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RESEARCH ARTICLE

INVESTIGATING OSTEOPENIA IN POSTMENOPAUSAL WOMEN USING DEXA SCANS

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Abstract

Aims and Objectives: This examines foremost goal is to evaluate bone mineral density (BMD) in women after menopause through Dual-energy X-ray Absorptiometry (DEXA) scans. It targets to find out how common osteopenia and osteoporosis are. The studies attempt to understand the link among BMD measurements at the femoral neck and lumbar spine. It additionally appears at how things like age, weight, peak, and frame mass index (BMI) have an impact on BMD. what's greater, the observe plans to examine the T-score spread to diagnose osteopenia and osteoporosis. , it desires to explore the hazard elements that lead to bone loss after menopause.

Materials and Methods: This carried out this forward-looking cross-sectional study in the Radio-Imaging and Diagnosis Department at A Medical College Haryana. The study looked at 45 women after menopause ranging from 45 to 80 years old, which may or may not have had osteopenia. A Hologen Discovery DEXA gadget measured their BMD. T-rankings and Z-rankings helped institution members as ordinary, osteopenic, or osteoporotic following the sector fitness company's (WHO) device. The group gathered data on age, weight, top, and BMI, linking those to BMD consequences. They did not consist of patients with current breaks long-term illnesses, or those taking bone-associated capsules.

Discussion: The research shows that osteopenia and osteoporosis occur often in women after menopause. The data points to a strong link between BMD in the femoral neck and lumbar spine, and both areas have positive connections with T-scores. Doctors found osteopenia in 32.56% of patients, while 34.88% had osteoporosis. These numbers stress the need to diagnose and provide preventive care for women who might lose bone due to less estrogen after menopause. Other studies back up the use of DEXA scans as a key way to spot early bone density loss, which can help lower the chance of breaks and make life better.

Conclusion: DEXA scans are an critical diagnostic device for assessing bone mineral density in postmenopausal girls. They have a look that concludes that ordinary BMD screenings ought to be advocated for early detection of osteopenia and osteoporosis, taking into consideration a timely intervention which

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includes calcium and nutrition D supplementation, hormone replacement therapy, and life-style modifications. By identifying and dealing with these situations early, the danger of fractures and associated morbidity in postmenopausal girls may be significantly decreased.

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Introduction:-

Osteoporosis and osteopenia are among the most prevalent skeletal disorders affecting millions of people worldwide, particularly postmenopausal women. “These conditions are often referred to as "silent diseases" because they progress without noticeable symptoms until a fracture occurs, significantly impairing quality of life.”[1]Osteoporosis is characterized through low bone mass and structural deterioration of bone tissue, which leads to bone fragility and a heightened hazard of fractures, especially within the spine, hip, and wrist.“Osteopenia, a precursor to osteoporosis, represents a state of reduced bone mineral density (BMD) that is less severe but still increases fracture risk”.[2]

The rapid decline in estrogen degrees following menopause is a number one issue contributing to elevated bone loss in ladies.[3] Estrogen plays a vital role in retaining the balance among bone resorption and bone formation. After menopause, the dearth of estrogen results in a full-size growth in bone resorption, outpacing the price of latest bone formation, which results in a decrease in BMD. As girls age, the chance of osteopenia and osteoporosis will become greater pronounced, with studies showing that most people of bone loss takes place within the first few years following menopause.

Globally, osteoporosis and osteopenia constitute predominant public health worries, affecting an predicted two hundred million people. In India, with its getting old populace, the prevalence of osteoporosis is also at the rise, mainly in postmenopausal girls. in line with the world health business enterprise (WHO), osteoporosis is defined by means of a BMD that is 2.5 general deviations or extra under the mean height bone mass of a healthful younger grownup (T-rating $\leq$ -2.5). Osteopenia is recognized while the BMD is between -1 and -2.five T-score. these diagnostic thresholds are crucial for determining the suitable scientific interventions to prevent fractures and similarly deterioration of bone health.

Dual Energy X-ray Absorptiometry (DEXA)is extensively regarded because the gold standard for measuring BMD, in particular at vital websites consisting of the lumbar backbone and femoral neck. DEXA scans are non-invasive, use minimum radiation, and provide fantastically accurate checks of bone density. The consequences of DEXA scans are reported as T-rankings, which examine the affected person's BMD to the average BMD of a healthy young adult, and Z-scores, which examine BMD to people of the identical age, intercourse, and race.

This observe makes a speciality of using DEXA scans to research osteopenia in postmenopausal girls, assessing the bone mineral density on the femoral neck and lumbar spine. [2] The examine ambitions to spotlight the superiority of osteopenia and osteoporosis in this populace and to evaluate the relationship between BMD and factors together with age, weight, top, and frame mass index (BMI). Given the severe implications of undiagnosed or untreated osteopenia and osteoporosis, early detection thru DEXA scanning is important for timely intervention.

