

Full Length Research Paper

Influence of Sleep Surface on Prevalence of Musculoskeletal Pain among Undergraduate Students in Lagos, Nigeria

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Certain sleep surfaces may trigger complaints of musculoskeletal pain and discomfort among otherwise healthy individuals. Thus, studies investigating the association between sleep surfaces and the prevalence of musculoskeletal pain and discomfort are imperative. This study investigated the influence of sleep surfaces on musculoskeletal pain among undergraduate students in Lagos, Nigeria. Five hundred undergraduate students of the College of Medicine University of Lagos from 300 to 600 level participated in this cross-sectional survey. They completed a 47-item modified Standardized Nordic Questionnaire for the analysis of musculoskeletal symptoms. Information sought included respondent's demographics, mattress characteristics, sleeping pattern, prevalence of musculoskeletal pain, location, predisposing factors, treatment approaches adopted and knowledge of ergonomics. Data was summarized using descriptive statistics of frequency, mean, standard deviation, percentages, and inferential statistics of chi-square to test for association among variables. Level of significance was set at $p \leq 0.05$. A 12-month 79.7% prevalence of musculoskeletal pain was observed with females significantly ($p < 0.05$) higher than males (57.9% vs 42.1%). The highest 12-month prevalence of musculoskeletal pain was on the low back (17.6%), while the highest point prevalence was on the neck (54.6%). Mattress type, size and duration of use were not significantly ($p > 0.05$) associated with the prevalence of musculoskeletal pain among undergraduate students. Prevalence of musculoskeletal pain among undergraduate students was high, more in females than males. Mattress type were not significantly associated with the prevalence of musculoskeletal pain among undergraduate students.

Keywords: Sleep surfaces, Musculoskeletal pain, Undergraduate students, Sleep quality, Quality of life.

INTRODUCTION

Sleep surfaces do matter when it comes to sleep quality and common health complaints of musculoskeletal pain and day time function (Wong, *et al.*, 2019). Studies on the effect of mechanical parameters of sleep systems (cushion, mattress, bed base) on posture, manner of load

distribution, comfort and physiological responses of the body such as muscle relaxation have shown that mattresses with high stiffness may produce mechanical pain, poor body load distribution, and poor sleep quality (Ancuelle, *et al.*, 2015; Victoria, *et al.*, 2015;

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Low, et al., 2017; Wong, et al., 2019). Usually, sleep surfaces come in different forms of mattresses such as inner spring mattress, air mattress, foam mattress, hybrid mattress, memory foam mattress (visco), latex mattress, water beds and adjustable beds (Victoria, et al., 2015; Low, et al., 2017; Wong, et al., 2019). Different weights and densities of petrochemical-based flexible polyurethane foams are used when creating these mattresses (Ugarte, et al., 2014; Victoria, et al., 2015). For instance, the latex foam in mattresses is a blend of the latex of the *Hevea brasiliensis* tree and synthetic latex (Ramli, et al., 2018). Also, mattresses come in various sizes such as twin size, full size, king size, futon, california, crib, and thicknesses according to industrial specifications (Christofoletti, et al., 2020). Regrettably, clients demand instead of professional advice give rise to industrial specifications of single/twin mattress ranges (36-39 inches x 75 inches or 99 cm x 191 cm) and the double / full mattress (48-54 inches x 75 inches or 122-137 cm x 191 cm) (Christofoletti, et al., 2020).

Previous studies have reported that the sizes, forms and nature of sleeping surfaces may influence body biomechanics and the occurrence of joint pain (Ancuelle, et al., 2015; Low, et al., 2016; Wong, et al., 2019). Both latex and memory foam mattresses are reported to provide a unique feel that relieves pressure on painful joints (Jacobson, et al., 2010). Also, studies posit that there is a bi-directional relationship between sleep disturbance and pain intensity, an implication that each of pain and disturbed sleep are capable of eliciting one another (Alsaadi, et al., 2014a; Alsaadi, et al., 2014b). Although, the exact mechanism underlining the relationship between sleep and chronic pain is still not very clear (Mathias, et al., 2018; Vinstrup, et al., 2020), several factors have been implicated including atypical levels of brain wave activity, structural changes in the brain, defaults in inflammatory pain markers, among others (Mork, et al., 2014; Mathias, et al., 2018; Babiloni, et al., 2020).

