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Federal University of Technology, Minna, Nigeria

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FEDERAL UNIVERSITY OF TECHNOLOGY MINNA

Technology for Empowerment

Nigerian Journal of Technological Research

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General Information

Background Brief: The Nigerian Journal of Technological Research (NJTR) is the official journal of the Federal University of Technology, Minna, Niger State, Nigeria. It was first published in June 1989. It has since made significant strides in its efforts to provide an avenue for the dissemination of relevant, up-to-date research information in the core areas of discipline available at the University at inception; namely, Pure and Applied Sciences, Engineering Technology, Environmental Technology and Agricultural Technology.

Philosophy: As a strictly scientific and technological journal, it tends to provide information on problem-solving technology to its immediate environment and the international community.

Development: The Journal's responsiveness to the dynamic nature of research and development at the Federal University of Technology, Minna, and its environs has widened its scope of information dissemination to include, but is not limited to, Agricultural Technology, Environmental Technology, Engineering, Information and Communication Technology (ICT), Life Sciences, Physical Sciences, Educational Technology, and Innovation Technology. It has developed electronic communication procedures to ensure it can reach a larger community more quickly. It is anticipated that the Journal will contain scientific data providing up-to-date information for problem-solving in the identified areas of the University program.

Management: The Nigerian Journal of Technological Research has a unique management structure which enables it to carry out its functions promptly. This includes the Management Board, Editorial Board, Editorial Advisory Board, Regional Editors, Associate Editors, and a Business Manager. These groups bring their vast knowledge to the journal, ensuring its quality and reputation for academic output.

Finally, the Management Board and the Editorial Board of the Nigerian Journal of Technological Research firmly believe in the quality of information that will benefit mankind, and they are committed to ensuring the productivity and quality of information dissemination.

EDITORIAL COMMENTS

This edition of the Nigerian Journal of Technological Research is the second for the year 2025, which was a remarkable year for the Editorial Board. The large number of submissions and the quality of the manuscripts are a huge encouragement to us. The Board organised a retreat for academic and administrative staff including our reviewers and thesis supervisors on the ethical use of Artificial Intelligence in academic writing. The knowledge gained through the workshop was brought to bear on the selection of articles published in this edition.

This issue presents a collection of papers covering practical developments across computing, environmental health, engineering, agriculture, and library science. In the technical fields, the research includes deep learning frameworks for real-time multi-facial recognition, genetic algorithm optimization for electrical distribution networks, and the analysis of hybrid support materials for direct methanol fuel cells. Cybersecurity and data-driven modelling are addressed through hybrid anomaly-based intrusion detection systems, STRIDE threat modelling for smart farms, and the use of explainable machine learning to analyse urban land surface temperature drivers. Environmental and public health investigations focus on radon exposure risks in drinking water, thermal comfort in university housing, the prevalence of water-related diseases, and the financial impacts of flooding on rural rice farming. Agricultural and commercial operations are examined through comparisons of soil microbial populations, the profitability of sorghum-legume cropping systems, and the role of digital procurement in supply chain resilience. The volume concludes with institutional studies in library science, which look at collection development under open access policies, service delivery metrics, and the specific information needs of visually impaired students.

As usual, the Editorial Board is ever grateful to the University Management for the immense support and encouragement provided to them. Also, the Board is appreciative of the support of TETFUND. The financial assistance received consistently from the Tertiary Education Trust Fund (TETFUND) has enabled the Journal to adopt the Diamond Open Access Policy. Authors no longer pay the Article Processing Fee. We hope to sustain this policy as long as we continue to receive funding from TETFUND.

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ASSESSMENT OF THERMAL COMFORT IN SELECTED FEMALE HOSTELS AT GIDAN-KWANO, FEDERAL UNIVERSITY OF TECHNOLOGY MINNA, NIGERIA

