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Research Paper

# Predictive Fracture Risk Assessment Tool Score Value of Dual-Energy Xray absorptiometry System Among Patients Screened for Osteoporosis in AL-HILLA City

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**ABSTRACT:**

**BACKGROUND:**

Osteoporosis is a disease that makes bones weak and fragile. This greatly increases the risk of breaking a bone. Even after a minor fall or bump. The disease has no obvious symptoms, so many people don't know they have osteoporosis until they suffer a fracture. Fractures can be life-altering, causing pain, disability, and loss of independence. That's why it is important to prevent osteoporosis.

**OBJECTIVE:**

The aim of this study was to evaluate the fracture risk predictions based on calculations prepared with bone mineral density (BMD) values using the Fracture Risk Assessment Tool (FRAX®).

**PATIENTS AND METHOD:**

This descriptive, cross-sectional study included male and female individuals aged 40–90 years. Osteoporosis patients who were not getting any treatment. A questionnaire was collected from participants face-to-face to obtain sociodemographic characteristics, fracture history, medical history. Fracture risk was calculated with FRAX® by two values MOR and HFR.

**RESULTS:**

The study included 250 (214 females and 36 males) patients. Total means for T-score, HFR, MOR were -1.8944, 2.506, and 5.99, respectively. There was a significant association of fracture risk with age and BMI. Mean of MOR and HFR was more in the osteoporotic group. As age increases major, fractures and hip fractures increases. Where T-score values toward normal fracture risk decreases. We determined the cutoff value of the FRAX score for hip fracture to predict future fracture, which was 2.2% with 98% sensitivity and 84% specificity.

**CONCLUSION:**

FRAX hip fracture is useful for prediction 10 years fracture probability in 40 -90year individual.

**KEY WORDS:** Osteoporosis; fractures; hip fractures; FRAX score; T-score

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## INTRODUCTION:

Osteoporosis is a condition that is defined as a musculoskeletal disorder that causes the bone tissue to weaken and become more prone to breaking; in this case, the bone loses its mineral density. Osteoporosis is diagnosed when bone density has reduced to the point that fractures occur under mild force. The human skeleton grows greatly in strength and size between birth and maturity; thus, the first two decades of life are critical for final bone mass and, perhaps, for eventual fracture risk. Osteoporosis is a disease that develops when the mechanism of bone growth and breakdown becomes unbalanced, resulting in insufficient new bone formation to maintain normal bone density. This process causes bone fragility, which increases the risk of hip, spine, and wrist fractures. Osteoporosis, a disease that can be prevented and controlled therapeutically, is commonly found among the elderly in current culture. Osteoporosis is a major health problem in the general population, affecting the older generation in an even distribution across the sexes[1]. The World Health Organization (WHO) defines osteoporosis as a progressive systemic skeletal illness that causes low bone mass and microarchitectural degradation of bone tissue, leading to increased bone fragility and fracture risk. The operational definition of osteoporosis is based on bone mass density (BMD).

The World Health Organization has determined two BMD criteria based on fracture risk. Osteoporosis is defined as a BMD value that is 2.5 SDs or lower than the young adult mean value for women (T-score equal to or less than -2.5). Dual-energy X-ray absorptiometry (DXA) applied to the femoral neck is the recommended reference technique for the diagnosis of osteoporosis by the World Health Organization and the International Osteoporosis Foundation. The site of preference for fracture risk is the femoral neck due to its superior predictive value[2]. Severe or established osteoporosis refers to osteoporosis with verified fragility fractures2. Osteoporosis is thought to represent a substantial financial burden on society due to the direct use of healthcare resources (hospital stays, outpatient visits, prescription drugs, long-term care, and rehabilitation), direct non-medical costs (transportation, caregivers), and indirect costs (family caregivers' time and labor, lost patient productivity, early retirement[3]).

