

An Evaluation of Ergonomic Principles and Anatomical Zoning in the Design of Women's Office Wear for Enhanced Comfort

Ms. Rajlaxmi Amandeep Ghuge¹, Dr. Vaishali MENON²

M.Design Student (or Postgraduate Student) Department of M.Design Sir Vithaldas Thackersey (SVT)
College of Home Science, SNDT Women's University

Abstract

This study evaluates the application of ergonomic principles and anatomical zoning in the design of women's office wear to enhance comfort and reduce pressure-related discomfort. The research addresses the limitations of conventional office garments, which often prioritize aesthetics over functionality and wearer comfort. An exploratory research design was adopted using literature review, questionnaire surveys, observational studies, anthropometric measurements, garment development, and wear-trial evaluation. Data collected from working women identified key discomfort areas, including the thigh, waist, bust, and hip regions. Based on these findings, ergonomically designed garments incorporating anatomical zoning, movement accommodation, pressure-reduction features, and appropriate fabric selection were developed. Four prototypes—a bamboo peplum top, spandex side-slit skirt, reversible waistcoat, and ergonomic blazer—were evaluated through user feedback and wear trials. The results indicated improved movement flexibility, enhanced comfort, reduced pressure accumulation, and positive user acceptance. The study concludes that integrating ergonomic principles and anatomical zoning into office wear design can significantly improve wearer comfort while maintaining professional aesthetics, contributing to the development of functional and user-centered apparel.

CHAPTER I: INTRODUCTION

1.1 Background of the Study

Clothing functions as an essential interface between the human body and its surrounding environment. Beyond fulfilling aesthetic and social requirements, garments influence physiological comfort, body movement, occupational performance, and overall well-being. As contemporary work environments continue to evolve, the functional role of clothing has gained increasing significance, particularly in professional settings where individuals spend prolonged durations performing occupational activities. In the context of office environments, women frequently engage in desk-based work, computer-related tasks, repetitive upper-body movements, and extended periods of sitting, thereby increasing the interaction between body posture and garment structure.

The increasing participation of women in professional occupations has simultaneously increased the need for workwear that supports both functionality and comfort. While conventional office garments generally emphasize visual appearance, silhouette, and professional presentation, relatively less attention has been directed toward physiological requirements and dynamic body movement. As a result, users may

experience discomfort caused by inappropriate fit, pressure concentration, movement restriction, and inadequate accommodation of posture changes.

Ergonomics is defined as the scientific discipline concerned with understanding interactions among humans and other components of a system and applying theoretical principles, data, and methods to optimize human well-being and system performance (Bridger, 2008). Within apparel design, ergonomics aims to ensure compatibility between the wearer and clothing system by considering body dimensions, movement characteristics, comfort requirements, and occupational activities.

According to Pheasant and Haslegrave (2006), products intended for direct human interaction should be designed considering anthropometric principles to ensure functional efficiency and comfort. Clothing systems that ignore body measurements and movement patterns may lead to physical discomfort and reduced performance. Therefore, ergonomic principles become particularly important in garment design where prolonged body interaction exists.

The application of ergonomics within clothing design includes several important considerations:

- Human-centered fit
- Freedom of movement
- Dynamic body accommodation
- Pressure management
- Postural support
- Thermal comfort
- Functional performance

Traditional garment construction methods generally rely on static body measurements obtained in standing postures. However, body dimensions continuously change during movement and postural transitions. Activities such as sitting, bending, reaching, stretching, and walking alter the dimensions of different body regions including the abdomen, hip, shoulder, and thigh areas. Therefore, garments developed solely using static measurements may fail to accommodate these dimensional changes effectively.

Corlett et al. (1986) reported that prolonged static postures and repetitive occupational activities contribute significantly to musculoskeletal discomfort and fatigue. Similarly, Hedge (2016) suggested that workplace comfort and productivity are strongly influenced by the interaction between the individual and surrounding systems, including clothing.

Prolonged sitting produces several biomechanical and physiological changes within the body such as:

- Increased pressure at contact regions
- Expansion of the abdominal and hip regions
- Alteration in spinal curvature
- Restricted circulation
- Muscular fatigue

These physical changes create additional requirements for clothing systems intended for prolonged use. Simultaneously, advances in functional clothing have introduced concepts such as pressure control and therapeutic garment systems. Compression garments are examples of specialized clothing systems designed to apply controlled pressure to body surfaces for improving circulation, supporting muscles, and reducing physical strain. The principle governing pressure application within garments can be understood through Laplace's Law:

$$P = T/R$$

Where:

P = Pressure exerted on body surface

T = Fabric tension

R = Radius of body curvature

The relationship indicates that garment pressure varies according to fabric tension and body dimensions. Pressure may increase in regions with smaller body radii and greater fabric tension. Excessive or uneven pressure concentration may contribute to discomfort and restricted movement.

Another important concept relevant to ergonomic clothing is **anatomical zoning**. Anatomical zoning refers to the division of garments into functional regions according to body movement requirements, physiological behaviour, and pressure sensitivity. Different regions of the body perform distinct functions and therefore require varying degrees of flexibility, support, and pressure management.

Pressure-sensitive regions commonly include:

- Neck and shoulder region
- Bust region
- Waist and abdominal region
- Hip region
- Thigh region
- Lower back region

Integrating anatomical zoning principles within office wear may contribute toward:

- Improved movement flexibility
- Better pressure distribution
- Enhanced comfort
- Reduced fatigue
- Improved postural support

Therefore, the integration of ergonomic principles and anatomical zoning into office wear design presents an opportunity to develop garments capable of improving wearer comfort and reducing clothing-induced discomfort while maintaining professional aesthetics.

1.2 Need for the Study

Women working in professional environments are increasingly involved in occupational activities that require prolonged sitting, computer usage, repetitive hand movement, and limited body mobility. These activities create continuous interaction between the body and clothing systems throughout the working day.

Traditional office wear often prioritizes aesthetic appearance and standardized sizing rather than movement adaptability and physiological comfort. Consequently, wearers may experience discomfort arising from excessive pressure concentration, restricted movement, inadequate ease allowance, and poor thermal performance.

Initial survey findings collected during the present study indicated the occurrence of clothing-related discomfort among respondents. The findings revealed that 58.1% of respondents experienced mixed work patterns and 58.1% reported occasional discomfort associated with office garments. Additionally, 96.8% of respondents expressed preference for ergonomically designed office wear solutions.

These findings indicate an existing need for clothing systems that provide comfort without compromising functionality and professional appearance.

1.3 Problem Statement

Current office garments available in the market are largely designed with emphasis on appearance and formal presentation. Such garments may not adequately accommodate changes in body posture and movement occurring during occupational activities.

The initial survey conducted during the study identified specific body regions experiencing discomfort during office wear usage. Survey responses indicated discomfort primarily in:

Table 1: Survey Findings for Type of Discomfort

Body Region	Percentage of Respondents
Thigh region	43.3%
Waist region	33.3%
Bust region	30.0%
Hip region	26.7%

Survey findings also indicated common types of discomfort including:

Table 2: Percentage of Discomfort

Type of Discomfort	Percentage
Tightness	53.3%
Restricted movement	50.0%
Sweating	40.0%

Source: Survey Responses

These findings suggest that clothing-induced discomfort may be associated with pressure concentration, inadequate movement accommodation, and unsuitable garment construction methods.

Therefore, there exists a need to investigate ergonomic principles and anatomical zoning approaches in the development of office wear capable of improving comfort and reducing pressure-related discomfort.

1.4 Research Gap

The reviewed literature indicates that extensive studies exist regarding ergonomics, anthropometry, occupational posture, and compression systems individually. However, limited research specifically integrates these concepts into women's office wear design.

Research gaps identified include:

- Limited integration of ergonomic principles within formal office garments
- Limited application of anatomical zoning in office wear
- Insufficient research regarding pressure management in occupational clothing
- Limited development of user-centered office wear systems

The present study attempts to address these gaps by integrating ergonomic principles and anatomical zoning into women's office wear development.

1.5 Aim of the Study

To evaluate ergonomic principles and anatomical zoning in the design of women's office wear for enhanced comfort and pressure control.

1.6 Objectives of the Study

The objectives of the study are:

1. To study ergonomic principles in garment design.

2. To identify discomfort zones in existing women's office wear through user responses and observational analysis.
3. To analyze anthropometric measurements for improved garment fit.
4. To examine the application of compression and pressure principles in apparel design.
5. To develop anatomically zoned office wear designs based on body movement requirements.
6. To evaluate fabric suitability with respect to breathability, flexibility, and pressure distribution.
7. To develop ergonomic office-wear prototypes integrating functional design interventions.
8. To evaluate the developed garments through wear trials and user feedback.

1.7 Scope of the Study

The present study focuses on evaluating ergonomic principles and anatomical zoning in women's office wear. The study includes assessment of user discomfort, identification of pressure-sensitive regions, development of design interventions, garment prototyping, and wear evaluation.

The study is restricted to:

- Women's office wear
- Ergonomic and functional design approaches
- Pressure-related comfort assessment
- Wear trial-based evaluation

1.8 Significance of the Study

The present research contributes toward understanding the relationship between clothing design and human comfort within occupational environments.

The study is expected to contribute in the following areas:

- Integration of ergonomic principles into fashion design practice
- Development of user-centered office wear systems
- Improvement in comfort-oriented garment design
- Enhancement of understanding related to clothing pressure and anatomical zoning
- Creation of future opportunities for ergonomic ready-to-wear apparel development



Figure 1 Conceptual Framework

CHAPTER II: REVIEW OF LITERATURE

2.1 Introduction

The design of clothing has progressively evolved from fulfilling basic protective functions to addressing physiological, psychological, and occupational requirements of users. With increasing awareness regarding user-centred design approaches, ergonomic considerations have gained importance in apparel development. Garments are no longer viewed solely as aesthetic products but are increasingly regarded as systems interacting continuously with the human body. Therefore, understanding the relationship between clothing and human factors has become an important aspect of functional apparel design.

Office wear in particular represents a category of clothing that requires prolonged interaction with the body. Professional activities involving extended sitting, repetitive movement, and restricted physical activity create a continuous relationship between body posture and garment structure. Improper clothing design under such conditions may lead to discomfort, restricted movement, and reduced occupational efficiency.

The present chapter reviews literature related to ergonomics, anthropometry, pressure principles, anatomical zoning, functional apparel, and garment design interventions. The review also identifies research gaps and establishes a theoretical foundation for the development of ergonomic office wear.

2.2 Ergonomics and Human Factors in Garment Design

Ergonomics is the scientific discipline concerned with understanding interactions between humans and the surrounding systems in which they operate. The purpose of ergonomics is to optimize human well-being and improve overall system performance (Bridger, 2008). Human factors engineering and ergonomics are frequently integrated to develop products and environments that accommodate physical and cognitive capabilities of users.

Within garment design, ergonomic principles focus on ensuring compatibility between clothing and the wearer. Clothing should support natural movement while maintaining comfort and functional performance. Ergonomic garment systems aim to reduce discomfort and improve mobility through consideration of body dimensions, movement patterns, and pressure distribution.

Konz and Johnson (2008) emphasized that ergonomic product design should prioritize user capabilities and limitations. Garments designed without accounting for movement characteristics may create strain and discomfort, especially during prolonged use.

Bridger (2008) suggested that the following factors are important in ergonomic design:

- Human-centered design approach
- Functional efficiency
- Reduction of physical strain
- Safety considerations
- Comfort enhancement
- Adaptability to user requirements

In garment development, these principles can be translated into pattern design, seam placement, material selection, and fit adjustments.

Table 3: Application of Ergonomic Principle

Ergonomic Principle	Application in Garment Design
Human-centered design	Garments designed according to user requirements
Comfort	Appropriate fit and ease allowance

Freedom of movement	Accommodation of dynamic body movements
Pressure distribution	Reduction of localized pressure points
Safety	Prevention of movement restriction
Adaptability	Adjustment to body movement and posture

Source: Adapted from Bridger (2008) and Konz & Johnson (2008)

2.3 Occupational Posture and Musculoskeletal Discomfort

Occupational posture significantly affects comfort, physical performance, and long-term health outcomes. Office environments often involve prolonged sitting and repetitive upper-body movement, which may contribute to musculoskeletal discomfort.

Corlett et al. (1986) reported that prolonged static postures increase the risk of discomfort and fatigue because muscles remain under continuous tension for extended durations. Similarly, repetitive activities such as typing and computer work increase stress on the shoulders, neck, and lower back.

