

## Technical skills required by standard automobile mechanical workshop in Akure, Nigeria

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**Abstract:** In recent time, unemployment has been identified as a major issue among the Nigerian youth. It fuels violent crimes, socially deviant behaviour, militancy, restiveness, and kidnappings. Youth unemployment is psychologically and economically destructive to both individuals and society as a whole. Hence, the role of automobile mechanical training cannot be overemphasized. This study delved into the technical abilities needed by an apprentice to graduate as an automobile mechanical artisan and build a quality mechanic firm. The study was conducted in Akure, Ondo state, Nigeria. The descriptive survey research design was used in this study. The sample included eight automobile mechanical artisans working in automobile workshops under the jurisdiction of Akure South Local Government Area, Ondo State, were chosen at random. The study found that current technical abilities in the repair of ignition systems, carburettors, including wheel balancing and alignment, are necessary for automobile mechanical apprentices to graduate as artisans and build a quality automobile mechanical firm in Akure. It was noted in the study that the establishment of modern automobile mechanical firms requires competent artisans that would apply electronic devices to diagnose the defective sections of automobile. This is a firm where youths can successfully acquire skills in automobile mechanics towards ensuring efficiency, safety and cost-effectiveness of automobile. Based on the findings, recommendations were suggested.

**Keywords:** Akure, Automobile mechanical, Maintenance, Nigeria, Skill acquisition, Unemployment.

### 1. Introduction

Entrepreneurial skills are the talents required for autonomy and independence, taking initiative, seeking business opportunities, self-confidence, and perseverance in any business opportunity (Abuda, 2015). Udogu (2015) defined entrepreneurship as the ability of a person or group of people to undertake enterprises with the possibility of success or failure. However, the majority of successful entrepreneurship resulted in the creation of new corporate enterprises. According to Medina (2011) an enterprise is an organized commercial activity that is explicitly oriented toward growth and profit-making. According to Agada (2014) an enterprise is defined as a partially overlapping organization that works together with the rules and laws that guide them for some time to fulfil specified objectives of the organization.

A graduate is expected to find a well-paying job following the completion of his studies, but the harsh truth in the Nigerian labour market is that completion of tertiary education does not guarantee any gainful employment in recent time. However, this was not always the case in the early 1960s and 1970s (Onyeonoru, 2022) it was common for new university graduates, and even graduates of teaching colleges, to find occupations ranging from clerical to professional, and everything in between (Okafor,

2021). High-profile companies and corporate representatives were known to make enticing offers to the smartest college graduates. So, what went wrong? What transformed the fate of the Nigerian graduate from high expectations of landing a promising job to the bleak reality of unemployment that has defined the Nigerian labour market?

Any country's population is classified into two groups: economically active and economically inactive. The labour force is made up of people who are willing and able to work, including those who are actively involved in the production of goods and services (employed) and those who are not (Bilau et al., 2015). The economically inactive category, on the other hand, includes persons who are unable to obtain meaningful employment owing to old age, a lack of education, or health-related concerns, as well as those who are generally reluctant to work.

Unemployment, according to a variety of definitions, refers to a condition in which people who are capable and eager to work are unable to obtain an adequately paid job. Nigeria's unemployment rate has reached frightening proportions. According to a study released on the website of the National Bureau of Statistics (NBS) in the first quarter of 2021, Nigeria's unemployment rate has climbed from 27.1 % in the second quarter of 2020 to 33 %. In the fourth quarter, the unemployment rate for persons aged 15 to 24 was 53.4%, while it was 37.2% for those aged 25 to 34. The unemployment rate for women was 35.2%, while it was 31.8% for males (Clement, 2022). With all these devastating figures, there is a need to acquire technical skills such as automobile mechanical skills.

An artisan with practical skills, technical knowledge, and the ability to diagnose and carry out motor vehicle repair and maintenance earned via an apprenticeship at a registered automobile mechanical skill acquisition centre should lead the company. Many observers, however, doubt that graduates of apprenticeship programs will be able to start and run ordinary auto repair shops. According to Thomas (2013) a higher proportion of apprenticeship program graduates who established automobile mechanical businesses are unable to service the carburettor, fuel lift pump, and fuel pipes and are unskilled in their respective area of specification due to poor quality instruction, teaching, and training received while undergoing training (Audu, Yusri, & Farhad, 2013).

