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Knowledge, Awareness, and Perception of Genetic Testing for Hereditary Disorders Among Palestinians: A Cross-Sectional Study

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Abstract

Background: Genetic disorders are prevalent in Palestine, posing significant health and social challenges. Nevertheless, little is known about genetic testing among the Palestinian population. This research aimed to examine the knowledge, awareness, and perception towards genetic testing for hereditary disorders among the public in Palestine. **Methods:** This cross-sectional study was based on a self-administered questionnaire comprising four sections, with a total of 42 closed-ended questions. These four sections evaluated the participants' demographic characteristics, as well as their knowledge, awareness and perceptions towards genetic testing for hereditary disorders. **Results:** Among the 438 respondents, 67.1% were females, and 79% were in the younger age range of 18–26 years old. A positive familial history of genetic or hereditary disorders was declared by 224 (51%). In this study, the knowledge, awareness, and perception of respondents were relatively good. Indeed, 370 (84.5%) had heard of genetic testing, 79.2% agreed it is important, and more than half of respondents considered the internet as their primary source of information about genetic testing. The highest percentage, 76.7%, was given to two statements: "Genetic testing is closely related to science and medicine" and "Genetic testing tells me the risk of acquiring certain diseases". The majority (83%) demonstrated adequate knowledge of genetic testing, influenced by factors such as the respondent's age, field of study, employment status, and residency, with each with a P-value of <0.001. Positive awareness of genetic testing was also influenced by the respondent's age, employment status, field of study, and whether they had heard of genetic testing or not, with a P-value of <0.001. A positive perception of genetic testing was associated with differences in gender, age, employment status, residency, field of study, and whether they had heard of genetic testing or not, each with a P-value of <0.001. **Conclusion:** Overall, there exists a good level of knowledge, awareness, and perception towards genetic testing among the Palestinian population. However, some gaps in applying this knowledge are evident, particularly in understanding the role of genetic testing in reducing the prevalence of genetic disorders, especially in certain cancers. This study revealed that familial hereditary and genetic disorders continue to be prevalent in Palestine. These findings underscore the need for stakeholders to take further actions to enhance genetic testing knowledge and address any gaps hindering the translation of this knowledge into more positive decisions. Ultimately, these efforts can contribute to reducing the prevalence of genetic disorders.

Keywords

Genetic testing; Hereditary; Knowledge; awareness; perceptions

Cover Page Footnote

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Knowledge, Awareness, and Perception of Genetic Testing for Hereditary Disorders Among Palestinians: A Cross-Sectional Study

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ABSTRACT

Background: Genetic disorders are prevalent in Palestine, posing significant health and social challenges. Nevertheless, little is known about genetic testing among the Palestinian population. This research aimed to examine the knowledge, awareness, and perception towards genetic testing for hereditary disorders among the public in Palestine. **Methods:** This cross-sectional study was based on a self-administered questionnaire comprising four sections, with a total of 42 closed-ended questions. These four sections evaluated the participants' demographic characteristics, as well as their knowledge, awareness and perceptions towards genetic testing for hereditary disorders. **Results:** Among the 438 respondents, 67.1% were females, and 79% were in the younger age range of 18–26 years old. A positive familial history of genetic or hereditary disorders was declared by 224 (51%). In this study, the knowledge, awareness, and perception of respondents were relatively good. Indeed, 370 (84.5%) had heard of genetic testing, 79.2% agreed it is important, and more than half of respondents considered the internet as their primary source of information about genetic testing. The highest percentage, 76.7%, was given to two statements: "Genetic testing is closely related to science and medicine" and "Genetic testing tells me the risk of acquiring certain diseases". The majority (83%) demonstrated adequate knowledge of genetic testing, influenced by factors such as the respondent's age, field of study, employment status, and residency, with each with a P-value of <0.001. Positive awareness of genetic testing was also influenced by the respondent's age, employment status, field of study, and whether they had heard of genetic testing or not, with a P-value of <0.001. A positive perception of genetic testing was associated with differences in gender, age, employment status, residency, field of study, and whether they had heard of genetic testing or not, each with a P-value of <0.001. **Conclusion:** Overall, there exists a good level of knowledge, awareness, and perception towards genetic testing among the Palestinian population. However, some gaps in applying this knowledge are evident, particularly in understanding the role of genetic testing in reducing the prevalence of genetic disorders, especially in certain cancers. This study revealed that familial hereditary and genetic disorders continue to be prevalent in Palestine. These findings underscore the need for stakeholders to take further actions to enhance genetic testing knowledge and address any gaps hindering the translation of this knowledge into more positive decisions. Ultimately, these efforts can contribute to reducing the prevalence of genetic disorders.

