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Empathetic Insights into Pregnancy Discomfort: Causes and Coping Strategies for Lower Back and Pelvic Pain

Mohammad Zaki

Abstract

Pregnancy in women, transcending societal boundaries, introduces a phase marked by substantial physical and psychological changes, often accompanied by debilitating lower back and pelvic pain, especially during the 3rd trimester. Unfortunately, a permanent solution to this pervasive issue remains elusive. Our research project seeks to enhance the quality of life for expectant mothers during this critical phase through the development of an innovative product that acknowledges and respects their resilience. This undertaking is informed by exhaustive research, interviews, and surveys to dissect the root causes and pain points experienced by pregnant women. The resultant design comprises two core elements: a Bralette and a Belly Belt. This innovative solution tactfully redistributes the load from the lower back to the shoulders, delivering maximum comfort and support. The Bralette functions as regular innerwear, with the inclusion of hooks or Velcro for the attachment of the lifting strap from the Belt, positioned under the armpit area. Our research draws from existing literature, underscoring the potential benefits of exercise and support belts in mitigating pregnancy-related back and pelvic pain. However, the distinct effects of various support belt types remain speculative, necessitating further scrutiny. Maternal Support Belts

exhibit the potential to enhance balance and Functional Reach Test scores, particularly in the third trimester. These support belts have also demonstrated efficacy in addressing symphysis pubis pain. Pregnancy-related lower back pain is pervasive, accentuating the need for proactive measures. While an array of support belts is available, only a handful have undergone scientific evaluation, revealing their effectiveness in bolstering postural stability, mitigating pain, and alleviating associated symptoms.

In summation, this research project endeavors to provide a precise, ergonomic, and pragmatic solution to the significant issue of lower back and pelvic pain during pregnancy. It acknowledges the sacrifices and patience exhibited by expectant mothers, aiming to impart happiness during this transformative period. The design, which elegantly redistributes load from the lower back to the shoulders, marks a meaningful stride in ameliorating the physical discomfort experienced by pregnant women, thereby advancing their overall well-being.

Introduction

Lower back pain is commonly described as discomfort in the lower back region, which is typically musculoskeletal in nature and can result from a combination of mechanical, circulatory, hormonal, and psychosocial factors. Pregnant women frequently experience this issue, with an estimated 50% of them reporting some form of back pain during pregnancy or in the postpartum period. The precise causes of pregnancy-specific low back pain remain somewhat ambiguous.

From a biomechanical perspective, the shifting center of gravity due to increased abdominal and breast size during pregnancy

leads to alterations in posture, such as reduced plantar arch, knee hyperextension, and pelvic anteversion. These changes create stress in the lumbar lordosis and subsequently result in tension in the paraspinal muscles. Additionally, the gravid uterus can compress major blood vessels, reducing blood flow to the spine and potentially causing low back pain, particularly in the latter stages of pregnancy. Notably, significant water retention triggered by progesterone and ligamentous laxity induced by relaxin secretion can destabilize the lumbar spine and hip joints, making them more susceptible to stress and pain.

Several risk factors associated with low back pain during pregnancy have been identified, including a history of low back pain during the menstrual period and a previous history of low back pain. Furthermore, younger patients are more likely to develop pregnancy-related low back pain, and increased body weight can lead to sacroiliac joint instability, heightened spinal flexibility, and the exacerbation or onset of low back pain. Numerous prevalence studies underscore the prevalence of low back pain during pregnancy, indicating the substantial impact it has on affected women in terms of severity, discomfort, and its adverse effects on sleep quality, physical well-being, work performance, social activities, household tasks, and leisure.

Given these considerations, this study aimed to assess the frequency of low back pain during pregnancy and examine its characteristics.

Literature Survey

The available evidence, though of limited quality, indicates that engaging in exercise may have a potential benefit in alleviating pregnancy-related low-back pain. Moreover, there is moderate to

low-quality evidence supporting the idea that any form of exercise can enhance functional ability and reduce sick leave more effectively than standard prenatal care alone. Additionally, acupuncture and craniosacral therapy have shown promise in addressing pregnancy-related pelvic pain, while osteomanipulative therapy and multi-modal interventions have also demonstrated potential benefits [1]. Pelvic discomfort typically emerged during the 14th to 21st week of pregnancy, often exacerbated by daily activities. Notably, the consistent use of support belts demonstrated a notable reduction in pain, resulting in a 20 mm decrease on the visual analogue scale. It is important to note that these findings hold true only when pregnant women utilize support belts regularly and for shorter durations.