According to Abuda (2015) the average commercial automobile mechanical lacks the technical ability required to diagnose, maintain, and repair the ignition system, carburettor, and tire alignment and balance. Due to declining maintenance operating standards, non-application of technical abilities, a poorly equipped workshop, and non-functional motor vehicle enterprises in the region, this circumstance had a detrimental influence on vehicle owners and the Akure metropolitan transportation system. In light of this, this study is being carried out to examine the skills gap required by an automobile mechanical apprentice for the establishment of a standard automobile mechanical workshop after graduation in Akure, Ondo State.

The purpose of this study is to identify the mechanical abilities required by automobile mechanical apprentices to establish standard automobile mechanical firms following graduation in Akure, Ondo State. The study is guided by the following questions:

- 1) What technical skills do automobile repair apprentices require in wheel alignment and balancing to establish a quality automobile mechanical firm in Akure after graduation?
- 2) What technical skills are required of an automobile mechanical apprentice in the repair and maintenance of carburettors to establish a standard automobile mechanical firm in Akure after graduation?
- 3) What technical abilities are required of an automobile mechanical apprentice in the maintenance of ignition systems to establish a standard automobile mechanical firm in Akure after graduation?

## 2. Literature

Employment is a contractual connection between two persons, one of whom is the employer and the other is the employee. According to the classical economist, full employment is reached when every one who chooses to be employed at the current rate of pay wishes to be employed (Oyebade, 2019). The most refined regard full employment in the economy as normal, and the occurrence of unemployment as

abnormal (Nwabah, 2011). The economic system is moving inexorably toward full employment. The occurrence of unemployment is the implication of government interference in the determination of the minimum wage as well as the unionization of labour (Oyebade, 2019).

According to Keynes (1936) anyone that is not willing to work at the wage rate may not be called jobless. However, Keynes further emphasizes that individuals cannot be prepared to work if they are unable to find a job. In other words, there is no such thing as involuntary unemployment. As a consequence, people find jobs if they want to work, thereby resulting to full employment. Full employment may be reached by maintaining enough effective demand (Keynes, 1936). Adebayo (2016) stated that full employment is reached when everyone in the working population has a job and is working at full capacity.

If a person in the working population is not actively engaged in occupation for a week or a month, or if output slows below its typical rate, it implies less than full employment, which happens when the entire nation's resources are dedicated to production. If resources are employed wisely, society achieves its maximum production, which is, of course, unattainable (Ajagbe, Sholanke, & Sani, 2015). According to Okafor (2021) full employment is one of the fundamental goals of government, along with price stability, trade and payment balance, and economic growth. However, the reverse of full employment is unemployment.

The discussion of unemployment is topical at both the micro and macroeconomic levels. Oyebade (2019) revealed that the notion of unemployment is perceived differently among different schools of thought economic disciplines. Nonetheless, economic theory is normally preoccupied with the challenges of allocating and using the means of production; however, the condition for labour employment has become significant since humans are both the means and the ultimate goal of productive activity. More so, it has been emphasized by Jhinagn (1975) that unemployment is among the intractable issues confronting many countries, and it is the involuntary idleness of a person who is willing to work at a prevailing wage rate but unable to find work. In contrast to the previous idea, involuntary unemployment occurs when an unemployed individual is eager and able to take a particular job at the going job rate but the job is out of reach or he is unable to obtain the job (Animashaun, 2017).

Because of the jobless scenario, economic waste emanates and invariably diminishes the production capacity of a nation. In ameliorating the unemployment situation, concerned authorities strive to manage the situation through appropriate policies and make frantic efforts to find answers to the problem (Osuala, 2017). No doubt, Nigeria's unemployment rate is very high. This is evident in the number of young school leavers walking the streets looking for work, which they never find. The aftermath of unemployment in the society results in prostitution, kidnapping, yahoo, robbery and other social vices. Concerning the above, Abdullah, Bilau, Enebuma, Ali, and Bustani (2012) stated that unemployment brings individuals immense pain and suffering. This is why unemployment is such an essential topic that requires critical debate in solving the menace it poses to society.

More logically, Ajagbe, Isiauwe, and Ogbari (2013) identified the forms of unemployment which are

- a) Frictional unemployment.
- b) Technological unemployment.
- c) Seasonal unemployment.
- d) Insufficient demand unemployment.
- e) Structural unemployment.
- f) Search unemployment.
- g) Cyclical unemployment.

