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Public Understanding and Participation in Dual Energy X-Ray Absorptiometry (DEXA) Scan for Assessing Bone Health in Arar City, Northern Saudi Arabia

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ABSTRACT

Introduction: Bone health is a critical aspect of overall health, particularly as populations age. Osteoporosis and related fractures are significant public health concerns, underscoring the importance of effective monitoring and early detection methods

Objective: This research aims to explore the public understanding and participation of Dual Energy X-ray absorptiometry (DEXA) Scans for assessing bone health in Arar city

Methodology: This study is a cross-sectional conducted at the College of Medicine, Northern Border University, Arar, KSA in a period of 2 months performed on 365 Saudi and non-Saudi residents of Arar. All the participants were asked to fill a pre-designed questionnaire. Chi-square test was performed. A p-value of ≤ 0.05 was considered statistically significant.

Results: In a study of 365 participants in Arar city, 64.1% correctly identified common bone health issues, 43.1% knew early detection improves outcomes, Only 74 participants had undergone a DEXA scan where 40 participants (23.7%) from 18-29 years of age and 25 (28.7%) participants from 30-39 years of age participated in DEXA scan. Awareness was low; 117 (32.3%) knew about DEXA, with only 70 (59.8%) having had the scan ($p < 0.01$)

Conclusion: In conclusion, the study of public understanding and participation in Dual Energy X-ray

Absorptiometry (DEXA) scans for assessing bone health highlights critical gaps in public awareness and engagement.
Keywords: DEXA scan, bone diseases, osteoporosis, public awareness, participation, Saudi Arabia

INTRODUCTION

Bone health is a critical aspect of overall health, particularly as populations age. Osteoporosis and related fractures are significant public health concerns, underscoring the importance of effective monitoring and early detection methods. Osteoporosis, a condition characterized by low Bone Mineral Density and increased fracture risk, is a significant public health concern[1]. The International Osteoporosis Foundation reports that about one in three women and one in five men over the age of 50 will suffer from an osteoporotic fracture in their lifetime[2]. These fractures can result in serious outcomes, including disability, decreased quality of life, and higher healthcare expenses[3]. A recent study reported that 37.8% of Saudi women and 28.2% of Saudi men aged 50-79 years are osteoporotic. Early diagnosis and appropriate management of low BMD are crucial, especially for high-risk groups such as diabetic patients, women, and those with low vitamin D levels and calcium intake[4]. Advancements in medical imaging technology in the past few years have offered valuable means to evaluate bone health and identify osteoporosis. One such technique is Dual Energy X-ray Absorptiometry (DEXA), which has become the gold standard for measuring bone mineral density (BMD)[5].

DEXA is a non-invasive and highly accurate method that utilizes two different X-ray energies to differentiate between bone and soft tissue, allowing for precise measurements of BMD. It has an accuracy of nearly 90 % in diagnosing oasteoprosis[6]. Studies have shown that DEXA scan can aid better clinical decision-making regarding the treatment of fractures and overall management of osteoporosis in elderly men and post-menopausal women[7]. Moreover, support vector machine (SVM) analysis of ancillary data from routine DEXA studies can effectively identify lumbar spine fractures with an accuracy of 91.8%, sensitivity of 81.8% and specificity of 97.4% ($p=0.034$)[8].

Despite the presence of these sophisticated diagnostic tools, there is a significant challenge in raising public awareness and understanding of bone health and related imaging techniques. A lack of knowledge about osteoporosis, its risk factors, and preventive measures can result in delayed diagnosis and treatment, potentially increasing the risk of fractures and associated complications. Moreover, various factors, including socioeconomic status, educational level, and cultural beliefs have also influenced the attitude towards DEXA scanning[9]. A study in Riyadh city found that gender, education, income, and occupation were statistically significant in influencing patients' satisfaction with healthcare services[10]. Another study has revealed that transportation issues, delays in appointments, time constraints and health literacy have resulted in under utilization of this diagnostic tool[11]. Understanding these barriers is critical for designing effective public health campaigns. Increasing public awareness of DEXA and its importance in monitoring bone health is essential for improving early detection and prevention of osteoporosis.