Musculoskeletal discomfort generally develops because of:

- Static body postures
- Inadequate movement
- Poor posture
- Repetitive occupational activities
- Pressure concentration at specific body regions

Hedge (2016) stated that work-related discomfort negatively influences productivity and employee well-being. Workplace systems, including clothing systems, should therefore accommodate body movement and support natural posture.



Figure 2 Working Posture During Office Activities

2.4 Anthropometry and Clothing Design

Anthropometry refers to the measurement of human body dimensions and characteristics used for design applications. Anthropometric information is essential in product design because it ensures compatibility between human dimensions and designed systems (Pheasant & Haslegrave, 2006).

Anthropometric data used in apparel design may be categorized into:

Static Anthropometry

Static measurements are obtained when the body remains in a fixed position.

Examples include:

- Height
- Bust circumference
- Waist circumference
- Hip circumference

Dynamic Anthropometry

Dynamic anthropometry considers body dimensions during movement and activity.

Examples include:

- Arm reach
- Knee flexion
- Sitting hip expansion
- Shoulder movement

Pheasant and Haslegrave (2006) emphasized that garments should not rely solely on static measurements because body dimensions change continuously during movement.

Table 4 Anthropometric Measurements Relevant to Garment Design

Measurement	Application
Bust circumference	Upper garment fit
Waist circumference	Waist fit
Hip circumference	Lower garment fit
Shoulder width	Sleeve construction
Arm length	Sleeve design
Sitting hip measurement	Sitting comfort

Source: Adapted from Pheasant & Haslegrave (2006)



Figure 3 Anthropometric Measurement Locations

2.5 Compression Principles and Pressure Distribution in Garments

Pressure generated by garments significantly affects comfort and physiological response. Compression garments are designed to apply controlled pressure to body surfaces and are commonly used in therapeutic applications, sportswear, and medical clothing systems.

According to the NCBI (2014) review on graduated compression systems, pressure generated by garments is influenced by fabric tension and body curvature. Compression garments function by improving circulation and reducing physical strain through controlled pressure application.

Pressure behaviour in garments is frequently explained using Laplace's Law:

$$P = T / R$$

Where:

P = Pressure exerted by garment

T = Fabric tension

R = Radius of body curvature

According to MDPI (2018), improper pressure distribution may create discomfort and reduce garment effectiveness. Excessive pressure at localized regions may restrict movement and circulation.

Factors affecting garment pressure include:

- Fabric elasticity
- Fabric tension
- Garment fit
- Seam placement
- Body dimensions

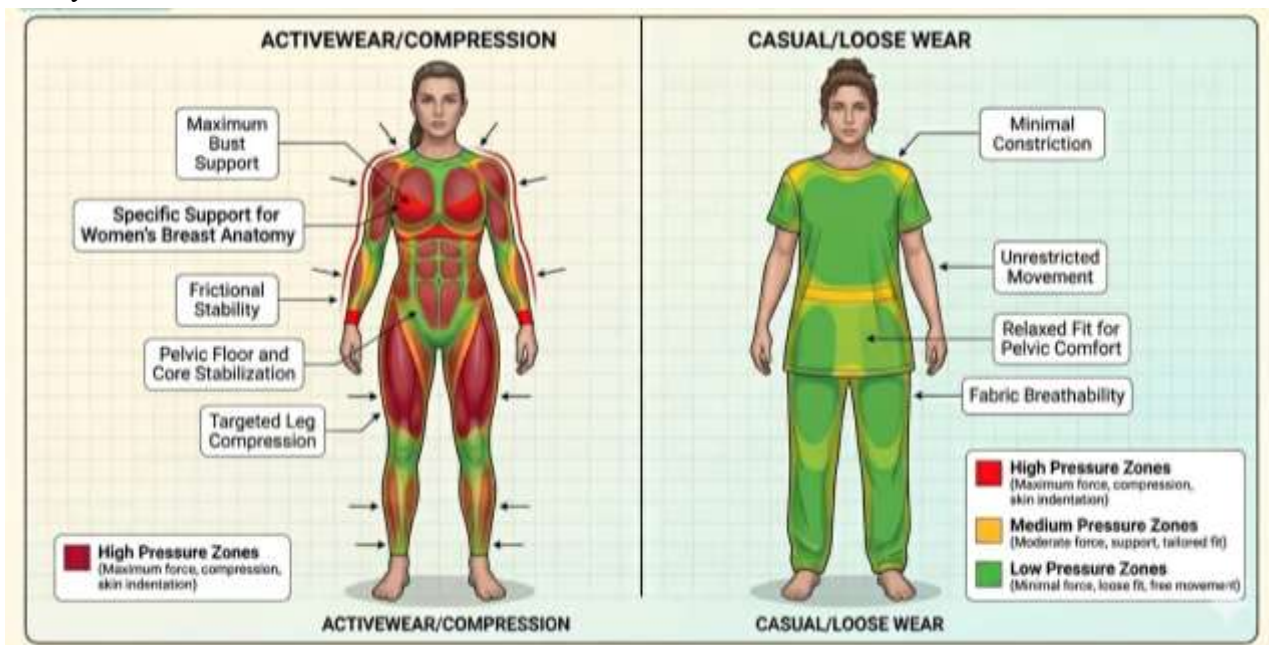


Figure 4 Pressure Distribution Zones in Garments

2.6 Anatomical Zoning in Garment Design

Anatomical zoning refers to the division of garments into different functional regions according to body movement and support requirements. Different regions of the body exhibit varying movement patterns and pressure tolerance.

Functional zoning in garments may be used to:

- Improve movement flexibility

- Reduce pressure accumulation
- Enhance support
- Improve comfort

Pressure-sensitive regions commonly include:

- Shoulder region
- Bust region
- Waist region
- Hip region
- Thigh region
- Lower back region

These regions require different construction methods and material behavior for effective comfort management.

Table 5 Functional Body Zones and Garment Requirements

Body Region	Functional Requirement
Shoulder	Increased mobility
Bust	Expansion allowance
Waist	Pressure control
Hip	Flexibility
Thigh	Reduced restriction
Lower back	Support

2.7 Fabric Properties and Ergonomic Performance

Fabric selection significantly influences clothing comfort and ergonomic performance. Comfort properties are associated with physical and mechanical characteristics of textile materials.

According to MacLeod (1995), material selection should be based on intended user requirements and functional conditions.

Important fabric properties include:

- Breathability
- Elasticity
- Stretch recovery
- Moisture absorption
- Thermal resistance
- Surface texture

The developed garments in the present study utilized bamboo fabric, spandex fabric, cotton lining, and structured blazer fabric based on functional requirements.

Table 6 Functional Properties of Selected Fabrics

Fabric Type	Characteristics	Intended Application
Bamboo fabric	Soft and breathable	Peplum garment
Spandex fabric	Stretch and flexibility	Skirt construction
Cotton lining	Breathability	Waistcoat lining
Structured fabric	Shape retention	Blazer construction

2.8 Review of Previous Studies

Table 7 Review of Papers

S. No.	Author (Year)	Title	Focus / Problem Identified	Key Findings / Solution
1	N. Gokarneshan (2017)	Design of Compression/Pressure Garments for Diversified Medical Applications	Scientific design of compression garments for medical and sports applications	Explained that controlled pressure garments require appropriate fabric selection, accurate fit, elastic knitted fabrics, and use of Laplace’s Law for effective garment design.
2	Zhao et al. (2018)	Study of an Arm Model for Compression Sleeve Design and Garment Pressure Measurement	Need for accurate garment pressure measurement	Introduced 3D-printed arm models to simulate human arm properties and improve pressure measurement accuracy while minimizing discomfort.
3	Partsch & Clark (2006)	Most Effective Compression Stockings Are Made of Inelastic Material	Effectiveness of compression materials	Found that material stiffness and elastic recovery influence garment effectiveness and emphasized controlled pressure application.
4	Maklewska et al. (2019)	Influence of Clothing Pressure on Physiological Comfort	Effect of clothing pressure on comfort	Showed that excessive pressure negatively affects blood flow, skin comfort, and can cause fatigue and discomfort.
5	Song & Ashdown (2015)	Effect of Body Movement on Clothing Pressure Distribution	Impact of body movement on pressure distribution	Observed increased clothing pressure during sitting, bending, and arm movement, relevant to office-wear design.
6	Pheasant (1991)	Anthropometric Principles in Design	Poor design due to lack of body dimension consideration	Recommended integrating anthropometric principles into design development for improved comfort and fit.

7	Corlett, Wilson & Manenica (1986)	Posture and Workplace Ergonomics Study	Discomfort caused by static posture and prolonged sitting	Suggested systems that accommodate posture changes and movement.
8	Hedge (2016)	Workplace Ergonomics Study	Workplace discomfort affecting health and productivity	Proposed implementing ergonomic workplace principles for better productivity and health.
9	Bhattacharya & McGlothlin (2012)	Occupational Ergonomics Study	Physical fatigue in occupational environments	Recommended occupational ergonomic approaches to reduce fatigue and improve work efficiency.

CHAPTER III: RESEARCH METHODOLOGY

3.1 Introduction

Research methodology provides a systematic framework for conducting scientific investigation and ensuring that the study objectives are achieved through organized procedures. The methodology adopted for the present research was developed to investigate the relationship between ergonomic principles, anthropometric considerations, pressure control, and anatomical zoning in women's office wear. The methodology was structured to move from theoretical understanding toward practical implementation through garment development and user evaluation.

The study adopted a user-centered approach where the identification of discomfort, movement requirements, and pressure-sensitive regions formed the basis for design interventions. The methodology further incorporated design development, garment construction, and wear-trial evaluation to examine the effectiveness of the developed garments.

The complete research process involved four major phases:

1. Literature review
2. Data collection
3. Design development and prototype construction
4. Wear trial and evaluation

3.2 Research Design

The present study adopted an exploratory research design.

Exploratory research is suitable for studies that investigate problems requiring detailed understanding and identification of relationships among multiple variables. Since the present study sought to examine discomfort associated with office wear and investigate ergonomic interventions for improved comfort, an exploratory approach was considered appropriate.

The exploratory design allowed:

- Identification of clothing-related discomfort
- Investigation of user requirements
- Study of pressure-sensitive regions
- Development of garment interventions
- Evaluation of developed garments

According to Bhattacharya and McGlothlin (2012), ergonomic research frequently adopts exploratory approaches because interactions between humans and systems require detailed understanding before design solutions are developed.

In addition to the exploratory research design, the study adopted an experimental approach during the garment development phase. This approach enabled the application of ergonomic principles, anthropometric considerations, and pressure-control concepts into actual garment prototypes.

Ergonomic features such as pressure-sensitive zoning, strategic seam placement, flexible fit elements, and movement accommodation were incorporated and evaluated through wear trials. The experimental approach supported the assessment of how these design interventions influenced user comfort, movement, and garment performance.

3.3 Research Framework

The research framework adopted in the study was developed to systematically progress from problem identification to garment evaluation.

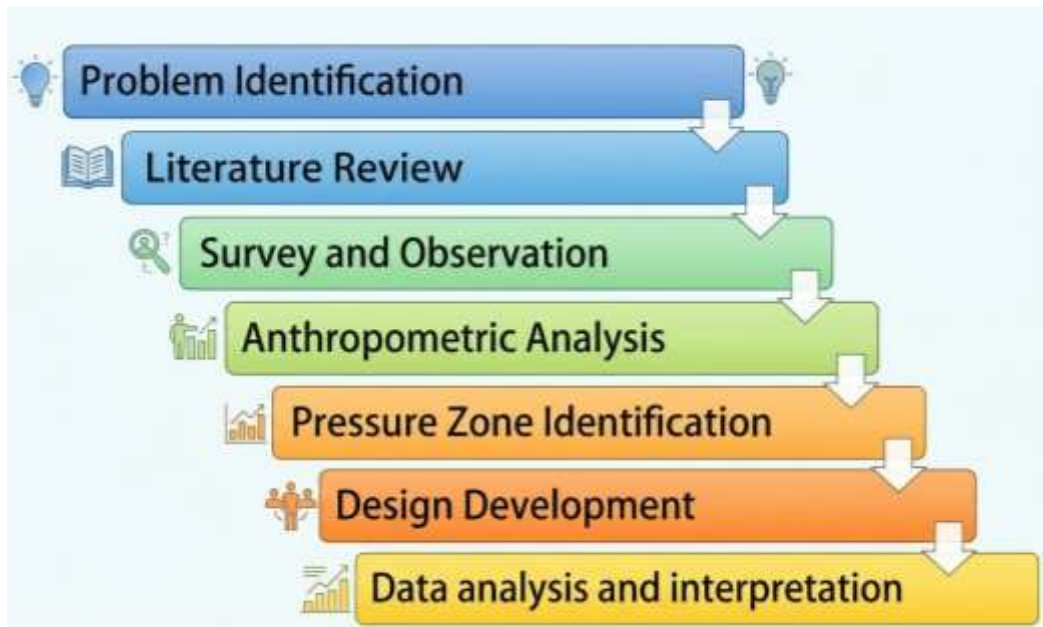


Figure 5 Research Framework of the Study

3.4 Sample Selection

The target population for the study consisted of women involved in professional office environments. The study initially proposed a sample size of 50 participants. However, responses collected during different phases of the study varied based on response availability.