Poor sleep is considered a risk factor for chronic musculoskeletal pain (Vinstrup, et al., 2020). Also, the risk for developing musculoskeletal pain from poor sleep is well established among adults than adolescents (Andreucci, et al., 2020a), however, emerging evidence suggests an association between sleep problems and musculoskeletal pain in adolescents (Andreucci, et al., 2020a; Andreucci, et al., 2020b). While about one-third of an average individual's life is spent sleeping, a prevalence of 4% to 40% musculoskeletal pain accounts for the period of adolescents in a life time (Aminoff, et al., 2011; Harrison, et al., 2014). Hence, the increasing research on measures to reduce musculoskeletal pain derived from sleep disturbance (Mork, et al., 2014; Low, et al., 2017; Babiloni, et al., 2020). Despite the array of research on factors of sleep disturbance and the development of musculoskeletal pain, there appear to be neglect on the impact of sleep surface on the occurrence

of musculoskeletal pain. Low, et al., (2017) affirmed that the nature of sleeping surface can affect sleep quality, whereas sleep surfaces were neglected in a study implementing a sleep education programme among undergraduates (Raley, et al., 2016). Hence, studies examining the impact of sleep surfaces on complaints of musculoskeletal pain and sleep quality, especially in adolescents, are imperative. This study investigated the influence of sleep surfaces on musculoskeletal pain among undergraduate students in Lagos, Nigeria.

MATERIALS AND METHODS

This study was a cross-sectional survey. A total of 500 undergraduate students across 9 departments of the College of Medicine, University of Lagos, were recruited through a sample of convenience. Inclusion criteria were 300-600 level students aged 17-30 years residing in the medical students' hostel who had slept on the same mattress for at least one academic year. Also, participants with moderate level of participation in sports of not more than 90 minutes daily and not more than 3 days a week were included. Exclusion criteria were participants with no previous history of trauma to the spine and extremities for at least 3 months prior to the time of data collection, no obvious postural or structural spinal deformities, and no cognitive impairments that might have an effect on sleep scoring and /or interpretation of the items in the questionnaire.

Study instruments included: a questionnaire modified from the Standardized Nordic Questionnaires for the analysis of musculoskeletal symptoms (Kuorinka, et al., 1987); portable bathroom weighing scale calibrated in kilograms from 0-220kg was used to measure the participants' body weights; portable height meter mounted on a wooden pole for portability and calibrated in centimeters from 0-300cm was used to measure heights of participants to the nearest 0.01metres, and a tape measure calibrated in centimeters from 0-250cm was used to measure the dimensions of the participants' mattresses to ensure that they were within the accepted range for this study. Mattress length and width were measured and documented, while the nature of the mattress was assessed by the researcher for hardness, soft or bare ground.

The questionnaire consisted of 47 questions divided into 5 sections which covered demographic data, information on mattress use and sleeping pattern, prevalence, location, severity, limitations and management of musculoskeletal pain, predisposing factors to musculoskeletal pain, and information on postural awareness and ergonomics. Prior to the distribution of the questionnaire, a focus group was set up comprising six physiotherapy educators in the College of Medicine, University of Lagos and a clinician in the Lagos University Teaching Hospital. Their input was incorporated to produce a final version as all the panels/specialists adjudged the questionnaires as having face and content validities to measure the expected outcome. Cronbach alpha coefficient (α) of the questionnaire was calculated using the formula stipulated by Cronbach (1951) for ascertaining the internal consistency of a scale: $\alpha = k (1 - \sum S_i^2 / S_T^2) \div k - 1$, where k =number of items of the questionnaire, S_i^2 =the total variance of the individual scores of the questionnaire, S_T^2 =the variance of the total score formed by summing all the items. From the questionnaire, $k=47$, $S_i^2=3.86$, $S_T^2=14.90$. Hence, $\alpha = 47(1 - 3.86/14.90) \div 47 - 1 = 47(1 - 0.2590) \div 46 = 0.76$. Thus, a score of 0.76 was derived for the Cronbach alpha coefficient (α) of the questionnaire.

