# KNOWLEDGE, ATTITUDE, AND PRACTICE OF ERGONOMIC PRINCIPLES AMONG AUTO-MECHANIC WORKMEN – A CROSS-SECTIONAL STUDY

**BY**

**UTHIHO CHRISTIAN ILUOGHENE**

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# CERTIFICATION

This dissertation by Uthiho, Christian Iluoghene is accepted in its present form as satisfying the dissertation requirement of the degree of Bachelor of Physiotherapy of the School of Basic Medical Sciences, College of Medical Sciences of the University of Benin.

**DR. SATURDAY NICHOLAS OGHUMU**

**SUPERVISOR**

**SIGNATURE AND DATE**

__________________________

**PROF. U. A. C. OKAFOR**

**EXTERNAL EXAMINER**

**SIGNATURE AND DATE**

__________________________

**APPROVED**

______________________________

**DR. (MRS) CO OBASEKI**

**HEAD**

**DEPARTMENT OF PHYSIOTHERAPY**

**COLLEGE OF MEDICAL SCIENCES**

**UNIVERSITY OF BENIN**

# DEDICATION

This dissertation is dedicated to God almighty and to my mum Hon. (Dr.) Princess Abigail Elo Oriri.

# ABSTRACT

**Background**: Ergonomics, the science of aligning work environments with human capabilities, remains underemphasized in Nigeria's informal auto-mechanic sector, where over 96% of workers train through apprenticeships that prioritize speed over safety. This study therefore assessed the level of knowledge, attitude, and practice (KAP) of ergonomic principles among auto-mechanic workmen in Benin City, Nigeria.

**Methods**: A descriptive cross-sectional design was used involving 384 auto-mechanic workmen with at least one year of experience, selected purposively from informal workshops in Benin City. Data on ergonomic KAP were obtained using an adapted questionnaire from a previous study. Participants sociodemographic characteristics and anthropometric parameters were collected. Data were summarized with descriptive statistics of means, standard deviations, frequencies, and percentages, while Chi-square test was employed to determine associations between KAP variables and selected socio-demographic factors at $p \leq 0.05$.

**Results**: Respondents were overweight ($26.13 \pm 4.01$ kg/m$^2$), while more than a third (44%) of respondents were aged 35–44 years). Most (88.5%) of the respondents lack knowledge of ergonomics, 80.5% lacked formal training, though 83.6–88.3% identified risks from awkward and repetitive tasks. Attitudes were positive with 74.1% of respondents agreeing that ergonomics should be part of practice. Most (93.8%) respondents valued stretching, while practices were moderate (81.0%) changed positions regularly; 90.1% ensured good lighting). Significant associations were observed between each of KAP variables ($p < 0.05$), with select demographics (Age, Years of work experience and Job type).

**Conclusion:** Although ergonomic knowledge remains limited, most auto-mechanic workmen display positive attitudes and fair ergonomic practices. The associations among KAP domains underscores the potential of targeted ergonomic education, low-cost tool adaptations, and integrated apprenticeship training to reduce work-related musculoskeletal disorders and enhance occupational health in Nigeria's auto-mechanic sector in Benin City.

**Keywords:** ergonomics, knowledge, attitude, practice, auto-mechanics

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# CHAPTER ONE

# INTRODUCTION

## 1.1 Background of the Study

The NIOSH states that ergonomics is the structuring of work activities so that workspace is efficient and the risks of the injury are reduced (NIOSH, 2024). From the Greek words ‘ergon’ (work) and ‘nomos’ (laws), ergonomics is concerned with the fitting of the jobs and the work setting to the workers. (International Ergonomics Association, 2000). Ergonomics aims to provide services and products that would reduce the risk factors at the work place so as to reduce work related musculoskeletal disorders (WMSDs) of which the back, neck and the upper extremities are mainly affected (Edwards et al., 2024).

The primary function of ergonomics is to reduce the work related musculoskeletel disorders by eliminating workplace risk factors such as doing the same task over and over, making forceful movements, and maintaining abnormal posture, which may lead to injury, fatigue, and turnover of workers (Gupta et al., 2014). There is evidence that certain activities at the work place such as lifting, twisting, prolonged standing, squatting, and doing the same task over and over are associated with high prevalence of WMSDS (Andersen et al., 2021; Waters et al., 2015). Some of the symptoms of the WMSDS are discomfort, swelling, and stiffness. Other symptoms are carpal tunnel syndrome, shoulder impingement, lower back pains and also varicose veins, and other postural imbalances, and also problems due the of the joints which may include the knee and ankle and hip joints.

Ergonomic principles guide workplace design to reduce physical strain and enhance productivity. Key principles include maintaining neutral postures and minimising repetitive motions, reducing excessive force, and ensuring proper workstation setups with adequate lighting, supportive seating, and adjustable equipment (Ergo Plus, 2023). Worker education and opportunities for movement and stretching are also critical. In the auto-mechanic industry, these principles are vital due to the physically demanding nature of tasks like lifting heavy components, working in confined spaces, and maintaining awkward postures for extended periods (He *et al*., 2023). Effective ergonomic practices in auto-mechanic workplaces reduce WMSDs, leading to fewer lost workdays, lower wage losses, and decreased financial burdens on workers (Work Health Solutions, 2023; CDC, 2024). Ergonomics also mitigates psychosocial issues, such as stress and job dissatisfaction, which are linked to chronic pain (Velocity EHS, 2014). Auto-mechanic workers, including mechanics, panel beaters, spray painters, and welders, face high WMSD rates, particularly shoulder, neck, and back pain, due to repetitive motions, challenging postures, and prolonged immobility (Sambo *et al*., 2023; Hongsranagon *et al*., 2011).

There are many auto-mechanics in Nigeria, who learn their craft in the practice of informal apprenticeships, which do not include ergonomic or occupational health safety training. Lack of this practice contributes to the high prevalence of WMSD. In the study carried out in the Lagos state of Nigeria, only 26.7% of the auto-mechanics had a positive safety attitude, while only 21.7% had the appropriate safety practice, which showed a shallow level of understanding of ergonomics (Ozomata et al., 2022). A survey conducted in eastern Nigeria showed 76.02% of the mechanics reported lower back pain, which has been associated with prolonged working hours, kneeling while working, and absence of ergonomic knowledge (Abaraogu et al., 2016). The field is very informal with absence of occupational health services, which is the reason why the above issues are so common, and ergonomic considerations are very rarely, if ever, implemented.

Similar issues affect many countries in the world. In Jeddah, Saudi Arabia, automotive technicians report severe musculoskeletal discomfort due to the lifting and working postures associated with the occupation (Hafez, 2022). Although auto mechanics are aware of the occupational risk, many show a negative response towards the implementation of safety measures. In a survey carried out in Uyo, Nigeria, artisans displayed a negative safety attitude with a safety score of 1.99 out of possible 5. This poor safety attitude has been linked to lack of formal training, absence of safety practice enforcement, socio-cultural practices, and poor economic conditions (Akowe, 2023). Denton (2011) reported a so-called fatalistic unhealthy attitude some mechanics have towards safety, arguing that it is pointless to practice safety as injury is inevitable, and so it is a waste of time to avoid it.

Although the Occupational Safety Health Administration (OSHA) and the World Health Organisation (WHO) publish ergonomic rules, little is known about how auto mechanics understand or apply them. Studies on Nigerian auto mechanics rarely deal with ergonomics - they usually cover general job hazards. Because of this shortfall, no focused measures or policies exist to improve their working conditions.

The study closes the gap - recording what auto mechanics know, think plus do about ergonomics. It pinpoints exact risks and measures present knowledge so that training schemes but also policy actions can be shaped. The work argues for adding ergonomic lessons to apprenticeships and for rules that shield the health of auto mechanics. In the end it strives to raise job health standards in a trade that has received scant attention.

## 1.2 Statement of the Problem

Auto mechanics often work in settings where they repeat the same movements, stay in awkward positions for long periods and lift heavy parts by hand. Those conditions raise the chance of musculoskeletal disorders. A study carried out in Eastern Nigeria showed that seventy six out of every hundred repair technicians suffered back pain - sixty three out of every hundred had to cut back on normal tasks because of that pain (Abaraogu et al., 2016). A later survey in Abuja found that only thirty two out of every hundred technicians followed safety rules, even though fifty seven out of every hundred knew a fair amount about job injuries and eighty out of every hundred viewed safety steps in a positive light (Olarewaju et al., 2021).

A central problem is the near absence of formal ergonomics instruction. In many low-plus middle-income countries, mechanics learn on the job as apprentices - they receive little information about safe methods (Ozomata et al., 2022). Although they know the work is risky, they seldom put ergonomic principles into practice. Informal workplaces, scarce ergonomic tools and poor training widen the gap between knowledge and practice. In Sokoto, ninety out of every hundred roadside mechanics stated that they had never received any instruction on how to prevent hazards (Oche et al., 2020).

Attitudinal barriers also slow change. Culture and tight budgets push owners to prize output over health plus many mechanics treat ergonomic tools as costly extras. Old habits raise strain and injury - workers lift parts by hand, pull on simple wrenches, slide on bare metal creepers, stand at rigid benches, wedge bars for extra force or work under a single bare bulb. Safer gear exists - hoists, air tools, benches that move up but also down, cushioned creepers, lamps aimed at the job - but it stays on the shelf.

Practical and systemic blocks add to the problem. Many shops run on cash, keep no records as well as lack credit - money for anti-vibration gloves or height adjustable benches never appears - the same hazards return each day (Amfo-Otu, 2017; Onawumi et al., 2022).

## 1.3 Research Questions

The study was designed to answer the following research questions;

i. What was the level of knowledge of ergonomic principles among auto-mechanic workmen in their daily tasks?
ii. What were the attitudes of auto-mechanic workmen towards ergonomic principles?
iii. What were the practices of auto-mechanic workmen in applying ergonomic principles in their daily tasks?
iv. What was the association between the level of knowledge and the attitudes and practices of ergonomic principles among auto-mechanic workmen?
v. What was the association between attitudes and practices of ergonomic principles among auto-mechanic workmen?

## 1.4 Aim of the Study

This study assessed the knowledge, attitude, and practice of ergonomic principles among auto-mechanic workmen.

### 1.4.1 Specific Objectives

The specific objectives of this study were to:

i. Determine the level of knowledge of ergonomic principles among auto-mechanic workmen.
ii. Determine the attitudes of auto-mechanic workmen toward ergonomic principles.
iii. Determine the level of practice of ergonomic principles among auto-mechanic workmen.
iv. Evaluate the association between the level of knowledge and the attitudes and practices of ergonomic principles among auto-mechanic workmen.
v. Evaluate the association between attitudes and practices of ergonomic principles among auto-mechanic workmen.

## 1.5 Hypotheses

### 1.5.1 Main Hypothesis

There would be no significant association between the level of knowledge and each of attitudes and practices of ergonomic principles among auto-mechanic workmen, as well as, there would be no significant association between attitudes and practices of ergonomic principles among auto-mechanic workmen.

### 1.5.2 Sub-Hypotheses

i. There would be no significant association between the level of knowledge of ergonomic principles and attitudes toward them.
ii. There would be no significant association between the level of knowledge of ergonomic principles and their practice.
iii. There would be no significant association between attitudes toward ergonomic principles and their practice.

iv. There would be no significant association between age and knowledge of ergonomic principles.

v. There would be no significant association between age and attitudes toward ergonomic principles.

vi. There would be no significant association between age and practice of ergonomic principles.

vii. There would be no significant association between years of work experience and knowledge of ergonomic principles.

viii. There would be no significant association between years of work experience and attitudes toward ergonomic principles.

ix. There would be no significant association between years of work experience and practice of ergonomic principles.

x. There would be no significant association between job type and knowledge of ergonomic principles.

xi. There would be no significant association between job type and attitudes toward ergonomic principles.

xii. There would be no significant association between job type and practice of ergonomic principles.

## 1.6 Significance of the Study

This research addressed a missing piece in workplace wellness - focusing on how auto repair technicians perceive and use body-safe methods. Though vital to urban function, these laborers face demanding shifts under harsh physical strain, rarely receiving advice about stance, proper load handling, or injury avoidance. Without ergonomic aid, they're more likely to develop movement-related injuries, ongoing discomfort, or lasting impairment.

The study looked at three teams able to change how things work during these sessions - each playing a distinct role in influencing outcomes through different actions and decisions made on site.

**Policymakers:** The findings suggest countries should adopt guidelines making ergonomics a key aspect of job site safety. Not only by updating current laws to include ergonomic criteria, but also by integrating hands-on learning into career-focused courses.

**Workshop Owners and Employers:** Some improvements need little spending. For instance, using cushioned floor pads, changing table heights, or shifting tool placement helps cut physical stress - leading to steadier performance. Workers feel less tired while tasks get done smoother when reach is minimized.

**Healthcare Providers:** Community outreach efforts ought to prioritise spotting muscle or joint concerns early while introducing prevention strategies suited to workshop conditions. Simple, hands-on advice enables employees to notice warning signs before serious harm occurs. Instead of waiting, proactive steps reduce long-term risks significantly.

To reach these communities, the research intends to improve safety, health, or sustainability in auto repair jobs within informal settings.

## 1.7 Scope of the study (Delimitation)

This cross-sectional study focused on auto-mechanics working in informal auto-mechanic workshops within Benin City, Edo State. It targeted skilled workers with at least one year of experience in trades directly involved in vehicle maintenance and repair. The study was delimited to the use of an adapted questionnaire on Knowledge, Attitudes, and Practices of Ergonomic Principles (Nasar *et al*., 2021) to assess both reported and actual ergonomic practices.

## 1.8 limitation of the study

This research focused only on auto mechanics in small shops across Benin City, meaning findings might not reflect other jobs or locations. Data came from a modified survey form, which could lead to memory errors or replies that sound good but aren't honest. Because the method used one-time snapshots, proving direct links between knowledge, attitude, and practices of ergonomics wasn’t possible. Also, varying reading skills likely shaped how individuals interpreted certain items.

## 1.9 Definition of Terms

**Knowledge:** Means knowing something either by theory or practice. This understanding comes from learning, studying, or doing tasks over time. It includes facts, data, and abilities picked up through school or real-life situations (Merriam-Webster, 2025). When used in studies, it usually points to being aware of certain ideas or methods (Polit & Beck, 2021).

**Attitude:** a lasting mental pattern that includes feelings, thoughts, and action inclinations about something particular - leading to favorable, unfavorable, or mixed judgments. While shaped through thinking, emotion, besides behavior, it affects choices as well as conduct, changing over time due to personal exposure or situation (Albarracín & Shavitt, 2021; Maio et al., 2022).

**Practice:** can be defined as doing something again and again on purpose to get better at it or reach a goal, using what you know in actual situations while adjusting over time - (Wenger-Trayner et al., 2020; Nicolini, 2012).

**Ergonomics:** studies how to design jobs, equipment, and spaces so people can work more safely, comfortably, or efficiently. (International Ergonomics Association, 2000).

**Auto-mechanic workmen:** Are experts fixing, checking, or servicing automobiles - including vans, lorries, and bikes - through equipment and digital systems to solve engine, wiring, or circuit problems. (U.S. Bureau of Labour Statistics, 2025; ONET OnLine, 2025).

## 1.10 List of Abbreviations/Acronyms

NIOSH: National Institute for Occupational Safety and Health

KAP: Knowledge, attitude, practice

MSDs: Musculoskeletal disorders

WMSDs: Work-related musculoskeletal disorders

WHO: World Health Organisation

IEA: International Ergonomics Association

# CHAPTER TWO

# LITERATURE REVIEW

## 2.1 Introduction

Every year, around 1.1 million people die from job-related causes while another 160 million face new health issues tied to their work - this large toll is confirmed by WHO and ILO data (Ozomata et al., 2022). Among these problems, work-induced musculoskeletal conditions stand out because they lead to more missed days than any other workplace issue (ALHazim, Al-Otaibi, & Herzallah, 2022). Fixing how tasks match human limits through ergonomic design helps lower body stress and stops many such disorders. These injuries appear across fields like manufacturing or care services; as an example, nearly 9 out of 10 nurses in Saudi Arabia suffer from muscle and joint pain linked to duties on the job (ALHazim et al., 2022).

Auto mechanics face serious risks because of heavy lifting, awkward postures, or constant motions (Ozomata et al., 2022). Still, minimal attention is given to how they think about, know, or act on ergonomic practices - particularly in Africa and Nigeria (Ugbede & Denga, 2018). Even when aware, most do not apply safe techniques (Ephraim et al., 2019). This review examines global evidence on ergonomics in auto repair, focusing on African countries and Nigeria specifically. It explores existing knowledge on knowledge, attitudes, and practices along with health outcomes; identifies gaps in studies; also proposes paths forward for future inquiry.

## 2.2 Background of Ergonomics in Occupational Health

Ergonomics helps reduce harm from bad job setups by mixing ideas from psychology, biology, and tech - aiming to boost safety and efficiency at work. Instead of forcing people into roles, it adjusts duties, gear, and spaces based on what bodies can handle without strain (Centres for Disease Control and Prevention, 2024; ALHazim et al., 2022). According to OSHA, shaping a role around someone lowers tiredness in muscles while also reducing bone and joint issues (Occupational Safety and Health Administration).

Studies show ergonomic setups cut down injuries quite a bit. In America, muscle and bone issues make up more than 30% of job-related health problems with days missed - costing loads of money (ALHazim et al., 2022). Groups like OSHA and NIOSH push for less manual lifting, correct gear use, along with adjusted desk or table heights (Centres for Disease Control and Prevention, 2024; Occupational Safety and Health Administration).

Still, in casual or underfunded environments, people tend to overlook ergonomics - even though it clearly helps. While the International Ergonomic Association pushes for both worker wellness and smooth operations (ALHazim et al., 2022), plenty of job sites don't get it right - or at all. Auto technicians might benefit from basic changes - say, smarter lifting habits, height-adjustable benches, or lift tools - but these ideas rarely show up (Abaraogu et al., 2016). That mismatch shows we should dig into why mechanics know so little, think what they do, act how they act - and how that harms their bodies.

### 2.2.1 Ergonomic Principles for Auto mechanic Workmen

Keep steady: adjust posture to ease strain - allow arms to relax, maintain straight wrists, avoid bends; at the same time, keep shoulders low during car repairs.

Reduce strain: Use a lightweight wrench to avoid arm fatigue during screw tightening - this lowers physical demand.

Change tasks regularly - this reduces repeating one motion too much, such as turning screws manually. Use power tools sometimes; these ease pressure on your hands while finishing work faster.

Stay comfortable - choose lifts that set vehicles at elbow height, so you don't bend or reach too far. Rather than struggling, simply adjust the base height and protect your spine with little effort.

Choose tools gentle on your hands - opt for models with soft handles reducing shake. Their design sits well in hand, making them less straining over time.

Choose proper lighting - position a bright lamp to remove shadows, which helps reduce eye strain during detailed tasks

Organize your workspace: use mobile trays to keep tools nearby - this reduces reaching or twisting during tasks.

Pause once in a while - take brief breaks every thirty to sixty minutes to avoid exhaustion during tasks. Because stopping briefly can refresh concentration without draining energy. Since even one or two moments matter when repeated regularly.

Use anti-fatigue mats - these cushioned platforms reduce strain on legs and spine while standing on hard garage floors.

Wear protective equipment – use comfortable gloves together with knee pads if crawling beneath vehicles. This helps reduce strain on your joints during tasks.

Lift heavy objects - like a tire - by lowering yourself with knees bent, holding it close to your chest. Rely on leg strength rather than risking back strain; keep steady during the motion.

Ventilate work areas - use exhaust fans to remove fumes during welding or engine operation.

Switch tool weight: Choose lighter options or well-balanced ones for overhead tasks - this eases shoulder strain.

Get familiar with ergonomic practices: teach employees to identify stress factors through improved motions suited to their duties.

Change tasks regularly - instead of heavy work such as tire changes, mix in lighter ones like system checks, which helps reduce physical strain.

(Anyaeche & Ishie, 2021; Ergo Plus, 2023)

## 2.3 Overview of Auto-Mechanic Work

Mechanics deal with loud sounds, shaky tools, and extreme temperatures - on top of handling fuel, cleaning fluids, or battery chemicals - with added dangers like cuts, electric jolts, or getting pinned under cars. In Nigeria, more than 50% of these workers said they had ongoing back pain; research shows common aches: lots mentioned tight necks or worn-out shoulders (Sambo et al., 2019). An Ethiopian report from 2020 showed close to half struggled with muscle or joint problems (Tamene et al., 2020), whereas American stats pointed out that one-third of mechanic injuries came from twisted limbs or pulled muscles. Around the world, fixing vehicles means heavy lifting plus never-ending hazard exposure (Ozomata et al., 2022).

## 2.4 Rationale for Studying Auto-Mechanic Workmen

Auto mechanics makes up a big chunk of Nigeria's everyday workforce, mainly because more people now need repairs done on their vehicles. These workers usually do jobs along roadsides, in basic setups - no proper schooling or rules guiding what they do (Ozomata et al., 2022). They're always moving heavy parts like motors, bending weirdly while fixing things, spending hours gripping tools tight - which can mess up muscles and joints over time (Okafor et al., 2020). Research shows many get hurt quite often. In one look at this group, over three out of four said they've had lower back pain - or some kind of job-linked harm - in just twelve months flat (Ojoawo et al., 2021; Olarewaju et al., 2021). Even with these dangers, plenty of mechanics don't get the right training or help to stay safe. That's where the KAP idea comes in - it checks more than facts; it looks at how they think and act when it comes to staying protected on the job.

Looking at this group matters since how they feel day-to-day ties more to what they do themselves than company rules. Checking their knowledge, attitudes, and practices around ergonomics helps build real fixes - so fewer get hurt while making work better in a field that often gets ignored.

## 2.5 Conceptual Framework

The KAP framework shows how individuals' understanding of dangers affects their mindset and actions. Knowing about ergonomic risks usually leads to better views, followed by improved habits. According to Zhou et al. (2025), insight impacts outlooks, which in turn affect conduct. Still, such logical progressions tend to fail under actual working conditions. A Nigerian investigation revealed health workers, despite solid awareness and positive views on ergonomics, often failed to apply proper methods (Ephraim-Emmanuel et al., 2019); thus, understanding by itself may fall short.

Other issues - like minimal training, tough working environments, or missing tools - can break this sequence. In auto repair jobs, such obstacles appear often. Because of that, the current analysis applies a more flexible version of the KAP approach. It looks at personal aspects (such as age, schooling, and background) along with outside pressures (for example, office rules or tool availability), and how they shape every stage of the KAP process (Olaiya et al., 2018). This method allows us to study not only mechanics' understanding, but whether that understanding may or may not translate into safe actions.

### 2.5.1 Definition of Ergonomics

Ergonomics is the science of designing work to fit the worker. According to the National Institute for Occupational Safety and Health (NIOSH), it involves shaping tasks to match workers' abilities, with the goal of reducing musculoskeletal disorders linked to lifting, poor posture, and repetitive motion (NIOSH, 2024). The International Ergonomics Association (IEA) adds that it focuses on understanding how people interact with their work environment and applying that knowledge to improve both well-being and performance (IEA, 2000).

In everyday terms, ergonomics means "fitting the job to the person". It covers physical factors like awkward postures and repetitive tasks, as well as cognitive and organisational ones such as mental load and work schedules (NIOSH, 2024). In manual work settings, this involve using lifting aids, adjustable tools, or task rotation to reduce strain. The core aim is to prevent work-related musculoskeletal disorders (WMSDs) injuries caused by how work is structured and performed.