Keywords: Genetic testing; Hereditary; Knowledge; awareness; perceptions.

INTRODUCTION

Genetic testing is defined as using laboratory tests to determine the genetic status of individuals who are suspected to be at high risk for a genetic disorder to reveal the presence of disease-causing genes [1]. There are several types of genetic testing depending on the purpose of the test. Diagnostic testing is used to confirm or rule out a particular genetic disorder in a symptomatic patient. Predictive testing is used to examine the genetic status of an asymptomatic family member at risk for a genetic disorder. Carrier testing is used to identify individuals who have genetic mutations for recessive inherited disorders.

Prenatal testing is used to confirm or rule out if the fetus has a genetic condition. Preimplantation testing is used to screen embryos for genetic defects before implantation [2.] Applications of genetic testing are rapidly increasing and evolving in modern healthcare settings. These applications include not only the diagnosis of inherited rare diseases both prenatally and postnatally but also the prediction of the risk of developing common disorders, such as certain cancers, heart diseases, and late-onset neurodegenerative diseases[3]. Moreover, genetic testing allows tailored intervention to prevent the complications of these disorders[4]. Thus, genetic testing can clearly influence social and economic outcomes, and overall well-being for individuals, their families, and their communities[5].

Public knowledge and awareness of genetic testing applications are crucial to the successful use of them in improving health and quality of life [6]. Expectedly, it was found that Low awareness of the importance of genetic testing contributes to the increase in the incidence of hereditary disorders [6], while people who are aware of genetic tests may be more interested in performing them[7].

Studying public knowledge and awareness towards genetic testing was performed in several previous studies among different populations[8–10]. These studies found great variations even within the same country depending on the level of education, ethnic group, age and income. Indeed, among the US population the awareness toward genetic knowledge varied from 35.6%[11] to 57%[12] to 75% [8] to 84% [13].

Insufficient knowledge and awareness of genetic testing and the need to improve health education were reported especially among the developing nations[9,14]. A recent study on the Jordanians found that higher scores of genetic knowledge and higher educated participants had favorable attitudes toward genetic testing[15].

Palestine is an Arab country where the incidence of several genetic disorders is high due mainly to the elevated rates of consanguineous marriages[16,17]. There is little research which examines the knowledge, awareness, and perception towards genetic testing. One interesting recent study found that the most significant risk factor for genetic disorder was ignoring premarital genetic testing[10]. There is limited research on the availability and types of genetic testing in Palestine. A previous study concluded that it is inadequate and does not cover all the population in several Arab countries including Palestine [18]. Therefore, an update on the public general knowledge, awareness, and perception toward genetic testing is necessary. To fulfill the research gap, this study aimed to examine the knowledge, awareness, and perception toward genetic testing of hereditary disorders in the public of Palestine. In addition, the study aimed to evaluate the association between knowledge, awareness and perceptions and several demographic factors of the investigated sample.