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Abstract

The construction and operation of hostel buildings in Nigerian tertiary institutions often overlook thermal comfort, a critical factor influencing occupant health, productivity, and overall sustainability. This study aims to assess the thermal comfort in selected female hostels at the Federal University of Technology, Minna, Nigeria. A quantitative, descriptive research design was adopted. Data were collected using AirVisual Pro, a high-accuracy monitoring device that measured indoor temperature and relative humidity across three hostel categories, A (6 occupants/room), B (4 occupants/room), and C (2 occupants/room) within the Gidan-Kwano campus for three months. Measurements were analysed using descriptive statistics, graphs, and chart analysis (ASHRAE Standard 55 and CIBSE Guide A benchmarks). Diurnal variations were examined descriptively through hourly mean pattern analysis. Findings revealed that while mean indoor temperatures in most hostel rooms fell within or marginally above the ASHRAE comfort range of 22°C–26°C, relative humidity consistently exceeded recommended limits. Specifically, the mean relative humidity values were 83.4% and 82.2% for Categories A and B, respectively, both exceeding the ASHRAE and CIBSE standards. Category C, with a relative humidity value of 63.6%, was within the standard comfort zone of 40–70%. The study concludes that hostel indoor environments require urgent intervention to align with global thermal comfort standards. The study recommends integrating mechanical ventilation, dehumidification systems, and climate-responsive design strategies, alongside occupant education and regular environmental monitoring. These findings provide empirical evidence to improve thermal comfort and advance sustainable building management in institutional housing.

Keywords: Thermal comfort, Female hostels, Indoor environment, Sustainable building design, Occupant well-being

1.0 Introduction

Sustainable building practices are central to contemporary environmental and architectural discourse, emphasising the creation of structures that minimise ecological impact while maximising occupant comfort and well-being. Among the key parameters of sustainable building design, thermal comfort stands out as a fundamental determinant of human health, productivity, and satisfaction. As Abbasi et al. (2019) and Lan et al. (2020) noted, thermal comfort significantly influences human physiological responses, cognitive function, and overall quality of life, making it a core objective in sustainable design. Consequently, achieving optimal indoor thermal conditions is widely recognised as a core objective of sustainable building design.

However, in many developing nations, including Nigeria, hostel buildings often fail to meet acceptable thermal comfort standards, thereby affecting the well-being and performance of their occupants. Hwang et al. (2016) and Lan et al. (2019) observed that inadequate thermal comfort leads to fatigue, poor concentration, and adverse health outcomes among students in educational facilities. Teli et al. (2017) similarly stressed that maintaining appropriate indoor environmental conditions is vital to ensuring a conducive learning and living atmosphere. From a sustainability standpoint, thermally comfortable buildings also reduce energy consumption, as they rely less on mechanical heating or cooling systems (Onososen et al., 2024).

Recent scholarships have advanced an occupant-centric approach to thermal comfort, which accounts for personal preferences, adaptive behaviour, and cultural context. This approach, alongside the adoption of passive design strategies such as natural ventilation, shading, and building orientation, has been shown to enhance indoor comfort while lowering environmental impact (Iwuanyanwu et al., 2024). Despite these advantages, many Nigerian hostels still exhibit poor thermal performance due to inadequate design consideration, high occupancy density, and limited use of climate-responsive materials. These shortcomings undermine building functionality, sustainability, and occupant satisfaction. Nevertheless, many students' hostels in Nigeria continue to exhibit suboptimal thermal performance due to limited climate-sensitive design considerations, material inefficiencies and overcrowding.

Thermal comfort is also closely linked to indoor air quality (IAQ), which together determine the overall performance of a building with respect to user health and productivity. Valderrama-Ulloa et al. (2020) reported that comfortable indoor environments lead to greater occupant satisfaction, higher productivity, and reduced absenteeism. These concerns are particularly pronounced in hot, humid regions where passive cooling effectiveness is often constrained by high ambient humidity.

Historically, the study of thermal comfort dates back to the 19th century with the pioneering work of Herschel and Peake, later formalised through the American Society of Heating, Refrigerating and Air-Conditioning Engineers ASHRAE thermal comfort standards (ASHRAE, 2021). The evolution of thermal comfort research has been shaped by technological progress and global environmental commitments, notably the United Nations Sustainable Development Goals (United Nations, 2015) and the Paris Agreement (Paris Agreement, 2018), both of which underscore sustainable, occupant-friendly building design.