Postmenopausal Women represent a big demographic vulnerable to osteopenia and osteoporosis due to hormonal modifications associated with getting older. As estrogen degrees fall, bone density decreases, main to a better chance of fractures, which could notably lessen mobility and great of life. Identifying and expertise the early signs of bone loss through regular BMD screenings can assist lessen the occurrence of osteoporotic fractures. These interventions include each pharmacological treatments, including bisphosphonates, hormone replacement remedy (HRT), and denosumab, and non-pharmacological tactics, which include calcium and vitamin D supplementation, way of life changes, and ordinary weight-bearing exercising.

In this context, the observe evaluates postmenopausal girls inside the Gurgaon district of Haryana, India, who have been referred for DEXA scans. The primary objective is to assess the BMD on the femoral neck and lumbar spine, examine the T-rankings and Z-scores, and perceive the prevalence of osteopenia and osteoporosis inside this

population. [5] With the aid of investigating these elements, the study goals to make contributions to a better know-how of bone health in postmenopausal girls and highlight the importance of early detection and intervention in stopping osteoporotic fractures. This research also seeks to tell scientific exercise by means of demonstrating the effectiveness of DEXA scans in diagnosing bone density problems and guiding remedy decisions.

Ultimately, the study emphasizes the need for regular BMD screening in postmenopausal women and advocates for preventive strategies to mitigate the risk of fractures, thereby enhancing the overall quality of life for this vulnerable population.[4]

Material:-

This prospective, pass-sectional observational study was carried out within the department of Radio-Imaging and diagnosis at A scientific university, The observe involved 45 postmenopausal women, either already diagnosed with low bone mineral density (BMD) or referred for osteoporosis evaluation. The BMD of these women was assessed using the Hologen Discovery DEXA scan machine, focusing on the lumbar spine and femoral neck regions.

Participants were included based on specific inclusion criteria, which required them to be between 40 and 80 years of age, have no family history of fractures, and provide written informed consent. Those with recent fractures, chronic illnesses, or a history of corticoid The study turned into performed over a duration of seven months, from October 2021 to April 2022. moral clearance changed into acquired from the moral research committee, and permission become granted by way of the sanatorium government. facts collection involved recording scientific parameters such as age, weight, top, BMI, menopausal fame, and life-style behavior. T-scores and Z-ratings have been used to classify participants into everyday, osteopenic, or osteoporotic classes, in step with WHO tips.

The DEXA scans were performed with patients positioned correctly on the scan table, ensuring optimal imaging of the spine and pelvis. Those on calcium supplements were asked to refrain from taking them 24 hours prior to the scan. The entire procedure was quick and non-invasive, and it allowed for the accurate assessment of bone mineral density.

Methodology:-

Ethics

Ethical clearance became obtained from the moral studies committee of SGT university. Permission to behavior the take a look at became granted by means of the health center authorities. All contributors were completely knowledgeable approximately the take a look at's cause and furnished written consent before participation.

Design

The clinical data and physical examination findings were systematically recorded using a structured pre-prepared proforma. a complete of 45 postmenopausal ladies elderly 45 to eighty years with symptoms together with returned pain or spinal deformity have been covered in this seven-month study The DEXA scans were conducted on the Hologen Discovery machine, and participants were instructed to remove any metallic items before the scan. Those taking calcium supplements were asked to stop 24 hours prior to the examination.

During the scan, patients were positioned to ensure proper alignment of the spine and pelvis, and the radiation source was directed at the regions of interest. The DEXA scan quickly provided results, diagnosing osteoporosis in patients with T-ratings below -2.5 and osteopenia in those with T-ratings between -1 and -2.5. The study recorded detailed demographic data, clinical features, menopausal status, and habits such as alcohol consumption and smoking, alongside the BMD values and T- and Z-ratings.

Procedure:-

The DEXA experiment method became conducted in the department of Radio-Imaging generation at A scientific university. Data series happened from October 2021 to April 2022, underneath the supervision of senior radiologists. Medical parameters together with age, weight, top, body mass index (BMI), menopausal fame, and life-style conduct (e.g., smoking, alcohol consumption) have been recorded. Every player turned into thoroughly knowledgeable about the procedure and advised to remove any metallic gadgets before the experiment. Patients on calcium dietary supplements have been recommended to forestall consumption 24 hours before the exam.

For the test, the affected person turned into positioned on the x-ray desk in a supine function (on her again). Right positioning became ensured to prevent movement and attain a clear, correct photograph. The lower backbone and hip (neck of the femur) had been the number one regions of awareness. A scanning arm slowly moved across the patient's body, emitting a low-energy x-ray beam to degree bone mineral density (BMD) inside the focused skeletal regions. The test turned into performed through an skilled radiographer, and the system become short, non-invasive, and comfortable for the affected person. The effects have been without delay to be had and categorized into every day, osteopenic, or osteoporotic primarily based on T-scores and Z-rankings consistent with WHO pointers.

