Association Of Maternal Height With Types Of Bony Pelvis & Its Effects On Mode Of Delivery In Females Of Reproductive Age In District Rahim Yar Khan.



SUPERIOR UNIVERSITY

Thesis Submitted to

The Superior University Lahore

In Partial Fulfillment of the

\Requirement for the Degree of

\Master of Philosophy in Basic Medical Science

By

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Roll No. MSBSMS-F21-033

Session: 2021 -2023

ABSTRACT

Introduction: X-ray pelvimetry is being used to determine the type of bony pelvis and its predictive role in mode of delivery in the females. Pelvises can be classified as Gynaecoid, android, anthropoid, and plateploid pelvis. Short heighted females have more chances of contracted pelvis as compared to heighted females which have broader pelvis.

Objectives: To determine the prevalent type of bony pelvis and its correlation with maternal height and its impact on mode of delivery among reproductive age females in district Rahim yar khan.

Methodology:

Study Design: Cross-sectional research at a single point.

Sample Technique: Stratified random sampling technique

Study Setting: Department of Gynecology of obstetrics and department of radiology Sheikh Zayed Hospital Rahim Yar Khan after the approval of ethical review board vide letter No. FRB/BMS/03/017/2024 dated 27-03-2024.

Methods: The subjects for this study were recruited from the department of gynecology & obstetrics, sheikh Zayed hospital Rahim yar khan. The females who were admitted in gynae ward and labour room for spontaneous vaginal delivery and caesarian section were sent to the radiology department for x-ray pelvimetry. X-ray pelvimetry was done in erect posture in both AP and lateral views. On the basis of which type of pelvis was determined height of females was documented in questionnaire Performa and later on impact of height was seen on type of bony pelvis and its association with mode of delivery.

Results: Data was collected among 384 postpartum females, mean age was 26.7$\pm$4.5 (range 18-35 years), mean height was 150.2$\pm$3.1 cm (range 145-155), mean weight was 67.4$\pm$8.5 kg (range 50-85) and mean BMI was 24.1$\pm$3.2 (range 18.5-29.9) while mean parity was 2.1$\pm$1.3 (range 0-5). The majority of 146 (38.0%) had gynecoid pelvis, followed by, android pelvis 96 (25.0%), anthropoid pelvis 84 (22.0%) and platypelloid

pelvis 58 (15.0%). Among these females, vaginal delivery is most suitable for females with gynecoid pelvis. A Pearson correlation analysis was conducted to calculate the relationship of maternal height to the type of bony pelvis. The results showed a positive correlation between maternal height and the presence of a gynecoid pelvis ($r = 0.35$, $p < 0.01$), suggesting that taller women are more likely to have a gynecoid pelvis, which is favorable for vaginal delivery. Conversely, a negative correlation between maternal height and the presence of an android pelvis ($r = -0.28$, $p<0.05$) was seen, indicating that shorter women are more likely to have an android pelvis, which may complicate vaginal delivery.

Conclusion: Maternal height is associated with the types of bony pelvis and can significantly influence the mode of delivery in females of reproductive age. Study concluded a substantial correlation of the maternal height with the mode of delivery. The taller women were more likely to have gynecoid pelvis, favorable for vaginal delivery.

CHAPTER-I
INTRODUCTION

Among the bony elements of human body the pelvis always gained importance due to its intricate structure as well as due to its important functional role in childbirth and locomotion.[1] The pelvis marks the junction of trunk and lower limb so it is the lowermost part of the trunk.[2] It is divided into a larger expanded part, major pelvis and the lower tapering part, the minor pelvis by the Linea terminalis.[3] The Linea terminalis makes the superior aperture, the structural limit between the true pelvis inferiorly and false pelvis superiorly (also called minor pelvis).[4] The boundaries of superior pelvic aperture or pelvic inlet include sacral promontory posteriorly, upper margin of pubic symphysis anteriorly and on each side by the ala of the sacrum, arcuate line of the ilium and the pectineal line of the pubis.[1] The bones of pelvic girdle are joined in a form of ring.[5,6]

Two functionally important joints exist between these bones. Anteriorly lies the pubic symphysis and posteriorly are the bilateral sacroiliac joints. Both of these joints play a crucial role in stability of pelvic ring. Along with providing stability, sacroiliac joint has an utmost importance in the oscillatory movements (nutation, counternutation, anteversion and retroversion) during the process of childbirth.[7]

The movements of anteversion and retroversion assist to increase the diameter of upper and lower pelvis while the nutation and counternutation help open the pelvis until the foetus reaches the perineum.[8] Nutation refers to the forward and downward movement of the sacrum, with the coccyx moving backward relative to the ileum. Counternutation, on the other hand, involves the backward and upward movement of the sacrum, with the coccyx moving forward relative to the ileum. [9] During nutation, the ischial tuberosities are separated, iliac crests are approximated, the pelvic inlet becomes narrow while pelvic outlet becomes wide. Contrary to nutation during counternutation the ischial tuberosities are approximated, iliac crests are separated, pelvic inlet widens, and pelvic outlet becomes narrow.[10]

As pelvis is the parturition passage, multiple differences exist in the structure of male and female pelvises. The female pelvis is broad with low height and blunt bony

markings.[11] To understand the obstetrics in terms of pelvimetry, we imagine the following planes that extend across the pelvis at different levels: the pelvic inlet, the plane of greatest diameter, the plane of least diameter, the midpelvis, the pelvic outlet, and the anterior and posterior sagittal diameters.[12]

1.1 Pelvic inlet

Pelvic inlet, also known as superior aperture, owes an irregular circumference. Its Anteroposterior diameter (AP) is the distance between the pubic symphysis and sacral promontory.[13] Three distances are taken relative to AP diameter of the pelvic inlet:[12]

i. True conjugate: Distance taken the anterior edge of the sacral promontory to the superior edge of pubic symphysis. Its average measurement is 11cm.

ii. Obstetric conjugate: Distance taken from the sacral promontory to the point bulging the most on the back of pubic symphysis, located about 1cm below its superior edge. Its average measurement is 10.5 cm.

iii. Diagonal conjugate: Distance taken between the sacral promontory and inferior edge of pubic symphysis. Its average measurement is 12.5 cm.

The transverse diameter is the maximum dimension, measured between the widest points on the pelvic brim. The oblique diameter is a dimension from the sacroiliac joint on one side to the iliopectineal eminence on the other side. [14-16]

1.2 Plane of greatest diameter:

It is the largest area of the pelvic cavity, which is measured by the posterior midpoint of the anterior pubis, the midpoint of superior part of the obturator foramina laterally, and the connection of the posterior border of second and third sacral vertebrae. The anteroposterior diameter is a dimension taken from the midpoint of the posterior surface of the pubis to the junction of the second and third sacral vertebrae. The largest transverse diameter lies between the lateral borders of the plane.[12]

1.3 Plane of least diameter

This plane is defined by the lower edge of the pubis at the front, the ischial

spines on the sides, and the midpoint of the fourth sacral vertebra at the back. The measurement of anteroposterior diameter is taken from the anterior boundary to the posterior boundary. The transverse diameter is measured between the two ischial spines on both sides.[12]

1.4 Midpelvis

The midpelvis is located at the level of the ischial spines and is the plane with the smallest pelvic measurements. The anteroposterior diameter of the midpelvis is taken from the posterior lower side of the symphysis pubis to the anterior cortical aspect of the sacrococcygeal junction. The transverse diameter, also known as the interspinous diameter, is measurement between the ischial spines.[12]

1.5 Pelvic outlet

It is comprised of two wedge-shaped planes with a shared base at the level of the ischial tuberosities. The front plane is bounded on both side by the pubic rami, the subpubic angle at the apex, and the intertuberous diameter inferiorly. The posterior plane is bounded by the sacrotuberous ligaments on either sides, the tip of the coccyx, and the intertuberous diameter inferiorly. The anteroposterior (AP) diameter is a measurement from the lower edge of the pubic symphysis to the tip of the coccyx. The transverse diameter, also known as the intratuberous diameter, is a dimension between the inner borders of the two opposing ischial tuberosities. [12,17] The most common classification system according to these parameters is the Caldwell-Moloy classification system, which includes Gynecoid, Android, Anthropoid, and Platypelloid types. [18,19]

1.6 Gynecoid pelvis

The pelvic inlet of this type is wide and slightly oval in transverse axis. The pelvic cavity is shallow with straight sidewalls and blunt ischial spines. The sacrum is broad and well curved while the sacrosciatic notch (a deep indentation in the posterior border of hip bone at the point of union of the ilium and ischium) and subpubic angle are wide (more than 90 degree). The ischial tuberosities are spaced well and ischial spines are blunt and rounded. It is the most common type of female pelvis.[12]

1.7 Android pelvis

It has a heart shaped pelvic inlet with anterior narrow apex having deep funnel shaped cavity with convergent sidewalls and projecting ischial spines. The sacrum is slightly curved with narrow sacrociatic notch and subpubic angle (less than 90 degree). The ischial tuberosities are nearer to each other as compared to gynecoid pelvis. It is typical male pelvis.[12]

1.8 Anthropoid pelvis

It is characterized by a distinctly oval shaped inlet in anteroposterior axis with a long deep cavity having divergent sidewalls and blunt ischial spines. The sacrum is long, narrow and slightly curved with a wide sacrosciatic notch. The subpubic angle is narrow. The pelvis is generally very deep.[12]

1.9 Platypelloid pelvis

It is characterized as an oval pelvic inlet in the lateral axis. The anteroposterior diameter is smaller as compared to the transverse diameter. The pelvic cavity is shallow with divergent sidewalls and blunt ischial spines. The sacrum is slightly curved with narrow sacrosciatic notch while the subpubic angle is wide.[12]

