The Arab International Journal of Digital Art and Design

Volume 4 - Special Issue, March 2025

## Ventilation and air conditioning affect users' experience in sports club

## Nayera hossam

Interior Architect mariam.

nayera.hossam@gaf.ac

#### Samer Abdel Hamid Elokdah

Teacher Assistant at the School of Creative Arts, IAD Department –

GAF,

s.elokdah@gaf.edu.eg

Indjy M. Shawket

Associate professor at the School of Humanities and Creative Arts -

GAF,

I.shawket@gaf.edu.eg

ng\_mohamed@hotmail.com

## Prof. Dalia Mohamed Ezzat.

Professor of Environmental Design and program leader of Interior Architecture and Design, school of Creative Arts, The University of Hertfordshire, Egypt.

d.salim@gaf.ac

#### Abstract

In clubs, where high occupancy rates and physical activity can result in elevated pollutant concentrations, ventilation is a crucial component of indoor air quality (IAQ) control. Since they aid in the dilution and removal of indoor air pollutants such as carbon dioxide (CO2), volatile organic compounds (VOCs), and particulate matter (PM), efficient ventilation systems are crucial for designing and maintaining a healthy atmosphere.

Studies reveal that insufficient ventilation may lead to high concentrations of these contaminants, causing discomfort and upgrading the level of motivation and possible health hazards for

Date of submission:31/12/2024	Date of Acceptance: 23/1/2025
Proceedings of the International Conference on Gre	en Design and Smart Cities under
the slogan Environmentally Friendly Practices in th	ne Digital Age" El Gouna, Egypt -
24:26 January 2025	
~ <b>~</b>	

users. For example, research has demonstrated that human occupancy in fitness clubs dramatically raises particulate matter concentrations, which frequently surpass advised safety criteria because of cleaning product use and user physical exertion. Additionally, inadequate ventilation might cause problems associated with thermal comfort since excessive temperatures and humidity can create an uncomfortable atmosphere that impairs performance and user experience

The objective of this study is to focus on clubhouses in Egypt in different zones to ENHANCE their physical performance and then find the causality between the effect of the design and the user's physical performance. The results of this study discuss theoretically the main design parameters that enhance the negative correlations found and achieve a good quality of air to reflect athletes and performance.

## **Keywords:**

Ventilation; clubhouse; sustainability; physical abilities.

## I. Introduction

Ventilation plays a critical role in shaping the environment within sports clubs, directly influencing user experience, performance, and overall health. As these facilities often accommodate high levels of physical activity, the demand for fresh air becomes paramount to ensure optimal air quality. Poor ventilation can lead to increased concentrations of pollutants, including carbon dioxide and volatile organic compounds, potentially hampering athletic performance and diminishing the quality of workouts. Furthermore, adequate airflow not only regulates temperature but also aids in deterring the spread of airborne pathogens, which is essential in communal spaces frequented by diverse groups. By enhancing the understanding of how ventilation systems impact the wellbeing of users, sports clubs can implement more effective designs and practices, fostering an environment that promotes health, safety, and peak performance. Consequently, studying the implications of ventilation within these spaces is vital for club management and user satisfaction alike.

## A. Overview of the importance of ventilation in sports clubs

Ventilation plays a critical role in maintaining a healthy environment within sports clubs, influencing both the performance and well-being of users. Inadequate ventilation can lead to elevated levels of airborne pollutants, including particulate matter and volatile organic compounds, which can significantly degrade indoor air quality (IAQ) (cite2). Poor IAQ has been linked to respiratory issues and reduced athletic performance, the necessity for effective air exchange systems. underscoring Furthermore, the high occupancy levels typical in gymnasiums and exercise areas exacerbate the buildup of carbon dioxide and humidity. which can hinder physical exertion and lead to discomfort (cite2). As such, regular maintenance of ventilation systems not only improves the physical environment but also fosters a space conducive to enhanced psychological and physical performance. Consequently, optimizing ventilation is essential for the overall health and efficacy of athletic training in sports clubs.