Ethical approval was sought and obtained from the Health Research and Ethics Committee of the Lagos University Teaching Hospital, Idi-Araba (Appendix). The purpose of the study was explained to the respondents and their consent obtained prior to

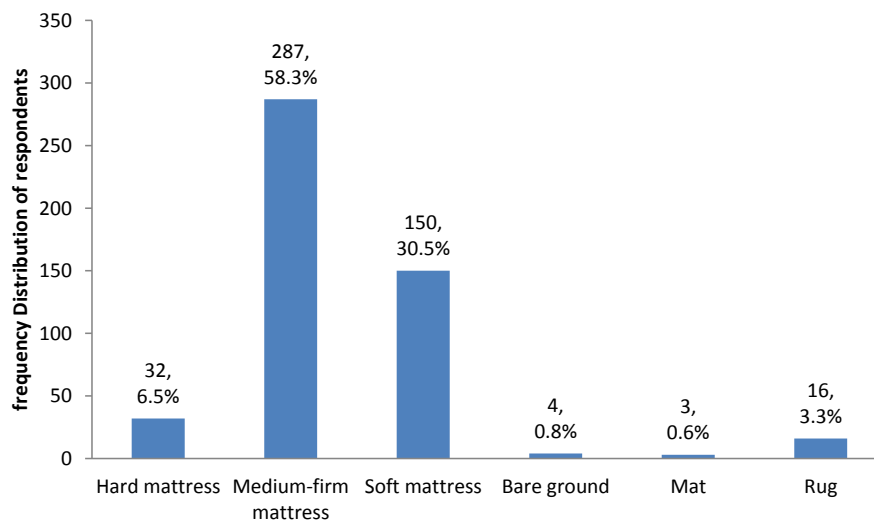
Table 1. Socio-demographic Characteristics of the Respondents

Variables	Mean \pm SD	Frequency (n)	Minimum	Maximum
Age	21.22 \pm 2.16	492	17	30
Height	1.69 \pm 0.10	492	1.49	1.94
Weight	63.21 \pm 10.33	492	44	108

SD= Standard Deviation

Table 2. Frequency Distribution of Levels of the Respondents

Study Level	Frequency (n)	Percentage (%)
300	228	46.3
400	118	24.0
500	117	23.8
600	29	5.9

**Figure 1.** Types of sleep surface

administering the questionnaire. The questionnaire was self-administered, distributed to the participants after lecture hours in the evening and was returned the same day while they were assured of confidentiality of their responses. Each participant's weight and height were measured and recorded. Participants' mattresses were also measured to ensure that they were within the normal range in focus. Data collected were analyzed using the Statistical Package for Social Sciences (SPSS) version 17 for Windows (SPSS Inc., Chicago, IL) and Microsoft Excel 2007 version. Frequency, mean, Standard Deviation, percentages and range were compiled for each of the variables. Chi-square was used to compare variables. Level of significance was set at $p < 0.05$.

RESULTS

A total of 500 undergraduate students across 9

departments of the College of Medicine, University of Lagos, who were recruited through a sample of convenience participated in this cross-sectional survey. Out of the 500 copies of the questionnaire distributed, 492 were returned yielding a response rate of 98.4%. The mean values of the respondents' age, height and body weight were 21.22 \pm 2.16years, 1.6 \pm 0.10m and 63.21 \pm 10.33kg respectively with a gender distribution of males (224, 45.5%) and females (268, 54.5%) (Table 1). Table 2 shows the frequency of the respondents from 300 to 600 levels.

The type of sleep surface is shown in Figure 1. Majority of the respondents (91.5%) slept on single mattresses while the rest (8.5%) slept on double mattresses. During the day, 120 (24.4%) of the participants slept for less than 1 hour, 296 (60.2%) slept

