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RESEARCH ARTICLE

AGE AND GENDER RELATED VARIATIONS OF PITUITARYGLAND SIZE OF RAJASTHAN PEOPLE USING MAGNETICRESONANCE IMAGING

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Abstract

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Aim: The aim of the study is to obtain standard reference values for the height, and length of pituitary gland in different age groups of both genders in Rajasthan population by using Magnetic Resonance Imaging.

Methods:A retrospective study was conducted among 121 patients, who were referred to department of Radiation & Imaging Technology, Nims Hospital Jaipur Rajasthan for the evaluation of Pituitary gland size measurements between June 2022 to June 2023 scientific clearance was obtained from the scientific committee of NIMS University before conducting the study.

Result: Pituitary height is the most dependable and consistent individual morphometric parameter for assessing pituitary.Based on the analysisit indicates that among the 121 patients (Male 62 & Female 59) included in the study, those aged between 20-40 years are the most affected, comprising approximately 17.36% of the total patients. This suggests that this particular age group has a higher incidence or prevalence of whatever condition or characteristic is being studied in the MRI brain scans.

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Introduction:-

The pituitary gland is indeed the "master gland" of the endocrine system, overseeing the functions of other glands and secreting essential hormones. Its size and shape are crucial indicators for identifying potential pathologies.[1]

Located at the base of the brain beneath the hypothalamus, it's about the size of a pea. Glands produce various substances like hormones, digestive juices, sweat, or tears, releasing them directly into the bloodstream. This highlights the pivotal role of the pituitary gland in regulating bodily functions through hormone secretion.[2]

The pituitary gland undergoes rapid growth from birth to adulthood, reaching a weight of 500 mg in adults. Its typical dimensions in adults are an anteroposterior diameter of 8 mm and a transverse diameter of 12 mm. There are differences in size between males and females. The gland is located within the Sellaturcica of the sphenoid bone. Functionally, the pituitary gland consists of two main regions: the anterior lobe and the posterior lobe, both of which are active. Additionally, there is an intermediate lobe situated between them. The anterior lobe primarily produces

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the majority of hormones from the pituitary gland, which are regulated by hormones produced by the hypothalamus.[3]

[Figure 1: The pituitary gland: location and individual parts]

This excerpt highlights the importance of understanding the normal anatomy and physiological variations of the pituitary gland across different age groups and genders. It emphasizes that changes in size, shape, and signal intensity of the pituitary gland reflect the complex hormonal physiology of the gland. The text mentions various borderline pituitary abnormalities such as physiological hypertrophy, microadenomas, increased lobulated margins, inflammatory diseases, and empty Sella syndrome. Furthermore, it suggests that measurements of the normal pituitary gland for various age groups can aid in the diagnosis of such cases. MRI is cited as an accurate diagnostic modality for assessing the pituitary gland, providing detailed imaging that allows for the detection of abnormalities and evaluation of pituitary function.[4]

The pituitary gland, a vital component of the endocrine system, undergoes dynamic changes in size, shape, and signal intensity throughout various stages of life, as observed in MRI studies. These fluctuations are closely linked to the intricate hormonal milieu of the gland. Understanding these changes is crucial for interpreting MRI findings accurately and assessing the gland's health across different age groups.[5]This excerpt discusses the importance of studying pituitary adenomas, particularly microadenomas, which are small tumours of the pituitary gland. These tumours can be identified based on the size and configuration of the pituitary gland.[6]

Figure 2:- Pituitaryglandanatomy.

The pituitary gland is highlighted as a crucial organ in the human body, situated within the Sellaturcica, a bony depression of the sphenoid bone. Surrounding structures include the optic chiasma, mammillary bodies, sphenoidal air sinuses, and cavernous sinuses. The pituitary gland is enveloped by a fold of dura mater, with an opening for the infundibulum to pass through, connecting it to the hypothalamus. This information provides a brief overview of the anatomy and significance of the pituitary gland in relation to pituitary adenomas.[7]

The pituitary gland, along with the hypothalamus, regulates various essential physiological processes such as growth, puberty, metabolism, stress response, and reproduction. In rodents, it consists of three lobes: the anterior lobe (AL), posterior lobe (PL), and intermediate lobe (IL)The posterior pituitary lobe does not produce hormones but stores and releases hormones produced by the hypothalamus, including antidiuretic hormone (ADH) and oxytocin. The anterior pituitary lobe secretes six hormones, which are regulated by hypothalamic hormones. These hormones include growth hormone, prolactin, thyroid-stimulating hormone, adrenocorticotropic hormone, follicle-stimulating hormone, and luteinizing hormone. The intermediate pituitary zone secretes melanocyte-stimulating hormone (MSH), which is involved in pigmentation regulation and other functions.[8]

Anterior pituitary hormones play crucial roles in regulating various physiological processes in the body. Human Growth Hormone (HGH): Produced by somatotropic cells, HGH regulates growth, metabolism, and other functions. Its secretion is tightly controlled by growth hormone-releasing hormone (GHRH) and growth hormone-inhibiting hormone (GHIH or somatostatin) from the hypothalamus.

Prolactin:
Secreted by lactotroph cells, prolactin is involved in lactation, reproduction, and immune regulation. Its secretion is regulated by dopamine from the hypothalamus, as well as factors like oestrogen, dopamine antagonists, and various physiological stimuli.

Follicle-stimulating Hormone (FSH) and Luteinizing Hormone (LH):
These gonadotropins regulate reproductive functions in both males and females. They are controlled by gonadotropin-releasing hormone (GnRH) from the hypothalamus.

Adrenocorticotrophic Hormone (ACTH):
Produced by corticotropic cells, ACTH stimulates the adrenal glands to produce cortisol and other corticosteroids. Its secretion is regulated by corticotropin-releasing hormone (CRH) from the hypothalamus.