In hot and humid regions like Gidan Kwano, Minna, Nigeria, ensuring thermal comfort presents distinct challenges due to persistently high temperatures and humidity levels. Poorly ventilated hostel environments often exacerbate thermal stress, leading to discomfort, reduced cognitive performance, and increased risk of sick building syndrome (Al Horr et al., 2016; Lan et al., 2022). Architectural factors such as orientation, window-to-wall ratio, roof form, and vegetation significantly influence thermal comfort by affecting heat gain and natural air movement (Pathirana et al., 2019). Incorporating climate-responsive architecture, innovative building materials, and green infrastructure can substantially improve indoor conditions (Santamouris et al., 2018; Sharifi & Yamagata, 2019). Despite the growing body of global and regional research on thermal comfort and sustainable design, there remains limited empirical evidence assessing the actual thermal performance of university hostel buildings in hot-humid Nigerian contexts, particularly within the Federal University of Technology, Minna. Against this backdrop, this study assesses thermal comfort conditions in selected female hostels at the Federal University of Technology, Minna, and identifies the physical and environmental factors influencing indoor comfort.

2.0 Literature Review

Thermal comfort refers to the condition of mind in which an individual expresses satisfaction with the thermal environment (International Organisation for Standardisation ISO 7730:2025). It represents a complex interaction between environmental parameters (temperature, humidity, air movement, and radiant heat) and personal factors such as clothing insulation and metabolic rate. Fanger's (1970) Predicted Mean Vote (PMV) and Predicted Percentage of Dissatisfied (PPD) indices remain foundational in evaluating thermal sensation within indoor spaces, while the Adaptive Comfort Theory (de Dear & Brager, 2018) recognises the influence of behavioural, cultural, and psychological adaptation, particularly important in naturally ventilated buildings within tropical climates like Minna.

Globally recognised standards guide acceptable thermal environments for indoor spaces. ASHRAE Standard 55 (2017), ISO 7730 (2005), and Chartered Institution of Building Services Engineers CIBSE (2007) all define comfort zones using parameters such as operative temperature, humidity, airspeed, and clothing levels. However, scholars such as Lam et al. (2006) have noted that these standards, developed for temperate climates, are often inadequate when applied to naturally ventilated buildings in tropical regions.

Key environmental parameters include air temperature, relative humidity, air velocity, and mean radiant temperature (Frontczak & Wargocki, 2011). In hot-humid regions like Minna, elevated temperatures and humidity levels often exceed standard comfort limits, intensifying occupants' discomfort (Waziri et al., 2015). Air temperature largely dictates indoor thermal perception, influencing the rate of heat exchange between the human body and surrounding air (Khalifa, 2017). Relative humidity affects evaporation and heat loss, with levels between 30–60% generally considered optimal (CIBSE, 2016). Air velocity contributes to perceived cooling; moderate air movement enhances comfort in warm climates (Tang et al., 2021). Mean radiant temperature, the effect of surrounding surface temperatures plays a substantial role in indoor thermal sensation (Wang et al., 2019). Personal factors such as clothing and metabolic rate also significantly influence thermal response. Lightweight clothing and moderate activity levels are typical for hostel occupants, particularly in tropical regions. Female students, however, often experience greater thermal sensitivity due to physiological and hormonal variations, which can affect comfort perception (Holmér and Rossi, 2017).

Educational buildings are key environments where indoor environmental quality directly affects health, concentration, and academic performance. Studies (Sarbu & Pacurar, 2015; Liu et al., 2021) have demonstrated that thermal comfort strongly correlates with learning efficiency. In tropical and subtropical climates, passive design strategies such as natural ventilation, shading, and orientation remain essential for maintaining comfort while minimising energy use (Gil-Ozoudeh et al., 2022).

Hostels are unique residential typologies characterised by high occupant density, limited mechanical cooling, and diverse user behaviours. Studies indicate that hostel occupants in warm and humid climates often prioritise thermal comfort over visual or acoustic comfort, with air temperature, humidity, and air movement serving as critical determinants (Olanipekun et al., 2014). Sanjay and Manoj (2022) found that in naturally ventilated hostels, the neutral temperature typically ranges from 26.2°C to 30°C, with a comfort bandwidth of approximately 25–32°C, which is typical of Minna's climatic context.

