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Ergonomic Principles for Organizing Garment-Making Work Environment in South Eastern Nigeria

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Abstract

The study focused on ergonomic principles for organizing garment-making work environment in South Eastern Nigeria. Specifically, it determined: important ergonomic principles for organizing garment-making work environment; ergonomic principles that are being practiced by garment workers, ergonomic principles that are needed by garment workers in their work environment, and work station design guidelines of the garment workers. Descriptive survey research design was used. The population was made up of 267 garment workers drawn from 19 registered garment companies in the area of the study. Questionnaire was used for data collection. Data were analyzed using mean, standard deviation, improvement need index and percentages. Findings include 19 important ergonomic principles for organizing garment work environment. These include; use of task lighting to distribute light evenly over the working surface to minimize shadow ($\overline{X}$ = 3.61), maintaining adequate ventilation and good temperature in workplace to minimize fatigue ($\overline{X}$ = 3.66), among others. Four (4) out of the 19 important ergonomic principles were being practiced include: alternating standing and sitting jobs to reduce fatigue ($\overline{X}$ = 3.13), among others. Fifteen (15) ergonomic principles are needed by garment workers for organizing their work environment which include; use of task lighting on work surfaces to minimize shadow ($\overline{X}$ = 3.06), maintaining adequate ventilation and good temperature to minimize fatigue ($\overline{X}$ = 2.07), and others. Further findings are nine areas of work station design guidelines that are not practiced. These include: work surface height, designing of work to reduce static loading of muscles, among others. It was recommended among others that the ergonomic principles should be packaged in a training manual for training of garment workers by relevant bodies.

Keywords: Ergonomics, Organizing, Garment, Workers, Workplace, Environment, Workstation.

Introduction

Ergonomics also known as human factor engineering or humanics is the science of designing machines, products and system to maximize safety, comfort and efficiency of the people who use them. It is the study and practice of arranging furniture and equipment to make work comfortable and safe. Ergonomics draws from the principles of Industrial Engineering, Psychology, Anthropometry the science of human measurement and Biomechanics (the study of muscular activity) to adapt the design of production and workplaces to people sizes and shapes and their

physical strength limitation (Occupational Safety and Health Administration 2000, Alan, 2008).

Ergonomics has principles that guides its application which include; working in neutral posture i.e maintaining the 'S' curve of the spine, reducing excessive force, repetitive motion and pressure points. Keeping everything within easy reach to prevent bending and twisting the trunk, working at proper heights, limiting the amount of load that is lifted instead mechanical aids should be used, taking short breaks and regular stretching and exercises among others (Mcleod, 2008; Health and Safety Authority, 2008). These principles are summarized as principles of maintaining good working posture, safety consciousness in work places and environment.

In the garment industry, ergonomic principles are applied in workstations, organization to make work comfortable and easier. Tilted tables and work surfaces are used to increase visibility, task lightings are used for greater visibility, ergonomic chairs with adjustable heights, anti fatigue mats are also used to reduce static load during prolonged period of standing, ergonomic hand tools e.g scissors and cutters used to reduce contact pressure on hands and cornification of skins and fingers, taking short breaks and intermittent periods of tests to allow the strained nerve and muscle to recover among others. (Gunning, Eaton, Femer, Fummin, Ker, King and Mattby 2001, Kabir and Armed 2013, Sewing craft and Alliance SC and A 2008, Polajnar, Leber and Herzog 2010).

The garment industry is usually seen as a safe place to work in when compared with other industries, because there are relatively fewer major accidents. However, the major health risk does not arise from potential injury but from more subtle injury whose effects accumulate over time. The Sewing process is highly technical and detailed, in most cases involving repetitive motions. Many of the tasks and sewing in particular are highly fragmental (Brisson and Vezina 1989). The processes include; making garment patterns, laying and cutting of fabric, stitching and assembling of garment, finishing and packaging ready for delivery. In assembly line, inspectors, testers, sorters, samplers, weighters, are involved for quality assurance and consistent standards (Bureau of Labour Statistics USA, 2010). Thus, garment workers stand or sit and lean over their tables or sewing machines performing the same task repeatedly, most times in awkward posture for a long period of time each day.