Thyroid-stimulating Hormone (TSH):
TSH stimulates the thyroid gland to produce thyroid hormones, which regulate metabolism and other functions. Its secretion is controlled by thyroid-releasing hormone (TRH) from the hypothalamus.[8]

The synthesis and storage of vasopressin (ADH) and oxytocin in the posterior pituitary gland. These hormones play crucial roles in regulating various physiological processes. Vasopressin primarily regulates water reabsorption in the kidneys, thus controlling blood volume and blood pressure, while oxytocin is involved in uterine contractions during childbirth and milk ejection during breastfeeding, among other functions. Their synthesis in the hypothalamus and storage in neurosecretory granules are key steps in their secretion and action.

Intermediate Pituitary Hormones:
The intermediate lobe of the pituitary gland produces two main hormones: melanocyte-stimulating hormone (MSH) and β-endorphin.[8]

Melanocyte-Stimulating Hormone (MSH):
This hormone plays a role in regulating skin pigmentation by stimulating melanocytes to produce melanin, the pigment responsible for skin coloration. MSH also has other physiological effects, such as influencing appetite and sexual arousal, although its significance in these functions is not as well understood as its role in pigmentation.[9]

β-Endorphin:
β-endorphin is an endogenous opioid peptide that functions as a natural pain reliever. It is released in response to stress and pain and is involved in the body's response to pain perception and stress modulation. Endorphins,

including β-endorphin, bind to opioid receptors in the brain, leading to analgesic effects and feelings of well-being or euphoria.[10]

Clinical significance

Hormones produced from the pituitary gland control blood pressure; growth; energy management; sex organs; thyroid glands; metabolism; some aspects of pregnancy, childbirth, breastfeeding; water/salt concentration at the kidneys; pain relief, and temperature adjustment.[11]

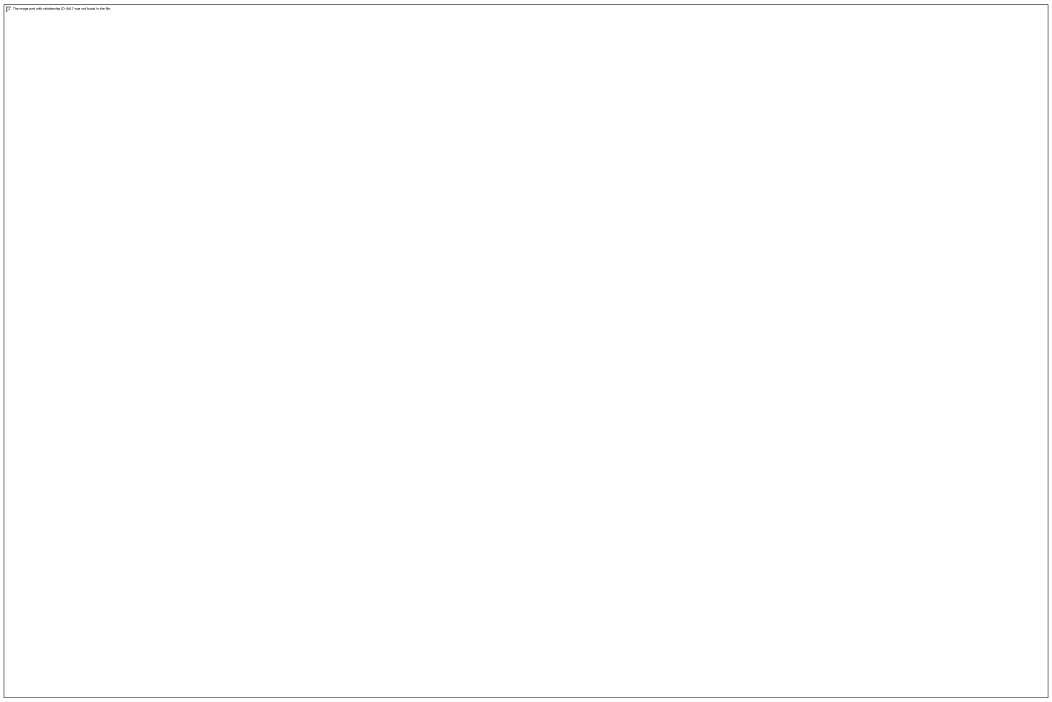


Figure 3:- Thisimageshowhormonesofpituitaryandtheiraffectedorgan.

Pituitary Gland Associated Diseases

- Central diabetes insipidus (deficiency of vasopressin)
- Hypothyroidism (deficiency of thyroid-stimulating hormone)
- Hyperpituitarism (increased secretion of hormones produced by the pituitary gland)
- Panhypopituitarism (decreased secretion of pituitary hormone).
- Hypopituitarism (decreased secretion of hormones produced by the pituitary gland)
- Gigantism and acromegaly (excess of growth hormone)

Pituitary adenomas indeed encompass a range of conditions that can have significant effects due to their location and potential hormonal secretion. Microadenomas, smaller than 1 cm, often present fewer symptoms and are typically discovered incidentally. However, macroadenomas, larger than 1 cm, can exert pressure on nearby structures, leading to various symptoms.[12]

When macroadenomas press against the pituitary gland itself, they can cause hypopituitarism by interfering with hormone production and release. Additionally, compression of the optic chiasm by these larger tumours can result in bitemporalhemianopsia, a condition characterized by a loss of vision in the outer half of both visual fields.[13]

Moreover, macroadenomas can lead to headaches, cranial nerve palsies, and hydrocephalus due to the obstruction of the outflow of the third ventricle in the brain. Secretory adenomas, which release hormones, can further complicate matters by causing hormonal imbalances.[14]

While most secretory adenomas release a single hormone, a small percentage may release two or more hormones simultaneously. For instance, dual hormone secretion could involve growth hormone and prolactin.[15]

Prolactinomas, which are the most common type of secretory adenoma, may or may not present with galactorrhoea (the spontaneous flow of milk from the breasts). Growth hormone-secreting adenomas are also relatively common, followed by adenomas that secrete adrenocorticotropic hormone (ACTH), gonadotrophic hormones (LH and FSH), and thyrotropes hormones.

