An educational program about premarital screening for unmarried female students in King Abdul-Aziz University, Jeddah

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Summary The present study was conducted to assess knowledge and attitude of unmarried female students in King Abdul-Aziz University (KAU) towards premarital screening (PMS) program, to determine predictors of high students' knowledge scores and to improve their knowledge about PMS through conduction of an educational campaign. Multi-stage stratified random sample method was used with recruitment of 1563 students from all faculties of KAU, during the educational year 2008—2009. The Pre-test included 30 knowledge items and 14 attitude statements with student's response through a 5-point Likert scale. Health education was conducted using audiovisual aids through pre-designed educational materials. Statistical analysis was done by SPSS version 16. Results: Students' knowledge about the program was generally low before the educational campaign. The predictors of high knowledge scores were being a health science student (aOR = 4.15; 95% CI: 2.97—5.81), age $\geq$20 years (aOR = 2.78; 95% CI: 2.01—3.85), family history of hereditary diseases and income $\geq$10,000 SR/month. Regarding attitude, almost all students (99.0%) agreed on the importance of PMS. After the educational program, students' knowledge about PMS was markedly improved. The mean students' knowledge score was 9.85 ± 5.36 in Pre-test and improved to 18.45 ± 4.96 in Post-test, with a highly statistical significant difference (*paired t* = 25.40, *p* < 0.000). Conclusion and recommendations: The educational program was successful in improving students' knowledge about the PMS. Conduction of similar educational programs and adding PMS in the curriculum of secondary and university education are recommended.
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Introduction

Premarital screening (PMS) is one of the most important strategies for prevention of genetic disorders, congenital anomalies and several medical, psychosocial marital problems [1—3]. It can provide an opportunity to intervene according to the identified risk. This intervention include vaccination, counseling regarding behavior (including those related to HIV and other infections), nutrition, genetic counseling, advice regarding contraception, modification of chronic disease, treatment of infections and medication to decrease teratogenic risk [4—6]. In addition, unlike standard marital therapies, premarital interventions (i.e. counseling or education) have been found to be effective in a variety of different ways, for example immediate and short-term improvements in interpersonal skills and overall relationship quality, likely decreasing risk factors (e.g. poor communication skills) for later marital problems and increasing the quality of life for couples and families who stay together [7]. Premarital counseling (PMC) is also the most appropriate procedure, as it is generally acceptable from the religious and ethical point of view as well as its minimal health, and economical requirements [8].

The majority of councelling concerns heamoglobinopathies (sickle cell anemia and thalassemia). These diseases are a major public health problem in the Mediterranean area, the Middle East, the Indian subcontinent, Asia, tropical Africa and the Caribbean. According to the WHO approximately 240 million people are heterozygous for inherited hemoglobinopathies including thalassemia and sickle cell disease [3—6]. In KSA the pattern of marriage, encourages consanguineous and other forms of relative marriages, leading to an increase in the occurrence of recessive genetic disorders [8]. Genetic disorders are very common and highly prevalent in the general population of KSA [4,9].

For these factors the Saudi Royal Cabinet issued the Saudi Royal Decree No. 3 dated 11-7-1424, 2003, establishing PMS as a health preventive measure for all Saudis, and requesting the 2 prospective partners (male and female) to carry out a pre-marital examination and present a certificate before the wedding. However, the prospective husband and wife are not obliged to abide by the laboratory results. This program started officially on the 1425 H (2004 G) [8—12]. This program is a part of the national project spear — headed by Saudi Ministry of Health named the ''Healthy Marriage Program'' [12]. The program began as screening program for hemoglobinopathies; specif-

ically sickle cell anemia and thalassemias in 2004. On 1/1/1429 H (10 January 2008), viral pathogen screening was added for HIV, Hepatitis B and C Virus as a prerequisite for issuing marriage certificate. There is no doubt that the implementation of pre-marital infectious disease screening is an ambitious and massive project scale of cost and impact. A recent study conducted in KSA (among 74,662 participants) revealed that the average HIV, HBV and HCV prevalence were 0.03%, 1.31% and 0.33%, respectively [11]. Initial data from screening tests for hemoglobinopathies point to significant regional differences. In addition, potential high-risk marriage was identified among 2.1% of the screened future spouses, with 86% proceeding with the marriage in spite of high-risk status [12].

The WHO has repeatedly recommended several measures to prevent genetic diseases including health education and the improvement of community knowledge and attitude towards the control of hereditary genetic diseases [6,8]. Health education is an important means of improving the public perception of newly introduced health interventions [7,9]. Studies conducted about PMS revealed low knowledge of adolescents about this important issue. In addition, there is lack of educational programs about PMS in Jeddah. A comprehensive epidemiological study including health education campaign for university students about PMS is urgently needed.

