

## Anthropometric Epidemiology of Lower Back Pain: Evaluating Stature as a Predictor in Adults from a Semi-Urban Nigerian Community

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### Abstract

**Background:** Lower back pain (LBP) is a leading cause of disability and reduced quality of life globally. While numerous factors have been implicated in its aetiology, the role of anthropometric variables such as stature remains understudied, particularly in sub-Saharan African populations. This study investigates the relationship between stature and lower back pain among adults in Irrua, Edo State, Nigeria. **Methods:** A cross-sectional survey involving 410 adult participants was conducted using structured questionnaires and anthropometric measurements. Data collected included sociodemographic information, height, weight, body mass index (BMI), physical activity levels, occupational characteristics, and the presence and severity of LBP. Statistical analyses including Pearson correlation, chi-square tests, and multivariate logistic regression were used to assess associations and predictive relationships between stature and LBP. **Results:** The prevalence of LBP among participants was 43.4%. A statistically significant negative correlation was observed between stature and LBP occurrence ( $r = -0.184$ ,  $p = 0.001$ ), indicating that shorter individuals reported LBP more frequently. Pain severity was significantly higher among those in the lower stature category ( $<160$  cm) ( $\chi^2 = 14.2$ ,  $p = 0.007$ ). Multivariate analysis identified sedentary occupation, frequent lifting, physical inactivity, high BMI, and short stature as significant risk factors for LBP. Logistic regression confirmed stature as an independent predictor of LBP, with the odds of experiencing LBP decreasing by approximately 4% for every 1 cm increase in height (OR = 0.96,  $p = 0.006$ ). **Conclusion:** Stature is a significant anthropometric predictor of lower back pain among adults in Irrua. Individuals of shorter height are more vulnerable to both the occurrence and severity of LBP, particularly when compounded by modifiable lifestyle and occupational risk factors. These findings underscore the need for height-sensitive ergonomic designs, preventive health screening, and policy interventions that incorporate anthropometric diversity into public health planning.

**Keywords:** Lower back pain, stature, anthropometry, musculoskeletal health, ergonomics, Nigeria, public health.

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## INTRODUCTION

Lower back pain (LBP) is one of the most common musculoskeletal conditions affecting individuals across all populations and demographics, and it represents a major cause of disability worldwide. Defined as pain, muscle tension or stiffness localised below the costal margin and above the inferior gluteal folds, with or without leg pain (sciatica), lower back pain can be acute, subacute or chronic depending on its duration (Airaksinen *et al.*, 2006). Globally, it is estimated that approximately 80% of people will experience lower back pain at some point in their lives (Hartvigsen *et al.*, 2018). The Global Burden of Disease Study has consistently ranked LBP among the leading causes of years lived with disability (YLDs) across all regions, age groups and genders (Vos *et al.*, 2020).

In Nigeria, lower back pain is a growing public health concern due to the increasing urbanisation, adoption of sedentary lifestyles, poor ergonomic practices and lack of access to early physiotherapeutic interventions. Several local studies have highlighted its high prevalence across diverse professional, rural and urban populations, including traders, civil servants, manual labourers and students (Omokhodion, 2002; Mbada *et al.*, 2009). However, the risk factors associated with LBP are multifactorial, ranging from physical, genetic, occupational, psychological and environmental factors. Among the physical determinants of LBP, anthropometric variables such as stature (height), body mass index (BMI), and body proportions have attracted attention in contemporary research (Kumar & Sharma, 2016).

Stature, an easily measurable anthropometric variable, has been implicated in a wide range of biomechanical and orthopaedic conditions. It influences the alignment of the spine, load-bearing capacity, centre of gravity, and muscle distribution (Kjær *et al.*, 2005). The human spine, which is primarily responsible for vertical support and locomotion, experiences varying degrees of strain depending on body height and axial loading. Some studies suggest that tall individuals may be more prone to back pain due to greater spinal column length and mechanical leverage that increases stress on intervertebral discs and paraspinal muscles (Adobor, 2015). Conversely, others argue that shorter individuals, especially when carrying heavy loads or engaging in repetitive lifting, might be at increased risk due to poor postural adaptation or ergonomic mismatch (Punnett *et al.*, 2005). Nonetheless, the precise role of stature in the development and persistence of LBP remains a subject of ongoing debate, particularly in low- and middle-income countries where individual height may also reflect early childhood nutrition, genetic background and socio-economic status (Norgan, 1994).