Ophthalmologic findings in patients with pituitary adenomas typically include visual field defects such as optic neuropathy, bitemporalhemianopsia, or functional visual loss. Less commonly, patients may experience ocular motility deficits due to involvement of the cavernous sinus, or even nystagmus.[16]

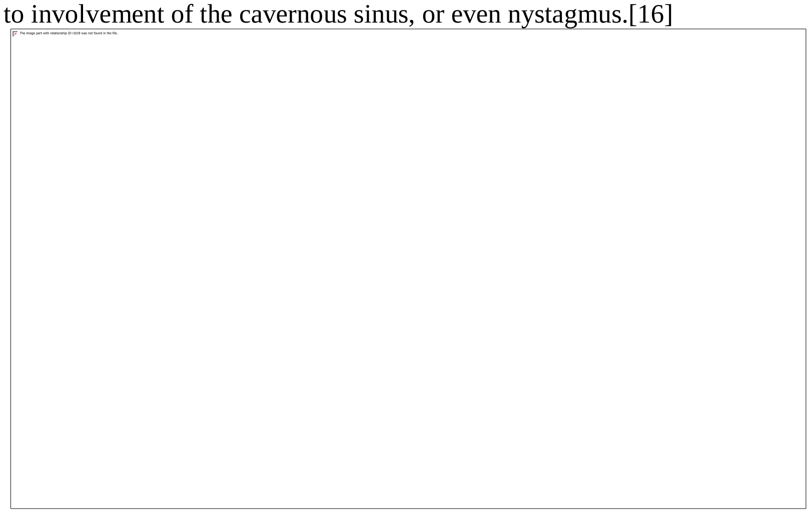


Figure 4:- T1 coronal MRI of a pituitary adenoma.

Empty Sella Syndrome

Empty Sella syndrome (ESS) is indeed a disorder involving the Sellaturcica, a bony structure at the base of the brain that houses the pituitary gland. In ESS, the Sellaturcica appears empty or partially empty on radiological imaging due to various factors such as a flattened or shrunken pituitary gland. This can occur when the pituitary gland is compressed and displaced by cerebrospinal fluid (CSF), leading to its lining the sellar floor and walls. ESS can sometimes be asymptomatic, but it may also cause symptoms related to hormonal imbalances due to pituitary dysfunction.[17]

Primary Empty Sella syndrome

Primary empty Sella syndrome occurs when the arachnoid layer covering the outside of the brain bulges into the Sellaturcica, a bony structure in the skull that houses the pituitary gland. This bulging can lead to compression of the pituitary gland.

Secondary Empty Sella syndrome

Secondary empty Sella syndrome occurs when the Sellaturcica is empty because the pituitary gland has been damaged by –[18]

1. A tumour
2. Surgery
3. Trauma
4. Radiation therapy

Pituitary Apoplexy

Indeed, when secondary empty Sella syndrome leads to sudden onset visual dysfunction, severe headache, and pituitary insufficiency, it constitutes a medical emergency requiring immediate neurosurgical intervention. These symptoms indicate significant compression and dysfunction of the pituitary gland and surrounding structures, necessitating urgent medical attention to relieve pressure and address potential complications.[16]

Genetic Disorders

One common genetic disorder encountered in clinical practice is multiple endocrine neoplasia type 1 (MEN-1). This disorder is characterized by neoplastic development in the pancreas, parathyroid glands, and pituitary gland.

Another genetic disorder related to the PIT1 gene can cause deficiencies in growth hormone (GH), prolactin (PRL), and thyroid-stimulating hormone (TSH). This deficiency can lead to various health issues associated with inadequate production of these hormones, affecting growth, metabolism, and other physiological processes.[19]

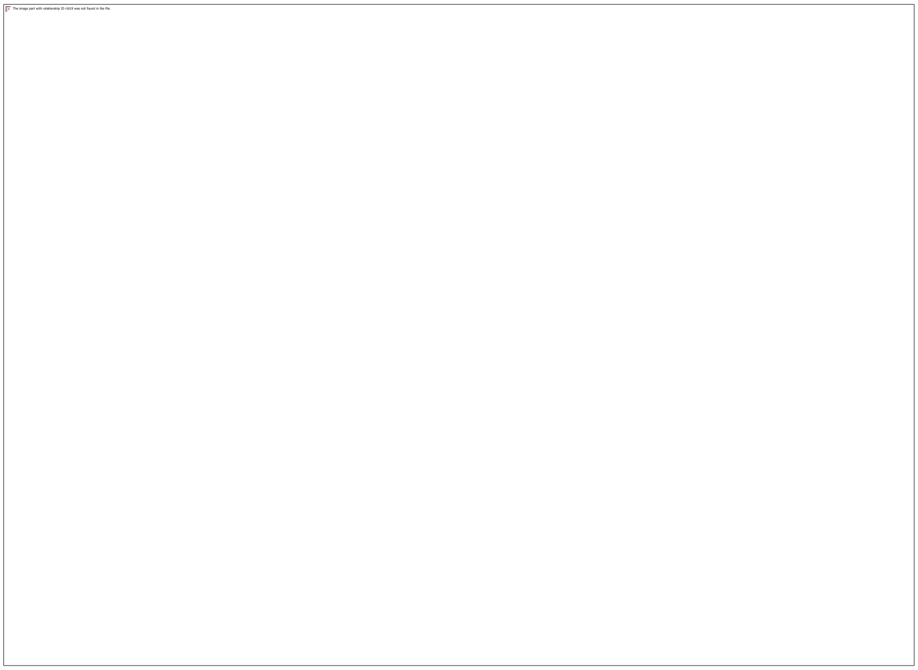


Figure 5:- Sagittal T2 FLAIR showing empty sella (arrow) in a patient with intracranial hypertension.