Sample Information

Planned sample size: **n = 50**

Initial survey responses received: **n = 50**

Wear-trial feedback responses received through Google Form evaluation: **n = 5**

The variation between proposed and obtained responses occurred because of limitations associated with participant availability and response collection duration.

Table 8 Sample Profile

Parameter	Description
Target population	Working women
Age category	Adult office-going women

Proposed sample size	50
Initial survey responses	50
Wear-trial responses	5
Study context	Office environments

3.5 Data Collection Methods

Both primary and secondary data collection methods were used for conducting the research.

Primary Data Collection

Primary data were collected directly from users through:

- Questionnaire survey
- Google Form responses
- Observation study
- Wear-trial evaluation
- User feedback

Secondary Data Collection

Secondary information was collected through:

- Books
- Research papers
- Journal articles
- Published ergonomic studies
- Compression garment literature
- Anthropometric references

The use of both primary and secondary sources ensured a comprehensive understanding of user requirements and theoretical concepts.

3.6 Research Tools Used

Several tools were used throughout the study to collect information and evaluate developed garments.

Table 9 Research Tools and Purpose

Research Tool	Purpose
Questionnaire survey	Identification of discomfort and user requirements
Observation method	Analysis of posture and movement
Anthropometric measurements	Garment fit considerations
Design sketch development	Generation of garment concepts
Pattern development	Prototype construction
Google Form evaluation	Wear-trial feedback collection
Rating scale	Evaluation of garment performance

3.7 Survey Method

A structured questionnaire survey was conducted to identify discomfort associated with office garments and understand user requirements.

The survey included questions related to:

- Age category
- Nature of work
- Working duration
- Garment preference
- Fit preference

- Frequency of discomfort
- Body discomfort zones
- Types of discomfort
- Preference for ergonomic office wear

The survey responses formed the basis for identifying discomfort zones and developing design interventions (refer Annexure A).

3.8 Observation Method

Observation studies were conducted to understand body movement and garment interaction during occupational activities. The observation method was adopted because questionnaire responses alone may not completely capture posture-related discomfort and movement behaviour associated with office wear usage. Observation enabled direct understanding of how occupational postures and body movements influence comfort and pressure generation at different body regions.

The use of observation in the present study was considered important because office work generally involves prolonged sitting, repetitive upper-body movement, computer usage, and limited physical activity. Such occupational activities may create localized pressure, movement restriction, and discomfort, which can influence overall garment performance.

The observations focused on common postures and activities performed during office work, including:

- Sitting posture during prolonged desk work
- Arm movement during work activities
- Shoulder movement
- Hip expansion during sitting
- Pressure concentration areas
- Garment movement behavior
- Forward bending during reaching activities
- Standing and walking transitions
- Neck and shoulder positioning during computer use

Specific observations were also made regarding:

- Shoulder elevation and tension during prolonged sitting
- Forward head posture during computer usage
- Lower back curvature during seated activities
- Waist and abdominal compression during sitting
- Hip and thigh restriction during sitting posture
- Garment pulling or shifting during movement
- Pressure accumulation around shoulder, waist, lower back, and thigh regions

Observation provided additional understanding regarding movement requirements and pressure-sensitive body regions. The observations further assisted in identifying body areas requiring ergonomic interventions and movement accommodation during garment development.

Table 10 Observation Variables

Observation Variable	Purpose
Sitting posture	Analysis of movement restrictions
Arm movement	Upper-body mobility analysis
Shoulder movement	Evaluation of movement comfort
Hip movement	Sitting comfort analysis

Pressure areas	Pressure-sensitive region identification
Garment movement	Functional performance assessment

The observational findings indicated that prolonged sitting postures often created discomfort around the shoulder, waist, lower back, hip, and thigh regions. It was also observed that restrictive garment structures and pressure concentration areas may affect movement efficiency and wearer comfort. These observations were subsequently used during the garment development stage for determining seam placement, ease allowance, anatomical zoning, and ergonomic design interventions.

3.9 Anthropometric Measurements

Anthropometric measurements were considered during garment development to improve fit and movement accommodation.

According to Pheasant and Haslegrave (2006), body measurements are important for ensuring compatibility between products and users.

Measurements considered included upper-body and lower-body dimensions.

Table 10 Upper Body Measurements

Measurement	Garment Application
Neck circumference	Neckline development
Shoulder width	Sleeve and shoulder construction
Bust circumference	Upper garment fit
Arm length	Sleeve length
Upper arm circumference	Movement allowance
Back length	Garment balance

Table 11 Lower Body Measurements

Measurement	Garment Application
Waist circumference	Waist construction
Hip circumference	Lower garment fit
Thigh circumference	Ease allowance
Knee circumference	Sitting comfort
Garment length	Overall proportion

Source: Adapted from Pheasant and Haslegrave (2006)

3.10 Design Development Process

The garment development process was conducted through multiple stages integrating ergonomic principles and user requirements.

The design process included:

Stage I: Mood Board Development

The mood board was developed to establish the visual direction and design theme for the collection.

The mood board incorporated:

- Professional aesthetics
- Comfort-oriented clothing
- Functional apparel references
- Minimal design language



Figure 6 Mood Board

Stage II: Inspiration Board

Sources of inspiration included:

- Functional clothing systems
- Therapeutic garments
- Ergonomic apparel
- Contemporary office wear



Figure 7 Inspiration Board

Stage III: Fabric Board

Fabric selection was based on:

- Professional appearance
- Minimal aesthetics
- Visual balance



Figure 8 Fabric Board

Design Development

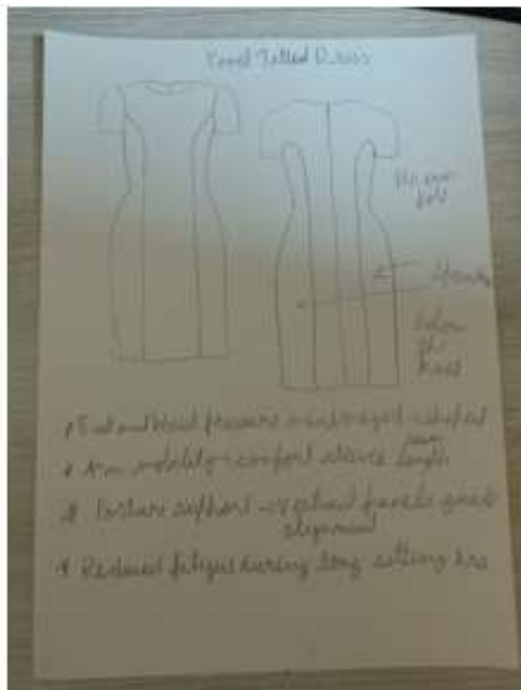


Figure 9 Design Development

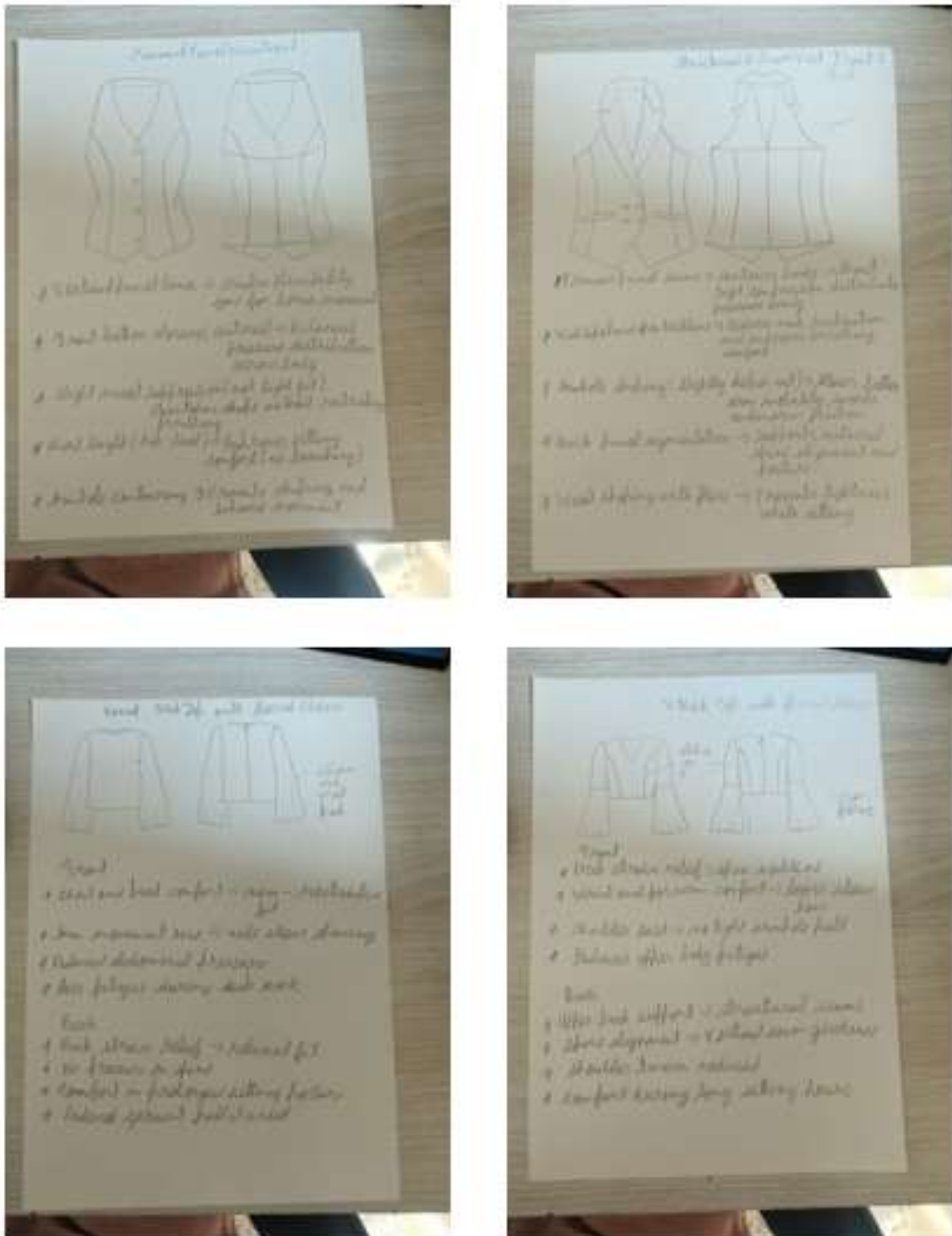


Figure 10 Design Development

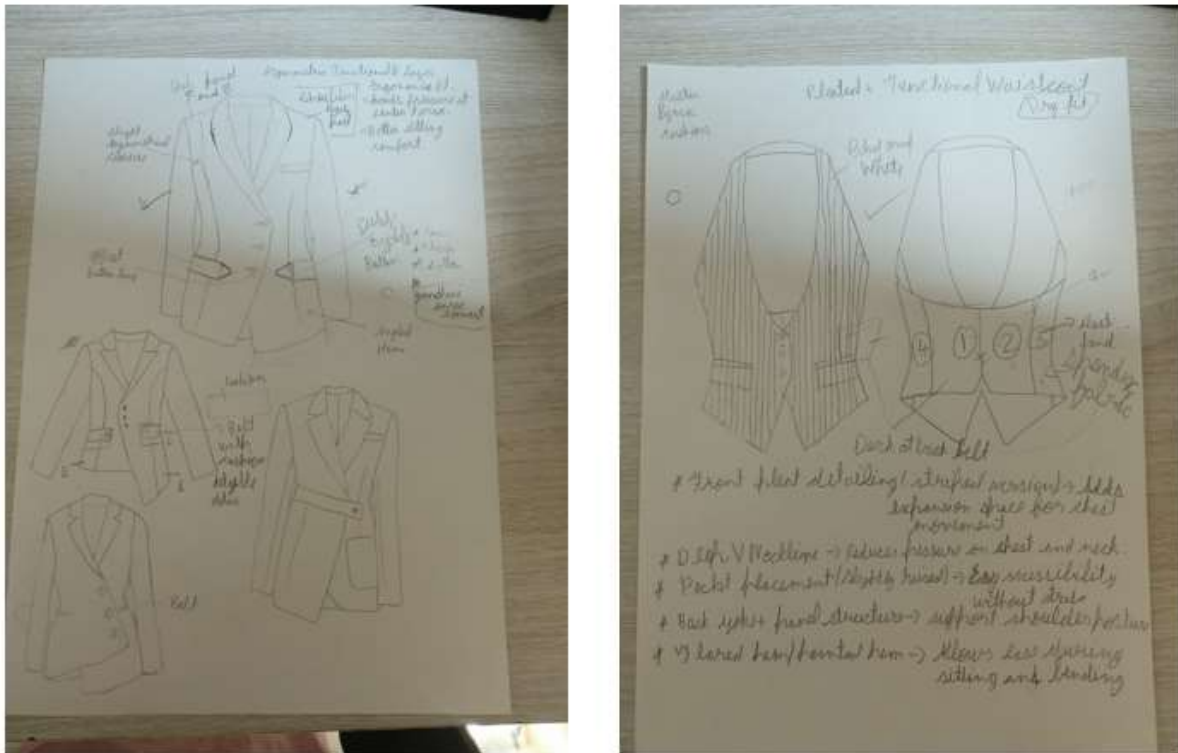


Figure 11 Design Development

CHAPTER IV: RESULTS AND DISCUSSION

4.1 Survey Analysis

A preliminary survey was conducted among working women to identify clothing-related discomfort and understand existing office wear preferences. The survey responses formed the basis for design development and ergonomic intervention selection.