### 2.5.2 Relevance of Ergonomic Principles in Manual Labor

Ergonomics matters a lot when you're doing tough physical work - like fixing cars - where hauling heavy pieces, staying on your feet all day, or stretching up high wears you out fast. OSHA says following smart movement rules can ease tiredness, get more done, cut chances of muscle and joint injuries (they call them MSDs). Take hoists: swapping them for hand-lifting, or setting jack heights right so you don’t twist or bend oddly, shields your spine, legs, arms. Still, even knowing this helps, plenty of tiny garages skip these safety moves. Mechanics usually stay in one spot, stuck in uncomfortable stances while handling heavy loads over and over. On top of that, they operate shaky equipment without any safeguards - clear triggers for muscle and joint issues. In Nigeria, garage workers face tough environments where constant vibrations hit their arms. Alongside this, twisted body positions add to the danger, raising injury risks significantly (Ozomata et al., 2022).

Studies show bad work setups often lead to harm. One look at Ethiopian workers tied body strain to repeated moves, heavy pushing, also carrying weights above 48 pounds (Tamene et al., 2020). Down in Nigeria, raising objects plus slouching raised lower back issues - seen in nearly 8 out of 10 repair techs (Ojoawo et al., 2021). Fact is, smarter gear, sitting or standing right, switching tasks now and then can shield laborers from lasting damage.

### 2.5.3 Knowledge of Ergonomic Principles among Auto Mechanics

#### 2.5.3.1 General Awareness and Sources of Ergonomic Knowledge

Auto mechanics usually don't get much schooling on body movement and posture. One look at traders in Nigeria showed just under 7% knew what ergonomics meant - chances are, mechanics from the same areas know about the same. They pick up tricks not from manuals but by watching others, messing up a few times, or getting tips from coworkers.

In the informal trade, classroom learning’s hard to find. Because most mechanics learn by doing under older workers, they usually skip proper safety steps - especially if they've never studied formally (Ozomata et al., 2022). That means their grasp of body-friendly work methods is spotty, built from trial and error instead of solid rules.

### 2.5.3.2 Factors Influencing Ergonomic Knowledge

A mechanic's understanding of ergonomics comes from many things - like how old they are, what they've been through, or how much they earn. Those who've been around longer usually spot job dangers easier, thanks to real-life work over time. Research in Lagos showed that staying longer in the field connects to knowing more about safety (Ozomata et al., 2022). Folks like this pick up safe moves after near-misses or past hurts, slowly building smarter routines. On the flip side, newer or young mechanics - especially ones taught outside official programs - tend to miss out on real-world know-how. Instead of learning how to avoid injuries, their lessons stick mostly to hands-on repairs, so spotting body strain risks doesn't come naturally. Money matters too. Those pulling in under ₦2,500 daily rarely get quality gear or structured classes, making it tough to follow safe work methods. Because of this gap, they end up figuring things out through mistakes, which builds shaky routines that aren't always safe (Ozomata et al., 2022).

People who go to school or get organized training usually understand how to work safely and avoid strain. Those learning from trade courses stick to safety rules more than folks taught just on the job - according to studies by Ozomata and others, plus Oche's team. Focus counts too. Workers fixing engines often take ergonomics seriously because their jobs require heavy lifting, awkward positions, or risky moves that make injuries more likely. On the flip side, people handling car paint or wiring might not see dangers clearly, so they're less careful about posture and body stress. Mechanics' grasp of ergonomics depends on their training, work history, also the kind of tasks they do. People without much schooling or who learned on the job usually know less - so they face higher risks.

### 2.5.4 Attitudes toward Ergonomic Practices

#### 2.5.4.1 Perceptions of Ergonomics among Auto-Mechanics

Most car repair workers know their jobs can be dangerous. Take Sokoto - there, nearly all mechanics said they face hazards like injuries, burns, soreness, or ongoing body strain (Oche et al., 2020). Still, even when aware, just over a quarter actually take safety seriously at work (Ozomata et al., 2022). Knowing the risk doesn't always lead to safer choices, which also happens in areas such as medical care. Cultural habits plus real-life money pressures influence how mechanics think about body-friendly work setups. Aches and tiredness? They're treated as normal, something you can't avoid - so safety steps don't hit hard (Abaraogu et al., 2016; Anyaeche & Ishie, 2016). A few know about gear like lift jacks yet figure it's just for big-name shops. In small roadside spots, tight budgets turn those tools into pipe dreams.

In short, even though most workers admit safety's important, tight budgets, missing tools, or thinking pain is normal on the job usually stop them from sticking to safer work habits.

#### 2.5.4.2 Barriers to Positive Attitude Formation

Auto mechanics often struggle to see ergonomics as helpful. One big reason? Money stress. Since lots of them earn based on tasks done, any extra step - like using helper tools or pausing - affects pay, particularly in busy, unstable workshops (Boston Consulting Group, 2021). Equipment costs add more strain. Research from Nigeria found nearly a quarter thought gear was too pricey; over half believed machines might take their jobs, viewing tech as danger instead of aid (Abatan & Adewale, 2024).

Cultural views shape how people think about risk. Many workshops treat rest or tool use like signs of being weak. Workers push through pain just to look strong, making safety steps less likely. Besides this, plenty operate on streets without rules or checks around them, cutting reasons to act safely (Ozomata et al., 2022). Knowing safer ways helps - but it won't shift habits by itself. If a mechanic doesn't connect bad posture to lasting damage, they might skip tips - or think it won't happen to them. On top of that, tight budgets, social influence, spotty rules, plus weak awareness build up into real hurdles for better work habits (Oche et al., 2020; Vonkat et al., 2024).

### 2.5.5 Practice of Ergonomic Principles

### 2.5.5.1 Common Ergonomic Practices in Auto-Mechanic Workshops

Ergonomic practices in auto shops often fall short. Rather than using lifts or adjustable stools with solid lighting, lots of garages rely purely on physical effort. Mechanics frequently haul heavy parts - batteries or tires - by hand, squat on hard floors barefoot, or squeeze into cramped areas awkwardly. Protective tools like knee pads or back braces show up only once in a while, mainly aimed at avoiding immediate injury instead of long-term strain (Zaki et al., 2023).

Data points to weak safety practices at work. In Lagos, only around one out of five mechanics stuck to safe routines - others either cut corners or didn't follow rules at all. Some admitted dangerous moves like sucking petrol through the mouth or using engine oil on cuts, suggesting low awareness. Almost all were aware of safety gear - 96.7% could name it - but hardly anyone used it, showing that knowledge doesn't always lead to action (Ozomata et al., 2022).

### 2.5.6 Observed Gaps between Knowledge, Attitude, and Practice (KAP) Framework

Research keeps pointing out that auto repair workers often don’t put into action what they know about body-safe work habits - what they think matches better than what they actually do. That mismatch? It shows up outside this job as well. Take med staff at the University of Port Harcourt hospital - they got solid awareness and positive views on posture safety, still hardly any used those ideas while working. The same goes for auto techs across Nigeria: lots recognized risks on site, were aware of protective gear, however just roughly one in five stuck to safe routines every day (Ephraim et al., 2019).

Some factors cause this mismatch - tight budgets, heavy tasks, no proper coaching, plus routines built when things get tough. The KAP idea says info shapes mindset, that affects actions. Still, those links break sometimes. Like, a worker might understand safe lifting helps (info), but rushes anyway because deadlines loom (mindset), so bad patterns stick (actions). On the flip side, another person could care about safety, just doesn’t know how to fix tools or set up their station. Studies from similar fields agree. In Nigeria, even physios and bank workers who knew a lot about ergonomics didn't follow good habits (Adje et al., 2019; Ekechukwu et al., 2025). But once proper teaching happens - especially where obstacles are fewer - safe actions go up (Ozomata et al., 2022; Tamene et al., 2020). So just increasing awareness doesn’t fix everything; mindset shifts plus helpful surroundings matter too. Fixing these weak spots really counts if we want mechanics to act safer on the job.

### 2.5.7 Determinants of Ergonomic Knowledge, Attitude, and Practice

#### Socio-demographic Factors (Age, Education, Experience)

A mechanic's age, level of schooling, hands-on time, or kind of work affects how they understand, feel about, or handle ergonomics. Those who've been around longer often spot dangers quicker - learning by doing, making mistakes, then adjusting. In Lagos, seasoned workers tended to take safety more seriously (Ozomata et al., 2022). Schooling matters as well, but results aren't always clear. Training's actual style makes a bigger difference. Workers with official tech schooling typically follow safer practices compared to ones learning just on the job (Oche et al., 2020). Instead of pay level or position, it's how stable your role is that shapes knowledge and behavior. People earning average wages while working regular hours do better than temporary staff - those folks might miss consistent schedules or skill-building chances. On top of that, what kind of repairs you handle plays a part: mechanics fixing engines are generally more aware of body stress risks versus people focused on paint jobs or wiring, simply because lifting and moving parts takes more physical effort. Older mechanics, especially those with steady jobs and proper training, usually get ergonomics better - especially when they handle different kinds of work. Things like age or job stability can help shape smarter training plans, depending on the person's background.

## Environment and Organizational Policies

The way mechanics use ergonomics really hinges on their working conditions. Across several low-income nations, car repair workers usually operate off-the-books - think street-side garages with zero official safety oversight. Take Lagos: even though technicians belong to NATA, they lack proper health support and consistent rule enforcement (Ozomata et al., 2022). Since shifts aren't standardised and downtime isn't guaranteed, staying safe leans more on individual routines than set policies. Groups such as NATA usually don't offer solid training or proper supervision. In hands-on sessions with seasoned guides, safe habits still get ignored - mostly because speed matters more. The research from Sokoto pointed out how regular health teaching via mechanic groups could help workers adopt safer routines on their own (Oche et al., 2020). According to Tamene et al., missing official instruction greatly raises chances of muscle and joint problems.

In short, no organized rules, coaching, or oversight in casual repair spots means lots of technicians miss out on help using safe work habits. Since there’s rarely a set plan or someone checking in, staying protected often gets ignored.

## 2.5.8 Importance of Ergonomics in Occupational Health

### Prevention of Musculoskeletal Disorders (MSDs)

Muscle, tendon, and nerve injuries at work often lead to missed days. Because of this, many people struggle with daily tasks. Heavy lifts, bad body positions, or doing the same move over and over raise the risk. So, changing how tasks are done makes a difference. OSHA points out that these strains are among the most frequent causes of absence. Workers lose comfort, companies lose output. Mechanics face constant strain from twisting, reaching, or pulling parts. Yet, simple fixes - like adjusting tool height or taking breaks - cut down harm. Using support gloves or lift aids helps avoid sore backs or worn discs. As shown in recent studies, small changes add up fast. Less stress on joints means quicker recovery times. Overall, smarter setups mean fewer doctor visits and saved money.

#### Prevalence of Musculoskeletal Disorders among Auto-Mechanics

Musculoskeletal problems pop up a lot in car repair workers - bad work setups play a big role. Research from Nigeria shows about 79 out of every 100 mechanics deal with lower back pain each year (Ojoawo et al., 2021). Joint soreness, hernias, plus stiffness in the neck or shoulders? Pretty common too (Ozomata et al., 2022; Omokhodion & Osungbade, 1996). Up north in Nigeria, close to fifty percent said they've had back issues, while some pointed to ache in wrists and joints. A study in Ethiopia showed around 48% of repair staff dealt with job-linked muscle issues during one year (Tamene et al., 2020). The tough physical side of the role - like frequent crouching, carrying loads, or twisted stances - explains these numbers; meanwhile poor body-friendly tools make things worse by fuelling lasting discomfort, harm, or quitting work sooner.

**Enhancement of Productivity and Work Efficiency**

Ergonomics keeps people safe while helping them perform better. Workers without discomfort often move quicker, mess up less, plus deliver stronger outcomes. According to OSHA, adjusting setups cuts effort needed and gets things done sooner (Occupational Safety and Health Administration, n.d.). Take hoists or cushioned floors - these let mechanics complete repairs faster but with reduced body strain. Basically, if employees feel good physically, their performance and precision usually go up.

## 2.5.9 Impact of Poor Ergonomic Practices

Neglecting ergonomics might result in severe harm or lasting physical issues. Across the U.S., twists and pulls - usually due to heavy lifting or uncomfortable motions - account for more than 30% of injuries among mechanics. Repeated actions and slouching slowly bring on ongoing troubles such as sore backs and joint damage. In Nigeria, close to fifty percent of mechanics dealing with lower back pain took time off work, while over seven out of ten visited a doctor (Ojoawo et al., 2021). Some folks lost wages; others spent personal cash on care. When there's no coverage or aid, workers and loved one's face bills alone. Injuries slow work output while medical costs climb, piling pressure on those already struggling. Fixing bad workspace setups isn't only about well-being - it's essential for financial survival.

### 2.5.10 Anatomical Risks of Poor Ergonomics

Poor ergonomics in auto repair cause serious muscle and bone problems from repeated physical strain. Major body areas at risk are:

Heavy loads or long periods of leaning forward - like working beneath cars - raise pressure inside lower spine discs, especially at L4–L5 or L5–S1 levels; this may lead to disc rupture (Ojoawo et al., 2021). Such damage can squeeze nearby nerves, resulting in nerve pain down the leg, commonly called sciatica.

Neck and shoulder areas often face stress from lifting arms overhead or holding them up too long; this can overload the lower neck bones (C5–C7) while also irritating key shoulder muscles like the supraspinatus and infraspinatus - resulting in painful conditions such as tendon inflammation or compression issues (Sambo et al., 2019).

Wrist and hand movements: Repeated bending of the wrist while using a wrench may lead to carpal tunnel syndrome, since this action squeezes the median nerve inside the wrist canal (Ozomata et al., 2022).

Knees: Staying on them over hard floors strains the knee joint along with cartilage, raising chances of wear-related arthritis or damage inside the knee (Tamene et al., 2020).

Vibration-Induced Damage: Using power tools such as impact wrenches transmits vibrations to hands and arms - this can injure tiny blood vessels along with nerve endings. As a result, blood flow to fingers may drop, triggering Raynaud's phenomenon, often called white-finger disease (Ozomata et al., 2021).

Such physical strains, unless treated, lead to ongoing discomfort along with limited movement and possible lasting impairment.

## 2.6 Relevant anatomy

### 2.6.1 Anatomy of the Neck

The neck joins the head to the trunk and limbs and serves as a major groove for structures passing between them (Moore *et al*., 2013). The neck includes the following structures: skin; fascia (superficial fascia (platysma), deep cervical fascia (investing, paratracheal and paravertebral layers), cervical vertebrae (C1-C7), hyoid bone, manubrium of the sternum, and clavicle (figure 1).

#### 2.6.1.1 Regions of The Neck

The regions of the neck include

**Sternocleidomastoid region:** each side of the neck is anatomically divided into anterior and lateral cervical triangles by the sternocleidomastoid muscle (SCM). The sternocleidomastoid region is the region between these triangles corresponding to the area of the wide straplike muscle.

**Posterior cervical region:** This is the region posterior to the anterior border of the trapezius.

**Lateral cervical region:** This region is covered by skin and subcutaneous tissues containing the platysma, and it wraps around the lateral surface of the neck like a spiral. It is formed anteriorly by the posterior border of the SCM, posteriorly by the anterior borders of the trapezius, inferiorly by the middle third of the clavicle between the trapezius and the SCM, and by an apex where the SCM and trapezius meet on the superior nuchal line of the occipital bone. By a root formed by the investing layer of deep cervical fascia and by a floor formed by muscles covered by the prevertebral layer of deep cervical fascia.

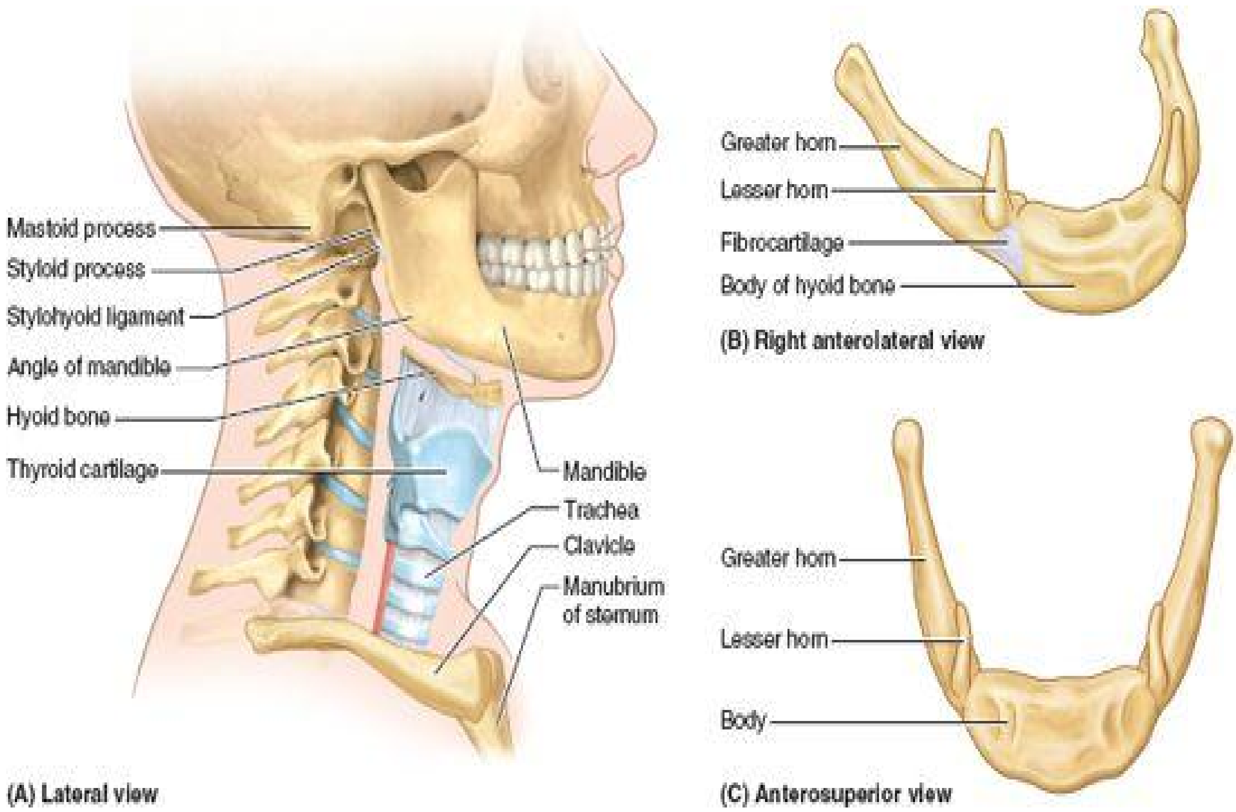


**Figure 1: Bones and cartilages of the Neck**

**Source:** Basicmedicalkey.com

### 2.6.1.2 Muscles in The Lateral Cervical Region

Splenius capitis, Levator scapulae, middle scalene (L. scalenus Medius), and Posterior scalene (scalenus posterior)

### 2.6.1.3 Innervation

The spinal accessory nerve, The suprascapular nerve, Cutaneous branches of the cervical plexus (Figure 2)

### 2.6.1.4 Venous supply

External jugular vein, Subclavian vein (Figure 2)

### 2.6.1.5 Arterial Supply

Subclavian artery, suprascapular artery, occipital artery, third part of the subclavian artery.

### 2.6.1.6 Anterior cervical region

It is subdivided into four small triangles (the unpaired submental triangle and three small, paired triangles: submandibular, carotid, and muscular) by the digastric and omohyoid muscles. The boundaries of the ACR include:

**Anterior boundary:** formed by the median line of the neck.

**Posterior boundary:** formed by the anterior border of the SCM.

**Superior boundary:** formed by the inferior border of the mandible.

**Apes:** located at the jugular notch in the manubrium of the sternum.

**Roof:** formed by subcutaneous tissue containing the platysma.

**Floor:** formed by the pharynx, larynx, and thyroid gland

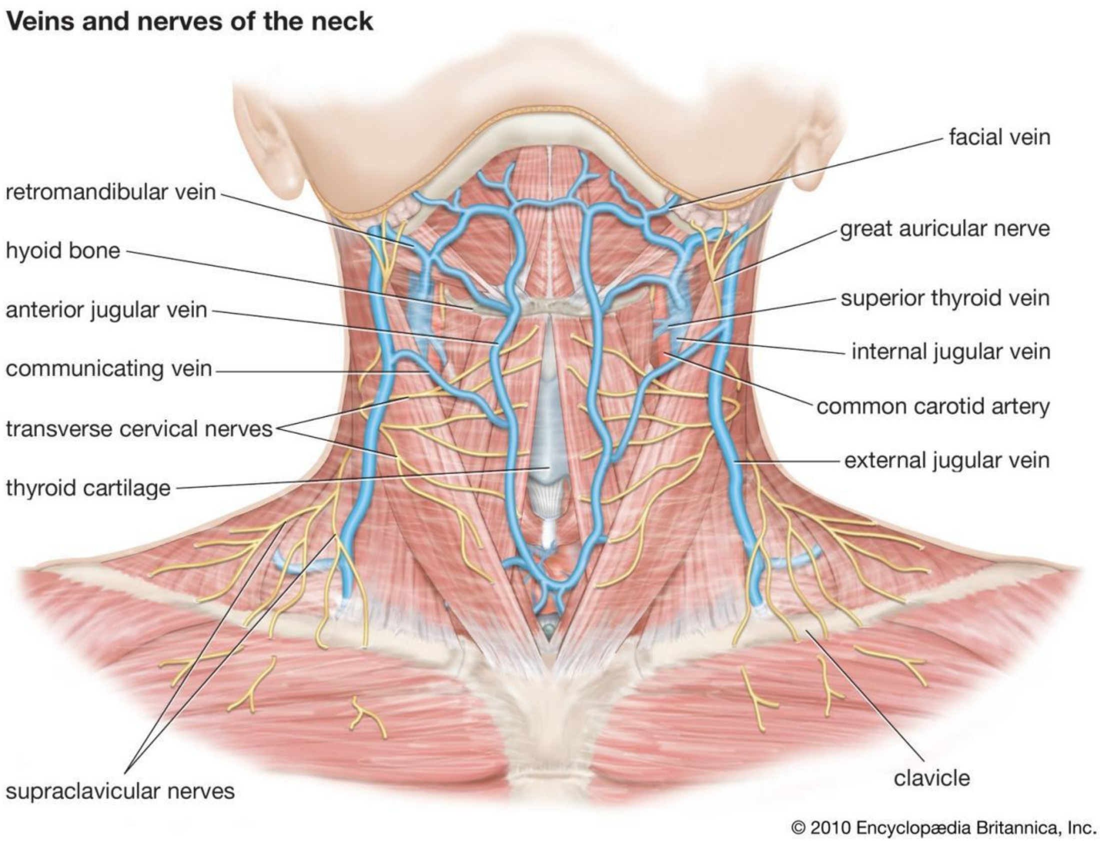


**Figure 2: Veins and nerves of the neck**

**Source:** Britannica

#### 2.6.1.7 Muscles in The Anterior Cervical Region

Suprahyoid, Infrahyoid (sternohyoid and omohyoid)

#### 2.6.1.8 Arterial Supply

The common carotid artery, internal carotid artery and external carotid artery divide into six branches: occipital artery, posterior auricular artery, facial artery, lingual artery, superior thyroid artery and ascending pharyngeal artery.

#### 2.6.1.9 Venous Supply

Internal jugular vein

#### 2.6.1.10 Nerve Supply

Transverse cranial nerve (C2-C3), hypoglossal nerve (CNXII), glossopharyngeal nerve, vagus nerve.

#### 2.6.1.11 Deep Structures of Neck

The deep structures of the neck are the prevertebral muscles; they are located posterior to the cervical viscera and anterolateral to the vertebral column and structures located on the cervical side of the superior thoracic aperture, the root of the neck. It consists of the anterior and lateral vertebral muscles, which lie directly posterior to the retropharyngeal space.