Osteoporosis remains undertreated, despite its significant clinical and economic impact and viable treatments. Women with a history of osteoporotic fractures face suboptimal care, increasing their risk of further fractures. In the United States, only one out of every four Medicare patients received treatment after a fracture[4,5]. Osteoporosis affects around 200 million people globally and is now ranked seventh among all common diseases, with a prevalence of 10–58% based on demographic studies. Osteoporosis is more prevalent in postmenopausal women, those over 65, white people of Asian descent, and those with small body weight[6]. Other risk factors include smoking, alcohol abuse, lack of physical activity, endocrine disorders (e.g., hyperthyroidism, hyperparathyroidism, diabetes mellitus, and hypogonadal states), and genetics (e.g., a family history of hip fracture, hemochromatosis, cystic fibrosis, osteogenesis imperfecta, porphyria, and hypophosphatasia), and gastrointestinal disorders (e.g., Crohn's disease, celiac disease, and cirrhosis[6,7,8].

Fragility fractures arise spontaneously during daily activities or as a result of mild accidents that would not typically cause a fracture in healthy people. Risk factors for fragility fracture include low bone density, older age, chronic use of certain medications (e.g., glucocorticoids), a personal history of fracture, female sex, low body weight, a history of falls, smoking, higher levels of alcohol use, and rheumatoid arthritis[9]. Advancing age, particularly in postmenopausal women and older men, and menopause are substantial indicators of fragility fracture, as is low bone density[10]. Fragility fractures have placed a significant burden on civilizations worldwide[11]. The Fracture Risk Assessment Tool without BMD values [clinical FRAX] predicts that 319 million people worldwide will be at high risk of fragility fractures by 2040[12]. The objective of the study was to evaluate the prediction of the fracture assessment tool to determine whether a person may benefit from treatment if their bone density is in the osteopenic range (pre-osteoporosis).

## PATIENTS AND METHODS:

**Study design, setting and time:**

This cross-sectional study was conducted on a sample of patients attending the orthopedic clinic in Al Hilla General Hospital suffering from nonspecific musculoskeletal complaints through the period from 1st February to 1st January 2024.

**Study population:**

A sample of 250 participants aged 40 years and older was included in this study. Convenient samples were applied as the sampling strategy. Bone mass density (BMD) was measured by the method of dual-energy x-ray absorptiometry (DXA). Data collection was performed through interviews. BMD values at the femoral neck, total hip, and greater trochanter have to be collected.

**Inclusion criteria**

Eligible participants are aged ≥ 40 years sent for complete BMD measurement data.

**The exclusion criteria**

Patients were excluded if they had previously received pharmacological treatment for osteoporosis

**Ethical consideration**:

The study will be approved by Iraqi Counseling for Medical Specializations. Official agreement will be obtained from the Babylon Directorate of Health. Patients' informed verbal consents will be obtained.

**Data collection tool:**

Data was collected from patients through interviews lasting 10-15 minutes. Everyone asked about his or her family and medical history; after that, the patient was sent to DXA examination to calculate the T-score value for the proximal femur (Femur neck, total hip, and trochanter). DXA examinations were applied by experienced radiology technicians. According to the World Health Organization classification, patients are classified as follows: T-scores of ≤-2.5 were considered osteoporotic.

T-score **-1 _ -2.5** were considered osteopenia.

T-score of **>-1** were considered normal.

The study included male and female patients aged 40–90 years with T-scores who were considered normal, osteopenic, or osteoporotic. Questionnaires were used within the FRAX score, including. Age (between 40 and 90), Sex, weight in kilograms (kg), height in centimeters (cm), prior fracture, hip fracture in a parent, current smoking, steroid use, having rheumatoid arthritis, having a secondary cause of osteoporosis, such as hyperparathyroidism, multiple myeloma, Cushing's disease, celiac disease, or hyperthyroidism, and drinking three or more alcoholic beverages per day. Body mass index was calculated for each patient from weight in kilograms divided by height in square meters. Risk factors questionnaire's answer (Prior fracture, parental history of hip fracture, Current smoking, Steroid use, having rheumatoid arthritis, and having a secondary cause of osteoporosis) were yes or no without considering dose and the duration of steroid, duration of smoking, or number of previous fracture.