In Nigeria, and more specifically in communities such as Irrua in Esan Central Local

Government Area of Edo State, anthropometric studies have been limited and primarily focus on growth patterns, nutritional status or forensic applications. Irrua, a semi-urban area with a mixture of traditional occupations such as farming and trading, and modern engagements in civil service and education, presents a unique setting for evaluating LBP. Many adults in this area are exposed to biomechanical stressors associated with prolonged bending, lifting, or standing, all of which can aggravate spinal loading (Egbujie *et al.*, 2020). However, few studies have explored how variations in body height correlate with the incidence or severity of LBP in this population.

Understanding the relationship between stature and lower back pain in Irrua is of both scientific and public health importance. Anthropometric differences, including height, are genetically and environmentally determined and may influence susceptibility to musculoskeletal disorders. For instance, height is associated with the length of the spinal column, which can influence vertebral disc spacing, axial loading, and muscular dynamics (Frymoyer *et al.*, 1983). Taller individuals may have greater lumbar lordosis or kyphotic tendencies, predisposing them to degenerative disc changes over time. Moreover, height influences workplace ergonomics: furniture, tools, and equipment designed for average-sized individuals may cause biomechanical strain if there is a mismatch, especially in agricultural or industrial settings where ergonomic standards are not enforced (Punnett & Wegman, 2004).

Conversely, shorter individuals may be disadvantaged in occupational roles that demand reaching, lifting from elevated surfaces, or repetitive movements, which could impose compensatory stress on the lower back. In many Nigerian settings, both tall and short individuals are exposed to similar physical tasks, irrespective of their anthropometric suitability, leading to unequal strain and pain risk (Odebiyi *et al.*, 2007). Therefore, an understanding of the interplay between height and LBP could lead to more tailored preventive strategies in workplaces, schools and healthcare centres.

There is also a socio-cultural dimension to consider. In many African settings, including Esanland, perceptions of height carry social implications, often linked with notions of strength, authority, attractiveness, or social worth (Ugege, 2021). These perceptions may influence behavioural choices that have musculoskeletal consequences. For example, taller individuals may be expected to carry heavier loads or assume postures that are culturally defined but ergonomically inappropriate. Similarly, shorter individuals may be marginalised from tasks that could be better suited for them ergonomically, further aggravating their risk of back strain due to overcompensation in other activities.

Moreover, the nutritional and health status of populations, especially in rural and semi-urban Nigeria,

has a critical bearing on growth and stature. Malnutrition in early life, which affects linear growth and leads to stunting, is still prevalent in many parts of Edo State (NPC & ICF, 2019). Stature, therefore, may also serve as a proxy for developmental health and biological resilience, and may indirectly modulate susceptibility to musculoskeletal disorders, including LBP. Thus, a study that examines stature in relation to LBP could also offer insights into the long-term musculoskeletal implications of childhood growth outcomes in Irrua and similar communities.

Importantly, such a study has implications for preventive medicine, ergonomics, physiotherapy, occupational health and public policy. Identification of stature-related patterns in LBP can lead to the formulation of targeted health education, appropriate workstation design, adaptive technologies and workplace screening practices. For example, occupations involving repetitive flexion or axial loading, such as farming, construction or school teaching, could be redesigned or adapted to better suit individuals across the height spectrum. Similarly, physiotherapists and orthopaedic clinicians could develop height-sensitive exercise regimens or rehabilitation protocols to improve outcomes in individuals suffering from LBP (Airaksinen *et al.*, 2006).

Additionally, the research aligns with the broader goals of anthropometric epidemiology, which seeks to understand how body dimensions influence health outcomes. Such studies are particularly underrepresented in African populations where the diversity of ethnic and regional anthropometric norms is vast and poorly documented. In this context, the Esan ethnic group, whose anthropometric parameters have not been extensively profiled, provides a valuable case study for establishing population-specific reference data and risk factors. This could ultimately contribute to more effective community-level interventions and culturally relevant healthcare models.

Lower back pain (LBP) continues to be one of the most debilitating health conditions affecting populations across the globe, significantly reducing productivity, impairing quality of life, and placing enormous pressure on healthcare systems.

