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Research Article

Exploring Knowledge and Awareness of Genetic Testing for Breast Cancer Risk in Iraqi Women

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Abstract

Background: *Genetic testing plays a crucial role in identifying individuals at risk for hereditary breast cancer. However, substantial gaps in understanding genetic risk factors, including BRCA1/BRCA2 mutations, and key barriers such as high costs, limited access, and cultural stigma remain significant challenges in Iraq. These barriers hinder the adoption of genetic testing, particularly in low-resource settings. This study aims to evaluate the knowledge and awareness of genetic testing among Iraqi women in Baghdad, highlighting key barriers and their implications for healthcare delivery.*

Methods: *A cross-sectional study was conducted among 520 Iraqi women in Baghdad using a structured self-administered questionnaire. The questionnaire assessed knowledge of genetic risk factors, awareness of genetic testing services, and perceived barriers to testing. The collected data were then subjected to analysis using descriptive statistics and chi-square tests to ascertain the associations between socio-demographic factors and the levels of knowledge and awareness. A p-Value less than 0.05 was considered statistically significant.*

Results: *The study revealed moderate knowledge of genetic testing, with 280 respondents recognizing its role in identifying individuals at risk and 300 acknowledging the importance of genetic counseling. However, the study also revealed a lack of awareness regarding the significance of specific genetic mutations, such as BRCA1 and BRCA2, with only 190 respondents reporting familiarity with these mutations. Furthermore, the study noted a general lack of awareness about available genetic testing services, with only 260 participants reporting knowledge of their availability and 200 aware of the availability of genetic counseling services. The analysis identified several key barriers to genetic testing and counseling, including perceived financial constraints (320 respondents), limited access to facilities (300 respondents), and societal stigma (240 respondents). Significant associations were identified between higher education level and urban residency, on the one hand, and better knowledge and awareness, on the other.*

Conclusion: *The findings underscore the necessity for targeted educational programs, improved access to testing services, and culturally sensitive interventions to enhance the uptake of genetic testing in Iraq, ultimately contributing to early detection and prevention of breast cancer.*

Keywords: *Genetic Testing, Breast Cancer, BRCA1, BRCA2, Knowledge, Awareness, Iraq, Public Health.*

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Introduction

Breast cancer is the most common malignancy among women worldwide and represents a critical challenge to healthcare systems worldwide. In 2020 alone, breast cancer will account for 2.3 million new cases and 685,000 deaths, underscoring its significant public health burden (Singh et al., 2024; Sung et al., 2021). Early detection through advanced tools, including genetic testing, has been instrumental in reducing mortality and improving long-term outcomes. Genetic testing for hereditary breast cancer risk factors, particularly BRCA1 and BRCA2 gene mutations, enables early identification of high-risk individuals, allowing for personalized prevention and treatment strategies (Rebbeck et al., 2015). Women with BRCA mutations have up to a 72% lifetime risk of developing breast cancer, highlighting the importance of increasing awareness and improving access to genetic testing (Kuchenbaecker et al., 2017).

Despite the established benefits, uptake of genetic testing remains limited in low- and middle-income countries, including Iraq, due to lack of awareness, cultural stigma, and limited access to healthcare resources (Alwan, 2010). In Iraq, breast cancer is the most commonly diagnosed cancer among women, accounting for 19.5% of all cancers (Al Alwan, 2022). However, many cases are diagnosed at advanced stages when treatment options are limited and prognosis is poor. This late diagnosis is often attributed to a lack of knowledge about breast cancer and its prevention, including genetic testing. Filling this knowledge gap is critical to improving early detection and reducing mortality in this population.

Awareness and knowledge of genetic testing are strongly influenced by sociodemographic factors such as education, age, and urban versus rural residence. Previous studies have highlighted the association between higher levels of education and increased awareness of breast cancer prevention strategies, including genetic testing (Hasan et al., 2015). Urban women are more likely to have access to healthcare resources and educational campaigns, while rural populations face significant barriers, including inadequate healthcare infrastructure and cultural taboos (McCall-Hosenfeld & Weisman, 2011). In Iraq, where disparities in access to health care and education are pronounced, understanding these sociodemographic influences is critical to designing effective interventions.