Support belts present themselves as promising tools for mitigating pelvic pain and enhancing the overall comfort of expectant mothers. However, the distinct effects of various support belt types on global, sacroiliac joint, and back pain during pregnancy remain speculative and necessitate further investigation for validation. This observed pain alleviation could potentially be attributed to an analgesic effect combined with proprioceptive and biomechanical influences [2]. The distribution of gestational weight, often asymmetrical, leads pregnant women to adopt a posture where they arch their backs to shift the center of mass of their upper body rearward. This adjustment increases the stress on the facet joints. Simultaneously, the growth of the uterus results in the lengthening of abdominal muscles and can contribute to an increase in lumbar lordosis. To estimate these three levels, Convexity Index (CI) and Normal Arrangement Index (NAI) maps were employed.

The CI map is instrumental in identifying flat, concave, and convex regions, while the NAI map aids in distinguishing cylindrical, planar, and spherical areas. In particular, the NAI map is a valuable tool for differentiating between cylindrical, planar, and spherical regions [3]. Utilizing Maternal Support Belts (MSB) demonstrates enhancements in addressing balance deficits and positively influences Functional Reach Test (FRT) scores across all pregnancy stages, with particular benefits evident in the third trimester. MSB proves to be a valuable tool in preventing falls during pregnancy, with the third trimester reaping significant advantages [4]. The problem of symphysis pubis pain is a significant issue for some pregnant women. This research sought to evaluate the effects of exercise, guidance, and the utilization of pelvic support belts in addressing symphysis pubis dysfunction during pregnancy. Subsequent to the intervention, there was a substantial reduction in the Roland-Morris Questionnaire score, the Patient-Specific Functional Scale score, as well as in both average and worst pain scores among all participants. Importantly, it is noteworthy that, except for the average pain level, there were no statistically significant differences observed among the participant groups in relation to the other measures [5]. Lower back pain is a common issue experienced by pregnant women, with approximately 50% of expectant mothers reporting varying degrees of back pain during their pregnancy or in the postpartum phase. The main aim of this study was to explore the occurrence and characteristics of lower back pain in pregnant women. It is evident that lower back pain is a prevalent issue during pregnancy, exhibiting unique attributes and frequently reaching its peak in the second trimester. These results emphasize the importance of implementing preventive measures to improve the overall health of pregnant women and alleviate the

impact of lower back pain [6]. Most of the available belts on the market often feature endorsements from health professionals lacking substantial scientific evidence, alongside anecdotal accounts of their efficacy from previous users. Only seven distinct belt brands have undergone scientific evaluation as standalone interventions, demonstrating effectiveness in enhancing postural stability, reducing symphyseal and back pain intensity and duration, and alleviating PGP symptoms.

These belts are offered in various sizes, accommodating hip circumferences ranging from 78 cm to 178 cm. Notably, one brand, 'The Ultimate Maternity Belt,' provides options in sizes extending up to 3XL. Prices for these belts vary, spanning from approximately $20 USD to $99.95 USD, contingent on factors such as belt width, construction materials, patented designs, and additional features. Some belts are equipped with extra straps that function as extenders, allowing for adjustments to accommodate abdominal growth, and they can be worn either under the belly or around the hips (high/low) [7].

Primary Research

User Interview Questions

Users were interviewed using a variety of techniques. A set of prepared questions that we developed after revisiting the problem statement a few times and engaging in a few quick brain-writing sessions. As the users is a group of extreme cases, so the interview was conducted with 5 people with their consent.

Fig. 1 Qualitative Survey with Pregnant women in Hospital

- ***What is your daily diet?***
- ***What is your daily routine?***
- ***What is your current weight and height?***
- ***What is your occupation?***
- ***How did the pain start?***
- ***How long ago did the pain started?***
- ***What do you think is the reason behind the pain in your back/spine?***
- ***Have you been suffering the pain since pregnancy?***
- ***At what stage/month of pregnancy did you started feeling the pain?***
- ***Is there any current medical conditions or issues you are facing?***
- ***Do you have any deficiency like Vit D or calcium?***
- ***Do you use Vit D or calcium supplements?***
- ***Have you ever consulted a doctor?***
- ***What did the doctor say?***
- ***What all home or self-remedies have you tried for reducing the pain?***
- ***Did you attend physiotherapy sessions?***
- ***Did the physiotherapy or exercises helped you in reducing pain?***

- ***Please rate the amount of pain relief and comfort provided by physiotherapy or exercises?***
- ***Have you ever seen or heard about Abdomen Support Belt?***
- ***Have you ever worn Abdomen Support Belt?***
- ***Did doctor ever suggested you to wear the belt for supporting back/spine?***
- ***Did belt help you in reduction of pain and supported your back?***
- ***Please rate the amount of support and comfort provided by the support belt?***
- ***Is it comfortable to wear the Support belt?***
- ***For how long do you wear the Support belt.***
- ***What features you don't like in current Support belt?***
- ***What features you would like to be implemented in the current Support belt so that it can be worn easily?***

Doctors Reviews & Interview Questions

Doctors and specialists were interviewed using a variety of techniques. A set of prepared questions that we developed after revisiting the problem statement a few times and engaging in a few quick brain-writing sessions.