In Nigeria, the thermal comfort challenges in hostels stem from climatic conditions, building design, and occupant behaviour. Studies by Akande et al. (2021) highlight the impact of building orientation and urban microclimate on indoor thermal conditions, showing that north–south orientations promote better thermal balance than east–west layouts. Other research (Olanipekun, 2014) underscores how user behaviour, such as cooking inside rooms, affects indoor temperature and air quality. The lack of effective thermal design strategies coupled with inadequate policy enforcement has resulted in persistent discomfort in student accommodations (Akubue, 2023). Despite extensive research on thermal comfort standards and adaptive models, notable gaps persist in Nigerian university hostels. International standards developed for temperate, mechanically conditioned buildings have not been validated in naturally ventilated, hot-humid contexts. Empirical studies focusing on female-only hostels are limited, and existing research often overlooks the integration of architectural characteristics with real occupancy and behavioural adaptation conditions. This study addresses these gaps by empirically assessing thermal comfort in selected female hostels at the Federal University of Technology, Minna, combining environmental measurements, architectural determinants, and occupant responses to generate context-specific design recommendations.

3.0 Materials and Methods

This study adopted a quantitative research approach to objectively assess thermal comfort conditions in female hostels at the Federal University of Technology, Minna (FUT Minna). The research focused on measuring indoor environmental parameters that influence perceived comfort in naturally ventilated hostel rooms. The study was conducted at the Gidan-Kwano main campus of FUT Minna, located along the Minna–Kataeregi–Bida road on approximately 10,650 hectares of land between latitudes 9.5°38′55.8″N to 9.0°31′15″N and longitudes 6.4°33′16″E to 6.0°36′22″E. The research population comprised female hostel rooms, including both self-contained and shared-room apartments. Four hostels were operational during the study period: the Old Female Hostel, the Newest Shehu Aliyu Female Hostel, the Shehu Aliyu Female Hostel, and the New Female Hostel.

Table 1: Hostel rooms were categorised based on occupancy capacity as shown below:

Category	Description
A	Old and Newest Shehu Aliyu Female Hostels – 6 persons per room
B	Shehu Aliyu and New Female Hostel – 4 persons per room
C	New Female Hostel – 2 persons per room

Environmental monitoring was conducted continuously for a three-month period (March, April, and May) corresponding to the peak hot season in Minna, when thermal discomfort is typically most pronounced. Indoor environmental parameters were recorded at one-hour intervals throughout the monitoring period. This hourly data logging approach generated 24 readings per day per room and allowed for the capture of diurnal variations, monthly trends, and fluctuations associated with occupancy patterns and behavioural adaptation. A stratified random sampling technique was employed to ensure proportional representation. Each category contributed four sampled rooms, resulting in a balanced distribution across occupancy types. Thermal comfort parameters were measured using AirVisual Pro, a high-accuracy portable multi-sensor device capable of recording temperature, relative humidity, carbon dioxide concentration, and particulate matter (PM2.5). The device specifications include a 5-inch LED display, rechargeable lithium-ion battery (1900 mAh), and operating temperature range of 0–40°C.

Plate 1: Air visual node monitoring device.

The instrument was positioned at three locations within each sampled room: near the exterior wall, adjacent to an internal wall, and midway between both points. Data were continuously logged and stored in the device's internal memory, then retrieved via the AirVisual online dashboard. Measurements followed the procedures of ASHRAE Standard 55 (2017) and ISO 7730 (2005), supported by methodologies from Ricciardi and Buratti (2018) and Nematchoua et al. (2014). The recorded parameters were analyzed using both descriptive statistics in Microsoft Excel. Descriptive analyses employed graphs

4.0 Results and Discussion

Mean Temperature Hourly Pattern for Category A - Old hostel and Ibrahim Aliyu hostel rooms

This illustrates the hourly variation in mean temperature recorded for three months period for Category A hostels specifically, the Old Female Hostel and the Ibrahim Aliyu Hostel each accommodating six occupants per room.

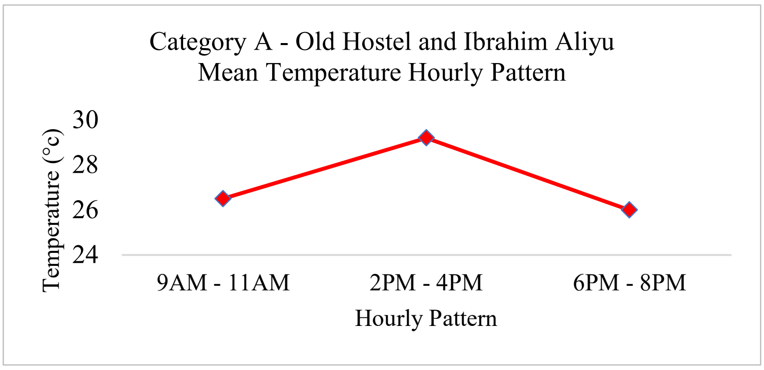

Figure 1: Mean temperature hourly pattern for category A Old hostel and Ibrahim Aliyu hostel

