EFFECT OF WORK SURFACES ON POSTURAL CONDITIONS AND LEVEL OF INTENSITY OF PAINS EXPERIENCED BY HOMEMAKERS RESIDING IN SELECTED COLLEGES OF EDUCATION, NORTH CENTRAL GEO-POLITICAL ZONE, NIGERIA

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Abstract

Work surfaces that are essential in the performance of household tasks determine the satisfaction and comfort derived by homemakers in their residential dwellings. This study examines the effect of work surfaces on postural conditions and the level of intensity of pains experienced by homemakers residing in selected Colleges of Education, North Central Geo-Political Zone. A factorial research design was employed for the study. Purposive sampling was used to select sixty-one (61) homemakers in six randomly selected Colleges of Education. A 50-cm Flexi curve, specially structured recording sheet, and a self-designed scorecard were used as an instrument for data collection. One-way Analysis of Variance (ANOVA) was used to test the two null hypotheses at 0.05 level of significance. The results showed that work surfaces used during the performance of household tasks had a significant effect on postural conditions and the level of intensity of pains experienced by homemakers. The study concluded that the performance of household tasks on poorly designed work surfaces in terms of counter height induces improper postures, leading to changes in postural conditions and pains experienced by homemakers residing in selected Colleges of Education, North Central Geo-Political Zone. The researchers recommended among others that an Enlightenment campaign should be organized for homemakers on the requirements for designing work surfaces as well as the benefits of performing household tasks on work surfaces appropriate to their heights.

Keywords: Work surfaces, Posture, Postural conditions and Pain

Introduction

A work surface is the surface one works on in kitchens, bathrooms, laundries, shops, offices, and other interior spaces; it is also a horizontal surface for supporting objects used in working. The floor, an ironing board, table, stool, sink, bed, tops of appliances (gas/electric cooker, washing machines, dishwasher), or a countertop may function as a work surface (Roklahr, 2011). A work surface has three basic dimensions, weight, width, and depth. The height of a work surface is an important aspect of a good work surface and should be based upon information on the body size (Mathew, 2005). Macleod, (2010) suggested that The elbow height which is the vertical distance from the floor to the lowest bony point of the elbow; is an important landmark for determining the desirable height of work surfaces for household tasks. For work that involves standing, the height of work surfaces should be planned 3 inches below the height of the elbow or slightly more depending on the activity while the height of work surfaces for work that involves sitting should be approximately at the same level as the elbows. According to Adams (2013), 3ft (36 inches) is the optimal and most ergonomic height for a kitchen countertop; it is the best overall compromise for the majority of tasks done in the kitchen and also provides a comfortable work surface for most people. The width of a work surface on the other hand refers to side–to–side measurement of the work surface. The arm reaches namely normal reach area and maximum reach area is an important consideration in the width of work surface design (Montana Labour, Safety and Health Report, 2010). The normal reach area is the portion of a work surface that can be reached by the hand without moving the arm from the side of the body. It also represents the distance reached without extension of the upper arm. The maximum reach area is the portion of a work surface that can be reached by stretching the arms reached to full length without disturbing the position of the body. While the depth of a work surface is the front-to-back measurement, which is determined by three factors: the distance that can be reached comfortably, the activity, and the items that must be used and stored temporarily during use (Heiner, 2009).

Postural condition is the state in which the body is held upright against gravity while standing, sitting, or lying down (Grieve and Pheasant, 2005). If work surfaces are not designed according to the human space needs and requirements, they produce degenerative changes in the human body leading to changes in postural conditions (Krishna and Sharma, 2005). This view is also supported by Kristwaria, McArthur, and Rana (2007) who reported that poorly designed work surfaces induce improper postures; posture is the position of the limbs or carriage of the body as a whole. It is the way the muscles and skeleton hold the body erect (Blankenship, 2010) Posture can either be good or bad/ correct or poor. A good/ correct posture is usually considered to be the natural and comfortable bearing of the body in normal healthy persons. Thus in a standing position, the body is naturally, but not rigidly straight with the alignment of the ear, shoulder, hip, knee, and ankle as seen from the sides and in a sitting position the back is comfortably straight and should maintain the three natural spinal curves (Columbia University Medical Center Report, 2013). Poor/ bad posture on the other hand is the posture that results from certain muscles tightening up, shortening, or lengthening, and becoming weak as a result of one's daily activities (Clark, 2010; Jeremy, 2013).