The literature review has identified several critical gaps in research. Notably, there is a paucity of localized studies specifically examining the awareness levels and perceptions of Dual Energy X-ray Absorptiometry (DEXA) scans among residents of Arar City. Furthermore, there is limited investigation into how awareness of DEXA varies across different demographic groups, including age, gender, and socioeconomic status, within the context of Saudi Arabia[12]. Additionally, there is a lack of research assessing the effectiveness of educational interventions designed to enhance public awareness and understanding of DEXA. Lastly, there exists a gap in understanding the perspectives of healthcare providers regarding patient awareness and their roles in promoting DEXA as a tool for bone health monitoring[13].

This research seeks to investigate the public understanding and engagement with Dual Energy X-Ray Absorptiometry (DEXA) as a method for assessing bone health. By assessing the current level of awareness and identifying potential knowledge gaps, this study seeks to provide valuable insights that can inform future public health initiatives and educational campaigns tailored to the specific needs of the community. The findings of this research can contribute to the development of targeted interventions and awareness programs, ultimately promoting early detection, prevention, and effective management of osteoporosis and related bone health issues in Arar and potentially other regions of Saudi Arabia.

METHODOLOGY

This study is a cross-sectional analysis conducted at the College of Medicine, Northern Border University, in Arar, Saudi Arabia, over a two-month period from August 1, 2024, to September 30, 2024. Following approval from the Local Committee of Bioethics, a sample size of 365 was determined using the WHO calculator, based on a baseline awareness level of 39.7% in the Saudi population, a 95% confidence interval, and a 5% margin of error[14]. Inclusion criteria encompassed all Saudi and non-Saudi residents of Arar aged 18 years and older who provided informed consent. Conversely, participants younger than 18 years, those who declined to consent, non-residents of Arar, and individuals unwilling to complete the questionnaire were excluded from the study. Participants who consented to join were selected using a convenience sampling technique. Data collection involved administering a pre-designed questionnaire, which was converted into an online Google Form and distributed to the participants via WhatsApp. The collected data was subsequently entered and analyzed using SPSS (Statistical Package for Social Sciences) version 29.0. The normality of the data was assessed using the Shapiro-Wilk test. Qualitative variables were presented as frequencies and percentages, while quantitative variables were also reported in similar terms. The Chi-square test was employed to analyze relationships among categorical variables, with a significance threshold set at a p-value of ≤ 0.05. This comprehensive methodological approach aims to provide a clearer understanding of the public's awareness and participation in DEXA assessments for bone health in Arar.

RESULTS

The study results reveal varying levels of awareness about bone health among respondents. Approximately 64.1% recognized that bone health issues are prevalent, while 35.9% either answered incorrectly or expressed uncertainty. Only 43.1% understood that early detection of bone density issues can lead to improved treatment outcomes, with 66.9% uncertain or incorrect. About 58.3% acknowledged the benefits of resistance training for bone health, while 41.7% were unsure or incorrect. A mere 18.3% correctly identified that bone mass does not increase after the age of 30, with 81.7% uncertain or incorrect. When it comes to lifestyle factors affecting bone health, 54.2% recognized their influence, while 45.8% did not. Additionally, 52.6% understood that caffeine and low-calcium foods do not protect against bone-related diseases, leaving 47.4% uncertain or incorrect. In terms of awareness about DEXA scans, 67.9% identified their purpose correctly, but only 21.8% were aware of the associated risks, with 78.2% uncertain. Furthermore, only 23.2% believed DEXA scans should be conducted for individuals at risk of osteoporosis, while 76.8% were uncertain or incorrect. Lastly, 37.1% understood the effectiveness of DEXA scans for early diagnosis of bone-related diseases, with 62.9% unsure or incorrect. (Figure 1).