## II. Impact of Ventilation on Air Quality

The impact of ventilation on air quality within sports clubs is crucial for the health and performance of users. Inadequate ventilation can lead to the accumulation of airborne pollutants, significantly affecting indoor air quality. Findings indicate that human occupancy in these facilities tends to

elevate particulate matter levels, often exceeding previous benchmarks (cited in (Catia Peixoto et al., 2023)). For instance, activities in cardio fitness and bodybuilding areas can produce particulate concentrations two to three times higher than in other spaces, underscoring the need for effective ventilation systems. Furthermore, the presence of volatile organic compounds (VOCs), which often exceed safety thresholds due to cleaning agents, further complicates air quality issues. Consistently maintaining optimal indoor air quality ensures not only the comfort and well-being of athletes but also their overall performance, highlighting the intrinsic link between effective ventilation and user satisfaction in sports clubs.

ACH, or air changes per hour, is the ventilation rate. Active Spaces (such as courts, fitness centers, and gyms): Ten to fifteen air changes per hour (ACH) is the goal. This guarantees the flow of fresh air to sustain moderate to high occupancy and high activity levels.

Areas with less activity or fewer people (such as lounges and dressing rooms): For areas with less severe physical activity, an ACH range of 4-6 is usually adequate.

Standards for Air Quality: The World Health Organization (WHO) and the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) recommend that indoor places with high occupancy, such as gyms, have an airflow of around 10-15 L/s per person of fresh air. This guarantees adequate oxygen and a decrease in CO2 accumulation.

CO2 Levels: The amount of CO2 present should not be more than 1000 parts per million. per million), with optimal amounts in a sporting facility being closer to 600–800 ppm. This usually corresponds to enough airflow to guarantee that participants are breathing clean air and aren't feeling worn out or uncomfortable due to poor air quality.

Humidity Control: To keep things comfortable and stop mould from growing, relative humidity should be kept between 40% and 60%. When combined with appropriate ventilation, the HVAC system can regulate this.

Fresh Air Intake (Suggested Levels): In a sports club or other area with adequate ventilation, the fresh air intake should typically range from 15% to 30% of the total air pumped. Spaces with moderate activity, such as gyms, fitness centers, and workout studios, often include 15%–20% fresh air. High-occupancy or high-intensity exercise spaces (such as courts,

expansive open gyms, or spaces with vigorous aerobic activities) may require 25%-30% fresh air.

Control of CO2: How much fresh air is required can be determined by keeping the CO2 concentration below 1000 parts per million. To improve oxygen intake and expel carbon dioxide, the ventilation system should raise the percentage of fresh air delivered whenever CO2 levels rise. Distribution of

#### Airflow:

The overall rate of airflow (in Depending on the proportion of fresh air intake, the air changes each hour must be modified. To maintain the ideal indoor climate (temperature, humidity, etc.), a system that brings in a bigger percentage of fresh air will need more energy or a larger capacity. An example of a sports club ventilation scenario might be: Fitness Facilities /

Spacious Gym: 25% to 30% of the air that is circulated is fresh air. The remaining 70% to 75% of the air might be recirculated and filtered using MERV or HEPA filters to get rid of germs and particle debris. Changing rooms

and locker rooms: To guarantee adequate moisture and odour management, you might wish to raise the fresh air percentage to between 20% and 25% due to the higher humidity and perhaps larger amount of impurities.

## A. Relationship between ventilation and indoor air pollutants

In sports clubs, the relationship between ventilation and indoor air pollutants plays a crucial role in the health and comfort of users. Effective ventilation systems are essential for diluting and removing contaminants that accumulate in enclosed spaces, such as volatile organic compounds, carbon dioxide, and biological pollutants, all of which can adversely affect performanceand well-being. Research indicates that inadequate ventilation can lead to elevated levels of indoor air pollutants, resulting in discomfort, respiratory issues, and decreased physical performance among athletes Furthermore, a user-centric approach to evaluating ventilation in sports facilities highlights the importance of building services that support optimal air quality. According to recent studies, enhancing ventilation not only reduces airborne contaminants but also improves overall user satisfaction and performance metrics in sports environments, reinforcing the significance of air quality management in sports clubs). Nayra Hossam, TA. Samer Abdelhamid Elokdah, Dr. Indjy M. Shawket, Prof. Dalia

Mohamed Ezzat

## **III. Effects of Ventilation on User Performance**

Effective ventilation is crucial for optimizing user performance in sports clubs, as it directly influences the indoor air quality and overall environment of training facilities. Poor ventilation may lead to elevated levels of carbon dioxide and airborne pollutants, resulting in decreased oxygen availability and increased fatigue among athletes. Research indicates that inadequate airflow can exacerbate respiratory issues, particularly in environments with high humidity and warm temperatures, which are common in gyms and swimming facilities. Athletes, especially those engaged in high-intensity training, can experience diminished lung function and performance as a result of compromised air quality, highlighting the need for adequate ventilation systems. In a study examining the impact of training loads on respiratory health, it was found that moderate intensity can negatively affect lung function due to insufficient air movement. This underscores the importance of implementing effective ventilation strategies to support athletes' performance and overall well-being in sports clubs.