Figure 1 illustrates the hourly variation in mean temperature recorded three months period for Category A hostels specifically the Old Female Hostel and Ibrahim Aliyu Hostel, each accommodating six occupants per room. The results revealed a diurnal pattern where temperatures peaked between 9:00 a.m. and 5:00 p.m., with mean values ranging from 26.5°C to 29.2°C, while the lowest readings 26°C occurred during early morning hours (6:00 p.m.– 8:00 p.m.). Beyond the descriptive pattern, these elevated temperatures can be attributed to several building-related abd behavioral factors. First, the high occupancy density of six students per room significantly increases internal heat gains through metabolic heat release and electrical appliance use. Student rooms typically contain multiple fans, chargers, lighting fixtures which collectively contribute to internal heat accumulation. Second, the architectural configuration of the older hostel blocks appears to limit effective cross-ventilation, thereby restricting the removal of accumulated heat. Where window openings are small or positioned on a single façade, airflow pathways become limited, resulting in stagnant indoor air and higher temperatures. Building orientation and façade exposure may also contribute to the observed conditions. Hostel rooms exposed to the east-west solar path are particularly susceptible to solar hear gain during morning and afternoon periods. In tropical climates such as Minna, solar radiation penetrating through poorly shaded windows significantly increases indoor operative temperature, particularly in building constructed with high thermal mass materials that absorb and radiate heat throughout the day. These values significantly exceed the ASHRAE Standard 55 (2017) comfort band of 22°C–26°C for naturally ventilated environments, confirming that Category A hostels frequently experience thermal discomfort during daytime hours. The high occupancy rate (six persons per room) and limited cross-ventilation contribute to internal heat build-up, consistent with findings by Ricciardi and Buratti (2018) and Nematchoua et al. (2014). Such thermal conditions are known to impair concentration and increase fatigue among students (Lan et al., 2018; Hwang et al., 2016), underscoring the need for design and ventilation interventions.

Mean Temperature Hourly Pattern for Category B - NeedS Assessment and Shehu Aliyu Hostel

This depicts the hourly variation in mean temperature throughout the day for Category B hostels specifically, the NeedS Assessment and Shehu Aliyu Hostel each accommodating four occupants per room.

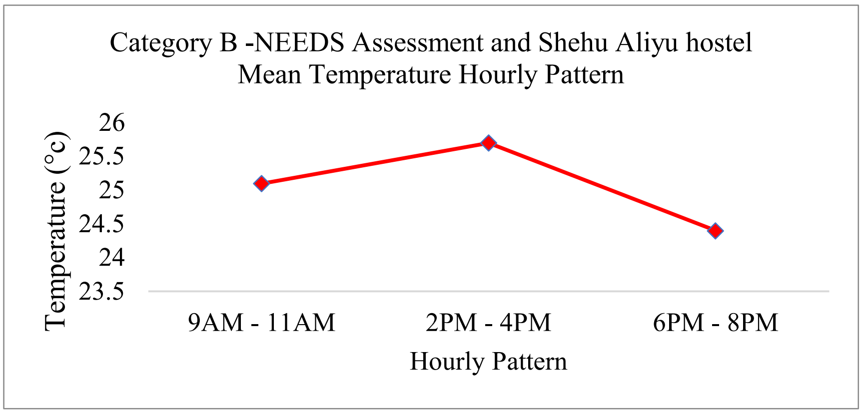

Figure 2: Mean temperature hourly pattern for category B - Needs Assessment and Shehu Aliyu hostel

Figure 2 presents the hourly mean temperature trend for Category B hostels, comprising the NEEDS Assessment and Shehu Aliyu hostel, with four occupants per room. The pattern mirrors that of Category A but with slightly reduced temperature amplitudes, averaging between 25.1°C and 25.7°C during peak hours. While at 6:00pm – 8:00pm it was 24.4°C. This relative improvement indicates that lower occupancy density contributes to a measurable reduction in indoor heat accumulation. With only four occupants per room, internal metabolic heat gain is considerably lower than in Category A hostels. Furthermore, the NEEDS Assessment hostels were constructed more recently and typically incorporate larger window openings and improved ventilation design, which enhances natural airflow through the rooms. Increased window-to-floor ratios allow greater air exchange between indoor and outdoor environments, thereby facilitating heat dissipation. In comparison with ASHRAE Standard 55 (2017) and CIBSE Guide A, most temperature values in Category B hostels fall within or very close to the upper comfort threshold. This indicates that while thermal conditions are relatively improved compared with Category A hostels, occupants may still experience occasional discomfort during peak afternoon hours when external air temperatures are highest. These findings reinforce the importance of occupancy density and ventilation effectiveness in determining indoor thermal performance (Frontczak and Wargocki (2011).