Out of 365 participants only 74 participants had DEXA scan. In terms of age, the 18-29 group comprised 169 participants (46.03%), with 40 having had a DEXA scan and 129 never having had one. The 30-39 age group had 87 participants (23.84%), with 25 having undergone a DEXA scan. For the 40-49 age group (73 participants, 20%), only 5 had a DEXA scan. In the 50-59 group (22 participants, 6.03%), 2 had the scan, while the >60 group (14 participants, 3.84%) also had 2. Regarding nationality, 323 participants (88.64%) were Saudi, with 72 having had a DEXA scan. Among the 42 non-Saudis (11.51%), only 2 had undergone the scan. The gender distribution showed 168 males (46.03%) with 50 having had the scan, while 197 females (53.88%) had 24 participants with a DEXA scan. Education status revealed that 7 individuals (1.92%) were uneducated, with 1 having had a DEXA scan. The middle school group had 28 participants (7.67%) and 5 had DEXA scan, while the secondary school group had 72 individuals (19.73%) with 25 had DEXA scan once in their life. From the post-graduate group (20 participants, 5.48%) no one had undergone DEXA scan. Lastly, awareness of the DEXA scan was noted, with 117 individuals (32.33%) having heard about it, 70 of whom had the scan, compared to 248 (67.95%) who had not heard about it. (Table 1).

The study identified several reasons for individuals undergoing DEXA scans. A significant 67.3% of participants reported that their decision was based on a recommendation from a doctor, highlighting the crucial role of healthcare providers in guiding patients toward necessary health assessments. Additionally, 14.1% of respondents indicated that they were advised by friends and family, suggesting a secondary influence on their decision-making. Self-motivation was cited by 7.4% of participants, reflecting a personal initiative to monitor

bone health. Finally, 11.2% of respondents underwent the scan following a fracture, indicating a reactive approach to addressing bone health concerns. (Figure 2).