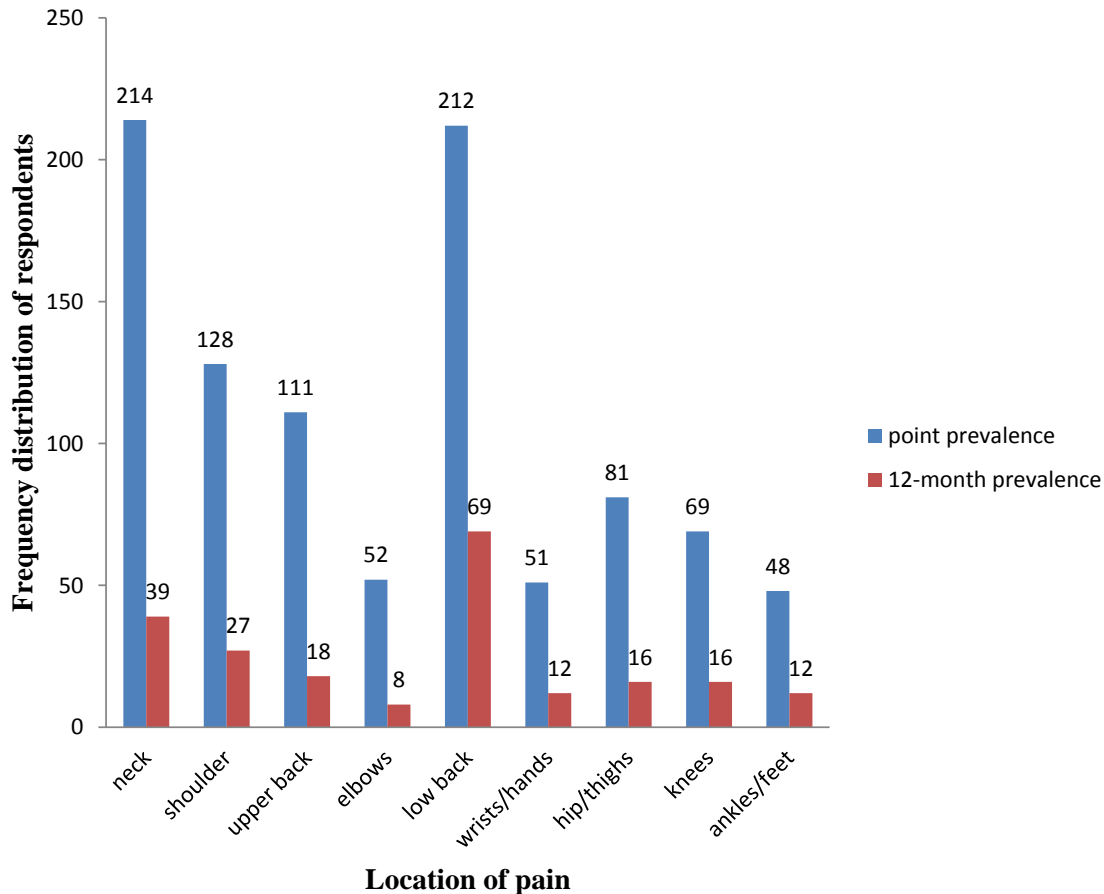


Figure 2. Location of Musculoskeletal Pain

for 1-2 hours, while 76 (15.4%) slept for more than 3 hours. At night, 19 (3.9%) of the participants slept for less than 3 hours, 189 (38.4%) slept for 3-5 hours, 262 (53.3%) slept for 5-7 hours, while 22 (4.5%) slept for over 8 hours.

Sleep postures of respondents are shown in **Figure 2** with a third (181, 36.8%) assuming the side-lying sleeping posture. Whereas 202 (41.1%) were aware of the correct sleeping posture, 152 (30.9%) claimed to have received lectures on postural care and ergonomics. Two hundred and ninety-seven (60.4%) of the respondents opined that they would seek more knowledge on correct mattresses whereas 335 (68.1%) would seek more knowledge on back care. **Figure 3** depicts the location, point prevalence and 12-month prevalence of pain.

The reading profile of the students showed that 75.2% of them read using a chair and table, 14.2% read lying down while the rest either sat on the floor or on a chair without table. In addition, 260 (57.5%) respondents believed the classroom furniture was not comfortable. More than half of the respondents (57.7%) actively participated in sporting activities and 36.6% of this population reported sport-related musculoskeletal pain.

This study found that there was no significant relationship between each of mattress types, sizes and duration of use and 12-month prevalence of musculoskeletal pain (**Table 3**).

DISCUSSION

This study investigated the influence of sleep surfaces on musculoskeletal pain among undergraduate students in Lagos, Nigeria. The response rate of respondents obtained in this study is higher than 77% reported in a previous study on the prevalence of musculoskeletal pain among dental students (Madaan & Chaudari, 2013). This indicates good interest and compliance by the respondents in this study. The 12-month prevalence of musculoskeletal pain among the respondents was quite high though lower than previous reports of 81% prevalence of musculoskeletal pain among undergraduate students (Madaan & Chaudari, 2013; Hasan, *et al.*, 2018). Our findings may not be unexpected in view of the fact that majority of the students complained of discomforts with their classroom furniture. This is in consonant with the submission of a previous