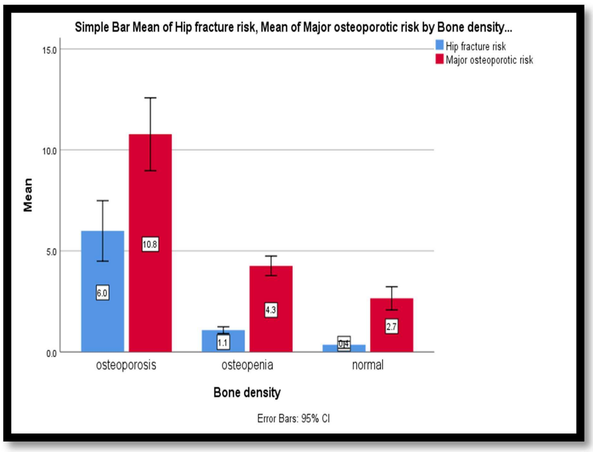
**Statistical analysis**

Descriptive statistics were used to demonstrate the sociodemographic characteristics of participants. Multivariate logistic regression analysis was used to analyze the factors that may be associated with osteoporosis of high scoring values in the study population by application of the SPSS version 26 program. The 10-yr probability fracture (major osteoporosis fracture risk, hip fracture risk) can be automatically calculated using FRAX algorithm by entering the *T*-score value for each patient. [13] Software program will calculate FRAX score in form of HFR and MOR. FRAX risk of 3% or more for a hip fracture or 20% or more for major risk are considered indications for pharmacological treatment. Chi square test was used to show the association between categorical variable. T-test and ANOVA test were used to show the association between numerical variable. P value of <= 0.o5 was considered as statistically significant.

## RESULTS:

Figure (1) Comparison of mean FRAX (HFR, MOR) among three groups. The blue bar denotes hip fracture the risk, red bar denotes the major osteoporotic risk group. Data are presented as the mean. Figure (2) shows Receiver Operating Characteristic (ROC) Curves for HFP. The true positive rate (sensitivity) is plotted in relation to the false positive rate (1-Specficity). Area under the Curve (AUC) for HFP is 0.937 (SE: 0.15, 95%). This scatter plot diagram shows in figure (3) the agreement between major osteoporotic risk and age, as age; increases the risk will increase. This scatter plot diagram shows in figure (4) the agreement between HFR and age; as age increases, the hip fracture increases. This scatter figure shows in figure (5) the association between T-score and major osteoporotic risk. As the T-score value move toward normal, the MOR decreases. This scatter plot diagram shows in figure (6) agreement between T-score and HFR. As the T-score value moves toward normal, the hip fracture risk decreases.

Mean of FRAX



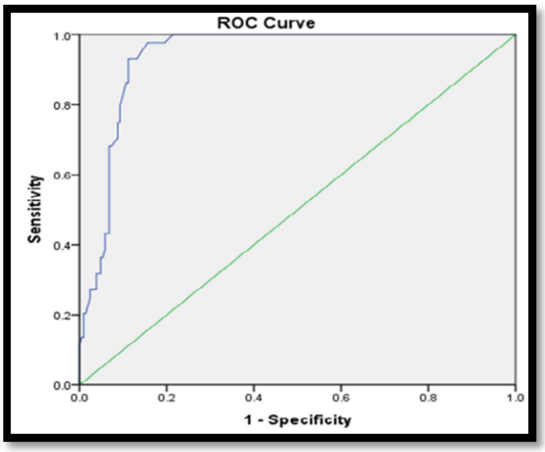
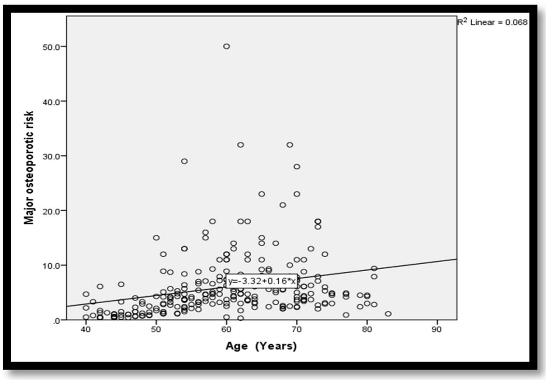




Figure1: Mean of HFR, Mean of MOR by bone density.