Developmental Abnormalities

Pituitary function failure can result from developmental deformities, leading to a decrease or total failure of pituitary hormone production. These deformities may affect the structure and function of the pituitary gland, disrupting its ability to secrete essential hormones such as growth hormone, prolactin, thyroid-stimulating hormone, adrenocorticotropic hormone, luteinizing hormone, and follicle-stimulating hormone. This can result in a range of health issues depending on which hormones are affected, including growth disorders, infertility, metabolic imbalances, and adrenal insufficiency**.**

Holoprosencephaly

During embryonic growth, if there's a deformity in the development of the foetal forebrain, it can lead to an abnormal hypothalamus, often accompanied by facial dimorphism. Facial abnormalities may include features such as a cleft palate, absent nasal septum, and widely spaced eyes. These anomalies are indicative of structural issues in the development of the face and central nervous system.

Septo-optic dysplasia

In cases of embryonic growth deformities, there may be either absence or underdevelopment (hypoplasia) of the optic chiasm, optic nerves, and the septum pellucidum. Additionally, there could be agenesis or hypoplasia of the corpus callosum, which is the structure connecting the two hemispheres of the brain. These structural abnormalities can have significant implications for vision, neurological function, and cognitive development.

Transcription factor mutations

Mutations in transcription factors such as PIT1 can indeed lead to developmental deformities in the formation and differentiation of the pituitary gland. These mutations can disrupt the normal regulatory processes involved in the development of pituitary cells, affecting their specialization and function. As a result, individuals with such mutations may experience deficiencies or abnormalities in pituitary hormone production, leading to various endocrine disorders and associated health complications.

Idiopathic Hypopituitarism

The pituitary gland can fail to secrete its hormones due to various conditions, including trauma, inflammation (bacterial, viral, or fungal), and radiation to the brain and hypothalamus. The impact of radiation depends on the age of the individual.

Rathke's Pouch

Rathke's cleft cysts are remnants of Rathke's pouch that can accumulate fluid and enlarge, causing compression of nearby structures and resulting in mass effect signs and symptoms. Additionally, vestigial remnants of Rathke's pouch can give rise to craniopharyngiomas, which are slow-growing benign tumours found in the suprasellar region. Craniopharyngiomas can be mostly cystic but may also have solid components. There are two types: the adamantinomatous form, which often contains calcifications and projections into adjacent brain tissue, leading to intense inflammatory reactions; and the papillary form, which tends to have fewer calcifications and cysts and is more surgically approachable.[16]

MRI (Magnetic Resonence Imaging)

MRI, or Magnetic Resonance Imaging, is a non-invasive medical imaging technique used to visualize organs and structures within the body. Unlike CT and PET scans, MRI does not utilize X-rays or ionizing radiation. Instead, it employs strong magnetic fields, magnetic field gradients, and radio waves to generate detailed images of the body's anatomy and physiological processes.[20]

The discovery of MRI in medicine occurred in two significant steps. Firstly, in 1971, Damadian observed differences in tissue proton relaxation between normal and cancerous tissues, proposing the use of external nuclear magnetic resonance (NMR) scanning on live human subjects.[21] Secondly, during 1972–80, imaging methods were developed. Lauterbur pioneered the reconstruction of two-dimensional images using magnetic field gradients[22] while Damadian patented his method in 1972. Subsequently, in 1977–78, Damadian and his team utilized a human-sized superconducting magnet to acquire the first whole-body MR images, including scans of the chest and abdomen in both healthy individuals and cancer patients.[23]

MRI images are created by placing the patient within a large magnet, generating a strong external magnetic field. This causes the nuclei of atoms in the body, notably hydrogen, to align with the magnetic field. When a radiofrequency (RF) signal is applied, energy is released from the body, which is then detected and utilized by a computer to construct the MRI image.[24]

[Figure-6: control console]

Figure-6:- Controlconsole.

[Figure-7: Philips (Ingenia) 1.5 T MRI scanner

MRI scanners vary in size and shape, with newer models offering increased openness around the sides. However, the fundamental design remains consistent, typically featuring a tube with a diameter of around 24 inches (60 centimeters) into which the patient is inserted. The magnet is the largest and most crucial component of an MRI system. Within the magnet, there is a horizontal tube called the bore, through which the patient enters.

The strength of magnets in MRI systems is measured in tesla (T), with 1 tesla equal to 10,000 gauss. Modern MRI systems typically produce magnetic fields ranging from 0.5 to 2.0 tesla, equivalent to 5,000 to 20,000 gauss.

MRI systems typically utilize superconducting magnets to generate a strong magnetic field of up to 2.0 tesla, achieved by passing electricity through coils or windings. These magnets rely on superconductivity, which minimizes electrical resistance in the wires, achieved by cooling them with liquid helium at around -452.4 degrees Fahrenheit (-269.1 degrees Celsius). Despite their high cost, superconducting magnets provide the highest-quality imaging while remaining economical to operate due to their efficient energy consumption.

In contrast, resistive magnets structurally resemble superconducting magnets but lack liquid helium, thus consuming a significant amount of electricity, particularly above 0.3 tesla, making them costly to operate.

Permanent magnets offer a constant magnetic field but are too heavy to sustain a large field effectively. Additionally, MRI machines contain gradient magnets of lower strength (ranging from 180 to 270 gauss) to create variable magnetic fields, enabling specific body parts to be scanned with precision.