Data Analysis

The data analysis for this take a look at worried each descriptive and inferential data to assess bone mineral density (BMD) in postmenopausal ladies the use of DEXA scans. Descriptive statistics, which include mean and fashionable deviation, had been used to summarize demographic data which include age, weight, top, and BMI, even as contributors had been categorized as every day, osteopenic, or osteoporotic based totally on their T-ratings and Z-rankings. The Pearson correlation coefficient became carried out to decide the connection among BMD and demographic factors, and a paired T-test become used to compare BMD values at the femoral neck and lumbar spine. Statistical importance become set at $p <$ zero.05. Comparative analyses had been additionally performed between osteopenic and osteoporotic sufferers, and graphical representations, along with scatter plots and bar graphs, were used to illustrate key findings.This comprehensive analysis provided insights into the prevalence of osteopenia and osteoporosis, highlighting the significant role of factors like age and BMI in influencing bone health.

Result:-

The study involved 45 postmenopausal women, analyzing their bone mineral density (BMD) alongside demographic factors such as age, height, weight, and body mass index (BMI). Participants were categorized into normal, osteopenic, and osteoporotic groups based on their T-scores. The average age of participants was similar across groups, with normal cases averaging 58.33 ± 9.55 years, osteopenic cases at 58.44 ± 9.77 years, and osteoporotic cases at 58.58 ± 9.51 years. Corresponding BMD values were 0.85 ± 0.15 g/cm² for normal, 0.83 ± 0.15 g/cm² for osteopenic, and 0.84 ± 0.16 g/cm² for osteoporotic individuals. Height measurements indicated that normal participants had a mean height of 150.23 ± 13.82 cm, while osteopenic participants measured 149.38 ± 14.57 cm, and osteoporotic participants stood at 149.95 ± 13.71 cm. Weight averages were recorded as 66.33 ± 14.89 kg for normal, 65.24 ± 15.09 kg for osteopenic, and 65.00 ± 14.54 kg for osteoporotic cases. Lastly, BMI values were 30.58 ± 11.91 for normal, 30.44 ± 11.83 for osteopenic, and 30.13 ± 11.99 for osteoporotic women. These findings highlight the similarities in age and slight variations in BMD, height, weight, and BMI among the different diagnostic groups, emphasizing the importance of these demographic factors in assessing bone health in postmenopausal women.

Table 1:- Distribution of T-score according to the age and BMD of the study subjects.

Classification	T-score	No of patients	Age	BMD
Normal	>-1.0	24	58.33 ± 9.55	0.85 ± 0.15
Osteopenia	<-1.0, >-2.5	14	58.44 ± 9.77	0.83 ± 0.15
Osteoporosis	<-2.5	5	58.58 ± 9.51	0.84 ± 0.16

In this study, table 1 shows the class of T-score in keeping with the age in years and bone mineral density of the have a look at members.. The mean age and BMD of the participants were 58.33 & 0.85 years with 9.55 & 0.15 SD of normal patients respectively. Similarly, for osteopenia patients it was 58.44 & 0.83 with 9.77 & 0.15 SD respectively. The mean age and BMD of osteoporosis patients were 58.58 & 0.84 with 9.51 years & 0.16 of variation.

Table2:- Distribution of T-score according to the Height, weight and BMI of the study subjects.

Classification	T-score	Height	Weight	BMI
Normal	>-1.0	150.23 ± 13.82	66.33 ± 14.89	30.58 ± 11.91
Osteopenia	<-1.0 , >-2.5	149.38 ± 14.57	65.24 ± 15.09	30.44 ± 11.83
Osteoporosis	<-2.5	149.95± 13.71	65.00± 14.54	30.13 ± 11.99

In this present study table 2 shows the classification of T-score according the height , weight , & BMI of the study participant . the mean height , weight &bmi of the participants were (150.23) ,(66.33) & (30.58) with (13.82),(14.89)& (11.91) SD of normal patient respectively. The mean of osteopenia patient were according to height, weight &bmi is (149.38) ,(65.24) & (30.44) with SD value of(14.57) , (15.09) & (11.83) of variation.