#### 2.6.1.12 The Root of the Neck

It is a junctional area between the thorax and the neck. The inferior boundary of the root of the neck is formed laterally by the first pair of ribs and their costal cartilages, anteriorly by the manubrium of the sternum, and posteriorly by the body of the TI vertebra. (Figure 3)

#### 2.6.1.13 Arterial Supply

Branches of the brachiocephalic trunk: common carotid artery and right subclavian artery, internal artery, internal thoracic artery, and thyrocervical artery.

#### 2.6.1.14 Venous Supply

External jugular vein, anterior jugular vein

#### 2.6.1.15 Nerve Supply

Vagus nerve (CNX), phrenic nerve, sympathetic trunk

### 2.6.2 Anatomy of the Shoulder

The shoulder region (pectoral girdle) is formed by the humerus, scapulae and clavicles and completed anteriorly by the manubrium of the sternum (Sinnatamby, 2011).

#### 2.6.2.1 Bones of The Shoulder

They include the Humerus and the scapula

#### 2.6.2.2 The Shoulder Joint

The shoulder joint is a multi-axial ball-and-socket joint. It is formed by an articulation between the head of the humerus and the glenoid cavity of the scapula (Sinnatamby, 2011).

#### 2.6.2.3 Joint Capsule

The joint capsule is a fibrous sheath which encloses the structures of the joint. It is attached to the scapula and to the anatomical neck of the humerus. The synovial membrane lines the inner surface of the joint capsule and produces synovial fluid to reduce friction between the articular surfaces (Sinnatamby, 2011).

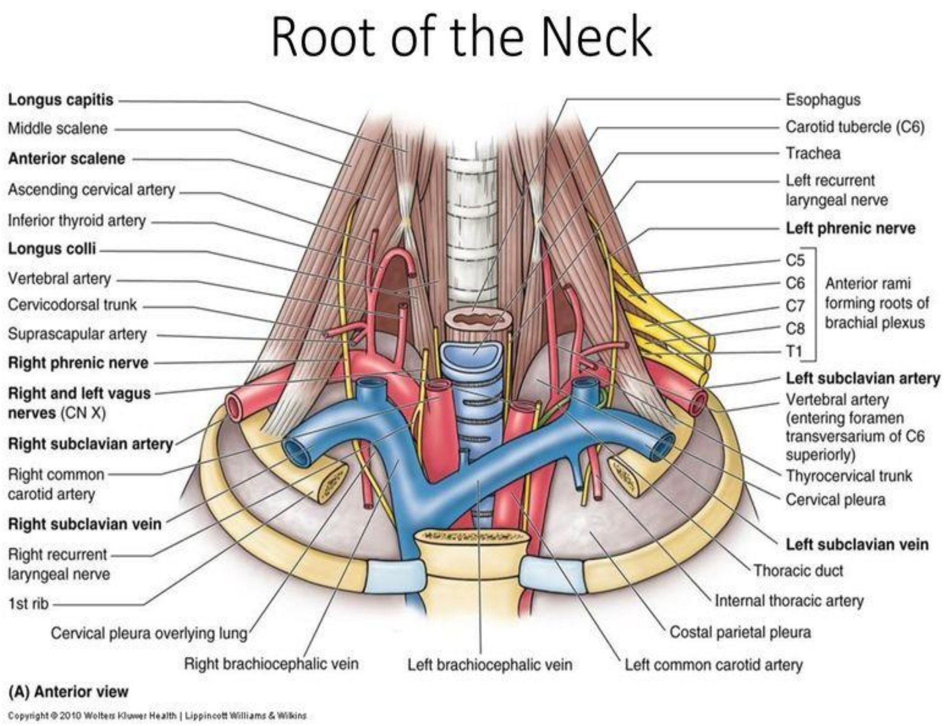


**Figure 3: The root of the neck**

**Source**: slideplayer.com

#### 2.6.2.4 Ligaments of The Shoulder

The ligaments play an important role in stabilising the shoulder. They include the glenohumeral ligament, coracohumeral ligament, coracoacromial ligament, and transverse humeral ligament (Sinnatamby, 2011).

#### 2.6.2.5 Muscles of The Shoulder

The shoulder joint is surrounded by a group of six muscles which converge from the scapula on to the humerus. They include subscapularis, supraspinatus, infraspinatus, teres minor, teres major, and deltoid (Sinnatamby, 2011). (Figure 5)

#### 2.6.2.6 Nerve Supply

The upper and lower subscapular nerves from the posterior cord of the brachial plexus supply the subscapularis muscles; the suprascapular nerve (C5-C6) supplies the supraspinatus and infraspinatus, the posterior branch of the axillary nerve (C5-C6) supplies the teres minor, the lower subscapular nerve (C5-C6) supplies the teres major muscle, and the axillary nerve (C5-C6) supplies deltoid (Figure 4). (Sinnatamby, 2011)

#### 2.6.2.7 Movement of The Shoulder

The head of the humerus is larger than the glenoid cavity, and this is for a considerable number of movements (Sinnatunihy, 2011). The movements of the shoulder joints include flexion, extension, adduction, abduction, rotation, and circumduction (Moore *et al*., 2013).

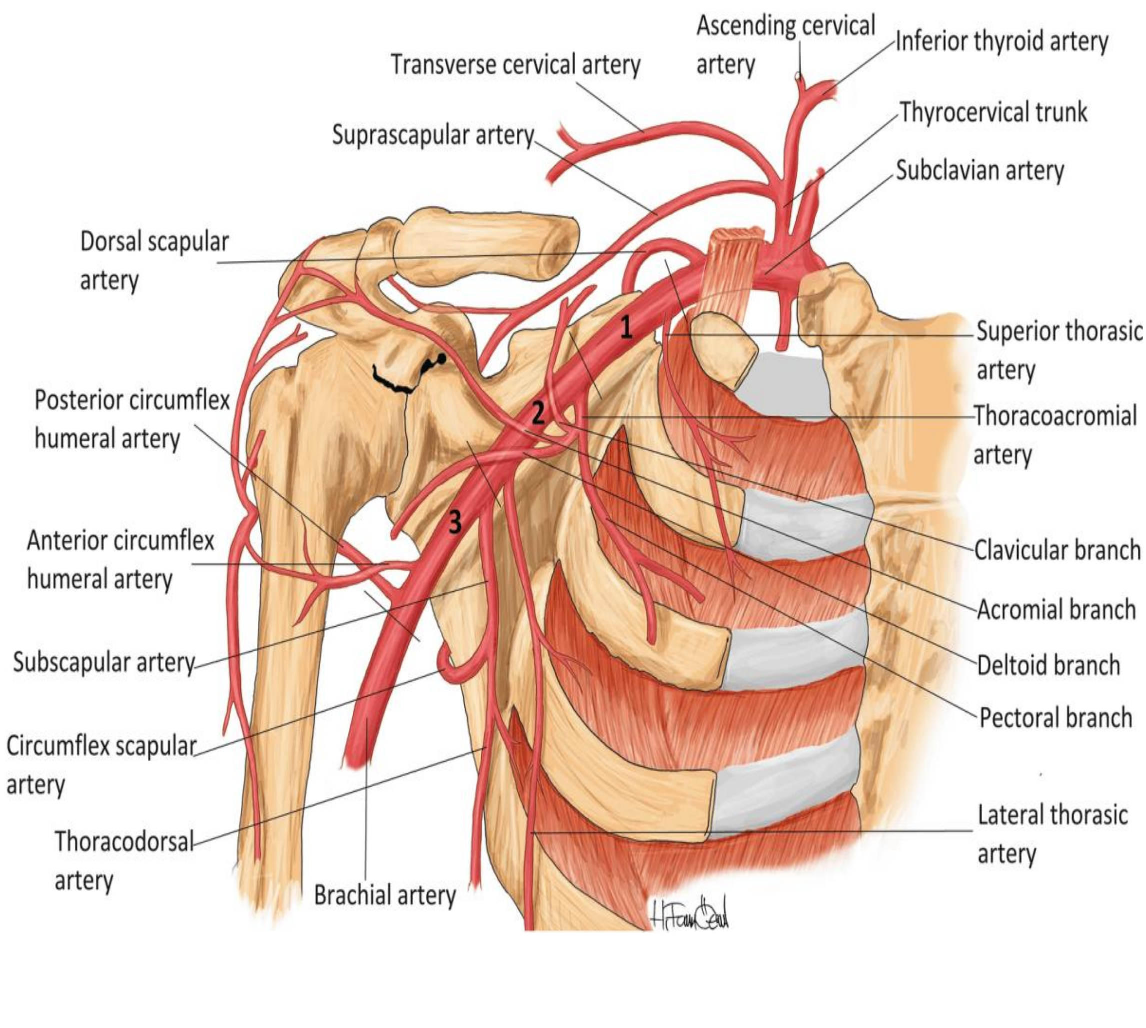


**Figure 4: Nerve and Blood supply of the shoulder**

**Source:** musculoskeletal key

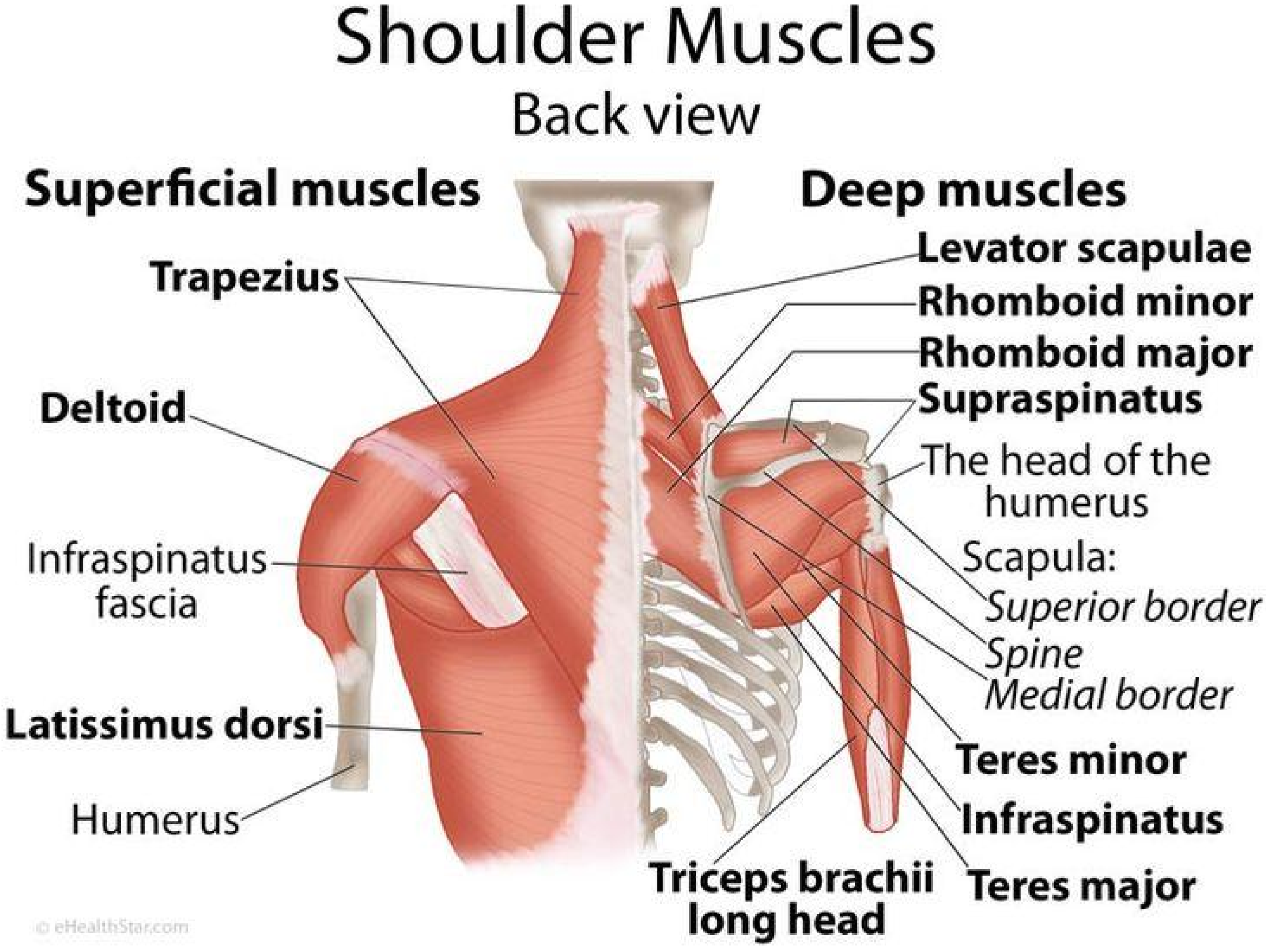


**Figure 5: Muscles of the shoulder**
**Source**: eHealthStar

### 2.6.3 Anatomy of the Back

The hack is the region of the body to which the head, neck, and limbs are attached. It is the posterior aspect of the trunk, inferior to the neck and superior to the gluteus region (Moore *et al*., 2013). Skin, subcutaneous tissue, deep fascia, Muscles (a superficial layer, concerned with positioning and moving the upper limbs, and deeper layers, concerned with posture, moving or maintaining the position of the axial skeleton), ligaments, vertebral column, ribs (in the thoracic region), spinal cord and meninges (membranes covering the spinal cord), and various segmental nerves and vessels.

#### 2.6.3.1 The Vertebral Column

The vertebral column (spine) extends from the cranium (skull) to the apex of the coccyx, and it forms the skeleton of the neck and back. Functions of the vertebral column include:

To support the weight of the body above the level of the pelvis

To protect the spinal cord and spinal nerves

To provide a partly rigid and flexible axis for the body and a pivot for the head

It plays an important role in posture and locomotion

The adult vertebral column typically consists of 33 vertebrae arranged in five regions, respectively: the cervical region, which is made up of 7 vertebrae; the thoracic region, which is made up of 12 vertebrae; the lumbar region, which is made up of 5 vertebrae;

the sacral region, which is made up of 5 vertebrae; and the coccygeal region, which is made up of 5 vertebrae.

The vertebrae become larger as the vertebral column descends to the sacrum and then become progressively smaller toward the apex of the coccyx. In an adult, the five sacral vertebrae are fused to form the sacrum, and the four coccygeal vertebrae are fused to form the coccyx... These significant structural differences are related to the fact that the successive vertebrae bear increasing amounts of the body's weight. Each one of these vertebrae is separated from the other superiorly and inferiorly by the intervertebral disc. The intervertebral discs are cartilaginous structures that consist of an outer avascular layer (annulus fibrosus) surrounding a soft nucleus pulposus (Valovska, 2011 & Desai *et al*., 2020). Significant motion occurs only between the superior 25 vertebrae (cervical, thoracic, lumbar, and first sacral vertebrae), and they facilitate and control the vertebral column's flexibility. The vertebral column gets its stability from the shape and strength of the vertebrae, IV discs, ligaments and muscles (Moore *et al*., 2013).

### 2.6.3.2 The Vertebrae

The structure of a typical vertebra consists of (Figure 6):

**The vertebral body** is the anterior part of the vertebra. It supports the weight of the body and gives strength to the vertebral column. The superior and inferior surfaces of vertebral bodies are covered with hyaline cartilage, and from 14 inferiorly, the size of the vertebral bodies increase to bear the progressively greater body weight (Moore *et al*., 2015)

**The vertebral arch** is formed by pedicles (left and right) and laminae. It lies posterior to the vertebral body. The pedicles are short, stout processes that join the vertebral arch to the vertebral body, and they project posteriorly to meet two broad, flat plates of bone, called laminae, which unite in the midline. The vertebral arch and the posterior surface of the vertebral body form the walls of the vertebral foramen. The vertebral foramina of all the vertebrae form a central canal in the vertebral column, referred to as the vertebral canal. The vertebral canal contains the spinal cord, its meninges, the spinal nerve roots and the associated blood vessels. (Moore *et al*, 2013)

**The spinous processes** are seven in number, and they arise from the vertebral arch. They include one median spinous process, which projects posteriorly from the junction of the laminae; two transverse processes that project posterolateral from the junction of the lamina and the pedicle; and four articular processes, also called zygapophyses (2 superior and 2 inferior), which arise from the junction of the lamina and the pedicle. The spinous and transverse processes project from the vertebral arch, and they provide attachments for the deep back muscles and serve as levers that help the muscles move the vertebrae. The articular processes articulate with the corresponding processes of vertebrae superior and inferior to them to form the zygapophyseal (facet) joints. This articulation keeps the adjacent vertebrae aligned and particularly prevents one vertebra from slipping anteriorly over the one below. The direction of the articular facets determines the types of movements allowed and restricted between the adjacent vertebrae of each region (Moore *et al*., 2013).

### 2.6.3.3 The Joints of The Vertebral Column

The joints of the vertebral column include the joints of vertebral bodies, joints of the vertebral arches, craniovertebral joints, costovertebral joints, and sacroiliac joints (Moore *et al*., 2013)

### 2.6.3.4 Movements of The Vertebral Column

The following movements of the vertebral column are possible: flexion, extension, lateral flexion, and rotation.

Movement of the column results primarily from the compressibility and elasticity of the IV discs and occurs at the nuclei pulposi of each intervertebral disc and the zygapophyseal joints. The normal range of movement possible in healthy young adults is typically reduced by 50% or more as they age. The range of movement varies across the different regions of the vertebra; it is wider at the lumbar and the cervical regions than the remaining three regions of the vertebral column. Movement is limited by the thickness, elasticity, and compressibility of the IV discs; the shape and orientation of the zygapophysial joints; tension of the joint capsules of the above joints; resistance of the back muscles and ligaments (such as the ligamentum flavum and the posterior longitudinal ligament); and attachment to the thoracic (rib) cage, bulk of the surrounding tissues (Moore *et al*., 2013).

### 2.6.3.5 Blood Supply of the Vertebral Column

The major arterial supply to the vertebral column is provided by the vertebral and ascending vertebral arteries and the segmental arteries of the trunk (posterior intercostal arteries, the subcostal and lumbar arteries, and the iliocostal, lateral and medial sacral arteries).

The anterolateral surfaces of the vertebrae are supplied by the periosteal and equatorial branches of these arteries. The spinal branches pass through the intervertebral foramina and divide into larger branches (radicular medullary arteries) and smaller anterior and posterior vertebral canal branches. The anterior vertebral canal branches supply the vertebral bodies, while the posterior branches supply the vertebral arches. Nutrient arteries to the vertebral bodies arise as branches from the anterior vertebral canal arteries; these arteries supply the red marrow of the central vertebral body. The radicular medullary arteries supply the posterior and anterior roots of the spinal nerves along with their meninges (Moore *et al*., 2013).

### 2.6.3.6 Nerve Supply of the Vertebral Column

The vertebral column is innervated by the (recurrent) meningeal branches of the spinal nerves. Most of the meningeal branches run back through the intravertebral foramen, but some of the branches remain outside the canal. The branches outside the canal supply the annuli fibrosi and anterior longitudinal ligament, while the branches inside the canal supply the periosteum, ligamenta flava, annuli fibrosi posteriorly, posterior longitudinal ligament, spinal dura mater, and blood vessels within the vertebral canal. The zygapophysial joints are innervated by articular branches of the medial branches of the posterior rami (Moore *et al*., 2013).

### 2.6.3.7 Muscles of the Back

Many strong muscles are attached to the spinous and transverse processes of vertebrae and are necessary to support and move the vertebral column. There are two major groups of muscles in the back (Figure 7)

**The Extrinsic Back Muscles**

They are divided into the superficial and intermediate muscles, which produce and control limb and respiratory movements, respectively. The superficial extrinsic back muscles (trapezius, latissimus dorsi, levator scapulae, and rhomboid) connect the upper limbs to the trunk, while the intermediate extrinsic back muscles (serratus posterior superior and inferior) are thin muscles commonly designated as superficial respiratory muscles but are more likely proprioceptive rather than motor in function.

**The Intrinsic Back Muscles**

The intrinsic muscles (deep back muscles) specifically act on the vertebral column, producing its movements and maintaining posture. They are innervated by the posterior rami of spinal nerves and extend from the pelvis to the cranium. The intrinsics are enclosed by deep fascia that attaches medially to the nuchal ligament, the tips of the spinous processes of the vertebrae, the supraspinous ligament, and the median crest of the sacrum. The deep back muscles are grouped into the superficial layer (the splenius capitis and splenius cervicis), the intermediate layer (the erector spinae muscles, the iliocostalis, longissimus and the spinalis muscles), and the deep layer (the transversospinalis muscles, the semispinalis, multifidus and rotator muscles).

The muscles in the superficial layer (the splenius capitis and splenius cervicis) are thick and flat and lie on the lateral and posterior aspects of the neck. They cover the deep neck muscles. The intermediate layer, the erector spinae muscles, act to extend the vertebral column. The muscles of the deep layer, the transversospinalis Muscles occupy the depression between the transverse and spinous processes of the vertebrae (Moore *et al.*, 2013). The transversospinalis muscles act to extend the back; the semispinalis muscle extends the head and the cervical and thoracic regions of the vertebral column; it also acts unilaterally on one side to rotate the contralateral side of these regions. The multifidus muscle serves to stabilise the vertebrae while it moves; the rotators also stabilise the vertebrae and assist with extension and rotatory movement (Moore *et al*., 2013).