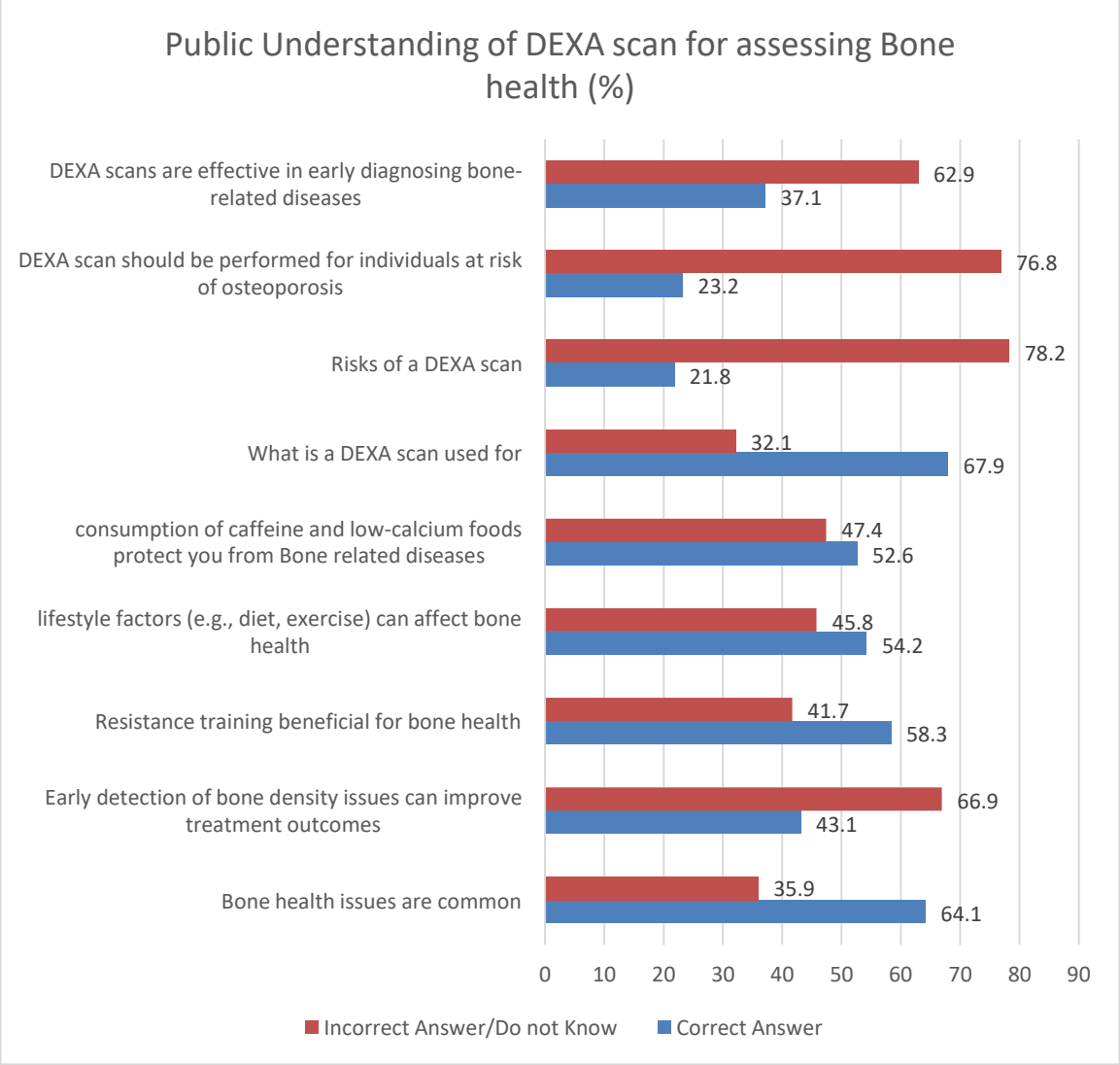

Figure 1: Public understanding of DEXA scan in terms of bone health assessment

Variable	Category	Total (N=365)	(%)	Had DEXA scan (n=74)	Never Had DEXA scan (n=291)	P value
Age (years)	18-29	169	46.03	40	129	0.004
	30-39	87	23.84	25	62	
	40-49	73	20	5	68	
	50-59	22	6.03	2	20	
	>60	14	3.84	2	12	
Nationality	Saudi	323	88.64	72	251	0.009
	Non-Saudi	42	11.51	2	40	
Gender	Male	168	46.03	50	118	0.00003
	Female	197	53.88	24	173	
Education status	Uneducated	7	1.92	1	6	0.04
	Middle school	28	7.67	5	23	
	Secondary school	72	19.73	25	47	
	College	238	65.34	43	195	
	Post-graduate	20	5.48	0	20	
Heard about DEXA scan	Yes	117	32.33	70	47	0.00001
	No	248	67.95	0	244	

Table 1: Analysis of DEXA Scan Experience by Age, Nationality, Gender, Education, and Awareness