Mean Temperature Hourly Pattern for Category C Needs Assessment Hostel

This represents the hourly pattern of mean temperature measurements over the course of a day for the Category C Needs assessment hostel (Rooms with two person capacity).

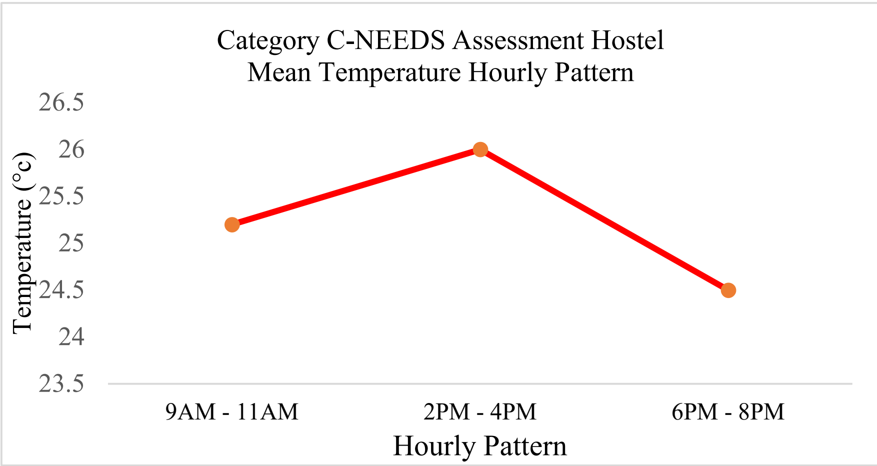

Figure 3: Mean temperature hourly pattern for category C Need assessment hostel

There was a minor fluctuation in the average temperature readings during the study period, as Figure 3 illustrates. Between 2:00 and 4:00 pm, the temperature was greater. The measured mean temperatures were 25.2°C, 26°C, and 24.5°C. The Category C pattern supports literature showing that reduced occupancy and favorable window-to-floor ratios enhance natural ventilation effectiveness and occupant thermal tolerance in warm climates (Yang et al., 2018; Lan et al., 2019). The improved thermal conditions observed in Category C hostels can largely be attributed to lower occupancy density and enhanced ventilation effectiveness, with only two occupants per room, the internal heat load generated by human metabilism and electrical appliances in minimal. Additionally, architectural design of the NEEDS Assessment hostels typically incorporates larger window openings, improved spatial planning, and better airflow pathways, which allow natural ventilation to remove excess heat more efficently. From a standards perspective, most recorded temperatures in Category C hostels fall within the acceptable thermal comfort limits of both ASHRAE Standard 55 and CIBSE guidelines, indicating that these rooms provide the most favourable indoor thermal environment among the hostel categories studied.

Mean Relative Humidity Hourly Pattern for Category A Old hostel and Ibrahim Aliyu Hostel

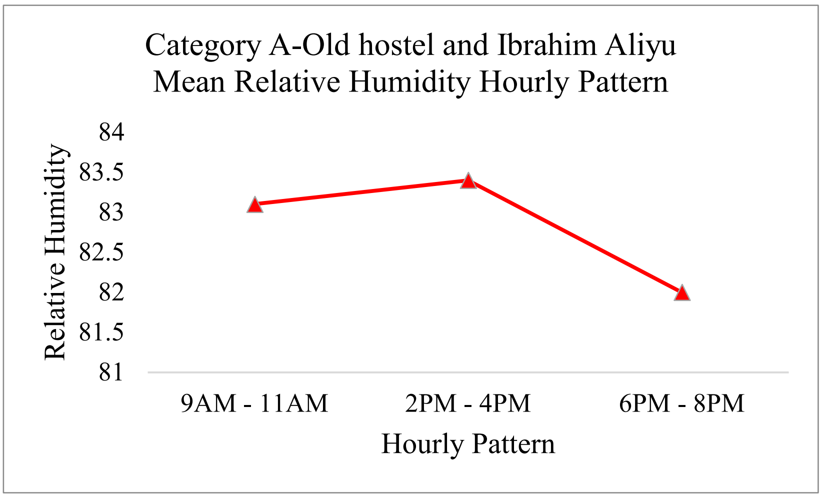

Figure 4: Mean relative humidity hourly pattern for category A Old hostel and Ibrahim Aliyu hostel room