In addition to magnets, MRI systems include coils that transmit radiofrequency waves into the patient's body. Different coils are used for various body parts such as knees, shoulders, wrists, heads, and necks, conforming to their contours during imaging. The system also comprises a powerful computer and a patient table, which positions the patient within the machine's bore. The orientation (head or feet first) depends on the body part being examined. Once the targeted body part aligns with the magnetic field's centre (isocentre), the scanning process begins.

MRI systems can produce axial, sagittal (side-to-side lengthwise slices), and coronal (layered cake-like) images, or any degree in between, without the need for the patient to move. However, to obtain high-quality images, patients must remain still during the scanning process. MRI scans typically require patients to maintain stillness for 20 to 90 minutes or even longer.[25]

MRI sequences commonly include T1-weighted and T2-weighted scans, with T1 emphasizing tissue properties for contrast and brightness using short TE and TR times, while T2 focuses on tissue T2 properties with longer TE and TR times. CSF appears dark on T1-weighted images and bright on T2-weighted images. Additionally, Fluid Attenuated Inversion Recovery (FLAIR) sequences, akin to T2-weighted scans but with very long TE and TR times, enhance pathology visibility by darkening normal CSF and highlighting abnormalities, aiding in easier differentiation.

	TR(msec)	**TE(msec)**
T1 Weighted (short TE and TR)	500	14
T2 Weighted (Long TE and TR)	4000	90
Flair (Very long TE and TR)	9000	114

[Most common MRI Sequences and their Approximate TR and TE times]

MRI offers a non-invasive method to assess the pituitary gland without exposing patients to ionizing radiation. Advancements in MRI hardware and software enable accurate measurement of the pituitary gland, facilitating precise evaluation in a timely manner.

A mid-sagittal T1-weighted image (T1-WI) in MRI is commonly utilized for measuring the height and length of the pituitary gland.[26]

Aim:-

To determine standard reference values for the height and length of the pituitary gland across various age groups and both genders within the Rajasthan population, utilizing Magnetic Resonance Imaging (MRI) technology.

Methodology:-

The study was a retrospective analysis involving 121 patients referred to the Department of Radiology at NIMS Hospital Jaipur Rajasthan for pituitary gland size evaluation.

Inclusion criteria:

1. Age between 5 to 84 years.
2. Willingness to provide written and informed consent.
3. Both males and females.
4. Referral for MRI Brain examination.

Exclusion Criteria:

1. Non-Rajasthani citizenship or abnormal description.
2. Non-cooperative patients.
3. Patients unwilling to provide consent.
4. Presence of any intracranial mass-occupying lesion.
5. Pregnancy or breastfeeding.
6. Presence of electromagnetic or ferromagnetic implants.
7. Known pituitary disease.
8. Empty Sella.

The study included a total of 121 patients (62 males and 59 females) ranging from 5 to 84 years of age, who underwent brain MRI at the Radio-diagnosis department. Patients were categorized into six age groups: 0-10 years, 10-20 years, 20-30 years, 30-40 years, 40-50 years, 50-60 years, 60-70 years, and >70 years for both genders.

MRI examinations were conducted using a PHILIPS 1.5 Tesla (Ingenia) MR unit. Pituitary gland height and length measurements were taken from the mid-sagittal T1-weighted images (T1WI) using an electronic cursor on a workstation. The mid-sagittal section was identified by visualizing the anterior and posterior pituitary lobes with the pituitary stalk in the same slice.

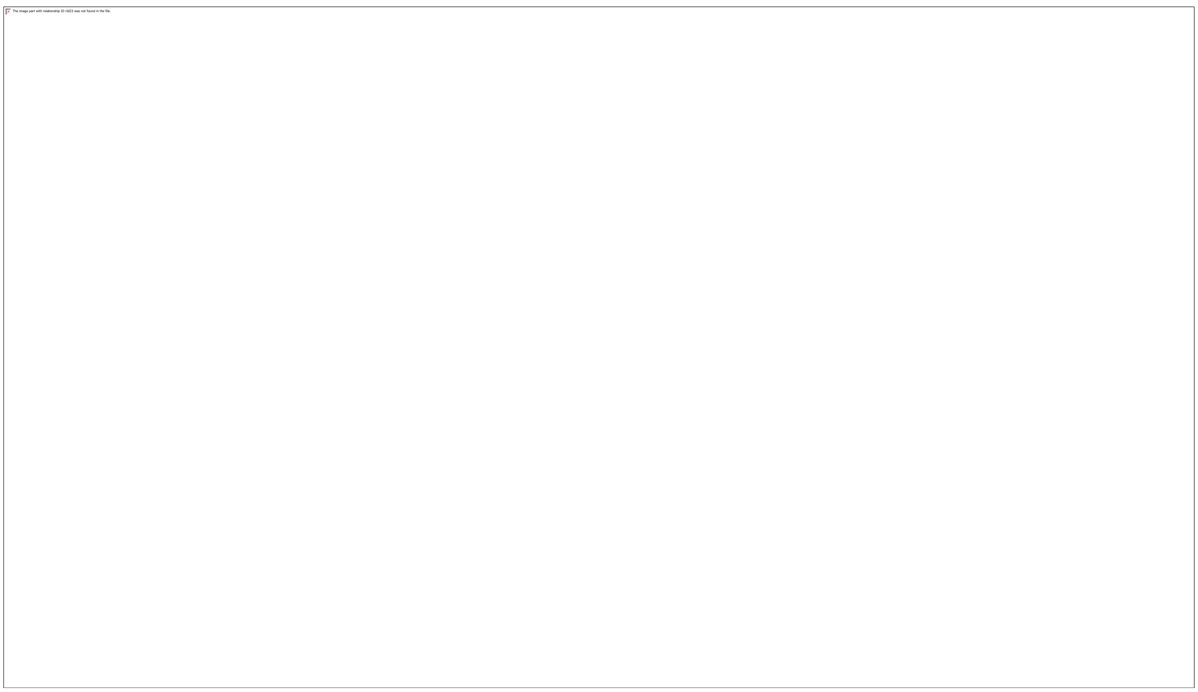
The MRI protocol for the sagittal scan involved a matrix of 350 x 256, a field of view (FOV) of 230 mm, and 5 mm slice thickness. Pituitary gland shape was observed in the mid-sagittal T1WI, noting the shape of the superior surface of the gland as flat, convex, or concave.

