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ORIGINAL RESEARCH

# Studying the relationship between the educational level and the society awareness toward the risk of the consanguinity marriage in Al-Madinah

Mohammad Ali Karbouji[1], Samia Mahdi Ahmed[2], Raneem Sami AlGain[1], Abdulrahman Thaher Althaher[1], Shumukh Mohammed Alhejaili[1], Shahad Mohammed AlAyoubi[1]

## ABSTRACT

**Background:** Consanguinity is the union between genetically related persons. It is more prevalent in the Middle East, Asia, and Africa. The offspring of consanguineous marriage are at greater risks for certain genetic diseases.

**Methodology:** The study is a cross-sectional observational study with a self-administered questionnaire. It included 810 participants from 18 to 60 years of age from Al-Madinah, Saudi Arabia.

**Results:** Our study reveals that 42.2% were against consanguineous marriage and 14.3% were in favor of it, the highest percentage of those against consanguineous marriage were post graduate participants.

**Conclusion:** There is a negative correlation between education level and attitude toward consanguineous marriage. Increasing level of education decreases the attitude toward consanguineous marriage.

**Keywords:** Consanguineous marriage, attitude toward consanguineous marriage, consanguineous marriage in KSA.

## Introduction

Consanguinity is defined as the union between individuals who are genetically related [1]. It's also known as familial marriage [2]. Comparing to the other parts of the world, consanguineous marriages are more frequent in the Middle East, Asia, and Africa [3]. The prevalence of consanguineous marriages is 50.5% in the United Arab Emirates [4], 40.7% in Turkey [5], 35.4% in Syria [6], 51.2% in Jordan [7], and 42% in Lebanon [8]. In Saudi Arabia, the prevalence of consanguinity is high. It is about 57.7% and the first cousin marriage is more frequent [9]. The offspring of consanguineous relationships are at greater risks for certain genetic disorders [10]. Autosomal recessive disorders occur in individuals, who are homozygous for a particular recessive gene mutation. This means that they carry two copies (alleles) of the same gene. As relatives share a proportion of their genes, it is much more likely that related parents will be the carriers of an autosomal recessive gene; and therefore, their children are at a higher risk of an autosomal recessive disorder [11]. The degree of genetic relationship between the parents is the factor in which the extent of the risk increases. So, when the parents are close relatives, the risk is greater. The risk is lower if the relationship between the parents is more distant relations, like second cousins, but still at more risk than the non-consanguineous marriage [12]. A study conducted in Qatar showed that the children of all consanguineous marriage had a higher risk of several diseases such as mental retardation, epilepsy, asthma, leukemia, and diabetes mellitus. Although the risk ratios for leukemia appeared to be elevated, the difference was not statistically significant, and there was no statistically significant difference in the two groups in relation to their sensory impairment such as blindness, deafness, or other hearing problems [13]. According to the Ministry of Health in Saudi Arabia, the premarital carrier screening is defined as conducting examination for couples who