The purpose of current study was to assess knowledge and attitude of unmarried female students in King Abdul-Aziz University (KAU), Jeddah, toward PMS, to determine predictors of students' knowledge scores and to improve their knowledge about PMS through an educational campaign.

Methodology

After choosing the study topic, an extensive literature review was done for construction of questionnaires, and designing the educational materials. Approvals for conducting the study were obtained from the female President of the university, and from the vice deans of all KAU female faculties. The study was conducted from January to April 2009. Multistage stratified random sample method was used to select students. The stratification put into consideration the type of faculty, educational level, the section (science/arts) and the educational grade (first—sixth). The numbers of students from science and arts were taken using the proportional allocation technique.

All unmarried students available on the day of interview were invited to participate. Those who accepted were recruited. The team followed the ethical standards of confidentiality and freedom participation. The topic of the research was discussed with each student separately and again upon acceptance a verbal consent. Questionnaires were anonymous, self-administered and confidential.

An intervention strategy with mass communication campaign was done. The educational program consisted of its 3 basic pillars; Pre-test, health education and Post-test. Upon enrollment in the study, each student filed out a pre-designed structured data collection sheet. The first part elicited respondents' personal and socio-demographic characteristics. History of consanguinity among parents and hereditary diseases as thalassemia, sickle cell anemia and Glucose 6 phosphate dehydrogenase Deficiency (G6PD) and the sources of their knowledge about PMS program were obtained.

Then, they completed the items of Pre-test form which inquired about students' knowledge and attitude towards the PMS program.

Students' knowledge

Thirty knowledge questions were asked using both true, false and do not know answers, and multiple choices with single correct answer questions. These questions included:

1. General knowledge about PMS program (5 items): These inquired about the year of starting the program in KSA and hospitals which provide this service in Jeddah.
2. Knowledge about the investigations done in PMS (15 items): included the offered tests, infectious disease and hemoglobinopathy screened in the PMS.
3. Knowledge about infectious diseases screened in the program (2 items): Those asked about HBV and AIDS.
4. Knowledge about hemoglobinopathy and enzymopathy (8 items): inquired about the manifestations and complications of hemoglobinopathy as G6PD, thalassemia and sickle cell anemia.

Students' attitude

Items addressed students' attitude towards PMS and counseling were inquired about through students' responses to 14 statements in a 5-point Likert scale (ranged from 1 = strongly disagree to 5 = strongly agree). These statements inquired about the students' attitude towards PMS and misconception that PMS violates Islamic rules.

Students' opinions regarding consanguinity may increase the risk of hereditary diseases. PMS is expected to decrease prevalence of some genetic and Sexually Transmitted Diseases (STDs). Statements regarding the importance of counseling before marriage to reduce and prevent the spread of genetic diseases or STDs were included whether religious leaders should adopt the ideas of PMS is to be discussed in different occasions. Student's opinion about if Ma'zoon (authorized person who carries out the religious marriage for Muslim prospective couples) should have the right to complete marriage contract only in case of couple conduction of PMS was also inquired about.

Educational message (intervention)

The health education intervention covered the most important issues related to PMS, and replies on almost all Pre-test questions. A computer-based, CD-ROM with multimedia interactive animated presentations was used to discuss the topic. The CD-ROM contained an Arabic lecture on pre-marital screening and counseling program. The CD was supported by attractive images about the details of all 5 big items inquired in the Pre-test. It included information about the definition the PMS program, its importance and hospitals which provided the service in Jeddah. The nature, mode of transmission, prevention and control of infectious diseases screened through the program (HIV/AIDS, HBV and HCV) were also discussed. Hereditary hemoglobinopathies as sickle cell anemia and thalassemia were also identified. The total show time took about 40 min. The education was followed by group discussion which lasted 20 min.

During the educational program, misconceptions and poor attitudes towards PMS were identified and discussed. Thousands of folders carrying the logo of the campaign and brochures with a great quantity of information about PMS were extensively distributed to the student ''target populations'', administrative staff and other interesting members. There are 5 different brochures with different topics. The educational computer CDs were given to administrators in the faculty and some students' leader to be repeated in at a later time. In addition, Hundreds of posters (five different styles and every one carry different PMS educational message) were distributed all over the visited faculties. Constructed models were also used in teaching. After finishing the field work an exhibition was constructed with help of educational materials that were used during the study. A video film of the exhibition was prepared and accompanied by Arabic and English clarification. The exhibition was done in Faculty of medicine.