Changes in postural condition can cause pain. Homemakers who have to work with the spine flexed forwards (by 60° for more than 5% of the day or 30° for more than 10% of the day) or rotated (more than 30°) suffer back pain (Hoogendoorn, 2006). The posture assumed during the performance of household tasks has a direct relationship with the comfort of the homemakers; Marshall (2013) remarked that the performance of household tasks should bring satisfaction to the homemakers rather than pains. Pain is the significant feelings of unpleasantness, discomfort, and distress in the body and can be measured with a numerical rating scale, which involves asking subjects to rate their pain intensity on a numerical scale that ranges from 0-10 (Powell, Downing, Ddungu and Mwangi- Powell, 2010). Poorly designed work surfaces in terms of counter height, width, and depth induce improper postures, leading to changes in postural conditions of homemakers while working (Kumar and Dayal, 2009). According to Vandana and Namrata, 2008; a deviation in the lumbar and thoracic region is directly related to the household tasks where more exertion and force has to be applied by the homemakers due to undesirable posture assumed in poorly designed work surfaces. The most ignored part of the work surfaces is the laundry work surface height (Bellis, 2009), when heights of laundry work surfaces are inadequate, they can cause problems in lifting; the elbow and arm in a strained position or the homemaker may adjust the whole body downward resulting in poor posture which strains the joints and makes the muscles work harder to support the body.

The effects of poor posture are numerous and may lead to mal-aligned joints and ligaments, lack of performance, and getting tired quickly as well as ache or pain (Kelly, 2012). Research has found associations between housework performed on poorly designed work surfaces and upper-extremity and lower back pain and disorders (Yip *et al.,* 2001 & Josephson2003). Furthermore, Burke (2010) posited that many household tasks performed in the home involve having the head and neck bent forward, increasing the angle of the neck and upper back curves in the forward direction. For every centimeter the head is forwarded from the body's centerline in a lateral measurement, the weight-bearing load on the neck and back muscles increases; when this accumulates over time it can be a constant source of discomfort, headaches, and pains. The performance of household tasks on working surfaces appropriate to homemakers' heights determines the satisfaction and comfort derived. A preliminary study was carried out by the researchers as a result of constant complaints of fatigue and body pains by homemakers in residential dwellings at a College of Education while performing household tasks such as (ironing of cloth dishwashing and meal preparation). Even after taking pain relievers, these pains re-occurred whenever they engaged in these household tasks. The researchers, therefore, assumed that these pains may be caused by the design of work surfaces which the homemakers were unaware of. It is based on this background that this study was designed to examine the effect of work surfaces on the postural conditions and level of intensity of pains experienced by homemakers residing in Colleges of Education, North-central Geopolitical Zone, Nigeria.

Null Hypotheses
Two null hypotheses were formulated for this study as:
1) There is no significant **effect** of work surfaces used during the performance of selected household tasks on the posture of homemakers residing in selected Colleges of Education, North-central Geopolitical Zone, Nigeria.

2) There is no significant effect of work surfaces used during the performance of selected household tasks on the level of intensity of pains experienced by homemakers residing in selected Colleges of Education, North-central Geopolitical Zone. Nigeria.

