*healthcare*

MDPI

*Article*

# Knowledge and Practice toward DEXA Scan among Women in Jazan City, Saudi Arabia

**Turki M. Dhayihi *, Nawaf F. Haqawi, Sarah A. Hakami, Fahad M. Harthi, Sarah H. Moafa, Yahya M. Alawi, Yazeed B. Abutaleb, Nadim I. Areshy and Ali M. Hendi**

Radiology Department, Faculty of Medicine, Jazan University, Jazan 45142, Saudi Arabia; nawafhaqawi@outlook.com (N.F.H.); sss0sss2001@gmail.com (S.A.H.); fahadharthi59@gmail.com (F.M.H.); sarhhhsn19@hotmail.com (S.H.M.); sirya021@gmail.com (Y.M.A.); abutalebyaz@gmail.com (Y.B.A.); moonar07@gmail.com (N.I.A.); dr.hendi@gmail.com (A.M.H.)

* Correspondence: tdhayihi@jazanu.edu.sa

**Abstract:** ***Background***: Osteoporosis, characterized by reduced bone mass and increased fracture risk, presents a significant public health challenge. Dual-energy X-ray Absorptiometry (DEXA) scans offer a reliable means of assessing bone mineral density (BMD) and detecting osteoporosis. ***The aim*** of this study is to assess awareness, attitude, and practice of women in the Jazan region toward DEXA scan. ***Methods***: Data were collected through a self-administered online questionnaire. Statistical analysis was conducted using SPSS version 29.0. The total knowledge scores of participants were calculated to assess potential associations with sociodemographic data. A *p*-value of less than 0.05 was considered statistically significant. ***Results***: Among 400 women, 230 (57.5%) had low knowledge scores primarily due to poor knowledge of the DEXA scan procedure. Merely 39 women had undergone a DEXA scan mainly due to medical prescription ($n$ = 22, 56.4%). Total knowledge scores were significantly higher among women with high monthly incomes ($p$ = 0.019) and those working in medical-related jobs ($p$ = 0.017). ***Conclusions***: This study underscores the need for targeted interventions to improve awareness of DEXA scans among women in Jazan City. Additionally, the findings suggest that socioeconomic factors may influence awareness levels, emphasizing the importance of tailored educational strategies to reach diverse demographics.

**Keywords:** osteoporosis; DEXA scan; menopause; women; Jazan; Saudi Arabia

check for updates

**Citation:** Dhayihi, T.M.; Haqawi, N.F.; Hakami, S.A.; Harthi, F.M.; Moafa, S.H.; Alawi, Y.M.; Abutaleb, Y.B.; Areshy, N.I.; Hendi, A.M. Knowledge and Practice toward DEXA Scan among Women in Jazan City, Saudi Arabia. *Healthcare* **2024**, *12*, 1459. https://doi.org/10.3390/healthcare12151459

Academic Editor: Abdel-Latif Mohamed

Received: 13 May 2024
Revised: 12 July 2024
Accepted: 20 July 2024
Published: 23 July 2024

**Copyright:** © 2024 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (https://creativecommons.org/licenses/by/4.0/).

## 1. Introduction

Osteoporosis is a prevalent condition characterized by a widespread decrease in bone mass, leading to weakened bones and an increased risk of fractures [1]. Dual-energy X-ray Absorptiometry (DEXA) is a method used to evaluate bone mineral density (BMD), and osteoporosis is diagnosed when the BMD T-score falls 2.5 or more standard deviations below the average of a young adult reference population. Approximately 40% of postmenopausal women of Caucasian descent experience osteoporosis, and given the aging demographic, this figure is projected to steadily rise in the coming years [2–4]. In Saudi Arabia, a few studies have estimated the prevalence of osteoporosis among adults ranging from 23.4% to 39.5%. However, most of these studies date back more than 15 years [5,6]. The most recent estimate of osteoporosis in Saudi Arabia is 52.8% of women and 63.6% of men in a hospital-based setting However, this was a screened population with a probable indication [7]. According to the International Osteoporosis Foundation, osteoporosis affects more than 200 million women worldwide, and one in three women over 50 will experience osteoporotic fractures [8]. The incidence of femur fractures caused by osteoporosis is approximately 4950/100,000 people-year for all individuals in Saudi Arabia [9]. Fractures resulting from osteoporosis significantly affect the quality of life, causing pain, limited mobility, and feelings of depression. Furthermore, mortality rates are elevated