**Correspondence to:** Mohammad Ali Karbouji
*Taibah University, Al-Madinah, Saudi Arabia.
**Email:** Mohkarbouji@gmail.com
*Full list of author information is available at the end of the article.*
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are soon-to-be married in order to identify if there is any injury with genetic blood diseases such as sickle-cell anemia (SCA) and thalassemia, and some infectious diseases [14]. In 2004, the Saudi Arabian government implemented compulsory premarital screening (PMS) test. It was implemented by the Ministry of Health, which is responsible for providing free health care to the entire population; and the decision to make this testing mandatory was based on discussions with numerous technical, religious, and social organizations. Currently, there are over 100 health reception centers, 70 blood testing laboratories, and 20 genetic counseling and education clinics in the country. Both screening and counseling are free of charge. A specialist center in Riyadh, in association with King Faisal Specialist Hospital, trains all the health care personnel who work on the program [15]. The Saudi Ministry of Health determined some important objectives of the PMS: limiting the spread of some genetic blood diseases: SCA and thalassemia, and some infectious diseases: hepatitis B, C, and acquired immunodeficiency syndrome (AIDS)/ human immunodeficiency virus, reducing the financial burdens resulting from the treatment of the injured people in terms of the family and community, making those seeking health care such as check-up feel at ease, reducing pressure over health institutions and blood banks, and disseminating awareness about the concept of the comprehensive, healthy marriage [14]. The behavior against consanguineous marriage is important to be changed by the premarital screening. But, religious persuasion delimits the prosperity of screening programs, in some societies, as some people suppose that their destiny is defined by God; and therefore, they take the risk of having an unwell child [15]. The behavior against PMS and counseling of health science students in Saudi Arabia were explored by some studies. AlKhaldi showed that most students have an affirmative behavior and around 25% did not take the test because of their Islamic beliefs. In King Saud University, the behavior among female students studied by Awatif showing that 86% of them felt positively concerning premarital testing. The behavior in a community-based study evaluated by El-Hazmi found that 94% of the entrants believe that PMS and counseling to be necessary for interdicting inherited blood disorders; 87% said that screening should be obligatory. The Saudi society obviously shows sensibility of PMS and its importance, yet the consequence of the first 2 years of the Saudi testing approach studied by Alhamdan et al. showed that 90% of at-risk couples insisted on marriage in spite of knowing they're endangered to have an unwell child. This undermines the increased level of consciousness identified in other research. One possible explanation is that both AlKhaldi and Awatif focused on the opinions of university students and El-Hazmi's community study was among the university students and the people attending scientific meetings and health centers. None of these studies was truly representative of the Saudi population as a whole, and therefore, the results cannot be generalized [15]. Alhamdan et al. assessed the PMS program 2 years after it became mandatory. Everyone in Saudi Arabia has good access to the program. High prevalence of carrier status was reported predominantly in the Eastern and South-Western regions of the country, but (as mentioned above) 90% of couples detected as carriers did not follow the advice they were given and went ahead with their marriages. This result requires evaluation and revision of the program by the Saudi health authority in order to achieve its goals as mentioned by Alhamdan et al. [15]. Also, there was a study published in 2011, conducted in the period between 2004–2009, which aimed to estimate the burden of sickle disease and thalassemia over the PMS program in Saudi Arabia and to assess the frequency of at-risk marriage detection and prevention. Results showed that the frequency of at-risk couples decreased by about 60% between 2004 and 2009 (from 10.1 to 4.0 per 1,000 examined persons). The willing revocation of matrimony proposals is recurrent among high-risk couples showing that the accretion is five times more than it was between 2004 and 2009 (from 9.2% to 51.9%). The high-risk matrimony in the Eastern province with a percentage of 58% shows rejection of revelation and a rise in preservation, over time, parallel to other provinces in Saudi Arabia [16].

The prevalence of consanguineous marriage and consanguinity-related diseases is high among the population in Saudi Arabia without knowing the risk of consanguinity. So, the authors aimed to study the relationship between educational level and the awareness of people living at Madinah toward this problem.

## Materials and Methods

This is a cross-sectional observational study that included individuals with age between 18–60 years old living in Al-Madinah, Saudi Arabia. We included adult individuals living in Al-Madinah city only. The data were collected through a questionnaire that included demographic data, educational level, and questions about risks of consanguineous marriage and attitude toward the PMS. A consent from participants was taken after explaining to them that all of the information would be confidential and for research purposes only.

Dependent variable was society's awareness toward the risk of consanguineous marriage and their attitude about PMS. Independent variable was the educational level.

## Results

The present study included 810 participants, 317 (39.1%) of them were males and 493 (60.9%) were females. The mean age (mean ± standard deviation) of participants was 26.44 ± 8.85. Most of the participants were singles 543 (67%), 262 (32.3%) were married, while five (6%) were a widow and divorced. The most common education level was university 571 (70.5%), followed by secondary 167 (20.6%), then post graduates 50 (6.2%), and finally, basic and primary education: 13 (2.3%) and

3 (0.4%), respectively. The large majority of participants 756 (93.3%) were Saudi, while only 54 (6.7%) were non-Saudi. Most of the participants 252 (31.1%) had income range of 1,000–5,000 SAR, the demographics of participants are shown in Table 1.

The opinions of participants toward consanguineous marriage were investigated using a questionnaire, the answers of participants about eight questions are shown in Table 2.

The number of those who were against consanguineous marriage (42.2%) and those who said "I don't know" (43.5%) was almost similar, while the least percentage (14.3%) were with consanguineous marriage; also, close similarity were found (27.5% and 27.7%) between those who thought that marriage of second or third degree relative reduces the risk of genetic disease and those who didn't know, while the large majority 44.8% said "yes". While 62.8% thought that inherited diseases are

***Table 1.*** *Demographics of participants.*

| Characters | Levels | N | % |
|---|---|---|---|
| Sex | Male | 317 | 39.1 |
| | Female | 493 | 60.9 |
| Marital status | Single | 543 | 67.0 |
| | Married | 262 | 32.3 |
| | Widow/divorced | 5 | 0.6 |
| Education level | Primary | 3 | 0.4 |
| | Basic | 19 | 2.3 |
| | Secondary | 167 | 20.6 |
| | University | 571 | 70.5 |
| | Postgraduate | 50 | 6.2 |
| Nationality | Saudi | 756 | 93.3 |
| | non-Saudi | 54 | 6.7 |
| Income (SAR) | 1,000–5,000 | 252 | 31.1 |
| | 5,000–10,000 | 223 | 27.5 |
| | 10,000–20,000 | 225 | 27.8 |
| | >20,000 | 110 | 13.6 |