Figure2: Diagonal segments are produced by ties.



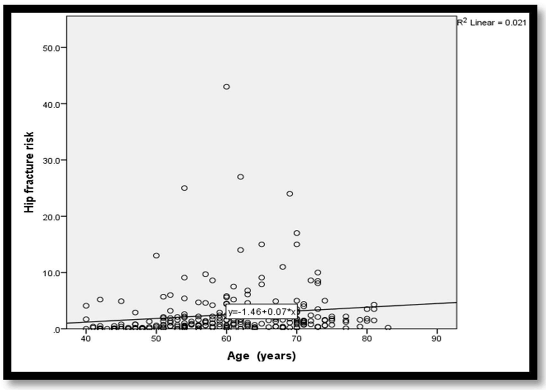




Figure3: Regression relationship between MOR and age

Figure 4: Regression relationship between HFR and age

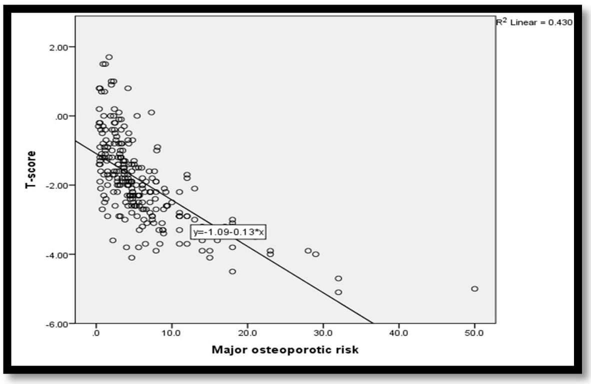



Figure 5: Negative relation ship between T-score and MOR

The table (1) shows the distribution of patients according to demographic characteristics (age, sex, BMI, and smoking). More patients were distributed within the (60-69) age group which was 78 persons with 31.2%. Female more than male (85.6% vs. 14.4%). Regarding BMI, the higher the percentage was within the obese group (45.2%). 10% of patients are more smokers.

**Table 1: Distribution of patients according to demographic characteristic.**

| Variables | | Frequency | Percent |
|---|---|---|---|
| **Age (years)** | 40-49 | 43 | 17.2 |
| | 50-59 | 74 | 29.6 |
| | 60-69 | 78 | 31.2 |
| | 70-79 | 48 | 19.2 |
| | 80and more | 7 | 2.8 |
| **Sex** | Male | 36 | 14.4 |
| | Female | 214 | 85.6 |
| **BMI ($kg/m^2$)** | Healthy | 29 | 11.6 |
| | Over weight | 66 | 26.4 |
| | Obese | 113 | 45.2 |
| | severely obese | 42 | 16.8 |
| **Smoking** | Yes | 25 | 10.0 |
| | No | 225 | 90.0 |
| | Total | 250 | 100.0 |

Table (2) shows the higher the percentages were within negative data presentation which answers were no by patients.

**Table 2: Distribution 0f patients according to their family and past medical history.**

| Independent variables | | Frequency | Percent |
|---|---|---|---|
| **Previous fracture** | yes | 51 | 20.4 |
| | No | 199 | 79.6 |
| **Parentral history of hip fracture** | yes | 28 | 11.2 |
| | No | 222 | 88.8 |
| **Glucocorticoids** | yes | 45 | 18.0 |
| | No | 205 | 82.0 |
| **Rheumatoid arthritis** | yes | 56 | 22.4 |
| | No | 194 | 77.6 |
| **Secondary osteoporosis** | yes | 42 | 16.8 |
| | No | 208 | 83.2 |
| | Total | 250 | 100.0 |

Table (3) shows data expressed as mean for study responders (T-score, HFR, MOR) according to age group. Mean T-score was -1.89, mean FRAX hip fracture risk was 2.5 and mean FRAX major osteoporotic risk was 5.99. T-score, hip fracture risk, major osteoporotic risk and age (p value =0.047, 0.01, and 0.00001), respectively.