METHODOLOGY

Study Design and Study Population: This is a cross sectional study conducted between December 2022 to July 2023, using a convenience sample. The target group was the local residents of a large city called Nablus. According to the Department of Statistics of Palestine, the total population of Nablus in 2022 was measured at 156,000. The sample size was calculated using Raosoft sample size calculator (Raosoft, Inc. 2004, http://www.raosoft.com/samplesize.html), providing a confidence level of 95%, with a margin of error of 5%[19,20], which indicated the need to approach 384 responses in this study. To consider any redundancy, a total of 438 responses were collected by three researchers over 7 months via social media, emails and by persons. Respondents who participated in this study were within the age range of 18–50 years old, and from different fields of profession.

Questionnaire Design

The questionnaire was adopted from previous reliable and valid research which was in English language with high Cronbach alpha test the permission to use the questionnaires was taken by email as presented in supplementary material[21]. The researchers translated the tool into Arabic version and back up translation was done. Expert opinion was done, and a few sentences were corrected grammatically and rephrased due to the use of medical terminology, pilot test was done prior to survey to 10% of expected sample 33 and no changes were done so they were included in final statistical analysis.

The self- administered questionnaire comprised four sections with a total of 42 closed-ended questions. The first section with a total of eight questions focused on the details of the respondents, including demographic characteristics. The second section with a total of 10 questions in trichotomous form, i.e., yes/no/maybe, focused on the knowledge of genetic testing. The third (11 questions) and fourth (13 questions) sections focused on the awareness and perception of genetic testing, respectively, which was assessed using a five-point Likert scale ranging from 1 to 5, where 1 represents "strongly disagree" and 5 represents "strongly agree."

Statistical Analysis

The collected data were analyzed using the Statistical Package for Social Sciences (SPSS) version 26.0 software. Descriptive data analysis, Cronbach's alpha test, t-test, chi-square and ANOVA used to determine all of the related factors associated with knowledge, awareness, and perception. A scoring system was used to analyze the data, which were coded and inputted into the SPSS software. For questions regarding knowledge of genetic testing, a score of 2 was given for "yes," a score of 1 was given for "maybe," and a score of 0 was given for "no." Then, the total score was summed and classified according to the following categories: inadequate = 0–53%, moderate = 54–66%, and adequate = 67–100%[13].

The Cronbach's alpha tests were for the scales for knowledge, awareness, and perception 0.759, 0.820 and 0.841 in current study is reliable and acceptable[22].

Ethical Consideration

This study was approved by IRB An Najah National University under number Med, Nov. 2022/14. The names of participants were hidden to ensure anonymity and confidentiality. Before the survey, informed consent was obtained from each respondent, and they were informed that the research was voluntary, confidential, and purely for academic purposes. Our study rigorously adheres to the ethical principles established by the Declaration of Helsinki, ensuring compliance with its standards throughout the research process.

RESULTS

Basic Demographic Data

Most of the respondents were in the age range of 18–26 years old (n=346, 79%) and female (n=294, 67.1%). Of the respondents, (n=292, 66.7%) graduated with a diploma or bachelor's degree or above. A significant number (n=339, 77.4%) of respondents were from science-related fields of study. Moreover, of the respondents, (n= 259, 59.1%) were residents in the city, and (n=179, 40.9%) from the village. In this study, 224 (51%) respondents declared having a history of genetic or hereditary disorders in their family, where diabetes (n= 161, 59.4%) and hypertension (n= 151, 55.7%) were the most prevailing disorder, followed by hypercholesterolemia (n=50, 18.5%), cancer (n=48, 13.3%) and thalassemia (n=16, 15.9%). Most sources for genetic testing were the internet (n=227, 58.7%), institutional education (n=196, 50.6%), family and friends (n=167, 43.2%).