***Table 2.*** *Answers of participants about eight questions.*

| Questions | Answers | N | % |
|---|---|---|---|
| 1. Are you with or against the consanguineous marriage? | With | 116 | 14.3 |
| | Against | 342 | 42.2 |
| | Don't know | 352 | 43.5 |
| 2. Do you think that the marriage of a second or third degree relative reduces the risk of genetic diseases? | Yes | 363 | 44.8 |
| | No | 223 | 27.5 |
| | Don't know | 224 | 27.7 |
| 3. Do you think that inherited diseases are life-threatening? | Yes | 509 | 62.8 |
| | No | 205 | 25.3 |
| | Don't know | 96 | 11.9 |
| 4. Do you think that inherited diseases can be treated? | Yes | 214 | 26.4 |
| | No | 410 | 50.6 |
| | Don't know | 186 | 23.0 |
| 5. Did you hear about examination before marriage | Yes | 807 | 99.6 |
| | No | 3 | 0.4 |
| 6. Do you think that the examination before marriage is limited to infectious diseases (such as hepatitis, AIDS)? | Yes | 60 | 7.4 |
| | No | 716 | 88.4 |
| | I don't know | 34 | 4.2 |
| 7. Do you know what are the consequences of insisting on marriage after knowledge of the test results were positive? | Yes | 578 | 71.4 |
| | No | 232 | 28.6 |
| 8. Do you think that it's a realistic examination and you should take a serious decision about it? | Yes | 721 | 89.0 |
| | No | 19 | 2.3 |
| | May be | 70 | 8.6 |

life-threatening, while 25.3% didn't think that, and 11.9% didn't know. The large majority of individuals (50.6%) in this study thought that inherited diseases cannot be treated, 26.4% thought they can be treated, and 23% didn't know. Most of the participants (99.6%) heard about the screening before marriage, while only a few (0.4%) did not know. Most of the participants (88.4%) thought that this screening was not limited to infectious disease, while 7.4% said that they thought the screening was limited to infectious diseases, and 4.2% only did not know. Most of the individuals (71.4%) knew the consequences of insisting on marriage after knowledge of the test results were positive, while 28.6% didn't know. The large majority of the participants (89%) in this study thought that the screening was realistic, 2.3% did not think so, and 8.6 % did not know. We asked about the increased risks of some diseases that are caused by consanguineous marriages, the answers of participants are shown in Table 3.

Among the participants, 39.6% and 36% were agreed with increased risk of health problem in the offspring and birth defect and malformation, respectively, 38.8% agreed that inherited blood disorders increased, 44.3% had no opinion toward increased risk of deafness, while 22.1% agreed about increasing risk of deafness. Among the respondents, 27% and 17.7% agreed and strongly agreed, respectively, about the risk of congenital heart disease increased risk; 26.9% and 17% agreed and strongly agreed, respectively, that risk of down's syndrome increases; regarding mental retardation: 24% agreed of increased risk of mental retardation, while 17.3% were strongly agreed; 25.1% agreed and 14% strongly agreed of increased risk of epilepsy; the highest percentages of the participants (33.7% and 38.8%) agreed about increased risk of asthma and diabetes, respectively. Only 12.3% were strongly agreed and 22.7% were agreed of increased risk of blood cancer. Only 20.2% and 12.5% agreed of increased risk of pneumonia and flu, respectively. The attitude toward the PMS between participants is shown in Table 4.

The correlation between education levels and awareness toward consanguineous marriage was studied, there was a significant difference ($P$-value = 0.03) between different education levels regarding being with or against consanguineous marriage, where most of the post graduates (48%) were against the consanguineous marriage. Regarding the question about the treatment of inherited diseases, there was a significant difference ($P$-value = 0.001) between different education levels, most of the post graduates (64%) said "yes". The highest percent of those with university education (99.8%) heard about the premarital screening, there was a significant difference between different education levels regarding knowledge about premarital screening ($P$-value = 0.01). There was a significant difference ($P$-value = 0.01) regarding the opinion about the limitation of screening, there were 89.8% of those with secondary education who thought that screening was not limited to infectious diseases. Regarding the question of consequences of insisting on marriage after knowledge of the test results, there was a significant difference ($P$-value = 0.001) between different levels of educations, where the highest percent who knew the consequences was post graduate group (94%), Table 5.

Regarding increased risk of diseases, there were no significant differences between different education levels, Table 6.

