods, move, stretch and adjust sit up and down throughout the day to avoid MSD.	3.24	0.80	Positive
20.	It actually would be ideal to alternate between sitting and standing throughout the day to avoid MSD due to static pressure.	3.28	0.76	Positive
	Grand Mean	**3.18**	**0.76**	Positive

Data in Table 1 show the mean response score of respondents on perceptions of static load as an ergonomic factor associated with musculoskeletal disorders among health and physical education teachers in Secondary Schools in Enugu State. From the Table, all the items 3 – 20 had a mean score greater than 2.50 set for the study. The Table had a grand mean score of 3.18 which indicates that health and physical education teachers in Secondary Schools in Enugu State positively perceived that static load is an ergonomic factor associated with musculoskeletal disorders. The grand standard deviation of 0.76 shows that the respondents' perception about static load as an ergonomic factor associated with musculoskeletal disorders does not vary so widely.

Table 2: Mean and Summary of t-test Analysis of Static Load as an Ergonomic Factor Associated with Musculoskeletal Disorders among Health and Physical Education Teachers in Secondary Schools in Enugu State based on Location

Variables	N	$\bar{X}$	SD	df	t-value	p-value	Decision
Rural	183	3.04	0.43				
				321	7.144	0.000	Significant
Urban	140	3.36	0.37				

Results in Table 2 show that the respondents from rural (3.04 ±0.43) and urban (3.36 ±0.37) perceived static load as an ergonomic factor associated with musculoskeletal disorder. However, urban teachers with a higher mean score of (3.36 ±0.37) than the rural ones (3.04 ±0.43) suggesting that there was a difference in the perception of static posture as an ergonomic factor associated with a musculoskeletal disorder based on location. Summary of t-test analysis indicated a significant difference in the perception of static load as an ergonomic factor associated with musculoskeletal disorder based on location. This is shown in the Table where t-value of 7.144 was significant at p=0.000. However, the hypothesis was rejected.

Table 3: Mean and Summary of t-test Analysis of Static Load as an Ergonomic Factor Associated with Musculoskeletal Disorders among Health and Physical Education Teachers in Secondary Schools in Enugu State based on Gender

Variables	N	$\bar{X}$	SD	df	t-value	p-value	Decision
Male	127	3.23	0.48				
				321	1.192	0.057	Significant
Female	196	3.14	0.38				

Results in Table 3 show that both male (3.23 ±0.48) and female (3.14 ±0.38) perceived static load as an ergonomic factor associated with musculoskeletal disorder., indicating that, there was no difference in the perception of a static load as an ergonomic factor associated with musculoskeletal disorder based on gender. Summary of t-test statistic indicated no significant difference in the perception of static load as an ergonomic factor associated with musculoskeletal disorder based on gender. This is shown in the Table where t-value of 1.912 was not significant at p=0.057. Hence, the hypothesis was not rejected.

Discussion

Data in Table 1 showed that health and physical education teachers in Enugu State positively perceived static load as an ergonomic factor associated with musculoskeletal disorders The study was done by Yue, Liu, and Li (2012) on Neck/shoulder pain and low back pain among school teachers in China, had a similar finding where static posture and uncomfortable back support were positively associated with Neck and/or shoulder pain and low back pain. This could be as a result of the work task of school teachers which often involves significant use of head-down postures, such as frequent reading and marking of assignments that require sustained mechanical load and constant trunk flexion (Chong et al., 2010).

Results in Table 2 indicated that there was a difference in the perception of static load as an ergonomic factor associated with musculoskeletal disorder based on location. When the data were further subjected to t-test statistic, the result indicated a significant difference in the perception of static load as an ergonomic factor associated with a musculoskeletal disorder based on location. However, urban teachers had higher perception score than the rural ones. The reason for these differences could be attributed to the fact that rural areas might be participating in intense labour and farming activities while the participants in the urban area may be used to a more sedentary lifestyle. The finding in this study is in agreement with the finding of Chiu and Ku (2010) which indicated that teachers in the urban schools had higher musculoskeletal disorders because they often made frequent use of computers on their daily work that involves repetitive movement such as reading, writing and prolonged static load.

The finding disagreed with the finding of Chiu et al.. (2002) which indicated that rural teachers had high static load than urban especially on neck pain and leg as a result of standing in the classroom teaching because of lack of equipment and other reading materials. The finding in this study equally disagreed with the finding of Solis-Soto, Schön, Solis-Soto, Parra, and Radon (2017) which revealed that MSD was most common in the neck and least common in the wrist/hands of teachers working in rural areas than the rural teachers.

Data on Table 3 indicated that both male and female teachers in Enugu State perceived static load as an ergonomic factor associated with musculoskeletal disorder. Furthermore, the summary of the t-test statistic indicated no significant difference in the perception of static load as an ergonomic factor associated with musculoskeletal disorder based on gender. This supported Chong and Chan (2010) which found that male and female Hong Kong teachers showed a higher prevalence for neck (68.9%), shoulder (73.4%) and low back pain (59.2%). The study further showed a significantly higher prevalence in all musculoskeletal complaints among the teachers. The finding was in line with Samad et al. (2010) which found that both male and female teacher has a high impact on workplace risk factors of static load. However, study in India by Yue and Liu (2012) which found a significant difference in the static load among teachers as regard to gender disagreed with the find in this study.

Conclusion

Although the perception of static load varied within the variable of location but not on gender, there is a clear demonstration that their perception regarding static load as an ergonomic factor associated with MSD was enriching. Hence, urban had a higher perception score than rural. Both male and female teachers in Enugu State perceived static load as an ergonomic factor associated with musculoskeletal disorder.

Recommendations

The following recommendations are suggested.

1. The researchers suggested time management and short break exercises between tasks to avoid pain, fatigue and discomfort as prevention strategy programme that may reduce musculoskeletal disorders among the teachers.
2. Appropriate intervention strategies like ergonomically designed workplaces, proper equipment and training sessions on the ergonomic guidelines should be provided by school management both in rural and urban schools.
3. Both male and female teachers should observe ergonomic principles in handling students and in reading, writing and standing while discharging their duties.
4. Health and physical education teachers should practice yoga and proper breathing exercises which could help to reduce musculoskeletal symptoms.

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