### 2.6.3.8 Blood Supply of the Back Muscles

The muscles of the back are supplied by the deep cervical, posterior intercostal, subcostal or lumbar vertebral arteries (Henson *et al*, 2020) (Figure 8)

### 2.6.3.9 Nervous Supply

The nerve supply for muscles of the back originates from the ventral and dorsal rami of the spinal nerves; the anterior rami of the spinal nerves innervate the extrinsic muscles, the splenius capitis muscle is innervated by lateral branches of the C2-C3 dorsal rami, the lateral branches of the lower cervical dorsal rami supply the splenius cervicis muscle, the erector spinae muscles are innervated dorsal rami of the spinal nerves, the lateral branches of the dorsal rami innervate the iliocostalis muscle and the longissimus muscle is innervated by the intermediate branches, The transversospinalis muscles supplied by the primary branches of the C1-15 dorsal rami. (Moore *et al*, 2013 & Henson *et al*, 2020)

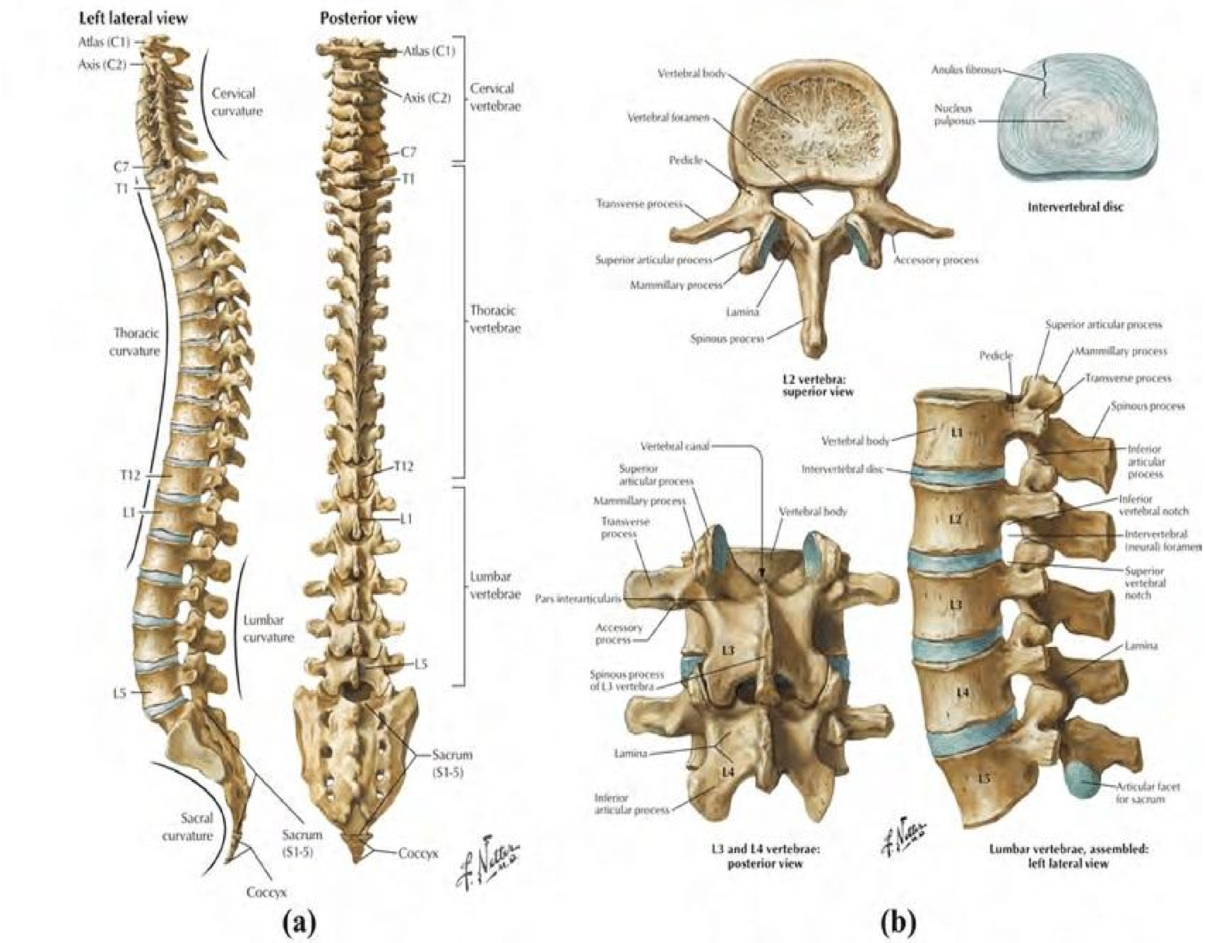


**Figure 6: The vertebral column**

**Source:** sport medicine wiki

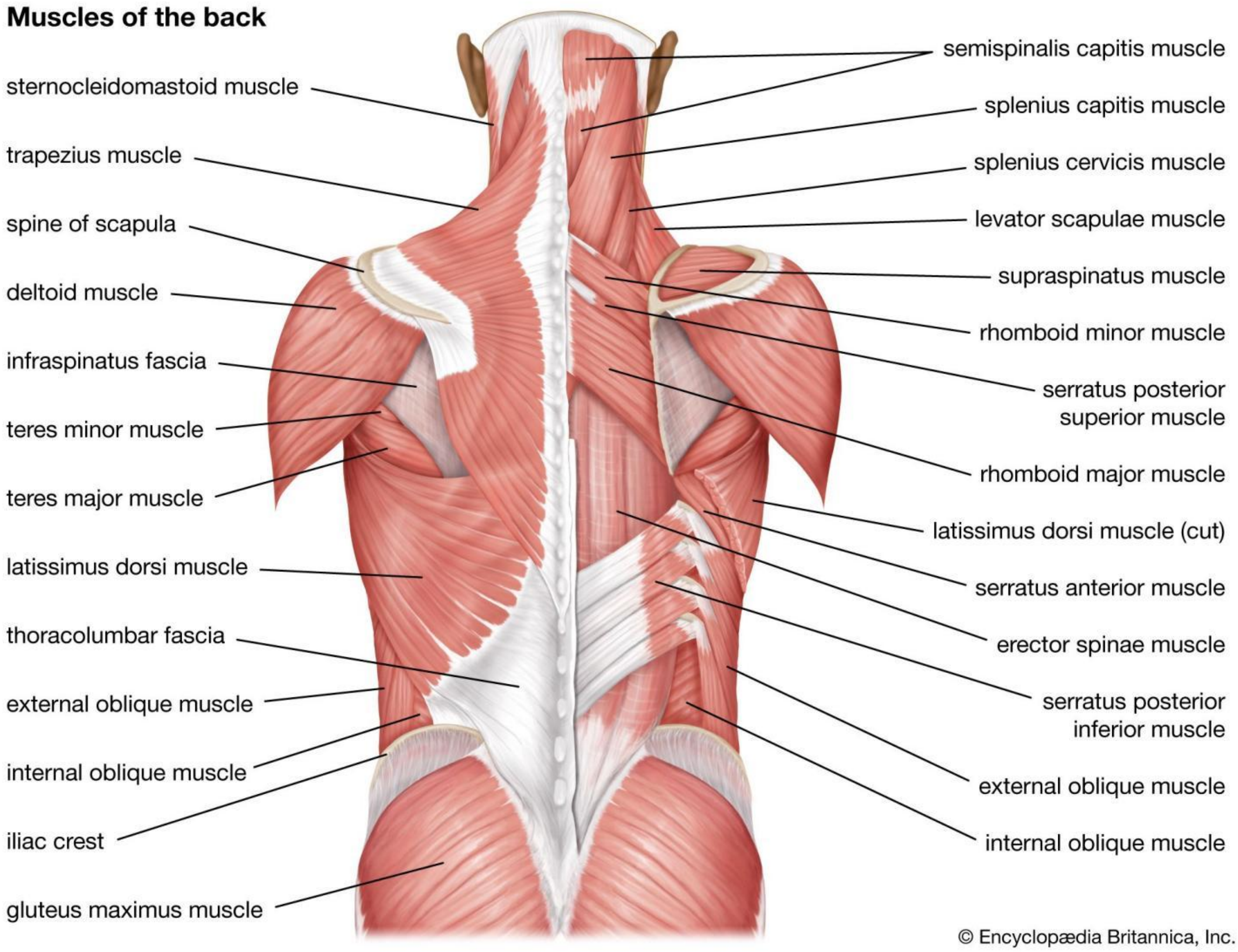


**Figure 7: Muscles of the back**

**Source**: Britannica

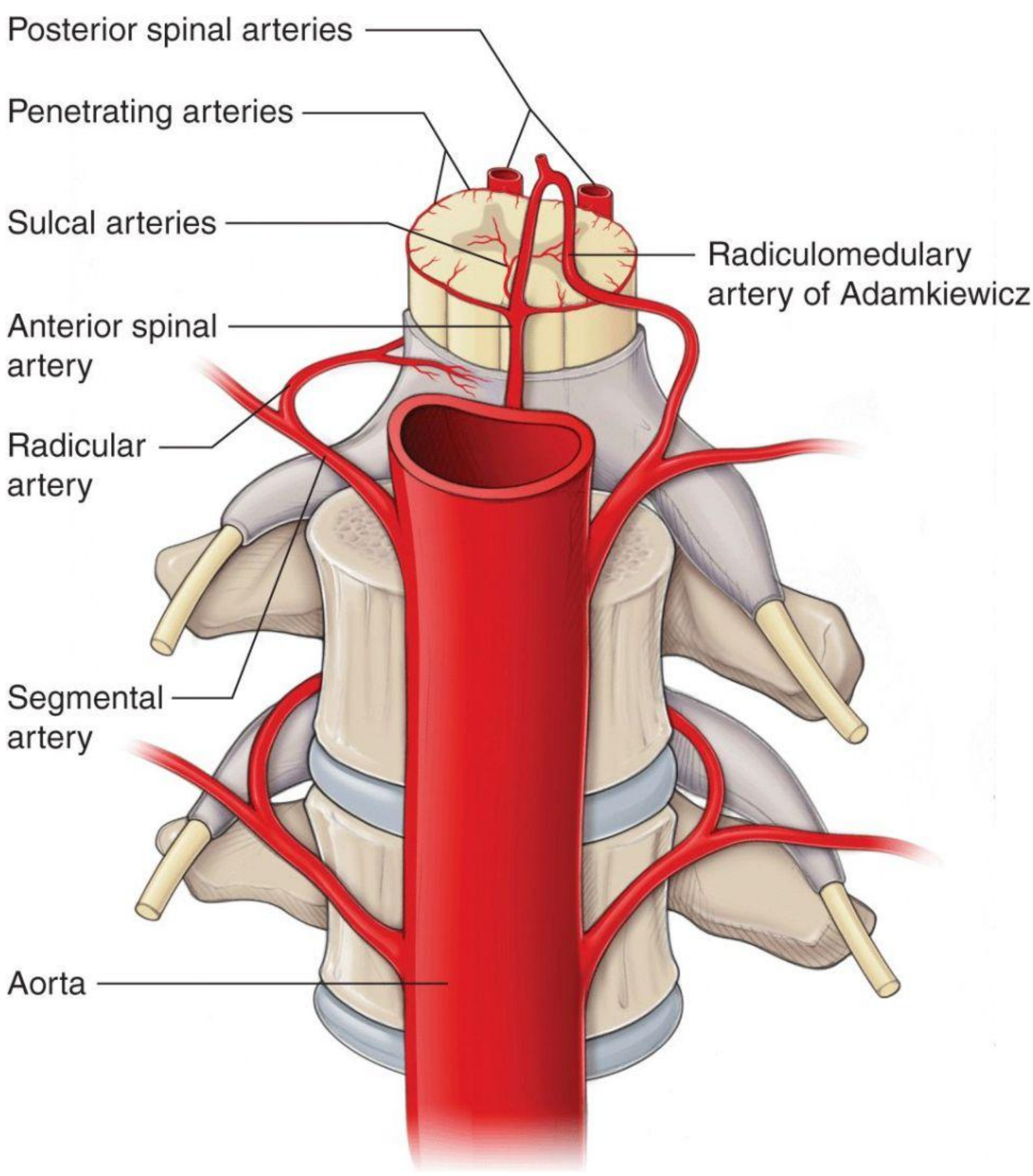


**Figure 6: Vertebral blood supply**

**Source:** Thoracic key

### 2.6.4 Anatomy of the Hand

The human hand is a complex structure comprising 27 bones, muscles, ligaments, nerves, and blood vessels, all working together to enable a wide range of movements and functions (Ken hub). (Figure 9)

#### 2.6.4.1 Bones

They include the Carpals (scaphoid, lunate, triquetrum, pisiform, trapezium, trapezoid, capitate, hamate), metacarpals (base, shaft, head), and the phalanges (proximal, middle, distal phalanges)

#### 2.6.4.2 Muscles

They include the thenar group (abductor pollicis brevis, flexor pollicis brevis, opponens pollicis), hypothenar group (abductor digiti minimi, flexor digiti minimi, opponens digiti minimi), metacarpal group (lumbricals, palmar interossei, dorsal interossei)

#### 2.6.4.3 Nerves

They include; Median nerve and its branches (common and palmar digital nerves) predominantly supply the thenar muscles, Radial nerve which provides cutaneous innervation along the outside of the thumb, Ulnar nerve and its branches (superficial, deep and dorsal) innervate the hypothenar and metacarpal groups.

#### 2.6.4.4 Arteries

All the branches originate from the radial and ulnar arteries. They include palmar arches (superficial, deep), palmar digital arteries (common, proper), dorsal carpal arch, dorsal metacarpal arteries, dorsal digital arteries, principal artery of the thumb.

### 2.6.4.5 Veins

Dorsal venous network of hand: predominant drainage route of the hand (also receiving palmar venous return via perforating veins). Gives rise to cephalic and basilic veins.

Palmar venous arches: Receives palmar metacarpal and digital veins. Drain into radial and ulnar veins.

### 2.6.4.6 Wrist

The wrist joint, also referred to as the radiocarpal joint is a condyloid synovial joint of the distal upper limb that connects and serves as a transition point between the forearm and hand. A condyloid joint is a modified ball and socket joint it is capable of various movements like flexion, extension, abduction and adduction. It also facilitates the passage of tendons and various neurovascular structures from the forearm to the hand (Ken hub).

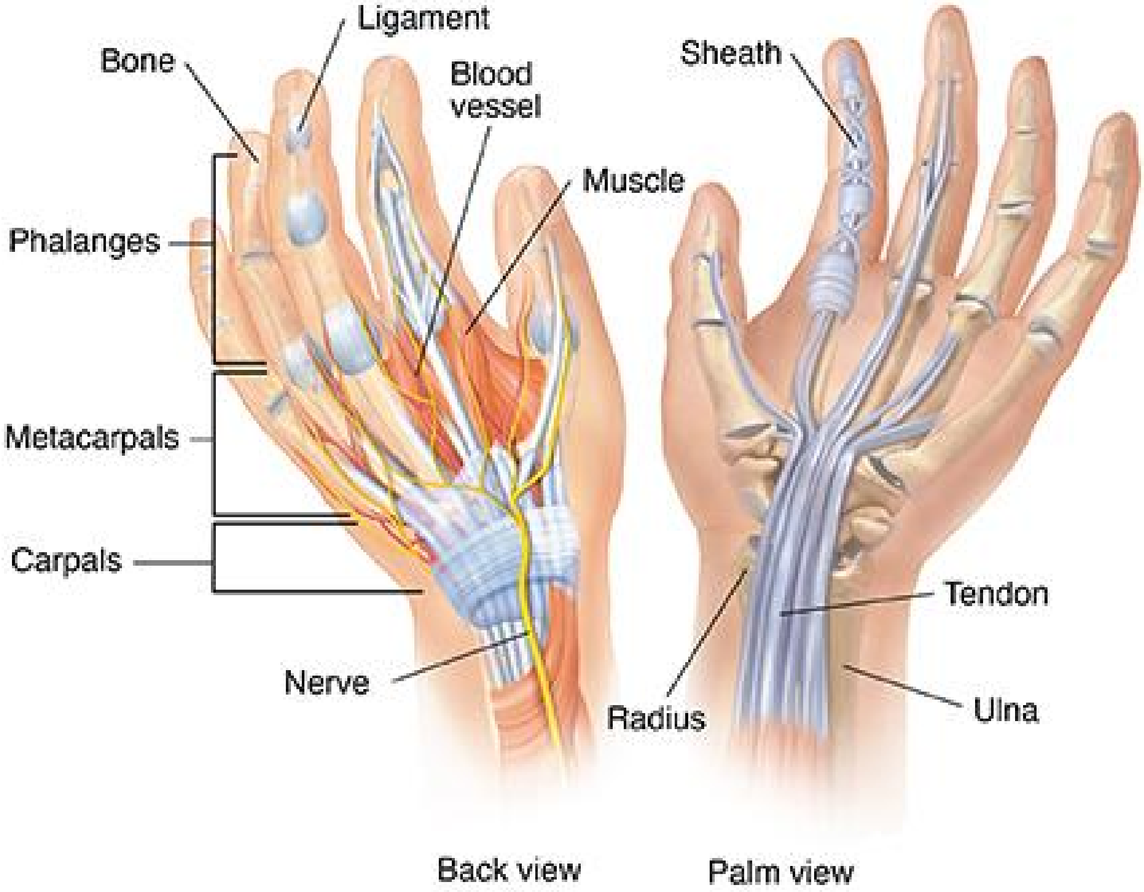


**Figure 7: Anatomy of the hand**

**Source**: MAG Online library

### 2.6.5 Anatomy of the Knee

The knee joint is a synovial joint that connects three bones: the femur, tibia and patella. It is a complex hinge joint composed of two articulations: the tibiofemoral joint and the patellofemoral joint. The tibiofemoral joint is an articulation between the tibia and the femur, while the patellofemoral joint is an articulation between the patella and the femur (Figure 10). (Ken hub)

#### 2.5.5.1 Type of joint

They include the tibiofemoral joint (Synovial hinge joint; uniaxial) and Patellofemoral joint (Plane joint)

#### 2.6.5.2 Articular surfaces

Tibiofemoral joint: lateral and medial condyles of femur, tibial plateaus

Patellofemoral joint: patellar surface of femur, posterior surface of patella

#### 2.6.5.3 Ligaments and Menisci

**Extracapsular ligaments:** patellar ligament, medial and lateral patellar retinacula, tibial (medial) collateral ligament, fibular (lateral) collateral ligament, oblique popliteal ligament, arcuate popliteal ligament, anterolateral ligament (ALL)

**Intracapsular ligaments:** anterior cruciate ligament (ACL), posterior cruciate ligament (PCL), medial meniscus, lateral meniscus

#### 2.6.5.4 Innervation

Femoral nerve (nerve to vastus medialis, saphenous nerve), tibial and common fibular (peroneal) nerves, posterior division of the obturator nerve

#### 2.6.5.5 Blood supply

Genicular branches of lateral circumflex femoral artery, femoral artery, posterior tibial artery, anterior tibial artery and popliteal artery

#### 2.6.5.6 Movements

Extension, flexion, medial rotation, lateral rotation

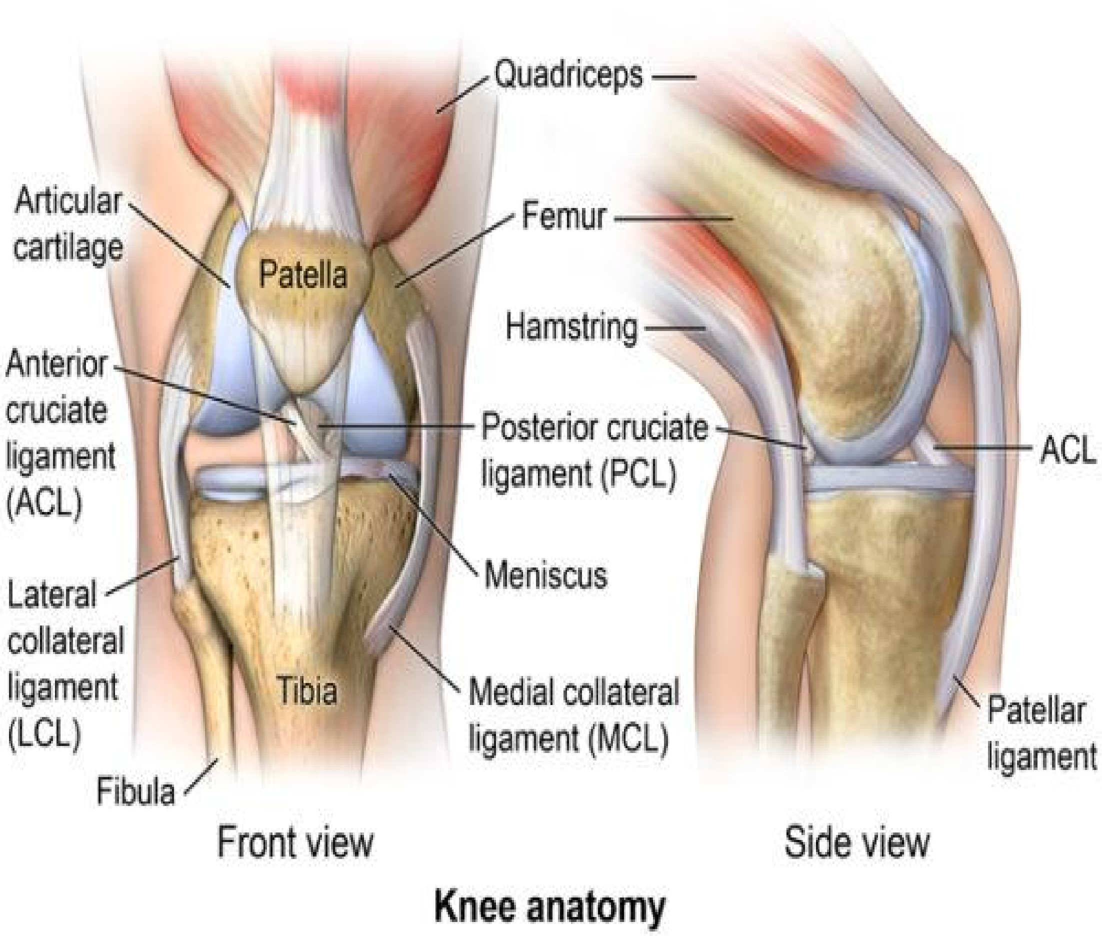


**Figure 8: Anatomy of the knee**
**Source**: Comprehensive Orthopaedics S.C.

## 2.7 Summary of Literature Reviewed

The literature indicates auto mechanics - particularly in areas with few resources - are highly exposed to job-related musculoskeletal issues. Research conducted in Nigeria and other African countries reveals frequent complaints of pain in the back, neck, or shoulders (Sambo et al., 2019). Although ergonomics plays a key role in workplace well-being, numerous workers don’t receive structured training on it. Even when individuals recognize hazards linked to their tasks (Oche et al., 2020; Ozomata et al., 2022), protective measures remain rare. Globally, patterns look alike - people know about ergonomics, yet habits don't follow (Ephraim et al., 2019). Outcomes are severe: studies in Nigeria, India, and Ethiopia reveal that between half and four-fifths of mechanics face musculoskeletal disorders (Ojoawo et al., 2021; Tamene et al., 2020), resulting in missed shifts, physical limitations, along with economic pressure.

While ergonomic training and improved equipment are advised, their use remains low in Nigeria’s repair shops. Because there's little information on what mechanics know, think, or do, focused studies are urgently needed. Fixing these issues might lower accident numbers while boosting worker well-being among this key group.