Working in awkward and constrained posture in unconducive environment predispose garment workers to high risk of developing repetitive strain or stress injury RSIs also known as Musculoskeletal Disorder (MSDs) or Cumulative Trauma Disorder (CTDs) which increases with years of experience. These injuries often develop slowly and affect different workers in different parts of their bodies. The severity of the injury increases overtime and does not stop unless the worker changes the factors that created the stress in the first place (Mantoba Federation of Occupational Health Centre (MFLOCHC, 1999; Occupational Safety and Health Administration (OSHA) 2000; Pascreli 2008; Stevenson 2018). According to Yuan, Gazi, Rahman, Dhar and Rahman (2022); most of the health problems faced by garment workers are

due to occupational stress and has been linked to numerous health hazards.

Preliminary study carried out by the researcher in (July,2012) in South Eastern Nigeria to ascertain ergonomics awareness and compliance of garment workers using Focus Group Discussion. The study revealed the prevalence of symptoms of repetitive strain injury among the garment workers. The respondents complained of pains at the neck, lower back and waist, eyes strain, numbness, pedal odema tingling, use of analgesics to reduce body pains among others. These challenges could have been as a result of their work station and place not being in accordance with ergonomic principles. Several studies have shown that ergonomically optimized workstation can considerably reduce the incidence of RSIs, or MSDs (Kelly, Oritz, Coutrey, Fold, Daris, Gerth and Schyrl 1992; Gunning, et al 2001; American Apparel and Foot Wear Association 2005; Polajner, Leber and Herzog 2010; Somnatu and Samrat 2010; Vandyck, Tackoe-ofosu and Senayah 2014 and Oviae 2020).

The obvious ignorance about ergonomic principles by garment workers and prevalence of RSIs or MSDs is a serious gap that needs to be filled. This cannot be achieved effectively until the current work practice and workstation have been carefully studied to determine the ergonomic principle, they needed for organizing their work environment for optimum well being.

Purpose of the Study

The major purpose of the study was to ascertain ergonomic principles for organizing garment-making work environment in South Eastern Nigeria. Specifically, the study determined:

1. important ergonomic principles for organizing garment- making work environment in South Eastern Nigeria.
2. important ergonomic principles practiced by garment workers in their work environment in South Eastern Nigeria.
3. ergonomic improvement needed by garment workers for organizing garment- making work environment in South Eastern Nigeria.
4. Work station design principles (or guidelines) for garment workers in South Eastern Nigeria

Methodology

***Design of the Study*:** Descriptive survey research design was used for the study.

***Area of the Study*:** The study was carried out in South Eastern Nigeria. South Eastern Nigeria is largely dominated by the Igbo ethnic group which is generally known for their commercial activities. Their entrepreneurship drive has made them to diversify in various areas of manufacturing, including garment production. Most of these garment industries are sited in Aba and Onitsha which are the two major commercial cities in the South Eastern Nigeria. There are many garment companies but only 19 garment companies were registered; ten (10) in Aba and nine (9) in Onitsha (Source: Garment Industries (Ad) www.webcrawler.com). However, for the purpose of this study, only the registered ones were used. The entire population was used since the population size was manageable.

***Population for the Study*:** The population for this study was made up of 267 garment workers who were drawn from the 19 registered garment companies in Aba and Onitsha (Source: Garment Industries Ad www.webcrawler.com). These are the

two major commercial cities where most garment companies were sited in South East Nigeria. The garment workers or operators within these companies were the respondents for the study, because they are directly involved in the sewing job, drafting, cutting, stitching/assembling, finishing and packaging of garments. The garment workers were mainly young and middle-aged men and women who spend 8hours or more in their job each day. Majority of them were literate who had secondary school education.