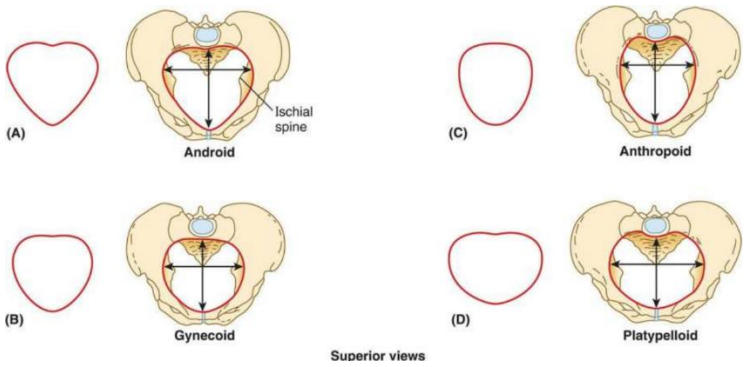


Figure 4.1: Types of bony pelvises

For each pelvic plane, different diameters are considered including AP, right and left oblique, transverse. However, not all diameters are important in estimation of obstetric prognosis for a fetus of average size. Normally the two important diameters for pelvic inlet, pelvic cavity and the pelvic outlet are AP diameter and transverse diameter. [20,21]

The pelvis serves many of the indispensable functions of human skeleton.[22] The key function of bony pelvis includes encasement of pelvic organs, weight bearing and acting as a strong support for muscles of gluteal and thigh regions.[23] The female pelvis catches the attention of many researchers due to its crucial role in the process of parturition.[24] Moreover, the dependency of development bony pelvis on the nutritional, geographical and environmental factors has made it more captivating for researchers of the different regions of the world.[1]

Many of the anthropometric parameters define the pregnancy outcomes but one of the most important parameters is the maternal height.[25] Various studies emphasized the relationship between maternal height and type of bony pelvis.[26] These studies concluded that maternal height is a major factor that impacts the pelvic dimensions, heighted females have broader pelvis as compared to short heighted females. The broader pelvis favours the spontaneous vaginal delivery.[27] The reciprocity among female height and pelvic measurements manifests that mean pelvic area of tall women is far more than those of short stature. The narrow pelvic area of short heighted females is a cause of labour dystocia as the fetal head or shoulder can get stuck in narrow pelvis. In contrast the wider pelvis of tall females serves as a roomier birth canal facilitating birth of even good size babies. Hence the wider pelvises of heighted females act as a positive factor for normal vaginal delivery. The strong impact of maternal height on obstetrics and fetal outcomes has been highlighted for ages and even in Demographic Health Survey (DHS) data from 109 countries.[28]

Various speculations had been made in the past to relate maternal build with the offspring's outcomes before or immediately after birth. However less evidence is present in previous research showing impact of short maternal build on health of offspring during infancy and childhood.[29]

Short stature of mothers leads to intrauterine growth retardation, low birth weight and small for gestational age evident on ultrasonography. Short statured females often face labour dystocia leading to caesarian sections (CS). One of the studies conducted by Austrian researchers Kirchengast and Hartmann in 2007, found that short maternal stature is directly related with an increase incidence of CS. [28]

The link between maternal height and child health has a biochemical basis (i.e.

shorter women have a narrower pelvis raising the chances of cephalopelvic disproportion (CPD) and obstructed labour).[30] Shorter mothers might have lower health reserves (i.e. inadequate nutrient supply during the early childhood years of mother leading to growth retardation and shortened stature), potentially leading to insufficient nutrient supply to fetus, resulting in intrauterine growth restriction and low birth weight which can impact child health and survival.[29]

In obstetric practice, the pelvimetry constitutes the measurements of various dimensions of the pelvic regions, including AP diameters and transverse diameters of pelvic inlet, midcavity and pelvic outlet. This is done to ascertain its adequacy for the passage of an average sized fetus.[20] Pelvimetry is helpful for obstetricians for predicting potential delivery challenges. Prior knowledge regarding individual's pelvic measurements, can help health provider to vigilantly plan about mode of delivery thus reducing chances of maternal and neonatal complications. In low resource settings like District Rahim Yar Khan, objective pelvic measurements serve as fundamental tools in enhancing clinical outcomes.([31,32]).

Pelvimetry is usually done by clinical examination as well as with the help of x-ray, CT scan or MRI. [33,34] Radiological pelvimetry measures the relevant diameters of the pelvis and the head of the fetus. Every type of pelvimetry does have some limitations like mothers feel uncomfortable during clinical examination while X Ray and CT scan might cause harm to the baby and MRI is usually very costly. Moreover, expertise is required in all types of pelvimetry to anticipate any complication during parturition. [35,36] X ray pelvimetry is still relevant in obstetric practice, although ultrasonography and MRI emerge as recent advancements. MRI is not a practical approach for low resource settings due to its expensive nature .Ultrasonography is cheaper than MRI and is radiation safe but it is more suitable for imaging soft tissues and fetal anatomy. X ray pelvimetry is more precise in measuring various dimensions of bony pelvis and requires less expertise as compared to other radiological techniques([37-39])

During clinical pelvimetry it is important to note that physical examination cannot directly measure the internal bony structures such as sacral promontory, pubic symphysis and ischial tuberosity due to their encasement in soft tissues.[20,40] X-ray pelvimetry is primarily employed to assess the pelvic inlet aiding clinicians in diagnosis of conditions like CPD or a contracted pelvic inlet.[27] Notably, CPD and arrest of dilatation are significant contributing factors in nearly 50% of CS deliveries.[41]

CPD occurs when there is a discrepancy between the measurements of maternal pelvis and the size of the fetus.[42,43] The outcome of the delivery is mainly dependent on three "Ps" of labour i.e., passage way (birth canal), passenger (fetus) and the power of uterus (contractile force).[44] Pelvimetry has investiagted the passageway component of this triad that measures the maternal bony pelvic dimensions, with very little importance on its shape or pelvic floor muscles.[45]

The obstetrician must know the diameters of the pelvis while deciding about the mode of delivery.[46] The biggest obstacle that a fetus encounters during labour is the superior pelvic aperture as it is bounded by bones and is unable to expand. Five diameters of the pelvis must be known by the obstetrician for healthy delivery. For Pelvic inlet, transverse diameter (taken between the widest point on the pelvic brim) and obstetrical conjugate (an anterioposterior diameter of the pelvic inlet which is a dimension from the sacral promontory to a short distance below the superior margin of pubic symphysis) are significant, while for pelvic outlet, transverse diameter(measured between the inner borders of opposite ischial tuberosities), interspinous diameter (measured between the ischial spines) and AP diameter (measured from the inferior margin of symphysis to the sacrococcygeal joint). Moreover, when a newborn's head is of normal size, if the obstetrical conjugate is less than 10 cm; interspinous diameter is less than 9.5 cm, and transverse diameter of the pelvic outlet is less than 8 cm, the pelvis is labelled as inadequate for normal delivery. An obstetrical conjugate must be above 10 cm for the process of normal vaginal delivery. [47-49] The information regarding interspinous diameter during labour is also very important for the obstetrician because the widest diameter of fetal skull i.e., biparietal diameter, has to pass through it.[50,51]

Many previous studies suggested that the most crucial diameter is this interspinous as it gives the maximum hinderance to the passage of fetus.[7] This hindrance can lead the obstetrician to carry on with the normal delivery with the help of forceps or vacuum extraction, which can prove to be risky for mother as well as the fetus.[7] When normal vaginal delivery is not possible, the surgical procedure done for child birth is caesarean section (CS). Although caesarean section is life saving for both the mother and the fetus, there are always possibilities of risk which include chances of infections, hemorrhage, injury to other organs, anesthesia and blood transfusion related complications for mother and increase chances of respiratory problems, Asthma and

obesity in childhood could be possible complications for the infant.[52] A cesarean sections should be performed only when the risks of complications for the mother and the fetus are significant. A high standard of expertise is required for deciding the (CS) as a mode of childbirth as it confers a long list of short- and long-term health issues for both the mother and the baby. There is an overall rise in the prevalence of CS throughout the world. Medical complications might account for some of this increase as well as non-medical factors may also play a vital role.[52] Previous studies documented short and long term consequences of this procedure for mother including higher risk of hysterectomy (due to abnormal placentation, atony of uterus, severe bleeding), uterine rupture (due to previous surgical scar), abnormal placentation (like placenta accreta due to previous scarring), stillbirth and increased chances of preterm childbirths in subsequent conceptions.[53] Health consequences of (CS) for children comprises of allergy, atopy, asthma, hypertension, type 1 diabetes and decrease intestinal gut microbiome diversity. The persistence of these risks into latter life is yet to be investigated as very little data is available.[45] Majority of the mothers opt for (CS) as a priority just to avoid the painful process of normal spontaneous vaginal delivery.[28]

One of the major reasons of maternal and neonatal morbidity and mortality is linked to emergency (CS).[54] Such women who are undergoing emergency (CS) are at always high risk of intra and post operative complications such as hemorrhage due to tearing of uterine incision into the parametrium or cervix and hysterotomy extension, infection due to wound sepsis and endometritis, deep vein thrombosis and prolong hospital stay.[55,56] Likewise, such emergency (CS) put neonate into high risk of immediate postoperative complications like respiratory distress due to inadequate surfactant production in lungs and trauma. Therefore, if we could diagnose the (CPD) well before time by using X-ray pelvimetry, it can reduce the need of emergency (CS) and obstetrician can plan for the mode of delivery well before time which would have better outcome both for mother and neonate.[35] In conclusion, while maternal height may exhibit some association with bony pelvis type, it is imperative to consider a multitude of factors and individual variabilities. Additionally, alternative imaging modalities like CT scan and MRI have supplanted X-ray pelvimetry for assessing pelvic dimensions due to their increased accuracy. However, these advanced modalities are not cost effective and are unaffordable for patients in the periphery of developing countries. In contrast X-rays are cheaper and available in public hospitals in

underdeveloped areas and accessible to the public.[57]

The current data lacks focused research regarding relationship between maternal height and dimensions of bony pelvis, as well as its relation to delivery outcomes ,specifically in District Rahim Yar Khan. Most of the current data is non South Asian which is different due to inherent variations in genetics, anthropometery, nutritional status and socioeconomic status,([58,59]).Thus there exist a region specific research gap, which needs to be addressed for clinical practices in South Punjab .

1.10 Objectives

The objectives of the study are:

1) To assess the prevalent type of bony pelvis in reproductive age females in the Rahim Yar Khan district.

2) To explore the correlation between maternal height and the type of bony pelvis, as well as assess the mode of delivery in different types of bony pelvis among reproductive age females.