Table 1 Relationship between knowledge level about premarital screening program and personal, socio-demographic factors among female students in King Abdul-Aziz University Jeddah, KSA.

Knowledge level variable	Poor		Fair and satisfactory		Total	x^2, p	OR, 95% CI
	No.	%	No.	%			
Age							
<20	536	88.6	69	11.4	605	37.5, $p < 0.000$	2.44, 1.82–3.27
≥20	729	76.1	229	23.9	958		
Nationality							
Saudi	1220	81.1	284	18.9	1504	0.8, $p > 0.05$	1.33, 0.72–2.46
Non Saudi	45	76.3	14	23.7	59		
Student's college							
Health science	707	74.0	248	26.0	955	75.8, $p < 0.000$	3.92, 2.83–5.41
Arts	558	91.8	50	8.2	608		
Father's education							
Less than university	572	83.4	114	16.6	686	4.7, $p < 0.02$	1.33, 1.03–1.72
University or above	693	79.0	184	21.0	877		
Mother's education							
Less than university	727	82.4	155	17.6	882	0.74, $p > 0.05$	1.25, 0.97–1.60
University or above	538	79.0	143	21.0	681		
Family income							
<10,000/month	475	84.8	85	15.2	560	$p < 0.003$	1.51, 1.14–1.98
≥10,000/month	790	78.8	213	21.2	1003		
Parental consanguinity							
Yes	475	84.8	85	15.2	560	0.127, $p > 0.05$	1.05, 0.80–1.37
No	790	78.8	213	21.2	1003		
Family history of genetic diseases							
No	1153	82.1	251	17.9	1404	12.6, $p < 0.001$	1.93, 1.43–2.78
Yes	112	70.4	47	29.6	159		
Grade of education							
1–3	1063	83.4	212	16.6	1275	26.6, $p < 0.000$	2.14, 1.59–2.86
4+	202	70.1	86	29.9	288		

Post-test

It was done after finishing the educational program, and included same questions inquired in Pre-test (Self-pairing).

Statistical analysis: The collected data were reviewed, coded, verified and statistically analyzed using computer program SPSS version 16. (SPSS Inc, Chicago, Ill) [13].

Knowledge score: Knowledge scoring system was developed for the 30 items. ''Do not know'' answers were treated as incorrect and given ''0'' while each of correct answer was given a score of ''1''. The total knowledge score was calculated and ranged from 0 to 30. Knowledge score was classified into: poor score: <15, fair score: 15–<20 and satisfactory score: ≥20.

Statistical tests used were Paired x^2 test (McNemar test) to compare proportions with different knowledge scores (poor, fair and satisfactory) before and after the program. Paired t-test (for comparison between students' total knowledge before and after the program and their knowledge of different aspects of the program) was also calculated. Chi square test was used for comparison between proportions. Odds ratio (OR) and 95% confidence intervals (CI) were also calculated. The significant variables from bivariate analysis were used for multivariate logistic regression analysis through construction of binary Logistic Regression model to identify the predictors of high knowledge score (fair and satisfactory). Adjusted odds ratios (aORs) and 95% confidence intervals (CI) were calculated. Statistical significance was set at $p < 0.05$.

Results

The total number of students enrolled in the Pre-test amounted to 1563 female KAU students, their ages ranged from 17 to 27 years with a mean of 20.3 ± 5.59 years. In the Post-test, 1549 of students accepted to participate (acceptance rate = 99.1%). The majority of students participated in the Pre-test were Saudis and from Western region (96.2% and 93.5%, respectively). Regarding faculties, 61.1% were enrolled in health science faculties (Medicine, Pharmacy, Dentistry and Allied Health Sciences), while 38.9% were enrolled in arts. Fathers of 65.1% of students had a university degree or above, while 43.6% of their mothers obtained the same degree.

Consanguinity between students' parents was reported by about one third (34.6%) of students. It was found that the first degree cousin consanguinity was reported by 21.7% of students' parents.

While 12.9% of students reported that their parents had other types of consanguinity.

Concerning presence of family history of genetic diseases, 28.5% of students reported presence of such problems. G6PD deficiency was reported to be present in the family by 5.1% of students. While 4.4%, 2% and 1.3% reported presence of sickle cell anemia, thalassemia and hemophilia, respectively.

Results of the study revealed that the vast majority (98.7%) of students heard about the PMS program. Fig. 1 demonstrates students' source of knowledge about the program. Friends and family were cited as the commonest source of information for the majority of students (92.6%). About two-thirds (65.9%) of females obtained their information from T.V. and a similar percentage (63.9%) from magazines and newspapers. A substantial proportion of participants (81.7%) obtained their information from street advertisements. Internet was a source of information for about one half of students.

