# Knowledge, Perception, And Utilization of Proper Ergonomic Dimensions in The Design Process by Office Furniture Makers in Lagos, Nigeria

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## Abstract

**Background:** Office furniture with no consideration for ergonomic dimensions and designs are potential causes of musculoskeletal discomfort and postural abnormality. Literature is sparse on the knowledge of office furniture makers in Nigeria, their perception and utilization of ergonomic dimensions and designs in the production of office furniture. This study investigated the knowledge, perception, and utilization of proper ergonomic dimensions and designs by office furniture makers in Lagos Nigeria. **Materials and Methods:** This is a cross-sectional survey involving 270 furniture makers. Participants were evaluated using a 19-item questionnaire which sought information on socio-demographic parameters, knowledge, perception, and utilization of ergonomic dimensions and designs in the production of office furniture. Data was analyzed using Statistical Package for Social Sciences version 22. Descriptive statistics of frequencies, percentages, pie charts, and bar charts were used to summarize the data while inferential statistics of Chi-square was used for association among the variables. **Results:** Majority of the respondents (88.1%) have heard about ergonomics. The source of knowledge of 40% of the respondents was at the work station, while 14.1% respondents' source of knowledge was internet-based. Majority (87.0%) of the respondents perceived that ergonomics is important in furniture design. More than one third of the respondents (41.9%) have poor utilization of ergonomic dimensions and designs in the production of office furniture. **Conclusion:** Furniture makers in Lagos Nigeria do not have in-depth knowledge of ergonomics. Majority of the furniture makers have positive perception of the use of ergonomic dimensions and designs. Poor utilization of ergonomic dimensions and designs was observed among some furniture makers.

**Keywords:** Ergonomics, Knowledge, Perception, Utilization, Office-furniture.

## Introduction

Modern office environment requires the use of office furniture, especially tables and chairs for a minimum of six to eight office hours (1). Dimensions and designs of office furniture are significant to the physical and mental well-being of a worker (2). Quite commonly, business and office activities of sitting, standing, and walking in a modern work environment are built around chairs and tables workstations (3). Maintaining a sitting posture can become hazardous in any setting depending on the type of chair, duration of seating, and the postural behavior adopted while seating (4,5,6).

Broadly, office furniture designs with no consideration for correct ergonomic dimensions and designs causes musculoskeletal discomfort and postural abnormality (2,4). Back and neck pain are some of the most frequent maladies affecting people working with unergonomic furniture (7,8). Also, neck and eye strains with concomitant headaches are sequela from

poor ergonomics. Forward bending has been found to reduce the lung volume capacity in sitting positions (8). Fluid circulation can be impaired by awkward sitting causing swollen legs (9). Furniture that does not allow movement while working can contribute to problems with attention and health (3). Also, the economic implication of wrong sitting postures is enormous as it results in losses of office hours and cost expenses from poor health (3).

Standards for office ergonomics, the design of workspaces, and the environment have been observed to help employers and employees maintain productivity and safe working conditions (10,11). Office ergonomic standards have also been observed to provide guidance to designers of office space, workstation, and office equipment (10). Hence, facility managers and safety officers are concerned with these standards as back, neck, spinal injuries, and repetitive stress injuries impact on individual productivity and work life (12).

In Nigeria, the design and development of office furniture appears to have been made without due considerations to ergonomic principles (8,13). This apparent oversight makes it unergonomic for efficient, convenient, and comfortable use of office furniture. Also, while majority of studies on furniture ergonomics in Nigeria are focused on the end users, little or no data is available on the role of furniture makers in their consideration of ergonomics in making furniture (11,14). Thus, there is scarcity of information on the knowledge, perception, and utilization of proper ergonomic dimensions and designs by furniture makers in the production of office furniture in Nigeria (8). Hence, this study investigated the knowledge, perception, and utilization of proper ergonomic dimensions and designs by furniture makers in Nigeria.

## Materials and Methods

This is a cross sectional survey of two hundred and seventy (270) furniture makers conveniently recruited from various furniture producing companies in Lagos state Nigeria. Inclusion criteria were furniture makers who take part in the manufacturing of office furniture with a minimum of one-year experience and are practicing in an organized setting. Furniture makers who do not practice in organized setting were excluded from the study. Ethical approval was sought from the Health Research and Ethics Committee of Lagos University Teaching Hospital (LUTH), Idi-Araba, Lagos, Nigeria with reference number ADM/ DCST/ HREC/ HREC/ 2178. All procedures were explained to the subjects verbally and an informed consent was obtained.