Fig. 2 Qualitative Survey with Gynaecologist

- ***What are stages of pregnancy?***

- ***What category of pregnancy does create the issues in back/spine/pelvis pain?***
- ***What category of pain issues are there in back/spine/pelvis?***
- ***What methods and steps are used by a doctor to diagnose the root cause of pain?***
- ***What are the major reasons behind the Pelvic or back pain?***
- ***Are the Symptoms of pregnancy same for every woman?***
- ***What are the changes during pregnancy in women's body?***
- ***What category of pregnant women face back pain?***
- ***What are the prominent areas of back pain?***
- ***What are the main reasons behind the back pain?***
- ***What all daily movement positions pregnant women struggle in their daily life?***
- ***Is there any relation in between back pain and size of abdomen?***
- ***What are the major issues dealt by the user regarding back pain?***
- ***What are different methods that users use to reduce the pain?***
- ***What all suggestion you provide to user for reducing the pain?***
- ***Is there a solution to reduce the compression and back pain both surgically and non-surgically?***
- ***Is there any external device available for user to use for support system?***
- ***At what stage of pregnancy, your advice a patient to wear the Maternity belts/Binders?***
- ***Does user prefer to wear the support devices?***
- ***How successful is the current solution of supporting belly and reduces the pain?***
- ***Does the existing solution work on pregnant females?***
- ***Does the existing product have any ill effect on the baby or user?***

- ***What features don't you like in current Support belt?***
- ***Have you ever advised any patient to use the maternity belt during pregnancy?***
- ***What all improvements can be made to enhance the efficiency and effectiveness of product?***

Secondary Research

The period during which a foetus develops inside a woman's womb or uterus is known as a pregnancy. When counting from the last menstrual cycle through delivery, a pregnancy typically lasts about 40 weeks, or just over 9 months. Pregnancy is divided into three trimesters, as described by healthcare professionals.

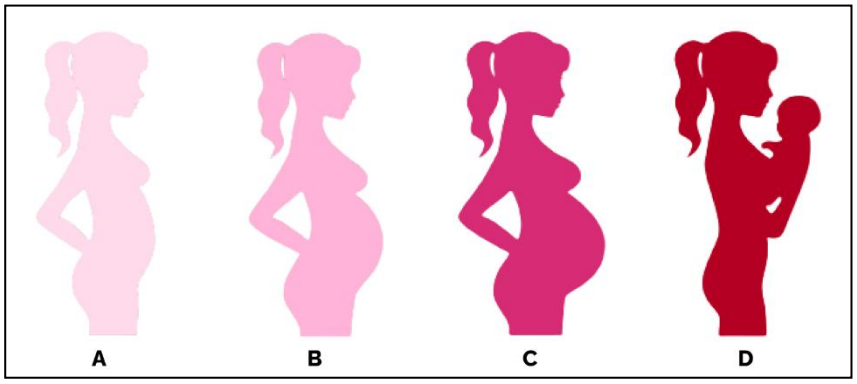

Fig. 3 Phases of Pregnant women; (A)-Women in 1st Trimester, (B)- Women in 2nd Trimester, (C)- Women in 3rd Trimester, (D)- Women in 4th Trimester

- **1st Trimester**
  - ***12 Week Foetus***
  - ***6cm Long***
  - ***End of 1st trimester, baby's heart start to beat***
  - ***Major organ starts to develop and mature***
  - ***Spine and brain begin to take shape***
  - ***Arm & Legs begin to bud***

- **2nd Trimester**
  - ***28 Week Foetus***
  - ***Women start to appear pregnant.***
  - ***Physical changes: Breast and Tummy Grow, Stretch Marks, Dark Skin Patches, Numbness on finger tips, Swelling on legs and ankles etc.***
  - ***Body ache, Light Back pain starts***
  - ***Foetus starts to move upward and inside in the uterus.***

- **3rd Trimester**
  - ***240 Week Foetus***
  - ***Women develops prominent belly.***
  - ***Physical changes: Breast and Tummy increases to full size, Stretch Marks, Dark Skin Patches, Numbness on finger tips, Swelling on legs and ankles etc.***
  - ***Body ache, Chronic pain starts in lower back and pelvic regions.***
  - ***Foetus starts to move downward and outside in the uterus. Week Foetus***
  - ***Women start to appear pregnant.***
  - ***Physical changes: Breast and Tummy Grow, Stretch Marks, Dark Skin Patches, Numbness on finger tips, Swelling on legs and ankles etc.***
  - ***Body ache, Light Back pain starts***
  - ***Foetus starts to move upward and inside in the uterus.***
- **4th Trimester**
  - ***4 - 8 weeks period after birth***
  - ***Also known as 4th trimester***
  - ***Women feels empty due to physiological changes***
  - ***Mild bleeding up to 8 weeks***