Figure 4 depicts the slight variation in the mean relative humidity records for three months duration when this study was conducted. The values obtained are 83.1%, 83.4% and 82%. The upper limit for comfort zone relative humidity as specified by ASHRAE standard is 70%, none of the obtained values within this category falls below the standard. CIBSE guidelines recommend maintaining indoor relative humidity between 40% and 70% to ensure comfort and prevent moisture-related health risk. The high relative humidity observed in these hostels can be attributed to several interacting factors. First, high occupant density increases moisture generation through respiration, perspiration, and domestic activities such laundry drying within rooms. Second, inadequate ventilation limits the removal of moisture-laden indoor air, allowing humidity levels to accumulate over time. Third, the tropical climate of Minna naturally experiences high outdoor humidity, which may infiltrate indoor spaces when ventilation openings are present but not effectively positioned for cross-ventilation. Persistent high humidity also raises risks for sick building symptoms and degraded indoor air quality, concerns highlighted in related studies of student housing (Al Horr et al., 2016; Lan et al., 2022).

Mean Relative Humidity Hourly Pattern for Category B Needs Assessment and Shehu Aliyu Hostel

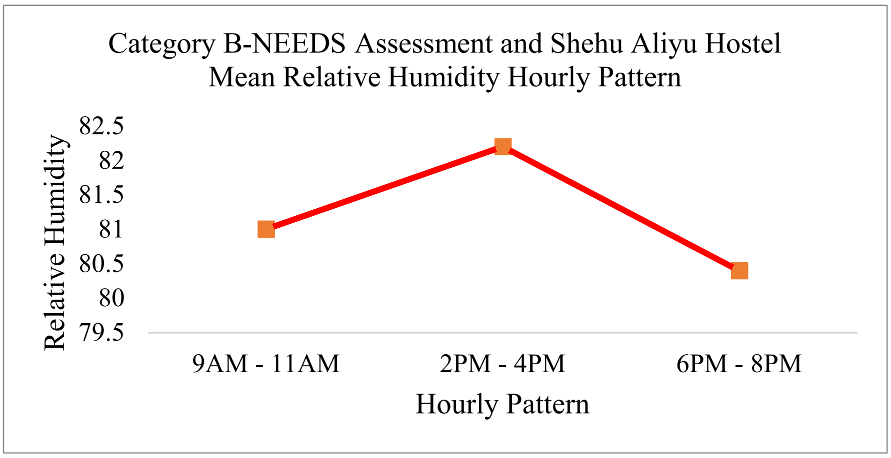

Figure 5: Mean relative humidity hourly pattern for category B NeedS assessment hostel and shehu aliyu hostel room

As shown in Figure 5, there was a slight variation in the mean relative humidity readings for the period the research was conducted. The values obtained are 81%, 82.2% and 80%. The reduction in humidity compared with Category A hostels can be explained by lower occupancy density and improved ventilation design. Rooms with fewer occupants generate less moisture, while improved airflow pathways facilitate moisture removal. However, despite these improvements, the humidity levels remain above the recommended limiteds due to the prevailing hot-humid climatic conditions and the absence of mechanical dehumidification systems. The upper limit for comfort zone relative humidity as specified by ASHRAE standard is 70%, none of the obtained values within this category falls below the standard. Elevated relative humidity reduces evaporative cooling and exacerbates thermal discomfort in hot–humid contexts (Waziri et al., 2015). This highlights the importance of integrating passive ventilation strategies such as larger window opening, shading devices, and improved airflow corridors in hostel design.