The instrument used in this study was a modified Knowledge, Attitude and Practice questionnaire adapted from the Ergonomic Standards for Furniture Design given by Human Factors and Ergonomic Society (ANSI/HFES100 2007), Business and Institutional Furniture Manufacturers Association (BIFMA-G1 2013) (15) and International Organization for Standardization (ISO 9241-5 1998) - Workstation layout and postural requirements and was reviewed by a focus group.

The questionnaire was reviewed by a five-man focus group comprising physiotherapy lecturers and clinicians who are well knowledgeable in questionnaire design. The questionnaire consisted of 19 open and closed-ended questions in 3 sections A, B and C and captured socio-demographic data, the respondent's knowledge of ergonomics, perception of ergonomic dimensions and designs in furniture making and also information relating to the respondent's utilization of ergonomics dimensions in the design of office furniture.

Prior to the distribution of the questionnaire, the title and purpose of the study were clearly explained to the respondents, and they were assured of the confidentiality of their response. Written informed consents were obtained from all respondents after explanation of the purpose of the study through an information sheet on the cover page of the questionnaire. Two hundred and ninety questionnaires were distributed

among the respondents. The questionnaire was distributed to the respondents at their work place. Each respondent was asked to respond correctly to the questionnaire and the researcher retrieved the questionnaires after they had been completed by the respondents at their current time.

Data was analyzed using Statistical Package for Social Sciences version 22. Descriptive statistics of frequencies, percentages, bar chart, and pie chart were used to summarize the data.

**Results**

Out of the 290 distributed questionnaires, 270 copies were duly completed and returned yielding a response rate of 93.1%. The socio-demographic characteristics of the respondents are presented in Table 1.

**Table 1: Socio-demographic Parameters of Respondents**

| Variables | Frequency | Percentage (%) |
|---|---|---|
| **Age** | | |
| 18-22 years | 26 | 9.7 |
| 23-27 years | 29 | 10.7 |
| 28-32 years | 74 | 27.4 |
| 33-37 years | 60 | 22.2 |
| 38-42 years | 51 | 18.9 |
| 43-47 years | 17 | 6.3 |
| 48-52 years | 12 | 4.4 |
| >52 years | 1 | 0.4 |
| **Sex** | | |
| Male | 223 | 82.6 |
| Female | 47 | 17.4 |
| **Educational qualification** | | |
| No formal education | 1 | 0.4 |
| Primary education | 8 | 3.0 |
| Secondary education | 62 | 23.0 |
| Technical education | 42 | 15.6 |
| OND | 74 | 27.4 |
| HND | 26 | 9.6 |
| Bachelor degree | 48 | 17.8 |
| Postgraduate education | 9 | 3.3 |
| **Duration as furniture maker** | | |
| 1-10 years | 214 | 79.3 |
| 11-20 years | 48 | 17.8 |
| 21-30 years | 6 | 2.2 |
| >30 years | 2 | 0.7 |
| **Furniture specialty** | | |
| Office furniture only | 120 | 44.5 |
| Office/kitchen furniture | 10 | 3.7 |
| Office/living room furniture | 45 | 16.7 |
| Office/school furniture | 13 | 4.8 |
| Office/living/kitchen furniture | 6 | 2.2 |
| All of the above | 76 | 28.1 |

The knowledge of ergonomic dimensions and designs in the production office furniture is summarized in Table 2. Figure 1 revealed the respondents' level of knowledge to determine if the furniture makers have knowledge of ergonomic dimensions and designs in the production of office furniture. Table 3 shows the perception of furniture makers on ergonomic dimensions and designs in the production of office furniture.

**Table 2: Knowledge of Ergonomic Dimensions and Designs**

| Variables | Frequency | Percentage (%) |
|---|---|---|
| **Have you ever heard about the word ergonomics?** | | |
| Yes | 238 | 88.1 |
| No | 32 | 11.9 |
| **If yes, where did you first hear about it?** | | |
| At work | 108 | 40.0 |
| Friend | 10 | 3.7 |
| Colleague | 21 | 7.8 |
| Electronic/print/social media | 31 | 11.5 |
| Training | 29 | 10.7 |
| Online | 38 | 14.1 |
| Others | 1 | 0.4 |
| **Participation in ergonomic training/workshops** | | |
| Yes | 119 | 44.1 |
| No | 151 | 55.9 |
| **Frequency of Participation** | | |
| Once in every 6 months | 31 | 11.5 |
| Once within a year | 36 | 13.3 |
| Once within two years | 52 | 19.3 |
| None | 151 | 55.9 |
| **Best description of ergonomics.** | | |
| A | 23 | 8.5 |
| B | 41 | 15.2 |
| C | 202 | 74.8 |
| D | 1 | 0.4 |
| E | 3 | 1.1 |
| **Knowledge of ergonomic dimensions and designs** | | |
| Yes | 215 | 79.6 |
| No | 55 | 20.4 |