Result:-

A total of 121 patients referred for MRI brain were included in this study with age ranging from 5 to 84 years. Patients are divided into different age group. From the below shown analysis, it is clear that the patients aged between 20-40 years are the most affected. The percentages of affected patients are (17.36%).

Table 1:- Frequency distribution of age of patients.

AgeInterval	n =121	In%
0 – 10	10	8.26%
10 – 20	11	9.09%
20 – 30	21	17.36%
30 – 40	21	17.36%
40 – 50	18	14.88%
50 – 60	15	12.40%
60 – 70	14	11.57%
>70	11	9.09%



Out of 121 patients selected for the study, 62 (51.24%) were males and 59 (48.76%) were females

Table 2:- Frequencydistributionof genderof patients.

Gender	n = 121	In %
Male	62	51.24%
Female	59	48.76%

The most remarkable height of pituitary gland for maximum number of patients were 8mm to 9mm (33.06%) and minimum height of pituitary gland was 9mm to 10mm (4.96%)

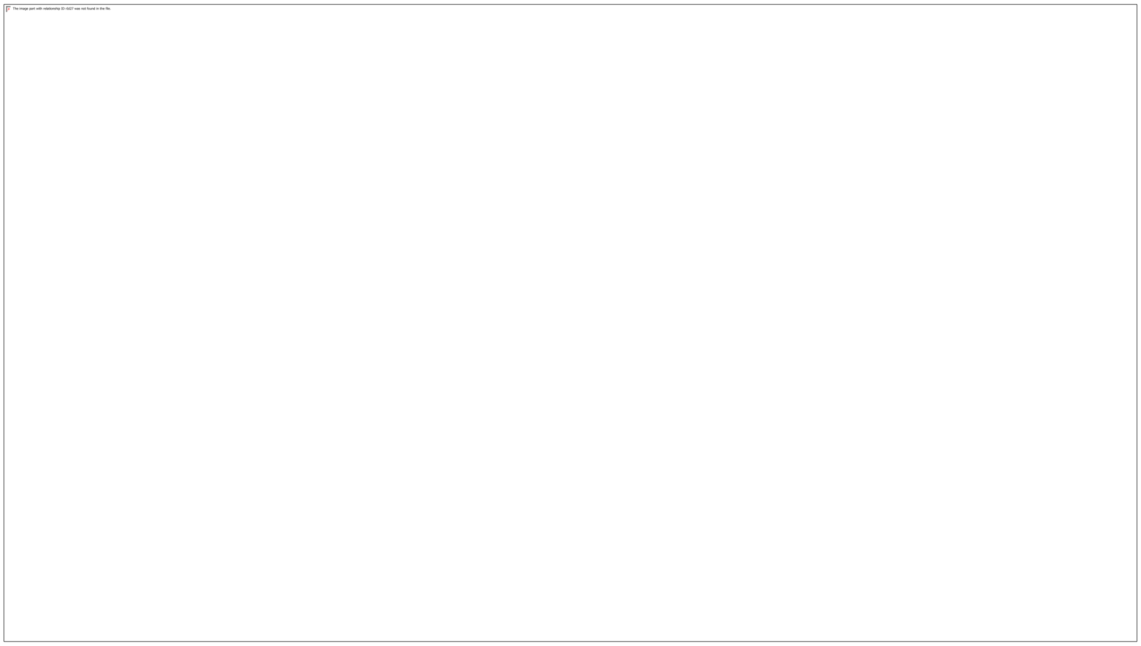
Table 3:- Frequency distribution of Pituitary height (In mm) of patient.

Height(Inmm)	n=121	In%
5-6	21	17.36%
6-7	16	13.22%
7-8	8	6.61%
8-9	40	33.06%
9-10	6	4.96%
10-11	30	24.79%

The most observable length of pituitary gland for maximum number of patients were6mm to 7 mm (71.07%) and minimum length of pituitary gland was 8bmm to 9mm(o.83%),showninbelowtable[Table4]

Table 4:- FrequencydistributionofPituitarylength (In mm)ofpatients.

Length(Inmm)	n=121	In%
5-6	14	11.57%
6-7	86	71.07%
7-8	17	14.05%
8-9	1	0.83%
9-10	3	2.48%



Age wise the mean pituitary height was 8.26 ± 1.73 mm and length was 6.612 ± 0.691mm in female and male subject between 5 years to 84 years age group as shown inTable-5.

Table 5:- Descriptivestatisticsofage, Pituitaryheight&lengthofpatients.

Variables	Minimum	Maximum	Median(IQR)	Mean±SD
Age	5	84	38(23-55)	40.74±20.67
Height	5.5	10.9	8.3(6.6-9.9)	8.26± 1.73
Length	5.1	9.3	6.5(6.3-6.9)	6.612±0.691

Gender wise the pituitary gland height was greater in females than males. The meanpituitary gland height was 9.1 ± 1.73 mm in female and 7.47 ± 1.31 mm in malesubjects.

Thepituitaryglandlengthwasgreater in femalesthanmales.The mean pituitarygland length was 6.71 ± 0.76 mm in female and 6.52 ± 0.61 mm in male subjects.[Table6]

Table 6:- GenderwisedescriptivestatisticsofPituitaryheight&lengthofpatients.

