Primary Prevention of Genetic Disorders among Secondary School Students in a Rural Area

Hanan Ibrahim Ahmed[1], Hemat Abd Elmonem Elsayied[1] and Naglaa. Girgis

[1]Department of Community Health Nursing, Faculty of Nursing, Ain Shams University,
[2]Department of Community Health Nursing, Faculty of Nursing, Benha University
mohamed.hemat@yahoo.com

Abstract: Aim: The aim of the study was to evaluate the effect of primary prevention program of genetic disorders among secondary school students in a rural area. **Design**: A quasi-experimental design was used **Setting**: The study was conducted at secondary school representing in a rural area in Egypt (El-khosos District, El Qalubia Governorate). **Sample:** All students in all classes (from the three grades) of the selected school, the total numbers were 750 students (380 male students & 370 female students). **Tool:** Self Administrated questionnaire was used by the researchers in Arabic language to assess socio-demographic characteristics, and students' knowledge. **Results:** Less than half of the male students 1st degree have family history consanguinity, while more than half of the studied sample do not prefer consanguinity marriage. The male and female students' knowledge regarding the reproductive health concepts, fertilization, risk of consanguinity marriage, causes of increasing genetic disorders , transmission of genetic traits from parents to children, also primary prevention of genetic disorders were improved after the program from poor to good. There was a highly statistically significant difference between socio-demographic characteristics of secondary school students and their total knowledge. **Conclusion:** This study showed highly statistical significant differences between pre / post program implementation and revealed highly statistically significant differences between socio-demographic characteristics of secondary school students and their total knowledge. **Recommendations:** Continuous health educational programs for students in different grades focusing on primary prevention of genetic disorders such as premarital care, consanguineous marriage, and reproductive health. Different mass media especially TV messages to give information for youth, family, and community.

[Hanan Ibrahim Ahmed, Hemat Abd Elmonem Esayied and Naglaa. Girgis. **Primary Prevention of Genetic Disorders among Secondary School Students in a Rural Area**. *Journal of American Science*. 2012;8(6):630-639]. (ISSN:1545-1003). http://www.americanscience.org. 78

Key word: Primary prevention, Genetic disorder

1. Introduction

Genetic disorders are diseases that are not acquired or caused from infection or trauma, but rather children inherit the gene from their parents. It could be congenital, if the disease appears at birth immediately but sometimes, if they have the gene, the disease will develop later on (El-Sobkey, 2007).

More than 2 billion people of various religious and ethnic backgrounds, live in countries, where a large proportion of marriages are contracted between blood relatives (Seronson & Cheuvront, 2005). According to Mokhtar and Abdel Fattah (2001), consanguineous marriage is widely favored in a large majority of the world's Islamic population. The rate of congenital malformations among the off springs is 2.5 times higher than that among the offspring of unrelated parents, mainly due to the expression of autosomal-recessive disorders.

Many studies in Egypt have shown that roughly 30% of admissions and about 40-50% of death occurring in pediatric hospitals are accounted for by children with genetic disorders or congenital malformations (Gomaa, 2007). As well El-Sobkey (2007) mentioned that consanguineous marriage is widely favored in a large majority of the Egyptian population. Estimates of consanguinity ratios in different parts of Egypt rated from 29-50%. The highest incidence was that in the rural areas. First cousin marriage occurred more often than the other types of consanguinity.

Approximately 4 million babies are born each year. About 3% - 4% will be born with a genetic disease or major birth defect. Approximately 1% of all babies will be born with chromosomal abnormality, which can cause physical problems and mental retardation; more than 20% of infant deaths are caused by birth defects or genetic conditions (e.g. congenital heart defects, abnormalities of the nervous system, or chromosomal abnormalities). Approximately 10% of all adults and 30% of children in hospitals are due to genetically related problems. High rates of consanguinity were found in autosomal. There was no increase in autosomal dominant, X linked or chromosomal disorders. The high consanguinity rate reported in rural area society results in an increased rate of certain genetic diseases, mainly autosomal recessive and polygenic disorders (Ministry of Health, 2010).

Genetic diseases are transmitted from parents to the offsprings through a specific pattern of inheritance exemplified by recessive genetic disorders. These diseases include the sickle cell gene, thalassemia, the

hemophilia, inborn errors of metabolism and red cell enzymopaties (Vessey & Jackson, 2006).

Primary prevention of genetic disorder services were recommended by the World Health Organization (WHO), as potential to reduce the prevalence of genetic disorders. Primary prevention of genetic disorders is providing information about genetic disease, birth defects and inherited disorders. Primary prevention of genetic disorders process is an educational service for individuals and families who have a genetic disease or who are at risk for such a disease. Primary prevention of genetic disorders is designed to provide individuals and their families with information about their condition and help them make informed decisions, (Gomaa, 2007).

School health nurses must be up to date with new trends related to secondary school student`s health for improving their health through the school settings, providing opportunities of designed school health programs for promoting health and preventing illness among them and their families (Edwards, 2008).

Magnitude of the Problem:

As reported by Temtamy *et al.* (2007), Egypt, a Mediterranean North African country with a central location at the junction of 3 continents attracted gene flow from various invaders. Geneticists classify unions between second cousins or closer as consanguineous. Children of first-cousin marriages inherit identical gene copies from each parent at 1/16 of their gene. Birth incidence of malformations in Egyptian newborns ranges between 1.16 and 3.17%. The frequency of malformations at birth showed that CNS malformations were the most common (9.33/1000). Studies of parental consanguinity in the Egyptian population showed a frequency ranging from 20-42%. Parental consanguinity rates in groups of Egyptian patients with various birth defects were high suggesting a high rate of autosomal recessive disorders related to other patterns of inheritance. The school health nurse should link secondary school students to needed services and assuring that the health services are available to them as primary prevention of genetic diseases, premarital investigations, and information about reproductive system, (Starfield, 2007).