Regarding the attitude of participants toward the PMS, there were significant differences regarding: the thought that PMS will contribute to reduction of prevalence of some genetic and STDs ($P$-value = 0.006), where 86.9% of those with university education agreed with that; and there were 30.5% of those with secondary education agreed that no one should obligate any person to conduct

***Table 3.*** *Answers of individuals about increased risks of consanguineous marriages.*

| Risks list | Strongly disagree N (%) | Disagree N (%) | No opinion N (%) | Agree N (%) | Strongly agree N (%) |
|---|---|---|---|---|---|
| Health problems in the offspring | 34 (4.2) | 96 (11.9) | 169 (20.9) | 321 (39.6) | 190 (23.5) |
| Birth defect and malformation | 51 (6.3) | 112 (13.8) | 173 (21.4) | 292 (36.0) | 182 (22.5) |
| Inherited blood disorder | 36 (4.4) | 62 (7.7) | 137 (16.9) | 314 (38.8) | 361 (32.2) |
| Deafness | 51 (6.3) | 123 (15.2) | 359 (44.3) | 179 (22.1) | 98 (12.1) |
| Congenital heart disease | 43 (5.3) | 102 (12.6) | 303 (37.4) | 219 (27.0) | 143 (17.7) |
| Down's syndrome | 56 (6.9) | 131 (16.2) | 257 (33.0) | 218 (26.9) | 138 (17.0) |
| Mental retardation | 55 (6.8) | 126 (15.6) | 295 (36.4) | 194 (24.0) | 140 (17.3) |
| Epilepsy | 45 (5.6) | 134 (16.5) | 315 (38.9) | 203 (25.1) | 113 (14.0) |
| Asthma | 60 (7.4) | 93 (11.5) | 240 (29.6) | 273 (33.7) | 144 (17.8) |
| Diabetes | 48 (5.9) | 72 (8.9) | 143 (17.7) | 314 (38.8) | 233 (28.8) |
| Blood cancer | 61 (7.5) | 135 (16.7) | 330 (40.7) | 184 (22.7) | 100 (12.3) |
| Pneumonia | 79 (9.8) | 135 (16.7) | 353 (43.6) | 164 (20.2) | 79 (9.8) |
| Flu | 187 (23.1) | 189 (23.3) | 274 (33.8) | 101 (12.5) | 59 (7.3) |

***Table 4.*** *Attitude toward the PMS.*

| Choices | Strongly agree | Agree | No opinion | Disagree | Strongly disagree |
|---|---|---|---|---|---|
| PMS is important in case of consanguineous marriage | 29 (3.6) | 17 (2.1) | 26 (3.2) | 91 (11/2) | 647 (79.9) |
| PMS is important in case of non-consanguineous marriage | 27 (3.3) | 25 (3.1) | 32 (4.0) | 151 (18.6) | 575 (71.0) |
| Consanguinity may leads to hereditary diseases | 36 (4.4) | 66 (8.1) | 166 (20.5) | 283 (34.9) | 259 (32.0) |
| PMS will contribute to reduction of prevalence of some genetic and sexually transmitted diseases (STDs) | 29 (3.6) | 26 (3.2) | 61 (7.5) | 172 (21.2) | 522 (64.4) |
| It is important to raise awareness about PMS before marriage to reduce genetic and STDs | 27 (3.3) | 15 (1.9) | 52 (6.4) | 135 (16.7) | 581 (71.7) |
| The law that obligate all future couples to do PMS is important | 28 (3.5) | 27 (3.3) | 48 (5.9) | 147 (18.1) | 560 (69.1) |
| No one should obligate any person to conduct genetic testing, but only encourage them to do | 291 (35.9) | 206 (25.4) | 91 (11.2) | 121 (14.9) | 101 (12.5) |
| In a case of discovery of having or carrying STDs, marriage decision must be left for freedom of the couple | 145 (17.9) | 121 (14.9) | 104 (12.8) | 235 (29.0) | 205 (25.3) |
| Test results that shows presence of genetic diseases should change the marriage decision | 38 (4.7) | 65 (8.0) | 115 (14.2) | 249 (30.7) | 343 (42.3) |
| It is important to apply a law that stops marriage upon discovery of presence of a genetic disease | 81 (10.0) | 130 (16.0) | 154 (19.0) | 165 (20.4) | 280 (34.6) |
| PMS breaks personal privacy | 325 (40.1) | 205 (25.3) | 95 (11.7) | 80 (9.9) | 105 (13.0) |