- ***Hormone level drops.***
- ***Take 3 - 5 to come back to normal.***
- ***Miss periods for 6 months***
- ***Sometimes women go in Postpartum depression due to emptiness feelings***

Spinal Areas Affected

The weight, position and size of the baby inside the womb of a women determines the level of pain and compression that will occur in the lower back and pelvic regions. Also, the level of nutrients, minerals and vitamins available in the body of the user effects the pain.

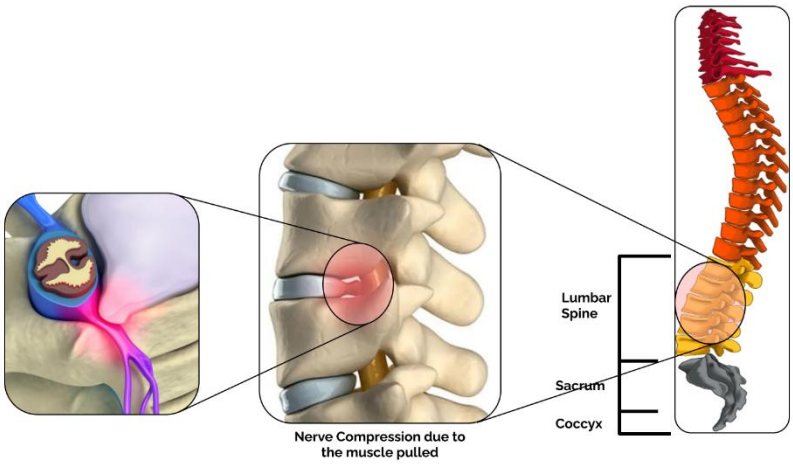

Fig. 4 Areas Affected in Spine during 3rd trimester causing Lower back pain

SPD (Symphysis Pubis Dysfunction)

A set of symptoms referred to as symphysis pubis dysfunction (SPD) is responsible for causing pain in the pelvic region. During pregnancy, pelvic joints can become stiff or move unevenly, leading to discomfort in both the front and back of the pelvis. It's estimated that up to one in five pregnant women may experience some level of SPD. This condition is a result of the release of

chemicals such as relaxin during pregnancy, which softens the muscles and ligaments in the hips, abdomen, pelvic floor, and pelvis. While SPD is not harmful to the baby, it can be exceptionally painful for the expectant mother. In severe cases, the pain may significantly impact the individual's mobility. Additionally, the baby's weight and position are believed to contribute to pelvic pain. As the pregnancy progresses, the symptoms of SPD typically become more pronounced.

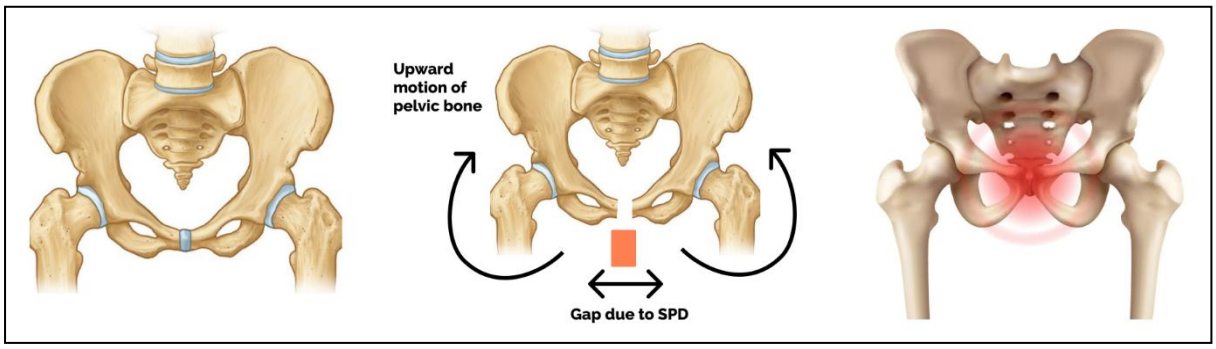

Fig. 5 Areas Affected in Pelvic area during 3rd trimester causing Lower back pain

- **Common Symptoms**
  - ***Pain in the front center of your pubic bone***
  - ***Pain in your lower back on one or both sides***
  - ***Pain in your perineum, the area between the anus & vagina***
- **Cause for Pain**
  - ***Walking***
  - ***Using stairs***
  - ***Putting your weight on one leg***
  - ***Turning over in your bed***
  - ***It might also be challenging to widen your legs.***
  - ***This can make daily tasks such as getting out of bed, getting dressed, or getting in and out of a car difficult.***

Effects of Exercise on SDP

While there is some evidence that exercise can help with lumbopelvic pain and low back pain in pregnant women, there isn't any proof that it can help with pelvic girdle discomfort. Exercise has a small protective effect against low back pain during pregnancy.