**Key:-**A- Ergonomics is a way of interacting with people

B-Ergonomics has to do with postures and measurements related to work

C-Ergonomics is the science that has to do with humans in relation to their work environment towards a better wellbeing and productivity.

D- Ergonomics is the study of men and women

E-Ergonomics is the study of economic factors and finances

The majority (87.0%) of the respondents were of the opinion that ergonomics is important in furniture design. Also, the majority (88.5%) were of the opinion that office furniture users could present with pain/discomfort due to wrongly designed furniture. About half (47%) of the respondents had experienced scenarios whereby office furniture users complained to them about pain/discomfort due to wrongly designed furniture. While 66 (24.4%) of them believe that pain/discomfort was not as a result of the furniture design, 61 (22.6%) are of the opinion that the pain/discomfort was as a result of the furniture design. Also, about half (16.7%) of the respondents tried to make changes to the furniture About one third of respondents have not experienced scenarios of complaints (31.4%) but confirmed that they would make changes when such scenes arise in the future. In Figure 2, while 87% of the respondents have a positive perception, 13% have a negative perception. The utilization of ergonomic dimensions and designs by furniture makers in the production office furniture is presented in Table 4. Overall, 58.1% of the respondents have a good utilization of ergonomic dimensions and designs, while 41.9% have a poor utilization in the production of office furniture (Figure 3).

**Table 3: Perception of Office Furniture Makers on Ergonomic Dimensions and Design**

| Variables | Frequency | Percentage (%) |
|---|---|---|
| **Importance of ergonomics in furniture design** | | |
| Yes | 259 | 95.9 |
| No | 11 | 4.1 |
| **Possibility of pain/discomfort as a result of wrongly designed furniture** | | |
| Yes | 239 | 88.5 |
| No | 31 | 11.5 |
| **Complaint of pain/discomfort due to the furniture designed by you/your company** | | |
| Yes | 127 | 47 |
| No | 143 | 53 |
| **Reaction/response to pain/discomfort due to the furniture designed by you/your company** | | |
| Pain/discomfort was not as a result of the use of the furniture you designed/made | 66 | 24.4 |
| Pain/discomfort was a result of the furniture you designed/made | 61 | 22.6 |
| Not applicable | 143 | 53 |
| **Choice made in the case of wrongly designed furniture** | | |
| I tried to make changes to the furniture design | 45 | 16.7 |
| I did not make changes to the furniture design | 16 | 5.9 |
| Not applicable | 209 | 77.4 |
| **Choice to be made in future cases of wrongly designed furniture** | | |
| I will make changes to the furniture design | 85 | 31.4 |
| I will not make changes to the furniture design | 58 | 21.6 |
| Not applicable | 127 | 47 |