Knowledge of Genetic Testing for Hereditary Disorders

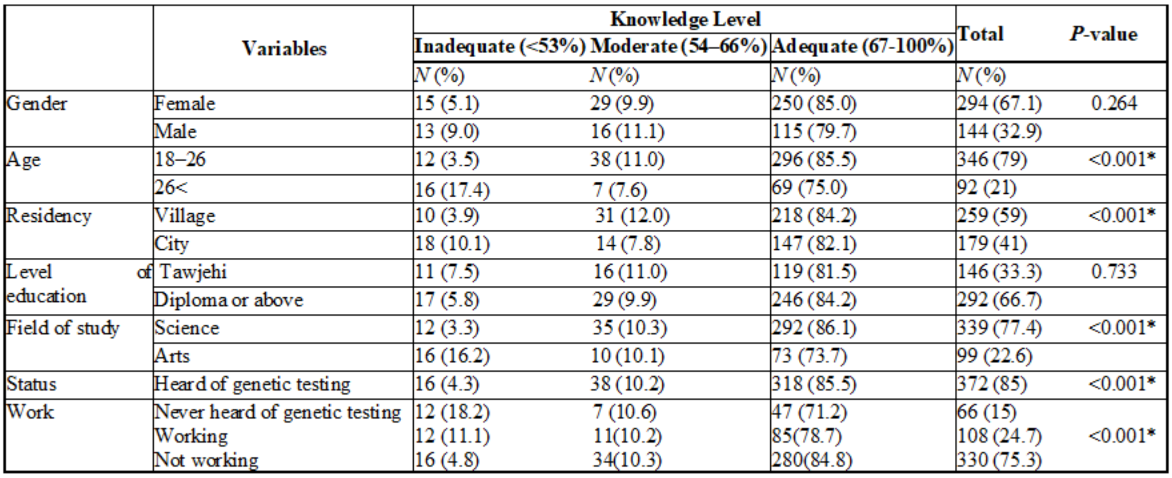
In this study, 370 (84.5%) respondents have heard of genetic testing, and the Internet was their key source of information (58.7%). Table 1 shows that most of the respondents (87.7%) knew that genetic testing can be used to diagnose inherited diseases. However, most of the respondents (56.6%) were unsure of the usefulness of genetic testing in reducing the prevalence of genetic diseases. They (84.9%) were also unaware that genetic testing can be used to test for various types of cancer (Table 1).

The majority of the respondents (83%) have adequate knowledge of genetic testing. As shown in Table 2, the knowledge of genetic testing can be associated with the respondent's age (P=0.000), their field of study (P=0.000), working (P=0.043), and residency (P=0.017), have heard of genetic testing with each having a P-value of <0.001.

Table (1): Total and percentage of the respondents’ answers pertaining to knowledge of genetic testing.

Statements	Yes*	Total (%) Maybe	No
Genetic testing allows the genetic diagnosis of vulnerabilities to inherited diseases.	384(87.67)	41 (9.36)	13 (2.97)
Genetic testing can reduce the prevalence of genetic diseases.	248(56.62)	97 (22.15)	93(21.23)
Genetic testing can help understand a genetic feature and its sequences.	372(84.93)	42 (9.59)	24 (5.48)
A person’s genetic profile can be used to check whether they are at risk of genetic or hereditary diseases.	321(73.29)	87 (19.86)	30 (6.85)
Genetic testing can identify specific disease that runs in the family.	348 (79.45)	64 (14.61)	26 (5.94)
Genetic diseases can be passed on in a family.	306 (69.86)	97 (22.15)	35 (7.99)
Prenatal screening is the testing for diseases or conditions of the fetus or embryo before it is born.	324 (73.97)	87 (19.86)	27 (6.16)
Genetic testing can be done during pregnancy to find out whether the baby will develop diseases, such as sickle cell disease, thalassemia, or neural tube defects.	295 (67.35)	101 (23.06)	42 (9.59)
Blood test or DNA analysis is one of the methods used in genetic testing.	298 (68.04)	87 (19.86)	53(12.10)
Genetic testing can identify various types of cancers, such as colon cancer and breast cancer.	237 (54.11)	145 (33.11)	56(12.79)

Table (2): *P*-value for the respective variables pertaining to questions on knowledge of genetic testing.