## 2.8 Empirical review

**Table 1: Empirical literature review on Knowledge, attitude and practice of ergonomic principles**

| Author / Year / Country | Title | Sample Size | Aim of Study | Study Type | Outcome / Measure | Findings |
|---|---|---|---|---|---|---|
| Adje *et al*. (2019), Nigeria | Ergonomic Principles in Patient Handling: Knowledge and Practice of Physiotherapists in Nigeria | 360 physiotherapists | To evaluate the knowledge and practice of ergonomic patient handling among Nigerian physiotherapists | Cross-sectional survey | Knowledge and practice of ergonomic principles; barriers to ergonomic compliance | Majority (95.9%) demonstrated high knowledge of ergonomic principles, but only 48.6% reported good practice. Lack of assistive devices and workload were major barriers to implementation. |
| Akter *et al*. (2016) Bangladesh | Musculoskeletal Symptoms and Physical Risk Factors among Automobile Mechanics in Dhaka | 100 automobile mechanics (ages 15–45) | To estimate the prevalence of musculoskeletal symptoms and identify associated physical risk | Cross-sectional study | Prevalence of musculoskeletal symptoms; physical risk factors | 77% reported musculoskeletal symptoms in the past 12 months. Most affected body parts were lower back (67%) and hip (53%). Significant associations found |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | between symptoms and factors like awkward posture, repetitive movement, force exertion, lifting, and vibration. |
| Anyaeche, C.O. & Ishie, P. (2021), Nigeria | Ergonomic Assessment of Risk Factors for Musculoskeletal Disorder in Selected Auto Repair Shops | 11 auto mechanics (ages 15–51) | To assess risk factors for musculoskeletal disorders in auto repair shops | Cross-sectional study | Awkward postures, high hand force, repetitive motion | 19 out of 23 tasks had very high-risk ratings (7). Lifting tasks violated ergonomic criteria for all modeled postures. Extreme stoop lift posture yielded the highest low back compression forces, increasing risks for low back pain. |
| Bolarinwa, M.A. & Kumapayi, A.O. (2023), Nigeria | Ergonomic Risk Assessment of Nigerian Teaching Personnel: Cases of a Secondary School and a Tertiary Institution in Ibadan, Nigeria | 60 teaching personnel | To assess ergonomic risk exposure among teachers in educational institutions. | Cross-sectional | Postural risk and musculoskeletal discomfort | Teachers reported high postural strain and back discomfort; long standing and poor posture were primary risk factors. |

| | | | | | | |
|---|---|---|---|---|---|---|
| Ephraim-Emmanuel *et al*. (2019), Nigeria | Knowledge, Attitude and Practice of Preventing the Occurrence of Work-Related Musculoskeletal Disorders Among Doctors in University of Port-Harcourt Teaching Hospital | 223 doctors | To assess doctors' knowledge, attitude, and practice towards WMSD prevention | Cross-sectional | Knowledge, attitude, and practice (KAP) on ergonomic risk and WMSD prevention | High knowledge and positive attitude reported; however, actual practice of preventive measures was low due to external barriers such as workload and lack of ergonomic resources. |
| Lawani-Luwaji *et al*. (2023), Nigeria | Awareness of Ergonomics in the Clinical Laboratory | 60 medical laboratory scientists | To assess awareness and practice of ergonomics among laboratory scientists. | Cross-sectional | Knowledge and awareness of ergonomic principles | 85% of participants demonstrated good ergonomic awareness; differences observed by gender and workplace setting; the study highlighted the need for formal ergonomic training programs. |
| Nasar *et al*. (2021), Oman | Ergonomics Knowledge, Attitude, and Practice Among Biomedical Scientists | 110 biomedical scientists | To assess ergonomics-related knowledge, attitude, and practice among | Cross-sectional | Knowledge, attitude, and practice regarding ergonomics and musculoskeletal | Over half (54.5%) demonstrated good ergonomics knowledge, 82.7% had positive |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | biomedical professionals | | risk prevention | attitudes, but 83.5% reported poor ergonomics practice. The study highlighted a strong attitude–practice gap, suggesting the need for institutional ergonomics training. |
| Oche *et al*. (2020), Nigeria | Determinants of Occupational Health Hazards among Roadside Automobile Mechanics in Sokoto Metropolis, Nigeria | 205 roadside auto-mechanics | To determine the prevalence and factors associated with occupational health hazards among roadside mechanics | Cross-sectional | Knowledge, attitude, and perception of occupational hazards; ergonomic risks | 91% perceived their job as risky, but only 26.7% showed positive safety attitudes. Lack of protective equipment, poor work environment, and inadequate training were identified as major barriers to implementing safety practices. |

| | | | | | | |
|---|---|---|---|---|---|---|
| Ojoawo *et al*. (2021), Nigeria | Prevalence, risk factors and health care service utilisation for low-back pain among Nigerian automobile technicians | 240 automobile technicians | To determine the prevalence, risk factors, and healthcare service utilization for low-back pain among automobile technicians. | Cross-sectional survey | Twelve-month and point prevalence of LBP; associated risk factors; health service use. | Twelve-month and point prevalence rates of LBP were 79.2% and 75%, respectively. Ongoing LBP was mostly associated with poor posture (46.7%), trauma (13.9%), and lifting of loads (11.7%). Despite high prevalence, health service utilization remained low. |
| Oladeinde *et al*. (2015), Nigeria | Awareness and Knowledge of Ergonomics Among Medical Laboratory Scientists in Nigeria | 106 medical laboratory scientists | To assess the awareness and knowledge of ergonomics among medical laboratory scientists in Nigeria | Descriptive cross-sectional study | Awareness and knowledge of ergonomics; association with demographic factors | Only 25.5% of participants had heard of ergonomics. Awareness was significantly higher among male respondents, indicating generally low knowledge and awareness of ergonomics in this professional group. |

| | | | | | | |
|---|---|---|---|---|---|---|
| Olaiya *et al*. (2018), Nigeria | Assessment of the Knowledge, Attitudes and Perception of Potential Occupational Hazards by Automobile Workers in Makurdi, Benue State, Nigeria | 117 auto-mechanics and spray painters | To evaluate perception and attitude towards occupational hazards among autoworkers | Cross-sectional | Knowledge, perception, and attitudes toward safety | Knowledge, perception, and attitudes toward occupational hazards among both spray painters and mechanics were generally low (<20% for knowledge, <30% for attitudes). Awareness of chemical hazards, effects of chemicals, and proper use of PPE was poor, with only 42.9% reporting regular PPE use |
| Olarewaju *et al*. (2021), Nigeria | Assessment of Occupational Injuries and Safety Practices among Automobile Repair Artisans in Apo and Gudu Area of Abuja, Nigeria | 400 artisans | To determine injury patterns and assess safety practices among auto repair workers | Descriptive cross-sectional | Prevalence of injuries; reported safety practices | 78.5% reported musculoskeletal injuries; poor safety practices observed. Despite good knowledge and positive attitude toward safety, compliance with safety practices was low. |

| | | | | | | |
|---|---|---|---|---|---|---|
| Ozomata *et al*. (2022), Nigeria | A Study of Knowledge of Occupational Health Hazards and Safety Practices among Automobile Mechanics in an Urban Area of South-Western Nigeria | 120 registered auto-mechanics | To assess knowledge and safety practices among mechanics | Descriptive cross-sectional | Knowledge of safety devices; safety practice scores | 96.7% had knowledge of safety devices, but only 21.7% practiced them well. Barriers included lack of PPE, inadequate training on PPE use, and underestimation of safety importance. |
| Sambo *et al*. (2023), Nigeria | Prevalence and Pattern of Musculoskeletal Disorder in Panteka Mechanic Village, Kaduna | 121 automobile mechanics | To determine the prevalence and pattern of musculoskeletal disorders among automobile mechanics in Kaduna State | Cross-sectional descriptive study | Prevalence of MSDs; affected body regions and risk factors | High prevalence of MSDs, especially in the lower back, neck, and shoulders. Poor posture, repetitive bending, and manual handling were key contributors. Ergonomic interventions were recommended. |
| Tamene *et al*. (2020), Ethiopia | Musculoskeletal Disorders and Associated Factors among Vehicle Repair Workers in | 344 vehicle repair | To determine the prevalence of work-related | Cross-sectional | WMSD prevalence; risk factors (e.g., | 47.7% had WMSDs; repetitive motions and heavy lifting |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Hawassa City, Southern Ethiopia | workers | musculoskeletal disorders (WMSDs) and associated ergonomic factors among vehicle repair workers in Hawassa City. | | lifting, posture) | were major factors |
| Vonkat *et al.* (2024), Nigeria | Ergonomics and Health Risk Awareness of Workers Involved in Manual Material Handling at Sabon Gari Market in Zaria, Nigeria | 308 market workers | To assess ergonomics knowledge and training exposure among market workers involved in manual material handling | Cross-sectional survey | Ergonomic awareness and training; musculoskeletal discomfort and injury occurrence | Only 6.8% of participants were aware of ergonomics; low exposure to formal training; 96.4% reported musculoskeletal discomfort; 75% resorted to self-medication; barriers included cost and fear of job loss. |

# CHAPTER THREE

# MATERIALS AND METHODS

## 3.1 Participant

This study was conducted among auto-mechanics working in auto-mechanic workshops located within the Uwelu Motor Spare Parts Market, Benin City, Edo State, Nigeria.

### 3.1.1 Inclusion Criteria

The inclusion criteria for this study were as follows:

i. Participants who were full-time auto-mechanics in Benin City, Edo State.
ii. Participants who were adults aged 18 years and above.
iii. Participants who had been working in the auto-mechanic industry for at least one year.
iv. Participants who were able to read and understand English.3.1.2 Exclusion Criteria

### 3.1.2 Exclusion Criteria

The exclusion criteria for this study were as follows:

i. Auto-mechanics with less than one year of work experience.
ii. Auto-mechanics with obvious deformities or musculoskeletal conditions, such as a history of previous fracture.
iii. Individuals who were not actively engaged in auto repair work (e.g., administrative staff within workshops).
iv. Individuals who declined to participate or were unable to complete the questionnaire due to language barriers.

## 3.2 Materials

### 3.2.1 Apparatus/Instruments

The research instruments used for this study were as follows:

i. Height meter

ii. Weight scale

iii. KAP questionnaire Developed by Nasar *et al*. (2021)

**Height meter:** To assess participant height in meters, a device featuring a fixed upright ruler with adjustable horizontal head support attached to a wall surface was applied. This tool gathered body measurement details from auto-repair workers involved in the research. By capturing direct linear values, it reflected actual stature - supporting relevance of recorded content, alignment with intended concept, along with general recognition by observers. Measurement precision reached within 0.5m above or below true value through standardized adjustment.

**Weighing scale:** This tool recorded each person's mass in kg by having them stand on it. As individuals stepped onto the surface, numbers appeared instantly. Researcher applied it here to gather one piece of physical measurement info. Alongside stature details, weight helped compute BMI - a value showing if body makeup could affect movement efficiency at work or raise chances of muscle-skeletal issues. The weight scale recorded mass directly, so it reflected the actual concept being studied, matched the intended measure logically, also appeared credible on surface level. It had been adjusted to work precisely within 0.1 kg margin, while readings were collected consistently - barefoot, using fixed procedures.

KAP questionnaire: A tool created by Nasar et al. (2021) measuring ergonomic knowledge, attitude, and practice in Nigerian health workers was modified for use here. This version included four parts. Part one(A) collected background details like age, education, time on the job, also job type e.t.c. Part B looked at how well individuals understood ergonomics tied to their tasks, using a rating system to judge grasp of core ideas. Section C looked at their attitude towards ergonomics, checking what they thought about its usefulness and practicality when used at work - responses came from a Likert-type scale. Part D focused on real-life practices linked to ergonomics during regular tasks; this was assessed using similar scaled answers.

This setup made it possible to fully check how auto mechanics grasped, saw importance in, or used ergonomics at work. To meet the research goals, the main tool was a survey that assessed knowledge, attitudes, and practices - focusing on ergonomic rules. Instead of using an original version, the modified KAP form improved accuracy after being reviewed by specialists and tried out first. Its design held up under statistical checks that confirmed whether questions fit into correct categories. Also, because the wording matched real-world tasks for auto technicians, it appeared suitable on initial inspection (Streiner, Norman, & Cairney, 2015). Results showed solid reliability inside the scale (Cronbach's alpha $\geq 0.70$), along with consistent outcomes when repeated. Reliability ($r \geq 0.70$).

## 3.3 Methods

### 3.3.1 Research Design

This study adopted a cross-sectional research design to assess the knowledge, attitude, and practice of ergonomic principles among auto-mechanics in Benin City, Edo State.

### 3.3.2 Sampling Techniques

The auto-mechanic workmen for this study were recruited through consecutive sampling, while the auto-mechanic workshops were selected using purposive sampling.

### 3.3.3 Sample size

The sample size was calculated using the "Cochran's formula"

Which is; $N_0 = \frac{Z^2(PQ)}{e^2}$

Where $n_0$ is the sample size, Z is the selected critical value of the desired confidence level (typically 1.96 or 95%), P is the estimated attribute (variability) that is present in the population, Q=1−P, and e is the margin of error (0.05).

The confidence level for this study will be 95%.

Taking a 95% confidence level, the sample size was calculated as follows:

P = 0.5,

and hence Q = 1−0.5 = 0.5; e = 0.05; Z = 1.96

So,

$$n_0 = N_0 = \frac{(1.96)^2(0.5\times0.5)}{(0.05)^2} = 384.16 = 384$$

Therefore, the estimated sample size for this study, as calculated using Cochran's formula, was approximately 384 participants.

### 3.3.4 Procedure for Data Collection

Before gathering any information, the researcher received permission from the Edo State Ministry of Health to follow proper ethical guidelines while respecting each participant's rights. This step was taken so that everyone involved would be treated fairly throughout the process.

After getting ethics approval, researcher went to key informal repair spots in Benin City. In every spot, talks took place with heads or lead mechanics to secure consent for the research on site. Instead of direct agreement, some gave verbal go-ahead through casual conversation. This process clarified ideal moments to engage workers - without interrupting workflows.

Participants were chosen according to set requirements, including a minimum of 1 year working as auto mechanics. Those falling short of these conditions were left out of the research project. While meeting the benchmarks was essential, exceptions weren't made for unqualified applicants.

When meeting possible participants face-to-face, the researcher outlined the study's goals - making it known that joining was optional. Participation relied on willingness; no pressure was applied during this stage. Each person signed a document confirming they understood what taking part meant. This form included key details about who I am, why the research is being done, and how data would be handled. It also clarified responsibilities held by both sides throughout the process.

Data were gathered with three primary instruments: a stadiometer to measure height, alongside a calibrated scale used for body weight. A tailored questionnaire was also applied in this research. It recorded information about participants' knowledge, attitudes, and practices concerning ergonomics guidelines.

All collected information was applied exclusively to study activities. In order to safeguard each participant’s identity, data were managed with high levels of discretion by the investigator while being kept in protected storage during every phase of the project.

### 3.3.5 Ethical Consideration

Ethical approval for this study was sought and obtained from the Edo State Ministry of Health (Approval number: HA/737/25/D/09180763) (Appendix I). Informed consent

(Appendix II) was obtained from all participants prior to their involvement. Participant confidentiality was strictly maintained, and all data were anonymised and stored securely.

### 3.3.6 Data Analysis

Data were analysed using the International Business Machines (IBM) Statistical Package for the Social Sciences (SPSS) version 27.0. Descriptive statistics, such as mean, standard deviation, frequency and percentages, were used to analyse the data. Chi-square tests was employed to determine associations between KAP variables and selected socio-demographic factors, with significance set at $p \leq 0.05$.

# CHAPTER FOUR

# RESULTS

## 4.1 Anthropometric Characteristics of all Respondents

The results presented in Table 2 summarize the anthropometric characteristics of the respondents. The participants had an average height of 1.72 ± 0.22 m and an average weight of 76.34 ± 11.21 kg**.** Based on these values, the calculated mean Body Mass Index (BMI) was 26.13 ± 4.01 kg/m² (Table 2).

**Table 2: Anthropometric Characteristics of all Respondents** **(N= 384)**

| Variables | Mean ± SD |
|---|---|
| Height (m) | 1.72 ± 0.22 |
| Weight (Kg) | 76.34 ± 11.21 |
| BMI ($Kg/m^2$) | 26.13 ± 4.01 |

**BMI**: Body Mass Index, **SD**: Standard Deviation

## 4.2 Socio-demographic Characteristics of all Respondents

The findings in Table 3 represent the sociodemographic profile of the respondents. Most participants were relatively young to middle-aged, with the largest group (44%) between 35–44 years**,** while only a small fraction (5.2%) were 55 years and above. In terms of marital status, the majority were married (57.6%)**,** with 40.1% single and only a few divorced (2.3%) (Table 3).

Religiously, the respondents were predominantly Christian (77.1%)**,** followed by Muslims (15.9%)**,** while a minority (7%) practiced other faiths. Educational background varied considerably: nearly one-fifth (18.2%) had no formal education, while more than half (53.4%) had attained secondary education, and only 7.6% reached tertiary education (Table 3).

Looking at lifestyle, about two-thirds (67.2%) engaged in physical activities outside work**,** while a notable 32.9% did not (Table 3).

When their job roles were examined, the majority worked as engine repairers (30.2%) **or** auto electricians (24.2%)**,** with smaller proportions being panel beaters (15.1%)**,** radiator repairers (11.7%)**,** and welders (11.5%)**.** A few (16.9%) performed multiple roles.

Work experience was quite diverse: about half had between 5–20 years of experience, while only 10.7% had more than 20 years in the field. The overwhelming majority (96.4%) gained their skills through the apprenticeship system**,** compared to a very small number (3.6%) who attended formal mechanic schools. Most of them (81.3%) completed training in less than six years**,** while a smaller group (18.8%) trained for longer (Table 3).

Finally, their daily workload was quite heavy. A vast majority **(**84.6%**)** reported working more than 8 hours per day, while only 15.4% worked fewer hours (Table 3).

**Table 3: Socio-demographic Characteristics of all Respondents (N= 384)**

| **Variable's** | **n** | **%** |
|---|---|---|
| **Age** | | |
| < 25 | 110 | 28.6 |
| 35-44 | 169 | 44.0 |
| 45-54 | 85 | 22.1 |
| > 54 | 20 | 5.2 |
| **Marital Status** | | |
| Single | 154 | 40.1 |
| Married | 221 | 57.6 |
| Divorced | 9 | 2.3 |

| | | |
|---|---|---|
| **Religion** | | |
| Christianity | 296 | 77.1 |
| Islam | 61 | 15.9 |
| Other | 27 | 7 |
| **Level of education** | | |
| No formal education | 70 | 18.2 |
| Primary education | 80 | 20.8 |
| Secondary education | 205 | 53.4 |
| Tertiary education | 29 | 7.6 |
| **Off work physical activity** | | |
| Yes | 258 | 67.2 |
| No | 126 | 32.9 |
| **Job type** | | |
| Panel beaters | 58 | 15.1 |
| Auto electricians | 35 | 24.2 |
| Welders | 44 | 11.5 |
| Radiator repair | 45 | 11.7 |
| Engine mechanics | 116 | 30.2 |
| Others | 21 | 5.5 |
| Multi jobs | 65 | 16.9 |
| **Years of experience** | | |
| < 4 | 52 | 13.5 |
| 5 - 9 | 100 | 26.0 |
| 10 – 14 | 91 | 23.7 |
| 14 - 20 | 100 | 26.0 |
| > 20 | 41 | 10.7 |
| **Mode of training** | | |
| Apprenticeship | 370 | 96.4 |
| Formal mechanic school | 14 | 3.6 |
| **Duration of training** | | |
| < 6 years | 312 | 81.3 |
| > 6 years | 72 | 18.8 |
| **Daily working hours** | | |
| < 8 hours | 59 | 15.4 |
| > 8 hours | 325 | 84.6 |

**Keys**: **n** = frequency, **%** = percentage

## 4.3 Respondent's knowledge of ergonomics

The findings in Table 4 indicate the respondents' level of knowledge about ergonomics. Out of the 384 respondents, only 2.6% reported knowing what ergonomics is, 8.9% had some knowledge, while 88.5% had none. Regarding training, 3.9% had received formal training on ergonomic practices, 15.6% had some exposure, and 80.5% had none. Awareness of the benefits of ergonomics was low, with 20.1% having good knowledge, 35.9% some knowledge, and 44.0% no knowledge. However, 57.3% recognized the health hazards of their job without ergonomics (Table 4).

Only 0.3% knew that ergonomics aims to adapt the job to the worker, while 92.1% lacked this knowledge. In contrast, knowledge of musculoskeletal risks was higher: 83.6% were aware that working in uncomfortable positions could cause problems, 79.2% that tight tool grip can cause hand and wrist strain, 86.5% that repetitive work contributes to fatigue and injury, and 88.3% that prolonged grasping of small instruments can lead to musculoskeletal disorders. Nearly all respondents (97.1%) disagreed with the misconception that keeping the shoulders relaxed could cause musculoskeletal problems (Table 4).

**Table 4: Respondent's knowledge of ergonomics (N= 384)**

| Variables | Yes | | To some extent | | No | |
|---|---|---|---|---|---|---|
| | n | % | n | % | n | % |
| Do you know what ergonomics is? | 10 | 2.6 | 34 | 8.9 | 340 | 88.5 |
| Have you received formal training on ergonomic work practices? | 15 | 3.9 | 60 | 15.6 | 309 | 80.5 |
| Do you know the benefits of ergonomics application? | 77 | 20.1 | 138 | 35.9 | 169 | 44.0 |
| Do you know what the health hazards of your job without ergonomics? | 220 | 57.3 | 54 | 14.1 | 110 | 28.6 |
| Do you know that ergonomics aims to adapt the job or tools to suit the worker, not force the worker to adjust to the job? | 1 | 0.3 | 29 | 7.6 | 354 | 92.1 |
| Have you heard that working in uncomfortable Positions for a long time may lead to musculoskeletal problems? | 321 | 83.6 | 58 | 15.1 | 5 | 1.3 |
| Do you know that holding tools tightly for a long Periods can cause strain in your hands and wrists? | 304 | 79.2 | 74 | 19.3 | 6 | 1.6 |
| Are you aware that repetitive work without a break can contribute to fatigue and injury? | 332 | 86.5 | 45 | 11.7 | 7 | 1.8 |
| Musculoskeletal disorders may be caused by grasping small instruments for long periods. | 339 | 88.3 | 30 | 7.8 | 15 | 3.9 |
| Keeping the shoulder relaxed could cause musculoskeletal disorders | 6 | 1.6 | 5 | 1.3 | 375 | 97.1 |

## 4.4 Respondent's Attitude Towards Ergonomics

As shown in table 5, 74.1% of respondents agreed that ergonomics should be part of auto-mechanic practice, while 20.3% agreed to some extent and 5.2% disagreed. About 24.5% reported that they preferred bending their head forward instead of adjusting their workspace for better viewing, 38.3% did so to some extent, and 37.2% did not. Similarly, 21.4% preferred bending or twisting their body rather than adjusting the vehicle height or workspace, 29.4% did so to some extent, while 49.2% disagreed (Table 5).

With regard to maintaining posture, 30.7% indicated they preferred retaining the same position for long periods to finish work on time, 29.2% sometimes did so, and 40.1% disagreed. A total of 26.0% believed taking short posture breaks was unnecessary, 33.6% agreed to some extent, and 40.4% disagreed. About 39.6% felt they could not work effectively without assuming uncomfortable positions, 27.9% somewhat agreed, while 32.6% disagreed (Table 4).

Concerning forceful hand movements, 31.5% believed they help complete tasks faster, 33.6% agreed to some extent, and 34.9% disagreed. A very large proportion (93.8%) acknowledged that exercises such as stretching and walking improve productivity, while 5.7% agreed to some extent and 0.5% disagreed (Table 5).

On the use of ergonomic tools, 30.7% reported not seeing the need for them in daily tasks, 44.5% were uncertain, and 24.7% disagreed. Similarly, 27.6% thought ergonomic training and tools were a waste of workshop resources, 10.9% agreed to some extent, while the majority (61.5%) disagreed. Almost all respondents (96.1%) agreed that angled elbow contact with work surfaces should be avoided, 2.1% agreed to some extent, and 1.8% disagreed (Table 5).