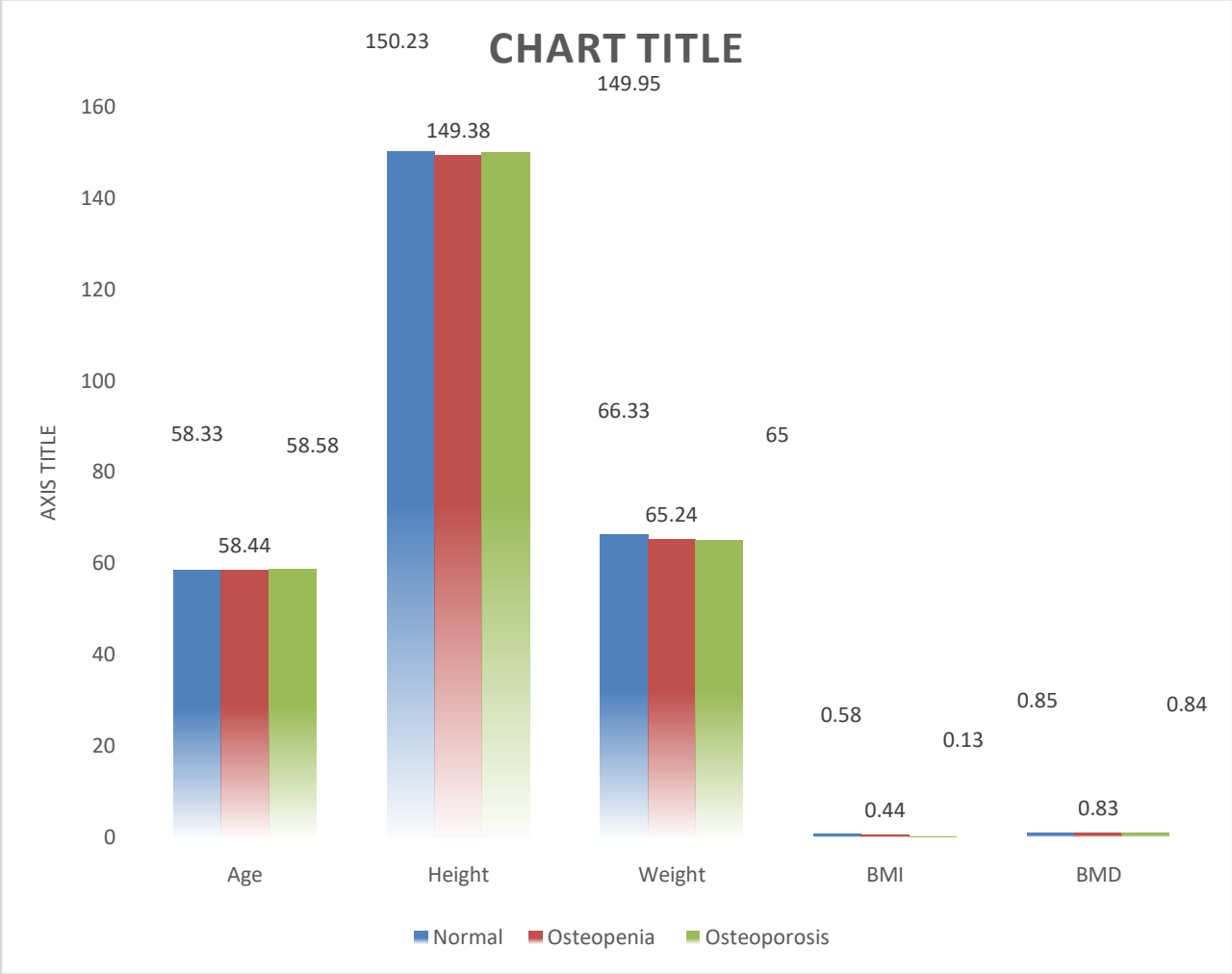
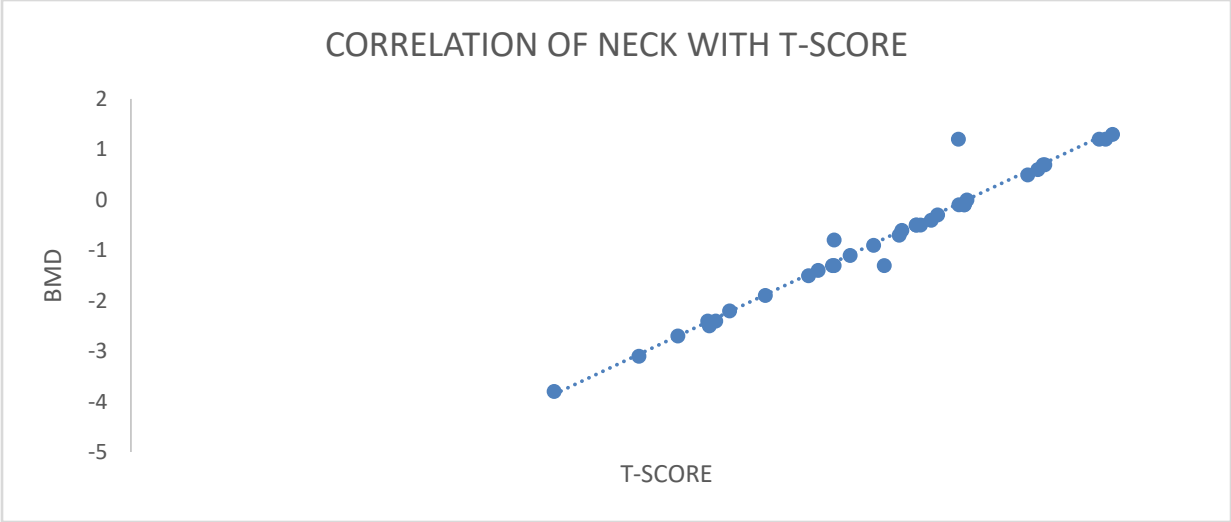


Table3:- Correlation among bone mineral density most of the T-rating of the have a look at contributors.