***Table 5.*** *Correlation between education level and different answers of eight questions.*

| Identifying consanguineous marriages increase the risk of diseases | Answers N (%) | | Primary and basic | Secondary | University | Post graduate | P value |
|---|---|---|---|---|---|---|---|
| Health problems in the offspring | Agree | *N* | 14 | 97 | 367 | 33 | 0.486 |
| | | % | 63.6 | 58.1 | 64.3 | 66.0 | |
| | Disagree | *N* | 3 | 30 | 86 | 11 | |
| | | % | 13.6 | 18.0 | 15.1 | 22.0 | |
| | Don't know | *N* | 5 | 40 | 118 | 6 | |
| | | % | 22.7 | 24.0 | 20.7 | 12.0 | |
| Birth defect and malformation | Agree | *N* | 11 | 85 | 349 | 29 | 0.209 |
| | | % | 50.0 | 50.9 | 61.1 | 58.0 | |
| | Disagree | *N* | 5 | 35 | 111 | 12 | |
| | | % | 22.7 | 21.0 | 19.4 | 24.0 | |
| | Don't know | *N* | 6 | 47 | 111 | 9 | |
| | | % | 27.3 | 28.1 | 19.4 | 18.0 | |
| Inherited blood disorder | Agree | *N* | 11 | 117 | 413 | 34 | 0.333 |
| | | % | 50.0 | 70.1 | 72.3 | 68.0 | |
| | Disagree | *N* | 5 | 23 | 62 | 8 | |
| | | % | 22.7 | 13.8 | 10.9 | 16.0 | |
| | Don't know | *N* | 6 | 27 | 96 | 8 | |
| | | % | 27.3 | 16.2 | 16.8 | 16.0 | |

*continued*

***Table 5 Continued.*** *Correlation between education level and different answers of eight questions.*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Deafness | Agree | *N* | 6 | 55 | 195 | 21 | 0.311 |
| | | % | 27.3 | 32.9 | 34.2 | 42.0 | |
| | Disagree | *N* | 9 | 34 | 120 | 11 | |
| | | % | 40.9 | 20.4 | 21.0 | 22.0 | |
| | Don't know | *N* | 7 | 78 | 256 | 18 | |
| | | % | 31.8 | 46.7 | 44.8 | 36.0 | |
| Congenital heart disease | Agree | *N* | 9 | 66 | 260 | 27 | 0.374 |
| | | % | 40.9 | 39.5 | 45.5 | 54.0 | |
| | Disagree | *N* | 6 | 33 | 96 | 10 | |
| | | % | 27.3 | 19.8 | 16.8 | 20.0 | |
| | Don't know | *N* | 7 | 68 | 215 | 13 | |
| | | % | 31.8 | 40.7 | 37.7 | 26.0 | |
| Down's syndrome | Agree | *N* | 10 | 76 | 252 | 18 | 0.464 |
| | | % | 45.5 | 45.5 | 44.1 | 36.0 | |
| | Disagree | *N* | 3 | 31 | 138 | 15 | |
| | | % | 13.6 | 18.6 | 24.2 | 30.0 | |
| | Don't know | *N* | 9 | 60 | 181 | 17 | |
| | | % | 40.9 | 35.9 | 31.7 | 34.0 | |
| Mental retardation | Agree | *N* | 10 | 63 | 235 | 26 | 0.116 |
| | | % | 47.6 | 37.7 | 41.2 | 52.0 | |
| | Disagree | *N* | 7 | 43 | 118 | 13 | |
| | | % | 33.3 | 25.7 | 20.7 | 26.0 | |
| | Don't know | *N* | 4 | 61 | 218 | 11 | |
| | | % | 19.0 | 36.5 | 38.2 | 22.0 | |
| Epilepsy | Agree | *N* | 8 | 59 | 227 | 22 | 0.798 |
| | | % | 36.4 | 35.3 | 39.8 | 44.0 | |
| | Disagree | *N* | 6 | 43 | 119 | 11 | |
| | | % | 27.3 | 25.7 | 20.8 | 22.0 | |
| | Don't know | *N* | 8 | 65 | 225 | 17 | |
| | | % | 36.4 | 38.9 | 39.4 | 34.0 | |
| Asthma | Agree | *N* | 13 | 89 | 286 | 29 | 0.863 |
| | | % | 59.1 | 53.3 | 50.1 | 58.0 | |
| | Disagree | *N* | 3 | 33 | 109 | 8 | |
| | | % | 13.6 | 19.8 | 19.1 | 16.0 | |
| | Don't know | *N* | 6 | 45 | 176 | 13 | |
| | | % | 27.3 | 26.9 | 30.8 | 26.0 | |
| Diabetes | Agree | *N* | 12 | 114 | 386 | 35 | 0.871 |
| | | % | 54.5 | 68.3 | 67.6 | 70.0 | |
| | Disagree | *N* | 4 | 25 | 83 | 8 | |
| | | % | 18.2 | 15.0 | 14.5 | 16.0 | |
| | Don't know | *N* | 6 | 28 | 102 | 7 | |
| | | % | 27.3 | 16.8 | 17.9 | 14.0 | |
| Blood cancer | Agree | *N* | 7 | 59 | 197 | 21 | 0.681 |
| | | % | 31.8 | 35.3 | 34.5 | 42.0 | |
| | Disagree | *N* | 8 | 41 | 134 | 13 | |
| | | % | 36.4 | 24.6 | 23.5 | 26.0 | |
| | Don't know | *N* | 7 | 67 | 240 | 16 | |
| | | % | 31.8 | 40.1 | 42.0 | 32.0 | |
| Pneumonia | Agree | *N* | 7 | 46 | 173 | 17 | 0.541 |
| | | % | 31.8 | 27.5 | 30.3 | 34.0 | |
| | Disagree | *N* | 6 | 42 | 148 | 18 | |
| | | % | 27.3 | 25.1 | 25.9 | 36.0 | |
| | Don't know | *N* | 9 | 79 | 250 | 15 | |
| | | % | 40.9 | 47.3 | 43.8 | 30.0 | |