Effects of Belts/Binders

The use of belts can cause a reduction in impairment and an improvement in functioning of body normally. Therefore, the pelvic belt, and the usage of a modified belt with lumbar and PG support can dramatically lessen back and pelvic pain in pregnant women.

Current Available Design of Maternity Garments

There are basically 5 major classification of maternity garment design available for users in market to use. They are as follows

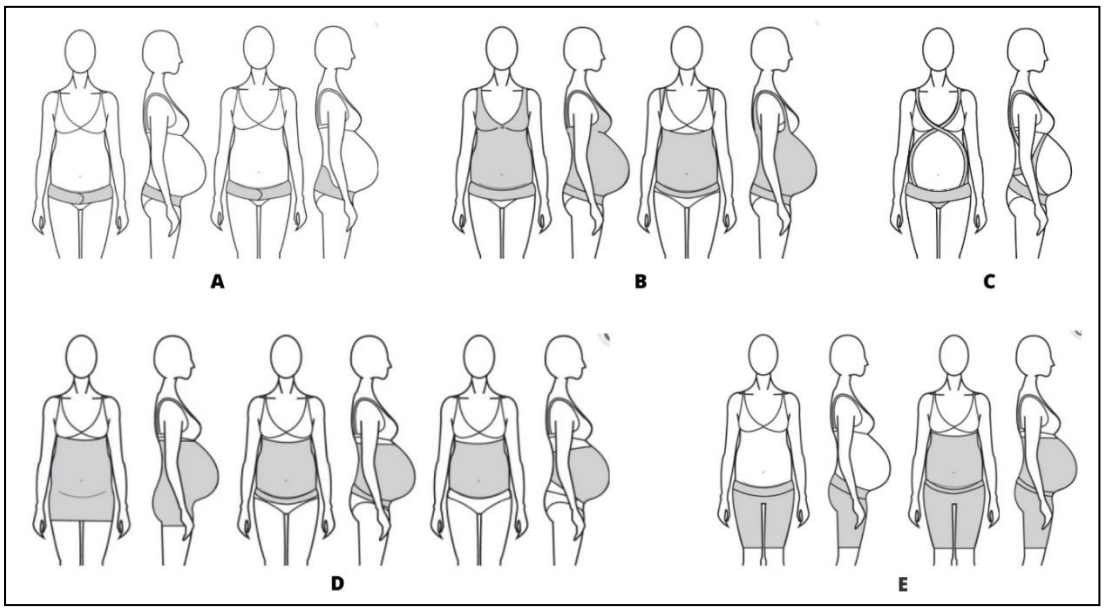

Fig. 6 Available Design of Maternity Garments; (A)- Maternity Support Belts, (B)- Full Torso MSGs, (C)- Maternity Support Cradles, (D)- Maternity Support Bands, (E)- Maternity Support Brief, Shorts and Legging

Analytics and Data

Almost 50% of women suffering from pregnancy related Lower Back Pain and seek advice from a health care professional. The symptoms get worse at night in 71.2% pregnant women with the frequency of lower back pain was 68%. The mean age of pregnant women was 26.2 years and the median gestational age was 30 weeks. 85% of women with back pain in a previous pregnancy will develop back pain in a subsequent pregnancy.

- **Target Audience - Currently there are 213 million Pregnant women present in World**
  - **World Market Size for Maternity products are -**
    - **2022 - USD 19.08 Billion**
    - **2029 - USD 25.62 Billion with CAGR - 4.8% (Expected)**
  - **Birth rate of India per 1000 people**
    - **2021 - 17.37 Births**
    - **2020 - 17.59 Births**
    - **2019 - 17.80 Births**
    - **2018 - 18.02 Births**

User Persona

I have built 3 user persona profile to understand pain and gain points of the user. 1st User Persona is a new mother who is facing her 1st ever delivery, the 2nd User Persona is a 2nd time mother who is facing her 2nd delivery, and the 3rd User Persona is a new mother who has just given birth 2 weeks ago and is in her Postpartum period.