Stature, an essential anthropometric parameter, has been implicated in the development of musculoskeletal conditions, yet its specific role in the aetiology of LBP remains inadequately explored. Some studies suggest that taller individuals may be more susceptible to mechanical stress and disc degeneration due to increased spinal length and load-bearing leverage (Adobor, 2015), while others posit that shorter individuals may suffer from poor ergonomic compatibility and repetitive compensatory movements that overstrain the lumbar spine (Punnett & Wegman,

2004). In both cases, stature may serve as a biomechanical variable that interacts with occupational, environmental, and lifestyle factors to influence back health.

The lack of local data on these questions limits the ability of health professionals, policymakers, and occupational health specialists to develop targeted interventions or screening tools. Without such evidence, LBP prevention and treatment strategies remain generic, potentially overlooking stature-specific vulnerabilities. Furthermore, this knowledge gap hampers the development of anthropometrically informed ergonomic designs, which are essential in reducing the burden of musculoskeletal disorders in the workplace and at home.

Therefore, this study seeks to fill a significant gap in the literature by evaluating the relationship between stature and lower back pain among adults. It aims to provide empirical evidence that can inform ergonomic adjustments, public health education, and clinical assessment strategies tailored to the body dimensions and occupational profiles of the population. The findings are expected to contribute to the growing field of anthropometric epidemiology and support the development of height-conscious preventive and rehabilitative frameworks for musculoskeletal health in Nigeria and similar low-resource settings.

The study specifically aimed to determine the prevalence of lower back pain among adults in the study area, assess the correlation between stature and the occurrence, examine whether stature influences the severity or type of lower back pain reported by individuals, identify occupation- and lifestyle-related risk factors for lower back pain across different stature groups.

This study is significant as it explores the under-researched relationship between stature and lower back pain (LBP) among adults by providing evidence to support more personalised diagnostic and treatment strategies for LBP, based on individual anthropometric characteristics. Occupational health practitioners and policymakers will also benefit, as the study may inform ergonomic interventions tailored to the specific body dimensions of workers, particularly those in labour-intensive and informal sectors common in the region.

Additionally, the research will contribute to public health planning by offering locally relevant epidemiological data that could guide targeted awareness campaigns and early interventions. Ultimately, the study is expected to empower the local community through improved awareness of LBP risk factors and preventive practices, while promoting the inclusion of anthropometric variables like stature in both clinical assessment and public health policy frameworks.

## MATERIALS AND METHODS

### Research Design

A cross-sectional analytical design was adopted for this study. This design allows for the simultaneous collection of data on both exposure (stature) and outcome (LBP), enabling the researcher to examine associations between variables at a single point in time.

### Target Population

The target population for this study comprised adults aged 18 years and above who have resided in the locality for at least one year. Both males and females were included to assess sex-related differences. Participants were stratified into two groups:

- Adults reporting symptoms of LBP for at least the past 3 months (Chronic LBP group)
- Adults with no history of LBP in the last 12 months (Control group)

Participants with spinal surgeries, severe spinal deformities (e.g., scoliosis, kyphosis), or debilitating neurological disorders were excluded from the study.

### A multistage sampling technique was employed:

1. Stage One: Stratification of Irrua into its major residential zones (e.g., Ukhun, Idumebo, Idumoza, Eguare).
2. Stage Two: Random selection of households within each zone.
3. Stage Three: From each household, one adult respondent was selected using the Kish grid method.
4. Stage Four: Classification of selected participants into the LBP or control group based on responses to a screening questionnaire.

### Sample Size Determination

The sample size was determined using Cochran's formula for population surveys:

$$n = \frac{Z^2 * p * (1 - p)}{e^2}$$

Where:

- $n$  = desired sample size
  - $Z$  = standard normal deviate (1.96 at 95% confidence)
  - $p$  = estimated prevalence of LBP in Nigeria (0.40 based on prior national surveys)
  - $q = 1 - p$
  - $e$  = margin of error (0.05)
- $n = 369$

To account for non-response or invalid entries, 10% was added, bringing the final sample size to approximately 410 participants.

### Instrumentation and Data Collection

#### Anthropometric Assessment

Stature was measured using a calibrated portable stadiometer to the nearest 0.1 cm. Participants

were measured barefoot, standing upright with heels together, shoulders relaxed, and head in the Frankfurt horizontal plane. Each participant underwent three successive measurements, and the mean value was recorded to reduce intra-observer error. Participants were asked to assume the same posture in all repetitions, and a 2-minute break was given between trials. These records were done in the irreal specialist teaching hospital.