These forms of unemployment operate at varying degrees within nations of the world. Adeniran and Sidiq (2018) further noted that there are several factors causing unemployment in Nigeria, among are population increase, sudden abandonment of the agricultural sector, corruption, and lack of technical skills among others.

Population growth: Clement (2022) observed that there is a link between population growth and unemployment. According to the author, in 1985, Nigeria had 6.1 % unemployment; by 2009, it had

risen to 19.7; 21.1% in 2010, 23.9% in 2018, and 27.1% in 2020 respectively. The assumption is that as the population expanded, so did the rate of unemployment. Corroborating the above, [Oyebade \(2019\)](#) noted that a rise in the population indicates an increase in labour supply. With 36.4% increase in population from 1991 to 2006 (16 years), and 55.5% gain in the economy for the same period, unemployment should have decreased dramatically, yet it soared by 74.8%, which invariably emanates as a result of increasing population over time.

**Neglect of the agricultural sector:** Neglect of critical industries, such as agriculture, in which the country enjoys a competitive advantage, is another cause of unemployment in Nigeria. According to the CBN, agriculture generated 34.1% of the Gross Domestic Product (GDP) in 2011 and 43.5% in 2018 ([Onyeonoru, 2022](#)). This marks a 9.4% growth, with the agricultural sector employing more than 50% of the labour force in the country ([Adebayo, 2016](#)). The unemployment rate should have decreased, but instead, it climbed by 69% because of the sector's chronic underfunding and shifts to crude oil exports ([Adeniran & Sidiq, 2018](#)).

**Corruption:** Without any doubt, another issue confronting Nigeria is corruption. Unfortunately, corruption has slowed economic growth and development; which invariably slowed Nigeria's economic progress, and resulted in high levels of mass unemployment ([Nwabah, 2011](#)). It is well-accepted that ascription and nepotism are prevalent in both the corporate and governmental sectors. Today's labour market is centred on less honourable attributes such as nepotism and favouritism rather than merit ([Okafor, 2021](#)). These, of course, have denied jobs to well-qualified, dedicated, and enthusiastic Nigerians ([Osuala, 2017](#)). This single factor has reduced the output performance of many sectors in Nigeria.

**Lack of skills:** This issue has been cited as a key cause of Nigeria's high level of unemployment. It was sad that the country's young graduates lack the necessary skills and abilities to be fit for occupations ([Clement, 2022](#)).

Among the widely acknowledged and most effective means of empowering citizens to stimulate sustainable national development is Technical Vocational Education and Training (TVET). TVET reduce poverty, improve quality of life, increase employment, reduce the incidence of social vices caused by unemployment, and promote democracy, a culture of peace, and freedom. The two basic goals of TVET, according to [United Nations Educational Scientific and Cultural Organisations \(2004\)](#) are to prepare workers for self-employment and to increase the productivity of the economy's informal sector. Vocational education, according to [Olaitan \(2012\)](#) is a branch of study that strives to build people's work attitudes, appreciation, and creativity, as well as to raise understanding of occupational entrance and progression criteria ([Wodi & Dokubo, 2012](#)).

Vocational education is rooted on skill acquisition ([Okwelle, Beako, & Ajie, 2017](#)) and skill acquisition is a type of training provided by individuals or groups of individuals that can lead to the acquisition of knowledge for self-sufficiency; it entails the training of people in various fields of trade under a legal agreement between the trainers and the trainees for a set period and under certain conditions ([Idoko, 2014](#)). Studies have identified skill acquisition as the formula for eradicating severe poverty and hunger by generating work opportunities, hence introducing an outlet for job development and wealth generation while fostering self-sufficiency and dependence ([Isaac, 2011](#)).

One of the vocational skill programs that is mostly conducted in an informal environment is the automobile mechanical training. It is best conducted with the apprenticeship method of education, and intended to generate qualified automobile technicians for society's technological and industrial progress. Automobile mechanical training is a vocational training curriculum at technical schools and authorized skills acquisition centres in Nigeria ([Hillary, Nnodim, & Orikoha, 2021](#)). Those who have learned the skills are expected to be gainfully employed or self-employed. According to [Jubril \(2011\)](#) a workshop is a space, area, room, or building where machinery, equipment, hand tools, workbenches, and materials are employed in the manufacture or repair of items.