**Table 4: - Respondents Utilization of Ergonomic Dimensions and Designs.**

| FURNITURE SPECIFICATION | Metric (cm) | Imperial (inches) | NEVER | SELDOM | OFTEN | ALWAYS |
|---|---|---|---|---|---|---|
| Seat height | 37.6- 51.2 | 14.80– 20.16. | 67 (24.8%) | 47(17.4%) | 83 (30.7%) | 73(27.0%) |
| Seat depth | Fixed: Max. 41.5 Adjustable: should include a depth of 41.5 or less | Fixed: Max 16.4 Adjustable: should include a depth of 16.4 in or less | 81 (30.0%) | 71(26.3%) | 58 (21.5%) | 60(22.2%) |
| Seat width | Min. 48.9 | Min. 19.25 | 94 (34.8%) | 38(14.1%) | 80 (29.6%) | 58(21.5%) |
| Seat pan angle | 0º-4º rearward | | 105(38.9%) | 77(28.5%) | 25 (9.3%) | 63(23.3%) |
| Back rest height | Min. 35.4 from compressed seat height | Min. 13.94 from compressed seat height | 68 (25.2%) | 96(35.6%) | 46 (17.0%) | 60(22.2%) |
| Back rest width | Min 36.0 | Min 14.17 | 94 (34.8%) | 44(16.3%) | 69 (25.6%) | 63(23.3%) |
| Lumbar support | 15.0 – 25.0 from compressed seat height | 5.9 – 9.84 from compressed seat height | 66 (24.4%) | 35(13.0%) | 86 (31.9%) | 83(30.7%) |
| Torso-thigh angle | Fixed: Min. 90(vertical) Adjustable: range of >15º | Fixed: Min 90(vertical) Adjustable: range of $>15^0$ | 106 (39.3%) | 49(18.1%) | 48 (17.8%) | 67(24.8%) |
| Arm rest | 37.6– 51.2 | 14.80 – 20.16 | 55 (20.4%) | 49 (18.1%) | 48 (17.8%) | 67(24.8%) |
| Inter-arm rest distance | Fixed: 49.3 Adjustable: Min. 49.3 | Fixed: 19.41 Adjustable: Min. 19.41 | 51 (18.9%) | 27(10.0%) | 85 (31.5%) | 107 (39.6%) |
| Table length | 152.00 | 59.84 | 52 (19.3%) | 29(10.7%) | 128 (47.4%) | 61(22.6%) |
| Table height | 74.00 | 29.13 | 49(18.1%) | 27(10.0%) | 129(47.8%) | 65(24.1%) |
| Table width | 62.00 | 24.41 | 45 (16.7%) | 43(15.9%) | 118 (43.7%) | 64(23.7%) |
| Table clearance | 14.2-18.9 | 36-48 | 50 (18.5%) | 39(14.4%) | 116 (43.0%) | 65(24.1%) |

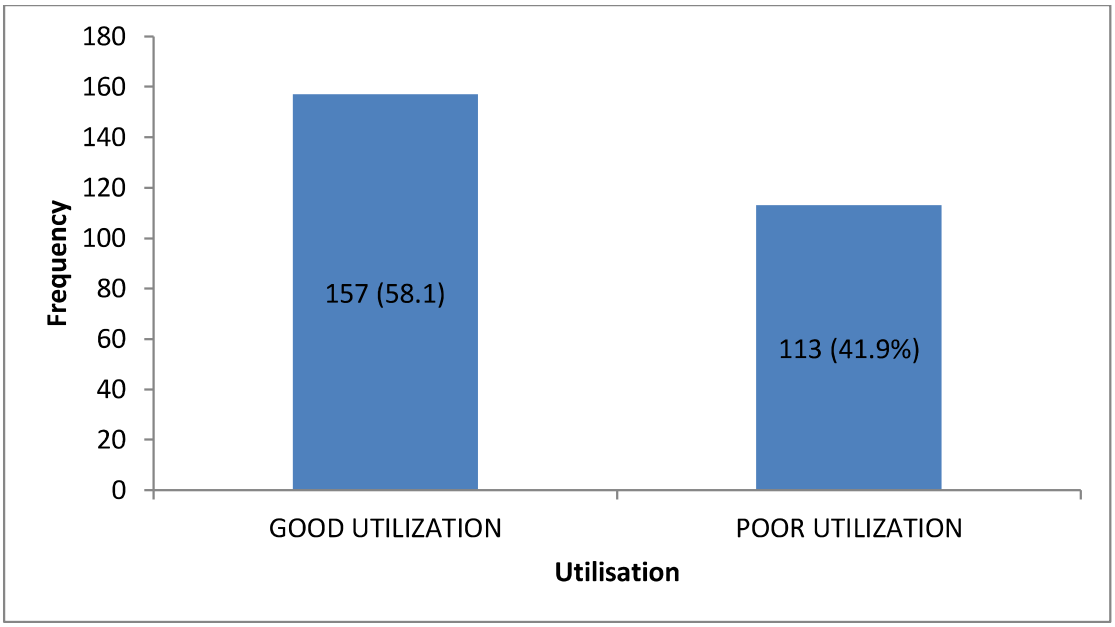


**Figure 3: Respondents Utilization of Ergonomic Dimensions and Designs.**

**Table 5: Associations between each of Respondents Knowledge and Years of experience, Perception and Utilization of Ergonomic Dimension and Designs, and Respondents Knowledge and Education**