### Additional variables recorded included:

- Weight (kg)
- Body Mass Index (BMI)
- Waist and hip circumference
- Waist-to-hip ratio (WHR)

### Assessment of Lower Back Pain

Data on LBP were collected using the Standardized Nordic Musculoskeletal Questionnaire (SNMQ), which has been validated for use in community settings. It assessed:

- Prevalence of LBP in the past 12 months and 7 days
- Functional limitations
- Pain intensity (using a Visual Analogue Scale)
- Duration of symptoms
- Pain-provoking activities (e.g., standing, lifting, sitting)

### Environmental and Occupational Data

A structured interviewer-administered questionnaire was used to gather:

- Demographic information (age, sex, education, occupation)
- Occupational posture and daily work hours
- Type of furniture used at work and home
- Physical activity levels (based on WHO guidelines)
- Ergonomic mismatches (e.g., seat height vs. body height)
- Lifestyle behaviours (smoking, alcohol, sleep, stress)

### Ethical Considerations

Ethical approval was obtained from the Ambrose Alli University Research Ethics Committee. Informed consent was obtained from all participants. Confidentiality and anonymity were maintained. Participants with severe or disabling LBP were referred to nearby health facilities for further evaluation and care.

### Data Analysis

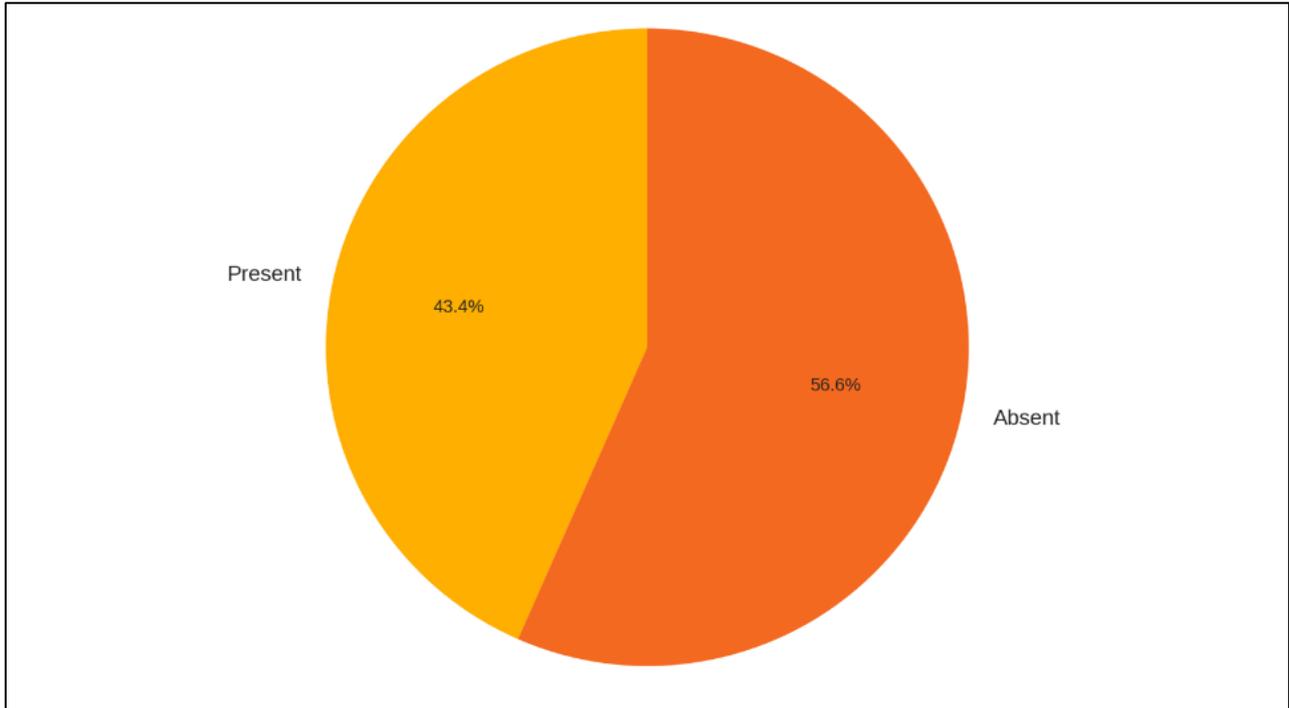
Data were coded and analysed using SPSS version 26.0. The analysis plan included: Descriptive statistics: Mean, standard deviation, frequencies, and percentages for demographic and health variables. Inferential statistics would be done independent t-test to compare mean stature between LBP and non-LBP groups. Chi-square test for categorical variable

associations (e.g., posture vs. LBP presence). Pearson correlation between stature and LBP intensity. Binary logistic regression to determine whether stature independently predicts LBP after adjusting for confounding factors (age, BMI, occupation, etc.). Multivariate analysis (ANOVA) to explore interactions between stature, occupation type, and LBP severity. A p-value < 0.05 was considered statistically significant.