following hip or vertebral fractures associated with osteoporosis [10]. National Osteoporotic Foundation, USA and the national consensus group on osteoporosis for the Middle East and North Africa have identified several major risk factors for low BMD, including premature menopause; low physical activity; a family history of fractures; a personal history of fracture as an adult; cigarette smoking; alcohol consumption; thin build; use of oral glucocorticosteroid therapy for three months or longer; or a history of rheumatoid arthritis, thyroid disease, or liver disease [11–13]. The DEXA scan offers several advantages that make it a valuable tool in clinical practice. One of the primary advantages is its low radiation exposure to the patient, which is approximately 90% less than that of a standard chest radiograph [14]. This feature enhances the safety profile of the DEXA scan, making it suitable for repeated use in monitoring BMD over time [15]. Additionally, DEXA scan provides accurate results with a low scanning period, making it time-efficient and convenient for both patients and healthcare providers [16]. Overall, the advantages of the DEXA scan, including its safety, accuracy, efficiency, and utility in assessing BMD, underscore its significance in clinical settings. Numerous studies have been conducted that have assessed the knowledge of osteoporosis, particularly among women, and most of the sample population had a fair level of knowledge about osteoporosis [17]. In contrast, there has been insufficient research carried out in Jazan City that assesses awareness of the DEXA scan as a screening tool for osteoporosis, and with this research, we aimed to fill that void and direct future work on the same theme. The significance here lies in understanding the general public's awareness and knowledge regarding the use of the DEXA scan as a screening tool for osteoporosis. By assessing public awareness, this study can identify gaps in knowledge and misconceptions, thereby informing targeted educational campaigns and interventions to improve understanding and promote the importance of the DEXA scan as a screening tool. Ultimately, enhancing public awareness can lead to early detection, timely treatment, and improved overall bone health outcomes in the population. So, the aim of this study is to assess the general public's awareness and knowledge regarding the use of the DEXA scan as a screening tool for osteoporosis.

## 2. Materials and Methods

### *2.1. Study Design: Cross-Sectional Study*

Study setting: This study was carried out in the Jazan region, including its 14 governorates, which is located on the Red Sea coast in Saudi Arabia's southwest corner, with the number of women in Jazan City at about 601,500.

### *2.2. Study Population*

- Inclusion criteria: All women aged 18 years and above were informed about the requirements of this study, and those living in Jazan communities and use Arabic language were selected.
- Exclusion criteria: Individuals who refused to participate or failed to complete the questionnaires, women less than age of 18, non-Jazan women, or those who did not use Arabic language were excluded from this study.

### *2.3. Method and Data Collection*

Sampling method: Convenience sampling in a nonrandom fashion.

Sample size calculation: Estimating that the number of women in Jazan City is 601,500, the sample size was thus 420 using http://www.raosoft.com/samplesize.html (accessed on 20 February 2024) with a 95% confidence interval, 5% margin of error, and a 10% nonresponse rate. The underlying assumption for this calculation is that the characteristic being assessed has a prevalence of 50%.

Data were collected through an online validated questionnaire sent to the participants by the authors. The questionnaire was designed to assess the level of public awareness and practices among women in Jazan City concerning bone health and DEXA scans. It included 18 questions about knowledge of DEXA scans and bone health, as well as 3 questions about

practices regarding DEXA scans. Participants were recruited through various channels, including social media, community groups, and local organizations, ensuring a wide reach within the Jazan region.

### 2.4. Ethical Consideration

All potential participants were informed about the objectives of this study at the beginning of the questionnaire. They were assured that no harm is expected to occur if they decide to participate in this study. Data were anonymously collected and kept secure. Their consent to participate was requested in a writing form at a mandatory section at the beginning of the questionnaire. Ethical approval from Jazan University Research Ethic Committee (HAPO-10-Z-001) was taken.

### 2.5. Statistical Analysis Plan

This study aims to assess the level of public awareness and practices among women in Jazan City concerning bone health and DEXA scans. Additionally, it aims to identify the factors that influence their knowledge about DEXA scans.

The analysis comprised both descriptive and inferential statistical methods. Since all variables are categorical, frequencies and percentages were utilized to describe their distribution. The survey included 18 questions to examine women's knowledge about DEXA scans (8 questions) and bone health (10 true or false questions). For the knowledge score, represented as a continuous variable, medians and interquartile ranges are provided. Additionally, participants were asked about their practices regarding DEXA scans through three questions. To assess significant differences in participants' knowledge scores based on sociodemographic features, the Mann–Whitney test (for two independent groups) and the Kruskal–Wallis test (for more than three groups) were utilized. Nonparametric tests were chosen due to the nonnormal distribution of the numeric variables, as confirmed by the Shapiro–Wilk test ($p < 0.05$). Statistical significance was determined at a $p$-value less than 0.05, with a 95% confidence interval. Data entry and analysis were performed using IBM SPSS version 29.

## 3. Results

Our study aims to evaluate women's knowledge and practices concerning DEXA scans in Jazan City, Saudi Arabia. A total of 400 women consented to participate in this study. The majority fell within the 18–25 age bracket ($n$ = 184, 46.0%), although women of other age groups were also found. A significant proportion held a university degree ($n$ = 263, 65.8%); however, a considerable number were unemployed ($n$ = 251, 62.7%), with 47.4% of participants reporting a monthly household income of 5000 Saudi Riyal or below ($n$ = 177), while the remainder earned more than 5000 Saudi Riyal. The marital status was almost evenly distributed between single ($n$ = 189, 47.3%) and married ($n$ = 181, 45.3%) participants, with the remaining being divorced or widowed. Among the married participants ($n$ = 211), over half reported having been pregnant more than three times ($n$ = 117, 55.5%), and a majority relied on alternative feeding methods for their babies aside from breastfeeding ($n$ = 139, 65.8%) (Table 1).