The students' knowledge about PMS and examination program was low before the educational program; 80.9% of students had poor scores, 12.5% obtained fair scores, and only 6.6% obtained satisfactory scores.

The relationship between students' knowledge about the PMS and the studied variables is illustrated in Table 1. It is apparent from the table that students aged ≥20 years had a higher percentage (23.9%) of fair and satisfactory knowledge scores compared to those aged <20 years (11.4%), with
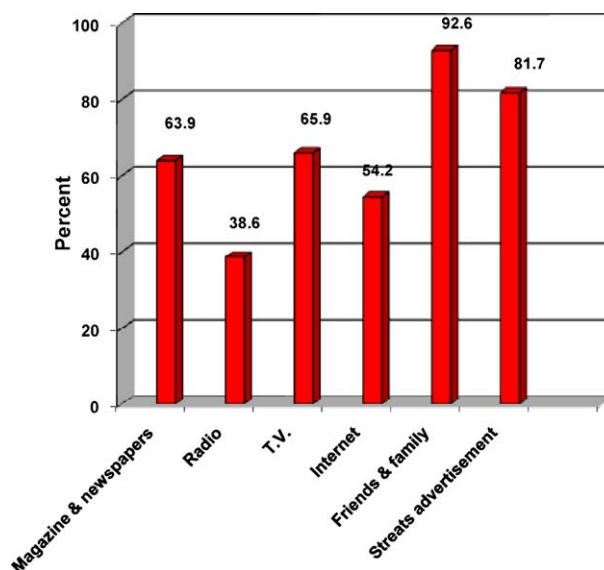

Figure 1 Sources of knowledge about pre-marital screening among female students in King Abdul-Aziz University Jeddah, KSA. N.B. Each question is separately asked.

highly statistical significant difference ($p < 0.000$). Females enrolled in science section obtained about 4 times more fair and satisfactory scores compared to those in arts section (OR = 3.92; 95% CI: 2.83–5.41). Students reporting presence of family history of genetic diseases also had a significantly higher level of knowledge compared to others (OR = 1.93; 95% CI: 1.43–2.78). Those who had a family income ≥10,000 SR/month also obtained better knowledge scores. (OR = 1.51; 95% CI: 1.14–1.95). Knowledge score was increased significantly with increasing the educational grade.

Table 2 emphasizes that many of statistical significant crude associations between personal, socioeconomic, familial factors with the high knowledge score persisted after adjusting for other confounders. Being a health science student was the first predictor of high knowledge score (aOR = 4.15; 95% CI: 2.97–5.81), followed by student's age ≥20 years (aOR = 2.78; 95% CI: 2.01–3.85), family history of hereditary disease (aOR = 1.85; 95% CI: 1.25–2.73) and finally income ≥10,000 SR/month (aOR = 1.42; 95% CI: 1.04–1.95).

Table 3 portrays attitudes of students towards the PMS. It is apparent from the table that the vast majority of students (99%, 96.7% and 99.4%) strongly agreed on the importance of PMS program, and that PMS should to reduce some genetic and STDs and raise awareness about PMS before marriage, respectively. On the other hand, the majority of them disagreed or strongly disagreed and disagree (90.9%) with the misconception that PMS is against Islamic rules. About two-thirds of students (67.1%) strongly agreed that test results which show presence of genetic diseases should change marriage decision. In addition, 44.8% strongly disagreed that no one should compel any person to conduct genetic testing. The table also illustrates that 64.6% strongly agreed that the presence or risk of disease should not compel a change in the decision to marry but should be left to the will of the couple.
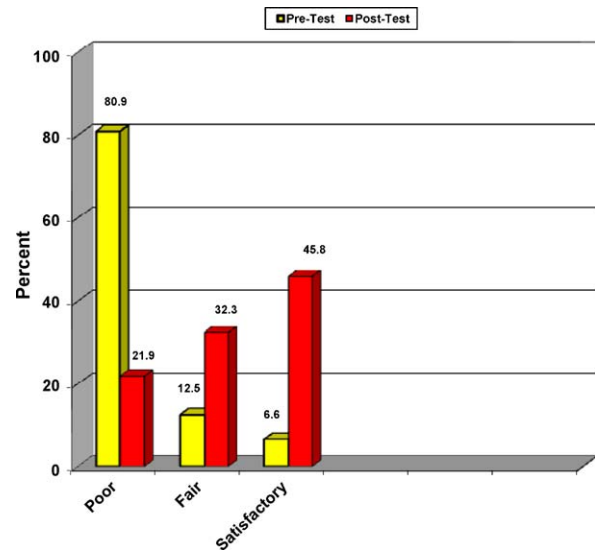

Figure 2 Knowledge about pre-marital screening program among female students in King Abdul-Aziz University, before and after the educational program.