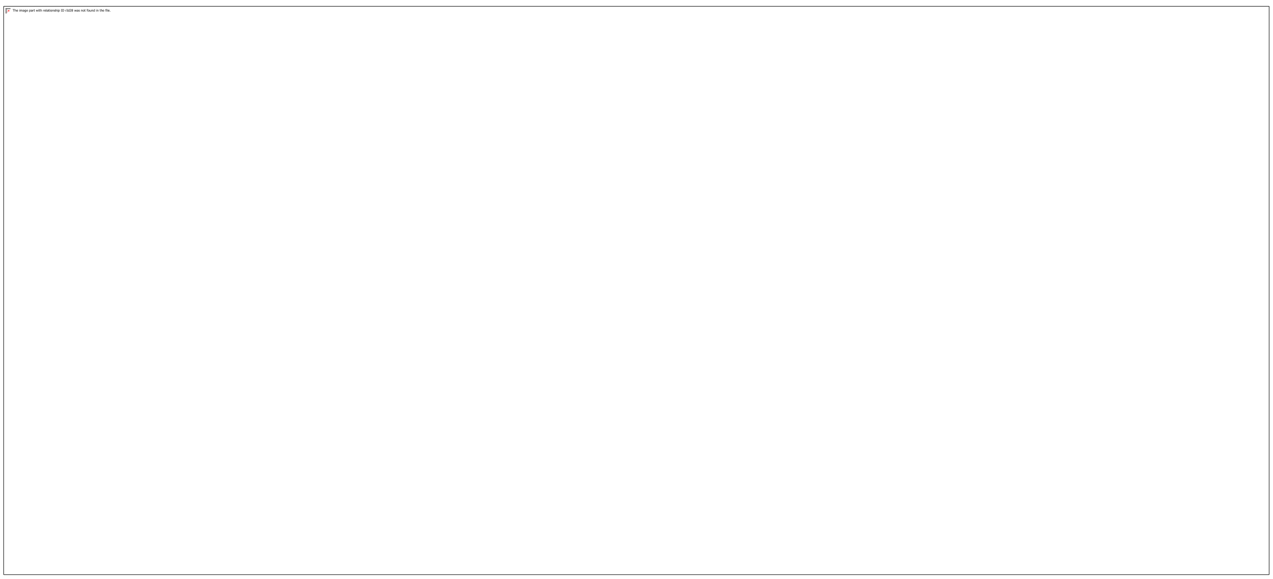
Variables		Minimum	Maximum	Median(IQR)	Mean±SD
Height	**Male**	5	10.9	8.1 (6.03- 8.6)	7.47± 1.31
	Female	5.7	10.9	9.9(8.05 -10.6)	9.1 ±1.73
Length	**Male**	5.3	9.3	6.5 (6.33 - 6.6)	6.52± 0.61
	Female	5.1	9.1	6.6(6.25 -7.15)	6.71± 0.76

The mean pituitary height in the age group 1-10 years came out to be 6.1 ± 0.25 mm.Inthe age group 10-20 years mean pituitary height was 8.49 ± 1.92 mm, in the agegroup 20-30 years 9.7 ± 1.1 mm, 30-40 years age group 9.62 ±

1.1 mm, in 40-50 yearsagegroup8.92±1mm,intheagegroup50-60years7.41±1.15mm,60-70yearsage group 7.13 ± 1.1 mm and individuals above 70 years of age mean pituitary heightwasobservedas6.16± 0.72mm[Table-7].

Table 7:- Agegroupwise descriptivestatisticsofPituitaryheightofpatients.

AgeInterval	Minimum	Maximum	Median(IQR)	Mean±SD
0–10	5.8	6.6	6(5.9-6.17)	6.1 ±0.25
10–20	6.1	10.9	8.1(6.6-10.15)	8.49± 1.92
20–30	7.9	10.9	10.2(8.710.6)	9.7±1.1
30–40	8.2	10.9	9.9(8.6-10.7)	9.62 ±1.1
40–50	6.7	10.9	8.8(8.53 -9.35)	8.92 ±1
50–60	5.7	8.8	8(6.2-8.3)	7.41± 1.15
60–70	5.7	8.7	7.15(5.93-8.15)	7.13 ±1.1
>70	5.5	8.1	5.9(5.75 -6.25)	6.16± 0.72



The mean pituitary length in the age group 1-10 years came out to be 5.6 ± 0.4 mm. Inthe age group 10-20 years mean pituitary length was 7.17 ± 1.3 mm, in the age group20-30 years 7.12 ± 0.49 mm, 30-40 years age group 6.57 ± 0.18 mm, in 40-50 yearsage group 6.37 ± 0.25 mm, in the age group 50-60 years 6.35 ± 0.3 mm, 60-70 yearsagegroup6.71±0.35 mm and individuals above 70 years of age mean pituitarylengthwasobservedas6.72± 0.88mm [Table-8].

Table 8:- AgegroupwisedescriptivestatisticsofPituitarylengthofpatients.