The survey comprised 18 questions assessing participants' knowledge. Those who correctly answered 10 questions or more were considered as highly knowledgeable, and vice versa. Overall, the knowledge scores of the 400 participants were below average, with a mean score of 8.96 and a median score of 9. Upon further classification, only 170 participants (42.5%) demonstrated a high level of knowledge by answering 10 or more questions about DEXA scans, while the majority 230 (57.5%) exhibited low knowledge of the topic by correctly answering 9 or fewer questions (Table 2).

**Table 1.** Sociodemographic Data (*n* = 400).

| Variable: | | *n* (%) |
|---|---|---|
| Age (years) | 18–25 | 184 (46.0) |
| | 26–35 | 60 (15.0) |
| | 36–45 | 84 (21.0) |
| | 46–55 | 54 (13.5) |
| | 56–65 | 18 (4.5) |
| Education | Primary | 14 (3.5) |
| | Intermediate | 13 (3.3) |
| | Secondary | 92 (23.0) |
| | Bachelor's | 263 (65.8) |
| | Postgraduate | 18 (4.5) |
| Marital status | Single | 189 (47.3) |
| | Married | 181 (45.3) |
| | Divorced | 17 (4.3) |
| | Widow | 13 (3.3) |
| Number of pregnancies (*n* = 211) | No | 25 (11.8) |
| | 1 | 30 (14.2) |
| | 2 | 39 (18.5) |
| | ≥3 | 117 (55.5) |
| Number of breast-fed children (*n* = 211) | 0 | 139 (65.8) |
| | 1 | 26 (12.3) |
| | 2 | 9 (4.5) |
| | ≥3 | 37 (17.4) |
| Employment status | Unemployed | 251 (62.7) |
| | Self-employed | 12 (3.0) |
| | Working in a medical field | 41 (10.3) |
| | Working in a nonmedical field | 96 (24.0) |
| Monthly income (SAR) | ≤5000 | 177 (47.2) |
| | 5000–10,000 | 73 (19.5) |
| | 10,000–15,000 | 62 (16.5) |
| | ≥15,000 | 27 (7.2) |

*n*: frequency, %: percentage.

**Table 2.** Knowledge Level of Participants (*n* = 400).

| | Mean (SD) | Median (IQR) |
|---|---|---|
| Sum Knowledge Score | 8.96 (2.45) | 9.00 (7–11) |
| Knowledge Level | High | Low |
| *n* (%) | 170 (42.5) | 230 (57.5) |

*n*: frequency, %: percentage, IQR: interquartile range.

Women's knowledge about bone health was evaluated, and their responses are summarized in Table 3. Most women recognized that osteoporosis affects both men and women (*n* = 375, 93.8%); it can be exacerbated by high caffeine and low calcium intake (*n* = 370, 92.5%). Additionally, many participants understood that premature menopause typically leads to increased bone loss (*n* = 330, 82.5%) and recognized the importance of calcium intake for women not taking estrogen (*n* = 328, 82%). Furthermore, a substantial proportion acknowledged the availability of treatment options for osteoporosis (*n* = 282, 70.5%) and the positive impact of activities like walking (*n* = 240, 60%) and high-impact exercise (*n* = 225, 56.3%) on bone health, as the decline in bone mass starts after the age of 30 (*n* = 240, 60%). However, fewer participants were aware that lower-weight women are more susceptible to osteoporosis than heavier women (*n* = 160, 40%), and that hormonal replacement therapy after menopause can mitigate bone loss (*n* = 144, 36%).

**Table 3.** Knowledge Regarding Bone Health ($n$ = 400).

| | Question: | Correct Answer | *n* (%) |
|---|---|---|---|
| 1. | Osteoporosis affects both men and women | True | 375 (93.8) |
| 2. | High caffeine and low calcium intake increase risk of osteoporosis | True | 370 (92.5) |
| 3. | Normally bone loss speed-up after menopause | True | 330 (82.5) |
| 4. | After menopause, women not on estrogen need about 1500 mg of calcium (5 glasses of milk) daily | True | 328 (82.0) |
| 5. | There are treatments for osteoporosis after it develops | True | 282 (70.5) |
| 6. | Most people gain bone mass after the age of 30 | False | 240 (60.0) |
| 7. | Walking has a great effect on bone health | True | 240 (60.0) |
| 8. | High impact exercise improves bone health | True | 225 (56.3) |
| 9. | Lower-weight women have osteoporosis more than heavier women | True | 160 (40.0) |
| 10. | Replacing hormones after menopause cannot slow down bone loss | False | 144 (36.0) |

*n*: frequency, %: percentage.