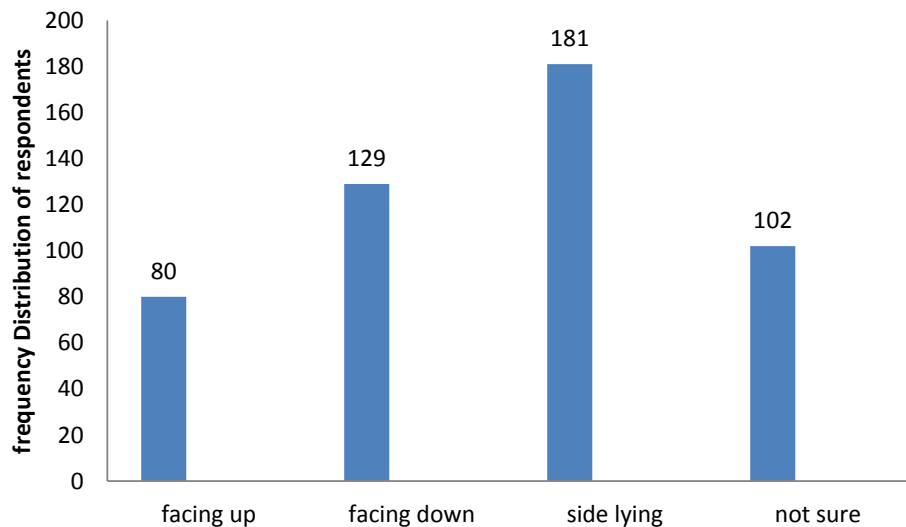


Figure 3. Sleeping Postures of Respondents

Table 3. Chi-square Analysis of Relationship between Types, Sizes and Duration of Mattress Use and Musculoskeletal pain (12- month Prevalence)

Variable	Total X ²		p-value		
	Yes n (%)	No n (%)			
Sleep surfaces					
Hard Mattress	20 (95.2)	1 (4.8)	21 (100)	6.308	0.789
Medium-firm Mattress	205 (90.0)	24 (610.0)	229 (100)		
Soft Mattress	100 (89.3)	12 (10.7)	112 (100)		
Bare Ground	4 (100.0)	0 (0.0)	4 (100)		
Mat	1(50.0)	1 (50.0)	2 (100)		
Rug	15 (93.8)	1 (6.2)	16 (100)		
Size of Mattress					
Single Mattress	172 (90.5)	18 (59.5)	190 (100)	0.234	0.972
Double Mattress	32 (91.4)	3 (8.6)	35 (100)		
Duration of Mattress Use					
< 3 Months	64 (91.4)	6 (8.6)	70 (100)	2.892	0.822
3-6 Months	54 (93.1)	4 (6.9)	58 (100)		
6-12 Months	30 (90.9)	3 (9.1)	33 (100)		
>12 Months	183 (88.4)	24 (11.6)	207 (100)		

study that the prevalence of musculoskeletal pain among students is high and may be connected with poor furniture for learning activities (Martin, *et al.*, 2017).

Also, this study revealed a significant relationship between gender and prevalence of musculoskeletal pain, with females reporting higher 12-month prevalence than males. There are conflicting reports in literature on the association of gender with musculoskeletal pain. Some

studies found no significant difference in the association of gender with musculoskeletal pain (Ayanniyi, *et al.*, 2011; Adegoke, *et al.*, 2015), others report either a higher female association or male association with musculoskeletal pain (Sato, *et al.*, 2008; Onofrio, *et al.*, 2012). However, our finding is consistent with previous studies in which neck pain and low-back pain were high for a 3-month and 12-month prevalence of

musculoskeletal pain (Hasan, *et al.*, 2018; Martins *et al.*, 2020).

Findings from our study also showed no significant relationship between mattress type, size, duration of usage and musculoskeletal pain among the respondents. This could be due to the fact that a majority of the respondents were aware of correct sleeping posture. This finding is consistent with results from a previous study which reported no significant difference between the randomized sleeping surfaces for any measure of actigraphic sleep or self-reported sleep and daytime symptoms (McCall, *et al.*, 2012). More than half of the respondents participated in sports and more than one third of them reported sport-related musculoskeletal pain. Thus, sport participation could contribute to the cause of the pain experienced by the respondents. This is in line with previous findings that school children experienced exercise-related injury and pain from physical activity (Sollerhed, *et al.*, 2020), but in contrast with previous report that found no relationship between exercises and musculoskeletal pain (Hasan, *et al.*, 2018).