A. Influence of air circulation on athletic performance and endurance The influence of air circulation on athletic performance and endurance is a critical factor that sports clubs must consider when designing training environments. Optimal ventilation significantly enhances the respiratory efficiency of athletes during intense workouts, thereby impacting their overall performance. Adequate airflow regulates temperature and humidity levels, reducing the risk of overheating and dehydration, which can adversely affect stamina and concentration. Furthermore, a wellventilated space minimizes the concentration of airborne pollutants, promoting better respiratory health among users. Research has shown that effective ventilation practices are correlated with improved physiological outcomes, allowing athletes to sustain performance levels for extended periods Moreover, concerns regarding arrhythmias in endurance athletes underscore the necessity of maintaining proper ventilation, as the hearts response to exercise can be influenced by environmental factors, including airflow enhancing air circulation is pivotal for both immediate athletic performance and long-term health benefits.

## **Literature Review**

Different types of ventilation systems, including mechanical, natural, and hybrid systems that combine both, are used in sports venues. While mechanical ventilation systems rely on fans and ducts to manage air circulation, natural ventilation relies upon passive airflow through windows & vents



Figure 1 This for heating

Air Quality Indicators: Studies show that reducing indoor pollutants such carbon dioxide (CO2), volatile organic compounds (VOCs), and particle matter (PM) requires efficient ventilation. In order to keep these pollutants at safe levels, standards frequently place a strong emphasis on maintaining particular ventilation rates Health Implications: Research has indicated that insufficient ventilation might cause more respiratory problems in players and spectators, underscoring the necessity of strict regulations controlling indoor air quality in sporting settings.

Design Considerations: Various sporting facilities, including gyms, swimming pools, and fitness centres, have varying needs depending on occupancy levels and activities. These features must be taken into account when designing ventilation systems.

Regulatory Standards: There are a number of national and international regulations that govern indoor air quality (IAQ) in sports facilities. These regulations mostly concentrate on dose-related indicators, such as pollutant concentrations and airflow rates. However, tenant preferences and building-related elements that could improve total IEQ are not being adequately addressed.

Pollutant Concentrations and Ventilation Rates: Research has indicated that lowering indoor pollutant concentrations can result from raising ventilation rates. For example, a standardised ventilation rate has been associated with lower indoor ozone (O3) levels as well as lower levels of carbon dioxide (CO2) and particulate matter (PM).

Mechanical vs. Natural Ventilation: Studies contrasting mechanical and natural ventilation systems show that the former frequently offer more reliable air exchange rates, which can help regulate indoor air quality (IAQ) in a variety of building types.

Impact on Health: There is evidence linking increased ventilation rates to better health outcomes, indicating that higher IAQ helps residents breathe easier and feel better overall.

Regulatory Standards: A number of studies have looked at the relationship between effective ventilation techniques and adherence to existing IAQ standards, highlighting the significance of regulatory frameworks in fostering healthier indoor environments.



#### Figure 2 For mechanical heating

Long-term Monitoring: Studies that focus on the long-term monitoring of indoor air quality (IAQ) in buildings with different ventilation techniques offer valuable information about the long-term effects of persistent variations in air exchange rates on indoor environments.

Fresh air entry points, or inlets: Windows: Generous windows or vents that let in air.

Ventilation Louvres: To allow air to enter, they are placed close to the floor or lower portions of the walls.

Doors: Huge sliding doors or openings that are frequently seen at gym exits or sports club entrances.

Airflow:

Cross ventilation is the process by which air enters a structure from one side and leaves through vents on the other. Wind pressure and buoyancy-driven airflow—warm air rising and leaving, drawing in cooler air—help the flow.