- **1st Time Mother**

Bio	**About**
Name – Simran Age – 27 years Occupation – Accountant Place – Ghaziabad Number of Child – 0 Pregnancy – 1st	Simran is 1st time mother. She works as an accountant in a MNC in Noida. She lives with her husband and belongs to Meerut, UP. She is in her 7th month of pregnancy. She is a little anxious and scared as its her 1st time and she has twins. She hopes for a healthy and normal delivery.

Pain Points

- Handling the other child while being in pregnancy
- Problem in doing Daily chores
- Sometimes problem in sleeping due to back pain
- Fatigue happens when standing for longer duration and back starts to ache.

Gain Points

- To have lesser Back Pain
- Can do daily chores easily
- To have relaxed back
- To have a safe and healthy baby

Bio	**About**
Name – Mehak Age – 34 years Occupation – Teacher Place – Delhi Number of Child – 1 Pregnancy – 2nd	Mehak is teacher in a Private School of Delhi. She lives with her In-Laws and belongs to Indore, MP. She has a 4-year-old daughter, Payal. Mehak is in her 8th month of pregnancy. She is very good and caring mother. Her utmost priority is to give best ordination and upbringing to her kids.

- **2nd Time Mother**

Pain Points

- **Problem in Sitting up and down.**
- **Sleeping in straight postures.**
- **Cannot do anything in pain and have to bear it anyway.**
- **Feels like a bag of potato.**
- **Have joint Pains.**

Gain Points

- **To reduce pain anyhow.**
- **Can do movement easily.**
- **don't want to feel like Bag of potato.**
- **Reduce joint pains.**
- **Lift the belly anyhow to remove stress.**

- **Postpartum Period Mother**

Bio	**About**
Name – Rabiya Age – 26 years Occupation – HR Place – Gurugram Number of Child – 1 Pregnancy – 1st	Rabiya is an HR in a Bank located in Delhi. She lives with her In-Laws and belongs to Delhi. She is in her Postpartum period of pregnancy. She had C - section delivery due to some complications. She faced her back pain since 7th month of pregnancy. She is very good and caring mother.

Empathy Mapping

Using Empathy mapping as a visualisation tool to understands about a user. With the aid of this tool, we wearable to gain a deeper knowledge of the "why" behind user needs and desires.

- **S**

imr

Say	**Thinks**
Pain in back.	Can bear the pain.
Sleeping problems	Pain is for short period.
Fatigue due to weight of baby.	Can feels relaxed if weight is less
Not able to do Daily chores	Pain will be gone after delivery

tpartum

ıores.

- Problem in standing up due to back pain during pregnancy.
- Has stretch marks and pigmentation on belly.

Gain Points

- To minimize Back Pain
- Can go back to normal lifestyle.
- To feel cheerful.
- To make her baby healthy and happy.

an (1st Time Mother)

Feels	**Does**
Feels uncomfortable.	Lie or sit down when feels pain.
Unbearable pain sometimes.	Massage the back and take painkillers.
Not able to sleep, stand, sit.	Take support while doing chores.
Movement increases pain.	Try to do less work.
	Do walking, exercise and physiotherapy.

- **Mehak (2nd Time Mother)**

Say

Pains a lot in lower back.

Sleeping problem if paining.

Unbearable pain sometime.

Problem in sitting up & down.

Thinks

Pain will go away soon.

Pain is due to twins.

Can feels relaxed if weight is less

Baby should not be harmed

Feels

Feels uncomfortable.

Unbearable pain.

Not able to sleep, stand, sit.

Jerky movement increases

Does

Lie or sit down when feels pain.

Massage the back with ointment.

Take painkillers.

Take support while doing chores.

Try to do less work.

Try to relax and sleep.

Do walking, exercise and physiotherapy.

Apply ice pack on the back.

- **R**

abi ya (Po stp art um Period)

Say

Was to have pain in back during pregnancy.

Feels in depressed.

Feels empty like something is lost

Thinks

Will have to suffer this.

My baby needs my attention.

Depression will go away.

Back pain was due to complications

Feels	Does
Feels depressed.	Lie or sit down when feels pain.
Feels empty.	Massage the back.
Still feels slight pain some times.	Try to relax.
Bearable pain and will fade in	Do walking, exercise and yoga
some time. pain.	Apply ointments or ice packs.
Pain is only for some time.	

User Needs and Requirements

After doing the research and analysis of all the reviews, interviews, data and surveys we go to noted down the need, requirement and Insights of user in the product and what they demand in the product.