Mean Relative Humidity Hourly Pattern for Category C Needs Aassessment Hostel

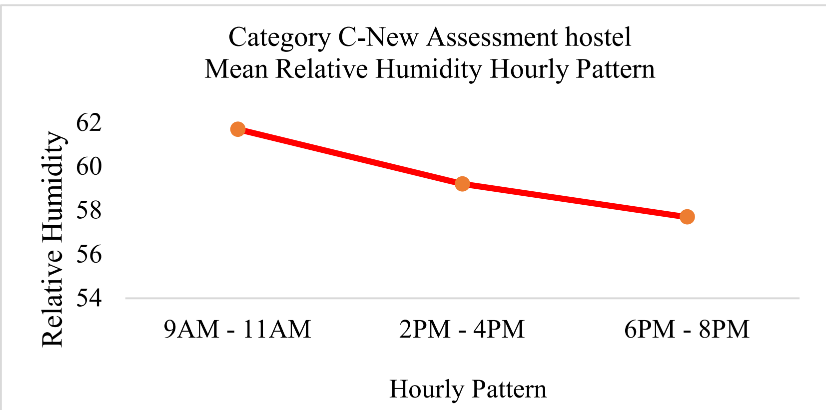

Figure 6: Mean relative humidity hourly pattern for category C New Assessment hostel

Figure 6 showed the hourly pattern of mean relative humidity readings within Category C lecture rooms over the course of a day. The mean readings obtained were 61.7% at 9am-11am, 59.2% at 2pm-4pm and 57.7% at 6pm-8pm, which were all within the standard as specified by ASHRAE Standard 55 and CIBSE guidelines. The relatively lower hudmidity levels in Category C rooms an be attributed to lower moisture generation due to reduced occupancy and more effective natural ventilation. Rooms designed for fewer occupants allow greater airflow circulation and reduce moisture accumulation. Additionally, improved window configuretion and building spacing may enhance natural wind movement, thereby improving humidity contral. This outcome reaffirms that occupancy density and ventilation effectiveness jointly determine RH control and perceived comfort (Frontczak & Wargocki, 2011; Nematchoua et al., 2014).

5.0 Conclusion

This study assessed the thermal comfort conditions in female hostels at the Federal University of Technology, Minna, focusing on temperature and relative humidity across varying occupancy categories. The findings showed that Category A hostel (Old Female Hostel and Ibrahim Aliyu Hostel), which accommodates six occupants per room, recorded the highest indoor temperatures ranging between 26.5 °C and 29.2 °C, exceeding the acceptable thermal comfort limits recommended by ASHRAE Standard 55 (22 °C - 26 °C) and CIBSE guidelines. Relatively humidity levels in these hostels were also consistently high, ranging from 82% to 83.4%, which is significantly above the recommended maximum threshold of 70%. These conditions are largely attributable to high occupancy density, limited cross-ventilation, and the architectural configuration of older hostel blocks, which restrict effective airflow and promote heat accumulation. In comparison, Category B hostels (NEEDS Assessment and Shehu Aliyu hostels), accommodating four occupants per room, record relatively lower temperatures ranging between 25.1oC and 25.7oC, although relative humidity levels remained high (80 – 82%). The improved thermal performance in these hostels is associated with moderate occupancy levels and improved ventilation features such as larger window openings, which enhance air exchange and reduce internal heat build-up. The most favourable indoor environmental conditions were observed in Category C hostels (two occupants per room), where temperature values generally remained within the acceptable thermal comfort range and relative humidity levels ranged between 57.7% and 61.7%, which fall within the recommended limited of both ASHRAE Standard 55 and CIBSE guidelines. These results demonstrate that lower occupancy density combined with improved ventilation design significantly enhances indoor thermal comfort in naturally ventilated hostel buildings in tropical climates. Based on the study's empirical evidence, several practical implications emerge for hostel planning and management in Nigerian universities. First, the results clearly indicate that high-density occupancy arrangements in older hostel buildings contribute significantly to thermal discomfort, as observed in Category A hostel. Therefore, university housing management should consider reducing the number of occupants per room or redesigning existing spaces to improve ventilation pathways. Second, the improved thermal conditions observed in Category B and Category C hostels highlight the importance of adequate window-or-floor ratios and effective cross-ventilation, indicating that future hostel developments should prioritise climate-responsive architectural design that enhances natural airflow and reduces solar hear gain. Third, the consistently high humidity levels recorded in Category A and B hostels indicate the need for targeted retrofitting measures such as improved window configurations, shading devices, and ventilation enhancements to reduce moisture accumulation and improve indoor air quality.

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