3. What is the nature of your work?

31 responses

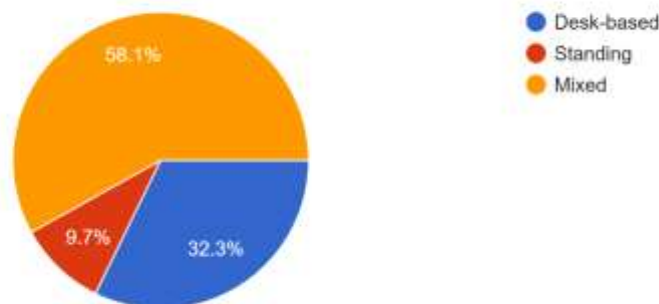


Figure 12 Graph: Nature of Work Pattern of Respondents

The findings indicate that a majority of respondents perform work involving both sitting and movement activities. Such work patterns suggest that office garments should support dynamic movement rather than accommodate only static body postures.

4.1.1 Garment Fit Preference

4. Do you usually wear fitted or semi-fitted clothing to work?

31 responses

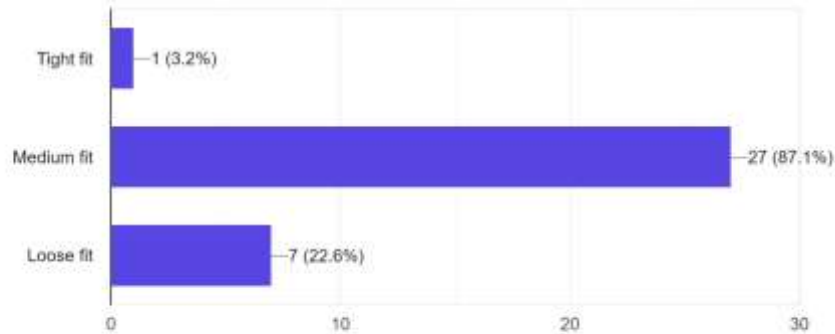


Figure 13 Graph: Garment Fit Preferences

Fit preference plays an important role in determining comfort and movement flexibility. Survey responses indicated that **87.1%** of respondents preferred medium-fit garments.

4.1.2 Frequency of Discomfort During Office Wear Usage

9. At what time of the day is the discomfort usually the highest?

31 responses

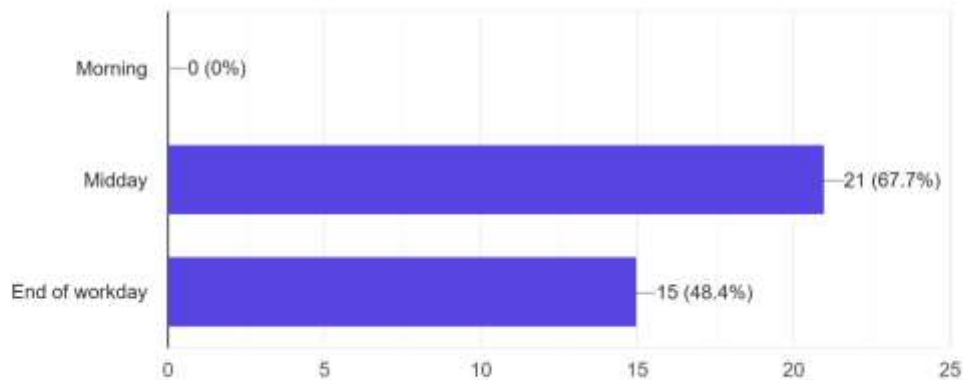


Figure 14 Graph: Frequency of Clothing Discomfort

Respondents were asked regarding the occurrence of discomfort during office wear usage. Survey findings indicated that **58.1%** of respondents reported occasional discomfort.

The results suggest that clothing discomfort is experienced by a substantial proportion of users and therefore warrants investigation into design improvements.

4.1.3 Identification of Discomfort Zones

7. In which body areas do you feel discomfort or pressure due to office wear? (Select all that apply)
30 responses

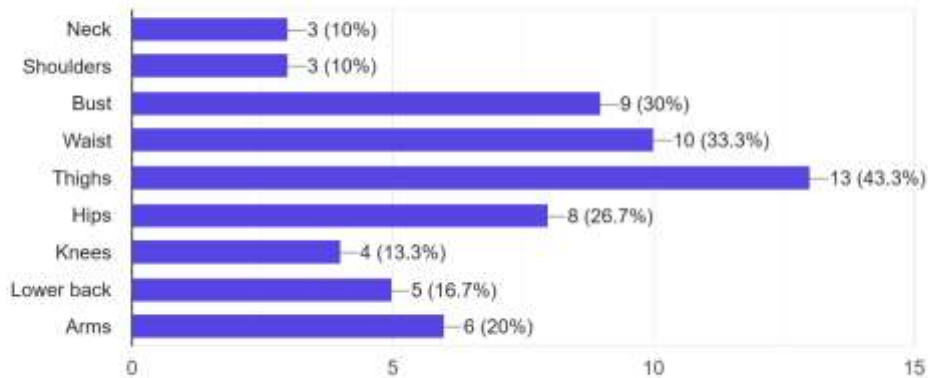


Figure 15 Graph: Distribution of Discomfort Zones

An important objective of the study was to identify pressure-sensitive body regions associated with office wear discomfort.

Survey responses indicated that discomfort occurred primarily within:

- Thigh region
- Waist region
- Bust region
- Hip region

The thigh region demonstrated the highest discomfort percentage (**43.3%**) among respondents. The waist and bust regions also showed considerable discomfort levels. These findings suggest that garments intended for office use should incorporate flexibility and pressure-control measures around these regions. The findings support previous studies indicating that prolonged sitting and movement restriction may create discomfort around lower body regions (Corlett et al., 1986; Hedge, 2016).

4.1.4 Types of Discomfort Experienced

8. What type of discomfort do you experience from your office clothing? (Select all that apply)
30 responses

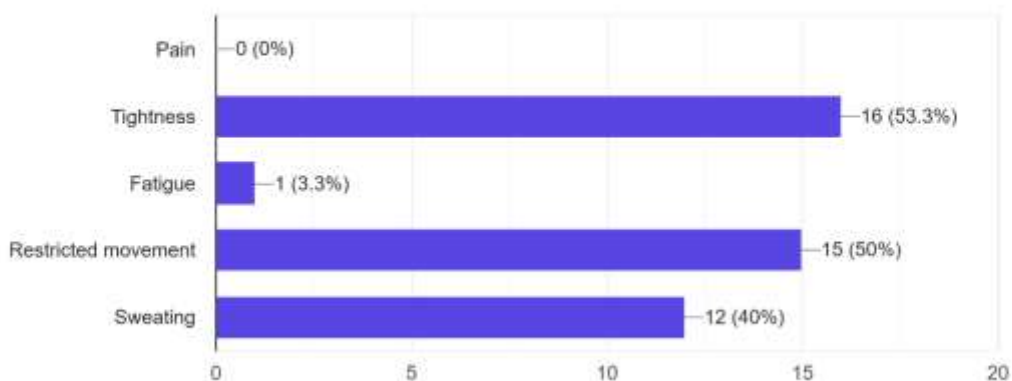


Figure 16 Graph: Types of Clothing Discomfort

Respondents were asked to identify the specific types of discomfort experienced during office wear usage. Tightness represented the most frequently reported discomfort among respondents. Restricted movement and sweating were also commonly identified. These findings suggest that fabric characteristics and garment fit influence comfort significantly.

The findings correspond with ergonomic literature suggesting that clothing systems should accommodate movement and avoid localized pressure accumulation (Bridger, 2008).

4.1.5 Preference Toward Ergonomic Office Wear

10. Would you prefer office wear that is specially designed for comfort and pressure control?

31 responses



Figure 17 Graph: Preference Toward Ergonomic Office Wear

Respondents were asked whether they would prefer ergonomically designed office wear integrating comfort and functionality.

Survey findings indicated that **96.8%** of respondents expressed positive preference toward ergonomic office wear.

The high percentage of preference toward ergonomic office wear indicates substantial user interest in garments designed with comfort-oriented interventions.

4.2 Observation Findings and Discussion

Observation studies were conducted to understand body movement, posture-related behavior, and garment interaction during occupational activities. The observation process assisted in identifying movement restrictions and pressure-sensitive body regions during routine office-related tasks.

The observations focused on postural positions and movement activities commonly performed in office environments, including prolonged sitting, arm movement during desk work, bending activities, standing posture, and body movement transitions.

4.2.1 Postural Observations

Table 12 Table Postural Observation Findings

Observation Variable	Findings
Sitting posture	Prolonged sitting resulted in lower back and waist discomfort
Arm movement	Repetitive movement during desk work required unrestricted upper-body mobility
Shoulder movement	Shoulder stiffness and slight movement restriction observed during prolonged posture maintenance
Hip movement	Hip expansion observed during sitting posture

Pressure concentration	Pressure accumulation observed around waist, hip, thigh and lower back regions
Garment movement behavior	Garment pulling and restriction may occur during body movement if adequate ease is absent

Source: Observation records from the present study

The observations indicated that prolonged static postures may contribute toward discomfort within specific body regions. Sitting posture was observed to influence waist, lower back, and hip regions because body dimensions and pressure distribution change during seated activities.

Forward leaning posture during desk work was observed to create strain within shoulder and neck regions. Repetitive arm movement associated with typing and reaching activities highlighted the importance of movement accommodation within garment construction.

The findings support ergonomic principles suggesting that body dimensions and movement patterns should be considered during product development to reduce discomfort and improve functional performance (Bridger, 2008; Pheasant & Haslegrave, 2006).

4.3 Anthropometric Measurement Findings

Anthropometric measurements were considered during garment development to support pattern construction and improve fit requirements. Anthropometric considerations assisted in understanding body dimensions and movement-related changes occurring during occupational activities.

The study considered body measurements relevant to office wear development including upper-body and lower-body dimensions.