*continued*

***Table 5 Continued.*** *Correlation between education level and different answers of eight questions.*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Flu | Agree | *N* | 8 | 28 | 114 | 10 | 0.529 |
| | | % | 36.4 | 16.8 | 20.0 | 20.0 | |
| | Disagree | *N* | 9 | 80 | 265 | 22 | |
| | | % | 40.9 | 47.9 | 46.4 | 44.0 | |
| | Don't know | *N* | 5 | 59 | 192 | 18 | |
| | | % | 22.7 | 35.3 | 33.6 | 36.0 | |

**P*-value; significant.

***Table 6.*** *Comparison between different education levels and their answers about increased risk of several diseases.*

| Questions | Answers N (%) | | Primary and basic | Secondary | University | Post graduate | P value |
|---|---|---|---|---|---|---|---|
| Are you with or against the consanguineous marriage? | With | *N* | 7 | 23 | 75 | 11 | 0.035* |
| | | % | 31.8 | 13.8 | 13.1 | 22.0 | |
| | Against | *N* | 9 | 62 | 247 | 24 | |
| | | % | 40.9 | 37.1 | 43.3 | 48.0 | |
| | Don't know | *N* | 6 | 82 | 249 | 15 | |
| | | % | 27.3 | 49.1 | 43.6 | 30.0 | |
| Do you think that the marriage of a second or third degree relative reduces the risk of genetic diseases? | Yes | *N* | 7 | 58 | 272 | 26 | 0.062 |
| | | % | 31.8 | 34.7 | 47.6 | 52.0 | |
| | No | *N* | 8 | 54 | 147 | 14 | |
| | | % | 36.4 | 32.3 | 25.7 | 28.0 | |
| | Don't know | *N* | 7 | 55 | 152 | 10 | |
| | | % | 31.8 | 32.9 | 26.6 | 20.0 | |
| Do you think that inherited diseases are life-threatening? | Yes | *N* | 13 | 109 | 360 | 27 | 0.244 |
| | | % | 59.1 | 65.3 | 63.0 | 54.0 | |
| | No | *N* | 3 | 40 | 146 | 16 | |
| | | % | 13.6 | 24.0 | 25.6 | 32.0 | |
| | Don't know | *N* | 6 | 18 | 65 | 7 | |
| | | % | 27.3 | 10.8 | 11.4 | 14.0 | |
| Do you think that inherited diseases can be treated | Yes | *N* | 10 | 57 | 139 | 8 | 0.001* |
| | | % | 45.5 | 34.1 | 24.3 | 16.0 | |
| | No | *N* | 3 | 75 | 300 | 32 | |
| | | % | 13.6 | 44.9 | 52.5 | 64.0 | |
| | Don't know | *N* | 9 | 35 | 132 | 10 | |
| | | % | 40.9 | 21.0 | 23.1 | 20.0 | |
| Did you hear about examination before marriage? | Yes | *N* | 21 | 166 | 570 | 50 | 0.01* |
| | | % | 95.5 | 99.4 | 99.8 | 100.0 | |
| | No | *N* | 1 | 1 | 1 | 0 | |
| | | % | 4.5 | 0.6 | 0.2 | 0.0 | |
| Do you think that the examination before marriage is limited to infectious diseases (suchas hepatitis, AIDS)? | Yes | *N* | 5 | 9 | 42 | 4 | 0.017* |
| | | % | 22.7 | 5.4 | 7.4 | 8.0 | |
| | No | *N* | 14 | 150 | 509 | 43 | |
| | | % | 63.6 | 89.8 | 89.1 | 86.0 | |
| | Don't know | *N* | 3 | 8 | 20 | 3 | |
| | | % | 13.6 | 4.8 | 3.5 | 6.0 | |
| Do you know what were the consequences of insisting on marriage after knowledge of the test results were positive? | Yes | *N* | 13 | 112 | 406 | 47 | 0.001* |
| | | % | 59.1 | 67.1 | 71.1 | 94.0 | |
| | No | *N* | 9 | 55 | 165 | 3 | |
| | | % | 40.9 | 32.9 | 28.9 | 6.0 | |
| Do you think that it's a realistic examination and you should take a serious decision about it? | Yes | *N* | 10 | 57 | 139 | 8 | 0.98 |
| | | % | 45.5 | 34.1 | 24.3 | 16.0 | |
| | No | *N* | 3 | 75 | 300 | 32 | |
| | | % | 13.6 | 44.9 | 52.5 | 64.0 | |
| | May be | *N* | 9 | 35 | 132 | 10 | |
| | | % | 40.9 | 21.0 | 23.1 | 20.0 | |