Women were also assessed for their knowledge about DEXA scans, as presented in Table 4. Overall, a poor level of knowledge was observed regarding this topic. Only 43% ($n$ = 172) of participants had heard of DEXA scans. Merely 24.3% ($n$ = 97) were aware that DEXA scans are primarily used to assess bone density. Additionally, only 5% ($n$ = 20) knew that DEXA scans are recommended for individuals aged 65 years or older. Furthermore, very few participants were aware that medical conditions such as postmenopausal status, family history of osteoporosis, history of fractures, and glucocorticoid use necessitate a DEXA scan for assessing bone mass density ($n$ = 131, 32.8%). Only a minority knew that patients should remove any jewelry or metallic objects before the start of the procedure ($n$ = 100, 25%), and that the procedure requires the patient to lie on the table while the scanner passes over the body ($n$ = 76, 19%). The highest level of knowledge was about the scan's contraindications such as pregnancy, recent nuclear medicine, and presence of any metallic implants ($n$ = 242, 60.6%).

Regarding women's practices toward DEXA scans, only 9.8% ($n$ = 39) had undergone the procedure, while 90.2% ($n$ = 361) had not. Among those who underwent the procedure, 22 (56.4%) reported that it was recommended by a doctor, while only 2 (5.2%) were advised by a family member or a friend. Three women (7.7%) had a history of fractures and wanted to know their BMD, and the remaining 12 (30.7%) had other reasons for undergoing the scan. Among those who did not undergo the DEXA scan, the reasons included lack of awareness about the procedure ($n$ = 162, 44.8%), it was not recommended by a doctor ($n$ = 167, 46.3%), inaccessibility of the service ($n$ = 23, 6.3%), fear ($n$ = 5, 1.4%), or the high cost of the procedure ($n$ = 4, 1.2%) (Table 5).

The results of the analysis revealed significant associations between participants' knowledge scores and some sociodemographic features (Table 6). Specifically, employment status ($p$ = 0.017) and monthly household income ($p$ = 0.019) showed significant associations with knowledge scores. Women employed in medical-related jobs demonstrated higher knowledge scores regarding DEXA scans and bone health, with a median score of 10 and an interquartile range (IQR) of 7.50–12, while unemployed women had the lowest knowledge scores with a median of 9.00 and an IQR of 7.00–10.00. Similarly, participants with higher monthly household incomes (10,000–15,000 SAR) exhibited greater knowledge scores, with a median score of 10 and an IQR of 8–11, whereas women with a low income (<5000 SAR) had the lowest knowledge score of 8.00 with an IQR of 7.00–10.00. Conversely, factors such as age, education level, marital status, the number of pregnancies, and the number of

breastfed infants did not show significant associations with knowledge scores regarding DEXA scans ($p > 0.05$).

**Table 4.** Knowledge Regarding DEXA Scan ($n$ = 400).

| | Question: | Correct Answer | *n* (%) |
|---|---|---|---|
| 11. | Have you heard about DEXA scan before? | Yes | 172 (43.0) |
| 12. | What is the primary purpose of DEXA scan? | To assess bone density | 97 (24.3) |
| 13. | What is the recommended age for DEXA scan? | 65 and above | 20 (5.0) |
| 14. | What medical conditions required DEXA scan screening? | - Postmenopausal women<br>- Family history of osteoporosis<br>- History of fractures<br>- Glucocorticoid use | 131 (32.8) |
| 15. | What precautions that person should take before undergoing DEXA scan? | Removing metal objects or jewelry | 100 (25.0) |
| 16. | What does a DEXA scan procedure involve? | Lying on the table while the scanner passes over the body | 76 (19.0) |
| 17. | How frequently should individuals with normal bone mineral density undergo DEXA scans for routine screening? | Every 3–5 years | 53 (13.3) |
| 18. | What conditions prevent someone from undergoing DEXA scan? | - Pregnancy<br>- Recent nuclear medicine<br>- Metal implants | 242 (60.6) |

*n*: frequency, %: percentage.

**Table 5.** Practices Toward DEXA Scan ($n$ = 400).

| | Question: | | *n* (%) |
|---|---|---|---|
| 1. | Did you preform DEXA scan before? | Yes | 39 (9.8) |
| | | No | 361 (90.2) |
| 2. | If yes, why? ($n$ = 39) | Doctor prescribed it | 22 (56.4) |
| | | Friend or family member suggested for me | 2 (5.2) |
| | | Had history of fracture and wanted to know bone mineral density | 3 (7.7) |
| | | Other causes | 12 (30.7) |
| 3. | If no, why? ($n$ = 361) | Lack of awareness | 162 (44.8) |
| | | Cost of procedure | 4 (1.2) |
| | | Wasn't recommended by doctor | 167 (46.3) |
| | | Accessibility issues | 23 (6.3) |
| | | Fear | 5 (1.4) |

*n*: frequency, %: percentage.