Table 13 Anthropometric Measurement Variables Considered

Measurement Variable	Measurement (cm)
Neck circumference	35
Shoulder width	37
Bust circumference	92
Under bust circumference	78
Waist circumference	76
Hip circumference	100
Upper arm circumference	30
Armhole circumference	44
Sleeve length	57
Back length	40
Shoulder to waist length	42
Thigh circumference	58
Knee circumference	38
Calf circumference	35
Waist to hip length	20

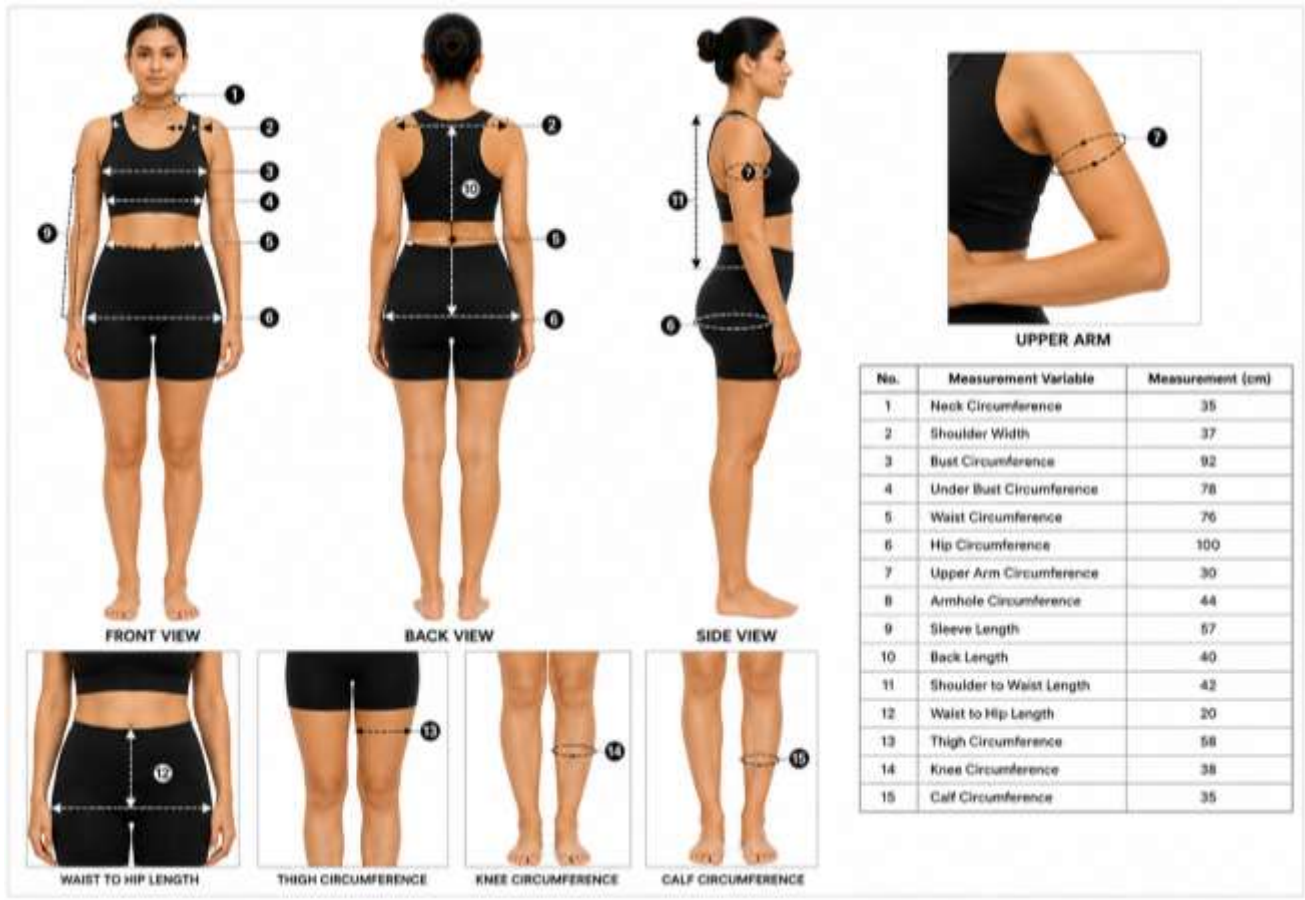


Figure 18 Anthropometric Measurement Locations

Anthropometric measurements were incorporated during the pattern development process to improve garment fit and movement accommodation. Dynamic body movements such as sitting and bending influence body dimensions and therefore require additional ease allowances during garment construction. The measurements assisted in identifying body regions requiring movement flexibility and pressure reduction considerations.

4.4 Design Development Results

Based on the survey findings and literature review, ten conceptual designs were developed integrating ergonomic principles and anatomical zoning.

Design development emphasized:

- Reduction of pressure concentration
- Mobility enhancement
- Sitting comfort
- Functional seam placement
- Postural support
- Professional aesthetics

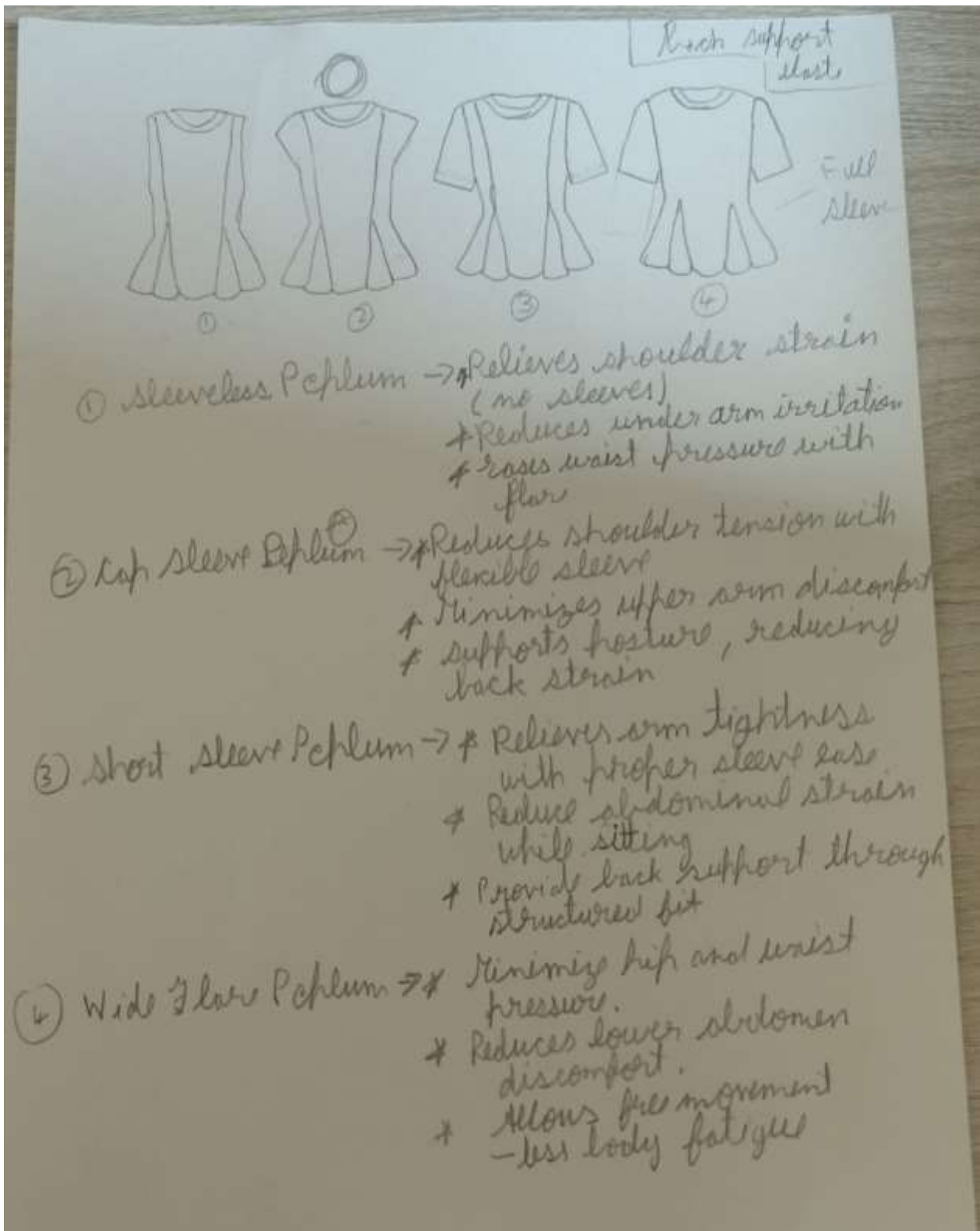


Figure 19 Design Development – Peplum Top



Figure 20 Design 1 – Peplum Top

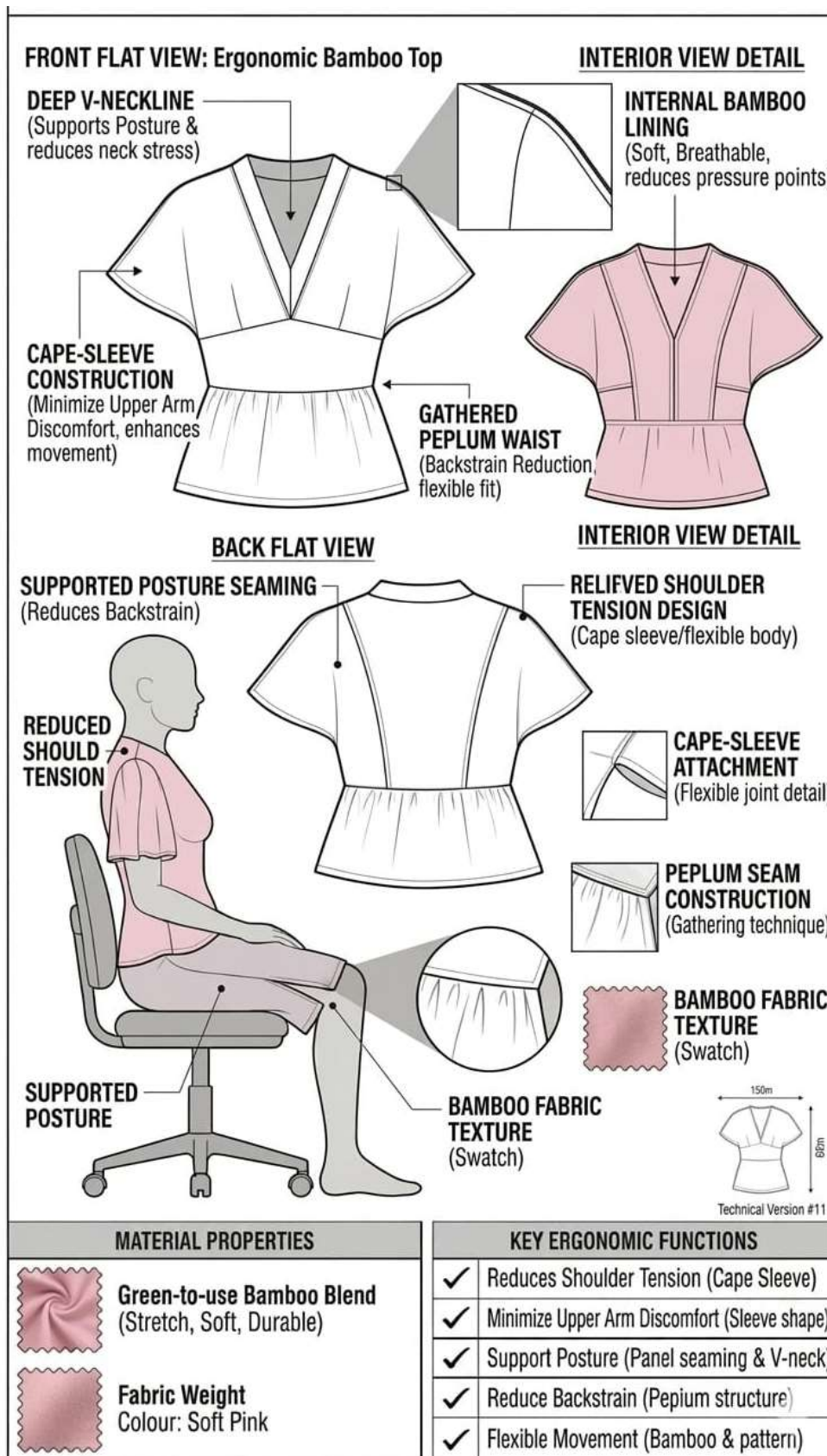


Figure 21 Garment Specification Sheet – Peplum Top



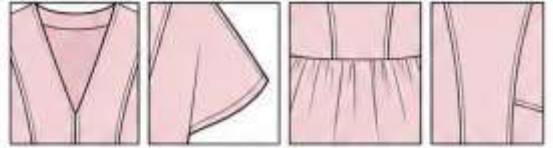

ACADEMIC THESIS COLLECTION	GARMENT COST SHEET			STYLE NO.: EBT-01	
	ERGONOMIC BAMBOO CAPE-SLEEVE PEPLUM TOP			DATE: 12-04-2024	
BRAND	Academic Thesis Collection	SIZE	M (Prototype)		
STYLE NAME	Ergonomic Bamboo Cape-Sleeve Peplum Top	SEASON	All Season		
GARMENT TYPE	Women's Ergonomic Top	SAMPLE STAGE	1 st Prototype		
FABRIC	Bamboo Blend Fabric	DESIGN FEATURES	Cape Sleeves, Deep V-neckline, Peplum Waist, Panel Seaming		
COLOUR	 Soft Pink	FUNCTIONAL BENEFITS	Reduces Shoulder Tension, Supports Posture, Enhances Movement, Reduces Back Strain		
GARMENT SKETCH		COST BREAKDOWN			
 <p>FRONT VIEW BACK VIEW</p>		REF	COST COMPONENT	DESCRIPTION	COST (INR)
		1	Material	1.8 m Bamboo fabric	₹1,371
<p>DETAIL HIGHLIGHTS</p>  <p>Deep V-Neckline (Posture Support) Cape Sleeve (Reduced Shoulder Tension) Gathered Peplum (Flexible Fit) Panel Seaming (Ergonomic Design)</p>		2	Trims & Notions	Thread and interfacing	₹143
		3	Pattern & Cutting	Pattern development and cutting	₹429
		4	Stitching & Assembly	Garment construction	₹667
		5	Finishing & Quality	Pressing and finishing	₹190
		TOTAL PRODUCTION COST			₹2,800
COST SUMMARY			ADDITIONAL NOTES		
Component	Cost (INR)	Percentage Contribution	<ul style="list-style-type: none"> Bamboo blend fabric is chosen for its softness, breathability and eco-friendly properties. Cape sleeve design helps reduce shoulder tension and allows ease of movement. Peplum waist with gathered construction provides flexibility and reduces back strain. Suitable for all-day wear, especially for prolonged sitting or work-from-home comfort. 		
Material Cost	₹1,371	48.96%			
Trims & Notions	₹143	5.11%			
Pattern Development	₹429	15.32%			
Stitching & Assembly	₹667	23.82%			
Finishing & Quality	₹190	6.79%			
TOTAL	₹2,800	100%	 ESTIMATED COST PER GARMENT ₹2,800		