3) To correlate the prevalent type of bony pelvis with mode of delivery in reproductive age females of district Rahim Yar Khan.

1.11 Hypothesis

Maternal height is positively correlated with pelvic dimensions and this correlation can be utilized as a predictive factor for the mode of delivery.

CHAPTER 2

LITERATURE REVIEW

Maternal height has long been a subject of interest in obstetric research, primarily due to its potential influence on pelvic dimensions and subsequent mode of delivery. The bony pelvis plays an important part in childbirth, affecting the labor process and determining whether a woman can deliver vaginally or requires a cesarean section. This literature review aims to survey the relationship between maternal height, types of bony pelvis, and their impact on the mode of delivery in females of reproductive age.

2.1 Maternal Height and Pelvic Dimensions

Several researchers have explored the correlation of maternal height and pelvic dimensions, suggesting that shorter women tend to have smaller pelvic measurements. A comprehensive study by Jolly et al. (2003) found a positive correlation between maternal height and the size of the pelvic inlet, midpelvis, and outlet. This implies that shorter women may be at a higher risk of cephalopelvic disproportion (CPD), where the baby's head is comparatively bigger to pass through the pelvis, potentially leading to obstructed labor and the need for surgical intervention.[60] A study done by Wells and colleagues (2018) reported that Maternal height had a weak correlation with pelvic dimensions, whereas BMI showed stronger correlations. The pelvic dimensions were interrelated, with correlation coefficients ranging from 0.49 to 0.67. [54]

2.2 Types of Bony Pelvis

Caldwell and Moloy (1933) classified the bony pelvis into four types: gynecoid, android, anthropoid, and platypelloid. Each type has distinct characteristics that can influence the labor and delivery process. The gynecoid pelvis, is the most suitable type for vaginal delivery because it is round and spacious. The android pelvis is heart-shaped and narrower, often associated with longer and more difficult labor. The anthropoid pelvis is oval and generally permits vaginal delivery, while the platypelloid pelvis, being flat, poses significant challenges for childbirth. [62-64]

2.3 Influence of Pelvic Type on Mode of Delivery

The type of bony pelvis significantly impacts the mode of delivery. For instance, a study by Treacy et al. (2012) demonstrated that women with a gynecoid pelvis had the highest rates of spontaneous vaginal delivery, while those with an android or platypelloid pelvis were more likely to require operative deliveries, including cesarean sections. This association is particularly pronounced in shorter women, who are more likely to have less favorable pelvic types.[65]

2.4 Maternal Height and Mode of Delivery

The impact of maternal height on the mode of delivery has been widely studied, with evidence suggesting that shorter women are at a greater risk of operative deliveries. A meta-analysis by Witter et al. (2018) indicated shorter maternal height was significantly linked to an greater risk of cesarean delivery. The authors suggested that shorter women might have a higher occurrence of CPD and labor dystocia, leading to the need for surgical intervention.[66]

A study carried out by Kuritani and Hayashi (2020) examined the relatioship between maternal height and mode of delivery in nulliparous Japanese women. A total of 1593 women were studied in this study. Cesarean delivery was more prevalent in shorter women as compared to the taller women.[67] Naskovica et al. (2024) reported in their study a cesarean section rate of 5.9% among women with a height of 170 cm or more, and 16.5% among women with a height of less than 170 cm. [68] A study conducted by Patil and teammates (2024) found that the incidence of emergency caesarean delivery in short mothers was 32.5%.[69]

A study performed by Kakoma and fellows (2010) reported that the rate of cesarean section deliveries progressively reduced as height increased (<150 cm: 33.3%; 150–159 cm: 20.7%; 160–169 cm: 17.9%; ≥170 cm: 10%; p=0.412).[70] Alobaidy and colleagues (2019) found that women with an average BMI (50.9%) and those who were underweight (85.7%) were more likely to have vaginal deliveries compared to women with a high BMI (33.3%). They also observed that taller women (71.4%) had a higher chance of delivering vaginally compared to women of average height (41%) or shorter

stature (48%).[71]

Starrach and companions (2023) highlighted that the average body height was similar between the cesarean section group (mean ± SD: 164.4 ± 7.9 cm) and the vaginal birth group (mean ± SD: 166.0 ± 6.0 cm). Women in the cesarean section group were slightly overweight than the vaginal birth group (mean ± SD: 71.5 ± 19.8 kg for the cesarean section group; 65.9 ± 19.8 kg for the vaginal birth group). However, the differences in body height and body weight between the two groups were not statistically significant.[72] The study done by Onyebuchi and Mamah (2023) showed that mean age of the participants was 30.4 ± 4.2 years, and the mean height was 164.5 ± 6.1 cm. Approximately 82% of the women had vaginal delivery. The majority (96.6%) of the participants were booked and more than 75% have had previous vaginal delivery. There was no significant relation between the maternal height and mode of delivery (P=0.95).[73]

A study done by Garg et al. (2016) showed 70 women had cesarean delivery (study group), and 55 women had vaginal delivery (control group). The average height of women in the study group was found to be145.34 cm, the control group showed it to be 154.02 cm. Out of 44 women of short stature (height ≤145 cm), 41 (93.18%) had a cesarean section, and 2 (4.55%) delivered vaginally. [74] Roldán et al. (2020) concluded that prevalence of C-section, including all live births, was 1.63 more prevelant in mothers shorter than 145 cm as compared with those equal or greater than 170 cm. [75]

Balamurugan and coworkers (2020) found that 63% of women with short stature had spontaneous vaginal deliveries, regardless of whether it was their first or later baby. Most of these babies weighed between 2.6-3.0 kg, with 65% being first-borns and 35% being later-borns. This rate is higher than what is usually reported in other studies.[76] Airao et al. (2017) reported that among 43 short statured women (height ≤138 cm) 27(62.8%) had caesarean section or instrumental delivery and 16(37.2%) women were delivered vaginally. Out of 8 women with high expected birth weight >3.5kg, 7 women (87.5%) delivered by either caesarian section or instrumental delivery and only one (12.5%) woman delivered by normal vaginal delivery.[77]

2.5 Combined Effect of Maternal Height and Pelvic Type

Understanding the combined effect of maternal height and pelvic type on the mode of delivery is crucial for predicting labor outcomes and managing childbirth effectively. A study by Zhang et al. (2010) explored this interplay and found that the risk of cesarean delivery was highest in shorter women with an android or platypelloid pelvis. Conversely, taller women with a gynecoid or anthropoid pelvis had the most favorable outcomes, with higher rates of spontaneous vaginal delivery.[78]

2.6 Implications for Obstetric Practice

The relation between maternal height, pelvic type, and the mode of delivery has important implications for obstetric practice. Antenatal screening for pelvic dimensions and maternal height can help identify women at risk of labor complications. This can inform clinical decision-making, allowing for timely interventions and better management of labor and delivery. Personalized care plans based on these assessments can improve maternal and neonatal outcomes, reducing the incidence of emergency cesarean sections and associated morbidities. Guidelines from global obstetrics associations recommend using pelvimetry selectively i.e in suspected cases of cephalopelvic disproportion or malpresentation of fetus. The aim is to limit irrelevant radiation exposure while promising that high risk patients are accurately evaluated in terms of pelvic measurements.([79,80]). Thus inspite of advancements in radiological tecniques , X- ray pelvimetry ,with proper shielding and with exposure of radiation less than1mGy is acceptable.[81] X-ray pelvimetry is still relevant in low resource settings in terms of its cost effectiveness, simplicity of its reporting,specificity for locating bony landmarks and endorsement by global health bodies.[37-39]

Literature underscores the significant association between maternal height, types of bony pelvis, and mode of delivery. Shorter maternal height is linked to smaller pelvic dimensions and less favorable pelvic types, increasing the risk of operative deliveries. These results show the importance of individualized obstetric care and the need for further research to develop predictive models for labor outcomes based on maternal height and pelvic type.

2.7 Further Exploration of Maternal Height and Pelvic Typology

Maternal height's relationship with pelvic dimensions is intricate, influenced by various genetic, nutritional, and environmental factors. Research by Kurjak et al. (2007) underscores the complexity of this relationship, noting that while shorter stature often correlates with smaller pelvic dimensions, other factors such as ethnic background and nutritional history also play significant roles. For instance, populations with a history of chronic malnutrition may exhibit shorter average heights and smaller pelvic sizes, increasing the risk of complicated deliveries.[82]

2.8 Ethnic and Geographic Variations in Pelvic Types

. Ethnic and geographic variations significantly influence pelvic types and their distribution among populations. Studies such as those conducted by Ahn et al. (2010) have shown that the distribution of pelvic types varies widely across different ethnic groups. For example, the gynecoid pelvis is more prevalent among Caucasian women, while the anthropoid pelvis is more common among African women. These variations necessitate a tailored approach to obstetric care, taking into consideration the patient's ethnic background to better predict and manage potential delivery complications.[83]

Kurki, Betti & Manica discovered that the average shape of the pelvis differs among populations in relation to their geographical location, with some changes associated to a latitudinal gradient.[84-86] Moreover, high-latitude populations mostly showed broader pelvis and larger body sizes. This finding is believed to be an evolution for effective heat regulation: as a lower surface-to-volume ratio is present in broader people, which aids in reducing heat loss in cold high-latitude environments, while narrower bodies increase heat dissipation in hot low-latitude environments.[87] In addition to the latitudinal trend, populations that are geographically closer were found to have similar pelvic shapes, whereas populations from various continents exhibit more significant differences. These facts show differences in human genetics [85,86] which resulted in minor genetic and morphological differences in populations as they colonized different regions of the world. Consequently, pelvic shape in different species has changed due to geographical variation, climatic adaptation and genetic drift. [88,89]

2.9 Technological Advances in Pelvic Measurement

Advancements in imaging technologies have revolutionized the assessment of pelvic dimensions and types. Techniques such as 3D pelvic CT scans and MRI offer precise measurements and detailed visualizations of pelvic anatomy, facilitating accurate prediction of delivery mode. [90-92] A study by Matic et al. (2013) demonstrated that 3D imaging could effectively identify women at risk for CPD, allowing for early intervention strategies such as planned cesarean sections, thereby reducing labor-related morbidities.[93]