AgeInterval	Minimum	Maximum	Median(IQR)	Mean±SD
0-10	5.1	6.2	5.55(5.33 -5.86	5.6±0.4
10-20	5.3	9.2	7.6 (6.25- 7.6)	7.17 ±1.3
20-30	6.5	8.2	7.1(6.8-7.4)	7.12± 0.49
30-40	6.3	6.9	6.5(6.5-6.6)	6.57± 0.18
40-50	5.8	6.8	6.4 (6.23- 6.4)	6.37± 0.25
50-60	5.9	7	6.3 (6.15- 6.5)	6.35 ±0.3
60-70	6.2	7.3	6.7(6.4-7)	6.71± 0.35
>70	6.1	9.3	6.5(6.4-6.6)	6.72± 0.88

Gender wise the mean pituitary height in the age group 0-10 years came out to be 6.12 ± 0.29mm for female and 5.98 ± 0.17 mm for male. In the age group 10-20 years mean pituitaryheight was 9.77 ± 1.59 mm for female and 6.96 ± 0.82 mm for male, in the age group 20-30years10.29±0.73mmforfemaleand8.5±0.383mmformales,in 30-40yearsagegroup10.58±0.33mmforfemalesand8.76±0.74mmformales,in 40-50yearsage group.64±0.85mmforfemalesand8.34±0.71mmformales,in50-60yearsagegroup8.24±0.38mm for female and 6.99 ± 1.19 mm for males , 60-70 years age group 7.27 ± 1.03 mm forfemalesand6.95±1.26mmformalesabove70yearsofagethepituitaryheightwas7.2±1.27mmforfemalesand5.92±0.32mmformales.The observation was divided into sixgroups according to age. Mean height of pituitary glandin femalepatientsof each agegroupwasgreaterthan malepatientsin thesame agegroup.Height of pituitary glandreached a maximum in the age 20-30 years and 30-40 yearsof agegroupin both females and males, after which, there was a decline in the pituitaryheightinthesubsequentagegroups.A difference in pituitary length between the two sexes was not statically significant for any ofthe age group. Females in age group of 10-20 years were seen maximum values (7.75 ± 0.7mm) and for males in the age group of 20-30 years were seen maximum values (6.64 ± 0.19mm), thevaluewashigherinfemalesthaninmales [Table-9]

Table 9:- Genderwise**mean±SD**ofpituitaryheightandlengthofpatients.

Agegroup	**Pituitary height(Inmm) mean±SD**			**PituitaryLength(Inmm) mean±SD**		
	Male	**Female**	**Total**	**Male**	**Female**	**Total**
0-10	5.98± 0.17	6.12± 0.29	6.1 ±0.25	5.83± 0.30	5.45± 0.41	5.6±0.4
10–20	6.96± 0.82	9.77± 1.59	8.49± 1.92	6.48± 1.59	7.75 ±0.7	7.17 ±1.3
20–30	8.5± 0.383	10.29±0.73	9.7±1.1	6.64± 0.19	7.36± 0.41	7.12± 0.49
30–40	8.76± 0.74	10.58±0.33	9.62 ±1.1	6.56± 0.19	6.58± 0.18	6.57± 0.18
40–50	8.34± 0.71	9.64± 0.85	8.92 ±1	6.46± 0.23	6.25± 0.23	6.37± 0.25
50–60	6.99± 1.19	8.24± 0.38	7.41± 1.15	6.48± 0.27	6.08± 0.13	6.35 ±0.3
60–70	6.95± 1.26	7.27± 1.03	7.13 ±1.1	6.48± 0.19	6.88± 0.35	6.71± 0.35
>70	5.92± 0.32	7.2 ±1.27	6.16± 0.72	6.82± 0.95	6.25± 0.21	6.72± 0.88

The mean pituitary height of male age groups was observed 7.47 ± 1.31 mm and 9.1 ± 1.73mm for female age groups. A p-value for relation of pituitary height with gender came out to0.000001usingunpairedt-test (-5.8) whichwashighlysignificant.

Themeanlengthofpituitaryglandformalewas6.52±0.61mmandforfemalewas6.71±0.76 mm.A p-value in relation with length with age came0.06091 as statistically notsignificant in between the group for both male and female category through unpaired t-test (-1.56),whichwasshownin[Table-10].

Table 10:- ComparingPituitary height&lengthbetweenmaleandfemaleby usingunpairedt-test.

Variables	Male	Female	Unpairedt-test	P-Value	Significance
Height	7.47± 1.31	9.1 ±1.73	-5.8	0.000001	**Highlysignificant**
Length	6.52± 0.61	6.71± 0.76	-1.56	0.06091	Notsignificant

The p-value of pituitary height was 0.00054 and t-test value -3.554 using Karl Pearson'scorrelationcoefficientstatisticswhichwasstatisticallysignificant.

Thep-valueofpituitarylengthwas0.98595andt-testvalue0.018byKarl Pearson'scorrelationcoefficientstatisticswhichwasnot significant [table-11].

Variables	Correlation(r)	t-test	P-Value	Significance
Height	-0.310	-3.554	0.00054	Significant
Length	0.002	0.018	0.98595	Notsignificant

Discussion:-

MRI is the preferred method for visualizing the pituitary gland, and it is crucial for radiologists to be familiar with the normal height and length of the gland, as well as the variations associated with gender and age. Even small changes in the size of the pituitary gland can significantly impact other neuroendocrine glands .

The height and length of the pituitary gland undergo dynamic changes throughout a person's life, influenced by both age and gender. Therefore, understanding the normal range of pituitary dimensions is essential for distinguishing between normal and abnormal gland sizes.

This study aimed to evaluate the normal height and length of the pituitary gland in the population of Rajasthan. It found that the differences in mean pituitary height between males and females were highly significant, while the differences in pituitary length were not statistically significant. The study also revealed that the mean height of the pituitary gland in female patients of each age group was greater than that of male patients in the same age group. Additionally, the height of the pituitary gland peaked during the second and third decades of life in both males and females, followed by a decline in subsequent age groups.

Conclusion:-

Magnetic Resonance Imaging (MRI) is considered the optimal modality for assessing the size and shape of the pituitary gland. This study aims to provide normative data on pituitary height and length, analyzing variations according to age and gender among the Rajasthan population. The findings indicate that the pituitary gland reaches its maximum size during the second decade of life, after which there is a progressive decrease in size with advancing age. Additionally, larger pituitary gland sizes were more frequently observed in the female population.

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