Figure 22 COST Sheet – Peplum Top

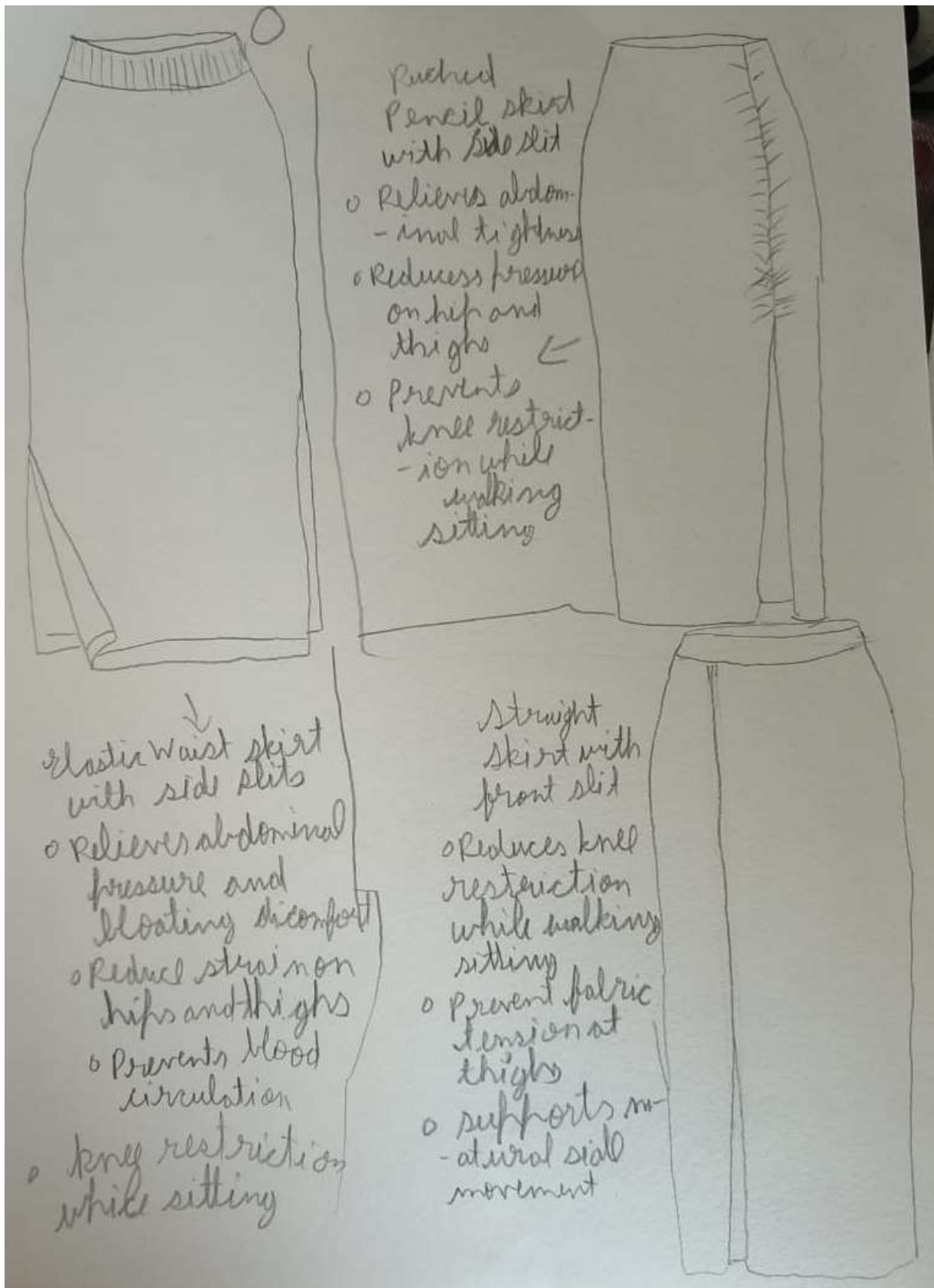


Figure 23 Design Development Side-Slit Skirt



Figure 24 Design 2 - Side-Slit Skirt

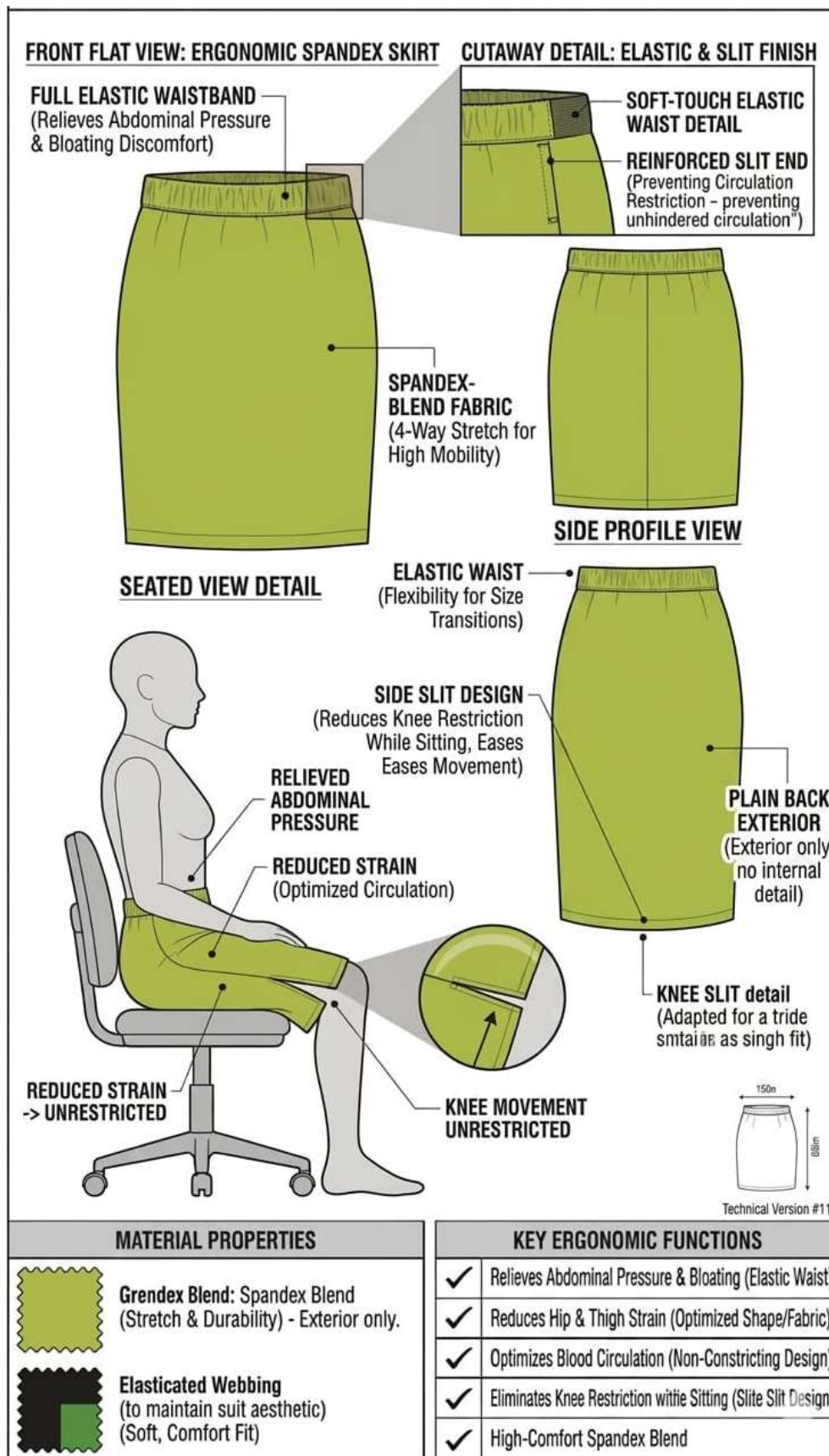


Figure 25 Garment Specification Sheet – Side-Slit Skirt


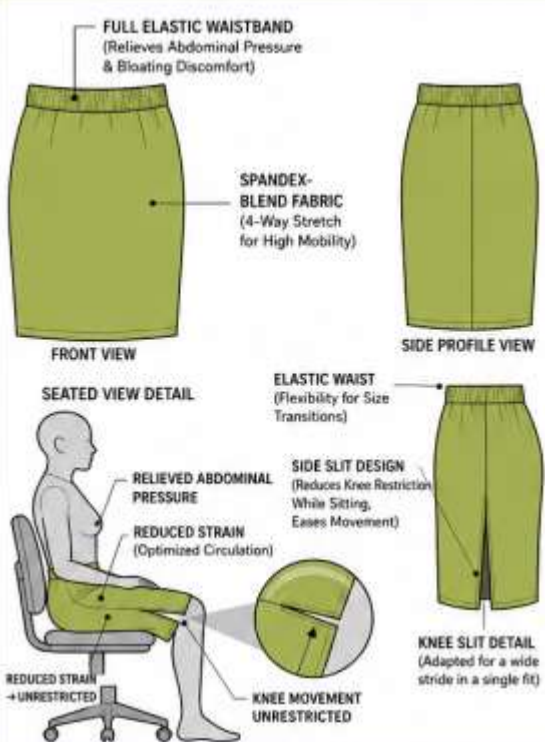



ACADEMIC THESIS COLLECTION		GARMENT COST SHEET ERGONOMIC SPANDEX SIDE-SLIT SKIRT		STYLE NO.: ESS-01		
				DATE: 12-04-2024		
BRAND	Academic Thesis Collection	SIZE	M (Prototype)			
STYLE NAME	Ergonomic Spandex Side-Slit Skirt	SEASON	All Season			
GARMENT TYPE	Women's Ergonomic Skirt	SAMPLE STAGE	1 st Prototype			
FABRIC	Spandex Blend Fabric (4-Way Stretch)	DESIGN FEATURES	Elastic Waistband, Side Slit, Knee-Length, Body Contouring Fit			
COLOUR	 Olive Green	FUNCTIONAL BENEFITS	Relieves Abdominal Pressure, Reduces Hip & Thigh Strain, Improves Mobility & Comfort			
GARMENT SKETCH & DETAILS			COST BREAKDOWN			
			REF	COST COMPONENT	DETAILS	COST (INR)
			1	Material	1.5 m Premium Spandex	₹857
			2	Trims & Notions	Elastic waistband and thread	₹210
			3	Pattern & Cutting	Cutting and slit layout	₹286
			4	Stitching & Assembly	Garment construction	₹476
			5	Finishing & Quality	Steam pressing and reinforcement	₹143
			TOTAL PRODUCTION COST		₹1,972	
COST SUMMARY			ADDITIONAL NOTES			
Component	Cost (INR)	Percentage Contribution	<ul style="list-style-type: none"> Premium spandex blend fabric ensures 4-way stretch, durability and shape retention. Elastic waistband reduces abdominal pressure and provides a comfortable fit. Side slit allows ease of movement and reduces knee restriction while sitting or walking. Designed for all-day wear with high mobility and breathable comfort. <div style="border: 1px solid black; padding: 5px; display: inline-block;">  ESTIMATED COST PER GARMENT ₹1,972 </div>			
Material Cost	₹857	43.46%				
Trims & Notions	₹210	10.65%				
Pattern & Cutting	₹286	14.51%				
Stitching & Assembly	₹476	24.14%				
Finishing & Quality	₹143	7.24%				
TOTAL	₹1,972	100%				
MATERIAL PROPERTIES		KEY ERGONOMIC FUNCTIONS				
	Spandex Blend: Premium Spandex (4-Way Stretch & Durability) – Exterior only.	✓	Relieves Abdominal Pressure & Bloating (Elastic Waist)			
	Elasticated Webbing (to maintain fit and comfort) Soft, Durable, Shape Retention	✓	Reduces Hip & Thigh Strain (Optimized Shape/Fabric)			
		✓	Optimizes Blood Circulation (Non-Constricting Design)			
		✓	Eliminates Knee Restriction while Sitting (Side Slit Design)			
		✓	High-Mobility & All-Day Comfort (Spandex Blend)			