In a study by Daghighi et al. (2013) the obstetric conjugate diameter measured by ultrasonography was done in 200 pregnant Iranian women during 25-35 weeks. It was seen that the obstetrical conjugate diameter in group V (vaginal delivery), and C (cesarean delivery) was 125.51±8.35 mm and 112.99±8.53 mm respectively.[94] In another research study which was done by Spörri and associates in 2002, MRI was carried out on 38 American pregnant women to study the delivery mode (vaginal or cesarean) and it was seen that the obstetric conjugate diameter was 10.8±0.9 cm and 11.8±07 for women who delivered by caessarian section and those in which vaginal delivery was done respectively. [95]

In one study in which Kim et al. (2011) conducted CT scan on 175 Korean women having age range from 20 to 50 years) to study the type of delivery (vaginal or cesarean) depending upon obstetrical conjugate. According to the results, 84 women having mean obstetrical conjugate 119.6+9.5 mm delivered vaginally while in another group of 20 females who had cesarean section it was 116.6±8.4 mm.[96] Sonal and colleagues in (2006) found that 55 pregnant women who were from Dehli, were having obstetrical conjugate less than 10cm on pelvimetery ultrasound, were being predicted to have caessarian sections as final mode of delivery.[97]

In a study conducted by Keller et al. (2003) magnetic resonance pelvimetric data in 781 women of swtzerland was analyzed to assess the mode of delivery. The mean diameter of obstetrical conjugate was 121.7±8.6 mm in women who delivered vaginally, while it was less in women who had cesarean.[98] Sarkar and Singh in 2019, concluded in their study that the incidence of caessarian sections was much high in females having obstetrical conjugate diameter less than 10 cm as compared to those females who had more than 10 cm obstetrical conjugate diameter. Pregnant females

having diameter of obstetrical conjugate less than 10 cm were having 100% chances of cesarean section while those having 10 cm to 10.9 cm were having chances of 39.7% cesarean section, 11 cm to 11.9 cm was associated 18.9% to cesarean section, more than or equal to 12 cm was associated 10% to cesarean section.[99] A study done by Liao and colleagues in 2018 showed that the diameter of mean obstetrical conjugate was 126.9±8.3 mm for Chinese pregnant females having normal vaginal delivery.[100]

2.10 Impact of Maternal Height and Pelvic Type on Labor Progression

Studies show that progression in labor is affected by the relationship between maternal height and pelvic type. Prolonged labor is seen in women having short stature due to the reason that there is not adequate space for the fetal descent. A longitudinal study by Cheng et al. (2004) found that labor duration was significantly longer in shorter women with android or platypelloid pelvises, leading to higher rates of labor augmentation and operative deliveries. This finding emphasizes the need for continuous labor monitoring and timely interventions in high-risk groups.[101] Prasad and Al-Taher conducted a study in 2002 to study the relationship between height of mothers, labour duration and mode of delivery.[102]

2.11 Maternal and Neonatal Outcomes

The relationship of pregnant female height and pelvic type extends beyond the delivery mode to affect infant and maternal outcome results. Mothers with short stature having less favorable pelvic types have high incidence rates of maternal complications like perineal tears, postpartum hemorrhage and uterine rupture. There was a high incidence of neonatal complications with increased risk of birth asphyxia, shoulder dystocia and neo-natal ICU admissions. Landy et al. in (2011) highlighted the importance of anticipating risks and importance of preventive measures to ensure the safety of both mother and child.[103]

Shankar and collaborators (2019) conducted a study to study the association of maternal height and neonatal morbidity. There were more NICU admissions in the neonates of short statured mothers and weight ($p<0.001$). Statistically, Pearson correlation showed significant relation ($p<0.001$) between mother's height and weight against new born weight at birth , body length and new born head circumference. Statistically strong relation of maternal height ($p<0.001$) was seen in relation to mean

birth weight, head circumference and length.[104]

Marshall and partners conducted a study in (2014) to study the influence of mother's height on antenatal possible outcomes in normal weight women. Increasing maternal height (short <5'3", average 5'3"-5'5", tall >5'5") had shown a decreased risk of cesarean delivery (CD) (29.30% vs. 25.11% vs. 22.74%), gestational diabetes mellitus (GDM) (5.36% vs. 4.02% vs. 2.88%), and small for gestational age (SGA) (14.74% vs. 10.36% vs. 6.98%), with no significant differences in gestational hypertension/pre-eclampsia (GHTN/PreE). Compared to women of average height with normal weight, shorter women faced higher risks of CPD, GDM, and SGA. [105] Teoh et al. (2024) reported a positive association between maternal height an neonate birthweight.[106]

In 2022, Tiwari carried out a study which showed that infant birth weight, body length and head circumference was related to maternal height. Women having short height gave birth to low birth weight babies and body length as compared to babies born to average height mothers. There was a strong association between infant birth weight and maternal height. Moreover , gestational diabetes mellitus also had a profound affect on infant body length and birth weight.[10]

In another study which was conducted by Arendt and his colleagues in 2018, they reported that incidence of Caessarean sections (CS) gradually increased with mothers having short statures. Incidence of CS was much less in average height mothers. Taller women were protected compared to those of average height (155.0–159.9 cm). The adjusted odds ratio (aOR) for tall women was 0.67, and for average-tall women, it was 0.78. Moreover, the risk was more in shorter women compared to women of average height. The aOR for short-average women was 1.19, for short women, it was 2.06, and for very short women, it was 2.50. It was found that very short and short women had increased odds of neonatal mortality as compared to average height women, with aORs of 1.95 and 1.66, respectively. While the highest risk is the day of delivery and the first postnatal day. These aORs increased to 2.36 and 2.34, respectively. The aORs for early neonatal death (first week of life) were 1.90 and 1.83, respectively.[108]

Chan and *et al*, carried out another study in 2009 to study the association between mother's height and duration of conception with singleton pregnancies in a

Chinese and south east Asian population. Results showed that 16384 women, who delivered 25th 50th and 75th percentile values of maternal height were 153 cm 156 cm and 160 cm respectively. Increased incidence of preterm birth between 32- and 37-weeks' gestation among women of shorter stature was seen. Also mother's height affects length of conception, with the lower three quartiles being linked to the greater odds of labor between 32 and 37 weeks.[109]

2.12 Strategies for Optimizing Obstetric Care

To optimize obstetric care for women of shorter stature and those with less favorable pelvic types, several strategies can be implemented. These include:

1. **Pre-pregnancy Counseling:** Educating women about the potential risks associated with their pelvic type and height can help them make informed decisions about their pregnancies and delivery plans.

2. **Antenatal Pelvic Assessments:** Routine pelvic assessments during antenatal visits can identify women at risk of delivery complications, allowing for early intervention planning.

3. **Tailored Labor Management Plans:** Developing individualized labor management plans based on pelvic assessments and maternal height can improve labor outcomes. This might include the use of labor augmentation techniques, continuous fetal monitoring, and readiness for operative deliveries.

4. **Multidisciplinary Approach:** A collaborative approach involving obstetricians, midwives, radiologists, and neonatologists can ensure comprehensive care for high- risk pregnancies, addressing both mother and newborn needs effectively.

The association between mother's height, types of bony pelvis, and mode of delivery is multifaceted, influenced by genetic, nutritional, and environmental factors. Shorter maternal height and less favorable pelvic types significantly impact labor progression and delivery outcomes, necessitating tailored obstetric care strategies. Technological advances in pelvic measurement and a multidisciplinary approach to labor management can enhance maternal and neonatal safety. Continued research in this

field is essential to develop predictive models and optimize care for women at risk of delivery complications.

CHAPTER 3

METHODOLOGY`

3.1 Inclusion Criteria:

1) Healthy and Postpartum females having age (18-35 years old) visiting Sheikh Zayed Hospital and residents of Rahim Yar Khan district.
2) Height between 150 cms- 155 cms will be included as a tall height [7]
3) Height in between 145 cms -149 cms will be included as short height [7]

3.2 Exclusion Criteria:

1) Pregnant females
2) Any congenital deformity of the bones.
3) Any history of pelvic trauma or pelvic surgery.
4) Females having weight more than 85 kg will not be included in the study.
5) Females having history of hypertension and diabetes were excluded.

3.3 Data Collection Procedure:

The research was proceeded after ethical consent approval from IRB and Ethical committee of Sheikh Zayed Hospital, Rahim Yar Khan. Data was collected in the department of Gynaecology and Obstetrics, Sheikh Zayed hospital, Rahim yar khan. Written consent was taken from subjects meeting the inclusion criteria. After getting general biodata including name of the subject, age, address and mode of delivery, then height was measured in centimeters with the help of stadiometer. The subjects were those who underwent normal delivery or caesarian section in gynaecology ward and at the day of their discharge from hospital, X-ray pelvimetery was done after their written consent. Subjects were sent to the radiology department escorted with aya g and ward boy on a wheelchair carrying a request form for x-ray pelvimetery in both AP and Lateral views in erect posture from gynaecology indoor department. The x-ray machine was having marking point options for taking different diameters in the x ray of that female in both AP and lateral views. The AP view was taken from the front to the back of the pelvis, i.e. pubic symphysis anteriorly and sacrum and coocyx posteriorly. It was to assess the transverse diameters of the inlet, midpelvis and pelvic outlet, already been explained. The transverse diameter of pelvic inlet was measured between widest points on the pelvic brim. The transverse diameter of the pelvic outlet was measured between

the inner borders of two ischial tuberosities. The transverse diameter of the midpelvis was measured between the two ischial spines. The lateral view was taken from the side, which helps in assessing the depth of the pelvis. It's especially important for measuring AP diameters of pelvic inlet, midcavity and pelvic outlet. All measurements were taken in cms. The types of the pelvises were determined on the following basis

X-rays were carried out in radiology department of sheikh Zayed hospital. The X -ray machine used for collecting data of x-ray pelvimetery was CGR 750 MA (milli amperes) and 70 to 90 kilovolts energy was used with Bucky. The x-rays were printed by FUJI CR system printer in which I personally identified landmarks of the subject on the monitor attached and accordingly x-ray was taken by the radiographer.