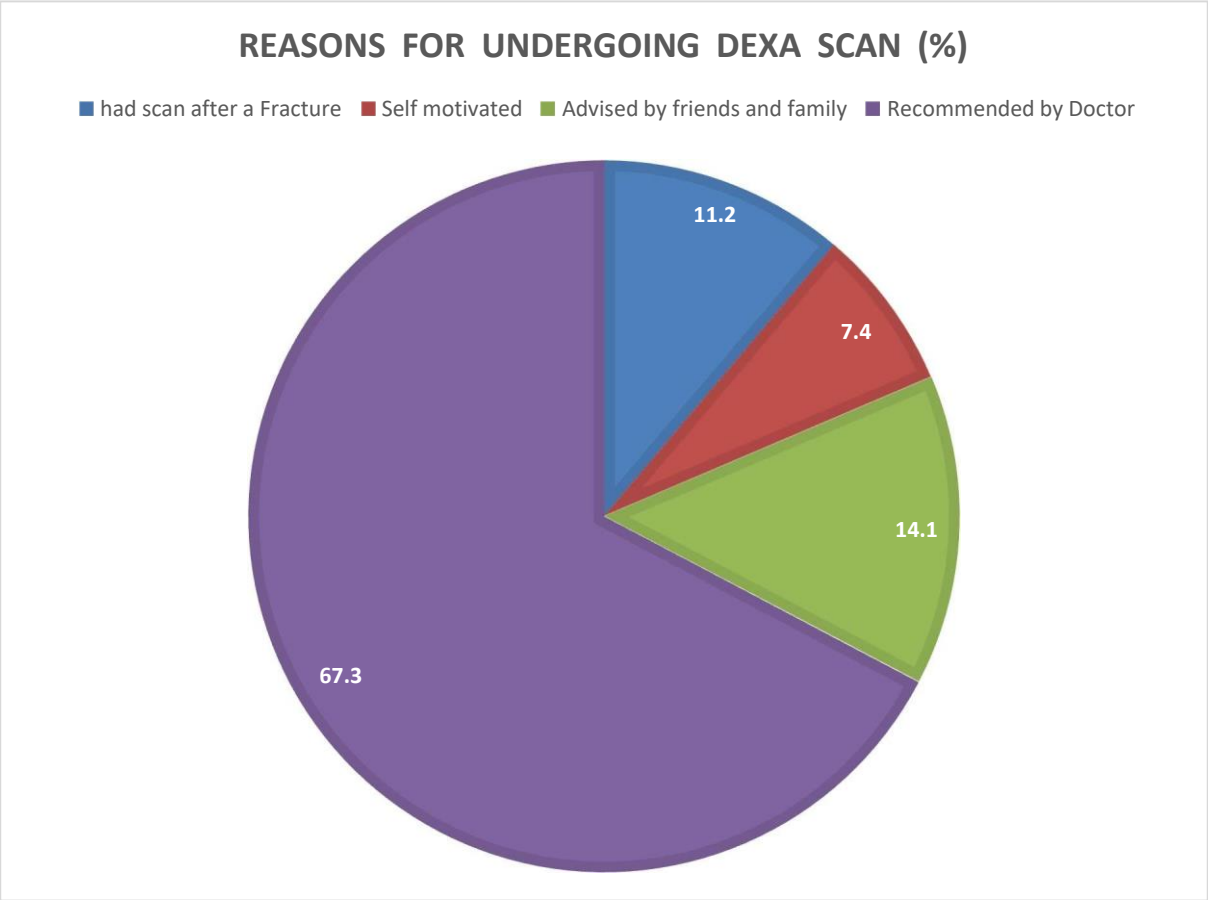

Figure 2: Reasons for undergoing DEXA scan

DISCUSSION

The data reflects varying levels of public understanding regarding bone health and DEXA scans, crucial for promoting awareness and participation in Arar City, Northern Saudi Arabia. A significant majority, 64.1%, recognize that bone health issues are common, indicating a general awareness of the importance of bone health. However, only 43.1% believe that early detection of bone density issues can improve treatment outcomes, suggesting a gap in understanding the proactive benefits of DEXA scans. The belief that resistance training is beneficial for bone health is supported by 58.3% of respondents, which aligns with current health guidelines promoting exercise for osteoporosis prevention. Another study conducted to assess the knowledge of people about bone diseases and prevention has also revealed that more than 43% of people are aware of the importance of resistance training in improving bone health[15]. While 54.2% acknowledged the impact of lifestyle factors, such as diet and exercise, on bone health, there remains significant potential for enhancing public education in this area. The statistic indicating that 52.6% believe caffeine and low-calcium foods protect against bone-related diseases highlights prevalent misconceptions that must be addressed. Although there is promising awareness (67.9%) regarding the purpose of DEXA scans, only 21.8% are aware of the associated risks, which could discourage individuals from seeking the scan. This emphasizes the need for comprehensive education that presents both the benefits and risks of DEXA scans to mitigate fears and misinformation. Bordini et al. have also emphasized the importance of increasing awareness within the general population to promote healthy habits for improved bone health in the long term[16]. Similarly, Dhayihi et al. found that over 57% of the population lacks adequate knowledge regarding DEXA scans with majority failed to identify high risk population[17]. While

37.1% believe DEXA scans are effective in early diagnosis, the substantial portion of respondents who do not know or are incorrect about these statements reveals a critical need for outreach programs. Increasing awareness about the role of DEXA scans in bone health assessment is vital for improving participation and ensuring that individuals in Arar City are informed about maintaining their bone health proactively.