After completion of the educational program, the students' knowledge about PMS markedly improved. Fig. 2 shows that more than four-fifths (80.9%) of students obtained a poor score in the Pre-test, this percentage declined to about one fifth (21.9%) after the program. On the other hand, percentage of satisfactory scores was enhanced from 6.6% to 45.8% in the Pre and Post-tests, respectively. A statistical significant difference was demonstrated ($p < 0.000$).

It is evident also from Table 4 that there was marked improvement in the students' mean knowledge score about PMS, after the intervention educational program. The total mean students' knowledge score was 9.85 ± 5.36 before the program, which doubled (18.45 ± 4.96) after the program (paired $t = 25.40$, $p < 0.000$). All areas about the program including investigations, infections and hemoglobinopathies were also significant ($p < 0.000$) improved after the program.

Table 2 Multiple logistic regression analysis of predictors of high knowledge score about premarital screening program, among female students in King Abdul-Aziz University Jeddah, KSA.

Score and variables	β	aOR	p	CI
Students' knowledge				
Being a health science student	1.424	4.15	0.000	2.97–5.81
Age ≥20 years	1.03	2.78	0.000	2.01–3.85
Family history of hereditary disease	0.614	1.85	0.002	1.25–2.73
Family income ≥10,000 SR/month	0.352	1.42	0.03	1.04–1.95
Constant	−5.319	0.005		

aOR: adjusted odds ratio.
CI: confidence interval.

Table 3 Attitude toward premarital screening program among female students in King Abdul-Aziz University Jeddah, KSA.

Sentence	Degree of agreement									
	Strongly agree		Agree		No opinion		Disagree		Strongly disagree	
	No	%	No	%	No	%	No	%	No	%
PMS is important	1451	92.8	97	6.2	6	0.4	1	0.1	8	0.5
PMS is against Islamic roles	22	1.4	27	1.7	93	6.0	349	22.3	1072	68.6
Consanguinity can increase the risk of hereditary diseases	488	31.2	913	58.4	87	5.6	58	3.7	17	1.1
PMS will contribute to reduction of prevalence of some genetic and STDs	1202	76.9	309	19.8	36	2.3	6	0.4	10	0.6
It is important to raise awareness about PMS before marriage to reduce genetic and STDs	1350	86.4	203	13.0	9	0.5	1	0.1	0	0
Religious leaders should adopt the ideas of PMS in their discussion	820	52.5	548	35.1	169	10.8	18	1.2	8	0.5
Ma'zoon (authorized person who carries out the religious marriage for Muslim prospective couples) should has the right to accept conducting marriage contract only if future couple did PMS	700	44.8	461	29.5	227	14.5	129	8.3	46	2.9
The law that obligate all future couples to do PMS is important	1037	66.3	421	26.9	67	4.3	30	1.9	8	0.5
No one should obligate any person to conduct genetic testing, but only encourage to do	287	18.4	474	30.3	101	6.5	382	24.4	319	20.4
In a case of discovery having or carrying STDs, marriage decision must be left for freedom of the couple	409	26.2	531	34.0	193	12.3	243	15.5	187	12.0
In the case of discovery having or carrying inherited disease in PMS, marriage decision must be left for freedom of couple	397	25.4	613	39.2	188	12	222	14.2	143	9.1
Test results that shows presence of genetic diseases should change marriage decision	543	34.7	506	32.4	298	19.1	152	9.7	64	4.1
It is important to apply a law that stop marriage upon discovery presence of a genetic disease	416	26.6	422	27.0	315	20.2	288	18.4	122	7.8
PMS breaks personal privacy	32	2.0	37	2.4	73	4.7	524	33.5	897	57.4

Table 4 Mean knowledge scores about different items of PMS before and after the educational intervention among female students in King Abdul-Aziz University Jeddah, KSA.