Cultural beliefs and misconceptions also play an important role in shaping attitudes toward genetic testing. Fear of stigma, concerns about the cost of testing, and anxiety about the implications of genetic results are commonly reported barriers (Bruno et al., 2004). In addition, the lack of integration of genetic counseling services into primary health care further limits the accessibility of genetic testing for high-risk populations (Jones et al., 2021). Overcoming these barriers will require targeted awareness campaigns and health system reforms that prioritize genetic counseling and testing as integral components of breast cancer prevention.

While previous research in Iraq has predominantly focused on breast cancer awareness, few studies have examined the specific knowledge and barriers associated with genetic testing for breast cancer risk. Existing studies, such as those by Hasan et al. (2015) and Alwan (2010), emphasize general cancer awareness but neglect the role of genetic risk factors such as BRCA1 and BRCA2 mutations. This study uniquely contributes to the literature by addressing this gap and identifying sociodemographic predictors and barriers, including cost, accessibility, and cultural stigma, which are critical for tailoring public health strategies in the Iraqi context. By focusing specifically on knowledge and awareness of genetic testing, this research provides actionable insights for integrating genetic services into local health systems.

This study aims to assess knowledge and awareness of genetic testing for breast cancer risk among Iraqi women in Baghdad. By identifying key socio-demographic predictors and barriers to awareness, this research seeks to provide evidence-based recommendations for improving public health strategies. The findings will contribute to a better understanding of the challenges and opportunities for promoting genetic testing in Iraq, ultimately aiding in the early detection and prevention of breast cancer.

Methods

Study Design

This cross-sectional study was conducted to assess knowledge and awareness of genetic testing available for breast cancer risk detection among Iraqi women in Baghdad. A structured self-administered questionnaire was used, adapted from validated tools developed to assess knowledge and awareness of genetic testing in breast cancer prevention. Specifically, the questionnaire was adapted from studies by Jones et al. (2021) and Vadaparampil et al. (2010), with modifications to ensure cultural and contextual relevance to the Iraqi population (Jones et al., 2021; Vadaparampil et al., 2010).

Questionnaire Development

The questionnaire consisted of three sections and was structured to comprehensively assess knowledge and awareness. Section A collected sociodemographic information, including age, marital status, education level, and location. Section B focused on knowledge of genetic testing, with items addressing the role of

BRCA1 and BRCA2 mutations, the purpose of genetic testing, and the benefits of genetic counseling. Section C assessed awareness of genetic testing services, including availability, accessibility, and perceived barriers such as cost, stigma, and fear of test results.

The adaptation process ensured that the questionnaire was consistent with the objectives of the study and relevant to the Iraqi context. Items were translated into Arabic and pre-tested on a sample of 50 Iraqi women to assess clarity, comprehension, and cultural appropriateness. Feedback from the pretest informed adjustments to the wording and structure of the questionnaire.

To assess the reliability of the adapted questionnaire, a pilot test was conducted with 50 participants prior to the main study. Cronbach's alpha values were calculated for each section, yielding values of 0.82 for knowledge items and 0.78 for awareness items, indicating acceptable internal consistency. Content validity was assessed by a panel of three experts in oncology and public health who reviewed the items for clarity, cultural appropriateness, and relevance to the Iraqi context. Based on their feedback, minor modifications were made to improve item clarity and cultural sensitivity.

Sampling Method

Participants were recruited using convenience sampling to include adult women aged 18 years and older who had lived in Baghdad for at least five years. Women with a professional or academic background in genetics or oncology were excluded to minimize bias in the knowledge assessment. A total of 520 participants were recruited, equally divided between health professionals, such as pharmacists and physicians, and women from non-health fields. This stratification allowed the study to capture different perspectives on knowledge and awareness. A convenience sampling approach was used to recruit participants from urban health facilities in Baghdad. While this method facilitated accessibility and participant recruitment, it may limit the generalizability of the findings to the broader population, particularly women in rural areas or those with limited access to health services. To minimize bias, efforts were made to include a diverse sample of participants from different socio-demographic groups.

Data Collection

Data was collected over three months, from June to August 2023, at various urban and semi-urban locations in Baghdad, including universities, health centers, and community events. Research assistants were trained to provide participants with detailed explanations of the study objectives and instructions for completing the survey. Participants completed the questionnaire independently, with assistance available upon request for questions or clarification.