**Table 3: Base line characteristics T-score, HFR**

| Variables | | N | Mean | Std. Error | 95% Confidence Interval for Mean | | p-value |
|---|---|---|---|---|---|---|---|
| | | | | | Lower Bound | Upper Bound | |
| T-score | 40-49 | 43 | -1.3814 | .18823 | -1.7613 | -1.0015 | 0.047 |
| | 50-59 | 74 | -2.0054 | .11509 | -2.2348 | -1.7760 | |
| | 60-69 | 78 | -2.0103 | .16464 | -2.3381 | -1.6824 | |
| | 70-79 | 48 | -1.9313 | .16661 | -2.2664 | -1.5961 | |
| | 80 And more | 7 | -2.3286 | .34621 | -3.1757 | -1.4814 | |
| Hip fracture risk | 40-49 | 43 | .619 | .1933 | .228 | 1.009 | 0.01 |
| | 50-59 | 74 | 2.146 | .4227 | 1.304 | 2.988 | |
| | 60-69 | 78 | 3.688 | .7487 | 2.197 | 5.179 | |
| | 70-79 | 48 | 2.883 | .5218 | 1.834 | 3.933 | |
| | 80and more | 7 | 2.314 | .5561 | .954 | 3.675 | |
| Major osteoporotic risk | 40-49 | 43 | 1.595 | .2281 | 1.135 | 2.056 | 0.001 |
| | 50-59 | 74 | 5.630 | .5405 | 4.553 | 6.707 | |
| | 60-69 | 78 | 8.318 | .8724 | 6.581 | 10.055 | |
| | 70-79 | 48 | 6.902 | .8092 | 5.274 | 8.530 | |
| | 80and more | 7 | 4.714 | 1.1126 | 1.992 | 7.437 | |
| | Total | 250 | 5.993 | .3821 | 5.241 | 6.746 | |
| p-value $\leq 0.05$ was significant. | | | | | | | |

Table(4) shows that t-test was conducted to show an association between study groups (T-score, hip fracture risk and major osteoporotic risk) and sex. MOR according to age There was a significant association between T-score and sex, and the p- value for T-score was 0.004.

**Table 4: Base line characteristics of study group according to sex.**

| Sex of patient | | N | Mean | Std. Error Mean | 95% Confidence Interval of the Difference | | p-value |
|---|---|---|---|---|---|---|---|
| | | | | | Lower | Upper | |
| T-score | male | 36 | -1.3500 | .21527 | .20367 | 1.06829 | 0.004 |
| | female | 214 | -1.9860 | .08244 | | | |
| Major osteoporotic risk | male | 36 | 4.486 | .5410 | -3.8969 | .3757 | 0.106 |
| | female | 214 | 6.247 | .4349 | | | |
| Hip fracture risk | male | 36 | 1.964 | .4171 | -2.2631 | .9956 | 0.444 |
| | female | 213 | 2.598 | .3323 | | | |
| p-value≤0.05 was significant. | | | | | | | |

Table (5) listed data expressed as mean for study responders (T-score, HFR, MOR) according to BMI. The mean T-score was -1.89, the mean FRAX hip fracture risk was 2.5, and the mean FRAX major osteoporotic risk was 5.99. ANOVA/Fisher's exact test was conducted to show an association between study groups (T-score, hip fracture risk, major osteoporotic risk) and BMI. There was a significant association between them (p-value ≤ 0.05). Data expressed as mean for study responders (T-score, HFR, and MOR) according to glucocorticoids.