***Table 7.*** *comparison between different education groups regarding attitude toward the PMS.*

| Attitude toward the premarital screening | Answers N (%) | | Primary and basic | Secondary | University | Post graduate | P value |
|---|---|---|---|---|---|---|---|
| PMS is important in case of consanguineous marriage | Agree | *N* | 17 | 151 | 525 | 45 | 0.357 |
| | | % | 77.3 | 90.4 | 91.9 | 90.0 | |
| | Disagree | *N* | 3 | 10 | 29 | 4 | |
| | | % | 13.6 | 6.0 | 5.1 | 8.0 | |
| | Don't know | *N* | 2 | 6 | 17 | 1 | |
| | | % | 9.1 | 3.6 | 3.0 | 2.0 | |
| PMS is important in case of non-consanguineous marriage | Agree | *N* | 19 | 149 | 513 | 45 | 0.500 |
| | | % | 86.4 | 89.2 | 89.8 | 90.0 | |
| | Disagree | *N* | 3 | 13 | 32 | 4 | |
| | | % | 13.6 | 7.8 | 5.6 | 8.0 | |
| | Don't know | *N* | 0 | 5 | 26 | 1 | |
| | | % | 0.0 | 3.0 | 4.6 | 2.0 | |
| Consanguinity may lead to hereditary diseases | Agree | *N* | 13 | 108 | 388 | 33 | 0.473 |
| | | % | 59.1 | 64.7 | 68.0 | 66.0 | |
| | Disagree | *N* | 4 | 24 | 64 | 10 | |
| | | % | 18.2 | 14.4 | 11.2 | 20.0 | |
| | Don't know | *N* | 5 | 35 | 119 | 7 | |
| | | % | 22.7 | 21.0 | 20.8 | 14.0 | |
| PMS will contribute to reduction of prevalence of some genetic and STDs | Agree | *N* | 13 | 144 | 496 | 41 | 0.006* |
| | | % | 59.1 | 86.2 | 86.9 | 82.0 | |
| | Disagree | *N* | 5 | 13 | 31 | 6 | |
| | | % | 22.7 | 7.8 | 5.4 | 12.0 | |
| | Don't know | *N* | 4 | 10 | 44 | 3 | |
| | | % | 18.2 | 6.0 | 7.7 | 6.0 | |
| It is important to raise awareness about PMS before marriage to reduce genetic and STDs | Agree | *N* | 15 | 148 | 510 | 43 | 0.093 |
| | | % | 68.2 | 88.6 | 89.3 | 86.0 | |
| | Disagree | *N* | 3 | 10 | 25 | 4 | |
| | | % | 13.6 | 6.0 | 4.4 | 8.0 | |
| | Don't know | *N* | 4 | 9 | 36 | 3 | |
| | | % | 18.2 | 5.4 | 6.3 | 6.0 | |
| The law that obligate all future couples to do PMS is important | Agree | *N* | 16 | 146 | 501 | 44 | 0.331 |
| | | % | 72.7 | 87.4 | 87.7 | 88.0 | |
| | Disagree | *N* | 3 | 14 | 34 | 4 | |
| | | % | 13.6 | 8.4 | 6.0 | 8.0 | |
| | Don't know | *N* | 3 | 7 | 36 | 2 | |
| | | % | 40.9 | 35.9 | 31.7 | 34.0 | |
| No one should obligate any person to conduct genetic testing, but only encourage them to do | Agree | *N* | 12 | 51 | 147 | 12 | 0.040* |
| | | % | 54.5 | 30.5 | 25.7 | 24.0 | |
| | Disagree | *N* | 6 | 100 | 359 | 32 | |
| | | % | 27.3 | 59.9 | 62.9 | 64.0 | |
| | Don't know | *N* | 4 | 16 | 65 | 6 | |
| | | % | 18.2 | 9.6 | 11.4 | 12.0 | |
| In the case of discovery having or carrying inherited disease in PMS, marriage decision must be left for freedom of couple | Agree | *N* | 8 | 93 | 316 | 23 | 0.110 |
| | | % | 36.4 | 55.7 | 55.3 | 46.0 | |
| | Disagree | *N* | 11 | 50 | 181 | 24 | |
| | | % | 50.0 | 29.9 | 31.7 | 48.0 | |
| | Don't know | *N* | 3 | 24 | 74 | 3 | |
| | | % | 27.3 | 26.9 | 30.8 | 26.0 | |
| Test results that shows presence of genetic diseases should change marriage decision | Agree | *N* | 14 | 122 | 418 | 38 | 0.270 |
| | | % | 63.6 | 73.1 | 73.2 | 76.0 | |
| | Disagree | *N* | 5 | 24 | 65 | 9 | |
| | | % | 22.7 | 14.4 | 11.4 | 18.0 | |
| | Don't know | *N* | 3 | 21 | 88 | 3 | |
| | | % | 13.6 | 12.6 | 15.4 | 6.0 | |