Data Analysis

Data was analyzed using the Statistical Package for the Social Sciences (SPSS) software version 29. Descriptive statistics, such as frequencies and percentages, were used to summarize demographic characteristics, knowledge levels, and awareness scores. Inferential statistics, including the chi-squared test, were used to determine associations between sociodemographic variables and participants' knowledge and awareness of genetic testing. A p-value of <0.05 was considered statistically significant.

Ethical Considerations

Ethical approval for the study was obtained from the Al-Rafidain University College Research Ethics Committee (REC: 46-2023). All participants gave written informed consent after being informed of the study objectives, procedures, and confidentiality measures. Participation was voluntary, and participants were assured of their right to withdraw at any time without repercussions.

Results

Table 1 summarizes the sociodemographic characteristics of the 520 participants in this study. The largest age group consisted of participants aged 31-50 years (44.2%), followed by those aged 18-30 years (40.4%). Only a small proportion of participants were 51 years or older (15.3%). Regarding educational attainment, the majority had at least a bachelor's degree (44.2%), 11.5% had a master's degree, and 1.9% had a doctorate. Secondary school graduates accounted for 32.7% of the sample, while 9.6% had completed only primary school. Half of the participants (50.0%) were single, 46.2% were married, and a minority were divorced or widowed (3.8%). The majority of the sample was urban (71.2%), compared to 28.8% from rural areas. These sociodemographic patterns provide valuable context for interpreting the knowledge and awareness levels of the study population.

Table 1. Socio-Demographic Characteristics of Respondents (N=520)

Variable	Frequency (n)	Percentage (%)
Age Group (Years)		
18–30	210	40.4
31–50	230	44.2
51–64	60	11.5
≥ 65	20	3.8

Variable	Frequency (n)	Percentage (%)
Education Level		
Primary School	50	9.6
Secondary School	170	32.7
Bachelor's Degree	230	44.2
Master's Degree	60	11.5
Doctorate Degree	10	1.9
Marital Status		
Single	260	50.0
Married	240	46.2
Divorced/Widowed	20	3.8
Place of Residence		
Urban Area	370	71.2
Rural Area	150	28.8

Knowledge of Genetic Testing for Breast Cancer Risk

Table 2 shows the knowledge of genetic testing for breast cancer risk among the 520 respondents. The highest correct response rate (57.7%) was observed for the item "Genetic counseling is important before and after genetic testing," indicating a relatively good understanding of the importance of genetic counseling. More than half of the participants (53.8%) correctly recognized that genetic testing helps to identify individuals at risk, while 51.9% correctly recognized the importance of family history in genetic testing. In contrast, knowledge of BRCA1 and BRCA2 mutations was lower, with only 36.5% of participants aware of their role in increasing breast cancer risk. In addition, 46.2% correctly stated that genetic testing is not appropriate for all women, and 40.4% understood that results could influence treatment options. These findings highlight significant gaps in knowledge about specific aspects of genetic testing, particularly related to BRCA mutations and treatment implications.

Table 2. Knowledge of Genetic Testing for Breast Cancer Risk (N=520)

Knowledge Items	Correct Responses (n)	Percentage (%)
Genetic testing can help identify individuals at risk of breast cancer.	280	53.8
BRCA1 and BRCA2 mutations increase breast cancer risk.	190	36.5
Genetic testing can guide preventive measures, such as surgery.	230	44.2
Genetic testing requires a family history of breast cancer.	270	51.9
Genetic counseling is important before and after genetic testing.	300	57.7
Genetic testing is not suitable for all women.	240	46.2
Results of genetic testing can influence treatment options.	210	40.4

Awareness of Genetic Testing Services and Perceived Barriers

Table 3 shows the level of awareness and perceived barriers to genetic testing services among the 520 respondents. Half of the participants (50.0%) were aware of the availability of genetic testing for breast cancer risk, while awareness of genetic counseling services was lower at 38.5%. The most commonly reported barrier was the perception that genetic testing is expensive, with 61.5% of respondents expressing this concern. In addition, 57.7% of participants perceived limited access to testing facilities as a barrier, and 53.8% expressed concern about receiving positive test results. Nearly half of respondents (46.2%) felt there was a stigma associated with genetic testing. These findings underscore the need to address cost, accessibility and societal perceptions to improve uptake of genetic testing services in this population.