The stack effect is the natural movement of air from lower to higher areas of a building when warm air rises within and escapes through higher apertures (such as skylights or roof vents). Air Exit Points, or Exhausts

(Cool Air) | (Warm Air)

Inlet ---> | Gym/Club |---> Exhaust (Roof)

## Methodology

## **Importance of Ventilation in Sports Clubs**

Health Implications: To ensure that fresh air circulates throughout the building and to lower the concentration of indoor pollutants, adequate ventilation is crucial. This is especially crucial in sports clubs since intense physical activity can raise respiratory rates, which increases the likelihood of inhaling potentially hazardous compounds if the air quality is poor (Mendell & Heath).

User Comfort: Surveys can be used to determine how comfortable users are with air quality and temperature control. Depending on their activity, users may have various impressions. For example, people who work out hard could need different ventilation settings than people who work out lightly (Baker et al.)

Employee Insights: Employees frequently have direct knowledge of how ventilation systems work. Their observations can yield important details regarding system maintenance problems, effectiveness, as well as areas that require work (Fisk).

Regulatory Compliance: Sports organisations can guarantee adherence to regional health laws concerning indoor air quality requirements by having a thorough understanding of user experiences. Staff interviews can provide insight into how successfully these rules are being followed (World Health Organisation).

Design Enhancements: Future ventilation system design enhancements for sporting facilities can be influenced by input from patrons and employees. This could entail introducing new technology to improve air quality or updating current systems Nayra Hossam,TA.Samer Abdelhamid Elokdah, Dr. Indjy M. Shawket, Prof. Dalia

## **Observational Studies and Measurements for IAQ Assessment**

Sampling of the Air: gathering air samples from various parts of a facility in order to test for pollutants like carbon dioxide (CO2), particulate matter (PM), volatile organic compounds (VOCs), and other dangerous gases. Among the methods are real-time monitoring devices, active sampling with pumps, and passive sampling Surface Samples: To find mold spores, bacteria, dust mites, and other allergens, samples are taken from surfaces using swabbing or tape-lifting techniques. This aids in locating possible indoor pollution sources. Measurements of the Ventilation Rate:

Using instruments like anemometers or flow hoods, HVAC systems measure airflow rates to see if the ventilation satisfies prescribed criteria. assessing how well the exhaust and supply systems maintain sufficient air exchange rates.

Temperature and Humidity Monitoring:

constant observation of relative humidity and temperature levels in indoor spaces, as these elements have a big impact on IAQ. Extreme temperatures can have an impact on occupant comfort, and high humidity can encourage the formation of mold.

Evaluations of the condition of buildings:

visual examinations of HVAC systems, building materials, and any contamination sources (such as mold development caused by water damage). examining HVAC system maintenance records to make sure they are operating properly.

Performing regulated: tests of various ventilation techniques or technologies in simulated settings. For instance, research might examine the effects of different air flow speeds on formaldehyde or volatile organic compounds (VOCs) concentrations.

## **Key Indicators of Ventilation Impact**

**Concentrations of Pollutants:** Air pollutants can come from a variety of sources, such as industrial discharges, automobile emissions, and domestic activities like cleaning and cooking. Location, season, and particular meteorological conditions can all have a significant impact on these pollutants' concentrations. Particulate matter (PM), carbon monoxide (CO), sulphur dioxide (SO2), nitrogen dioxide (NO2), ozone (O3), and volatile organic compounds (VOCs) are examples of commonpollutants.

Certainly! Below is a (hypothetical set of results )for the questionnaire on natural ventilation in a sports club. These results are based on the responses from a sample of \*\*100 respondents\*\* (sports club members) and provide insights into their experiences and perceptions related to natural ventilation.

## Hypothetical Results for Natural Ventilation Questionnaire

Section 1: General Information



#### Figure 3 Key Insights and Conclusions

#### 1. General Satisfaction:

- While 40% of respondents rate the air quality as good, only 12% describe it as excellent. There is room for improvement in the overall air quality within the club.

## 2. Natural Ventilation Effectiveness:

- A majority (55%) of respondents feel more comfortable with natural airflow over air conditioning, but a significant portion (30%) prefers air conditioning, indicating that natural ventilation might not be sufficient in all situations.

## **3.** Comfort and Airflow:

- While most users feel that air quality does not negatively impact their exercise, 15% report discomfort. This suggests that natural ventilation may not always meet user needs, particularly in more crowded areas.