Figure 26 COST Sheet – Spandex Side-Slit Skirt



Figure 27 Design 3 - Reversible Waistcoat



Figure 28 Garment Specification Sheet – Reversible Waistcoat












ACADEMIC THESIS COLLECTION		GARMENT COST SHEET REVERSIBLE ERGONOMIC WAISTCOAT		STYLE NO.: RW-01			
				DATE: 12-04-2024			
BRAND	Academic Thesis Collection	SIZE	M (Prototype)				
STYLE NAME	Reversible Ergonomic Waistcoat	SEASON	All Season				
GARMENT TYPE	Women Ergonomic Waistcoat	SAMPLE STAGE	1st Prototype				
FABRIC	Side A: Spandex Blend Side B: Cotton Woven	DESIGN FEATURES	Reversible Design, Deep V-Neckline, Raised Pockets, U-Plus Back Panel, 4-Button Closure				
COLOUR	 Side A: Lime Green  Side B: Brown	FUNCTIONAL BENEFITS	Improved Chest Movement, Reduced Neck Tension, Effortless Accessibility, Posture Support				
GARMENT SKETCH & DETAILS			COST BREAKDOWN				
SIDE A: LIME GREEN (SPANDEX-BLEND)  <ul style="list-style-type: none"> Deep V-Neckline Reduces Pressure Spandex Fabric Allows Chest Expansion Raised Pocket Allows Chest Expansion Raised Pocket Placement for Easy Access 		SIDE B: BROWN (COTTON)  <ul style="list-style-type: none"> Breathable Cotton Fabric Reversible 4-Button Closure Raised Pocket Placement 		REF	COST COMPONENT	DETAILS	COST (INR)
BACK VIEW (BOTH SIDES)  <ul style="list-style-type: none"> Back U-Plus Panel Structure Supports Shoulder Posture 		DETAIL VIEW: FLATTENED POINTED HEM  <ul style="list-style-type: none"> Allows Ease During Sitting & Bending 		1	Material Side A	1.0 m Spandex	₹571
MATERIAL PROPERTIES  Side A: Spandex Blend (Stretch & Comfort)  Side B: Cotton Woven (Breathability & Structure)		KEY BENEFITS <input checked="" type="checkbox"/> Improved Chest Movement <input checked="" type="checkbox"/> Reduced Neck Tension <input checked="" type="checkbox"/> Effortless Accessibility <input checked="" type="checkbox"/> Posture Support		2	Material Side B	1.0 m Cotton	₹476
				3	Trims & Notions	Buttons and interfacing	₹381
				4	Pattern & Cutting	Reversible drafting	₹571
				5	Stitching & Assembly	Dual-side construction	₹1,191
				6	Finishing & Quality	Edge finishing	₹333
				TOTAL PRODUCTION COST		₹3,524	
COST SUMMARY			ADDITIONAL NOTES				
Component	Cost (INR)	Percentage Contribution	<ul style="list-style-type: none"> • Reversible design offers two functional looks in one garment. • Spandex side enhances flexibility and chest expansion. • Cotton side ensures breathability and structured comfort. • Raised pocket placement improves accessibility while maintaining ergonomic ease. 				
Material Side A	₹ 571	16.21%	<div style="border: 1px solid black; padding: 5px; display: inline-block;">  ESTIMATED COST PER GARMENT ₹3,524 </div>				
Material Side B	₹ 476	13.52%					
Trims & Notions	₹ 381	10.81%					
Pattern & Cutting	₹ 571	16.21%					
Stitching & Assembly	₹ 1,191	33.85%					
Finishing & Quality	₹ 333	9.46%					
TOTAL	₹ 3,524	100%					
FABRIC REFERENCE			FUNCTIONAL HIGHLIGHTS				
 Side A: Spandex Blend (Stretch & Comfort)	 Side B: Cotton Woven (Breathability & Structure)		<input checked="" type="checkbox"/> Improves Chest Movement <input checked="" type="checkbox"/> Reduced Neck Tension <input checked="" type="checkbox"/> Effortless Accessibility	<input checked="" type="checkbox"/> Posture Support <input checked="" type="checkbox"/> Dual-Side Wear <input checked="" type="checkbox"/> All-Day Comfort			

Figure 29 COST Sheet – Reversible Waistcoat



Figure 30 Design 4 - Blazer



Figure 31 Garment Specification Sheet – Blazer






ACADEMIC THESIS COLLECTION		GARMENT COST SHEET LONG LINE STRUCTURED BLAZER		STYLE NO.: LSB-01		
				DATE: 12-04-2024		
BRAND	Academic Thesis Collection	SIZE	M (Prototype)			
STYLE NAME	Long Line Structured Blazer	SEASON	All Season			
GARMENT TYPE	Women's Ergonomic Blazer	SAMPLE STAGE	1st Prototype			
FABRIC	Blazer Fabric (Spandex Blend)	DESIGN FEATURES	Deep V-Neckline, Shawl Collar, Raised Pockets, 4-Button Closure, Back Waist Belt, U-Plus Back Panel			
LINING	Cotton Woven Lining	FUNCTIONAL BENEFITS	Improved Chest Expansion, Reduced Shoulder Pressure, Strain-Free Access, Posture Support, Extended Seated Comfort			
COLOUR	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">■ Exterior: Green</div> <div style="text-align: center;">■ Lining: Brown</div> </div>					
GARMENT SKETCH & DETAILS			COST BREAKDOWN			
<p>FRONT VIEW: GREEN SPANDEX-BLEND</p>  <p>CUTAWAY DETAIL: BROWN COTTON LINING</p>  <p>BACK VIEW: GREEN EXTENSION</p>  <p>INTERIOR LINING VIEW</p>  <p>Back Waist Belt Detail (Pressure Point Relief)</p> <p>Interior Brown Cotton Lining Panels (Reduced Pressure, Breathable, reduces shoulder pressure for long working hours)</p>			REF	COST COMPONENT	DETAILS	COST (INR)
			1	Material	2.5 m Blazer fabric (Spandex Blend)	₹2,143
			2	Lining	2.0 m Cotton lining	₹857
			3	Trims & Notions	Buttons and interfacing	₹429
			4	Pattern & Cutting	Pattern drafting	₹714
			5	Stitching & Assembly	Garment construction	₹1,524
			6	Finishing & Quality	Pressing and reinforcement	₹381
			TOTAL PRODUCTION COST		₹6,048	
COST SUMMARY			ADDITIONAL NOTES			
Component	Cost (INR)	Percentage Contribution	<ul style="list-style-type: none"> Spandex-blend exterior ensures stretch, durability and shape retention. Cotton lining offers breathability and reduces pressure for all-day comfort. Raised pocket placement and U-plus back panel enhance ergonomics. Designed for posture support, reduced neck & shoulder tension, and extended seated comfort. <div style="border: 1px solid black; padding: 5px; text-align: center;">  ESTIMATED COST PER GARMENT ₹6,048 </div>			
Material	₹2,143	35.44%				
Lining	₹857	14.18%				
Trims & Notions	₹429	7.10%				
Pattern & Cutting	₹714	11.81%				
Stitching & Assembly	₹1,524	25.21%				
Finishing & Quality	₹381	6.31%				
TOTAL	₹6,048	100%				
MATERIAL PROPERTIES			KEY ERGONOMIC FUNCTIONS			
<p>■ Green Exterior: Spandex Blend (Stretch & Durability) – Exterior only.</p> <p>■ Brown Interior: Cotton Woven Lining (Breathability & Low Pressure) – Interior lining only.</p>			<ul style="list-style-type: none"> ✓ Improved Chest Expansion (Spandex Front Panels) ✓ Reduced Shoulder Pressure (Cotton Lining & U-Plus Back Panel) ✓ Strain-Free Pocket Access (Raised Pocket Placement) ✓ Posture Support (Back-Paneling & Waist Belt) ✓ Extended Seated Comfort (Flat Hem & Structured Fit) 			

Figure 32 COST Sheet – Blazer

4.5 Trial and User Feedback Analysis

Wear trials were conducted through Google Form evaluation.

Total responses received: **n = 5**

Because evaluation responses were obtained from a limited number of participants, findings should be interpreted within the study context.

4.5.1 Observation Findings

Observation findings indicated:

- Garments allowed movement accommodation
- Minimal garment pulling was observed
- Users demonstrated comfortable sitting postures
- No major discomfort marks were reported

Table 14 Observation Summary

Observation Variable	Findings
Shoulder movement	Comfortable
Sitting posture	Comfortable
Garment movement	Minimal restriction
Pressure marks	Not prominently observed



Figure 33 Rating Scale Evaluation Sheet

BEST GARMENT IN EACH CATEGORY	
Category	Selected Garment
Best Texture	Top
Best Comfort	Top
Best Pressure Control	Skirt
Best Mobility	Skirt
Best Professional Appearance	Blazer
Best Functional Design	Waistcoat
Best Ergonomic Integration	Top + Skirt
Best Overall Prototype	Top

Figure 34 Best Garment in Each Category

OVERALL RATING SUMMARY		
Garment	Average Score (out of 5)	Rank
Top	4.68	1
Skirt	4.58	2
Blazer	4.42	3
Waistcoat	4.26	4

INTEGRATED COLLECTION SCORE (Top + Skirt Combination Prototype)	4.82
--	------

Figure 35 Garment Rating

Additional Feedback / Observations

- The bamboo top demonstrated good softness and breathability, which contributed to comfortable wear during prolonged office activities.
- The cape sleeve and flexible upper-body construction allowed improved shoulder and arm movement with minimal restriction.
- The elastic waist structure and side-slit design of the skirt reduced pressure around the abdominal and hip regions during sitting.
- The skirt provided better lower-body movement flexibility and reduced knee restriction during walking and seated postures.
- The ergonomic blazer demonstrated improved postural support and maintained a structured professional appearance suitable for office environments.
- The integrated back support features of the blazer appeared to reduce strain during prolonged sitting periods.
- The reversible waistcoat provided functional versatility and improved accessibility through pocket placement and flexible construction.
- Garment movement during bending, reaching, and sitting activities was observed to be smooth with minimal fabric pulling.
- No visible pressure marks or major discomfort zones were prominently observed during wear trials.
- The developed garment collection successfully integrated ergonomic principles with office wear aesthetics while maintaining comfort and functional performance.

4.6 Discussion Based on Research Objectives

Objective 1: To Study Ergonomic Principles in Garment Design

Ergonomic principles in apparel design focus on improving the interaction between the wearer and the garment by considering comfort, movement, posture, and body requirements. The application of ergonomics in clothing aims to reduce physical discomfort and improve garment performance during routine activities (Bridger, 2008).

The present study incorporated ergonomic principles during the design and development process of office wear garments. Survey responses and observational findings indicated the presence of discomfort during

prolonged sitting and movement activities, particularly around pressure-sensitive body regions. Based on these findings, ergonomic interventions were integrated into the garment collection.

Table 15 Ergonomic Principles Applied in Developed Garments

Ergonomic Principle	Application in Present Study
Movement accommodation	Ease allowance in garment construction
Pressure reduction	Flexible structures in pressure-sensitive regions
Anthropometric consideration	Pattern development based on body dimensions
Reduced restriction	Functional seam placement
Mobility enhancement	Stretch-compatible construction

The incorporation of these ergonomic principles influenced the design decisions during garment development. The findings suggest that ergonomic integration contributed toward improved movement accommodation and comfort performance during wear trials.

Objective 2: To Identify Discomfort Zones in Existing Office Wear

Identification of discomfort zones is necessary because body movement and posture changes can create pressure and restriction in specific body regions during garment usage. Understanding these areas assists in developing appropriate design interventions.