Variables	BMD	T-score (Median)	r-value	p-value
Neck	0.83 ± 0.15	-0.87 ± 1.33(-0.80)	0.70	<0.0001*
Lumbar	0.85 ± 0.18	-1.82 ± 1.61(-1.70)	0.86	<0.0001*

*=Significant

In keeping with the desk.3.it describes the effectiveness of total bone mineral density of neck and backbone among the T-rating the take a look at individuals. The imply bone mineral density of neck and lumbar changed into 0.eighty three & zero.85 respectively. whereas the imply T-score of neck become -zero.87 and for lumbar it was -1.eighty two. The Pearson's correlation check turned into carried out and it changed into determined that there was a effective correlation for each the parameter with T-score and the consequences was giant at 0.05 degree of significance.



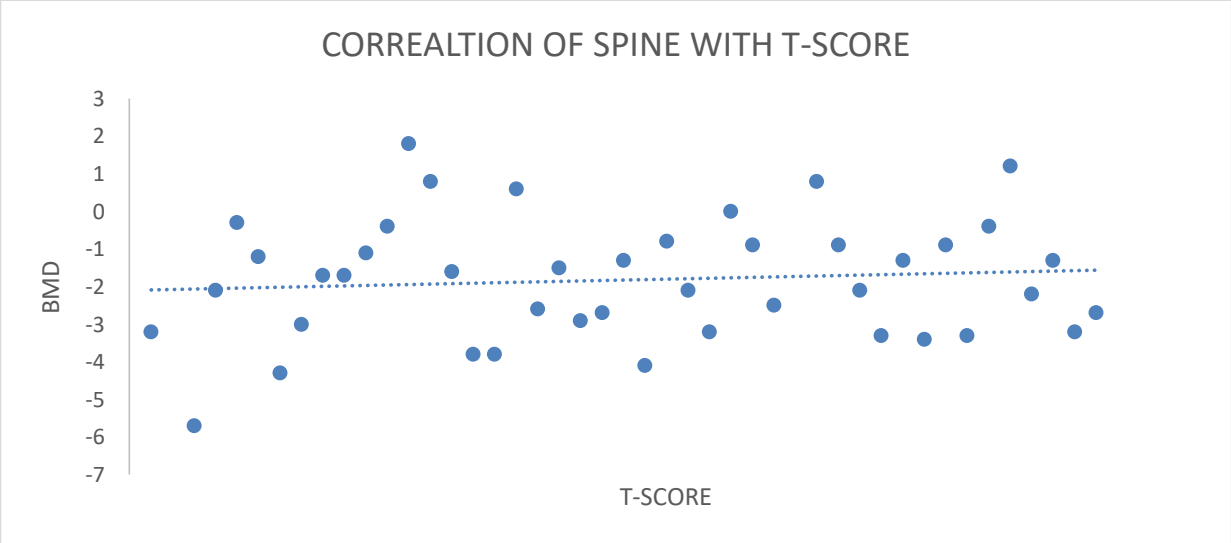


Table4:- Distribution of the study subjects according to their diagnosis by neck and lumbar spine.

Variables	Osteopenia	Osteoporosis	Normal
Neck	14(32.56%)	15(34.88%)	14(32.56%)
Lumbar	12(27.91%)	18(41.86%)	13(30.23%)

In this present study table show the no of individuals undergo by dexa scan for diagnosis of proximal femur & lumbar spine. For osteopenia individual show 14(32.56%) less than the osteoporosis 15(34.88%) with normal 14(32.56%) of the neck variable. For lumbar spine osteopenia individuals 12(27.91%) less tan the osteoporosis or normal variable 18(41.86%) , 13(30.23%).