	Variables	Knowledge Level			Total	*P*-value
		Inadequate (<53%)	Moderate (54–66%)	Adequate (67-100%)		
		N (%)	*N* (%)	*N* (%)	*N* (%)	
Gender	Female	15 (5.1)	29 (9.9)	250 (85.0)	294 (67.1)	0.264
	Male	13 (9.0)	16 (11.1)	115 (79.7)	144 (32.9)	
Age	18–26	12 (3.5)	38 (11.0)	296 (85.5)	346 (79)	<0.001*
	26<	16 (17.4)	7 (7.6)	69 (75.0)	92 (21)	
Residency	Village	10 (3.9)	31 (12.0)	218 (84.2)	259 (59)	<0.001*
	City	18 (10.1)	14 (7.8)	147 (82.1)	179 (41)	
Level of education	Tawjehi	11 (7.5)	16 (11.0)	119 (81.5)	146 (33.3)	0.733
	Diploma or above	17 (5.8)	29 (9.9)	246 (84.2)	292 (66.7)	
Field of study	Science	12 (3.3)	35 (10.3)	292 (86.1)	339 (77.4)	<0.001*
	Arts	16 (16.2)	10 (10.1)	73 (73.7)	99 (22.6)	
Status	Heard of genetic testing	16 (4.3)	38 (10.2)	318 (85.5)	372 (85)	<0.001*
Work	Never heard of genetic testing	12 (18.2)	7 (10.6)	47 (71.2)	66 (15)	
	Working	12 (11.1)	11(10.2)	85(78.7)	108 (24.7)	<0.001*
	Not working	16 (4.8)	34(10.3)	280(84.8)	330 (75.3)	

**Significant value*

Awareness of Genetic Testing for Hereditary Disorders

As shown in **Table 3**, The highest percentage which is 76.7% were given to two statements “genetic testing is closely related to science and medicine” and “genetic testing tells me the risk of acquiring certain diseases”. A half (53.2%) of the respondents showed willingness to undergo genetic testing. Questions regarding the potential providers of genetic testing were also asked, in which there is a strong support (55.9%) that genetic testing should be performed only in hospitals with a doctor’s prescription. Moreover, a significant number of respondents (73.1%) agreed that the public’s view and awareness of genetic testing is essential (**Table 3**).

Overall, the respondents showed relatively good awareness of genetic testing for hereditary disorders, which is influenced by their age (P=0.011), working (P=0.000), their field of study (P=0.003), and whether they have heard of genetic testing or not (P=0.031), with each having a P-value of <0.001 (**Table 4**).

Table (3): The respondents' answers to awareness of genetic testing statement by frequency and percentage.

Statements	**Total (%)**				
	Strongly disagree	**Disagree**	**Neutral**	**Agree**	**Strongly agree**
I have sufficient knowledge of genetic testing.	53 (12.1)	89 (20.3)	161 (36.8)	116 (26.5)	12 (2.7)
I am aware that I have a unique genetic feature compared with others.	42(9.4)	74 (16.9)	150 (34.2)	127 (29.0)	40 (9.1)
I would like to have genetic testing.	37 (8.4)	69 (15.8)	93 (21.2)	152 (34.7)	81 (18.5)
Genetic testing tells me the risk of acquiring certain diseases.	27 (6.3)	24 (5.5)	46 (10.5)	218 (49.8)	118 (26.9)
I am aware that not all genetic disorders can be cured.	32 (7.3)	47 (10.7)	75 (17.1)	164(37.4)	111 (25.3)
Genetic test should only be performed in the hospital with a doctor's prescription.	24 (5.5)	53 (12.1)	111 (25.3)	145 (33.1)	100 (22.8)
Genetic test can be sold through the Internet.	132 (53.0)	99 (22.6)	56 (12.8)	37 (8.4)	7 (1.6)
Genetic test can be sold in stores.	246 (56.2)	90 (20.5)	64 (14.6)	28 (6.4)	6 (1.4)
Genetic testing is closely related to science and medicine.	22 (5.0)	26 (5.9)	48 (11)	159 (36.3)	177 (40.4)
There are technologies in documenting genetic profiles for various genetic disorders.	21 (4.8)	21 (4.8)	84 (19.2)	199 (45.5)	107 (24.4)
Public's view and awareness of genetic testing is important.	20 (4.6)	19 (4.3)	74 (16.9)	184 (42.0)	136 (31.1)