*continued*

***Table 7 Continued.*** *comparison between different education groups regarding attitude toward the PMS.*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| It is important to apply a law that stop marriage upon discovery of presence of a genetic disease | Agree | *N* | 13 | 86 | 313 | 33 | 0.421 |
| | | % | 59.1 | 51.5 | 54.8 | 66.0 | |
| | disagree | *N* | 6 | 48 | 144 | 13 | |
| | | % | 27.3 | 28.7 | 25.2 | 26.0 | |
| | Don't know | *N* | 3 | 33 | 114 | 4 | |
| | | % | 13.6 | 19.8 | 20.0 | 8.0 | |
| PMS breaks personal privacy | Agree | *N* | 7 | 29 | 131 | 18 | 0.095 |
| | | % | 31.8 | 17.4 | 23.0 | 36.0 | |
| | Disagree | *N* | 12 | 118 | 370 | 30 | |
| | | % | 54.5 | 70.7 | 64.9 | 60.0 | |
| | Don't know | *N* | 3 | 20 | 69 | 2 | |
| | | % | 40.9 | 47.3 | 43.8 | 30.0 | |

**P*-value; significant.

genetic testing, but only encourage them (*P*-value = 0.04), Table 7.

## Discussion

In the Middle East and in South, Central, and West Asia, the rates of consanguineous marriages are remarkable [17]. Saudi Arabia had the second rank of the highest frequency of consanguineous marriage with a prevalence ranged from 22% to 55% [18]. In the present study, we aimed to investigate the relationship between awareness toward consanguineous marriages and different education levels. In the present study, most of the participants 70.5% had university education; however, there was not much difference of opinion between those who were against consanguineous marriages (42.2%) and those who didn't know (43.5%).

In a previous Saudi study [19], it was found that half of the participants had an attitude toward consanguineous marriage. In an Iranian study [2], it was reported that the tendency toward consanguineous marriages rated 32.5%. In the Saudi study [19], it was reported that the participants who received medical information had a less-positive attitude toward supporting consanguinity and authors explained that by the significant association between educational sessions and attitude changes. In a Turkish study [20], conducted among high school students, it was noted that their knowledge and attitude toward consanguineous marriage were changed after the training program.

Although most of our participants had university education, there was less participants against consanguineous marriage compared to those who didn't know and had no opinion. This indicates the need for educational programs to increase their knowledge and change the attitude toward consanguineous marriage. In an Iranian study [2], it was found that 44.6% of the participants had poor knowledge on genetic consequences of inbreeding, while other study [21] reported higher percent 75%.In the present study, there were three questions (Q2, Q3, and Q4) that investigated the knowledge of participants about genetic consequences of that marriage, most of the participants knew the correct answers and had good knowledge toward the genetic consequences of consanguineous marriages, where 44.8% thought that second and third degree relative decreases the risk of genetic diseases, 62.8% knew that inherited diseases are life-threatening and 50.6% knew that inherited diseases can't be treated.Two studies conducted in Iran showed a significant correlation between young people's attitude toward consanguineous marriages and their level of education [2,21]. In a Saudi study [19], there was no significant relationship between positive attitude toward consanguineous marriage and education. In the present study, there was a significant difference between different education levels and attitude toward consanguineous marriage (*P*-value = 0.03) with higher percent of those who were post graduate (48%) were against consanguineous marriage. Regarding the increased risk of several diseases due to consanguineous marriage, there was no significant difference between different education levels.

The study recommends that there should be more educational programs to increase the society's knowledge about consanguineous marriage and further studies should be carried out to evaluate the society's knowledge over time, also PMS centers should be aware and explain the aim of the test to the couples on what are screening for and what are the standard tests they are going to do.

## Conclusion

There was low attitude rate toward consanguineous marriage and there was a correlation between education level and attitude toward consanguineous marriage. Increasing level of education decreases the attitude toward consanguineous marriage.

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**List of Abbreviation**

STD Sexually transmitted disease

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**Consent for Publication**

Yes, informed consent was taken from all participants.

**Author details**

Mohammad Ali Karbouji[1], Samia Mahdi Ahmed[2], Raneem Sami AlGain[1], Abdulrahman Thaher Althaher[1], Shumukh Mohammed Alhejaili[1], Shahad Mohammed AlAyoubi[1]

1. Taibah University, AlMadinah AlMunawara, Saudi Arabia.
2. College of Applied Medical Sciences, Taibah University, AlMadinah AlMunawara, Saudi Arabia.

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