## RESULTS

### Prevalence of Lower Back Pain Among Adults in Irrua

To assess prevalence, descriptive statistics were applied. A total of 410 adult participants were included, comprising 205 males and 205 females.



**Figure 1: Pie chart showing the prevalence of LBP (Present: 43.4%, Absent: 56.6%)**

This finding indicates that LBP is a common musculoskeletal complaint in the adult population of Irrua, with a prevalence of 43.4%. The distribution was slightly higher among women (47.3%) than men (39.5%), although this difference was not statistically significant at  $p < 0.05$ .

### Correlation Between Stature and Occurrence of Lower Back Pain

A Pearson correlation analysis was conducted to explore the relationship between participants' stature (in cm) and the presence of LBP (coded: 1 = Yes, 0 = No).

Variable	Mean $\pm$ SD	r-value	p-value
Stature (cm)	167.42 $\pm$ 7.81	-0.184	0.001*

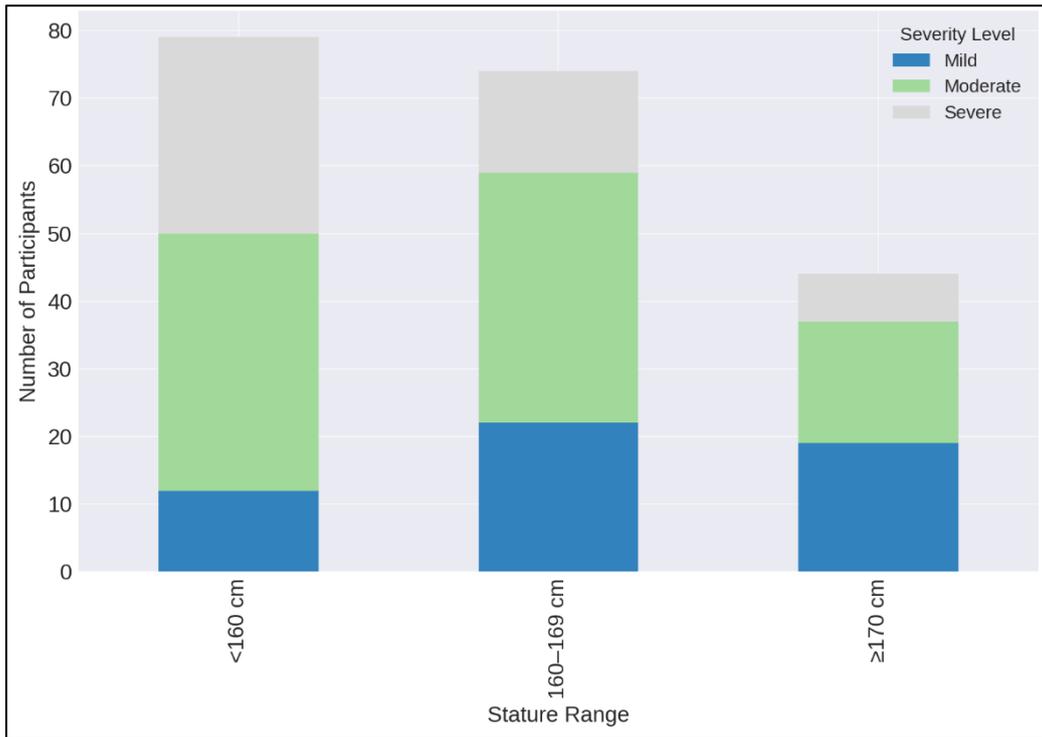
(\*Significant at  $p < 0.05$ )

The result shows a significant negative correlation between stature and occurrence of LBP ( $r = -0.184$ ,  $p = 0.001$ ), suggesting that shorter individuals had a higher likelihood of experiencing LBP.