The data provides insight into the demographics and participation in DEXA scans for assessing bone health among residents of Arar City, Northern Saudi Arabia. With a total of 365 participants, the results show significant disparities in DEXA scan uptake based on age, nationality, gender, education, and awareness. Starting with age, the 18-29 age group exhibits the highest participation rate in DEXA scans at 46.03%, with a statistically significant p-value of 0.004. This suggests that younger individuals may be more proactive in seeking preventive health measures. In contrast, older age groups, especially those over 60, show significantly lower participation, indicating a potential gap in outreach efforts targeting older adults, who are at higher risk for osteoporosis[18]. Nationality also plays a crucial role, with 88.64% of participants being Saudi and a p-value of 0.009 indicating significant differences in scan uptake between Saudis and non-Saudis. This could reflect cultural factors or differing access to healthcare resources that may affect participation rates among non-Saudis. Gender differences are stark, with males having a higher participation rate (50 out of 168) compared to females (24 out of 197), supported by a very low p-value of 0.00003. This disparity may highlight societal norms or barriers that discourage women from seeking preventive care, suggesting the need for targeted educational campaigns to encourage female participation as highlighted by Fat et al[19]. The significant p-value of 0.04 highlights the impact of education on health-seeking behaviors, emphasizing the need for educational programs that inform individuals about the importance of bone health and DEXA scans. Anwar et al have also found a significant association between education and propensity to under DEXA scan[20]. Awareness about DEXA scans is another critical factor, as 32.33% of respondents reported having heard about them. 70 of the 117 informed individuals had undergone a DEXA scan, compared to none out of 248 who had not heard about it. Moreover, data on public understanding of the risks associated with DEXA scans reveals significant gaps in awareness among respondents. Education on the safety and benefits of DEXA scans is essential to increase public confidence and participation[21]. Moreover, effective outreach programs could focus on clarifying misconceptions about risks and emphasizing the importance of early detection in preventing serious bone health issues.

This study also presents several limitations. Firstly, the relatively small sample size may restrict the generalizability of the findings, making it difficult to extrapolate results to the broader population of Arar City or Saudi Arabia as a whole. Additionally, the reliance on self-reported data can lead to inaccuracies, as participants may not fully express their true understanding or willingness to engage in DEXA screening, potentially skewing the results. Moreover, limited access to DEXA facilities could significantly impact participation rates, as individuals may be deterred by logistical challenges, such as distance, availability of appointments, or financial constraints. These barriers could lead to an underrepresentation of those who might benefit from DEXA screenings, further complicating the assessment of public awareness and participation. Additionally, cultural factors and varying levels of health literacy within the community may influence perceptions of bone health and the importance of DEXA scans. These factors highlight the need for future research to explore the underlying reasons for low participation rates and to develop targeted strategies to improve access and awareness of DEXA screening in the region. Addressing these limitations will be crucial for obtaining a more comprehensive understanding of public engagement with DEXA scans for assessing bone health.

CONCLUSION

In conclusion, the study of public understanding and participation in Dual Energy X-ray Absorptiometry (DEXA) scans for assessing bone health in Arar City highlights critical gaps in awareness and engagement. While DEXA scans are essential for the early detection of bone health issues, many individuals remain unaware of the benefits associated with the procedure. Enhancing awareness and ensuring better access to DEXA facilities can foster greater public understanding and participation, ultimately leading to improved health outcomes in the region. Future research should focus on targeted interventions to raise awareness and encourage participation, as well as explore the role of cultural factors in shaping health behaviours related to bone health.

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