**Table 6.** Relationship Between Sociodemographic Data and Knowledge Scores of Participants.

| Variable: | | Median (IQR) | *p*-Value * |
|---|---|---|---|
| Age (years) | 18–25 | 9.00 (7.00–11) | 0.564 |
| | 26–35 | 9.00 (7.00–10.75) | |
| | 36–45 | 9.00 (7.00–11) | |
| | 46–55 | 9.50 (8.00–11.00) | |
| | 56–65 | 9.50 (6.00–10.00) | |
| Education | Primary | 8.00 (4.75–9.50) | 0.111 |
| | Intermediate | 8.00 (6.50–10.00) | |
| | Secondary | 9.00 (7.00–10.00) | |
| | Bachelor's | 9.00 (7.00–11.00) | |
| | Postgraduate | 10.50 (7.00–12.00) | |

**Table 6.** *Cont.*

| Variable: | | Median (IQR) | *p*-Value * |
|---|---|---|---|
| Marital status | Single | 9.00 (7.00–11.00) | 0.784 |
| | Married | 9.00 (7.00–11.00) | |
| | Divorced | 9.00 (7.50–10.50) | |
| | Widow | 9.00 (7.00–10.00) | |
| Number of pregnancies | No | 9.00 (7.00–11.00) | 0.351 |
| | 1 | 9.00 (7.00–11.00) | |
| | 2 | 9.00 (7.00–11.00) | |
| | ≥3 | 9.00 (7.00–11.00) | |
| Number of breast-fed children | 0 | 9.00 (7.00–11.00) | 0.228 |
| | 1 | 8.00 (6.75–11.25) | |
| | 2 | 9.00 (7.50–12.00) | |
| | ≥3 | 8.00 (6.50–10.50) | |
| Employment status | Unemployed | 9.00 (7.00–10.00) | 0.017 |
| | Self-employed | 9.00 (7.25–10.00) | |
| | Working in a medical field | 10.00 (7.50–12.00) | |
| | Working in a non-medical field | 10.00 (7.25–11.0) | |
| Monthly income (SAR) | ≤5000 | 8.00 (7.00–10.00) | 0.019 |
| | 5000–10,000 | 9.00 (7.00–10.00) | |
| | 10,000–15,000 | 10.00 (8.00–11.00) | |
| | ≥15,000 | 9.00 (7.00–11.00) | |

*: Kruskal Wallis test, IQR: Inter-Quartile Range.

The potential associations between DEXA scan performance and participants' sociodemographic data were explored. Only age showed a significant association with DEXA scan performance ($p = 0.043$), with older women in the age groups of 46–55 and 56–65 being more likely to have undergone a DEXA scan (16.7% and 22.2%, respectively) compared with other age groups. Other sociodemographic data did not show any significant associations with DEXA scan performance among participants (Table 7).

**Table 7.** Associations Between Sociodemographic Data and Practices Toward DEXA scan.

| Variable: | | Did You Perform DEXA Scan before? | | *p*-Value |
|---|---|---|---|---|
| | | Yes | No | |
| Age (years) | 18–25 | 13 (7.1) | 171 (92.9) | 0.043 [f] |
| | 26–35 | 3 (5.0) | 57 (95.0) | |
| | 36–45 | 10 (11.9) | 74 (88.1) | |
| | 46–55 | 9 (16.7) | 45 (83.3) | |
| | 56–65 | 4 (22.2) | 14 (77.8) | |
| Education | Primary | 1 (7.1) | 13 (92.9) | 0.167 [f] |
| | Intermediate | 1 (7.7) | 12 (92.3) | |
| | Secondary | 14 (15.2) | 78 (84.8) | |
| | Bachelor's | 20 (7.6) | 243 (92.4) | |
| | Postgraduate | 3 (16.7) | 15 (83.3) | |
| Marital status | Single | 16 (8.5) | 173 (91.5) | 0.635 [f] |
| | Married | 19 (10.5) | 162 (89.5) | |
| | Divorced | 2 (11.8) | 15 (88.2) | |
| | Widow | 2 9 (5.4) | 11 (84.6) | |
| Employment status | Unemployed | 19 (7.6) | 232 (92.4) | 0.084 [f] |
| | Self-employed | 1 (8.3) | 11 (91.7) | |
| | Working in a medical field | 3 (7.3) | 38 (92.7) | |
| | Working in a non-medical field | 16 (16.7) | 80 (83.3) | |
| Monthly income (SAR) | ≤5000 | 4 (5.3) | 71 (94.7) | 0.216 [c] |
| | 5000–10,000 | 12 (9.2) | 118 (90.8) | |
| | 10,000–15,000 | 14 (14.7) | 81 (85.3) | |
| | ≥15,000 | 9 (9.0) | 91 (91.0) | |

f: fisher's exact test, c: chi-square test.

## 4. Discussion

Osteoporosis is a major public health concern especially with the increase in elderly population; its prevalence increases with age, as, for women, it increases from 2% at 50 years to 25% at 80 years [18]. Osteoporosis prevalence in the Kingdom of Saudi Arabia (KSA) was estimated to be 63.3% in men and 58.4% in women; these numbers demonstrate a huge burden of osteoporosis on the healthcare system [7]. Normally, by the third decade of life, bone resorption starts to exceed bone formation, which results in a net loss of bone mass leading to an increased bone fragility and risk of fracture [19]. Osteoporosis is a silent disease that goes undiagnosed until complications occur, mainly osteoporotic fragility fractures caused by minor trauma as a result of the BMD; the fragility fractures mainly affect the spine, forearm, hip, and shoulder [18].