The present study identified discomfort zones through survey findings and observational studies. Survey responses indicated that discomfort was experienced primarily in the thigh, waist, bust, and hip regions.

Table 16 Identified Discomfort Regions

Body Region	Percentage (%)
Thigh	43.3
Waist	33.3
Bust	30.0
Hip	26.7

Observation findings additionally indicated changes in body posture during sitting activities and movement transitions. These findings suggested that lower-body regions and pressure-sensitive areas require additional movement accommodation and flexibility.

The identification of these discomfort regions provided a basis for the integration of ergonomic interventions during garment development.

Objective 3: To Analyze Anthropometric Measurements for Improved Fit

Anthropometric measurements are used in apparel development to improve garment fit and accommodate body dimensions and movement requirements. Appropriate measurement consideration assists in reducing fit-related discomfort and improving user interaction with garments.

The present study considered anthropometric measurements during pattern development and garment construction. Measurements related to shoulder width, bust, waist, hip, and thigh dimensions were considered during the development process.

- Anthropometric Variables Considered
- Shoulder width
- Bust circumference
- Waist circumference
- Hip circumference
- Thigh circumference

The incorporation of anthropometric considerations assisted in developing garments with improved fit and movement allowance.

Objective 4: To Examine Compression and Pressure Principles

Pressure control within garments influences wearer comfort because excessive localized pressure can create movement restriction and discomfort. Pressure-related principles were considered in the present study to reduce pressure accumulation within identified discomfort regions.

The present study incorporated pressure-reduction considerations through garment design interventions rather than therapeutic compression methods.

Table 17 Pressure-Related Design Features

Design Feature	Purpose
Elastic waist structure	Reduced pressure around waist region
Side slit	Reduced lower-body restriction
Flexible construction	Improved movement comfort

Wear-trial observations indicated that no major pressure marks were visibly observed during garment usage.

Objective 5: To Develop Anatomically Zoned Garments

Anatomical zoning in garment design refers to the incorporation of specific design interventions according to the functional requirements of different body regions. Since body movement is not uniform throughout the body, different regions require different levels of flexibility, support, and ease. In occupational clothing, anatomical zoning assists in improving movement comfort and reducing localized discomfort by addressing the functional requirements of pressure-sensitive areas.

In the present study, discomfort regions identified through survey responses and observations included the waist, hip, thigh, shoulder, and bust regions. These regions were therefore considered during garment development to incorporate movement allowance and comfort-oriented interventions.

Table 18 Anatomical Zoning Applied in Developed Garments

Body Region	Intervention Applied	Garment
Shoulder	Flexible upper-body construction	Top
Waist	Elastic structure and additional ease	Skirt
Hip	Movement allowance	Skirt
Thigh	Side-slit feature	Skirt
Lower back	Supportive construction	Blazer

The findings indicate that anatomical zoning assisted in developing garments according to movement and comfort requirements of different body regions rather than using a uniform construction approach throughout the garment.

Objective 6: To Evaluate Fabric Suitability

Fabric selection was considered an important component of the present study because material properties influence comfort, movement behavior, and garment performance. Since the developed garments were intended for office wear usage, fabrics were selected according to ergonomic requirements including breathability, flexibility, softness, and structural stability.

The developed garments incorporated different materials according to the intended function of each design. Bamboo fabric was selected for the top because of its soft and breathable characteristics. Spandex fabric was selected for the skirt to improve movement flexibility. Cotton material was incorporated within

the waistcoat construction because of comfort properties, while structured fabric was selected for the blazer to maintain shape and professional appearance.

Table 19 Fabric Selection and Intended Function

Fabric	Purpose in Present Study	Garment
Bamboo fabric	Breathability and comfort	Top
Premium Spandex	Movement flexibility	Skirt
Cotton	Comfort and lining purpose	Waistcoat
Structured fabric	Shape retention	Blazer

Wear-trial observations indicated comfortable movement and positive responses regarding overall garment usability, suggesting that the selected fabrics supported the functional requirements of the developed garments.

Objective 7: To Develop Office Wear Prototypes

Prototype development formed an important stage of the study because it enabled the translation of theoretical concepts into physical products. The process involved converting findings obtained from literature review, survey responses, observational studies, and ergonomic considerations into wearable garments.

Ten initial concepts were developed during the design stage, from which four garments were selected for further development based on ergonomic suitability, construction feasibility, and functionality.

The final developed garments included:

- Bamboo Peplum Top
- Spandex Side-Slit Skirt
- Reversible Waistcoat
- Ergonomic Blazer

Table 20 Developed Garments and Functional Purpose

Garment	Functional Objective
Bamboo Top	Improved upper-body comfort
Side-Slit Skirt	Lower-body flexibility
Reversible Waistcoat	Functional adaptability
Ergonomic Blazer	Support and professional appearance

The developed prototypes incorporated ergonomic principles including movement accommodation, pressure reduction, and functional design interventions.

Objective 8: To Evaluate Developed Garments

Evaluation of developed garments was carried out through wear trials and user feedback collection using Google Form-based assessment and observation studies. The evaluation focused on identifying user responses toward comfort, movement flexibility, garment performance, and ergonomic functionality.

The wear-trial findings indicated comfortable movement behavior and minimal restriction during occupational activities. Observations additionally suggested that users were able to maintain comfortable sitting postures while wearing the developed garments.

Table 21 Garment Evaluation Findings

Evaluation Parameter	Findings
Sitting posture	Comfortable
Movement accommodation	Positive response

Garment movement	Minimal restriction
Pressure marks	Not prominently observed
Overall response	Positive

Additional feedback indicated that the garments maintained office wear aesthetics while incorporating comfort-oriented design interventions. The findings suggest that the developed garments were successful in integrating ergonomic requirements within office wear applications.

CHAPTER V: SUMMARY AND CONCLUSION

5.1 Introduction

This chapter presents a comprehensive summary of the study, major findings obtained from the research process, conclusions drawn from the findings, limitations encountered during the investigation, and recommendations for future work. The study was undertaken to evaluate the role of ergonomic principles and anatomical zoning in women's office wear for improving comfort and controlling clothing-induced pressure.

The research attempted to integrate theoretical understanding from ergonomics and anthropometry with practical design interventions in order to develop office garments that support comfort, movement flexibility, and occupational functionality.

5.2 Summary of the Study

The present study entitled:

“An Evaluation of Ergonomic Principles and Anatomical Zoning in the Design of Women's Office Wear for Enhanced Comfort”

was conducted to investigate the relationship between ergonomic principles and office wear design and to examine the role of anatomical zoning in improving garment comfort.

The study adopted an **exploratory research design** because the research aimed to investigate user discomfort, identify clothing-related issues, and develop design interventions based on user requirements.

The study was conducted in four major phases:

Phase I: Literature Review

A detailed review of literature was conducted to establish a theoretical understanding regarding:

- Ergonomics and human factors
- Anthropometry
- Occupational posture
- Compression principles
- Anatomical zoning
- Functional garments
- Clothing comfort

The literature indicated that ergonomics contributes significantly toward improving compatibility between humans and products (Bridger, 2008). Previous studies also highlighted the importance of anthropometric considerations and movement accommodation in product design (Pheasant & Haslegrave, 2006).

The literature review further revealed that while substantial studies exist regarding therapeutic garments and sportswear, limited studies specifically address ergonomic office wear for women.

Phase II: Survey and Data Collection

Primary data collection involved survey and observational methods.

The proposed sample size for the study was: **n = 50**

The responses obtained during the study included:

Initial survey responses: **n = 50**

Wear-trial responses: **n = 5**

The survey findings indicated:

- 58.1% respondents reported mixed work patterns.
- 87.1% preferred medium-fit garments.
- 58.1% experienced occasional discomfort.
- 96.8% expressed preference toward ergonomic office wear.

Survey findings further indicated discomfort in specific body regions including:

- Thigh region
- Waist region
- Bust region
- Hip region

The findings suggested that clothing discomfort exists within office wear usage and may be associated with fit, movement restriction, and pressure concentration.

Phase III: Design Development and Prototype Construction

The design development stage involved translation of survey findings and ergonomic principles into garment concepts.

The design process included:

- Mood board development
- Inspiration board development
- Color palette selection
- Fabric selection
- Concept sketch development
- Pattern development
- Prototype construction

Ten conceptual garment designs were developed integrating:

- Pressure reduction
- Ease allowance
- Functional movement
- Anatomical zoning
- Postural support
- Professional aesthetics

Four final garments were selected:

1. Bamboo Peplum Top
2. Spandex Side-Slit Skirt
3. Reversible Ergonomic Waistcoat
4. Ergonomic Blazer

The garments incorporated design interventions intended to improve movement accommodation and comfort.

Phase IV: Wear Trial and Evaluation

The developed garments were evaluated through wear trials and Google Form responses.

The evaluation process considered:

- Comfort
- Breathability
- Movement flexibility
- Pressure reduction
- Postural support
- Overall garment performance

Wear-trial responses suggested favorable user responses toward developed garments.

However, since responses were obtained from a limited number of participants ($n = 5$), the findings should be interpreted within the context of the present study.

5.3 Major Findings of the Study

Table 22 Major Findings of the Study

Objective	Major Findings
To study ergonomic principles	Ergonomic principles supported movement accommodation and comfort improvement
To identify discomfort zones	Thigh, waist, bust, and hip regions showed notable discomfort
To analyze anthropometric measurements	Anthropometric considerations improved garment fit understanding
To examine pressure principles	Pressure-sensitive regions required design modifications
To develop anatomically zoned garments	Functional zoning assisted in movement and support integration
To evaluate fabrics	Bamboo and stretch fabrics demonstrated suitable functional characteristics
To develop prototypes	Ergonomic concepts were translated into wearable garments
To evaluate garments	User feedback suggested positive responses toward comfort and movement

The present study attempted to investigate the application of ergonomic principles and anatomical zoning within women's office wear to improve comfort and pressure control. The findings indicate that clothing systems designed without consideration of movement requirements and pressure-sensitive regions may contribute to discomfort during occupational activities.

The survey findings demonstrated the presence of discomfort associated with existing office wear and indicated demand for comfort-oriented clothing systems. The discomfort reported in regions such as the thigh, waist, bust, and hip areas suggests that garment fit and construction significantly influence user comfort.

The incorporation of ergonomic principles through movement accommodation, anthropometric considerations, and anatomical zoning contributed toward development of functional garment solutions. Design interventions including ease allowance, flexible construction approaches, and attention to pressure-sensitive regions were integrated during garment development.

The findings of the present study support the view proposed by Bridger (2008) that user-centered design approaches improve compatibility between users and products. Similarly, anthropometric considerations discussed by Pheasant and Haslegrave (2006) further support the need for body-responsive design approaches in apparel systems.

Although the present findings are limited to the scope and sample size of the study, the results suggest that ergonomic office wear presents potential for improving user comfort and occupational experience.

5.4 Limitations of the Study

The study was conducted under several limitations that should be considered while interpreting the findings.

1. The proposed sample size for the study was 50 respondents, whereas complete responses obtained during the study varied according to different phases of data collection.
2. Wear-trial responses were limited to five participants.
3. The study focused only on women's office wear.
4. Long-term wear evaluation was not conducted.
5. Instrument-based pressure measurement techniques were not used.
6. Three-dimensional body scanning and sensor-based technologies were not incorporated.
7. The study was conducted within limited time and resource availability.

5.5 Future Scope

The present study provides opportunities for future research and design development.

Future studies may consider:

1. Increasing sample size for improved generalization of findings.
2. Conducting long-term wear studies.
3. Incorporating pressure sensors for quantitative pressure measurement.
4. Using three-dimensional body scanning techniques.
5. Investigating thermal comfort behavior of developed garments.
6. Integrating smart textiles and wearable technologies.
7. Developing ergonomic garments for additional user categories including:
 - Healthcare professionals
 - Industrial workers
 - Maternity wear users
 - Elderly users
8. Exploring commercialization opportunities for ergonomic office wear collections.

5.6 Recommendations

Based on the findings of the present study, the following recommendations are proposed:

- Garment development should incorporate anthropometric considerations during pattern construction.
- Pressure-sensitive body regions should be considered during clothing design.
- Movement accommodation should be integrated during garment construction.
- Breathable and flexible materials should be selected according to functional requirements.
- User-centred approaches should be adopted for future ergonomic clothing systems.

5.7 Conclusion

The present research demonstrates the importance of integrating ergonomic principles and anatomical zoning into clothing design. Garments interact continuously with the body and therefore should be developed not only for aesthetic appeal but also for comfort and functional performance.

The study suggests that ergonomic interventions may contribute toward improving clothing comfort and user experience while maintaining professional appearance requirements in office environments.

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