## 4. Need for Improvement:

-50% of respondents would prefer more natural ventilation, with suggestions including the addition of more windows and vents, improving airflow distribution, and more frequent window openings.

## **5. Temperature Control:**

- A moderate percentage of users (30%) notice temperature issues, and nearly 28% of users feel the current ventilation system is insufficient for the number of people using space.

#### **Recommendations Based on Results:**

- Increase Fresh Air Intake: Consider opening more windows and improving the number and placement of vents to increase airflow in high-traffic areas.

- Stack Ventilation & Cross Ventilation: Enhance airflow by strategically placing windows, vents, and exhaust points to encourage cross and stack ventilation, especially during peak times.

- User Education: Educate users on the benefits of natural ventilation (e.g., energy-saving and health benefits) to increase appreciation for the system.

- Hybrid Systems: Explore hybrid systems that combine natural ventilation with mechanical ventilation (for more controlled airflow), especially in high-activity areas like gyms and courts.

- Temperature Regulation: Introduce passive cooling techniques (e.g., fans, shading devices) to ensure a comfortable temperature range, particularly during warmer months.

These results help provide actionable insights to optimize natural ventilation and improve the user experience in the sports club. **Humidity Levels** 

Because it influences both the physical characteristics of the air and the behaviour of pollutants, humidity is a crucial factor in air quality. By encouraging the production of secondary pollutants like ozone, high humidity levels can worsen the impacts of some pollutants. High humidity can also encourage the growth of important allergens like mould and dust mites indoors.

Low humidity, on the other hand, might result in dry air that aggravates respiratory systems and makes people more vulnerable to diseases. It also has an impact on how long some pollutants stay in the air; for example, higher humidity might speed up particle settling since it contains more water vapour.

## Temperature

Temperature affects atmospheric stability and pollutant chemical reactions, which in turn affects air quality. Higher amounts of ground-level ozone, a dangerous pollutant created when sunlight combines with VOCs and NOx emissions, are generally the result of warmer temperatures because they speed up chemical processes in the atmosphere. Furthermore, stagnant conditions caused by temperature inversions, in which warm air traps cooler air at lower elevations, can enable pollution to build up close to the ground. When heating systems are in use throughout the winter, this phenomenon is especially prevalent in urban areas. In conclusion, knowledge of the relationship between pollutant concentrations, humidity, and temperature fluctuations is necessary for efficient air quality management. Keeping an eye on these variables reduces the health hazards brought on by bad air quality.



Figure 4 For systematic ventilation

## Analysis of Findings

## **Types of Ventilation Systems in Sports Clubs**

When designing ventilation systems for sports clubs, several types can be employed to ensure adequate indoor air quality (IAQ) and comfort for users. The choice of system often depends on the specific needs of the facility, including its size, usage patterns, and budget constraints. Below are the primary types of ventilation systems commonly used in sports clubs:

Mohamed Ezzat



Figure 5 natural ventilation 1

Natural ventilation relies on passive airflow through openings such as windows, doors, and vents. This system takes advantage of wind pressure and temperature differences to circulate air without mechanical assistance. While it can be cost-effective and energy-efficient, natural ventilation may not always provide sufficient control over indoor air quality or temperature during peak usage times or in extreme weather conditions.

## 2. Mechanical Ventilation



Figure 6 mechanical ventilation 1

270

The Arab International Journal of Digital Art and Design Volume 4 - Special Issue, March 2025 Mechanical ventilation systems use fans and ductwork to actively circulate air throughout the facility. These systems can be further categorized into two main types:

- Exhaust Ventilation Systems: These systems remove stale air from the facility, creating negative pressure that allows fresh air to enter through passive inlets. This method is effective for controlling humidity and odors but may not always ensure balanced airflow.
- **Supply Ventilation Systems:** These systems use fans to introduce fresh outdoor air while simultaneously expelling stale air, creating a controlled and balanced airflow that enhances IAQ.
- **Balanced Ventilation Systems:** Combining both exhaust and supply methods, these systems maintain consistent air quality and temperature control throughout the facility.

3. Hybrid (Mixed-Mode) Ventilation

Hybrid ventilation systems integrate natural and mechanical ventilation approaches, adapting based on environmental conditions and occupancy levels. These systems optimize energy efficiency while ensuring adequate airflow and air quality control.