Diagnosis of osteoporosis was made by a BMD radiological study using DEXA assessment [20]. However, given the nature of the disease and its late presentation, screening is crucial to decrease the incidence of complications. According to the U.S. Preventive Services Task Force (USPSTF), all women aged 65 years and older should be screened, preferably using DEXA of the hip and lumbar spine [21]. Thus, in this community-based cross-sectional study, we assessed the awareness of the women of Jazan City toward the DEXA scan and the reasons determining their practices.

According to our results, the majority of responders had good knowledge about bone health, with most women knowing that osteoporosis affects both men and women ($n$ = 375, 93.8%), and that high caffeine and low calcium intake increase the risk of osteoporosis ($n$ = 370, 92.5%). On the other hand, the lowest level of knowledge was about postmenopausal hormonal therapy with most women not realizing its role in slowing down bone loss ($n$ = 256, 64.0%). This is consistent with the results of A. Alamri et al. who studied the knowledge, attitude, and practice of Saudi population toward osteoporosis, with most participants showing a fair level of knowledge with a significantly higher level of knowledge among women compared with men [22]. Our findings are also consistent with what was previously reported by Al-Rawi et al., which was a cross-sectional study assessing the knowledge and awareness among the Saudi residents regarding the DEXA scan and osteoporosis [8]. They reported that most of the participants have a good level of knowledge regarding bone health and the DEXA scan. Although that study included men and women, there was a significant difference in the level of knowledge between the two sexes, with women showing a higher level of knowledge [8]. They also stated that most participants have not heard about the DEXA scan, which is similar to our findings. However, in contrast to Al-Rawi et al., we assessed the knowledge about the DEXA scan separately, and we found that most women had generally a low level of knowledge about the DEXA scan, with the highest level of knowledge being about the scan's contraindications such as pregnancy, recent nuclear medicine, and presence of any metallic implants ($n$ = 239, 60.6%), while the lowest level of knowledge being about the recommended age for the DEXA scan, which is 65 years old or above ($n$ = 20, 5.0%). These findings emphasize the urgent need for awareness campaigns for women to increase their knowledge about the importance of osteoporosis screening in general and the role of hormonal therapy for postmenopausal women to lower the incidence of osteoporosis complications and reduce its burden on the healthcare system.

Upon assessing women's practice toward the DEXA scan in Jazan, we found that most women had not undergone a DEXA scan before ($n$ = 361, 90.2%). However, most of the participants were young, but we found that the primary reasons were that it was not recommended by a doctor ($n$ = 167, 46.3%) or due to a lack of awareness about the procedure ($n$ = 162, 44.8%). These findings are consistent with those of Al-Rawi et al., which demonstrated that the majority of participants had not undergone a DEXA scan, and among those who did, it was often based on a recommendation from a doctor [8]. This suggests that medical advice plays a crucial role in determining whether individuals are aware of the procedure. Furthermore, it is important to assess the physician's attitude and practice toward osteoporosis and the DEXA scan and how often do they recommend DEXA

scanning. Ahmed et al. investigated regarding osteoporosis among general practitioners in Al Majmaah, KSA, and reported that most respondents exhibited sufficient knowledge of the disease. Moreover, most of them were familiar with the role of plain X-rays for fracture prediction, while only a few had accesses to perform BMD tests [23]. Similarly, Yehia et al. conducted a study in which the majority of physicians recognized plain X-rays as useful for fracture prediction. Additionally, most were aware that DEXA scans are the optimal diagnostic method for osteoporosis and can help predict fracture risk and determine BMD. Interestingly, less than one-third of physicians acknowledged that their patients were adequately informed about osteoporosis [24].

The results of our analysis revealed a significant association between participants' knowledge scores and employment status ($p$-value = 0.017), showing higher knowledge scores among women in medical-related jobs. This is similar to the results of Al-Rawi et al. that showed a relatively higher level of knowledge among employees and students in the medical field [8]. Moreover, we noticed significantly higher knowledge scores among women attaining high monthly incomes ($p$-value = 0.019), particularly participants with a monthly income of 10,000 to 15,000 SAR, while those getting less than 5000 SAR/ month scored lower scores. Contrarily, another study reported that participants within the middle-income category had significantly higher levels of awareness about osteoporosis compared with those in the lower and high-income categories [8].

The relationship between age and participants' level of knowledge regarding osteoporosis appears to be subject to controversy. While Hurst et al. underscored that older age is linked with heightened knowledge [25], A. Alamri et al. showcased a higher level of knowledge among younger individuals [22]. Despite this study not finding a significant association between age and levels of knowledge about osteoporosis and DEXA scans, it did show a significant association between age and the performance of DEXA scans ($p$ = 0.043). Older women underwent DEXA scans more than younger ones, which might be attributed to their higher awareness level compared with younger women as revealed in Hurst et al. [25].

The association between individuals' level of education and their knowledge about osteoporosis appears to yield conflicting findings across different studies. For instance, Raizah et al. reported that highly educated individuals had poor knowledge about osteoporosis [26], whereas Al-Rawi et al. found a higher level of knowledge among those with higher education [8]. In our study, we did not observe a significant association between knowledge scores and participants' level of education despite the majority of our participants holding a bachelor's degree. This discrepancy in findings underscores the complexity of factors influencing individuals' understanding of osteoporosis and highlights the need for further research to elucidate these relationships.