Items of premarital screening	Mean Pre-test	Mean Post-test	Paired t, p-value
PMS program (5 items)	1.42 ± 1.25	3.76 ± 1.30	54.9, <0.0001
Investigations done in program (15 items)	5.76 ± 3.34	8.99 ± 2.87	47.89, <0.0001
Infection (2 items)	0.57 ± 0.49	1.10 ± 1.10	77.5, <0.0001
Hemoglobinopathy, enzymopathy: (8 items)	2.06 ± 1.9	3.96 ± 1.94	35.5, <0.0001
Thalassemia (3 items)	0.72 ± 0.01	0.98 ± 0.94	23.1, <0.0001
Sickle cell anemia (2 items)	0.67 ± 0.72	1.34 ± 0.72	26.5, <0.0001
G6PD (3 items)	0.87 ± 1.04	1.63 ± 1.00	26.1, <0.0001
Total knowledge score (30 items)	9.85 ± 5.36	18.45 ± 4.96	25.40, <0.0001

Discussion

In the Arabian Peninsula, high percentages of consanguineous marriages and the tribal nature of marriages have resulted in high incidence of genetically based disorders [14]. The consanguinity rate in the region is in the region ranges from 25 to 60% [15,16]. Similarly, the current study revealed that about one third (34.1%) of students' parents had consanguineous marriage. The present study also showed that 2% of students reported presence of thalassemia in their families. A study conducted to determine the prevalence of beta-thalassemia among subjects coming for PMS in the Al-Hassa area, SA, found that the prevalence was 3.4%. The higher reported rate from Al Hassa may be due to testing differences between the two geographic locations [17].

The current study showed that students' knowledge about PMS program was low in the Pre-test; 80.9% of students obtained poor score while only 19.1% obtained fair and satisfactory scores. These results go on line with that of a recent study conducted in KAU, Jeddah and found that university students had inadequate knowledge about the national PMS program where less than one-third of the students knew which disorders are tested for by the PMS [14]. A study done in Alexandria to assess knowledge and attitude of nursing students towards premarital counseling revealed that 46.5% had an average score in knowledge [2]. The difference between current and the previous study may be because Alexandria's study was done among nursing students only, with some background about the program, while the present study was done among students from all faculties. Al Sulaiman et al. [1], found that there was a fair knowledge among three groups of Saudi participants about the nature of tests for targeted disorders included in PMS. Another study conducted by Al Sulaiman et al. [18], which explored the impact of the PMS program and genetic counseling on couples at risk for tha-

lassemia and sickle cell anima in an area of the country with high hemoglobinopathy prevalence, found a lack of awareness about genetic diseases and a misunderstanding of the impact of genes on health. The study showed some early benefits of the PMS in prevention of the targeted diseases and confirmed that the program helped in early detection of the disease in their offspring. Another study done in Syria, 2009, showed that although university students had a considerable knowledge of premarital testing, they had a limited knowledge about certain aspects [19]. In Nigeria a cross-sectional survey conducted among University students, 2006, found that the majority of study respondents (63.6%) knew the benefits of genetic counseling [20].

In recent years, premarital counseling has gained acceptance [21]. Results of the present study showed that there is an overall positive attitude towards the program; 99% of female students either strongly agreed or agreed on the importance of PMS. These results agree with results of many other studies. An educational program conducted among female students in King Saud University, Riyadh, found that students' attitude was positive. (81.8% of students in the Pre-test and 85.9% in the Post-test approved the importance of PMS) [9]. Al Suliman et al. [1], found that there was positive attitude of Saudi population towards the program and the majority of participants agreed that the PMS program should apply to all couples in all regions of Saudi Arabia. Results from Germany, 2009, found that there was an overall positive attitude toward genetic testing among the respondents aged 14—95 years of German sample [22]. Hassan et al., 2002 [23], reported that 80.9% of medical students in Alexandria, Egypt, supported the idea of premarital examinations. Similarly, results of a study done to assess the attitude of Pakistani doctors, medical students, lawyers, parliament members and parents of thalassemic children towards genetic diagnosis found that premarital carrier screening was favored by 77% of respondents [24]. Results

of a study conducted to explore the attitude of the students of Health Sciences College in Abha, towards PMC illustrated that 70% of the participants accepted PMC [25]. The Alexandria study conducted among nursing students showed that 65.5% of them had a positive attitude towards premarital counseling [2]. On the other hand, the Syrian study reported that although students had some positive attitude, they still had negative attitude and perceptions towards other aspects of PMS [19].

The previous study from Jeddah [14] demonstrated that 84% of KAU students believed that consanguinity can increase the risk for genetic diseases which is similar to results of the present study where 89.6% of students strongly agreed and agreed that consanguinity can increase the risk of hereditary diseases.