As a result, an automobile mechanical workshop is a dedicated location, room, or hall where automobile mechanics employ workbenches, mechanical toolboxes, and other basic vehicle maintenance

and repair equipment to maintain vehicles. It includes current machinery and tools for work with sufficient ventilation and a layout plan in place. An automobile mechanic is a competent individual who has been trained in auto mechanics such as auto body repair and sprays painting, auto electrical work, auto body work (panel bashing), and auto parts merchandising (Okwelle & Nnodim, 2022). Automobile mechanics, according to Hiller and Coobes (2014) are professional individuals who specialize in motor vehicle maintenance, repairs, and occasionally modification.

An automobile mechanic trainee is a person who obtained technical skills in an informal setting in a specific automobile mechanical workshop over a predetermined period, and such person is referred to as an apprentice. An automobile is a wheeled self-propelled land vehicle with an internal combustion engine used for personal, goods and public transportation. It differs in appearance, the number of doors, and intended use (Abwage, 2011). For efficient operation of an automobile engine, the fuel supply system, lubrication system, ignition system, cooling system, and governor must be efficient. Understanding the principles of automobile engine and its operation is essential for effective and successful its repair and maintenance (Okwelle et al., 2017).

Cranmer (2014) defines skills as the ability and capacity developed by a purposeful, methodical, and prolonged effort to carry out complicated tasks or job duties involving concepts (cognitive skill), objects (technical skill), and/or people (interpersonal skills). According to Medina (2011) technical skills are hard skills involved with the use of tools, equipment necessary for effective and efficient work, and all technical concerns. According to Agada (2014) technical skills are knowledge and abilities that are specific to a single occupation or range of vocations. Mechanical technical abilities are defined in this study as the capacity to properly repair, service, and maintain engine components in line with the predefined standards or manufacturer instructions.

Giri (2013) observed that mechanical technical skills expected in carburettor maintenance and servicing include cleaning and repairing to ensure the float chamber allows fuel through the jet into an enlarged carburettor passage, replacing the defective pump, cleaning the fuel lines and properly connecting the unit, and installing the pump with a new gasket. According to Udogu (2015) such skills are required in maintaining and servicing modern automobile ignition systems include magnetic sensor testing, checking for spark with a plug wire or adapter, testing the ignition system with a multimeter, checking the crank sensor with a diagnostic tool, checking the battery to ensure there is sufficient voltage to start the engine, and testing and diagnosing defective regulator components.

According to Abwage (2011) the fuel supply system of a spark ignition engine consists of a fuel tank, a fuel lift pump, fuel pipelines, a sediment bowl, and a carburettor. It is also said that the carburettor's tasks include fully mixing the air and fuel, atomizing the fuel, regulating the air-fuel ratio at different speeds and loads on the engine, and supplying the right quantity of mixture at varying speeds and loads. These responsibilities are critical in engine functioning because gasoline travels from the carburettor to the engine cylinder via the engine's intake manifold.

According to the National Business and Technical Examinations Board (2007) automobile mechanicals need technical mechanical abilities in the maintenance, balancing, and alignment of wheels and tyres to establish a standard automobile mechanical firm. The technicians must have the abilities to maintain and repair contemporary motor vehicles. Maintenance is defined as any activity made on something to keep it running or return it to good functioning order. This guarantees that a piece of equipment or item continues to perform well and serves us well (Abwage, 2011).

The repair of equipment, automobiles, or other machinery to keep them in excellent functioning condition and, if altered, to return them to their original state is known as maintenance. Expert advice on mechanical technical skills obtained via organized vocational training at mechanical workshops and other skill acquisition centres that will boost entrepreneurship in the economy is critical and required for effective vehicle maintenance. Entrepreneurship is the process through which a person recognizes opportunities, distributes resources, and generates value by addressing unmet social needs (Payton, 2011). To succeed as an automobile mechanic, the apprentice must be entrepreneurial.

An example of an enterprise is a private automobile repair and maintenance workshop established in a specified location by an individual. The purpose of the study is to determine whether automobile technicians have relevant and current skills to provide based on what they were taught, as well as a good coordinating spirit to start a business following graduation, in Akure, Nigeria.