- **More Comfortable Material - Comfortable, breathable and soft in feel**
- **Overall Surround Support - Should provide overall support to belly & womb**
- **Stretchable Material - Should be elastic and stretchable**
- **Flexibility in Material - Should have Flexibility and adjustability**
- **Good Fabric - Fabric and material should be skin friendly and soft**
- **Low Impression Fabric - Product should not leave any marks or impressions of skin**
- **Overall Affordability - Product should be affordable**
- **Easy to Wear - Product should be easy to wear and remove without any fuss**

How Might We Statements

After having the research data, we analysed it. The pain points and insights of users were gathered on sticky notes. Then the clusters were formed and common pain points of users were observed. These pain points were then converted into HOW MIGHT WE? questions. These questions were later on used during the Concept exploration, prototyping.

- **How might we bring the comfort in back and pelvis region of a user?**
- **How might we try to reduce the stress from spine of a pregnant women without effecting the health of baby?**

Problem Statement

A way to reduce the Lower back pain amongst pregnant women to achieve overall comfortable pregnancy experience during there last trimester.

Concept Exploration

Crazy 8 Method

Using of crazy 8 method for idea generation and HMWs as a reference, I brainstormed and noted all the wild, basic, stupid, amazing ideas that came to our mind. Useful and feasible ideas from these are being used currently for generation.

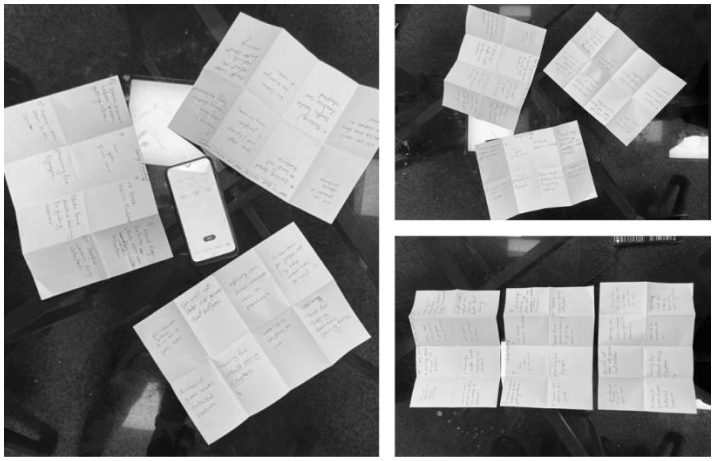

Fig. 7 Crazy 8 Method

Feasible Ideas	**Crazy Ideas**
Was to have pain in back during pregnancy.	Mechanical Straps
Feels in depressed.	Spinal Straps
Feels empty like something is lost	Metal Strapping around body
Has stretch mark and	Body Web
	Belts with stockings

for Concept Exploration

Human Factor Criteria

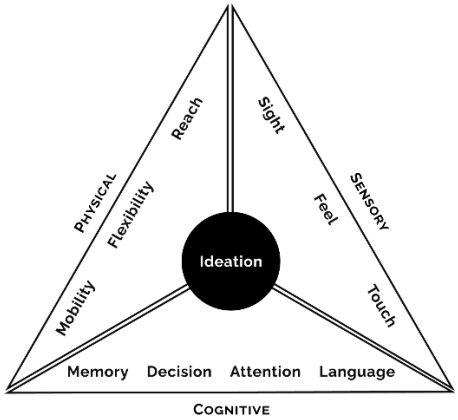

Fig. 8 Human Factor Criteria for Development and selection of Concept

Ideation

With the help of research and analysis I have tried to generate the ideation and concept keeping the constraints, needs, requirements demand and comfort the user. There were many iterations and variations before we reached the final design solution.