| Variables | | | Total | $X^2$ | df | p-value |
|---|---|---|---|---|---|---|
| **Experience** | **Knowledge** | | | | | |
| | **Good** | **Poor** | | | | |
| 1-10 years | 144 | 70 | 214 | 49.062 | 4 | 0.006 |
| 11-20 years | 27 | 21 | 48 | | | |
| 21-30 years | 2 | 4 | 6 | | | |
| >30 years | 1 | 1 | 2 | | | |
| Total | 174 | 96 | 270 | | | |
| **Perception** | **Utilization** | | | | | |
| | **Good** | **Poor** | | | | |
| Positive | 28 | 7 | 35 | 7.890 | 1 | 0.005 |
| Negative | 129 | 106 | 235 | | | |
| Total | 157 | 113 | 270 | | | |
| **Knowledge** | **Education** | | | | | |
| | 1 2 3 4 | 5 6 7 8 | | | | |
| Good | 1 3 26 28 | 47 23 37 9 | 174 | 31.771 | 7 | 0.000 |
| Poor | 0 5 36 14 | 27 3 11 0 | 96 | | | |
| Total | 1 8 62 42 | 74 26 48 9 | 270 | | | |

Key:1= No formal education; 2= Primary education; 3= Secondary education; 4= Technical school; 5= OND; 6= HND; 7= Bachelor degree; 8= Postgraduate