In the present study the vast majority of students agreed that PMS will help to reduce the prevalence of some genetic and STDs. This is similar to results obtained from other Riyadh [9] studies and agrees with results on another study conducted among decision makers in Palestine [26]. Similarly, the majority of students in our study agreed that Ma'zoon should have the right to accept marriage contract only if the future couple did PMS, and that religious people should adopt ideas of the PMS in their discussion. These results also agree with results of the Palestinian's study [26]. Results of a study reported in 2010 from KAU found that most of students favor the PMS program but there were concerns regarding mandating the testing and interference with individual decision making [27].

The present study showed that 64.6% agreed on that in case of discovering presence or carrying inherited disease, marriage decision must be left for freedom of the couple which is also agree with the Palestinian's results [26]. Hassan et al. [23] reported that the majority of medical students emphasized the free choice of the partners regarding finalizing the marriage whatever the results of PMS and less than one third had a positive attitude towards the results.

About two-thirds of students (67.1%) in the current study agreed that when test results show presence of genetic diseases, the marriage decision should be changed. Al Suliman et al. [1], reported also that more than 60% of all three Saudi participants were in favor of preventing at-risk marriages.

The predictors of students' knowledge scores included: being a health science student, age ≥20 years, family history of hereditary disease and family income <10,000 SR/month. The higher knowledge score among those enrolled in health science faculties may reflect understanding of PMS, genetic, infectious diseases acquired during their studies. This indicates the importance of introducing such information in secondary schools and university curricula.

The Health Impact Assessment as defined by the World Health Organization (WHO) calls for the identification of the relevant stakeholders at the initial stage of an assessment [9,28]. Female university students were used as the study population in our educational program about PMS because women have greater stake in this issue. Our educational program was successful in that it improved female students' knowledge about the PMS. Students' knowledge was low before the educational program and it was markedly improved after it. These results agree with that of an educational program conducted through construction of teaching unit for upgrading university-nursing students' knowledge about genetic counseling in Alexandria. Their results revealed the teaching unit had an obvious effect on their knowledge as the total score of their knowledge had improved after implementation of the teaching unit. Moreover, there was a significant relationship between nursing students' knowledge towards genetic counseling before and after implementation of the teaching unit [29]. The Riyadh study showed also that the attitude of students improved after the educational sessions [9].

Strength and limitations of the study

The current study is the first large scale community-based educational program conducted among university students in Jeddah about PMS program. The participation rate was very high in both pre and Post Tests. The educational program markedly improved knowledge of participants. The information provided during the educational program could assist in making students better aware of the dangers and more selective of their future partners. They will spread their corrected knowledge and ideas to their friends, family and community.

The main limitation is the time of conduction of Post-test. Post-test is better to be repeated again after a period of time, for example after 6 months or 1 year.

Conclusion and recommendations

This study highlights that knowledge of female university students about the PMS program was low before the educational campaign. On the other hand, there was general positive attitude towards the importance of the PMS. Our educational program was successful in improving students' knowledge about PMS. In light of our results, there

is certainly a need for more information and education about the program. The recommendations focused on the importance of dissemination of information about PMS through formal and informal education and media publicity. Identification of PMS and its benefits highlight the need to this topic to high school and university curricula. Awareness of the general public should be raised about the benefits of PMS in KSA in an educational campaign similar to the current one that should be implemented in high schools and universities in Saudi Arabia. Public education regarding testing, and its implications also recommended. As a matter of fact, professionals in genetics, health education and the media can work together to increase the awareness of genetic diseases in the adult population, Television documentaries on specific disease and videos might be watched prior to implementation of the PMS. In addition, PMS could be extended to include a broader spectrum of health and genetic disorders. Finally, the success of PMS depends on adequate religious support, government policy, education and counseling. Others with vested interests include the local community (particularly vulnerable groups), planners, local/national Government, health workers at various levels, and decision makers. In addition, PMS could be extended to include a broader spectrum of health/genetic disorders which would allow early identification and possible interventions to prevent of complications.

Conflict of interest statement

Acknowledgments

References

[1] Al Sulaiman A, Suliman A, Al Mishari M, Al Sawadi A, Owaidah TM. Knowledge and attitude toward the hemoglobinopathies premarital screening program in Saudi Arabia: population-based survey. Hemoglobin 2008;32(6):531—8.

[2] Mitwally HH, Abd El-Rahman DA, Mohamed NI. Premarital counseling: view of the target group. J Egypt Public Health Assoc 2000;75(1—2):31—51.

[3] Zunyou W, Keming R. Acceptability of HIV/AIDS counseling and testing among premarital couples in China. AIDS Educ Prev 2005;17(1):12—21.

[4] Al-Arrayed SS, Hafadh N, Al-Serafi S. Premarital counseling: an experience from Bahrain. East Mediterr Health J 1997;3(3):415—9.