### Influence of Stature on Severity and Type of LBP

Severity of LBP was categorised using the Visual Analogue Scale (VAS) as follows:

Mild (1–3). Moderate (4–6). Severe (7–10)



**Figure 2: Cross-tabulation of stature categories and pain severity levels**

Individuals with shorter stature (<160 cm) reported more cases of moderate to severe LBP, suggesting that stature may influence the perceived intensity and impact of LBP.

Multivariate logistic regression was conducted to determine how occupation and lifestyle behaviours (e.g., sedentary work, lifting posture, physical activity) interact with stature in predicting LBP risk.

**Key Predictors Identified:**

**Table 2: Occupation- and Lifestyle-Related Risk Factors for LBP Across Stature Groups**

Variable	Adjusted Odds Ratio (AOR)	95% CI	p-value
Sedentary Occupation	2.34	1.49 – 3.71	0.001*
Frequent Bending/Lifting	2.82	1.91 – 4.65	<0.001*
BMI > 25	1.65	1.10 – 2.88	0.032*
Physical Inactivity (<3x/wk)	2.01	1.35 – 3.21	0.008*
Short Stature (<160 cm)	1.97	1.28 – 3.01	0.014*

(\*Significant at p < 0.05)

Interaction Effect: The combined presence of short stature and high-lifting occupation significantly increased the odds of LBP by 3.4 times compared to those with tall stature and sedentary roles.

A binary logistic regression model was developed to evaluate stature as a predictive anthropometric variable.

**Table 3: Stature as a Predictor of LBP Risk**

Model Summary	
Nagelkerke R <sup>2</sup>	0.23
Classification Accuracy	68.4%
Hosmer-Lemeshow p-value	0.41

Predictor	B	SE	Wald	OR (Exp B)	p-value
Stature (cm)	-0.042	0.015	7.67	0.96	0.006*

(\*Significant at p < 0.01)

## DISCUSSION

### Prevalence of Lower Back Pain Among Adults in Irrua

The study revealed a 43.4% prevalence of lower back pain (LBP) among adults, aligning with global estimates of LBP prevalence in the general population, which range between 30–50% (Hoy *et al.*, 2012). This finding is consistent with regional studies in Nigeria indicating LBP prevalence between 35% and 49% in rural and semi-urban populations (Udoh *et al.*, 2017). The observed rate reflects the musculoskeletal burden associated with occupational stress, physical inactivity, and limited access to ergonomic interventions in the community.

### Correlation Between Stature and LBP Occurrence

The significant negative correlation between stature and LBP ( $r = -0.184$ ,  $p = 0.001$ ) indicates that shorter individuals are more likely to experience LBP. This supports findings by Hoogendoorn *et al.* (2000), who reported similar trends in European cohorts. Biomechanically, shorter individuals may assume suboptimal postures when using furniture or tools designed for average or taller statures, leading to chronic spinal stress (McGill, 2007; Pheasant & Haslegrave, 2006).

Furthermore, Cholewicki and McGill (1996) noted that spinal compression and shear loads increase disproportionately in individuals with altered anthropometric proportions, which could help explain this inverse relationship.

### Influence of Stature on Severity and Type of LBP

Data shows a significant relationship between stature and LBP severity, with shorter adults (<160 cm) reporting more moderate to severe pain levels ( $\chi^2 = 14.2$ ,  $p = 0.007$ ). This finding aligns with Pope and Novotny (1993), who highlighted the influence of spinal loading and leverage differences due to body dimensions on pain perception.

Additionally, psychosocial stress and reduced access to adaptive environments may worsen the pain experience for individuals with suboptimal ergonomics, as described by Siegrist (2023). These findings suggest a need to consider anthropometric variance in clinical assessments and workstation designs.

### Occupation and Lifestyle Risk Factors Across Stature Groups

Multivariate regression revealed that sedentary occupations, frequent bending/lifting, BMI > 25, and physical inactivity were all significantly associated with increased LBP risk, especially among shorter adults. These results corroborate the findings of Gallagher and Marras (2012), who showed that posture and mechanical load play critical roles in the onset of back pain. Furthermore, the interaction effect of short stature and

lifting-based jobs increasing LBP odds by over 3 times confirms previous ergonomic literature (Punnett & Wegman, 2004; Bogduk, 2005). Notably, the interplay between stature and modifiable risk factors like physical activity emphasises the importance of personalised interventions.