**Table 5: Base line characteristics T-score, HFR, MOR according to BMI.**

| | | N | Mean | Std. Error | 95% Confidence Interval for Mean | | p-value |
|---|---|---|---|---|---|---|---|
| | | | | | Lower Bound | Upper Bound | |
| **T-score** | Healthy | 29 | -2.4138 | .21339 | -2.8509 | -1.9767 | 0.011 |
| | Over weight | 66 | -2.0242 | .18211 | -2.3880 | -1.6605 | |
| | Obese | 113 | -1.8434 | .09548 | -2.0325 | -1.6542 | |
| | severly obese | 42 | -1.4690 | .20045 | -1.8739 | -1.0642 | |
| **Hip fracture risk** | Hea;thy | 29 | 4.790 | 1.7283 | 1.249 | 8.330 | 0.001 |
| | Over weight | 65 | 3.429 | .6316 | 2.167 | 4.691 | |
| | Obese | 113 | 1.858 | .2381 | 1.386 | 2.329 | |
| | severly obese | 42 | 1.245 | .2341 | .772 | 1.718 | |
| **Major osteoporotic risk** | Hea;thy | 29 | 7.766 | 1.9758 | 3.718 | 11.813 | 0.047 |
| | Over weight | 66 | 7.129 | .8296 | 5.472 | 8.786 | |
| | Obese | 113 | 5.329 | .4097 | 4.517 | 6.141 | |
| | severely obese | 42 | 4.771 | .5655 | 3.629 | 5.913 | |
| | Total | 250 | 5.993 | .3821 | 5.241 | 6.746 | |
| **p-value $\leq 0.05$ was significant.** | | | | | | | |

Table (6) shows that a t-test was conducted to show an association between study groups (T-score, hip fracture risk, and major osteoporotic risk) and glucocorticoids. There is no significant association between study group and Glucocorticoids.

**Table 6:Base line characteristics of study group according to Glucocorticoids.**

| Glucocorticoids | | N | Mean | Std. Error Mean | 95% Confidence Interval of the Difference | | p-value |
|---|---|---|---|---|---|---|---|
| | | | | | Lower | Upper | |
| **T-score** | yes | 45 | -1.6800 | .17465 | -.13890 | .66183 | 0.200 |
| | No | 205 | -1.9415 | .08717 | -.12806 | .65098 | |
| **Major osteoporotic risk** | yes | 45 | 7.124 | .8818 | -.5754 | 3.3345 | 0.166 |
| | No | 205 | 5.745 | .4228 | -.5730 | 3.3321 | |
| **Hip fracture risk** | yes | 45 | 2.649 | .5468 | -1.3164 | 1.6651 | 0.818 |
| | No | 205 | 2.475 | .3342 | -1.1008 | 1.4496 | |

Table (7) shows data expressed as mean for study responders (T-score, HFR, and MOR) according to Rheumatoid arthritis. This table shows that a t-test was conducted to show an association between study groups (T-score, hip fracture risk and major osteoporotic risk) and rheumatoid arthritis. There was a not significant association between study group and rheumatoid arthritis.

**Table 7: Base line characteristics of study group according to Rheumatoid arthritis**

| Rheumatoid arthritis | | N | Mean | Std. Error Mean | 95% Confidence Interval of the Difference | | p-value |
|---|---|---|---|---|---|---|---|
| | | | | | Lower | Upper | |
| **T-score** | yes | 56 | -1.9036 | 1.19270 | -0.38197 | 0.35834 | 0.950 |
| | No | 194 | -1.8918 | 1.25175 | -0.37517 | 0.35154 | |
| **Major osteoporotic risk** | yes | 56 | 6.989 | 6.2844 | -0.5177 | 3.0850 | 0.162 |
| | No | 194 | 5.706 | 5.9543 | -0.5898 | 3.1570 | |
| **Hip fracture risk** | yes | 56 | 2.861 | 4.2533 | -0.9152 | 1.8304 | 0.512 |
| | No | 193 | 2.403 | 4.6846 | -0.8540 | 1.7692 | |

Table (8) shows data expressed as mean for study responders (T-score, HFR, and MOR) according to secondary osteoporosis. This table shows that a test was conducted to show an association between study groups (T-score, hip fracture risk, and major osteoporotic risk) and secondary osteoporosis. There was a not significant association between study group and secondary osteoporosis.