Methodology

Factorial research design which is used when interaction effects are required in a study was employed for this study. Two hundred and seventeen homemakers (217) residing in Colleges of Education, North Central Geo-Political Zone constituted the population for the study. Out of the eleven Colleges of Education with residential dwellings, a simple random sampling method was used to select the six Colleges of Education with a sample frame of one hundred and twenty-two (122). Purposive sampling was used to select sixty-one (61) homemakers, who were physically fit, free of any physical deformity, and whose body mass was between 18.5 -24.9 (normal weight in BMI categories). This is by the suggestion of Denga (2002) who stated that half the number of sample frames is ideal as the sample size in an experimental research design study. Proportionate sampling was used to determine the number of homemakers that were selected from the six Colleges of Education. A 50-cm Flexi curve, specially structured recording sheet, and a self-designed scorecard were used as an instrument for data collection. The instruments were validated by experts in various fields of study while the reliability was ascertained through a pilot study conducted in Plateau State College of Education, Gindiri, data collected were subjected to a reliability test using Cronbach- alpha coefficient, the result revealed that the specially structured recording sheets had a reliability coefficient of 0.90 while the scorecard had 0.80.

Prior visits were made to the selected Colleges of Education by the researchers to obtain permission and to abreast the homemakers about the research study. Postural conditions of sampled homemakers were measured with 50- cm surveyor's Flexi curve in two different ways; the first measurement was carried out in centimeters before the commencement of the household tasks and the second was taken while performing each of the selected household tasks on the various heights of work surfaces. The Flexi curve measure was based on the following procedure as described by Hinman (2004), first the researcher palpates and marks the spinous process of the seventh cervical vertebra (C-7) and the superior aspect of the sacrum (S-1). The Flexi- curve was then placed over the spinous processes of the cervical, thoracic and lumbar spine and gently presses to fit the curve of the spine. Readings were recorded on the specially structured recording sheets.

The level of intensity of pains experienced by homemakers was ascertained through subjective evaluation with the use of a scorecard which was drafted on a modified pain numerical rating scale of five descriptors as 1= no pain, 2= mild pain, 3= moderate pain, 4= severe pain, 5= very severe pain. A scorecard was given to respondents after the performance of selected tasks on a specific work surface to indicate the level of intensity of pains felt.

Results

The data collected were coded and subjected to statistical analysis; one-way analysis of variance (ANOVA) at 0.05 level of significance was used to determine the significance of the obtained variability on posture and level of intensity of pains experienced by homemakers during the use of different work surfaces for the selected tasks (washing of clothes, ironing of clothes and dishwashing). Table 1 & 2 shows the summary of the analysis of variance models.

Table 1: One Way Analysis of Variance on Effect of Work Surfaces used during the performance of selected Household tasks on Posture of Homemakers

Task	Source	Sum of Squares	df	Mean Square	F	Sig.
	Between Groups	1032.111	3	344.0369	381.568	0.000
Washing of clothes	Within Groups	216.3934	240	0.901639		
	Total	1248.504	243			
	Between Groups	1544.406	3	514.8019	509.995	0.000
Ironing of clothes	Within Groups	242.2623	240	1.009426		
	Total	1786.668	243			
Dishwashing	Between Groups	690.2418	3	230.0806	239.572	0.000

Within Groups	230.4918	240	0.960383
Total	920.7336	243	

$F (3, 240) = 2.65, P < 0.05$

The results in Table1 revealed that the observed F-values obtained for work surfaces used for performing the selected household tasks were 381.568 for washing of clothes, 509.995 for ironing of clothes, and 239.572 for dishwashing. The observed probability levels for the tests were all 0.000 (P < 0.05). The F-critical at the same degree of freedom (df)= 3, 240) is 2.65. This implies that the work surfaces used during the performance of selected household **tasks affected the postural conditions of homemakers; therefore the null hypothesis states that there is no significant effect of work surfaces used during the performance of selected household tasks on the posture of homemakers** was rejected.