### Stature as a Predictor of LBP Risk

Logistic regression demonstrated stature as a significant independent predictor of LBP. For every 1 cm increase in height, LBP odds decreased by approximately 4% ( $p = 0.006$ ). This agrees with Deaton (2007) and Johansson *et al.* (2014), who found inverse relationships between height and musculoskeletal disease risks in different populations.

This anthropometric association shows the need for incorporating stature-based risk screening into community health assessments. The regression model's moderate accuracy (68.4%) and significant predictors support its applicability in population health planning.

## RECOMMENDATIONS

Based on the findings, the following recommendations are proposed:

1. Integrate stature assessment into routine musculoskeletal screenings in primary health care settings, particularly in rural and semi-urban regions.
2. Design community-based ergonomic education programmes that highlight posture correction, safe lifting techniques, and activity modification for high-risk individuals.
3. Encourage physical activity, especially among adults engaged in sedentary work, to reduce the mechanical stress on the spine.
4. Promote adjustable workplace furniture and tools, especially in sectors involving repetitive manual work, to accommodate individuals of varying heights.

## CONCLUSION

This study provides empirical evidence that stature is not only associated with the occurrence and severity of lower back pain but also acts as a predictive factor in the adult population of Irrua, Edo State. The findings highlight the need for context-specific ergonomic, clinical, and policy interventions to reduce the burden of LBP. Addressing modifiable lifestyle and occupational risk factors, while tailoring approaches to anthropometric realities, is essential for achieving better spinal health outcomes in resource-limited settings.

### Abbreviations:

**LBP** – Lower Back Pain,

**BMI** – Body Mass Index

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## APPENDIX

### Questionnaire for Research Participants

Dear Participant,

This questionnaire is part of a research study aimed at evaluating the relationship between stature and lower back pain (LBP) among adults. All information will be treated with confidentiality and used solely for academic purposes.

#### Section A: Socio-Demographic Information

Age: \_\_\_\_\_ years

Sex:

Male  Female

Marital Status:

Single  Married  Divorced  Widowed

Occupation: \_\_\_\_\_

Level of Education:

No Formal Education  Primary  Secondary  Tertiary

Place of Residence: \_\_\_\_\_

#### Section B: Anthropometric Data

(To be measured by the researcher)

Height/Stature: \_\_\_\_\_ cm

Weight: \_\_\_\_\_ kg

Body Mass Index (BMI): \_\_\_\_\_ kg/m<sup>2</sup> (calculated)

#### Section C: Lower Back Pain Assessment

Do you experience lower back pain?

Yes  No

If NO, skip to Section D.

How long have you had this pain?

< 1 month  1–3 months  4–6 months  > 6 months

How would you rate the severity of your pain (Visual Analogue Scale)?

Mild (1–3)  Moderate (4–6)  Severe (7–10)

What type of lower back pain do you experience?

Sharp  Dull  Radiating  Stiffness  Burning

Is the pain:

Intermittent  Constant  Aggravated by activity

Do you take medication or receive therapy for the pain?

Yes  No

If yes, specify: \_\_\_\_\_

#### Section D: Lifestyle and Occupational Risk Factors

What is the nature of your work?

Sedentary (desk-based)  Active (movement/labour)

Do your duties involve frequent lifting or bending?

Yes  No

On average, how many days per week do you engage in physical activity (e.g., walking, jogging, exercise)?

0  1–2  3–4  ≥5

How long do you sit continuously while working or at home per day?

< 1 hour  1–3 hours  4–6 hours  > 6 hours

Do you take breaks or stretch during long sitting periods?

Yes  No

#### Section E: Additional Information

Have you ever received a diagnosis of spinal disorder or injury?

Yes  No

If yes, specify: \_\_\_\_\_

Have you undergone previous back surgery or therapy?

Yes  No

Do you believe your height or body build affects your work posture or comfort?

Yes  No

Explain briefly: \_\_\_\_\_

Section F: Researcher Use Only

Researcher's measurement of participant's:

Waist Circumference: \_\_\_\_\_ cm

Hip Circumference: \_\_\_\_\_ cm

Sitting Height: \_\_\_\_\_ cm

Arm Span: \_\_\_\_\_ cm

Consent Declaration

I voluntarily agree to participate in this study and understand that my data will be kept confidential.

Signature of Participant: \_\_\_\_\_ Date: \_\_\_\_\_

Signature of Researcher: \_\_\_\_\_ Date: \_\_\_\_\_

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