Furthermore, the reading profile of these students could be a contributing factor to the pain experienced. Majority of them read using tables and chairs and thus spent more hours in this posture but it could not be ascertained if these furniture's were ergonomically suited to the students as limitations to some activities of daily living due to pain was also reported. Many of the students also indicated that the class furniture was uncomfortable so this could be an additional factor responsible for the pain experienced by these students. This is consistent with some previous studies which suggested that a potential contributor to non-specific low back pain is the time spent sitting on poorly designed furniture (Musa-Olokuta, *et al.*, 2011; Saes, *et al.*, 2015). Hasan, *et al.*, (2018) reported that studying in a bed is associated with the prevalence of musculoskeletal pain among undergraduates. Overall, musculoskeletal pain has been linked with adolescent's wellbeing and school performance (Salathe, *et al.*, 2020). Thus, it is probable that bad ergonomic behavior during academic activities could be responsible for the high prevalence rate of musculoskeletal pain given the result of no significant relationship between mattress type, size with respondents' musculoskeletal pain obtained in this study.

A limitation of this study was that the type of classroom furniture and their ergonomic suitability was not determined in this study. Knowledge of these would aid in the determination of the cause of the musculoskeletal pain experienced by the students so that appropriate measures could be taken.

CONCLUSION AND RECOMMENDATIONS

Sleep surface type, size and duration of use had no significant impact on the prevalence of musculoskeletal pain among undergraduate students of the College of

Medicine of the University of Lagos. We recommend that continuous education of undergraduate students on the correct sleeping posture, improved postural awareness and ergonomics for prevention of musculoskeletal pain by Physiotherapists are imperative. Further studies should determine the ergonomic suitability of the classroom furniture of undergraduate students in order to ascertain their role in the development of musculoskeletal disorders.

Conflict of Interest

The authors declare no conflict of interest whatsoever.

Funding

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References

- Adegoke, B.O.A., Odole, A.C., Adeyinka, A.A., 2015. Adolescent low back pain among secondary school students in Ibadan, Nigeria. *Africal Journal of Health Sciences*, 15, pp 2.
- Alsaadi, S.M., McAuley, J.H., Hush, J.M., Bartlett, D.J., McKeough, Z.M., Grunstein, R.R., Dungan, G.C., Maher, C.G., 2014a. Assessing sleep disturbance in low back pain: the validity of portable instruments. *PLoS One*, 9(4), pp. e95824.
- Alsaadi, S.M., McAuley, J.H., Hush, J.M., Lo, S., Bartlett, D.J., Grunstein, R.R., Maher, C.G., 2014b. The bidirectional relationship between pain intensity and sleep disturbance/quality in patients with low back pain. *Clinical Journal of Pain*, 30(9), pp. 755-765.
- Aminoff, M.J., Boller, F., Swaab, D.F., 2011. We spend about one-third of our life either sleeping or attempting to do so. *Handbook of Clinical Neurology*, 7, pp. 1.
- Ancuelle, V., Zamudio, R., Mendiola, A., Guillen, D., Ortiz, P.J., Tello, T., Vizcarra, D., 2015. Effects of an adapted mattress in musculoskeletal pain and sleep quality in institutionalized elders. *Sleep Science*, 8(3), pp. 115-120.
- Andreucci, A., Campbell, P., Mundy, L.K., Sawyer, S.M., Kosola, S., Patton, G.C., Dunn, K.M., 2020a. Sleep problems increase the risk of musculoskeletal pain in boys but not girls: a prospective cohort study. *European Journal Pediatrics*, 179(11), pp. 1711-1719.
- Andreucci, A., Campbell, P., Richardson, E., Chen, Y., Dunn, K.M., 2020b. Sleep problems and psychological symptoms as predictors of musculoskeletal conditions in children and adolescents. *European Journal of Pain*, 24(2), pp. 354-363.
- Ayanniyi, O., Mbada, C.E., Muolokwu, C.A., 2011. Prevalence and Profile of Back Pain in Nigerian Adolescents. *Medical Principles and Practice*, 20, pp. 368-373.
- Babiloni, A.H., De Koninck, B.P., Beetz, G., De Beaumont, L., Martel, M.O., & Lavigne, G.J., 2020. Sleep and pain: recent insights, mechanisms, and future directions in the investigation of this relationship. *Journal of Neural Transmission*, 127, pp. 647-660.
- Christofoletti, M.M., de Araujo, S.A., Cherri, A.C., 2020. Integrated lot-sizing and cutting stock problem applied to the mattress industry. *Journal of the Operational Research Society*, pp. 1-15.
- Cronbach, L.J., 1951. Coefficient alpha and the internal structure of tests. *Psychometrika*, 16, pp. 297-333.
- Harrison, L., Wilson, S., Munafò, M.R., 2014. Exploring the associations between sleep problems and chronic musculoskeletal pain in adolescents: a prospective cohort study. *Pain Research Management*, 19(5), pp. e139-45.
- Hasan, M.M., Yaqoob, U., Ali, S.S., Siddiqui, A.A., 2018. Frequency of Musculoskeletal Pain and Associated Factors among Undergraduate Students. *Case Report in Clinical Medicine*, 7, pp. 131-145.