Table (4): *P*-value for the respective variables pertaining to questions on awareness of genetic testing**.**

	Variables	**Total**	***P*-value**
		***N* (%)**	
Gender	Female	294 (67.1)	0.61
	Male	144 (32.9)	
Age	18–26	346 (79)	<0.001*
	26<	92 (21)	
Residency	Village	258 (59)	0.371
	City	178 (41)	
Level of education	Tawjehi	145 (33.3)	0.99
	Diploma or above	291 (66.7)	
Field of study	Science	337 (77.4)	<0.001*
	Arts	99 (22.6)	
Status	Heard of genetic testing	370 (85)	<0.001*
Work	Never heard of genetic testing Working Not working	66 (15) 108 (24.7) 328 (75.3)	<0.001*

**Significant value.*

Perception of Genetic Testing for Hereditary Disorders

Table 5 shows that the majority of the respondents (79.2%) agreed that genetic testing is important; (67%) believed it helped in improving the quality of life and (59.8%) agreed it does more good than harm. Majority of them agreed that genetic testing is mainly for preventive care purposes (56.1%) and that it should be offered to all newborn babies (53.2.0%) and pregnant women (55.5%). They also agreed that it is necessary to increase awareness of genetic testing (80.6%) and that the lack of education and knowledge leads to ethical issues concerning the practice of genetic testing (54.8%). Hence, many respondents (76.1%) agreed that laws and policies should be implemented by the government to address the ethical issues concerning the use of genetic testing, and 80.6% agreed that it is necessary to raise awareness of genetic testing. Interestingly, most of the responders disagreed with the statement that genetic testing tampers with nature (62.0%) and opposes religion and their beliefs (66.7%) statement **(Table 5).**

In general, as shown in **Table 6**, the respondents showed a relatively good perception of genetic testing, which can be associated with their differences in gender (P=0.019), age (P=0.000), working or not (P =0.000), residency (P=0.033), field of study (P=0.000) and whether they have heard of genetic testing or not (P=0.000), with each having a P-value of <0.001 (**Table 6**).

Table (5): Total and percentage of the respondents’ answers pertaining to perception of genetic testing. Total (%)

Statements	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Genetic testing is important.	17 (3.9)	22 (5)	46 (10.5)	153 (34.9)	194 (44.3)
Genetic testing is mainly for preventive care purposes.	23 (5.3)	41 (9.4)	124 (28.3)	164 (37.4)	82 (18.7)
Genetic test should be offered to all newborn babies.	28 (6.4)	43 (9.8)	130 (29.7)	144 (32.9)	89 (20.3)
Genetic test should be offered to all pregnant women.	30 (6.6)	40 (9.1)	122 (27.9)	148 (33.8)	95 (21.7)
Knowledge of the genetic background of a disease will help people to live longer.	39 (8.9)	46 (10.5)	133 (30.4)	144 (32.9)	71 (16.2)
Genetic testing does more good than harm.	14 (3.2)	36 (8.2)	122 (27.9)	180 (41.1)	82 (18.7)
Genetic testing will not influence one’s health.	53 (12.1)	86 (19.6)	150 (34.2)	106 (24.2)	41 (9.4)
Genetic tests aid in improving one’s quality of life.	3 (0.7)	29 (6.5)	115 (25.8)	220 (49.3)	79 (17.7)
Genetic testing tampers with nature.	127 (29.0)	145 (33.1)	115 (26.3)	39 (8.9)	10 (2.3)
Genetic testing opposes religion and their beliefs.	173 (39.5)	119 (27.2)	99 (22.6)	31 (7.1)	12 (2.7)
Lack of education and knowledge of genetics and genetic tests are what raised ethical issues in genetic testing.	24 (5.5)	37 (8.4)	135 (30.8)	146 (33.3)	94 (21.5)
It is necessary to raise awareness of genetic testing.	16 (3.7)	18 (4.1)	48 (11.0)	182 (41.6)	171 (39.0)
Implementation of government laws and policies is needed to ensure the safe and effective use of genetic testing.	17 (3.9)	23 (5.3)	63 (14.4)	165 (37.7)	168 (38.4)