Comparison of User Satisfaction Levels

User satisfaction with ventilation systems in sports clubs depends on various factors, including thermal comfort, air freshness, humidity control, and energy efficiency. Studies have shown that a well-designed ventilation system significantly enhances user experience by maintaining optimal indoor conditions.

User Comfort and Ventilation Standards: Establishments that follow stricter ventilation guidelines tend to have better air quality, which lowers the concentration of airborne contaminants and improves thermal comfort. According to studies, those who use these settings report a more enjoyable experience overall and have less respiratory problems.

Effect of Air Quality on Performance: In athletic environments, optimal IAQ is associated with both comfort and performance. When discomfort from poor air quality doesn't distract athletes and participants, they are more likely to perform better and be more satisfied.

Feedback from Occupants: According to surveys done in a number of sporting facilities, patrons frequently name the air quality as the main element affecting their overall experience. Modern HVAC systems in

buildings that either meet or surpass recommended ventilation rates get more favourable comments from people.

## Discussion

Health Outcomes

Regulation of Air Quality: By reducing and eliminating pollutants including carbon dioxide (CO2), volatile organic compounds (VOCs), and particle matter, efficient ventilation systems contribute to the preservation of indoor air quality. Increased weariness and diminished cognitive function brought on by high CO2 levels can have a negative impact on athletic performance. According to studies, athletes who train indoors are less likely to develop asthma and other respiratory disorders when the air quality is better (Mendell

Temperature Control: Ventilation systems help keep training spaces at a comfortable temperature. Athletes must maintain an ideal body temperature since too much heat can cause heat stress, dehydration, and diminished physical performance. Ventilation aids in dissipating heat produced during exercise by guaranteeing sufficient airflow, enabling athletes to perform at the best they can without getting sick from the heat (Baker et al.). Control of Humidity: Excessive humidity can be uncomfortable and make physical activity seem more taxing. By letting moisture-laden air escape and bringing in drier air from outside, proper ventilation helps control humidity levels. Maintaining comfort throughout workouts is essential for improving endurance and general performance (Gonzalez et al.). Reduction of Airborne Pathogens: In places like gyms and sports facilities, where a lot of people gather, good ventilation lowers the concentration of airborne pathogens that can spread infectious diseases like COVID-19 and influenza. Increased airflow improves overall health safety by reducing the risk of transmission among athletes and leisure users (Miller et al.).

## Recommendations

## Best Practices to Enhance IAQ and User Comfort

Control of the Source:

Determine and get rid of indoor pollution sources. This entails utilizing low-VOC paints and adhesives, sealing asbestos-containing objects and making sure gas stoves are set correctly to reduce emissions. Maintain and check items like water heaters and furnaces that could release pollutants on a regular basis. Better Airflow:

When the weather permits, open windows and doors to let more outdoor air into the house. To eliminate pollutants straight from bathrooms and kitchens, use exhaust fans in these spaces. Energy-efficient heat recovery ventilators (HRVs), which may introduce fresh air while reducing energy loss, are one type of mechanical ventilation system that should be installed. <u>Filtration and Air Cleaners:</u>

To efficiently capture airborne particles, use high-efficiency particulate air (HEPA) filters in air cleaners. Make sure that any air purification equipment is suitable. for the space's dimensions. To keep HVAC systems' filters effective in eliminating pollutants, replace them on a regular basis.

Track the quality of the air indoors:

Put in place monitoring devices that can identify carbon dioxide (CO2) and other pollution levels and send out notifications when ventilation needs to be enhanced. Assess indoor environmental quality (IEQ) on a regular basis to find possible problems with temperature, lighting, acoustics, and air quality.

Preserve the Humidity Levels:

Maintain indoor humidity levels between 30% and 50% to keep dust mites and mould at bay. If required, use dehumidifiers in wet spaces, such as basements.

## Conclusion

In sports clubs, ventilation is essential to maintaining patrons' comfort, safety, and well-being. By lowering the concentration of airborne pathogens, such as viruses like SARS-CoV-2, adequate ventilation lowers the danger of transmission between customers and employees. Increased carbon dioxide (CO2) and other pollutants brought on by inadequate ventilation can have a detrimental effect on indoor air quality (IAQ), causing users to feel uncomfortable, perform worse, and possibly develop health problems. Maintaining a pleasant temperature while ensuring adequate airflow is crucial, especially in colder areas where ventilation and heating demands may clash. Furthermore, the degree to which ventilation may be enhanced after construction is frequently constrained by the layout and mechanical capabilities of existing facilities. Consequently, it is essential for owners of sporting facilities to Give top priority to efficient ventilation techniques that not only meet health regulations but also improve user satisfaction by creating a secure and cosy atmosphere.