**Table 5: Respondent's Attitude Towards Ergonomics (N= 384)**

| Variables | Yes | | To some extent | | No | |
|---|---|---|---|---|---|---|
| | n | % | n | % | n | % |
| Ergonomics should be part of auto mechanic practice. | 286 | 74.1 | 78 | 20.3 | 20 | 5.2 |
| I prefer to bend my head forward instead of adjusting the workspace for better viewing. | 94 | 24.5 | 147 | 38.3 | 143 | 37.2 |
| I prefer bending or twisting my body Instead of adjusting vehicle height or my workspace. | 82 | 21.4 | 113 | 21.4 | 189 | 49.2 |
| To finish my work on time I prefer to retain the same position (e.g., sitting) for long period instead of changing my posture. | 118 | 30.7 | 112 | 29.2 | 154 | 40.1 |
| I believe taking short posture break slow me down and is unnecessary. | 100 | 26.0 | 129 | 33.6 | 155 | 40.4 |
| I feel I can't work effectively without assuming uncomfortable or awkward positions. | 152 | 39.6 | 107 | 27.9 | 125 | 32.6 |
| Forceful hand movements while working enables me get the work done on time regardless of the consequences that may occur. | 121 | 31.5 | 129 | 33.6 | 134 | 34.9 |
| Doing exercises like stretching, walking etc, are important to be more productive at work. | 360 | 93.8 | 22 | 5.7 | 2 | 0.5 |
| I don't see the need for ergonomic tools or equipment in my daily tasks. | 118 | 30.7 | 171 | 44.5 | 95 | 24.7 |
| I think ergonomic training and tools are a waste of workshop money. | 106 | 27.6 | 42 | 10.9 | 236 | 61.5 |
| I should always try to avoid putting my angled elbow in direct contact with the work surface for a long period of time. | 369 | 96.1 | 8 | 2.1 | 7 | 1.8 |

## 4.5 Respondent’s Practice of Ergonomics

The results from Table 6 showed that large proportion of the respondent’s regularly change their positions (81.0%), keep their back straight in tight spaces (63.5%), bend their knees when lifting heavy parts (60.2%), and uses tools suited to their hand size (58.3%). Many also positioned work materials within easy reach (84.1%), took short stretching breaks (84.9%), adjusted stool or workbench height (67.7%), and avoided gripping tools too tightly (64.8%). Good practices were also observed in positioning vehicle parts to avoid overreaching (74.5%) and ensuring adequate lighting in the workplace (90.1%). However, fewer respondent’s places frequently used tools at waist pocket (45.8%) or used gloves when handling vibrating tools (53.9%). On the other hand, poor ergonomic practices were evident as 8.6% still lifted heavy parts with their back, 12.2% did not store frequently used tools at waist level, 15.4% did not use gloves when handling vibrating tools, and 2.3% did not ensure proper lighting. (Table 6)

**Table 6: Respondent's Practice of Ergonomics (N= 384)**

| Variables | Yes | | To some extent | | No | |
|---|---|---|---|---|---|---|
| | n | % | n | % | n | % |
| Do you change your position regularly? | 311 | 81.0 | 73 | 19.0 | 0 | 0 |
| Is your back straight while working under vehicles or in tight spaces? | 244 | 63.5 | 140 | 36.5 | 0 | 0 |
| Do you bend your knees instead of your back when lifting? | 231 | 60.2 | 120 | 31.3 | 33 | 8.6 |
| Use tools that match the size of your hand? | 224 | 58.3 | 139 | 36.2 | 21 | 5.5 |
| Do you try to position your work materials for easy reach? | 323 | 84.1 | 61 | 15.1 | 0 | 0 |
| Do you take short breaks? | 326 | 84.9 | 50 | 13.0 | 8 | 2.1 |
| Do you adjust the height of your stool, creeper, or workbench? | 260 | 67.7 | 103 | 26.8 | 21 | 5.5 |
| Do you avoid gripping tools too tightly? | 249 | 64.8 | 126 | 32.8 | 9 | 2.3 |
| Do you position vehicle parts or engines in a way that allows you to work without overreaching or twisting? | 286 | 74.5 | 93 | 24.2 | 5 | 1.3 |
| Do you store frequently used tools and items at waist level? | 183 | 45.8 | 154 | 40.1 | 47 | 12.2 |
| Do you use gloves or padding when working with vibrating tools to reduce hand-arm strain? | 207 | 53.9 | 118 | 30.7 | 59 | 15.4 |
| When doing overhead work, do you rest your arms or switch hands to reduce shoulder fatigue? | 337 | 87.8 | 35 | 9.1 | 12 | 3.1 |
| Do you ensure that your work area has enough lighting to reduce eye strain and awkward body movements? | 346 | 90.1 | 29 | 7.6 | 9 | 2.3 |

## 4.6 Association between Respondents Knowledge and each of their Attitudes and Practices of Ergonomics

From Table 7, the Chi-square analysis revealed significant associations between respondents' knowledge and attitudes toward ergonomics. Specifically, knowledge of ergonomics was significantly associated with attitudes H ($\chi^2 = 41.2$, $p = 0.00$) and K ($\chi^2 = 23.6$, $p = 0.00$). Formal training on ergonomics was significantly associated with attitude H ($\chi^2 = 11.7$, $p = 0.02$). Knowledge of the benefits of ergonomics was significantly associated with attitudes E ($\chi^2 = 12.3$, $p = 0.02$), F ($\chi^2 = 13.9$, $p = 0.01$), and I ($\chi^2 = 13.9$, $p = 0.01$) (Table 7).

Knowledge, that long uncomfortable positions can cause musculoskeletal problems was significantly associated with attitudes D ($\chi^2 = 10.2$, $p = 0.04$), H ($\chi^2 = 12.8$, $p = 0.01$), and K ($\chi^2 = 18.6$, $p = 0.00$) (Table 7).

Knowledge that holding tools tightly for long periods can strain the hands or wrists was significantly associated with attitudes B ($\chi^2 = 11.4$, $p = 0.02$), H ($\chi^2 = 11.2$, $p = 0.02$), and K ($\chi^2 = 15.1$, $p = 0.00$). Knowledge that repetitive work without breaks can cause fatigue or injury was significantly associated with attitudes B ($\chi^2 = 10.2$, $p = 0.04$), C ($\chi^2 = 9.5$, $p = 0.05$), H ($\chi^2 = 21.1$, $p = 0.00$), and K ($\chi^2 = 36.4$, $p = 0.00$). Knowledge that grasping small tools for long can cause musculoskeletal disorders was significantly associated with attitudes H ($\chi^2 = 19.0$, $p = 0.00$) and K ($\chi^2 = 26.5$, $p = 0.00$) (Table 7).

Finally, knowledge that keeping the shoulder relaxed could cause musculoskeletal disorders was significantly associated with attitudes E ($\chi^2 = 11.5$, $p = 0.02$), H ($\chi^2 = 12.5$, $p = 0.01$), and K ($\chi^2 = 9.6$, $p = 0.05$). All other associations were not statistically significant ($p > 0.05$). (Table 7

**Table 7: Association between Respondents Knowledge and their Attitudes towards Ergonomics (N= 384)**

| **Variable** | **Attitudes toward Ergonomics** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Knowledge** | A ($x^2$, p) | B ($x^2$, p) | C ($x^2$, p) | D ($x^2$, p) | E ($x^2$, p) | F ($x^2$, p) | G ($x^2$, p) | H ($x^2$, p) | I ($x^2$, p) | J ($x^2$, p) | K ($x^2$, p) |
| Q1 | 3.6 (0.46) | 7.7 (0.10) | 7.4 (0.12) | 2.4 (0.66) | 5.5 (0.24) | 5.8 (0.22) | 5.4 (0.25) | 41.2 (0.00) | 7.2 (0.13) | 1.4 (0.85) | 23.6 (0.00) |
| Q2 | 4.9 (0.29) | 5.0 (0.28) | 2.4 (0.67) | 0.9 (0.93) | 1.9 (0.75) | 3.3 (0.51) | 4.8 (0.30) | 11.7 (0.02) | 2.7 (0.62) | 0.4 (0.98) | 3.7 (0.44) |
| Q3 | 9.5 (0.05) | 2.0 (0.73) | 6.5 (0.16) | 4.8 (0.31) | 12.3 (0.02) | 13.9 (0.01) | 5.2 (0.27) | 6.3 (0.18) | 13.9 (0.01) | 5.3 (0.26) | 2.4 (0.66) |
| Q4 | 6.0 (0.20) | 1.1 (0.89) | 2.0 (0.74) | 7.5 (0.11) | 8.0 (0.09) | 0.2 (1.00) | 1.3 (0.86) | 5.0 (0.28) | 5.9 (0.21) | 2.5 (0.64) | 6.5 (0.17) |
| Q5 | 5.1 (0.28) | 3.8 (0.44) | 5.2 (0.27) | 3.2 (0.52) | 3.3 (0.51) | 4.1 (0.40) | 4.6 (0.33) | 20.6 (0.00) | 7.6 (0.11) | 3.2 (0.53) | 13.3 (0.01) |
| Q6 | 3.6 (0.46) | 4.6 (0.33) | 9.3 (0.06) | 10.2 (0.04) | 7.4 (0.12) | 2.5 (0.65) | 2.9 (0.58) | 12.8 (0.01) | 6.2 (0.19) | 1.7 (0.79) | 18.6 (0.00) |
| Q7 | 4.7 (0.32) | 11.4 (0.02) | 7.3 (0.12) | 5.6 (0.23) | 5.6 (0.23) | 3.7 (0.44) | 2.0 (0.74) | 11.2 (0.02) | 3.4 (0.50) | 2.1 (0.72) | 15.1 (0.00) |
| Q8 | 4.2 (0.39) | 10.2 (0.04) | 9.5 (0.05) | 7.0 (0.14) | 9.3 (0.05) | 5.6 (0.23) | 6.3 (0.18) | 21.1 (0.00) | 1.7 (0.78) | 0.4 (0.98) | 36.4 (0.00) |
| Q9 | 4.4 (0.35) | 3.1 (0.55) | 4.4 (0.35) | 5.8 (0.21) | 8.8 (0.07) | 3.4 (0.49) | 3.3 (0.50) | 19.0 (0.00) | 4.2 (0.38) | 0.8 (0.94) | 26.5 (0.00) |
| Q10 | 0.7 (0.95) | 2.4 (0.66) | 5.9 (0.21) | 1.0 (0.91) | 11.5 (0.02) | 6.9 (0.14) | 6.8 (0.15) | 12.5 (0.01) | 8.0 (0.09) | 1.3 (0.86) | 9.6 (0.05) |

**Keys**: **Knowledge of ergonomics**

**Q1:** Do you know what ergonomics is, **Q2:** Have you received formal training on ergonomic work practices, **Q3:** Do you know the benefits of ergonomics application, **Q4:** Do you know the health hazards of your job without ergonomics, **Q5:** Do you know that ergonomics aims to adapt the job or tools to suit the worker, not force the worker to adjust to the job, **Q6:** Have you heard that working in uncomfortable positions for a long time may lead to musculoskeletal problems, **Q7:** Do you know that holding tools tightly for long periods can cause strain in your hands and wrists, **Q8:** Are you aware that repetitive work without breaks can contribute to fatigue and injury, **Q9:** Musculoskeletal disorders may be caused by grasping small instruments for long periods, **Q10:** Keeping shoulders relaxed could prevent musculoskeletal disorders.

**Keys**: **Attitudes toward ergonomics**

**A:** Ergonomics should be part of auto mechanic practice, **B:** I prefer to bend my head forward instead of adjusting the workspace for better viewing, **C:** I prefer bending or twisting my body instead of adjusting vehicle height or my workspace, **D:** To finish my work on time, I prefer to retain the same position (e.g., sitting) for a long period instead of changing my posture, **E:** I believe taking short posture breaks slows me down and is unnecessary, **F:** I feel I can't work effectively without assuming uncomfortable or awkward positions, **G:** Forceful hand movements while working enable me to get the work done on time regardless of the consequences that may occur, **H:** Doing exercises like stretching or walking is important to be more productive at work, **I:** I don't see the need for ergonomic tools or equipment in my daily tasks, **J:** I think ergonomic training and tools are a waste of workshop money, **K:** I should always try to avoid putting my angled elbow in direct contact with the work surface for a long period of time.

**Table 8: Association between Respondents Knowledge and their Practices of Ergonomics**

From Table 8, the Chi-square analysis revealed significant associations between respondents' knowledge and their practice of ergonomics. Specifically, knowledge of ergonomics was significantly associated with practices A ($\chi^2 = 6.5$, $p = 0.04$), H ($\chi^2 = 17.0$, $p = 0.00$), L ($\chi^2 = 21.8$, $p = 0.00$), and M ($\chi^2 = 16.5$, $p = 0.00$). Having formal training on ergonomics was significantly associated with practices F ($\chi^2 = 11.1$, $p = 0.03$), H ($\chi^2 = 10.0$, $p = 0.04$), and M ($\chi^2 = 9.5$, $p = 0.05$). Knowledge of the benefits of ergonomics was significantly associated with practices C ($\chi^2 = 17.8$, $p = 0.00$) and I ($\chi^2 = 17.4$, $p = 0.00$) (Table 8).

Awareness of health hazards without ergonomics was significantly associated with practices D ($\chi^2 = 9.9$, $p = 0.04$), F ($\chi^2 = 13.2$, $p = 0.01$), I ($\chi^2 = 9.6$, $p = 0.05$), and L ($\chi^2 = 12.7$, $p = 0.01$). Knowledge that ergonomics fits the job to the worker was significantly associated with practices E ($\chi^2 = 7.0$, $p = 0.03$), L ($\chi^2 = 22.0$, $p = 0.00$), and M ($\chi^2 = 12.4$, $p = 0.01$). Knowledge that long uncomfortable positions can cause musculoskeletal problems was significantly associated with practice H ($\chi^2 = 12.0$, $p = 0.02$). Knowledge that holding tools tightly for long periods can strain the hands or wrists was significantly associated with practice H ($\chi^2 = 13.1$, $p = 0.01$). Knowledge that repetitive work without breaks can cause fatigue or injury was significantly associated with practices F ($\chi^2 = 10.9$, $p = 0.03$), H ($\chi^2 = 25.2$, $p = 0.00$), L ($\chi^2 = 27.8$, $p = 0.00$), and M ($\chi^2 = 31.4$, $p = 0.00$). Knowledge that grasping small tools for long periods can cause musculoskeletal disorders was significantly associated with practices F ($\chi^2 = 10.5$, $p = 0.03$), H ($\chi^2 = 24.8$, $p = 0.00$), L ($\chi^2 = 15.6$, $p = 0.00$), and M ($\chi^2 = 10.0$, $p = 0.04$). Lastly, knowledge that keeping the shoulder relaxed could cause musculoskeletal disorders was significantly associated with practices A ($\chi^2 = 6.9$, $p = 0.03$), E ($\chi^2 = 8.4$, $p = 0.02$), and L ($\chi^2 = 12.0$, $p = 0.02$). All other associations were not statistically significant ($p > 0.05$). (Table 8)

**Table 8: Association Between Respondents Knowledge and their Practices of Ergonomics (N= 384)**

| Variable | Practice of Ergonomics | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Knowledge** | A ($x^2$, p) | B ($x^2$, p) | C ($x^2$, p) | D ($x^2$, p) | E ($x^2$, p) | F ($x^2$, p) | G ($x^2$, p) | H ($x^2$, p) | I ($x^2$, p) | J ($x^2$, p) | K ($x^2$, p) | L ($x^2$, p) | M ($x^2$, p) |
| Q1 | 6.5(0.04) | 0.3(0.85) | 2.5(0.64) | 3.5(0.47) | 3.3(0.19) | 8.4(0.08) | 1.8(0.77) | 17.0(0.00) | 1.7(0.79) | 2.1(0.71) | 1.2(0.87) | 21.8(0.00) | 16.5(0.00) |
| Q2 | 2.6(0.28) | 0.7(0.70) | 0.9(0.92) | 2.3(0.68) | 0.6(0.75) | 11.1(0.03) | 2.5(0.64) | 10.0(0.04) | 4.3(0.37) | 6.2(0.18) | 8.3(0.08) | 7.1 (0.13) | 9.5 (0.05) |
| Q3 | 1.7(0.43) | 0.4(0.82) | 17.8(0.00) | 6.3(0.18) | 5.0(0.08) | 5.8 (0.21) | 6.7(0.15) | 1.6 (0.80) | 17.4(0.00) | 4.2(0.37) | 3.7(0.44) | 9.0 (0.06) | 2.8 (0.59) |
| Q4 | 2.2(0.34) | 2.8 (0.25) | 3.0 (0.56) | 9.9(0.04) | 2.0(0.37) | 13.2(0.01) | 6.0(0.20) | 8.7 (0.07) | 9.6 (0.05) | 6.6(0.16) | 5.4(0.25) | 12.7(0.01) | 4.1 (0.39) |
| Q5 | 4.3(0.11) | 2.1 (0.35) | 0.8 (0.94) | 2.7(0.60) | 7.0(0.03) | 7.4 (0.12) | 0.9(0.92) | 6.5 (0.17) | 4.3 (0.36) | 2.4(0.66) | 2.6(0.62) | 22.0(0.00) | 12.4(0.01) |
| Q6 | 1.2(0.55) | 1.0 (0.59) | 4.5 (0.34) | 1.4(0.85) | 0.2(0.92) | 3.3 (0.52) | 3.6(0.47) | 12.0(0.02) | 7.3 (0.12) | 3.0(0.56) | 3.6(0.47) | 7.8 (0.10) | 3.5 (0.49) |
| Q7 | 0.5(0.78) | 0.7 (0.71) | 6.0 (0.20) | 8.0(0.09) | 1.0(0.62) | 3.5 (0.48) | 7.6(0.11) | 13.1(0.01) | 2.8 (0.59) | 2.4(0.66) | 6.3(0.18) | 9.3 (0.05) | 5.2 (0.27) |
| Q8 | 0.5(0.77) | 0.2 (0.92) | 6.2 (0.18) | 2.0(0.74) | 0.7(0.72) | 10.9(0.03) | 5.4(0.25) | 25.2(0.00) | 3.1 (0.55) | 1.9(0.76) | 5.9(0.21) | 27.8(0.00) | 31.4(0.00) |
| Q9 | 3.3(0.19) | 0.8 (0.67) | 3.1 (0.54) | 4.6(0.33) | 2.9(0.24) | 10.5(0.03) | 5.5(0.24) | 24.8(0.00) | 2.1 (0.71) | 2.6(0.62) | 2.0(0.74) | 15.6(0.00) | 10.0(0.04) |
| Q10 | 6.9(0.03) | 3.5 (0.17) | 2.4 (0.65) | 4.6(0.33) | 8.4(0.02) | 1.4 (0.85) | 5.4(0.25) | 0.4 (0.99) | 3.8 (0.43) | 5.0(0.29) | 1.6(0.80) | 12.0(0.02) | 2.1 (0.72) |

**Keys**: **Knowledge of ergonomic**

**Q1:** Do you know what ergonomics is, **Q2:** Have you received formal training on ergonomic work practices, **Q3:** Do you know the benefits of ergonomics application, **Q4:** Do you know the health hazards of your job without ergonomics, **Q5:** Do you know that ergonomics aims to adapt the job or tools to suit the worker, not force the worker to adjust to the job, **Q6:** Have you heard that working in uncomfortable positions for a long time may lead to musculoskeletal problems, **Q7:** Do you know that holding tools tightly for long periods can cause strain in your hands and wrists, **Q8:** Are you aware that repetitive work without breaks can contribute to fatigue and injury, **Q9:** Musculoskeletal disorders may be caused by grasping small instruments for long periods, **Q10:** Keeping shoulders relaxed could prevent musculoskeletal disorders.

**Keys**: **Practice of ergonomic**

**A:** Do you change your working position regularly to avoid staying in one posture for too long, **B:** Do you make sure that your back is straight while working under vehicles or in tight spaces, **C:** When lifting heavy parts, do you bend your knees instead of your back, **D:** Do you use tools that match the size of your hand to avoid unnecessary strain, **E:** Do you try to position your work materials so they are within easy reach, **F:** Do you take short breaks to stretch your arms, shoulders, and back during long repair tasks, **G:** Do you adjust the height of your stool, creeper, or workbench to suit the task you're doing, **H:** Do you avoid gripping tools too tightly when using them for extended periods, **I:** Do you position vehicle parts or engines in a way that allows you to work without overreaching or twisting, **J:** Do you store frequently used tools and items at waist level to reduce bending or reaching, **K:** Do you use gloves or padding when working with vibrating tools to reduce hand-arm strain, **L:** When doing overhead work, do you rest your arms or switch hands to reduce shoulder fatigue, **M:** Do you ensure that your work area has enough lighting to reduce eye strain and awkward body movements.

## 4.7 Association Between Respondents Attitudes and their Practices of Ergonomics

From Table 9, the Chi-square analysis revealed significant associations between respondents' attitude and their practice of ergonomics. Specifically, the attitude that ergonomics should be part of auto-mechanic practice was significantly associated with practices A ($\chi^2 = 12.2$, $p = 0.00$), B ($\chi^2 = 7.6$, $p = 0.02$), C ($\chi^2 = 9.8$, $p = 0.04$), E ($\chi^2 = 7.3$, $p = 0.03$), and G ($\chi^2 = 20.8$, $p = 0.00$). The attitude of bending or twisting the body instead of adjusting the workspace was significantly associated with practice A ($\chi^2 = 6.8$, $p = 0.03$). The attitude of staying in the same position for a long time instead of changing posture was significantly associated with practice G ($\chi^2 = 11.1$, $p = 0.03$) (Table 9).

The belief that taking breaks slow work down and are unnecessary was significantly associated with practices D ($\chi^2 = 9.6$, $p = 0.05$) and L ($\chi^2 = 13.4$, $p = 0.01$). The attitude of not being able to work without awkward positions was significantly associated with practice L ($\chi^2 = 10.4$, $p = 0.03$). The attitude that forceful hand movements help finish work on time was significantly associated with practices G ($\chi^2 = 14.1$, $p = 0.01$), I ($\chi^2 = 15.1$, $p = 0.01$), and K ($\chi^2 = 12.1$, $p = 0.02$). The attitude that exercises like stretching and walking improve productivity was significantly associated with practices L ($\chi^2 = 9.5$, $p = 0.05$) and M ($\chi^2 = 13.5$, $p = 0.01$). The attitude that ergonomic tools are not needed for daily tasks was significantly associated with practice K ($\chi^2 = 17.7$, $p = 0.00$). The attitude that ergonomic training and tools are a waste of workshop money was significantly associated with practices B ($\chi^2 = 13.4$, $p = 0.00$), I ($\chi^2 = 13.3$, $p = 0.01$), and K ($\chi^2 = 20.3$, $p = 0.00$). Lastly, the attitude of avoiding resting the angled elbow on the work surface for a long time was significantly associated with practices H ($\chi^2 = 11.0$, $p = 0.03$), I ($\chi^2 = 9.6$, $p = 0.05$), and L ($\chi^2 = 45.9$, $p = 0.00$). All other associations were not statistically significant ($p > 0.05$). (Table 9)

**Table 9: Association Between Respondents Attitudes and their Practices of Ergonomics (N= 384)**

| Variable | Practice of Ergonomics | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Attitude** | A ($x^2$, p) | B ($x^2$, p) | C ($x^2$, p) | D ($x^2$, p) | E ($x^2$, p) | F ($x^2$, p) | G ($x^2$, p) | H ($x^2$, p) | I ($x^2$, p) | J ($x^2$, p) | K ($x^2$, p) | L ($x^2$, p) | M ($x^2$, p) |
| Q1 | 12.2(0.00) | 7.6(0.02) | 9.8(0.04) | 3.3(0.51) | 7.3(0.03) | 3.4(0.49) | 20.8(0.00) | 0.8(0.94) | 6.2(0.19) | 4.1(0.39) | 2.6(0.63) | 1.6(0.81) | 2.4(0.66) |
| Q2 | 2.0(0.36) | 4.1(0.13) | 5.1(0.27) | 4.2(0.38) | 1.9(0.38) | 1.4(0.84) | 4.7 (0.32) | 1.4(0.85) | 5.1(0.28) | 0.3(0.99) | 1.4(0.85) | 5.5(0.24) | 5.7(0.23) |
| Q3 | 6.8(0.03) | 0.8(0.66) | 1.5(0.82) | 2.0(0.74) | 1.3(0.51) | 8.0(0.09) | 5.7 (0.22) | 6.7(0.15) | 1.7(0.79) | 3.6(0.47) | 7.5(0.11) | 1.3(0.86) | 4.6(0.33) |
| Q4 | 4.9(0.09) | 4.6(0.10) | 3.7(0.45) | 4.4(0.36) | 3.2(0.20) | 5.6(0.23) | 11.1(0.03) | 7.6(0.11) | 3.8(0.43) | 8.9(0.06) | 3.4(0.49) | 2.7(0.61) | 5.7(0.23) |
| Q5 | 0.9(0.63) | 0.9(0.64) | 2.4(0.66) | 9.6(0.05) | 1.0(0.62) | 3.5(0.48) | 3.0(0.56) | 5.8(0.21) | 7.0(0.14) | 2.3(0.69) | 7.6(0.11) | 13.4(0.01) | 6.2(0.18) |
| Q6 | 1.6(0.44) | 1.3(0.53) | 9.1(0.06) | 4.2(0.38) | 0.1(0.93) | 1.9(0.75) | 9.1(0.06) | 1.6(0.81) | 4.4(0.35) | 2.8(0.58) | 4.2(0.39) | 10.4(0.03) | 4.6(0.33) |
| Q7 | 0.3(0.85) | 2.8(0.25) | 6.2(0.19) | 7.9(0.10) | 0.9(0.63) | 1.5(0.82) | 14.1(0.01) | 7.5(0.11) | 15.1(0.01) | 5.2(0.27) | 12.1(0.02) | 4.3(0.36) | 3.8(0.44) |
| Q8 | 1.5(0.48) | 1.0(0.61) | 5.3(0.26) | 8.7(0.07) | 2.6(0.27) | 3.5(0.48) | 6.8 (0.15) | 1.0(0.91) | 1.7(0.80) | 5.6(0.23) | 1.9(0.76) | 9.5(0.05) | 13.5(0.01) |
| Q9 | 1.8(0.40) | 0.0(1.00) | 2.9(0.57) | 2.9(0.58) | 3.1(0.22) | 2.3(0.68) | 3.1 (0.54) | 5.3(0.26) | 2.0(0.74) | 7.5(0.11) | 17.7(0.00) | 7.7(0.10) | 2.9(0.58) |
| Q10 | 5.3(0.07) | 13.4(0.00) | 3.0(0.56) | 3.7(0.45) | 2.7(0.26) | 2.0(0.73) | 8.4 (0.08) | 6.4(0.17) | 13.3(0.01) | 4.8(0.31) | 20.3(0.00) | 3.6(0.46) | 5.9(0.21) |
| Q11 | 0.6(0.73) | 0.2(0.91) | 3.2(0.52) | 9.3(0.06) | 2.9(0.24) | 4.6(0.33) | 3.8 (0.44) | 11.0(0.03) | 9.6 (0.05) | 1.1(0.89) | 5.6(0.23) | 45.9(0.00) | 5.1(0.27) |

**Keys**: **Attitude toward ergonomics**

**Q1:** Ergonomics should be part of auto mechanic practice, **Q2:** I prefer to bend my head forward instead of adjusting the workspace for better viewing, **Q3:** I prefer bending or twisting my body instead of adjusting vehicle height or my workspace, **Q4:** To finish my work on time, I prefer to retain the same position (e.g., sitting) for a long period instead of changing my posture, **Q5:** I believe taking short posture breaks slows me down and is unnecessary, **Q6:** I feel I can't work effectively without assuming uncomfortable or awkward positions, **Q7:** Forceful hand movements while working enable me to get the work done on time regardless of the consequences that may occur, **Q8:** Doing exercises like stretching or walking is important to be more productive at work, **Q9:** I don't see the need for ergonomic tools or equipment in my daily tasks, **Q10:** I think ergonomic training and tools are a waste of workshop money, **Q11:** I should always try to avoid putting my angled elbow in direct contact with the work surface for a long period of time.