Table (6): *P*-value for the respective variables pertaining to questions on perception of genetic testing.

	Variables	**Total** ***N* (%)**	***P*-value**
Gender	Female	294 (67.1)	<0.001*
	Male	144 (32.9)	
Age	18–26	343 (78.3)	<0.001*
	26<	92 (21)	
Residency	Village	259 (59.1)	<0.001*
	City	179 (40.9)	
Level of education	Tawjehi	145 (33.1)	0.678
	Diploma or above	290 (66.2)	
Field of study	Science	336 (76.7)	<0.001*
	Arts	99 (22.6)	
Status	Heard of genetic testing	369 (84.2)	<0.001*
Work	Never heard of genetic testing	66 (15.1)	
	Working	107	<0.001*
	Not working	328	

**Significant value.*

DISCUSSION

The current study found that most of the participants had adequate knowledge of genetic testing. The genetic knowledge was positively correlated with the level of education, age below 26 years, being female and living in villages. These findings are consistent with a previous study in Palestine which was performed on parents of children with genetic disorders[10]. The rapid increase in performing genetic testing recently in Palestine has resulted from improving the public knowledge and familiarity towards genetic concepts [23–25], which resulted in greater public familiarity of the topic of genetic testing for hereditary disorders. Similar results were observed in some countries in the Middle East, where the majority of respondents in Jordan had heard of genetic testing[26]. Indeed, it is noteworthy that about half of the participants were unaware that genetic testing can be used to test for various types of cancer including common cancers such as breast and colorectal which could be inherited. This is worrying since a recent study reported that the vast majority of Palestinian women with breast cancer did not perform any genetic testing [27]. Moreover, the highest percentages of them were diagnosed in stage three which is an advanced stage for curative management[27]. This supports the hypothesis that good knowledge does not necessarily relate to true understanding [6,28]. Having adequate knowledge and being familiar with basic genetic concepts does not ensure a positive effect on decision making in the field since these decisions need deep understanding and advanced rather than basic knowledge. Notably, a recent study which found that the majority of Palestinian university students were familiar with general genetic terms but was less familiar with advanced genetic terms [29]

Most respondents were aware that genetic testing is related to science and medicine. And also they were aware that genetic testing could determine the risk of having a specific genetic disease. This is in agreement with previous studies which highlighted the role of education in having better awareness and making correct decisions about genetic testing [30] Also, as it was reported previously, having a personal or familial experience with a genetic disorder, or having undergone early screening for certain genetic disorders allow people to make decisions regarding prevention and early treatment regarding issues such as abortion, marriage, and having more children[31].

Nearly half of the respondents show

willingness to undergo genetic testing, which were correlated with their age, education level and their work. The other half of respondents gave a negative response or a neutral response. It is important to mention that the negative responses might be related to the fact that social stigma and economic issues have an impact on public awareness [32]. Individuals from low- and middle-income countries face financial obstacles that hinder them from genetic testing.[33]. These people might also be psychologically affected by their genetic test results which contribute to their unwillingness to undergo genetic testing. This is due to their belief of no cure is present for most genetic diseases. [34]

In addition, many respondents agree that genetic testing should be utilized exclusively in hospitals while the majority denies the idea of selling genetic tests through the internet or stores. This in practice allows health care providers to make trustworthy decisions based on clinical evidence and guidelines [35] . Moreover, there is strong support from respondents ensuring public view and awareness should be improved regarding genetic testing.