*Limitations of the Study*

While our study provides valuable insights into the knowledge and practices of women in Jazan City regarding osteoporosis and the DEXA scan, it is important to acknowledge several limitations. Firstly, the use of an online questionnaire may have led to a sample biased toward younger, more educated individuals, potentially limiting the generalizability of our findings to the broader population. Additionally, reliance on self-reported data introduces the possibility of response biases and inaccuracies. Moreover, the cross-sectional design of this study prevents the establishment of causal relationships between variables. Furthermore, the convenience sampling method utilized may not fully represent the diversity of the population in the Jazan region. Lastly, as all participants were women, we lack insight into the perspectives of men on this topic. Despite these limitations, this study sheds light on an important public health issue and suggests avenues for further research and intervention.

## 5. Conclusions

This study showed that the overall knowledge level of women was relatively low due to their poor understanding of the DEXA scan procedure. However, further investigations revealed that the knowledge level was significantly higher among women employed in medical-related jobs and those with high monthly household incomes when compared with their counterparts.

**Author Contributions:** Conceptualization, T.M.D. and N.F.H.; methodology, S.A.H.; software, N.F.H.; validation, N.F.H. and S.A.H.; formal analysis, F.M.H.; investigation, Y.B.A.; resources, Y.M.A.; data curation, N.I.A.; writing—original draft preparation, N.F.H.; writing—review and editing, S.H.M.; visualization, N.I.A.; supervision, T.M.D.; project administration, N.F.H.; funding acquisition, T.M.D. and A.M.H. All authors have read and agreed to the published version of the manuscript.

**Funding:** The authors gratefully acknowledge the funding of the Deanship of Graduate Studies and Scientific Research, Jazan University, Saudi Arabia, through Project Number: GSSRD-24.

**Institutional Review Board Statement:** This study was conducted in accordance with the Declaration of Helsinki and approved by the Ethics Committee of the Jazan University (HAPO-10-Z-001, approved on 27 March 2024).

**Informed Consent Statement:** Informed consent was obtained from all subjects involved in this study.

**Data Availability Statement:** All data will be made available by the authors upon request.

**Conflicts of Interest:** All authors declare no conflicts of interest.

## References

1. Rachner, T.D.; Khosla, S.; Hofbauer, L.C. Osteoporosis: Now and the future. *Lancet* **2011**, *377*, 1276–1287. [CrossRef] [PubMed]
2. Melton, L.J.D.; Chrischilles, E.A.; Cooper, C.; Lane, A.W.; Riggs, B.L. Perspective how many women have osteoporosis? *J. Bone Miner. Res.* **1992**, *7*, 1005–1010. [CrossRef] [PubMed]
3. Burge, R.; Dawson-Hughes, B.; Solomon, D.H.; Wong, J.B.; King, A.; Tosteson, A. Incidence and economic burden of osteoporosis-related fractures in the united states, 2005–2025. *J. Bone Miner. Res.* **2007**, *22*, 465–475. [CrossRef]
4. Ray, N.F.; Chan, J.K.; Thamer, M.; Melton, L.J. Medical expenditures for the treatment of osteoporotic fractures in the united states in 1995: Report from the national osteoporosis foundation. *J. Bone Miner. Res.* **1997**, *12*, 24–35. [CrossRef] [PubMed]
5. Sadat-Ali, M.; Al-Habdan, I.M.; Al-Turki, H.A.; Azama, M.Q. An epidemiological analysis of the incidence of osteoporosis and osteoporosis-related fractures among the Saudi Arabian population. *Ann. Saudi Med.* **2012**, *32*, 637–641. [CrossRef] [PubMed]
6. Sadat-Ali, M.; AlElq, A. Osteoporosis among male Saudi Arabs: A pilot study. *Ann. Saudi Med.* **2006**, *26*, 450–454. [CrossRef] [PubMed]
7. Sadat-Ali, M.; AlZamami, J.F.; AlNaimi, S.N.; Al-Noaimi, D.; AlDakheel, D.; AlSayed, H.N.; Al-Turki, H.; AlOmran, A.S. Osteoporosis: Is the prevalence increasing in Saudi Arabia. *Ann. Afr. Med.* **2022**, *21*, 54–57. [CrossRef] [PubMed]
8. Al Rawi, M.N.; Saati, A.M.; Alhaidari, M.G.; AlAli, S.S.; Abu Melha, M.A.; Alqarni, F.A.; Alfryyan, A.A.; Al_Rawi, M. Public awareness of DEXA-scan in detecting osteoporosis A Cross-Sectional Study. *Int. J. Med. Dev. Ctries.* **2024**, *8*, 996–1002. [CrossRef]
9. Sadat-Ali, M.; Al-Dakheel, D.A.; Azam, Q.; Al-Bluwi, M.T.; Al-Farhan, M.F.; AlAmer, H.A.; Al-Meer, Z.; Al-Mohimeed, A.; Tabash, I.K.; Karry, M.O.; et al. Reassessment of osteoporosis-related femoral fractures and economic burden in Saudi Arabia. *Arch. Osteoporos.* **2015**, *10*, 37. [CrossRef]
10. National Osteoporosis Foundation. What is Osteoporosis and What Causes It? 2017. Available online: www.nof.org/patients/what-is-osteoporosis (accessed on 18 February 2024).
11. Maalouf, G.; Gannagé-Yared, M.H.; Ezzedine, J.; Larijani, B.; Badawi, S.; Rached, A.; Zakroui, L.; Masri, B.; Azar, E.; Saba, E.; et al. Middle East and North Africa consensus on osteoporosis. *J. Musculoskelet. Neuronal Interact.* **2007**, *7*, 131–143.
12. Cosman, F.; De Beur, S.J.; LeBoff, M.S.; Lewiecki, E.M.; Tanner, B.; Randall, S.; Lindsay, R. Clinician's Guide to Prevention and Treatment of Osteoporosis. *Osteoporos. Int.* **2014**, *25*, 2359–2381. [CrossRef] [PubMed]
13. Rouzi, A.A.; Al-Sibiani, S.A.; Al-Senani, N.S.; Radaddi, R.M.; Ardawi, M.-S.M. Independent predictors of all osteoporosis-related fractures among healthy Saudi postmenopausal women: The CEOR Study. *Bone* **2012**, *50*, 713–722. [CrossRef] [PubMed]
14. Schuiling, K.D.; Robinia, K.; Nye, R. Osteoporosis update. *J. Midwifery Women's Health* **2011**, *56*, 615–627. [CrossRef] [PubMed]
15. Myint, Z.W.; Kunos, C.A. Bone fracture incidence after androgen deprivation therapy-investigational agents: Results from cancer therapy evaluation program-sponsored early phase clinical trials 2006–2013. *Front. Oncol.* **2020**, *10*, 1125. [CrossRef] [PubMed]
16. Patil, K.A.; Prashanth, K.V.M.; Ramalingaiah, A. Detection of osteoporosis in lumbar spine [L1–L4] trabecular bone: A review article. *Int. J. Res. Orthop.* **2021**, *7*, 872–884. [CrossRef]