***Instrument for Data Collection*:** Data was collected using a structured 39- item questionnaire. The instrument was validated by three experts. Two Home Economics lecturers and one Physiotherapist. The questionnaire items were designed based on the specific purposes of the study. The reliability coefficient of 0.83 was obtained for the instrument. The questionnaire was structured into four responses of Highly Important (HI), Averagely Important (AI), Slightly Important (SI) and Not Important (NI), while the Practiced category was structured into four responses; Highly Practiced (HP), Averagely Practiced (AP), Slightly Practiced (SP) and Not Practiced (NP). The observation checklist was made up of 21 structured items with Yes or No answer. This guided the researcher to observe and rate their work environment. Any work environment that met the required standard is marked yes but the substandard ones received no response.

***Method of Data Collection*:** Two hundred and sixty-seven (267) copies of the questionnaire were administered by hand to the respondents with the help of five research assistants. A total of 260 copies were returned out of the 267 copies of the instrument administered. This gave 97.3% return rate.

***Method of Data Analysis*:** The data were analyzed using mean, standard deviation and percentages. To determine the need, gap the following procedures were adopted:

Weighted mean of each item under the needed category (XN) was calculated.

Weighted mean of each item under the performance category (XP) was calculated.

Difference between the two means for each item (XN-XP) was determined.

The decision rules were as follows:

- A zero (0) value indicated that ergonomic principles were not needed because the level at which the item was needed is equal to the level at which the respondents can perform it.
- A positive (+) value indicated that capacity building is needed because the level at which the item was needed is higher than the level at which the respondents perform it.
- A negative (-) value indicated that ergonomic principles is needed because the level at which the item was needed is lower than the level at which the respondents can perform it.

Results

The result of this study was presented in Tables 1and 2 based on the four specific purposes. The data for answering research questions one, two and three are presented in Table 1.

Table 1: Need Gap Analysis (NGA) of Ergonomics Principles Needed by Garment Workers for Organizing Work Environment (N – 260)

S/N	Ergonomic principles needed by garment workers for organizing their work environment	$\overline{X}_I$	$\overline{X}_P$	NG $(\overline{X}_N - \overline{X}_P)$	RMK
1	Using task lighting to distribute light evenly over the working surface to minimize shadow	3.61	3.06	0.55	IN
2	Providing general lighting in the room to avoid contrast in the amount of light in the room	3.39	2.26	1.13	IN
3	Choosing colours of ceilings, walls, floors and furnishing with light colours to produce more light from the same wattage	3.64	2.49	1.15	IN
4	Using correct wattage for good visibility at the work area	3.32	2.61	0.62	IN
5	Providing just enough shade needed for the light to prevent glare	3.31	3.09	0.22	IN
6	Avoiding glare directly or reflected to prevent eye strains and discomfort	3.81	2.63	1.18	IN
7	Having source of light for right-handed worker should come from the left and for left hand workers from right to minimize shadow	3.18	3.20	- 0.02	INN
8	Placing a study lamp or high intensity lamp beside and close to the machine, by 1" to the side of the needle and 1" above the needle and 6" behind the needle	3.72	2.30	1.42	IN
9	Lighting fabric storage units with florescent light which keeps colours true, incandescent light gives a yellow tint	3.63	2.45	1.18	IN
10	Laying out workplace to allow enough natural lighting which is usually soft and illuminating	3.00	3.12	-0.12	INN
11	Maintaining adequate ventilation and good temperature in the workplace to minimize fatigue	3.66	2.07	1.59	IN
12	Planning for regular intervals of short breaks and rests	3.16	2.41	0.75	IN
13	Rotating of workers in different tasks to help reduce repetition	3.41	2.30	1.11	IN
14	Using stronger muscle for lifting and twisting instead of the small muscle of the wrist and fingers	3.15	2.23	0.92	IN
15	Arranging work tools and notions within easy reach to avoid excessive reaching and stretching	3.52	2.18	1.34	IN
16	Alternating standing and sitting jobs to reduce fatigue	3.13	3.21	-0.08	INN
17	Adding incentives and bonuses to the job for increased job satisfaction	3.55	2.92	0.63	IN
18	Having healthy and flowing communication among workers and management is essential to help reduce mental stress	3.55	2.70	0.85	IN
19	Providing background music to help reduce mental tress	3.02	3.15	-0.13	INN