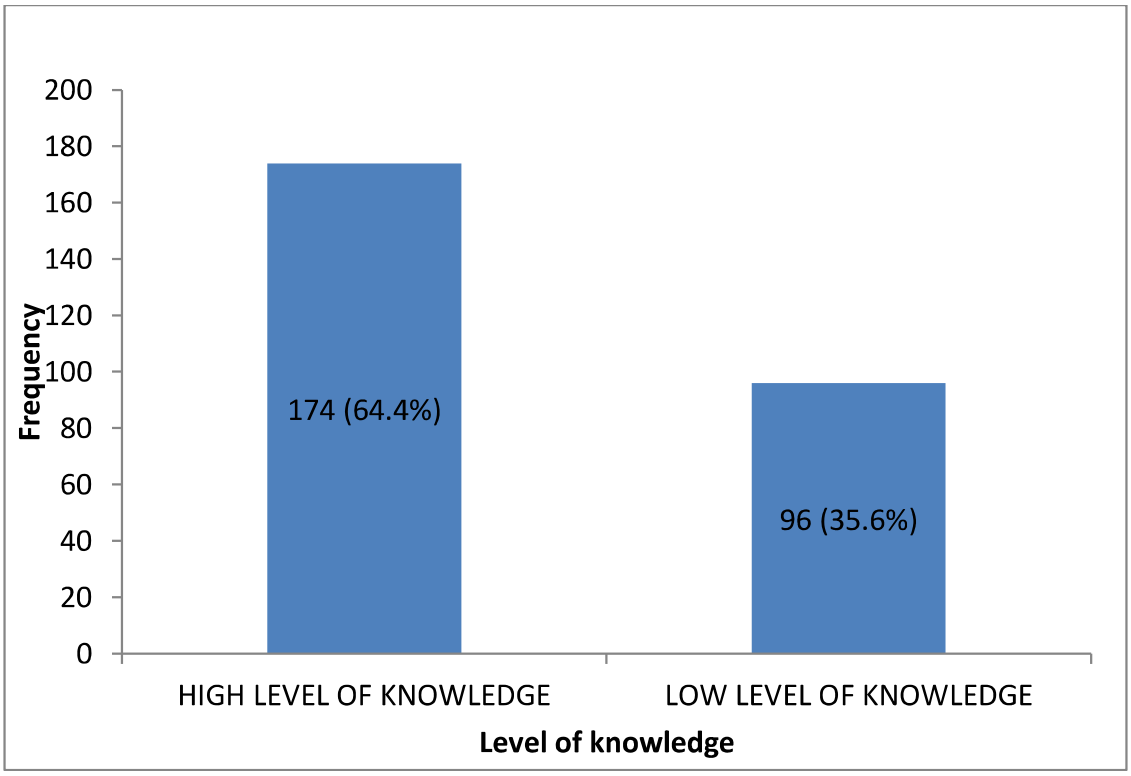


**Figure 1: Level of knowledge exhibited by respondents**

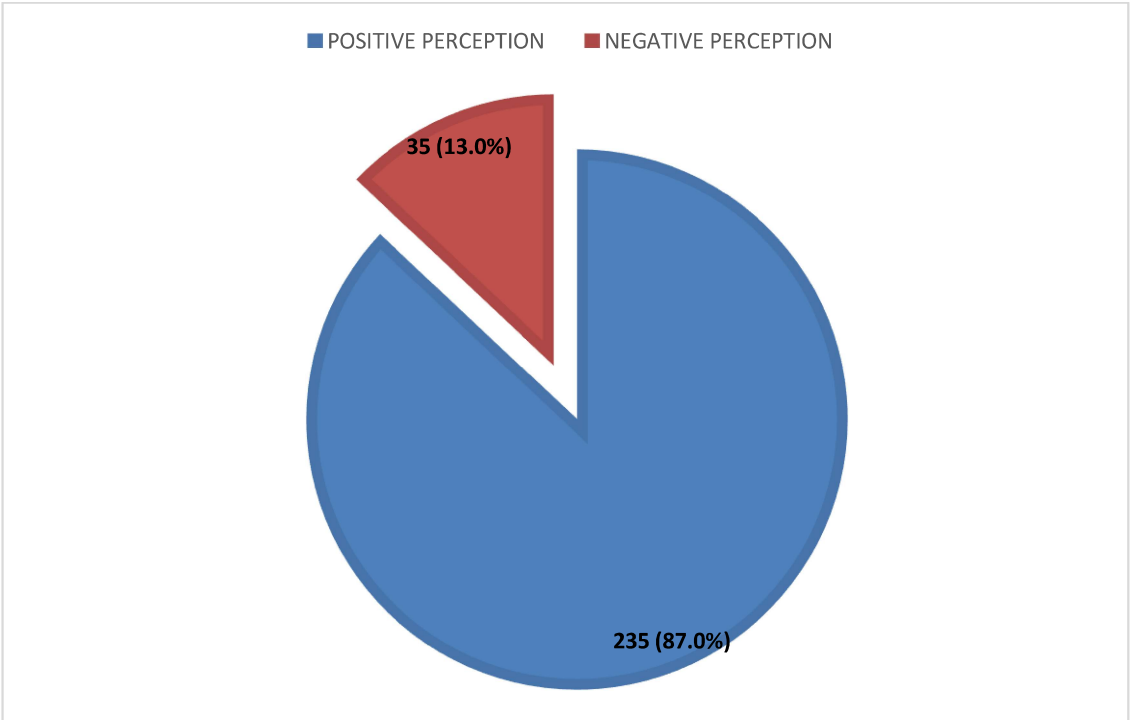


**Figure 2: Respondents' Perception on Ergonomics**

Chi-square analysis shows a statistically significant difference between the respondents' knowledge and years of experience. Also, a statistically significant difference was found between respondents' perception and utilization (Table 5). There

was also a statistically significant difference between respondents' knowledge and their educational attainment (Table 5). However, no statistically significant difference was found between respondents' perception and educational attainment. Also, no statistically significant difference was found between respondents' utilization and educational attainment.

**Discussion**

This study investigated the knowledge, perception, and utilization of proper ergonomic dimensions and designs by furniture makers in Lagos state, in the production of office chairs and tables. This study observed that more than half of the furniture makers had technical Colleges, Ordinary National Diploma, or Higher National Diploma as their highest educational attainment. This suggests that a higher concentration of the furniture makers had hands-on experience while schooling. This finding of hands-on experience while schooling is consistent with the report of International Labour Organization (2018) (16) that integrating core work skills into the curricula of schools will enhance the employability of graduates.

The result shows that most of the respondents have between 1-10 years of experience and more than two third of them have good knowledge of ergonomic dimensions and designs. Our finding also suggests that those with fewer years of experience seem to be abreast of the current trends in office furniture designs compared to those who have more years of experience; as only one third of the respondents with 21-30 years of experience have good knowledge of ergonomic dimensions and designs. This evidence is supported by the study of Springer (2010) which revealed a wide array of modern office furniture reflecting the current understanding of the new experts and designers in the furniture industry (17).