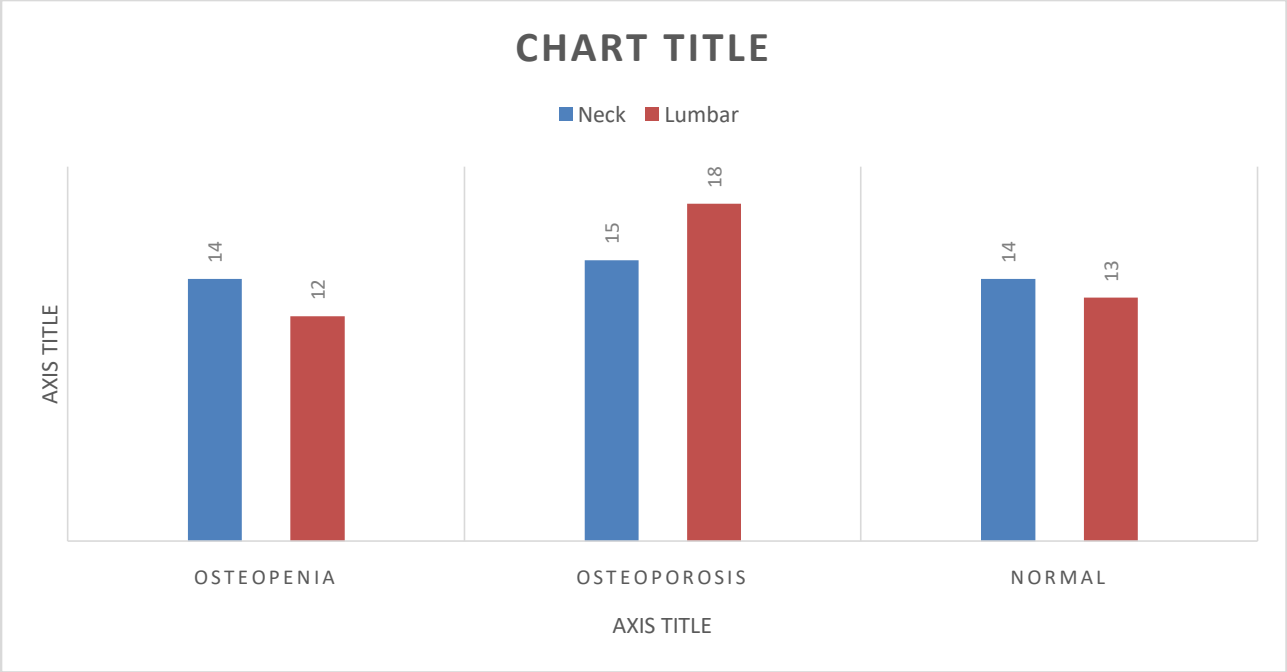


Table5:- Effectiveness of age, weight, BMI, T-score, Z-score with BMD of neck.

Correlation	Age	Weight	BMI	T-Score	Z-score
BMD of Neck	-0.011	0.44	0.41	0.70	0.71
p-value	0.943^{NS}	0.003*	0.006*	<0.0001*	<0.0001*

NS=Not significant; *= Significant

In the present study, table 5 describes the effectiveness of age, weight, BMI, T-score with bone mineral density of neck. Karl Pearson's test was applied for find out the effectiveness and the results were significant for all the parameters except age at 0.05 level of significance.

Table6:- Effectiveness of age, weight, BMI, T-score, Z-score with BMD of spine.

Correlation	Age	Weight	BMI	T-Score	Z-score
BMD of Lumbar	0.04	0.44	0.09	0.86	0.76
p-value	0.799^{NS}	0.003*	0.573^{NS}	<0.0001*	<0.0001*

NS=Not significant; *= Significant

In the present study , table 6 shows the correlation of BMD of lumbar , describe the effectivences of age ,weight ,BMI,t-score with bone minerals density of spine , karl person test was applied for find out the effectiveness and the result for significant for the parameter except age and bmi is not significant.

Table7:- Comparison of BMD of neck with the total bone mineral density of lumbar.

	Mean ± SD	t-value	p-value
Total BMD of Neck	0.83 ± 0.16	0.021	0.983^{NS}
Total BMD of Lumbar	0.83 ± 0.22		

NS=Not significant

According to the table 7, it shows the comparison of bone mineral density of neck and spine. Student t-test was applied and the results were not significant at 0.05 level of significance.