Note: X_I = Mean Important; X_P = Mean Practices; NG = Need Gap; IN = Improvement Needed; INN = Improvement Not Needed

Table 1, shows that all the 19 identified ergonomic principles were important for the garment workers with values ranging from $\overline{X}$ 3.00 to $\overline{X}$ 3.81 which were

all positive. Also, the table also shows that out of the 19 important ergonomic principles identified, only 4 items out of the 19 important ergonomic principles were practiced, specifically items 7, 10, 16, and 19 which were in the positive.

Furthermore, 15 out of the 19 ergonomic principles had their need gap (NG) values ranged from 0.22 to 1.42 which are all positive. This implied that garment workers in Southeast Nigeria require improvement in all the 15 identified ergonomics principles that are needed for organizing work environment in the garment industry. On the other hand, the need gap values of the remaining four items, specifically items 7, 10, 16 and 19 were - 0.02, - 0.12, - 0.08 and - 0.13 respectively which were negative. This indicated that the level at which the garment workers are practicing these four principles are greater than the level at which they are needed and therefore did not require improvement in the four ergonomics principles for organizing work environment in garment industry in Southeast Nigeria.

Table 2: Frequency and Percentage Distribution of the Result of Non-Participant Work Station Checklist

S/N	Work Station Design of Garment Workers	Yes F (%)	No (F%)
1	Does the work place allow the operator full range of movement?	10(65.5%)	6(37.5%)
2	Are work aids or other accessories available?	4(25%)	12(75%)
3	Can height of the surface be adjusted easily?	-	16(100%)
4	Can the work surface be tilted or angled?	-	16(1000%)
5	Is the work station designed to reduce bending or twisting at the wrist?	11(68.75%)	5(31.25%)
6	Is the work station designed to reduce reaching behind the midline of the body?	9(56.25%)	7(43.75%)
7	Is the work station designed to reduce reaching above the shoulder?	13(81.25%)	3(18.75%)
8	Is the work station designed to reduce static muscle loading?	-	16(100%)
9	Is the work. Station designed to reduce full extension arms?	11(68.75%)	5(31.25%)
10	Is the work. Station designed to reduce raised elbows?	7(43.75%)	9(56.25%)
11	Is the work station designed to reduce lifting load or bundles over 20 pounds from seated position?	12(75%)	4(25%)
12	Are the workers able to vary posture?	8(50%)	8(50%)
13	Are the hands and arms free from sharp edge on work surface?	14(87.5%)	2(12.5%)
14	Is an arm rest provided where needed?	-	16(100%)
15	Is a foot rest provided if needed or can the treadle be adjusted?	2(12.5%)	14(87.5%)
16	Is the floor surface flat and free from obstacles?	8(50%)	8(50%)
17	Are cushioned floor mats provided for employees required to stand for long periods?	-	16(100%)
18	Are chairs or stools adjustable and suited to the task?	-	16(100%)
19	Are all tasks elements visible and from comfortable positions?	8(50%)	8(50%)
20	Is the workstation well ventilated or congested?	8(50%)	8(50%)
21	Is the environment noisy with low rate of ventilation?	9(56.25%)	7(43.75%)

F= Frequency; % = Percent

Table 2 shows that eight out of the 21 items in the Table received positive (Yes) percentage scores greater than 50 percent. This implies that eight items out

of the 21 identified are practiced in their work station. On the other hand, nine out of 21 items in the Table received negative (No) percentage scores greater than 50 percent, in other words their workstation design are below standard or not practiced at all on these items.

The remaining four items had average scores of (50%) for both the positive and negative (50%), this implies that these workstation designs are partly practiced by some of the respondents while others do not.