Landmarks taken in X-ray pelvimetery are the following

3.4 Pelvic Inlet:

The anteroposterior diameter was measured between the upper margin of pubic symphysis anteriorly to the sacral promontory posteriorly. The transverse diameter was measured between the widest points on the pelvic brim.

3.5 Midcavity:

The anteroposterior diameter of the midpelvis was measured between posterior inferior aspect of symphysis pubis and the anterior surface of sacro coccygeal junction. The transverse diameter was taken between the ischial spines

3.6 Pelvic Outlet:

The anteroposterior diameter of the outlet was measured from inferior margin of pubic symphysis anteriorly to the tip of coccyx posteriorly. The transverse diameter was measured between inner margins of ischial tuberosities.

Modes of delivery were documented to find out association of maternal height with types of bony pelvis on Xray Pelvimetry in reproductive age (18-35 years). All the information got entered in Annexure-I and Annexure II.

3.7 Research Design:

This study was a cross-sectional research design to collect data from a Healthy and Postpartum female at a single point in time during hospital stay at Sheikh Zayed hospital, Rahim yar khan.

3.8 Study Population:

The target population consisted of reproductive age females who underwent spontaneous vaginal delivery or cesarian sections during hospital stay at Sheikh Zayed Hospital, Rahim yar khan and born in District Rahim Yar Khan, Pakistan.

3.9 Sampling Method:

To ensure unbiased representation across relevant sub groups, this research opted for a stratified random sampling method. The participants were grouped based on age, height, weight, BMI and parity.[110]

3.10 Sample Size:

$$n = \frac{Z^2(p(1-p)}{e^2}$$

Where:

n = required sample size

Z = Z-score corresponding to your chosen confidence level (e.g., 1.96 for a 95% confidence level)

P = estimated proportion of the population with specific characteristics

e = $minoferrorz$ = 1.96ez = 0.5p = 0.5($Irnotsure, use$50%)

$$n = \frac{1.96^2(5(.5))}{(.05)^2}$$

$$n = 384(12)$$

3.11 Data Collection:

Primary Data: The primary data was collected through structured interviews and Maternal height and weight measurements were taken and participants underwent X-ray pelvimetry to assess the types of bony pelvis. All the relevant data was tabulated in an annexure - I

Variables:

Independent Variables: Maternal height.

Dependent Variables: Modes of delivery (e.g., vaginal delivery, cesarean section), types of bony pelvis (e.g., gynecoid, android, anthropoid, platypelloid).

Control Variables: Age, parity, weight, BMI, socioeconomic status and previous

medical conditions.

3.12 Data Analysis:

The collected data was entered in computer software SPSS (Statistical Package For Social Sciences) version 25.0.To assess demographic characteristics of the participants, a descriptive analysis was done. Inferential statistics, such as chi-square tests or logistic regression, were employed to determine the association between maternal height with modes of delivery and types of bony pelvis. Statistical value of <0.05 was taken as significant.

3.13 Ethical Considerations:

Informed consent was obtained from all participants. The review board/ethics committee of the relevant institution approved the study. Confidentiality and privacy of participants was strictly maintained.

3.14 Data Collection Tools:

Structured questionnaires were designed for demographic and medical history information. Measurements of maternal height was done by me and X-ray pelvimetry was conducted by trained radiologists.



Figure 4.2: X-ray Machine (CGR 750 MA)

3.15 Data Validation and Reliability:

To ensure data accuracy, data entry was doublechecked and any inconsistencies present in data were addressed. Reliability was assessed through test-retest procedures for measurements and inter-rater reliability for X-ray pelvimetry.

3.16 Data Presentation:

Findings were presented using tables, graphs and charts to facilitate clear communication of the results.

CHAPTER 4

RESULTS

Table – 4.1: Demographic Information of Females

Variable	Mean ± SD	Range
Age (years)	26.7±4.5	18–35
Height (cm)	150.2±3.1	145–155
Weight (kg)	67.4±8.5	50–85
BMI	24.1±3.2	18.5–29.9
Parity (number of children)	2.1±1.3	0–5

BMI = Body Mass Index; SD = Standard Deviation

Table depicts that among 384 postpartum females, mean age was 26.7±4.5 (range 18-35 years), mean height was 150.2±3.1 cm (range 145-155), mean weight was 67.4±8.5 kg (range 50-85) and mean BMI was 24.1±3.2 (range 18.5-29.9) while mean parity was 2.1±1.3 (range 0-5).

Table – 4.2: Frequency Distribution of Females according to Pelvic Types

Pelvic Type	Frequency (n)	Percentage (%)
Gynecoid	146	38.0
Android	96	25.0
Anthropoid	84	22.0
Platypelloid	58	15.0
Total	384	100.0

Table exhibits that among 384 females, majority 146 (38.0%) had gynecoid pelvis, followed by, android pelvis 96 (25.0%), anthropoid pelvis 84 (22.0%) and platypelloid pelvis 58 (15.0%). Among these females, majority had gynecoid pelvis which is considered most favorable type for vaginal delivery.