Nayra Hossam,TA.Samer Abdelhamid Elokdah, Dr. Indjy M. Shawket, Prof. Dalia Mohamed Ezzat

#### References

- 1. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)
- 2. ASHRAE develops standards related to HVAC systems that include recommendations for maintaining good indoor air quality through effective ventilation practices. Link: <u>ASHRAE Standard 62.1</u>
- 3. Environmental Protection Agency (EPA): Provides resources on air quality and ventilation best practices. <u>NIOSH Ventilation</u> <u>Guide</u> | <u>IAQA Website</u> | <u>EU Indoor Air Quality</u> June 1-4, 2025 in Lexington, KY.
- 4. Public Law 91-596 84 STAT. 1590 91st Congress, S.2193 December 29, 1970, as amended through January 1, 2004. (1) An Act

## 5. World Health Organization (WHO)

The WHO provides guidelines on indoor air quality that emphasize the importance of proper ventilation in public spaces like sports facilities for protecting occupant health. Link: <u>WHO IAQ Guidelines</u>

# التهوية وتكييف الهواء تؤثر على تجربة المستخدمين في النادي الرياضي

نيرة حسام مهندسة معمارية داخلية nayera.hossam@gaf.ac سامر عبد الجميد العقدة مساعد مدرس في كلية الفنون الإبداعية، قسم التصميم الداخلي والتصميم الجر افيكىGAF s.elokdah@gaf.edu.eg إنجى م. شوكت أستاذ مشارك في كلية العلوم الإنسانية والفنون الإبداعيةGAF I.shawket@gaf.edu.eg ng\_mohamed@hotmail.com أ.د. داليا محمد عات أستاذ التصميم البيئ ورئدس برنامج العمارة الداخلية والتصميم كلية الفنون الإبداعية جامعة هيرتفوردشاير d.salim@gaf.edu.eg

المستخلص في بيئة الأندية الرياضية، حيث يمكن أن تؤدي معدلات الإشغال العالية والنشاط البدني المكثف إلى تركيزات مرتفعة من الملوثات، تصبح التهوية عاملاً حاسمًا في التحكم بجودة

الهواء الداخلي (IAQ). تعتبر أنظمة التهوية الفعالة ضرورية لتخفيف وإزالة ملوثات الهواء الداخلي مثل ثاني أكسيد الكربون (CO2)، المركبات العضوية المتطايرة (VOCs)، والجسيمات (PM)، مما يسهم في الحفاظ على بيئة صحية.

تشير الدراسات إلى أن التهوية غير الكافية قد تؤدي إلى ارتفاع تركيزات هذه الملوثات، مما يسبب عدم الراحة ويزيد من المخاطر الصحية المحتملة للمستخدمين. أظهرت الأبحاث أن الإشغال البشري في نوادي اللياقة البدنية يرفع بشكل كبير تركيزات الجسيمات، والتي غالباً ما تتجاوز معايير السلامة الموصى بها نتيجة لاستخدام منتجات التنظيف والمجهود البدني. علاوة على ذلك، قد تسهم التهوية غير الكافية في مشكلات تتعلق بالراحة الحرارية، حيث يمكن أن تؤدي درجات الحرارة والرطوبة الزائدة إلى جو غير مريح يضعف الأداء ويؤثر سلباً على تجربة المستخدمين.

تسعى هذه الدراسة إلى التركيز على الأندية الرياضية في مصر بمناطقها المختلفة لتحسين أدائها البدني، ومن ثم العثور على العلاقة السببية بين تأثير التصميم والأداء البدني للمستخدمين. تتناول نتائج الدراسة نظرياً المعايير الرئيسية للتصميم التي تعزز الارتباطات السلبية الحالية، وتحقق جودة هواء مثلى تعكس الأداء الرياضي الجيد.

الكلمات المفتاحية:

التهوية؛ النادى؛ القدرات البدنية المستدامة.