Table 2: One Way Analysis of Variance on Effect of Work Surfaces used   during the performance of selected Household tasks on level of intensity of Pains experienced by Homemakers

Task	Source	Sum of Squares	df	Mean Square	F	Sig.
Washing of clothes	Between Groups	268.3074	3	89.43579	395.810	0.000
	Within Groups	54.22951	240	0.225956e		
	Total	322.5369	243			
Ironing	Between Groups	430.4385	3	143.4795	952.194	0.000
	Within Groups	36.16393	240	0.150683		
	Total	466.6025	243			
	Between Groups	173.2582	3	57.75273	258.721	0.000
	Within Groups	53.57377	240	0.223224		
Dishwashing	Total	226.832	243			

$F (3, 240) = 2.65, P < 0.05$

The analysis in table 2, showed the F-values obtained for work surfaces used during washing of clothes, ironing of clothes and dishwashing was 395.810, 952.194, and 258.721 respectively. The probability levels of significance for the three tests were all 0.000 (P < 0.05). The F- critical value at the same degree of freedom (df)= 3, 240) is 2.65 implying that work surfaces used during the performance of selected household tasks have a significant effect on the level of the intensity of pains. Thus, the null hypothesis states that; there is no significant effect of work surfaces used during the performance of selected household tasks on the level of intensity of pains experienced by homemakers residing in selected Colleges of Education, North-central Geopolitical Zone, Nigeria was rejected.

Discussion

This study was specifically designed to investigate the effects of work surfaces on postural conditions and the level of intensity of pains experienced by homemakers residing in Colleges of Education, North-Central Geopolitical Zone, Nigeria. The result of Table 1 revealed that the work surfaces used during the performance of selected household tasks have a significant effect on the postures of homemakers. This is because the heights of work surfaces used by homemakers reflect the postural changes in their physical bearing during work. The findings were in agreement with those of Kristwaria, Mathur, and Rana (2007) stated that poorly designed work surfaces in terms of height induced improper postures, leading to changes in postural conditions. The findings were also a reflection of those of Vandana and Namrata (2008) who stated that a deviation in the lumbar and thoracic region was directly related to the household tasks where more exertion and force had to be applied by the homemakers due to the wrong posture assumed in a poorly designed work surface. The findings on the relationship of heights of work surfaces to posture are supported by the work of Bellis (2009) who extrapolated that the most ignored part of the work surfaces were the heights when heights of work surfaces were inadequate, they could cause the homemaker to adjust the whole body downward resulting in poor posture.

The result of the study in Table 2 revealed that the work surfaces used during the performance of selected household tasks have a significant effect on the level of intensity of pains experienced by homemakers. This is because when work surfaces are located too low, homemakers would have to lean and bend their

back, which causes pain. This observation is supported by the works of Yip *et al*., 2001, and Josephson 2003 all of whom have reported associations between housework performed on poorly designed work surfaces and upper extremity and lower back disorders. Furthermore, Hoogendoorn (2006) had also reported that changes in a postural condition caused pains as homemakers who had to work with the spine flexed forwards (by 60 degrees for more than 5% of the day or 30 degrees for more than 10% of the day) or rotated (more than 30 degrees) suffered back pain.

Conclusion
Based on the findings of this study, it can be inferred that the performance of household tasks on poorly designed work surfaces in terms of counter height induces improper postures, leading to changes in postural conditions and pains experienced by homemakers. The more appropriate the work surfaces used are to the heights of homemakers, the less strain on the posture and level of intensity of pains experienced by homemakers during the performance of household tasks in their residential dwellings.

Recommendations
The following are recommended based on the findings of the study:
1. Enlightenment campaigns should be organized for homemakers on the requirements for designing work surfaces as well as the benefits of performing household tasks on work surfaces appropriate to their heights.
2. Homemakers should ensure that heights of work surfaces used during the performance of household tasks are based upon their body size information such as height to maintain a good comfortable posture for healthy living.
3. Homemakers should be more involved in the design of kitchen work surfaces and avoid the use of one size fits all types of work surfaces

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