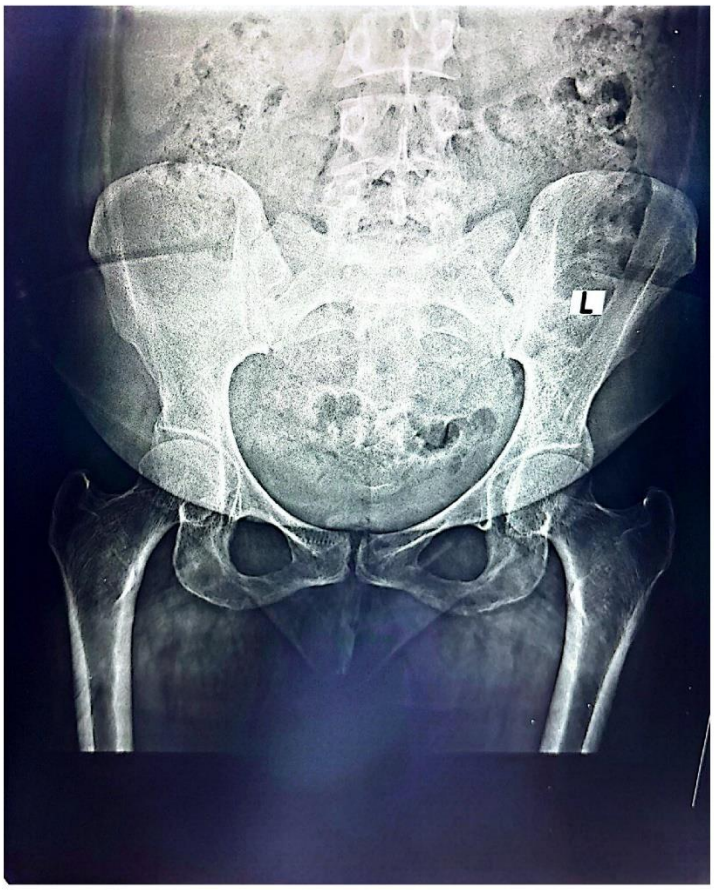


Figure 4.3(a): Gynecoid

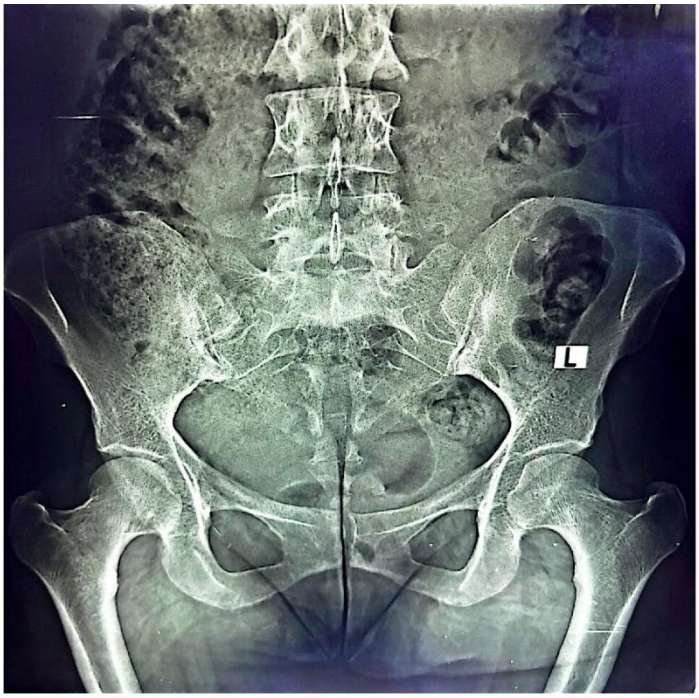


Figure-4.3(b): Android

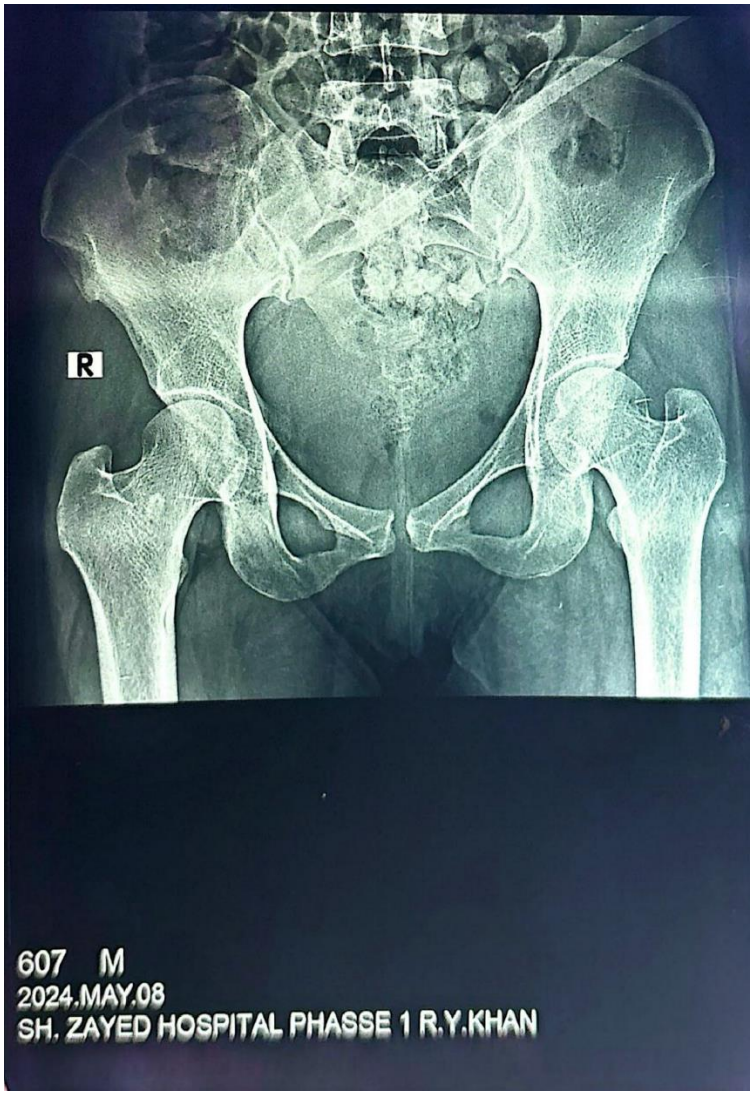


Figure-4.3(c): Anthropoid

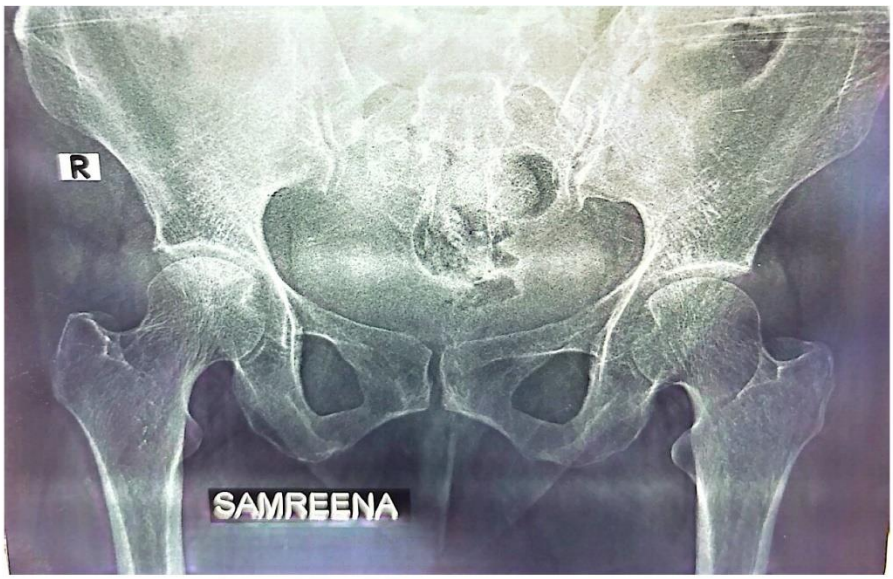


Figure-4.3(d): Platypelloid

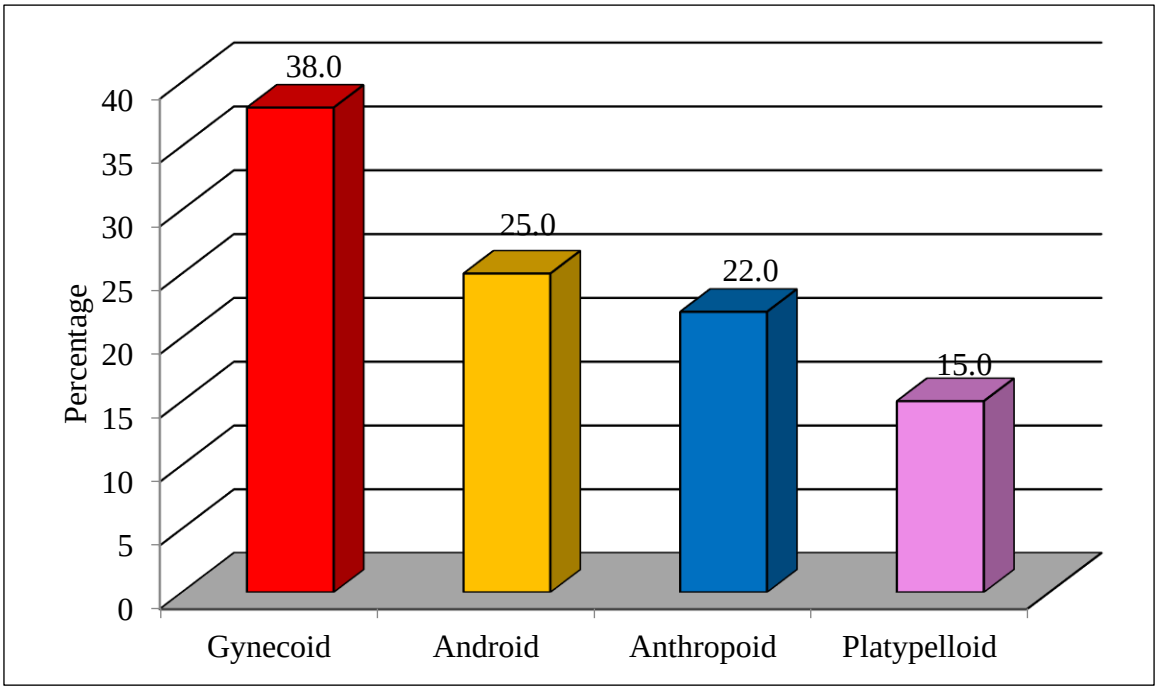


Figure – 4.4: Frequency Distribution of Females according to Pelvic Types

Table – 4.3: Frequency Distribution of Females according to Mode of Delivery

Mode of Delivery	Frequency (n)	Percentage (%)
Vaginal delivery	238	62.0
Cesarean section	146	38.0
Total	384	100.0

Table demonstrates that among 384 females, mainstream 238 (62.0%) experienced vaginal delivery while 146 (38.0%) experienced cesarean section. These findings are consistent with the pelvic type distribution, with a higher incidence of vaginal delivery associated with the gynecoid pelvis.

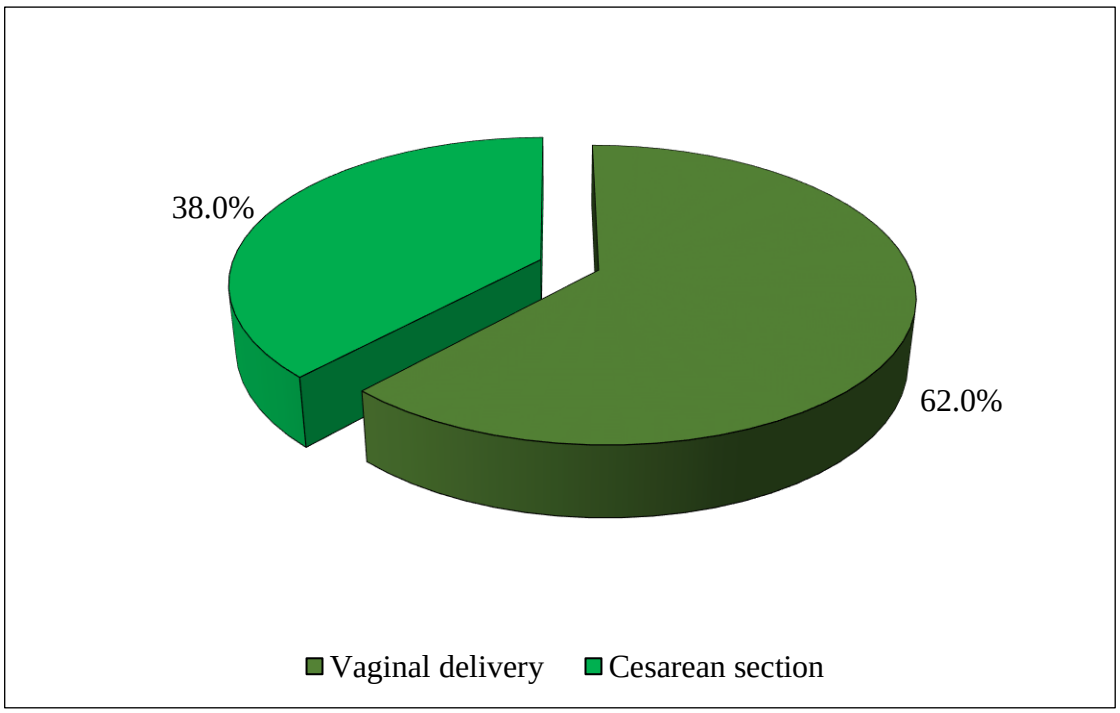


Figure – 4.5: Frequency Distribution of Females according to Mode of Delivery

Table – 4.4: Correlation Between Maternal Height and Pelvic Type

Pelvic Type	r	p-value
Gynecoid	0.35	< 0.01
Android	-0.28	< 0.05
Anthropoid	0.15	0.12
Platypelloid	-0.10	0.32

r = Pearson correlation coefficient

A Pearson correlation analysis was conducted to explore the association between mother's height and the bony pelvis type. The results showed a strong correlation between mother's height and the presence of a gynecoid pelvis ($r = 0.35$, $p < 0.01$), suggesting that taller women are more likely to have a gynecoid pelvis, which is favorable for vaginal delivery. Conversely, there was a negligible correlation between mother's height and the presence of an android pelvis ($r = -0.28$, $p<0.05$), indicating that shorter women are more likely to have an android pelvis, which may complicate vaginal delivery.