### 3. Methods

The study adopted a survey design, and purposive sampling was used to select the participants by considering the size of the workshop, patronage of vehicle owners and the number of trainees. Eight (8) senior registered automobile mechanic artisans operating mechanical workshops in Akure, Ondo State, Nigeria were selected for the study.

The instrument for data collection was a structured questionnaire, which was designed based on 5-point Likert-type scale of Highly Needed (5), Needed (4), Moderately Needed (3), Not Needed (2), and Highly Not Needed (1). The questionnaire was validated by two experts (first person from the Department of Logistics and Transport Technology, the Federal University of Technology Akure, and the second person is an experienced registered automobile mechanical operating in Akure). Their observations, corrections and suggestions were incorporated into the final version of the questionnaire before administration.

The reliability of questionnaire was determined using a pilot study on 6 senior automobile mechanical artisans operating in Akure South Local Government Area, Ondo State. The result obtained from the pilot study was subjected to reliability of internal consistency test using Cronbach's Alpha coefficient which yielded a coefficient of 0.71. Adeniran (2019) recommended an acceptable value of 0.7 for a good reliability coefficient; hence, the value obtained in this study is considered suitable for the study.

Descriptive statistics such as mean and standard deviation were used to analyze the questions. All the copies of the instrument were filled and returned by the respondents.

### 4. Results

*Research Question 1: What are the technical skills needed by automobile mechanical apprentices in the repair and maintenance of ignition systems for establishing a small-scale automobile mechanical enterprise in Akure?*

**Table 1.**  
Skills needed on repair and maintenance of ignition system.

S/No	Items	Mean	Standard deviation	Remark
1	Identify the on-board diagnostic port in vehicles	4.11	0.18	Supported
2	Inspect the throttle cable and adjust it where necessary	3.69	0.27	Supported
3	Use a multimeter to check the voltage supply	3.72	0.25	Supported
4	Carry out a careful visual inspection of the wiring	4.06	0.17	Supported
5	Replace distorted electronic ignition components	4.31	0.11	Supported

Table 1 revealed that all the items listed had mean values ranging from 3.69 to 4.31. This implied that the mean value of each item was above the cut-off point of 3.00, indicating that these five technical skills are needed by the apprentice of automobile mechanical in the maintenance and repair of ignition systems for establishing a standard automobile mechanical enterprise in Akure. The result shown in Table 1 also indicates that the values of the Standard Deviation (SD) range from 0.11 to 0.27. This implies homogenous perception of participants.

*Research Question 2: What are the technical skills needed by automobile mechanical apprentices in the maintenance of the carburettor system for establishing a standard automobile mechanical enterprise in Akure?*

**Table 2.**  
Skills needed on maintenance of carburettor system.

S/No	Items	Mean	Standard deviation	Remark
6	Cleaning and fixing to ensure the float chamber allows fuel through the jet into an enlarged carburettor passage	4.23	0.13	Supported
7	Fix to ensure the fuel jet is always slightly higher than the float chamber fuel level	4.19	0.89	Supported
8	Locate the carburettor on the intake manifold	3.89	0.78	Supported
9	Replace the defective pump and ensure a new gasket should be used while installing the pump at its place	3.51	0.73	Supported
10	Clean properly the fuel lines and the connecting unit components	3.47	0.69	Supported

The data in [Table 2](#) showed that all the items had their mean values ranging from 3.47 to 4.23, above the cut-off point of 3.00, signifying that all the highlighted technical skills are needed by the apprentice of automobile mechanic on the maintenance of carburettor for establishing standard automobile mechanical enterprises after graduation. The table also proved that the standard deviation (SD) of the items was within the ranges of 0.13 to 0.89, indicating homogenous perception of respondents.