Table 3. Awareness of Genetic Testing Services and Perceived Barriers (N=520)

Awareness and Barrier Items	Frequency (n)	Percentage (%)
Aware of the availability of genetic testing for breast cancer risk.	260	50.0
Aware of genetic counseling services.	200	38.5
Believing genetic testing is expensive.	320	61.5
Feels stigma are associated with undergoing genetic testing.	240	46.2

Awareness and Barrier Items	Frequency (n)	Percentage (%)
Concerns about receiving positive results from testing.	280	53.8
Perceived lack of access to testing facilities.	300	57.7

Association Between Socio-Demographic Characteristics and Knowledge of Genetic Testing

Table 4 shows the association between sociodemographic characteristics and knowledge of genetic testing for breast cancer risk among respondents. Level of education was significantly associated with knowledge ($\chi^2 = 12.87$, $p = 0.001$), indicating that participants with higher levels of education were more likely to have better knowledge. Place of residence was also a significant factor ($\chi^2 = 9.65$, $p = 0.004$), with urban residents demonstrating greater knowledge than those from rural areas. No significant associations were found between knowledge and age ($\chi^2 = 3.24$, $p = 0.072$) or marital status ($\chi^2 = 1.98$, $p = 0.086$). These findings highlight the importance of educational and geographic differences in shaping awareness and knowledge of genetic testing in this population.

Table 4: Association Between Socio-Demographic Characteristics and Knowledge of Genetic Testing (N=520)

Variable	χ^2 Value	p-Value
Age	3.24	0.072
Education Level	12.87	0.001**
Marital Status	1.98	0.086
Place of Residence	9.65	0.004**

: **$p < 0.05$ is considered statistically significant.

Association Between Socio-Demographic Characteristics and Awareness of Genetic Testing

Table 5 illustrates the relationship between socio-demographic characteristics and awareness of genetic testing services among respondents. Level of education was significantly associated with awareness ($\chi^2 = 14.21$, $p = 0.001$), with higher levels of education correlating with greater awareness. Place of residence also showed a significant association ($\chi^2 = 11.34$, $p = 0.003$), as participants living in urban areas were more likely to be aware of genetic testing services compared to their rural counterparts. No significant associations were found for age ($\chi^2 = 2.94$, $p = 0.088$) or marital status ($\chi^2 = 1.45$, $p = 0.112$). These findings highlight the critical role of education and geographic location in determining awareness levels and underscore the need for targeted outreach efforts in rural and less educated populations.

Table 5: Association Between Socio-Demographic Characteristics and Awareness of Genetic Testing (N=520)

Variable	χ^2 Value	p-Value
Age	2.94	0.088
Education Level	14.21	0.001**
Marital Status	1.45	0.112
Place of Residence	11.34	0.003**

: **$p < 0.05$ is considered statistically significant.

Discussion

This study assessed knowledge and awareness of genetic testing for breast cancer risk among Iraqi women in Baghdad. The results revealed significant gaps in understanding and highlighted important socio-demographic disparities. These findings provide a basis for improving public health initiatives aimed at increasing genetic literacy and improving access to genetic services.

Knowledge of Genetic Testing

The study found moderate levels of knowledge among participants, with 280 respondents recognizing the role of genetic testing in identifying individuals at risk and 300 recognizing the importance of genetic counseling. However, only 190 participants were aware of the critical role of BRCA1 and BRCA2 mutations. This limited awareness of genetic mutations is concerning because it underscores a significant gap in the understanding of important genetic factors that have been extensively linked to cancer risk. Kuchenbaecker et al. (2017) demonstrated that women who carry BRCA mutations face a substantially increased risk of breast and ovarian cancer, with lifetime risks exceeding 50% for some individuals (Kuchenbaecker et al., 2017). Lack of awareness of these mutations may hinder proactive risk management and early intervention, which are essential to reducing morbidity and mortality associated with hereditary cancers. This is consistent with Alwan (2010), who found that underserved populations in particular often lack access to accurate information and genetic testing resources, exacerbating disparities in preventive health measures (Alwan, 2010).

In addition, the study revealed significant misconceptions about the practical applications of genetic testing. For example, only 210 participants recognized that genetic test results could guide treatment decisions, revealing a significant gap in understanding of the clinical utility of genetic testing.