17. Alqahtani, G.M.; Alghamdi, A.M. Assessment of osteoporosis knowledge among adult Saudi females attending the family medicine department at Security Forces Hospital, Riyadh, Saudi Arabia. *J. Fam. Med. Prim. Care* **2021**, *10*, 1209–1214. [CrossRef] [PubMed]
18. NICE. Osteoporosis: Assessing the risk of fragility fracture. In *NICE Clinical Guideline*; NICE: Manchester, UK, 2012.
19. NICE. Alendronate, etidronate, risedronate, raloxifene, strontium ranelate and teriparatide for the secondary prevention of osteoporotic fragility fractures in postmenopausal women. In *NICE Technology Appraisals*; NICE: Manchester, UK, 2011.
20. World Health Organization. *WHO Scientific Group on the Assessment of Osteoporosis at the Primary Health Care Level: Summary Meeting Report, Brussels, Belgium, 5–7 May 2004*; World Health Organization: Geneva, Switzerland, 2007.
21. U.S. Preventive Services Task Force. Screening for osteoporosis: U.S. Preventive Services Task Force recommendation statement. *Ann. Intern. Med.* **2011**, *154*, 356–364. [CrossRef] [PubMed]
22. Alamri, F.A.; Saeedi, M.Y.; Mohamed, A.; Barzanii, A.; Aldayel, M.; Ibrahim, A.K. Knowledge, attitude, and practice of osteoporosis among Saudis: A community-based study. *J. Egypt Public Health Assoc.* **2015**, *90*, 171–177. [CrossRef] [PubMed]
23. Ahmed, Z.; Alharbi, D.; Junaid, A.L.; Shaik, R.A.; Sami, W. Knowledge, Attitude and Practice towards Osteoporosis among General Practitioners Working in Al Majmaah Province, KSA. *Asian, J. Pharm. Res. Health Care* **2019**, *11*, 45–54. [CrossRef]
24. Saeedi, M.Y.; Al-Amri, F.; Mohamed, A.; Ibrahim, A.K. Knowledge, Attitude and Practice towards Osteoporosis among Primary Health Care Physicians in Riyadh, Saudi Arabia. *Sci. J. Public Health* **2014**, *2*, 624–630. [CrossRef]
25. Hurst, P.; Wham, C. Attitudes and knowledge about osteoporosis risk prevention: A survey of New Zealand women. *Public Health Nutr.* **2006**, *10*, 747–753. [CrossRef] [PubMed]
26. Raizah, A.; Alsabaani, A.; Alqahtani, K.; Aseeri, M.; Alqahtani, N.; Alqahtani, A. Awareness of Osteoporosis among the General Population of the Aseer Region, Saudi Arabia. *Bahrain Med. Bull.* **2022**, *44*, 841–845.

**Disclaimer/Publisher's Note:** The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.