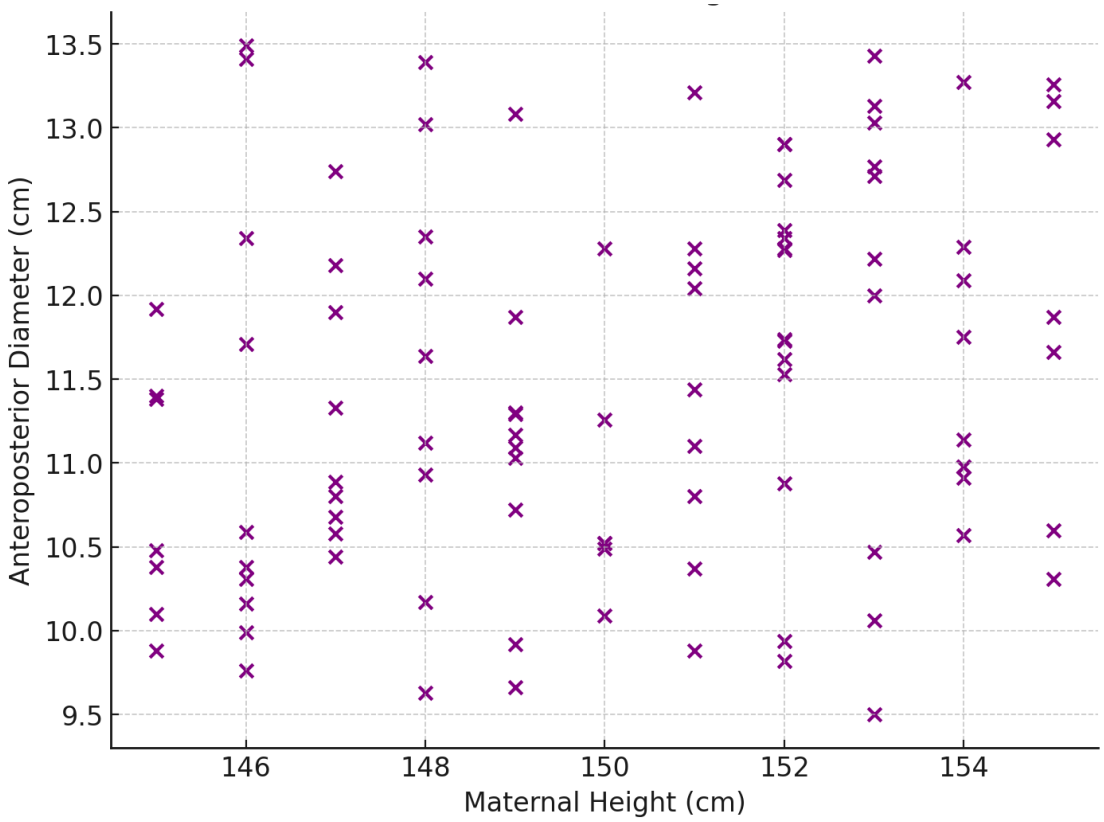


Figure – 4.6: Correlation Between Maternal Height and AP Diameter

The scatter plot in Graph-4.3 illustrates the relationship between mother's height and the AP diameter of pelvic inlet. A positive association was noted ($r = 0.35$, $p < 0.01$), indicating that taller women tend to have larger AP diameters. This correlation supports the hypothesis that maternal height is positively associated with favorable pelvic dimensions for vaginal delivery.

Table – 4.5: Mode of Delivery by Pelvic Type

Pelvic Type	Mode of Delivery		Total
	Vaginal Delivery	Cesarean Section	
Gynecoid	119 (82.0%)	27 (18.0%)	146
Android	38 (39.0%)	58 (61.0%)	96
Anthropoid	54 (64.0%)	30 (36.0%)	84
Platypelloid	27 (47.0%)	31 (53.0%)	58
Total	238	146	384

The association of pelvis type and delivery mode was analyzed using a chi-square test and found that among 146 females who had gynecoid pelvis, 119 (82.0%) had vaginal delivery and 27 (18.0%) had CS. Among 96 females who had android pelvis, 38 (39.0%) had vaginal delivery and 58 (61.0%) had CS. Among 84 females who had anthropoid pelvis, 54 (64.0%) had vaginal delivery and 30 (36.0%) had CS. Among 58 females who had platypelloid pelvis, 27 (47.0%) had vaginal delivery and 31 (61.0%) had cesarean section. The results revealed a significant association between pelvis type and mode of delivery ($p < 0.01$). Specifically, females with a gynecoid pelvis were having more predisposition for having a vaginal delivery while those with an android pelvis had a higher likelihood of requiring a CS.

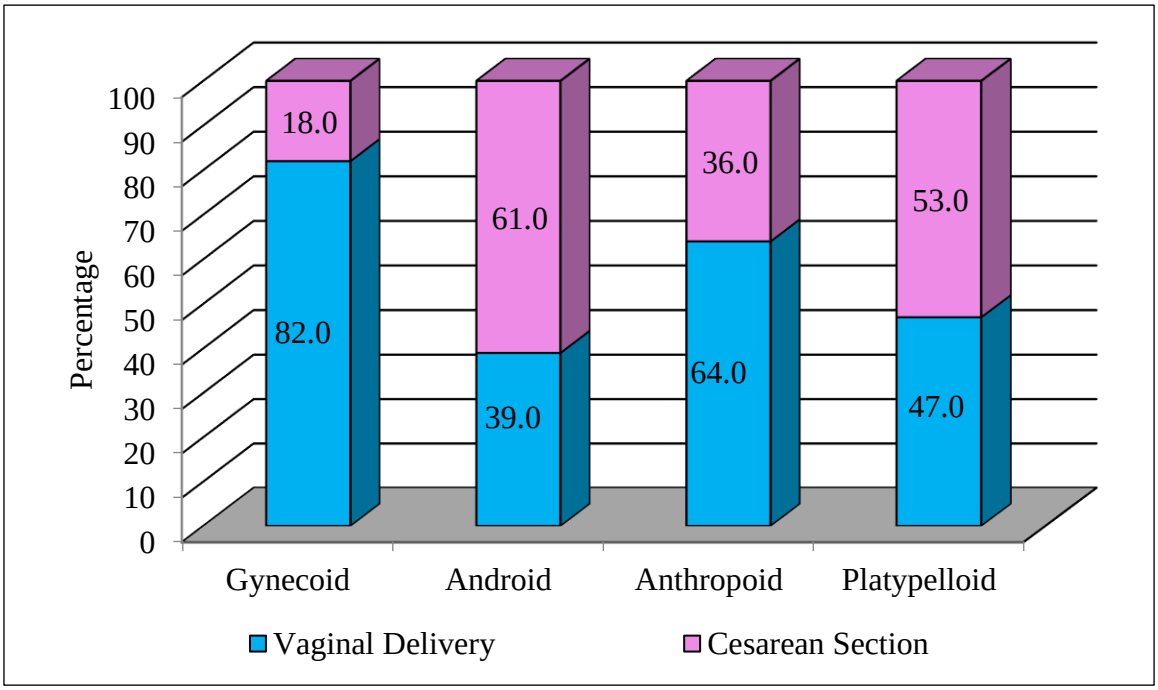


Figure – 4.7: Mode of Delivery by Pelvic Type

Table – 4.6: Association between Pelvic Type and Height of Females

Pelvic Type	Height		Total
	Tall	Short	
Gynecoid	135 (92.5%)	11 (7.5%)	146
Android	15 (15.6%)	81 (84.4%)	96
Anthropoid	13 (15.5%)	71 (84.5%)	84
Platypelloid	11 (19.0%)	47 (81.0%)	58
Total	174	210	384

P-value = 0.000 -

Table depicts that among 146 females who had gynecoid pelvis, 135 had tall height and 11 had short height. Among 96 females who had android pelvis, 15 had tall height and 81 had short height. Among 84 females who had anthropoid pelvis, 13 had tall height and 71 had short height. Among 58 females who had platypelloid pelvis, 11 had tall height and 47 had short height.

Table – 4.7: Logistic Regression predicting Vaginal Delivery

Predictor	B	SE	Wald χ^2	df	p-value	Odds Ratio (OR)	95% CI for OR
Maternal height (cm)	0.37	0.18	4.22	1	0.04	1.45	1.02–2.06
Gynecoid pelvis	1.16	0.43	7.28	1	< 0.01	3.20	1.43–7.18
Parity	0.24	0.17	2.01	1	0.16	1.27	0.91–1.78

B = Unstandardized beta coefficient; SE = Standard error; CI = Confidence interval

Maternal Height: For every 1 cm increase in maternal height, the odds of vaginal delivery increase by a factor of 1.45 (OR = 1.45, 95% CI [1.02, 2.06], p = 0.04). This indicates that taller women are more predisposed for having a vaginal delivery as compare to short heighted females, controlling for pelvis type and parity.

Gynecoid Pelvis: Having a gynecoid pelvis is associated with a 3.20 times higher likelihood of vaginal delivery compared to other pelvis types (OR = 3.20, 95% CI [1.43, 7.18], p < 0.01). This confirms that the gynecoid pelvis is the most favorable for vaginal delivery, consistent with the literature.

Parity: Although not statistically significant (p = 0.16), the analysis suggests that higher parity may be associated with an increased likelihood of vaginal delivery (OR = 1.27, 95% CI [0.91, 1.78]). This is in line with the expectation that women with previous deliveries are more likely to have subsequent vaginal deliveries.