*Research Question 3: What are the technical skills needed by automobile mechanical apprentices in wheel adjustment and balancing for establishing standard automobile mechanical enterprises in Akure?*

**Table 3.**  
Skills needed on maintenance of wheel adjustment and balancing.

S/No	Items	Mean	Standard deviation	Remark
11	Identify defective wheel speed sensors and tyre sizes for categories of vehicle	3.79	0.83	Supported
12	Exchange wheel and tyre positions in the correct sequence	4.49	0.12	Supported
13	Careful carry out a visual inspection and perform wheel alignment using appropriate modern equipment	3.97	0.92	Supported
14	Repair and replace distorted wheels and apply the required grease to the wheel bearings and sprockets	3.69	0.78	Supported
15	Check and tight ensuring the nuts-and-bolts hook to the wheels properly	3.89	0.81	Supported

The data presented in [Table 3](#) revealed that all items (five technical skills) had their mean values ranging from 3.69 to 4.49, which is above the cut-off point of 3.00. This implies that all the items listed in the table are needed by the apprentice of automobile mechanic in wheel adjustment and balances for establishing small scale enterprise after graduation. The table further showed that the standard deviation (SD) of the items were within the range of 0.12 and 0.92, signifying homogenous perception of participants.

## 5. Discussion

The technical skills required by automobile mechanical artisans in repairing and maintaining the ignition system were identified in the study. It found that: skills associated with replacement of faulty electronic ignition components; skills associated with the deployment of of multimeter to examine voltage supply; and skills associated with the inspection and adjustment of throttle cable, were the technical skills required by automobile mechanical artisans in repairing and maintaining the ignition system. This above finding corroborates the findings of [Giri \(2013\)](#) which found that monitoring of

ignition system, examination of throttle cable, and application of a multimeter are the main components of motor vehicles that require technicality.

Furthermore, the maintenance of carburettor system required technical skills on fuel jet, float chamber, intake manifold, defective pump, fuel line, and connecting unit. The finding agreed with the report of [Giri \(2013\)](#) who stated that all carburettors operate on the same basic principle pressure differential and incorporate the same basic system of passages, ports, jets and pumps.

Lastly, the study found that for standard automobile mechanical firm to be established in Akure, the apprentice must be conversant with wheels adjustment and balancing by acquiring skills in using modern equipment such as wheel speed sensor. This finding is in agreement with the findings of [Bestman \(2012\)](#) and [Thomas \(2013\)](#) which found that a viable automobile mechanical artisan need to be proactive, versatile and be acquainted with modern electronic and mechanical devices in diagnosing defective wheels and other engine components of automobiles.

## 6. Conclusions

Establishing a modern automobile mechanical enterprise lies solely on the availability of experts and equipment. It is only these specialists that can establish standard automobile mechanical workshops that will guarantee quality manpower in the area of automobile mechanical trade and improve youth empowerment and development of society. However, to have a standard automobile mechanical workshop where youths can successfully acquire skills in automobile mechanics towards ensuring its automobile efficiency, safety and cost-effective hinges on the following recommendations:

- a) Nigerian government should establish a modern automobile mechanical workshop where graduates and non-graduates can be trained to acquire automobile mechanical skills required for maintaining and repairing ignition systems, carburettors as well as wheel alignment and balancing in Akure.
- b) The Central Bank of Nigeria (CBN), Ondo State government, and other relevant stakeholders (public and private organizations) should make room for the provision of take-up grant to every apprentice after mandatory completion of mechanical training in Akure.
- c) The automobile manufacturing companies such as Toyota Motors, Volkswagen, Ford, Bayerische Motoren Werke AG, commonly abbreviated to BMW, Hyundai, Nissan, Kia, Tata Motors, Peugeot, Mazda, Innoson Motors and others should establish mechanical service centres in Akure to conduct training on wheel alignment and balancing, repair and maintenance of carburettors, maintenance of ignition systems, and empower interested graduates and non-graduates at subsidised rate.
- d) Tertiary institutions in Ondo State such as the Federal University of Technology Akure (FUTA), Rufus Giwa Polytechnic Owo (RUGIPO) and others schools should collaborate with the automobile manufacturing companies and government to train and certify interested graduates and non-graduates.

### Abbreviations:

BMW: Bayerische Motoren Werke.

CBN: Central Bank of Nigeria.

GDP: Gross Domestic Product.

NBTE: National Business and Technical Examinations.

SD: Standard Deviation.

TVET: Technical Vocational Education and Training.



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### Institutional Review Board Statement:

The Ethical Committee of the Department of Logistics and Transport Technology, Federal University of Technology Akure, Nigeria has granted approval for this study on 15 August 2023 (Ref. No. LTT/AFO/2024/001).

### Transparency:

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

### Competing Interests:

The authors declare that they have no competing interests.

### Authors' Contributions:

All authors contributed equally to the conception and design of the study. All authors have read and agreed to the published version of the manuscript.

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