[5] WHO. Community control of hereditary anemia: memorandum from a WHO meeting. Bull World Health Organ 1983;61(1):63—80.

[6] WHO. Hereditary anemia: genetic basis, clinic cal features, diagnosis and treatment. Bull World Health Organ 1982;60(5):643—60.

[7] Melissa LK. At-risk individuals' awareness, motivation, roadblocks to participation in premarital interventions, and behaviors following completion of the relationship evaluation. Thesis (Master of Science). Marriage and Family Therapy Program. Brigham Young University; 2005.

[8] El-Hazmi MA. Pre-marital examination as a method of prevention from blood genetic disorders. Community views. Saudi Med J 2006;27(9):1291—5.

[9] Alam AA. Perception of female students of king Saud University towards premarital screening. J Saudi Soc Fam Commun Med 2006;13(2):83—8.

[10] Adibi P, Hedayati S, Mohseni M. Attitude towards premarital screening for hepatitis B virus infection in Iran. Med Screen 2007;14:43—5.

[11] Alswaidi FM, O'Brien SJ. Is there a need to include HIV, HBV and HCV viruses in the Saudi premarital screening programme on the basis of their prevalence and transmission risk factors? J Epidemiol Commun Health 2010;64:989—97.

[12] Editorial. Premarital HIV screening in Saudi Arabia, is antenatal next? J Infect Public Health 2009;2:4—6.

[13] Statistical Package for Social Science (SPSS). Version 16. Chicago: SPSS Inc, Ill.

[14] Al-Odaib AN, Abu-Amero KK, Ozand PT, Al-Hellani AM. A new era for preventive genetic programs in the Arabian Peninsula. Saudi Med J 2003;24(11):1168—75.

[15] Al-Aama JY, Al-Nabulsi BK, Alyousef MA, Asiri NA, Al-Blewi SM. Knowledge regarding the national premarital screening program among university students in western Saudi Arabia. Saudi Med J 2008;29(11):1649—53.

[16] Meyer BF. Strategies for the prevention of hereditary diseases in a highly consanguineous population. Ann Hum Biol 2005;32(2):174—9.

[17] Al-Suliman A. Prevalence of beta-thalassemia trait in premarital screening in Al-Hassa, Saudi Arabia. Ann Saudi Med 2006;26(1):14—6.

[18] Al Sulaiman A, Saeedi M, Al Suliman A, Owaidah T. Postmarital follow-up survey on high risk patients subjected to premarital screening program in Saudi Arabia. Prenat Diagn 2010;30:478—81.

[19] Gharaibeh H, Mater FK. Young, Syrian adults' knowledge, perceptions and attitude to premarital testing. Int Nurs Rev 2009;56(4):450—5.

[20] Moronkola OA, Fadairo RA. University students in Nigeria: knowledge, attitude toward sickle cell disease, and genetic

counseling before marriage. Int Q Commun Health Educ 2006—2007;26(1):85—93.

[21] Abdel-Meguid N, Zaki MSA, Hammad SA. Premarital genetic investigation: effect of genetic counseling. East Mediterr Health J 2000;6(4):652—60.

[22] Balck F, Berth H, Meyer W. Attitude toward genetic testing in a German population. Genet Test Mol Biomarkers 2009;13(6):743—50.

[23] Hassan HZ, Tayel S, Shukair NF. Premarital counseling: I-Knowledge and attitude of Alexandria medical students. Bull High Inst Public Health 2001;31(2):335—50.

[24] Gilani AI, Jadoon AS, Qaiser R, Nasim S, Meraj R, Nasir N, et al. Attitude towards genetic diagnosis in Pakistan: a survey of medical and legal communities and parents of thalassemic children. Commun Genet 2007;10(3):140—6.

[25] Al-Khaldi YM, Al-Sharif AI, Sadiq AA, Ziady HH. Attitude to premarital counseling among students of Abha Health Sciences College. Saudi Med J 2002;23(8):986—90.

[26] El Sharif N, Rifai A, Assi S, Al Hmidat A. Attitude and opinions of Palestinian decision-makers about premarital examination law. East Mediterr Health J 2006;12(6):873—85.

[27] Al-Aama JY. Attitude towards mandatory national premarital screening for hereditary hemolytic disorders. Health Policy 2010;97(1):32—7.

[28] World Health Organization. Health Impact Assessment (HIA); 2005. Available at: www.who.int.

[29] Sobhy SI, Shoeib FM, Zaki NH. Assessment and upgrading of Alexandria University nursing students' knowledge and attitude about genetic counseling. J Egypt Public Health Assoc 2001;76(3—4):205—22.