- Jacobson, B.H., Boolani, A., Dunklee, G., Shepardson, A., Acharya, H., 2010. Effect of prescribed sleep surfaces on back pain and sleep quality in patients diagnosed with low back and shoulder pain. *Applied Ergonomics*, 42, pp. 91-97.
- Kuorinka, I., Jonsson, B., Kilbom, A., Vinterberg, H., Biering-Sorensen, F., Andersson, G., Jorgensen, K., 1987. Standardised Nordic questionnaires for the analysis of musculoskeletal symptoms. *Applied Ergonomics*, 18(3), pp. 233-237.
- Low, F., Chua, M.C., Yeow, C., 2017. Effects of mattress material on body pressure profiles in different sleeping postures. *Journal of Chiropractic Medicine*, 20, pp. 1-9.
- Madaan, V., Chaudari, A., 2013. Prevalence and risk factor associated with musculoskeletal pain amongst students of MGM Dental College: A cross sectional survey. *Journal of Contemporary Dentistry*, 2(2), pp. 22-27.
- Martin, A., Bertha, O.Y., Hosea, B., Acheampong, B., Edward, A., Cynthia, O.Y., 2017. Prevalence of Musculoskeletal Pain and Body-Chair Mismatch among Junior High School Students in Ghana: A Risk Factor for the Young. *Journal of Advance Medicine in Medical Research*, 23(12), pp. 1-9.
- Mathias, J., Cant, M., Burke, A., 2018. Sleep disturbances and sleep disorders in adults living with chronic pain: A meta-analysis. *Sleep Medicine* 52, pp. 198-210.
- Martins, R.L., Carvalho, N., Albuquerque, C., Andrade, A., Martins, C., Campos, S., Batista, S., Dinis, A.I., 2020. Musculoskeletal disorders in adolescents: a study on prevalence and determining factors. *Acta Paulista de Enfermagem*, 33, pp. 1-8.
- McCall, W.V., Boggs, N., Letton, A., 2012. Changes in sleep and wake in response to different sleeping surfaces: A pilot study. *Applied Ergonomics*, 43(2), pp. 386-391.
- Mork, P.J., Vik, K.L., Moe, B., Lier, R., Bardal, E.M., Nilsen, T.I., 2014. Sleep problems, exercise and obesity and risk of chronic musculoskeletal pain: the Norwegian HUNT study. *European Journal of Public Health*, 24(6), pp. 924-929.
- Musa-Olokuta, A.I., Ismaila, O.S., & Adejuyigbe, S.B., Akinyemi, O.D., 2011. Ergo- effects of designed school furniture and sitting positions on students' behaviour and musculo-skeletal disorder in Nigerian tertiary institutions. *Management Science Letters*, 1, pp. 331-334.
- Onofrio, A.C., da Silva, M.C., Domingues, M.R., Rombaldi, A.J., 2012. Acute low back pain in high school adolescents in Southern Brazil: prevalence and associated factors. *European Spine Journal*, 21(7), pp. 1234-1240.
- Raley, H.R., Naber, J.L., Cross, S., Perlow, M.B., 2016. The Impact of duration of sleep on academic performance in university students. *Madridge Journal of Nursing*, 1(1), pp. 11-18.
- Ramli, R., Kamaruddin, S., Rasdi, F.R.M., Lang, M.K., Hassan, A.A., Yatim, A.H.M., 2018. Malaysian epoxidised natural rubber latex foam for sound absorption and vibration damping applications. *MRB Rubber Technology Development*, 18(1).
- Saes, M., Ribeiro, C.D., & Muccillo-Baisch, A.L., Soares, M.C.F., 2015. Prevalence of musculoskeletal pain and its association with inadequate school furniture. *Revista Dor Sao Paulo*, 16(2), pp. 124-128.
- Salathé, C.R., Kälin, W., Zilse, S., Elfering, A., 2020. Baseline musculoskeletal pain and impaired sleep related to school pressure influence the development of musculoskeletal pain in N=107 adolescents in a 5-year longitudinal study. *European Spine Journal*, 29, pp. 540-548.
- Sato, T., Ito, T., Hirano, T., Morita, O., Kikuchi, R., Endo, N., Tanabe, N., 2008. Low back pain in childhood and adolescence: a cross-sectional study in Niigata City. *European Spine Journal*, 17, pp. 1441-1447.
- Sollerhed, A-C., Horn, A., Culpan, I., Lynch, J., 2020. Adolescent physical activity-related injuries in school physical education and leisure-time sports. *Journal of International Medical Research*, 48(9), pp. 1-12.
- Ugarte, L., Saralegi, A., Fernandez, R., Martin, L., Corcuera, M.A., Eceiza, A., 2014. Flexible polyurethane foams based on 100% renewably sources polyols. *Industrial Crops Production*, 62, pp. 545-551.
- Victoria, A.A., Rodrigoa, Z.H., Andreaa, M.Y., Daniela, G.M., Saavedrab, P.O., Rodriguez, T.T., Vizcarra-Escobar, D., 2015. Effects of an adapted mattress in musculoskeletal pain and sleep quality in institutionalized elders. *Sleep Science*, 8(3), pp. 115-120.
- Vinstrup, J., Jakobsen, M.D., Andersen, L.L., 2020. Poor sleep is a risk factor for low-back pain among healthcare workers: prospective cohort study. *International Journal of Environmental Research and Public Health*, 17, pp. 996.
- Wong, D.W., Wang, Y., Lin, J., Tan, Q., Chen, T.L., Zhang, M., 2019. Sleeping mattress determinants and evaluation: a biomechanical review and critique. *Peer Journal*, 25(7), pp. e6364.