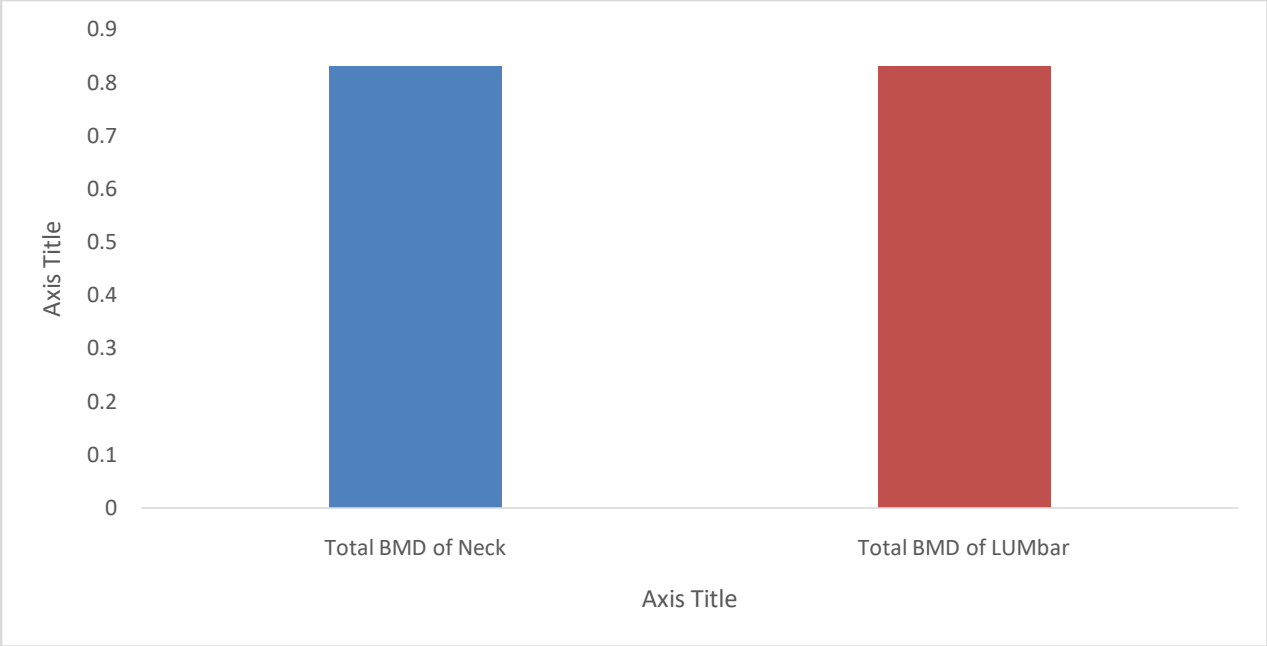
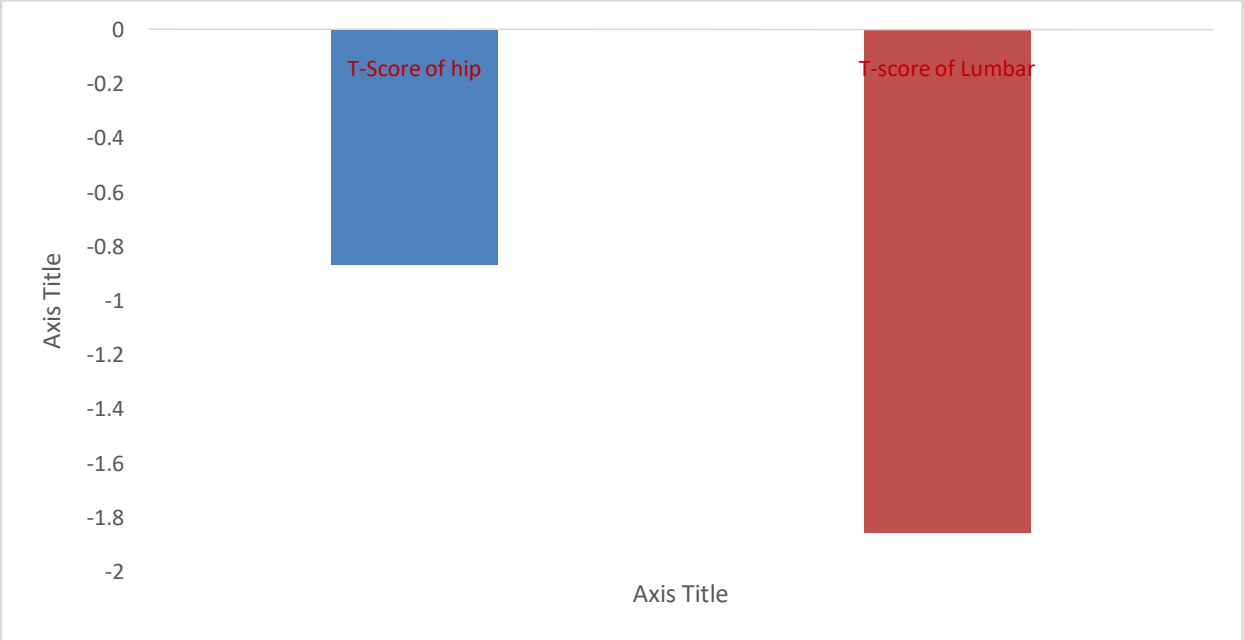


Table8:- Comparison of T-score of hip with the T-score of lumbar.

	Mean ± SD	t-value	p-value
T-Score of hip	-0.87 ± 1.33	3.11	0.003*
T-score of Lumbar	-1.86 ± 1.61		

According to table 8, it shows the comparison of bone mineral density of lumber & neck with T-score, p-value is (0.003) is significant.