**Table 8:Base line characteristics of study group according to Secondary osteoporosis.**

| Secondary osteoporosis | | N | Mean | Std. Error Mean | 95% Confidence Interval of the Difference | | p-value |
|---|---|---|---|---|---|---|---|
| | | | | | Lower | Upper | |
| **T-score** | yes | 42 | -1.7881 | 0.19907 | -0.28471 | 0.54025 | 0.542 |
| | No | 208 | -1.9159 | 0.08510 | -0.30577 | 0.56131 | |
| **Major osteoporotic risk** | yes | 42 | 5.588 | 0.9405 | -2.5027 | 1.5289 | 0.635 |
| | No | 208 | 6.075 | 0.4189 | -2.5474 | 1.5736 | |
| **Hip fracture risk** | yes | 42 | 2.417 | 0.7338 | -1.6394 | 1.4245 | 0.890 |
| | No | 207 | 2.524 | 0.3172 | -1.7080 | 1.4930 | |

## DISCUSSION:

Osteoporosis is a preventable bone disorder, and is considered one of the main causes of disability and death in geriatric patients. The Primary Health Care (PHC) centers represent the cornerstone for the diagnosis and management of osteoporosis [14]. Relationship between FRAX mean and bone mineral density, the FRAX score was higher in osteoporosis group, about 6.0 for HFR and 10.8 for MOR as mean values compared to (1.1 for HFR ,4.3 for MOR) in the osteopenia group and (0.4 for HFR ,2.7 for MOR) in the normal BMD. So, this agreement with other study [19] bone mineral density (BMD) is a measure used for assessing fracture risk in bones and to predict osteoporosis. Increased bone fragility is correlated with lower BMD values [20]. FRAX assessment tool was introduced at WHO center in Sheffield for calculation of a 10-yr risk of major osteoporotic fracture and hip fractures with and without BMD by adding 10 risk factors as questionnaire, the National Osteoporosis Foundation (NOF) defined threshold values for deciding treatment for hip fractures at ≥3% and major osteoporotic fractures at ≥20%. In the current study, we calculated FRAX tool value with BMD via T-score measurement. In the current study, the Receiver Operating Characteristic curve (ROC) has been used to find the sensitivity and specificity of FRAX hip fracture risk test. The AUC was 0.937 with a 95% confidence interval (0.908-0.966). The cutoff value was 2.2%, estimated by the ROC curve. At this cutoff value, the sensitivity was 98%, the specificity was 84%, In the current study the AUC was higher compared with other study as the Canadian FRAX mode, which had AUC 0.830 [18] and Japanese FRAX model, which had AUC 0.789 [15] so this.

means that the FRAX score (HFR) is considered a useful tool to differentiate between true positive and false positive values, depending on the area under the curve (AUC), which was within excellent range of 0.937. Current study shows agreement between FRAX scores (MOR, HFR) with age, 10-year prediction of major osteoporotic fracture and hip fracture increased with increase in age; and this was approved by equation y=3.32+0.16x, y=1.46+0.07x respectively. Fracture percentage at age 40 was 3% and at age 90 was approximately 10% for MOR. Fracture percentage at age 40 was 1%, at age 90 was approximately 5% for HFR. This result is consistent with other studies [19,21] .The current reference standard for diagnosing osteoporosis is bone mineral density (BMD) evaluated by dual X-ray absorptiometry (DXA), since BMD is one of the most powerful predictors of fracture risk [8]. In the present study, T-score values toward normal, the percentage of FRAX major osteoporotic fracture risk and FRAX hip fracture risk were the lowest, and this was approved by equation y=-1.09-0.13x, y=-1.48-0.17x respectively. Many authorities worldwide use BMD-based criteria as intervention thresholds, whereas a T-Score threshold of -2.5 SD was a strong risk factor for fracture with advancing age. More patients were distributed within 60-69 years age group. Number of female more than male (85.6% vs 14.4), and patients was highest as obese 113 with 45.2%. The percentage of smoker was 10% among patients. Regarding patients according to family and medical history, most of them were negative history within this sample size.