Appendix


APPENDIX 1

**LAGOS UNIVERSITY TEACHING HOSPITAL
HEALTH RESEARCH AND ETHICS COMMITTEE**

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6th May, 2014

NOTICE OF EXEMPTION

PROJECT TITLE: "RELATIONSHIP BETWEEN MATTRESS AND MUSCULOSKELETAL PAIN AMONG UNDERGRADUATE STUDENTS IN COLLEGE OF MEDICINE, UNIVERSITY OF LAGOS".

HEALTH RESEARCH COMMITTEE ASSIGNED NO.: ADM/DCST/HREC/APP/1839

NAME OF PRINCIPAL INVESTIGATOR: ODUKOYA JOY ADETOUN

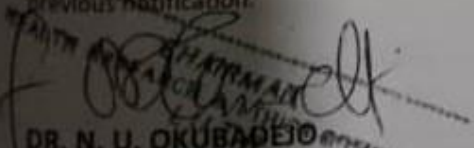
ADDRESS OF PRINCIPAL INVESTIGATOR: DEPT. OF PHYSIOTHERAPY, CMUL.

DATE OF RECEIPT OF VALID APPLICATION: 05-05-14

This is to inform you that the research described in the submitted protocol, the consent forms, and all other related materials where relevant have been evaluated and are exempted from full review by the Lagos University Teaching Hospital Health Research Ethics Committee (LUTHHREC).

All informed consent forms used in this study must carry the HREC assigned number and duration of HREC approval of the study. In multiyear research, endeavor to submit your annual report to the HREC early in order to obtain renewal of your approval and avoid disruption of your research.

The National code for Health Research Ethics requires you to comply with all institutional guidelines, rules and regulations and with the tenets of the code including ensuring that all adverse events are reported promptly to the HREC. No changes are permitted in the research without prior approval by the HREC except in circumstances outlined in the code. The HREC reserves the right to conduct compliance visits to your research site without previous notification.


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