**Keys**: **Practice of ergonomic**

**A:** Do you change your working position regularly to avoid staying in one posture for too long, **B:** Do you make sure that your back is straight while working under vehicles or in tight spaces, **C:** When lifting heavy parts, do you bend your knees instead of your back, **D:** Do you use tools that match the size of your hand to avoid unnecessary strain, **E:** Do you try to position your work materials so they are within easy reach, **F:** Do you take short breaks to stretch your arms, shoulders, and back during long repair tasks, **G:** Do you adjust the height of your stool, creeper, or workbench to suit the task you're doing, **H:** Do you avoid gripping tools too tightly when using them for extended periods, **I:** Do you position vehicle parts or engines in a way that allows you to work without overreaching or twisting, **J:** Do you store frequently used tools and items at waist level to reduce bending or reaching, **K:** Do you use gloves or padding when working with vibrating tools to reduce hand-arm strain, **L:** When doing overhead work, do you rest your arms or switch hands to reduce shoulder fatigue, **M:** Do you ensure that your work area has enough lighting to reduce eye strain and awkward body movements.

## 4.8 Association Between Age of Respondents and Knowledge, Attitudes and Practices of Ergonomic Principles

From Table 10, it can be observed that there was no statistically significant association between the age of respondents and their knowledge of ergonomics, as all the p-values were greater than the standard level of significance ($p > 0.05$). (Table 10).

From Table 11, it was also observed that there was no statistically significant association between the age of respondents and their attitude toward ergonomics, as all the p-values were greater than the standard level of significance ($p > 0.05$). (Table 11).

However, from Table 12, there was a statistically significant association between the age of respondents and their practice of ergonomics in variable A ($\chi^2 = 9.728$, $p = 0.021$), while all other associations were not statistically significant ($p > 0.05$). (Table 12).

**Table 10: Association between Age of Respondents and Knowledge of Ergonomics**

| Variable | AGE | |
|---|---|---|
| **Knowledge** | **$X^2$** | **P** |
| Do you know what ergonomic is? | 1.478 | 0.961 |
| Have you received formal training on ergonomic work practices? | 5.567 | 0.473 |
| Do you know the benefits of ergonomics Application? | 3.433 | 0.753 |
| Do you know what the health hazards of Your job without ergonomics? | 9.515 | 0.147 |
| Do you know that ergonomics aims to adapt the job or tools to suit the worker, not force the worker to adjust to the job? | 4.171 | 0.653 |
| Have you heard that working in uncomfortable Positions for a long time may lead to Musculoskeletal problems? | 9.412 | 0.152 |
| Do you know that holding tools tightly for a Long Periods can cause strain in your hands and wrists? | 12.495 | 0.052 |
| Are you aware that repetitive work without break an contribute to fatigue and injury? | 3.933 | 0.686 |
| Musculoskeletal disorders may be caused by grasping small instruments for long periods. | 7.516 | 0.276 |
| Keeping shoulder relaxed could cause Musculoskeletal disorders | 7.154 | 0.307 |

**$X^2$** = Chi square**,**
**P** = P value

**Table 11: Association between Age of Respondents and Attitudes Toward Ergonomics**

| Variable | AGE | |
|---|---|---|
| **Attitude** | **$X^2$** | **P** |
| Ergonomics should be part of auto mechanic Practice | 4.262 | 0.641 |
| I prefer to bend my head forward instead of adjusting the workspace for better viewing. | 6.059 | 0.417 |
| I prefer bending or twisting my body instead of adjusting vehicle height or my workspace | 5.465 | 0.486 |
| To finish my work on time I prefer to retain the same position (e.g., sitting) for long period instead of changing my posture. | 5.350 | 0.500 |
| I believe taking short posture break slow me down and is Unnecessary | 3.881 | 0.693 |
| I feel I can't work effectively without assuming uncomfortable or awkward positions | 9.288 | 0.158 |
| Forceful hand movements while working enable me get the work done on time regardless of the consequences that may occur. | 2.004 | 0.919 |
| Doing exercises like stretching, walking etc, are important to be more productive at work | 5.100 | 0.531 |
| I don't see the need for ergonomic tools or equipment in my daily tasks | 5.722 | 0.455 |
| I think ergonomic training and tools are a waste of workshop money. | 4.103 | 0.663 |
| I should always try to avoid putting my angled elbow in direct contact with the work surface for a long period of time. | 4.896 | 0.557 |

$X^2$ = Chi square,
**P** = P value

**Table 12: Association between Age of Respondents and Practices of Ergonomics**

| Variable | AGE | |
|---|---|---|
| **Practice** | $X^2$ | **P** |
| Do you change your working position regularly to avoid staying in one posture for too long? | 9.728 | 0.021* |
| Do you make sure that your back is straight while working under vehicles or in tight spaces? | 1.948 | 0.583 |
| When lifting heavy parts, do you bend your knees instead of your back? | 4.300 | 0.636 |
| Do you use tools that match the size of your hand to avoid unnecessary strain? | 3.148 | 0.790 |
| Do you try to position your work materials so they are within easy reach? | 0.472 | 0.925 |
| Do you take short breaks to stretch your arms, shoulders, and back during long repair tasks? | 5.580 | 0.472 |
| Do you adjust the height of your stool, creeper, or workbench to suit the task you're doing? | 5.580 | 0.472 |
| Do you avoid gripping tools too tightly when using them for extended periods? | 5.121 | 0.528 |
| Do you position vehicle parts or engines in a way that allows you to work without overreaching or twisting? | 2.537 | 0.864 |
| Do you store frequently used tools and items at waist level to reduce bending or reaching? | 4.000 | 0.677 |
| Do you use gloves or padding when working with vibrating tools to reduce hand-arm strain? | 5.644 | 0.464 |
| When doing overhead work, do you rest your arms or switch hands to reduce shoulder fatigue? | 2.988 | 0.810 |
| Do you ensure that your work area has enough lighting to reduce eye strain and awkward body movements? | 3.457 | 0.750 |

$X^2$ = Chi square,

**P** = P value

## 4.9 Association between Respondents Years of Work Experience and Knowledge, Attitudes and Practices of Ergonomic Principles

From Table 13, it can be seen that there was no statistically significant association between the respondents' years of work experience and their knowledge of ergonomics, as all the p-values were greater than the standard level of significance ($p > 0.05$). (Table 13)

From Table 14, it can be seen that there was a statistically significant association between respondents' years of work experience and their attitude toward ergonomics in variable E ($\chi^2 = 21.333$, $p = 0.006$). All other associations were not statistically significant ($p > 0.05$).

(Table 14)

From Table 15, it can be seen that there was no statistically significant association between respondents' years of work experience and their practice of ergonomics, as all the p-values were greater than the standard level of significance ($p > 0.05$). (Table 15)

**Table 13: Association between Respondents Years of Work Experience and Knowledge of Ergonomics**

| Variable | Years of work experience | |
|---|---|---|
| **Knowledge** | **$X^2$** | **p** |
| Do you know what ergonomic is? | 4.851 | 0.773 |
| Have you received formal training on ergonomic work practices? | 6.739 | 0.565 |
| Do you know the benefits of ergonomics Application? | 7.606 | 0.473 |
| Do you know what the health hazards of Your job without ergonomics? | 13.900 | 0.084 |
| Do you know that ergonomics aims to adapt the job or tools to suit the worker, not force the worker to adjust to the job? | 9.346 | 0.314 |
| Have you heard that working in uncomfortable Positions for a long time may lead to Musculoskeletal problems? | 8.621 | 0.375 |
| Do you know that holding tools tightly for a Long Periods can cause strain in your hands and wrists? | 10.684 | 0.220 |
| Are you aware that repetitive work without break an contribute to fatigue and injury? | 4.008 | 0.856 |
| Musculoskeletal disorders may be caused by grasping small instruments for long periods. | 8.396 | 0.396 |
| Keeping shoulder relaxed could cause Musculoskeletal disorders | 8.270 | 0.408 |

**$X^2$** = Chi square**,**
**P** = P value

**Table 14: Association between Respondents Years of Work Experience and Attitude Toward Ergonomics**

| Variable | Years of work experience | |
|---|---|---|
| **Attitude** | **$X^2$** | **P** |
| Ergonomics should be part of auto mechanic Practice. | 2.121 | 0.977 |
| I prefer to bend my head forward instead of adjusting the workspace for better viewing. | 8.712 | 0.367 |
| I prefer bending or twisting my body instead of adjusting vehicle height or my workspace | 6.429 | 0.599 |
| To finish my work on time I prefer to retain the same position (e.g., sitting) for long period instead of changing my posture. | 9.172 | 0.628 |
| I believe taking short posture break slow me down and is unnecessary | 21.333 | 0.006* |
| I feel I can't work effectively without assuming uncomfortable or awkward positions | 10.851 | 0.210 |
| Forceful hand movements while working enable me get the work done on time regardless of the consequences that may occur. | 10.268 | 0.247 |
| Doing exercises like stretching, walking etc, are important to be more productive at work | 11.230 | 0.189 |
| I don't see the need for ergonomic tools or equipment in my daily tasks | 8.790 | 0.360 |
| I think ergonomic training and tools are a waste of workshop money. | 12.962 | 0.113 |
| I should always try to avoid putting my angled elbow in direct contact with the work surface for a long period of time. | 4.157 | 0.843 |

**$X^2$** = Chi square**,**
**P** = P value

**Table 15: Association between Respondents Years of Work Experience and Practice Toward Ergonomics**

| Variable | Years of work experience | |
|---|---|---|
| **Practice** | **$X^2$** | **P** |
| Do you change your working position regularly to avoid staying in one posture for too long? | 8.563 | 0.073 |
| Do you make sure that your back is straight while working under vehicles or in tight spaces? | 7.411 | 0.116 |
| When lifting heavy parts, do you bend your knees instead of your back? | 7.276 | 0.507 |
| Do you use tools that match the size of your hand to avoid unnecessary strain? | 7.254 | 0.529 |
| Do you try to position your work materials so they are within easy reach? | 2.327 | 0.676 |
| Do you take short breaks to stretch your arms, shoulders, and back during long repair tasks? | 10.070 | 0.260 |
| Do you adjust the height of your stool, creeper, or workbench to suit the task you're doing? | 13.800 | 0.087 |
| Do you avoid gripping tools too tightly when using them for extended periods? | 7.216 | 0.513 |
| Do you position vehicle parts or engines in a way that allows you to work without overreaching or twisting? | 10.795 | 0.214 |
| Do you store frequently used tools and items at waist level to reduce bending or reaching? | 11.805 | 0.160 |
| Do you use gloves or padding when working with vibrating tools to reduce hand-arm strain? | 5.010 | 0.756 |
| When doing overhead work, do you rest your arms or switch hands to reduce shoulder fatigue? | 4.368 | 0.823 |
| Do you ensure that your work area has enough lighting to reduce eye strain and awkward body movements? | 11.032 | 0.200 |

**$X^2$** = Chi square,
**P** = P value

## 4.10 Association between Respondents Job Type and Knowledge, Attitudes and Practices of Ergonomic Principles

From Table 16, it can be seen that there was no statistically significant association between respondents' job type and their knowledge of ergonomics, as all the p-values were greater than the standard level of significance ($p > 0.05$). (Table 16)

From Table 17, it can be seen that there was a statistically significant association between respondents' job type and their attitude toward ergonomics in variable E ($\chi^2 = 31.218$, $p = 0.002$). All other associations were not statistically significant ($p > 0.05$). (Table 17)

From Table 18, it can be seen that there was no statistically significant association between respondents' job type and their practice of ergonomics, as all the p-values were greater than the standard level of significance ($p > 0.05$). (Table 18)

**Table 16: Association between Respondents Job Type and Knowledge of Ergonomics**

| Variable | Job Type | |
|---|---|---|
| **Knowledge** | **$X^2$** | **P** |
| Do you know what ergonomic is? | 11.717 | 0.469 |
| Have you received formal training on ergonomic work practices? | 12.276 | 0.424 |
| Do you know the benefits of ergonomics Application? | 9.647 | 0.647 |
| Do you know what the health hazards of Your job without ergonomics? | 3.617 | 0.989 |
| Do you know that ergonomics aims to adapt the job or tools to suit the worker, not force the worker to adjust to the job? | 16.685 | 0.162 |
| Have you heard that working in uncomfortable Positions for a long time may lead to Musculoskeletal problems? | 13.452 | 0.337 |
| Do you know that holding tools tightly for a Long Periods can cause strain in your hands and wrists? | 9.385 | 0.670 |
| Are you aware that repetitive work without break an contribute to fatigue and injury? | 9.687 | 0.643 |
| Musculoskeletal disorders may be caused by grasping small instruments for long periods. | 6.082 | 0.912 |
| Keeping shoulder relaxed could cause Musculoskeletal disorders | 8.331 | 0.759 |

**$X^2$** = Chi square

**P** = P value

**Table 17: Association between Respondents Job Type and Attitude Toward Ergonomics**

| Variable | Job Type | |
|---|---|---|
| **Attitude** | **$X^2$** | **P** |
| Ergonomics should be part of auto mechanic Practice | 8.664 | 0.731 |
| I prefer to bend my head forward instead of adjusting the workspace for better viewing. | 7.942 | 0.790 |
| I prefer bending or twisting my body instead of adjusting vehicle height or my workspace | 14.797 | 0.253 |
| To finish my work on time I prefer to retain the same position (e.g., sitting) for long period instead of changing my posture. | 14.066 | 0.297 |
| I believe taking short posture break slow me down and is unnecessary | 31.218 | 0.002* |
| I feel I can't work effectively without assuming uncomfortable or awkward positions | 16.437 | 0.172 |
| Forceful hand movements while working enable me get the work done on time regardless of the consequences that may occur. | 12.204 | 0.429 |
| Doing exercises like stretching, walking etc, are important to be more productive at work | 8.531 | 0.742 |
| I don't see the need for ergonomic tools or equipment in my daily tasks | 8.247 | 0.766 |
| I think ergonomic training and tools are a waste of workshop money. | 13.224 | 0.353 |
| I should always try to avoid putting my angled elbow in direct contact with the work surface for a long period of time. | 6.762 | 0.873 |

**$X^2$** = Chi square**,**
**P** = P value

**Table 18: Association between Respondents Job Type and Practice of Ergonomics**

| Variable | Job Type | |
|---|---|---|
| **Practice** | **$X^2$** | **P** |
| Do you change your working position regularly to avoid staying in one posture for too long? | 5.759 | 0.451 |
| Do you make sure that your back is straight while working under vehicles or in tight spaces? | 10.321 | 0.112 |
| When lifting heavy parts, do you bend your knees instead of your back? | 8.526 | 0.743 |
| Do you use tools that match the size of your hand to avoid unnecessary strain? | 8.002 | 0.785 |
| Do you try to position your work materials so they are within easy reach? | 4.198 | 0.650 |
| Do you take short breaks to stretch your arms, shoulders, and back during long repair tasks? | 11.462 | 0.490 |
| Do you adjust the height of your stool, creeper, or workbench to suit the task you're doing? | 12.028 | 0.443 |
| Do you avoid gripping tools too tightly when using them for extended periods? | 6.965 | 0.860 |
| Do you position vehicle parts or engines in a way that allows you to work without overreaching or twisting? | 13.975 | 0.302 |
| Do you store frequently used tools and items at waist level to reduce bending or reaching? | 13.632 | 0.325 |
| Do you use gloves or padding when working with vibrating tools to reduce hand-arm strain? | 11.184 | 0.513 |
| When doing overhead work, do you rest your arms or switch hands to reduce shoulder fatigue? | 15.861 | 0.198 |
| Do you ensure that your work area has enough lighting to reduce eye strain and awkward body movements? | 10.125 | 0.605 |

**$X^2$** = Chi square**,**
**P = P value**

## 4.11 Hypothesis Testing

## Hypothesis 1

Statement: There would be no significant association between the level of knowledge of ergonomic principles and the attitude towards it.

Test statistics: Chi-square ($\chi^2$) test of association

Stated p value: $p \leq 0.05$

Observed p value: $p \leq 0.05$

Decision Rule: Since the observed p-value was less than or equal to the stated p-value ($p \leq 0.05$), the null hypothesis ($H_0$) was REJECTED.

Hence, there was a significant association between the level of knowledge of ergonomic principles and the following attitude towards ergonomics:

i. Knowledge of ergonomics was significantly associated with the attitude that doing exercises like stretching and walking is important to be more productive at work ($\chi^2 = 41.2$, $p = 0.00$), and the attitude that one should always try to avoid putting the angled elbow in direct contact with the work surface for a long period ($\chi^2 = 23.6$, $p = 0.00$).

ii. Having formal training on ergonomics was significantly associated with the attitude that doing exercises like stretching and walking is important to be more productive at work ($\chi^2 = 11.7$, $p = 0.02$).

iii. Knowledge of the benefits of ergonomics was significantly associated with the attitude that ergonomics should be part of auto mechanic practice ($\chi^2 = 9.5$, $p = 0.05$), and the attitude that there is no need for ergonomic tools or equipment in daily tasks ($\chi^2 = 13.9$, $p = 0.01$).

iv. Knowledge that ergonomics fits the job was significantly associated with the attitude that doing exercises like stretching and walking is important to be more productive at work ($\chi^2 = 20.6$, $p = 0.00$), and the attitude that one should always try to avoid putting the angled elbow in direct contact with the work surface for a long period ($\chi^2 = 13.3$, $p = 0.01$).

v. Knowledge that bad posture harms health was significantly associated with the attitude that to finish work on time, one should retain the same position (e.g., sitting) for a long period instead of changing posture ($\chi^2 = 10.2$, $p = 0.04$), the attitude that doing exercises like stretching and walking is important to be more productive at work ($\chi^2 = 12.8$, $p = 0.01$), and the attitude that one should always try to avoid putting the angled elbow in direct contact with the work surface for a long period ($\chi^2 = 18.6$, $p = 0.00$).

vi. Knowledge of grip strain effects was significantly associated with the attitude that bending the head forward is preferred instead of adjusting the workspace for better viewing ($\chi^2 = 11.4$, $p = 0.02$), the attitude that doing exercises like stretching and walking is important to be more productive at work ($\chi^2 = 11.2$, $p = 0.02$), and the attitude that one should always try to avoid putting the angled elbow in direct contact with the work surface for a long period ($\chi^2 = 15.1$, $p = 0.00$).

vii. Knowledge of the harms of repetitive work was significantly associated with the attitudes that bending the head forward is preferred instead of adjusting the workspace for better viewing ($\chi^2 = 10.2$, $p = 0.04$), bending or twisting the body is preferred instead of adjusting vehicle height or workspace ($\chi^2 = 9.5$, $p = 0.05$), taking short posture breaks slows one down and is unnecessary ($\chi^2 = 9.3$, $p = 0.05$), doing exercises like stretching and walking is important to be more productive at work ($\chi^2$ = 21.1, p = 0.00), and one should always try to avoid putting the angled elbow in direct contact with the work surface for a long period ($\chi^2$ = 36.4, p = 0.00).

viii. Knowledge of small tool strain was significantly associated with the attitudes that doing exercises like stretching and walking is important to be more productive at work ($\chi^2$ = 19.0, p = 0.00), and one should always try to avoid putting the angled elbow in direct contact with the work surface for a long period ($\chi^2$ = 26.5, p = 0.00).

ix. Knowledge that relaxed shoulder posture increases risk was significantly associated with the attitudes that taking short posture breaks slows one down and is unnecessary ($\chi^2$ = 11.5, p = 0.02), doing exercises like stretching and walking is important to be more productive at work ($\chi^2$ = 12.5, p = 0.01), and one should always try to avoid putting the angled elbow in direct contact with the work surface for a long period ($\chi^2$ = 9.6, p = 0.05).

## Hypothesis 2

Statement: There would be no significant association between the level of knowledge of ergonomic principles and its practice.

Test statistics: Chi-square ($\chi^2$)

Stated p-value: $p \leq 0.05$

Observed p value: $p \leq 0.05$

Decision rule: Since the observed p-value was less than or equal to the stated p-value, the null hypothesis was therefore REJECTED.