The mean T-score among patients was within the osteopenia range (-1.89). This agrees with another study [22] and the highest osteopenia mean among those 80 years and older, which explains the increasing risk of osteoporosis with increasing age. The mean HFR and MOR were 2.5 and 5.99, respectively. The highest mean HFR and MOR were among the 60-69 age group (3.688 and 8.318, respectively). The mean MOR result nearly agrees with the Japanese study [(15)] .The ANOVA test was applied, which revealed a significant association between T-score, hip fracture risk, major osteoporotic risk, and age (p-value = 0.047, 0.01, and 0.001, respectively). Age is considered a risk factor for osteoporosis and subsequent fracture, mainly in menopausal women [(3)]. This result is in agreement with another study [(15)]. Regarding baseline characteristics of the study group according to sex, the t-score mean of each sex was within the osteopenia range (male -1.35, female -1.98). There was a significant agreement between t-score and sex (p-value < 0.05). FRAX mean for both sexes was lower than the threshold. There is no significant association regarding FRAX risk and sex and this agreement with the Canadian study [(18)], sex is considered a risk factor for osteoporosis and femoral fracture risk (both men and women). In female sex, following menopause or surgical removal of the ovaries, estrogen shortage is associated with a rapid loss in bone mineral density, whereas in men, a decrease in testosterone levels has a comparable (but less significant) effect [(16)].

Approximately 10% for MOR. Fracture percentage at age 40 was 1%, and at age 90 it was approximately 5% for HFR. This result is consistent with other studies [19,21]. Approximately 10% for MOR. Fracture percentage at age 40 was 1%, and at age 90 it was approximately 5% for HFR. This result is consistent with other studies [(19,21)]. The number of females was more than males (85.6% vs. 14.4%), and the patients were highest as obese, 113 with 45.2%. The percentage of smokers was 10% among patients. Regarding patients, according to family and medical history, most of them were negative history within this sample size. The mean T-score among patients was within the osteopenia range (-1.89), in agreement with another study [(22)], and the highest osteopenia mean was among those 80 years and older, which explains the increasing risk of osteoporosis with increasing age. The mean HFR and MOR were 2.5 and 5.99, respectively. The highest mean HFR and MOR were among the 60-69 age group (3.688 and 8.318, respectively). The mean MOR result nearly agrees with the Japanese study [(15)].

The ANOVA test was applied, which revealed a significant association between T-score, hip fracture risk, major osteoporotic risk, and age (p-value = 0.047, 0.01, and 0.001), respectively. Age is considered a risk factor for osteoporosis and subsequent fracture, mainly in menopausal women ([3]); this result is in agreement with another study [(15)]. The T-score mean according to BMI was in an osteopenia range, and the highest value was osteopenia (-2.4) in normal BMI (18.5-24.9 kg/m). FRAX mean for HFR and MOR was lower than the threshold of 2.5 and 5.9, respectively. Nutrition has an essential and complex function in maintaining healthy bones, including normal vitamin D and calcium; people who are overweight have a lower risk of osteoporosis [(16,17)]. In the current study, our patients were distributed as obese (113), with 45% related to nutritional and economic improvement in our country. This result showed a significant association between BMI and T-score, HFR, and MOR (p-value was 0.011, 0.001, and 0.047, respectively), and this agrees with a Canadian study [(18)]. The current study shows that a high number of patients had a negative history regarding parameters (glucocorticoids, rheumatoid arthritis, secondary osteoporosis), and there is no significant agreement between these parameters with study group a. This result may be due to negative data collected from patient questionnaires or may be due to the good nutritional state of the individuals protecting them from complications of a positive patient history.

**Limitation of study:**

There was difficult to verify information from patients regarding family and medical history.

## CONCLUSION:

In conclusion, FRAX hip fracture risk was able to differentiate between subjects who are at risk for 10-year fracture or not in my patients aged 40-90 years. FRAX hip fracture risk and major osteoporotic risk were statistically useful to determine T-score value. Age and body mass index were significantly related to FRAX risk, while other variables taken by the study showed no significant differences.

**Conflicts of interest**

The authors declare no conflict of interest.

**Authors' Contributions**

**Author 1 prepared the manuscript and contributed to data collecting and study design. The statistical analysis was carried out by Author 2, and the completed version was reviewed and approved by all authors.**

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