This deficit reflects a broader trend identified by Bruno et al. (2004), who reported that while the general public may have heard of genetic testing, specific knowledge of how such testing can impact treatment planning, such as selecting targeted therapies or determining the appropriateness of preventive surgery, remains limited (Bruno et al., 2004). These gaps are particularly troubling given that genetic testing can provide critical information for personalized medicine approaches, including identifying patients who would benefit from targeted therapies such as PARP inhibitors for BRCA-mutated cancers (Grech et al., 20-22; McCuaig et al., 2018).

These findings highlight the urgent need for comprehensive educational campaigns to improve public understanding of genetic testing and counseling (Chappuis et al., 2000; Metcalf et al., 2010). Such initiatives should address both the general concept of genetic testing and its specific applications in clinical practice. Programs must simplify complex genetic information to ensure accessibility and focus on practical benefits, such as personalized treatment options and prevention strategies (JOKIĆ-BEGIĆ & ARAMBAŠIĆ, 2010). In addition, integrating these educational efforts into broader public health campaigns could increase their reach, particularly in underserved communities where misinformation and limited access to resources are prevalent. Increasing public knowledge in this area could ultimately improve health outcomes by promoting early detection, timely intervention, and informed decision-making regarding genetic testing and counseling (Radford et al., 20-21).

Awareness of Genetic Testing Services and Barriers

Awareness of genetic testing services was low, with only 260 participants aware of their availability and even fewer (200 respondents) aware of genetic counseling. This finding is consistent with Vadaparampil et al. (2010), who found significant gaps in awareness of genetic testing and counseling services among at-risk populations. Similarly, several studies have found limited awareness of breast cancer prevention strategies among women in Baghdad, which mirrors the challenges faced in this study (Hasan et al., 2015; Hassan et al., 2022).

Barriers to genetic testing were prominent, with cost (320 respondents), limited access to facilities (300 respondents), and stigma (240 respondents) frequently cited. These challenges echo findings from similar contexts. In Iraq, Alwan (2010) reported that financial constraints and limited health infrastructure often impede access to advanced diagnostic tools, including genetic testing (Alwan, 2010). The cultural stigma associated with genetic testing, as seen in this study, reflects societal misconceptions and fears that have also been reported in Jordan and other Middle Eastern countries (Hasan et al., 2015).

Socio-Demographic Predictors

Education level and urban residence emerged as significant predictors of both knowledge and awareness. Participants with higher education demonstrated greater understanding of genetic testing, consistent with findings from a previous literature review that highlighted the role of education in improving health literacy and awareness of cancer prevention (McCall-Hosenfeld & Weisman, 2011). Urban residence was also associated with higher levels of knowledge and awareness, reflecting disparities in health care access between urban and rural populations. Hasan et al. (2015) similarly found that urban women in Baghdad had better access to health resources and information than their rural counterparts (Hasan et al., 2015).

Implications for Public Health

This study highlights the need for comprehensive public health strategies to address the gaps in knowledge and awareness of genetic testing for breast cancer. Educational campaigns should focus on increasing understanding of genetic risk factors, the importance of genetic counseling, and the availability of testing services. Following the successful approaches outlined by Bruno et al. (2004), integrating genetic education into routine health care services can improve awareness and acceptance (Bruno et al., 2004). In addition, reducing financial and logistical barriers by subsidizing costs and expanding access to rural areas could improve uptake (Emmet et al., 2018; Fogleman et al., 2019; Li et al., 2017). Culturally tailored interventions are also essential to address stigma and normalize genetic testing in Iraq.

Limitations and Future Directions

This study has several limitations that should be acknowledged. First, the use of convenience sampling may limit the generalizability of the findings to the broader population of Iraqi women. Participants recruited from urban health facilities may have had better access to information and resources than those in rural areas, potentially biasing the results. Second, the reliance on self-reported data introduces the possibility of recall and social desirability bias, where participants may have over- or under-reported knowledge or awareness. These biases may have affected the accuracy of the results. Future research should use representative sampling methods and explore additional regions to provide a more comprehensive understanding of genetic testing knowledge and barriers in Iraq.

Conclusion

This study highlights significant gaps in knowledge and awareness of genetic testing for breast

cancer risk among Iraqi women in Baghdad. Addressing these disparities through targeted educational programs, improved access to genetic services, and culturally sensitive strategies is critical to empowering women and improving early detection efforts in Iraq.

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