Hence, there was a significant association between the level of knowledge of ergonomic principles and the following practices of ergonomics:

i. Knowledge of what ergonomics is was significantly associated with changing working position regularly to avoid staying in one posture for too long ($p = 0.04$), avoiding gripping tools too tightly when using them for extended periods ($p = 0.00$), performing overhead work with rest or switching hands to reduce shoulder fatigue ($p = 0.00$), and ensuring that the work area has enough lighting to reduce eye strain and awkward body movements ($p = 0.00$).

ii. Having formal training on ergonomics was significantly associated with taking short breaks to stretch the arms, shoulders, and back during long repair tasks ($p = 0.03$), avoiding gripping tools too tightly when using them for extended periods ($p = 0.04$), and ensuring that the work area has enough lighting to reduce eye strain and awkward body movements ($p = 0.05$).

iii. Knowledge of the benefits of ergonomics was significantly associated with bending the knees instead of the back when lifting heavy parts ($p = 0.00$) and positioning vehicle parts or engines in a way that allows work without overreaching or twisting ($p = 0.00$).

iv. Awareness of job hazards was significantly associated with using tools that match the size of the hand to avoid unnecessary strain ($p = 0.04$), taking short breaks to stretch the arms, shoulders, and back during long repair tasks ($p = 0.01$), ensuring that the work area has enough lighting to reduce eye strain and awkward body movements ($p = 0.05$), and performing overhead work with rest or switching hands to reduce shoulder fatigue ($p = 0.01$).

v. Knowledge that ergonomics fits the job was significantly associated with trying to position work materials so they are within easy reach ($p = 0.03$), performing overhead work with rest or switching hands to reduce shoulder fatigue ($p = 0.00$), and ensuring that the work area has enough lighting to reduce eye strain and awkward body movements ($p = 0.01$).

vi. Knowledge that bad posture causes harm was significantly associated with avoiding gripping tools too tightly when using them for extended periods ($p = 0.02$).

vii. Knowledge of grip strain effects was significantly associated with avoiding gripping tools too tightly when using them for extended periods ($p = 0.01$) and performing overhead work with rest or switching hands to reduce shoulder fatigue ($p = 0.05$).

viii. Knowledge that repetitive work causes harm was significantly associated with taking short breaks to stretch the arms, shoulders, and back during long repair tasks ($p = 0.03$), avoiding gripping tools too tightly when using them for extended periods ($p = 0.00$), performing overhead work with rest or switching hands to reduce shoulder fatigue ($p = 0.00$), and ensuring that the work area has enough lighting to reduce eye strain and awkward body movements ($p = 0.00$).

ix. Knowledge of strain from small tools was significantly associated with taking short breaks to stretch the arms, shoulders, and back during long repair tasks ($p = 0.03$), avoiding gripping tools too tightly when using them for extended periods ($p = 0.00$), performing overhead work with rest or switching hands to reduce shoulder fatigue ($p = 0.00$), and ensuring that the work area has enough lighting to reduce eye strain and awkward body movements ($p = 0.04$).

x. Knowledge that relaxed shoulder posture poses risks was significantly associated with changing working position regularly to avoid staying in one posture for too long ($p = 0.03$), trying to position work materials within easy reach ($p = 0.02$), and performing overhead work with rest or switching hands to reduce shoulder fatigue ($p = 0.02$

## Hypothesis 3

Statement: There would be no significant association between attitude towards ergonomic principles and its practice.

Test statistics: Chi-square ($\chi^2$)

Stated p-value: $p \leq 0.05$

Observed p value: $p \leq 0.05$

Decision: Since the observed p-value was less than the stated p-value, the null hypothesis was therefore REJECTED.

Hence, there was a significant association between attitude towards ergonomic principles and the following practices of ergonomics:

i. The attitude that ergonomics should be part of auto mechanic practice was significantly associated with changing working position regularly to avoid staying in one posture for too long ($p = 0.00$), keeping the back straight while working under vehicles or in tight spaces ($p = 0.02$), bending the knees instead of the back when lifting heavy parts ($p = 0.04$), trying to position work materials within easy reach ($p = 0.03$), and adjusting the height of stool, creeper, or workbench to suit the task being done ($p = 0.00$).
ii. The attitude of preferring to bend or twist the body instead of adjusting vehicle height or workspace was significantly associated with changing working position regularly to avoid staying in one posture for too long ($p = 0.03$).
iii. The attitude of preferring to retain the same position (e.g., sitting) for long periods instead of changing posture was significantly associated with adjusting

the height of stool, creeper, or workbench to suit the task being done (p = 0.03).

iv. The attitude that taking short posture breaks slows work down and is unnecessary was significantly associated with using tools that match the size of the hand to avoid unnecessary strain (p = 0.05) and performing overhead work with rest or switching hands to reduce shoulder fatigue (p = 0.01).

v. The attitude that one cannot work effectively without assuming uncomfortable or awkward positions was significantly associated with performing overhead work with rest or switching hands to reduce shoulder fatigue (p = 0.03).

vi. The attitude that forceful hand movements help finish work faster regardless of consequences was significantly associated with adjusting the height of stool, creeper, or workbench to suit the task being done (p = 0.01), positioning vehicle parts or engines to allow work without overreaching or twisting (p = 0.01), and using gloves or padding when working with vibrating tools to reduce hand-arm strain (p = 0.02).

vii. The attitude that doing exercises like stretching or walking improves productivity was significantly associated with performing overhead work with rest or switching hands to reduce shoulder fatigue (p = 0.05) and ensuring that the work area has enough lighting to reduce eye strain and awkward body movements (p = 0.01).

viii. The attitude that ergonomic training and tools are a waste of workshop money was significantly associated with making sure the back is straight while working under vehicles or in tight spaces (p = 0.00), positioning vehicle parts or engines to allow work without overreaching or twisting (p = 0.01), and using gloves or padding when working with vibrating tools to reduce hand-arm strain ($p = 0.00$).

ix. The attitude that one should always avoid putting the angled elbow in direct contact with the work surface for long periods was significantly associated with avoiding gripping tools too tightly when using them for extended periods ($p = 0.03$), positioning vehicle parts or engines to allow work without overreaching or twisting ($p = 0.05$), and performing overhead work with rest or switching hands to reduce shoulder fatigue ($p = 0.00$).

## Hypothesis 4

Statement: There would be no significant association between age and knowledge of ergonomic principles.

Test statistics: Chi-square ($\chi^2$)

Stated p-value: $p \leq 0.05$

Observed p value: $p > 0.05$

Decision: Since all the observed p-values were greater than the stated p-value, the null hypothesis was therefore NOT REJECTED.

Hence, there was no significant association between age and knowledge of ergonomic principles.

## Hypothesis 5

Statement: There would be no significant association between age and attitude towards ergonomic principles.

Test statistics: Chi-square ($\chi^2$)

Stated p-value: $p \leq 0.05$

Observed p value: $p > 0.05$

Decision: Since all the observed p-values were greater than the stated p-value, the null hypothesis was therefore NOT REJECTED.

Hence, there was no significant association between age and attitude towards ergonomic principles.

## Hypothesis 6

Statement: There would be no significant association between age and practice of ergonomic principles.

Test statistics: Chi-square ($\chi^2$)

Stated p-value: $p \leq 0.05$

Observed p value: $p < 0.05$

Decision: Since the observed p-value for practice variable A ($p = 0.021$) was less than the stated p-value, the null hypothesis was therefore REJECTED.

Hence, there was a significant association between age and the practice variable "Do you change your working position regularly to avoid staying in one posture for too long?"

## Hypothesis 7

Statement: There would be no significant association between years of work experience and knowledge of ergonomic principles.

Test statistics: Chi-square ($\chi^2$)

Stated p-value: $p \leq 0.05$

Observed p value: $p > 0.05$

Decision: Since all the observed p-values were greater than the stated p-value, the null hypothesis was therefore NOT REJECTED.

Hence, there was no significant association between years of work experience and knowledge of ergonomic principles.

## Hypothesis 8

Statement: There would be no significant association between years of work experience and attitude towards ergonomic principles.

Test statistics: Chi-square ($\chi^2$)

Stated p-value: $p \leq 0.05$

Observed p value: $p < 0.05$

Decision: Since the observed p-value for attitude variable E ($p = 0.006$) was less than the stated p-value, the null hypothesis was therefore REJECTED.

Hence, there was a significant association between years of work experience and the attitude statement "I believe taking short posture breaks slow me down and are unnecessary."

## Hypothesis 9

Statement: There would be no significant association between years of work experience and practice of ergonomic principles.

Test statistics: Chi-square ($\chi^2$)

Stated p-value: $p \leq 0.05$

Observed p value: $p > 0.05$

Decision: Since all the observed p-values were greater than the stated p-value, the null hypothesis was therefore NOT REJECTED.

Hence, there was no significant association between years of work experience and practice of ergonomic principles.

## Hypothesis 10

Statement: There would be no significant association between job type and knowledge of ergonomic principles.

Test statistics: Chi-square ($\chi^2$)

Stated p-value: $p \leq 0.05$

Observed p value: $p > 0.05$

Decision: Since all the observed p-values were greater than the stated p-value, the null hypothesis was therefore NOT REJECTED.

Hence, there was no significant association between job type and knowledge of ergonomic principles.

## Hypothesis 11

Statement: There would be no significant association between job type and attitude toward ergonomic principles.

Test statistics: Chi-square ($\chi^2$)

Stated p-value: $p \leq 0.05$

Observed p value: $p < 0.05$

Decision: Since the observed p-value for attitude E ($\chi^2 = 31.218$, $p = 0.002$) was less than the stated p-value, the null hypothesis was therefore REJECTED.

Hence, there was a significant association between job type and the attitude that "taking short posture breaks slows me down and is unnecessary."

## Hypothesis 12

Statement: There would be no significant association between job type and the practice of ergonomic principles.

Test statistics: Chi-square ($\chi^2$)

Stated p-value: $p \leq 0.05$

Observed p value: $p > 0.05$

Decision: Since all the observed p-values were greater than the stated p-value, the null hypothesis was therefore NOT REJECTED.

Hence, there was no significant association between job type and the practice of ergonomic principles.

# CHAPTER FIVE

# DISCUSSION, CONCLUSION, RECOMMENDATIONS AND IMPLICATIONS

## 5.1 Discussion

This study provided insights into the knowledge, attitudes, and practices regarding ergonomic principles among auto-mechanic workmen in Benin City, Nigeria. The findings are discussed chronologically below, following the order of presentation in Chapter Four.

### 5.1.1 Anthropometric and Socio-demographic Characteristics

The findings indicated that participants' height and weight fell into ranges pointing toward mild overweight levels. Therefore, elevated BMI might raise the chance of physical stress when bending or handling loads in tight areas common in vehicle maintenance. In terms of background, many were middle-aged, married men identifying as Christian, with high school-level schooling; also, they took part in exercise outside job duties. Most focused-on engine repairs, held substantial field experience, learned via hands-on mentorship, and put in extended shifts each day. Such traits point to a labor group facing ongoing musculoskeletal challenges linked to lengthy tasks and learning shaped by practice rather than structure. This demographic trend matches results from a Nigerian study on auto repair workers - most were middle-aged men trained through apprenticeships, although their average BMI was somewhat lower (Ozomata et al., 2022). A related Ethiopian report found comparable age groups along with long work shifts for mechanics (Tamene et al., 2020). Still, these parallels probably stem from common features of informal labor markets in low-income countries; contrasts might arise from differing levels of schooling or job rules.

### 5.1.2 Knowledge of Ergonomics

The results showed limited awareness of ergonomics across participants. Even though some recognized certain risks - like awkward postures or repeated movements causing tiredness and discomfort - they often didn't grasp what ergonomics truly means, nor had they undergone official instruction. This implies that real-world exposure aids hazard spotting; however, organized learning is key to strengthening foundational knowledge and supporting better safety habits at work.

These outcomes match those seen in Nigeria, where auto-repair workers faced repeated harm due to heavy lifting or strained positions - yet lacked proper safety awareness. In Ethiopia, research by Tamene and team (2020) confirmed similar patterns: most laborers noticed recurring physical stress, but hardly any received structured ergonomics instruction. Conversely, findings from Malaysia show technicians held better baseline knowledge of posture-related risks - even when training access was minimal (Jaafar et al., 2024). Common gaps might stem from missing ergonomic standards within African informal sectors; divergent results could point toward stronger workplace health frameworks across parts of Asia.

### 5.1.3 Attitudes Towards Ergonomics

Respondents mostly held favorable views on ergonomics, seeing it as useful for lowering physical stress while boosting job performance. A majority felt ergonomic principles belong in automotive repair work; they backed routine stretches yet warned against long-term pressure from rigid materials. Still, a few thought uncomfortable positions or heavy exertion sped up tasks - revealing outdated beliefs shaped by output demands and tight schedules.

This result agrees with Olarewaju et al. (2021), whose research showed Nigerian craftsmen held comparable views - valuing ergonomics yet favoring speed in tasks. Likewise, Kgakge et al. (2025) found nurses in Botswana recognized ergonomic advantages but avoided frequent pauses during shifts. In contrast, AlHazim et al. (2022) reported few workers in Saudi Arabia expressed skepticism about ergonomics, possibly because of stronger knowledge on workplace safety. Shared patterns suggest environments focused on output shape such behaviors; meanwhile, disparities might arise from differing levels of training and organizational backing.

### 5.1.4 Practices of Ergonomics

The research showed respondents followed simple ergonomics fairly well - like shifting posture often, placing items close by, pausing to stretch, or ensuring proper light while working. Still, only a small number applied more detailed methods, such as organizing gear at mid-body height or wearing vibration-dampening gloves. This suggests that every day, easy-to-do habits are somewhat widespread; yet specific techniques aren't widely used, possibly because of insufficient instruction and limited availability of supportive tools.

These results match a survey from Abuja, where most craftsmen said they maintain proper posture and take breaks - yet seldom used safety gear (Olarewaju et al., 2021). On the flip side, workers in South Africa followed safer tool routines after receiving organized ergonomics instruction (Tshabalala & Takalani, 2025). Shared patterns might stem from tight budgets and unregulated job setups common in low-income regions; meanwhile, variations probably arise because training initiatives operate within stricter systems.

### 5.1.5 Associations Between Knowledge, Attitude, and Practice

Chi-square results showed clear links between what the auto mechanics knew and how they felt, their knowing and doing, also feelings tied to actions. Because of this, Hypotheses 1–3 were dropped - proof of real connections across factors. It implies better ergonomics understanding may improve both mindset and actual work habits.

This result matches what Amdan et al. (2024) found in their study of railway maintenance staff in Malaysia - where better understanding didn't necessarily lead to safer actions. Still, it shows why continuous ergonomic education matters, along with encouraging practical behavior changes so that knowing leads to doing, consistently.

### 5.1.6 Associations with Socio-demographic Factors

No significant association between what the respondents do at work and how much they know about ergonomics or use it; however, their job role did relate to how they feel about taking breaks. While age connected with shifting postures during tasks, time spent working tied into views on resting. As a result, certain assumptions held up under testing, whereas others did not. Overall, personal background factors influenced ergonomic behavior only slightly - except when considering position type and career duration.

## 5.2 Conclusion

This research found that auto repair workers have little grasp of ergonomics, although they are well aware of muscle and joint problems and show favorable views on using ergonomic methods. While basic habits like rest periods and organizing workspaces were reasonably followed, the use of specialized tools was less common. Connections among understanding, mindset, and actions suggest training could improve real-world performance. Personal background played a small role, with only certain ties seen through job category and years on the job. In sum, results point to key shortcomings in applying ergonomics across Nigeria's informal vehicle repair settings, underlining demand for hands-on solutions to lower work-related health dangers.

## 5.3 Recommendations

Findings from this study suggest adding ergonomics lessons to apprentice and hands-on classes - this helps workers understand better ways to stay safe while doing their jobs. Instead of just handing out gear, bosses or officials could step up by providing things like height-adjustable tables or safety gloves. To tackle wrong ideas about sitting positions and getting tasks done quickly, short community talks might help - these can show how taking pauses often keeps you sharper. Because long shifts wear people down, setting clearer limits on hours worked makes sense. On top of that, job training rules need a refresh: the National Occupational Safety and Health Centre ought to weave movement-safe methods directly into mechanic courses.

## 5.4 Implications for Further Study

This study had limits due to its one-time snapshot approach plus being focused on just one region, making it hard to prove cause or apply findings widely. Going forward, tracking shifts in knowledge, attitude, and practice after ergo changes - over a year or two - could help through longer-term projects. Reaching into countryside areas might balance out who's included while tackling uneven access. On top of that, talking with respondents about hurdles like expense, tight workspaces, or local views may reveal deeper reasons behind posture choices. Looking at differences between African nations could also show how rules, traditions, and money shape daily working conditions.

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# APPENDICES

## APPENDIX I: Ethical Approval

EDO STATE MINISTRY OF HEALTH
HEALTH RESEARCH ETHICS COMMITTEE

| | |
|---|---|
| PROTOCOL NUMBER | HA/737/25/D/07100763 (PLEASE QUOTE IN ALL ENQUIRIES) |
| APPROVAL NUMBER | HA/737/25/D/09180763 |
| TITLE OF RESEARCH PROPOSAL | KNOWLEDGE, ATTITUDE AND PRACTICE OF ERGONOMIC PRINCIPLES AMONG AUTO-MECHANIC WORKMEN- A CROSS-SECTIONAL STUDY |
| PRINCIPAL INVESTIGATOR (S) | UTHIHO CHRISTIAN ILUOGHENE |
| DATE CONSIDERED | 18TH SEPTEMBER, 2025. |
| DECISION OF THE COMMITTEE | APPROVED |

*THIS APPROVAL DATES 18/09/2025 TO 18/09/2026. IF THERE IS A DELAY IN STARTING THE RESEARCH, PLEASE INFORM THE HREC EDO SMoH SO THAT THE DATES OF APPROVAL CAN BE ADJUSTED ACCORDINGLY*

**REMARK: Please kindly note that the HREC Edo SMoH seal authenticates this approval**

DR (MRS) Omonyemen B. BELLO
(MBBS, MPH, FPHCM) *(CHAIRMAN)*

SIGNATURE & DATE 29/9/2025

SUPERVISOR(S) DR. SATURDAY NICHOLAS OGHUMU

**ATTESTATION BY INVESTIGATOR(S)**

No participant accrual or activity related to this research may be conducted outside of the approval dates. All informed consent forms used in this study must carry the Edo SMoH HREC-assigned number and duration of your research. No changes are permitted in the research without prior approval of the Edo SMoH HREC except in circumstances outlined in the Code. The Edo SMoH HREC reserves the right to conduct compliance visits to your research site without previous notification.

Signature & Date 29/9/2025

EDO STATE MINISTRY OF HEALTH RESEARCH & ETHICS COMMITTEE
SECRETARIAT
DATE 18/9/25
SIGN
DATE 29/9/25

edohrec@edostate.gov.ng
Room 16, Block D, 2nd floor, State secetariat building.

## APPENDIX II: Informed Consent Form

Title of the Study: Knowledge, Attitude, and Practice of Ergonomic Principles among Auto-mechanic Workmen – A Cross-sectional Study

Investigator: Uthiho christian iluoghene

Contact Phone Number: 08134749460

Purpose of the Study: This study aims to assess the level of knowledge, attitude, and practice regarding ergonomic principles among auto mechanic workmen through an adapted questionnaire.

**Participants:** You are eligible to participate if you have been working as a mechanic for at least a year and do not have any major medical conditions such as arthritis, chronic fatigue, or severe musculoskeletal disorders. Participation is limited to individuals in good health who are able to carry out their regular duties without significant limitations.

**Procedure:** Participation involves completing an adapted questionnaire in a single session. The questionnaire is designed to collect information about your understanding and application of ergonomic principles in your daily work.

**Risks of Participation:** There are no known physical or psychological risks involved in participating. The study consists solely of answering questions and poses no harm to your health or well-being.

**Cost/Compensation:** There is no financial cost to you for participating in the study. No monetary compensation will be provided. Participation requires only a one-time response to the questionnaire, which will be scheduled around your normal work hours.

**Contact Information:** If you have any questions, concerns, or need further clarification about the study, you may contact the investigator at the phone number provided above.

**Voluntary Participation:** Your participation is entirely voluntary. You may choose not to participate or to withdraw from the study at any time without penalty, even after initially agreeing to take part.

**Confidentiality:** All information collected during the study will be kept strictly confidential. No identifying details will be disclosed in any report or publication resulting from the research.

**Participant Consent:** I have been given a clear explanation of the study and understand what my participation involves. I agree to take part in the study willingly and without pressure.

| | |
|---|---|
| ……………………………. | ……………………………….. |
| Participant's signature and Date | Witness's signature and Date |

……………………………

Researcher's signature and Date

## APPENDIX III: Questionnaire

**Section A:** socio-demographic and Work-related characteristics and profile of the participant.

**Date** ______________

**Height** ____________________ Weight ________________

**Age:** ☐ <25 ☐ 35-44 ☐ 45-54 ☐ >54

**Marital status:** ☐ Single ☐ Divorced ☐ Married

**Religion:** ☐ Christianity ☐ Islam ☐ others

**Level of education:**

No formal education ☐

Primary education ☐

Secondary education ☐

Tertiary education ☐

**Off work physical activity:** ☐ Yes ☐ No

**Job category:**

Panel beaters ☐

Auto electricians ☐

Welders ☐

Radiator repair ☐

Engine mechanics ☐

Others ☐

**Mode of training:**

Apprenticeship ☐

Formal mechanic school ☐

**Duration of training:**

< 6 years ☐

> 6 years ☐

**Years of experience:**

< 4 ☐ 14 - 20 ☐

5 - 9 ☐ 10 - 14 ☐

> 20 ☐

**Daily working hours:**

< 8 hours ☐

> 8 hours ☐

**Section B**: Participant knowledge of ergonomics

| Statements | Yes | To some extent | No |
|---|---|---|---|
| Do you know what ergonomics is? | | | |
| Have you received formal training on ergonomic work practices? | | | |
| Do you know the benefits of ergonomics application? | | | |
| Do you know what the health hazards of your job are without ergonomics? | | | |
| Do you know that ergonomics aims to adapt the job or tools to suit the worker, not force the worker to adjust to the job? | | | |
| Have you heard that working in uncomfortable positions for a long time may lead to musculoskeletal problems? | | | |
| Do you know that holding tools tightly for long periods can cause strain in your hands and wrists? | | | |
| Are you aware that repetitive work without breaks can contribute to fatigue and injury? | | | |
| MSDs may be caused by grasping small instruments for long periods. | | | |
| Keeping shoulders relaxed could cause MSDs. | | | |

**Section C:** Participant attitude towards ergonomics

| Statements | Yes | To some extent | No |
|---|---|---|---|
| Ergonomics should be part of auto mechanic practice. | | | |
| I prefer to bend my head forward instead of adjusting the workspace for better viewing. | | | |
| I prefer bending or twisting my body instead of adjusting vehicle height or my workspace. | | | |
| To finish my work on time, I prefer to retain the same position (e.g., sitting) for a long period instead of changing my posture. | | | |
| I believe taking short posture breaks slows me down and is unnecessary. | | | |
| I feel I can't work effectively without assuming uncomfortable or awkward positions. | | | |
| Forceful hand movements while working enable me to get the work done on time regardless of the consequences that may occur. | | | |
| Doing exercises like stretching, walking, etc., is important to be more productive at work. | | | |
| I don't see the need for ergonomic tools or equipment in my daily tasks. | | | |
| I think ergonomic training and tools are a waste of workshop money. | | | |
| I should always try to avoid putting my angled elbow in direct contact with the work surface for a long period of time. | | | |

**Section D:** Participant practice of ergonomics

| Statements | Yes | To some extent | No |
|---|---|---|---|
| Do you change your working position regularly to avoid staying in one posture for too long? | | | |
| Do you make sure that your back is straight while working under vehicles or in tight spaces? | | | |
| When lifting heavy parts, do you bend your knees instead of your back? | | | |
| Do you use tools that match the size of your hand to avoid unnecessary strain? | | | |
| Do you try to position your work materials so they are within easy reach? | | | |
| Do you take short breaks to stretch your arms, shoulders, and back during long repair tasks? | | | |
| Do you adjust the height of your stool, creeper, or workbench to suit the task you're doing? | | | |
| Do you avoid gripping tools too tightly when using them for extended periods? | | | |
| Do you position vehicle parts or engines in a way that allows you to work without overreaching or twisting? | | | |
| Do you store frequently used tools and items at waist level to reduce bending or reaching? | | | |
| Do you use gloves or padding when working with vibrating tools to reduce hand–arm strain? | | | |
| When doing overhead work, do you rest your arms or switch hands to reduce shoulder fatigue? | | | |
| Do you ensure that your work area has enough lighting to reduce eye strain and awkward body movements? | | | |