This study shows that most of the respondents have heard about ergonomics with opinion of high level of knowledge of ergonomics. However, they do not have in-depth knowledge of ergonomics as less than a third of them have training in ergonomics and only about one third of them heard about ergonomics at work. The source of knowledge for others were either from friends or internet sources. Furthermore, among the respondents who attended ergonomic trainings and workshops, majority did only once in two years while others attend trainings once in 6months or once in a year. Thus, the respondents in this study may lack in-depth knowledge of ergonomics because majority of them have no training in ergonomics despite the superficial knowledge they have displayed in ergonomics. The respondents differed in their knowledge of the definition of ergonomics. More than one third of the respondents chose an incomplete definition of ergonomic which describes it as having to do with posture and measurements related to work only. Overall, the assumption that respondents may lack in-depth knowledge of ergonomics is consistent with the results of a survey carried out by Shah, Silverstein, and Snow (2001) who reported that participants who attended a workshop on ergonomics implementation increased their knowledge of the ergonomic rules with more significant increase with those who had no previous knowledge of ergonomics (18). Reports from the same authors' study (18) also confirms that frequent participation in training and workshops would increase the chances of having great knowledge of ergonomics or hearing about the word "ergonomics".

Our study found that almost all the respondents agreed that ergonomics is important in the dimensions and designs of office furniture. Most of the respondents are of the opinion that it is possible for furniture users to present with pain/discomfort as a result of wrongly designed furniture. This finding is consistent with previous studies that musculoskeletal pain and discomfort are consequences of poorly designed furniture (13, 19). Our study found that more than one third of the respondents admitted that a furniture user has complained to them about pain/discomfort due to the furniture they

designed; whereas more than one third of the respondents opined to have made changes to the wrongly designed furniture. The reasons adduced by previous studies for the association of poorly designed furniture with musculoskeletal pain are the differences in individual characteristics of anthropometric parameters such as trunk length and pelvic width which are determinants of furniture factors of seat height and seat width respectively. Thus, the advocacy for furniture usage should be adapting the furniture for the individual user.

Almost all the respondents have positive perception of the use of ergonomic dimensions and designs in the production of office furniture. This is very impressive as it shows that the furniture makers acknowledge that ergonomics is important in the design of office furniture. This result is consistent with literature report (20) which stated that new age international furniture companies with branches in different countries including Nigeria are embracing ergonomics due to the increasing awareness for the need of a healthy lifestyle amongst office workers.

Again, while more than half of the respondents have good utilization of ergonomic dimensions and designs in the production of office furniture, more than one third of the respondents have poor utilization of ergonomic dimensions and designs in the production of office furniture. The poor utilization of ergonomic dimensions and designs asserted by more than one third of the respondents is in line with an earlier study (13) report, which documented an apparent oversight in the use of ergonomic dimensions and designs by furniture makers in the production of office furniture in Nigeria. However, the affiliation of established foreign furniture companies in Nigeria is reported to account in the improvement of ergonomic dimensions and designs among furniture makers in Nigeria (21). Hence, the use of ergonomic dimensions and designs in furniture making is dependent on the technical know-how of the furniture makers.

This study further shows a statistically significant difference between respondents' knowledge and years of experience. Similarly, a statistically significant difference was found between respondents' knowledge and educational attainment. This finding is unique because professional experience is reported to reflect higher sense of professionalism than education and knowledge (22). Thus, buttressing the fact that despite the educational background of the respondents in this study, majority of the respondents have less than ten years' experience in furniture making which may underscore their lack of in-depth knowledge of ergonomic dimensions and designs in furniture production. Also, this study found a significant difference between respondents' perception and utilization of ergonomic dimensions and designs. This finding is contrary to the reports of previous studies that perceptions of services are positively associated with the utilization of the service (23,24). While majority of the respondents in this study have both positive perception and utilization of ergonomic dimensions and designs, more than one third of the respondents have poor utilization of ergonomic dimensions and designs. Hence, there still exists relative differences between the respondent's perception and their utilization of ergonomic dimensions and designs.

**Conclusion**

Furniture makers in this study do not have in-depth knowledge of ergonomics as less than a third of them have training in ergonomics. Only about one third of them heard about ergonomics at work, while the source of knowledge for others were either from friends or internet sources. However, almost all of the respondents in this study have positive perception of the use of ergonomic dimensions and designs in the production of office chairs and tables. Also, more than one third of the respondents have poor utilization of ergonomic dimensions and designs in the production of office furniture.

The use of ergonomic dimensions and designs in the production of office furniture should be enforced by the Manufacturers

Association of Nigeria and the Standards Organization of Nigeria. Trainings and workshops should be organized for staff of furniture companies in Nigeria as a pre-requisite guideline in furniture making.

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