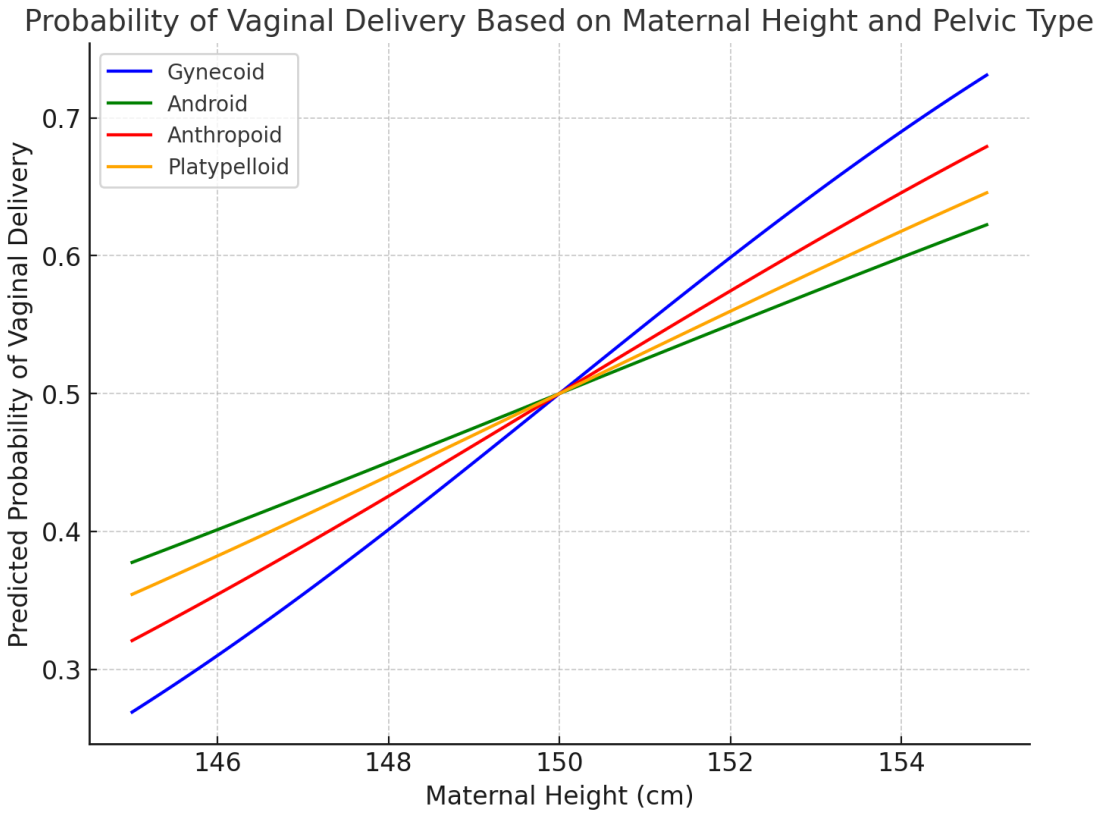


Figure – 4.8: Logistic Regression predicting Vaginal Delivery

The Graph-4.5 shows the predicted probability of vaginal delivery based on maternal height for different pelvis types. The probability increases with height across all pelvic types, with the gynecoid pelvis showing the highest likelihood of vaginal delivery. This graph highlights the significant interaction between maternal height and pelvis type, suggesting that both factors should be considered when predicting delivery outcomes.

CHAPTER 5

DISCUSSION

The pelvis is an anatomically complex and functionally significant bone. It plays a key role in both human locomotion and obstetrics. Due to its crucial role in obstetrics, the pelvis is considered one of the most sexually dimorphic bony elements. The bony pelvis has essential functions, such as transferring force and weight, providing muscle attachment, and offering protection. The outer surface of the pelvis stabilizes several strong muscles, including the thigh and gluteal muscles. Additionally, the pelvis is vital during childbirth as the baby must pass through the birth canal. Maternal height has long been a subject of interest in obstetric research, primarily due to its potential influence on pelvic dimensions and subsequent mode of delivery. The bony pelvis plays a critical role in childbirth, affecting the labor process and determining whether a woman can deliver vaginally or requires a cesarean section. This study was carried out to know the relationship of maternal height with types of bony pelvis and its effect on mode of delivery in females of reproductive age in District Rahim Yar Khan.

To acquire appropriate outcomes, a group of 384 postpartum women was included in the study and found that majority of the women were in their good reproductive age group as the mean age was 26.7±4.5 years. The findings of our study are comparable with a study undertaken by Munabi and teammates (2016) who reported that mean age of the women was 25.52 ± 5.74 years which is considered peak reproductive period for a woman.[111] Another study conducted by Softa and fellows (2022) exhibited almost similar scenario that mean age of the females was 24.7 ± 4.6 years.[25] But the results of a study carried out by Salk and comrades (2016) showed different scenario that most of the women belonged to elderly age group as the mean age of the women was 49.9 ± 9.8 years.[12]

As far as height of the females is concerned, our study disclosed that mean height of the females was 150.2±3.1 cm. But a study carried out by Softa and fellows (2022) indicated that the females who participated in their study were taller than females who participated in our study. They reported that mean height of the females study was 156.4±6.2 cm.[25] Another similar study carried out by Salk and comrades (2016) highlighted that mean maternal height was 160.0 ± 4.2 cm.[12] This finding

indicates that the women in their study were taller on average than both the participants in our study and those in a study conducted by Softa and fellows in 2022.[25] This discrepancy in height suggests potential differences in population demographics, nutritional status, or genetic factors that may influence maternal height across different studies. Munabi and teammates (2016) also elucidated in their study females that included were taller than the females who enrolled in our study.[111]

In medical literature, there are numerous classifications of pelvis as per its shape. Generally, pelvis types can be commonly classified as gynecoid, android, anthropoid and platypelloid. The vaginal delivery can significantly be difficult, delayed or even impossible if shape of pelvis is not according to fetus size.[7] It was found during study that most of the females (38.0%) in our study had gynecoid pelvis, followed by, android pelvis (25.0%), anthropoid pelvis (22.0%) and platypelloid pelvis (15.0%). Among these females, majority had gynecoid pelvis which is considered most favorable type for vaginal delivery. Vučinić and companions (2022) also reported in their study that the gynecoid pelvic type was the most prevalent, observed in 28 pelvises (52%). This was followed by the platypelloid type, found in 11 pelvises (20%), the anthropoid type in 8 pelvises (15%), and lastly, the android type in 7 pelvises (13%). The predominance of the gynecoid type, often considered as the most favorable for childbirth, aligns with typical anatomical distribution patterns. The lower frequencies of the platypelloid, anthropoid, and android types highlight the diversity in pelvic shapes, which can have implications for obstetric outcomes. Understanding the distribution of these pelvic types is crucial for tailoring obstetric care to optimize maternal and fetal health.[7] The findings of a recent study done by Polat and coworkers (2023) highlighted that mainstream of the females (50.9%) had gynecoid pelvis, followed by, anthropoid pelvis (24.8%), platypelloid pelvis (14.6%) and android pelvis (9.7%).[1] But a study performed by Manandhar and Shrestha (2023) indicated that among females, the prevalence of gynecoid pelvis was 46.7%.[112]

In our study, the Pearson correlation analysis was conducted to explore the relationship between maternal height and the type of bony pelvis. A positive correlation was found between maternal height and the presence of a gynecoid pelvis ($r = 0.35$, $p < 0.01$), suggesting that taller women are more likely to have a gynecoid pelvis, which is favorable for vaginal delivery. Conversely, there was a negative correlation between

maternal height and the presence of an android pelvis ($r = -0.28$, $p<0.05$), indicating that shorter women are more likely to have an android pelvis, which may complicate vaginal delivery. Chen and associates also confirmed that maternal height is positively correlated with pelvic measurements; this correlation is more at the inlet than at midplane and outlet. Also, it was evident in gynecoid and platypelliod than in anthropoid and android pelvises. If maternal height is smaller than 150 cm, then it is more probable that inlet capacity will be less than average; if it is less than 145 cm, the probability of low borderline contraction is less.[113] Munabi and teammates (2016) reported in their study that maternal pelvis height was associated with maternal height. There is a correlation between the height of the mother's pelvis and her overall body height. This means that taller women tend to have taller (or larger) pelvises, while shorter women may have shorter (or smaller) pelvises. The relationship between pelvic height and maternal height is important because it is favorable for vaginal delivery and reduces the risk of complications.[111]

During study relationship between pelvis type and mode of delivery was analyzed using a chi-square test and found that among 146 females who had gynecoid pelvis, 82.0% had vaginal delivery and 18.0% had cesarean section. Among 96 females who had android pelvis, 39.0% had vaginal delivery and 61.0% had cesarean section. Among 84 females who had anthropoid pelvis, 64.0% had vaginal delivery and 36.0% had cesarean section. Among 58 females who had platypelloid pelvis, 47.0% had vaginal delivery and 61.0% had cesarean section. Study showed a significant association between pelvis type and mode of delivery ($p < 0.01$). Specifically, women with a gynecoid pelvis were more likely to have a vaginal delivery while those with an android pelvis had a higher likelihood of requiring a cesarean section. The results of a study carried out by Mirgalobayat and collaborators (2019) also confirmed that women with a gynecoid pelvis were more likely to have a successful vaginal delivery, as this pelvic type is generally considered the most favorable for childbirth due to its rounded shape and spacious dimensions. In contrast, women with an android pelvis exhibited a higher likelihood of requiring cesarean section. The android pelvis, characterized by a narrower and more heart-shaped structure, often presents challenges during labor, such as a higher risk of obstructed labor, making vaginal delivery more difficult and increasing the probability of surgical intervention.[114]

The findings of our study showed a significant association between the maternal height and mode of delivery, with taller women being more likely to have vaginal deliveries. A positive correlation between maternal height and the presence of a gynecoid pelvis was seen, suggesting that taller women are more likely to have a gynecoid pelvis, which is favorable for vaginal delivery. The women with an android pelvis had a higher likelihood of requiring a cesarean section. There was a negative correlation between maternal height and the presence of an android pelvis, indicating that shorter women are more likely to have an android pelvis, which may complicate vaginal delivery. The results of our study also confirmed that among 146 females who had gynecoid pelvis, 135 had tall height and 11 had short height while among remaining proportion (238) of females who had android, anthropoid, platypelloid pelvises, only 39 had tall height and 199 had short height (P=0.000). The findings of our study are comparable with a study undertaken by Gummadi and partners (2024) who reported that among 680 females, 15.29% had short stature (<150cm), while 84.71% females were taller (> 150cm). The short-stature group had an elevated incidence of cesarean sections while tall-stature group had an elevated incidence of normal delivery.[115] Another study carried out by Mogren and research team (2018) exhibited similar scenario that height of females within the range of 178 to 179 cm was related to lowest risk for cesarean section indicating that women with more height are more likely to have a gynecoid pelvis, which is favorable for vaginal delivery.[116] The findings of a study performed by Marbaniang and colleagues (2022) also confirmed that risk of cesarean section is found high among mothers with short height when compared to taller mothers. Mothers with 120 cm height were 5 times more likely while mothers with 147 cm height were 1.2 times more likely to experience cesarean section when compared to mothers with 150 cm height.[28]

CHAPTER 6

CONCLUSION

Mother's height seems to have a strong association with the types of bony pelvis and can significantly influence the mode of delivery in females of reproductive age. Present study assessed the association of mother's height with types of bony pelvis and its effect on mode of delivery in females of reproductive age. Study concluded that there was a significant relationship between mother's height and delivery mode. The taller women were more likely to have a gynecoid pelvis which is favorable for vaginal delivery. More research is with larger sample size is required to assess this association.