Discussion:-

The existing study tested bone mineral density (BMD) in postmenopausal women using dual-strength X-ray Absorptiometry (DEXA) scans, presenting crucial insights into the prevalence of osteopenia and osteoporosis in this

demographic. The statistics analysis involved both descriptive and inferential information, allowing for a comprehensive evaluation of the connection between BMD and numerous demographic elements inclusive of age, height, weight, and body mass index (BMI). The participants have been labeled into 3 classes: normal, osteopenic, and osteoporotic, based on their T-scores and Z-rankings, which provided critical markers for knowledge their bone fitness popularity.

In terms of descriptive statistics, the mean age across all three groups (normal, osteopenic, and osteoporotic) was similar, approximately 58 years. The study found minor variations in BMD across these groups, with normal patients having a mean BMD of 0.85 ± 0.15 g/cm², osteopenic patients with 0.83 ± 0.15 g/cm², and osteoporotic patients with 0.84 ± 0.16 g/cm². These findings suggest that while osteopenia and osteoporosis are prevalent, BMD values in postmenopausal women are fairly close across diagnostic groups. However, despite these small numerical differences, the clinical implications of osteopenia and osteoporosis are significant, as bone loss progresses with age.

Height and weight measurements also showed slight variations among the groups, with normal individuals recording a mean height of 150.23 ± 13.82 cm and a weight of 66.33 ± 14.89 kg. Osteopenic and osteoporotic individuals demonstrated slightly lower height and weight, but the differences were not statistically significant. This pattern suggests that while height and weight are contributing factors, their impact on BMD in this particular cohort may not be as pronounced as other factors like BMI, which showed a stronger correlation with BMD.

A Pearson correlation analysis revealed important relationships between demographic factors and BMD. A significant positive correlation ($p < 0.05$) was found between BMD and weight, BMI, T-scores, and Z-scores, indicating that higher body weight and BMI are associated with better bone health. However, age did not show a statistically significant correlation with BMD, a somewhat unexpected finding given that bone density generally decreases with age. This discrepancy may be due to the relatively narrow age range of the participants or other confounding factors not accounted for in this study.

When comparing BMD values at extraordinary anatomical websites, the look at revealed that BMD values for the femoral neck and lumbar spine had been not significantly one-of-a-kind, with an average BMD of zero.83 ± 0.16 g/cm² for the neck and 0.83 ± zero.22 g/cm² for the lumbar spine. This indicates that both sites offer constant records concerning bone health, permitting clinicians to use either website for recurring screening. however, the T-scores showed a extra great difference, with the hip recording a mean T-score of -zero.87 ± 1.33, while the lumbar backbone confirmed a much lower mean T-rating of -1.86 ± 1.sixty one. This locating suggests that bone loss is more suggested in the lumbar backbone than inside the hip, which has essential implications for the prognosis and management of osteoporosis.

Similarly analysis of the relationship among BMD and T-rankings at each the femoral neck and lumbar backbone confirmed a robust nice correlation ($p < 0.0001$), reinforcing the validity of using T-rankings as a diagnostic device for osteoporosis. The take a look at additionally revealed that 34.88% of members had been diagnosed with osteoporosis at the femoral neck, and a higher percent (41.86%) changed into diagnosed with osteoporosis on the lumbar backbone. these effects propose that the lumbar backbone may be a extra touchy site for detecting early bone loss in postmenopausal women.

In Culmination, this looks at highlights the vital importance of early detection and intervention in coping with bone fitness in postmenopausal ladies. the superiority of osteopenia (32.fifty six%) and osteoporosis (34.88%) underscores the need for ordinary BMD screenings. moreover, the good sized correlation between BMD and elements consisting of BMI, weight, and T-ratings provides valuable insight into the demographic variables that impact bone fitness. however, the have a look at's boundaries, inclusive of the exceedingly small pattern size and absence of precise lifestyle or dietary facts, recommend that in addition research is wanted to discover extra risk elements and capacity intervention techniques for improving bone health consequences in this populace.

Conclusion:-

In end, this examines underscores the urgent want for early detection and intervention strategies for osteopenia and osteoporosis among postmenopausal ladies, given the alarming incidence prices diagnosed. The great correlation among bone mineral density at the femoral neck and lumbar spine highlights the significance of centered assessments to assess average bone fitness. Demographic factors including age and frame mass index substantially have an effect on BMD effects, suggesting that clinicians must recall these variables when assessing fracture threat

and growing individualized treatment plans. Routine screenings using DEXA scans are essential for timely identification of at-risk individuals, enabling proactive measures like lifestyle modifications and pharmacological interventions. Despite the limitations of the study, including a small sample size, the findings call for a broader understanding of the multifactorial nature of bone health and emphasize the necessity of further research to explore additional risk factors. Standard, prioritizing bone health in postmenopausal ladies thru improved cognizance, everyday screening, and complete management strategies is essential for lowering the weight of osteoporosis-associated fractures and improving excellent of lifestyles.

Funding:
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Conflicts of Interest:
No conflict of interest has been declared by any author.

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