Most respondents agreed that genetic testing is important, and it’s used for preventive care purposes. In addition, they agreed that genetic testing should be applicable to all pregnant women and newborn babies. These results are correlated with a previous study that was done in Palestine, it measured the level of parent’s knowledge and attitude toward genetic testing in children with genetic disorders, results have shown that parents have proper knowledge related to their children’s disease and the main risk factor was ignoring the premarital genetic testing for consanguineous marriage and families with history of genetic diseases [10].

Moreover, the majority of respondents agreed that genetic testing improves quality of life and does more good than harm. However, some respondents had a neutral response while a minority disagreed, as they could relate it with the negative psychological or financial consequences on individuals upon genetic diagnosis due to the lack of treatment availability and/or affordability[33]. In addition, more than half of respondents disagreed on the statements that genetic testing tampers with nature or opposes religion and their beliefs. A minority of respondents agreed with these statements which could be related to their ethnicity.

Responses were variable with the statements of genetic testing will not influence individuals’ health or make people live longer, its noteworthy that the level of perception is associated with the respondent gender, age, level and field of education, a previous study was done in university students in Palestine, it has shown that students from medicine and medical science colleges have better understanding and perception toward genetic testing compared to non-medical students[29]. Also, another study in Jordan has shown that positive awareness and attitudes toward genetic testing are mostly derived from education and media sources, the availability of informative websites provides general and specific knowledge on genetic testing, however older people or people who lack internet access might be negatively influenced from the lack of knowledge and perception toward genetic testing[9] Most respondents agreed that population awareness on genetic testing must be increased as they believe that the insufficient education and knowledge of genetics and genetic testing can raise ethical concerns in genetic testing. Most respondents agreed on the implementation of laws and policies by the government to ensure the safe and efficient use of genetic testing.

This is a leading study which focuses on an important issue in Palestine. However, there were several limitations of this study. The convenient sample was obtained from a single large city in Palestine. Yet, it may not be representative of all Palestinians. Additional thorough studies including participants from all other cities in Palestine are needed. The questionnaire was self-reported, and so reporting bias cannot be excluded. The questionnaire was distributed online, so we could not calculate the response rate.

CONCLUSIONS

This study confirmed that genetic disorders are still prevalent among the Palestinian families. Despite there is a relatively good knowledge of genetic testing, this is not necessarily reflected in useful decisions towards reducing the prevalence of genetic disorders including common cancers. The study indicated the significant impact of internet and institutional education in improving knowledge and awareness of genetic testing among Palestinians. Further studies should be conducted in this field at the large national scale in Palestine. Altogether, this study concluded that stakeholders should perform further efforts to enrich the public knowledge of genetic testing in Palestine to translate it into practical decisions to reduce the prevalence of genetic disorder.

Availability of data and materials: The corresponding author will provide the data supporting the study's findings upon a reasonable request.

Author Contributions: Each of the authors played a substantial role in this research, including contributions to the conception, study design, data acquisition, analysis, and interpretation. Additionally, they were involved in drafting, revising, and critically reviewing the article. Furthermore, all authors provided final approval for the manuscript's publication, selected the journal for submission, and committed to being accountable for all aspects of this research.

Ethical Consideration and consent for publication: This study was approved by Institutional Review Board (IRB) at An-Najah National University under number Med, Nov. 2022/14. The names of participants were hidden to ensure anonymity and confidentiality. Before the survey, informed consent was obtained from each respondent, and they were informed that the research was voluntary, confidential, and purely for academic purposes.

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