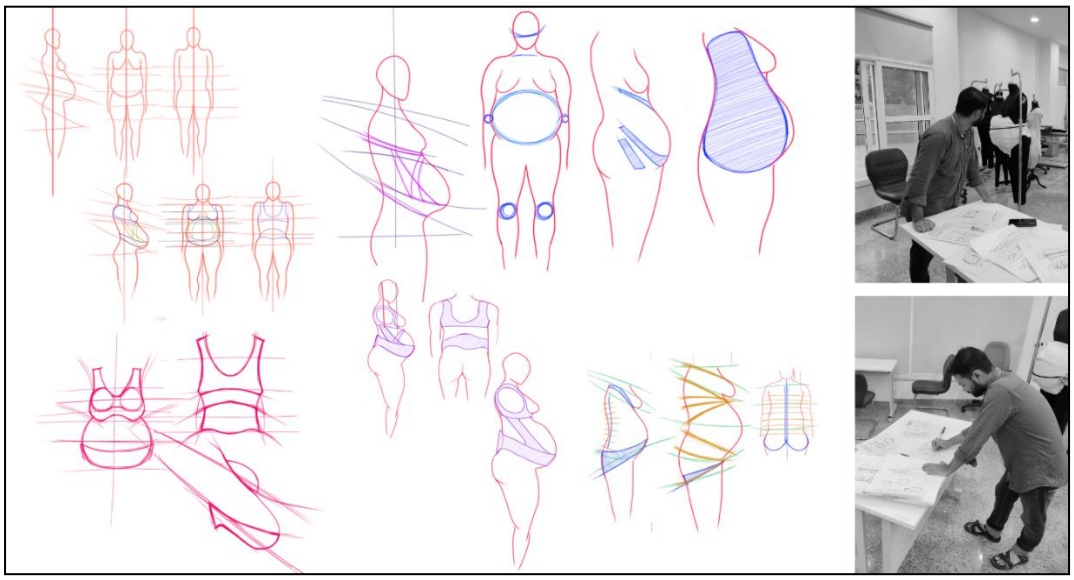

Fig. 9 Ideation and Concept Exploration

Render and Working

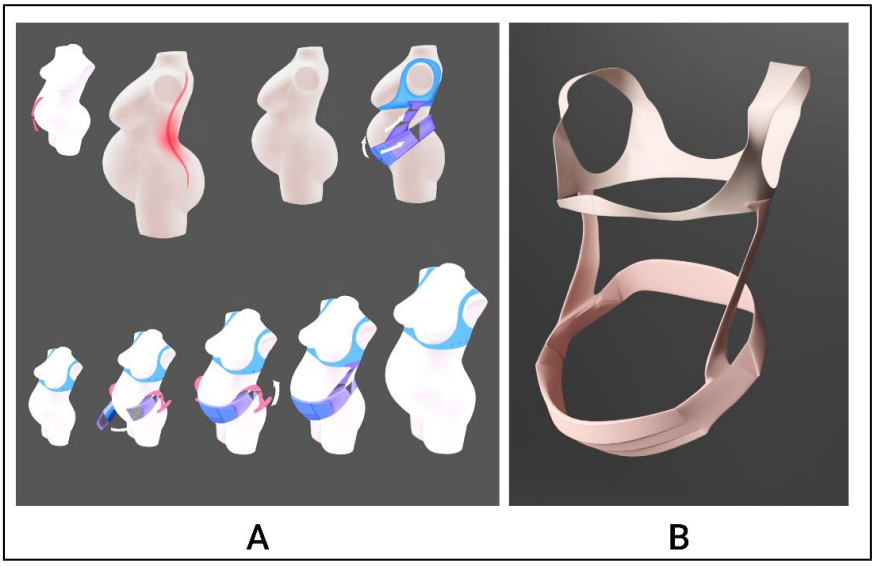

Fig. 10 (A)Working concept of Product; (B)3D Render of Product

In the figure 10 there is a representation of the load distribution and product wearability technique. There are 2 major components of the product, a Bralette and a Belt. The Bralette can be worn like a normal brassiere. Under the armpit area, near the middle of rim there can be hooks or Micro hook Velcro so that its easier to attach the lifting strap of the belt. The belt can be worn like a normal support belt. The belt will have layered front end which allows the belt to be flexible to adjust and allows air to circulate through layers to reduce the humidity under belt. The closing strap being in front end allows women to access the closing of belt easier with the help of Velcro. Unlike the regular maternity belts the load is divided into two directions and in which majority will be directed towards the shoulder through bralette.

Prototyping

An attempt to prototype the design was conducted to evaluate the feasibility of the product in real life. In the figure given below, the low fidelity prototype with a belly resembling the womb of pregnant women and blue colour wrap is the prototype of the product.

Fig.11 Prototype of the Product

Conclusion

In conclusion, this research project addresses a significant issue affecting pregnant women during their 3rd trimester, namely, the discomfort and pain in the lower back and pelvic region. This problem is widespread and often goes unmitigated due to the absence of a permanent solution. With a deep respect for the women who endure this pain and the sacrifices they make for the sake of motherhood, the project aimed to develop a product that could enhance their quality of life during pregnancy. Extensive research, interviews, and surveys were conducted to understand the root causes of this problem and the pain points experienced by users. The result is a thoughtful and ergonomic solution, comprising a Bralette and a Belly Belt, which redistributes the load from the lower back to the shoulders. This design not only offers maximum comfort and support but also maintains simplicity, aesthetics, and wearability. Ultimately, this project represents a significant step towards alleviating the physical discomfort experienced by pregnant women, contributing to their well-being during a crucial phase of life.

Abbreviations

CAGR – Compound annual growth rate

SPD – Symphysis pubic Dysfunction

PGP – Pelvic Girdle Pain

MSG – Maternity support garment

PGP – Pelvic girdle pain

LBP – Lower Back Pain

CI – Convexity Index

NAI – Normal Arrangement Index

MSB – Maternal Support Belts

FRT – Functional Reach Test

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