Discussion of Findings

The findings of this study showed that garment workers identified the following important ergonomic principles for organizing their work environment such as ; use of task lighting to distribute light evenly over the work surface to minimize shadow ($\overline{X}$ = 3.61), maintaining adequate ventilation and good temperature in the workplace to minimize fatigue ($\overline{X}$ = 3.66), planning for regular intervals of short breaks ($\overline{X}$ = 3.16), and rests, alternating standing and sitting posture ($\overline{X}$ = 3.13), arranging work tools and notions within easy reach to avoid excessive reaching and stretching ($\overline{X}$ = 3.52), provision of background music to help reduce mental stress ($\overline{X}$ = 3.02), adding incentives and bonuses to the job for increased job satisfaction ($\overline{X}$ = 3.55) among others. This corroborates the findings of Gunning .et al (2001), Saravani, (2011), and Muhundhan, (2013), which emphasized the need for fundamental ergonomic principles as possibilities for optimizing the tasks in the workplace. According to OSHA, (2000), if task and equipment do not include ergonomic principles in their design workers may be exposed to undue physical strains and over exertion including vibrations, awkward posture, forceful exertion, repetitive motions and heavy lifting. Smith (2014) identified them as risk factors which are major causes of back pain, workplace stress and RSI resulting in loss of time, reduced productivity, poor employee health and low morale. Therefore, garment workers are required to practice these ergonomic principles in their workplace.

Furthermore, the findings revealed that the garment workers practiced only 4 ergonomic principles out of the 19 identified ergonomic principles which include; having the source of light for right hand workers come from left and left hand workers come from right, laying out workplace to allow enough natural lighting which is soft and illuminating, alternating standing and sitting jobs to reduce fatigue and providing background music to help reduce mental stress. The low practice level could be as result of ignorance, which corroborates the findings of Ismaila (2010), in his survey on ergonomic awareness in Nigeria. His findings revealed that only 3.4% of his respondents were aware of ergonomics, which is very low.

Finally, the findings of the study show that, ergonomic improvement is needed in 15 ergonomic principles which include; use of task lighting to distribute light evenly over the work surface to minimize shadow, maintaining adequate ventilation and good temperature in the workplace to minimize fatigue, planning for regular intervals of short breaks and rests among others.This is consistent with the findings of Sardar, Imohan and Mandahani (2006); Menke (2017) and Sanchez (2021) which reported deplorable working conditions of garment workers, jobs were neither well structured nor routinely organized, tasks

being general repetitive and burdensome to workers, workspaces were congested and sitting postures were typically constrained and uncomfortable. Similarly, Anishi (2020) also decried the incredible poor working conditions of garment workers, working up to 18 hours per day. Arriving early in the morning and leaving past midnight, working in small chairs that stress their backs and necks. Earlier studies by Gunning et al (2001) and Sealetsa and Thatcher (2009) also reported this incidence too; garment workers working continuously without breaks to alleviate static load of muscles of the back, neck, shoulder arms and legs. These extended work periods do not allow the body to recover, predisposing employees to elevated risk of RSIs or MSDs. This corroborates the findings of Tella, Akodu and Fasuba (2010) which reported increased prevalence of RSI among bank workers in Nigeria with poor work strategy (80%) and poor work breaks (82.5%). These findings resemble the poor state of the garment workers surveyed under the study, underscoring the need for ergonomic improvement.

Conclusion

Health and work are related; thus, health remains a critical issue for every worker in a production floor. Creating an environment that value ergonomics requires investment of time and money and employers who value the general wellbeing of their workers. Ergonomics considers efficiency, productivity and speed. Employers should ensure that workers perform their jobs in optimal comfort without experiencing the necessary physical and mental fatigue that slow down work performance, reduce accuracy or cause accident or occupational injuries. Occupational health and safety education should form an integral part of workers training and development in the garment industry.

Recommendations

Based on the finding of the study, the following recommendations were made:

1. Public enlightenment by Health and Home Economics Extension workers on occupational hazards in garment production and need for ergonomic principles.
2. Integration of ergonomic principles in Home Economics school curriculum under First Aid and safety education
3. Packaging of ergonomic principles into training manual for garment workers by Government through their trade union
4. Home Economics Teachers should educate their students on ergonomics in the course of their training during practical lesson.

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