Aim of the study:

The aim of the study was to evaluate the effect of primary prevention program of genetic disorders among secondary school students in a rural area through:

1- Assessing students' health knowledge related to preventing genetic disorders to identify their needs.
2- Developing and implementing of primary prevention program of genetic disorder according to students needs.
3- Evaluating the effect of program on improving students knowledge related to preventing genetic disorders.

Research hypotheses:

Primary prevention program will improve students' knowledge regarding to genetic disorders, and help students to conduct premarital investigations.

2. Subjects and Methods

Research design:

A quasi-experimental design was used in order to meet the aim of the study.

Technical Design:

Setting:

The study was conducted at secondary school representing in rural area in Egypt (El-khosos district, El Qalubia Governorate). This setting was chosen for its high density with a total number of 750 students.

Sample:

The sample included all students' in all classes (from the three grades) of the selected school. The total number was 750 students (380 male students & 370 female students).

Tool:

A self Administrated questionnaire was used by the researchers in Arabic language based on review of recent literature related to genetic sciences in order to assess students' socio-demographic characteristics, and their knowledge. It included the following parts:

Part 1: Students' socio-demographic characteristics, such as, age, sex, and family history related to consanguinity grade.

Part 2: Students knowledge regarding the reproductive male and female system and reproductive health.

Part 3: Students' knowledge regarding genetic disorders: nature, risk from consanguineous marriage, causes, chromosome, transmission of genetic traits, early detection, community resources, and genetic testing.This tool was used before and after implementation of the program in order to evaluate students' acquisition of knowledge.

Scoring system:

The total knowledge included 28 closed ended questions which included 108 items, every correct answer scored 1 grade, the total knowledge score =108 grades.

The total score was evaluated in three categories as follows:

Good: 81-108 score, (75%+) or more was graded as good knowledge

Average: 54-80-score (50% -< 75%) was graded as average knowledge

Poor: <54-score (<50%) was graded as poor knowledge

Content validity of the tools was done by 5 experts from the community specialty of Faculty Staff Nurses.

Operational Design:

Preparatory phase:

Pilot Study:

It was carried out on 20 students at El- khosos Secondary School in El Qalubia Governorate to test the content clarity and applicability. Necessary modifications were made based on findings of the pilot study.

Ethical Considerations:

Permission for conducting the study was obtained from administrative authority of the school. The researchers took into consideration students rights based on their needs, giving complete necessary information, assuring them that confidentiality will be maintained and students have the right to refuse participation or withdraw at any time without giving any reason. A verbal agreement constituted acceptable consent.

Field Work:

Official permissions were obtained from the Administrator of the school (at El- khosos Secondary School) El-khosos district, El Qalubia Governorate.

-Preparation of data collection tools was carried out over a period of three months beginning from of May, 2011 to end of July, 2011, after being revised from experts to test their validity.

- Data collection for assessment was done by the researchers; three days/week (Mondays, Tuesdays & Wednesdays), from October, 2011 to March ,2012, in the mentioned school from 11.00 a.m. – 1.00 pm, the questionnaire took about 45 minutes to be filled in.

Primary prevention program construction: This program was conducted on three consecutive phases, assessment, developing and implementing and evaluating.

Phase 1: A pre-program assessment tool, using the previous self administrated questionnaire for data collection from secondary school students. This phase aimed at identifying the student (male & female) learning needs towards reproductive health and primary prevention of genetic disorders.

Phase 2: Developing and implementing the primary prevention program of genetic disorders among secondary school students according to their needs.

The general objective of the program: To improve students' knowledge regarding prevention of genetic disorders and to conduct premarital investigations.

Contents of the program:

- Anatomy and physiology of the reproductive system of male and female systems.
-Reproductive health concepts, and time of fertilization
- Relation of fertilization and pregnancy occurrence
- Importance of preconception care to reproductive health
- Risk of consanguinity marriage as inherit of chronic diseases such as ,cardiac diseases, hypertension, diabetes mellitus, cancer, and obesity.
-Genetic diseases resulting from consanguinity marriage such as sickle cell gene, thalassemia, hemophilia, inborn errors of metabolism and red cell enzymopaties.
- Causes of increasing genetic disorders in rural area.
- Meaning, and number of chromosome
- Transmission of genetic traits from parents to children.
- Meaning of primary prevention of genetic disorders.
- Community health services of primary prevention of genetic disorders.
- Premarital investigations.
- Genetic investigation during pregnancy.

Sessions

The sessions content has been sequenced through four sessions, 3days/week (Mondays, Tuesdays and Wednesdays), from 11.00am to 1.00pm) for 2 weeks (2sessions/day/each class), the total number of classes were (20), and each class contained (35-38 student), each session took about 45 minutes. The study was carried out within 6 months from October, 2011 to March, 2012.

Each session started by giving the objectives, taking into consideration using simple and clear Arabic language. Different methods were used such as, lectures, role play, and interaction with laptop. Using effective media of conveying information as laptop, posters, real objects and a model for reproductive system. A booklet was developed for students as a reference after program implementation.

Phase 3. The evaluation phase emphasized the effect of program on improving students knowledge related to preventing genetic disorders by using the same assessment tool.

Administrative Design:

Approval has been taken for carrying out this study in the selected areas from the administrator of the of the school at El- khosos Secondary School) El-khosos district, El Qalubia Governorate.

Statistical Design:

Data were revised, coded, analyzed and tabulated using the number and percentage distribution. The quantitative data were presented using the arithmetic mean, standard deviation, and tests of significance ($p <$ 0.5).

3. Results

Table(1)shows that 37.9 % of the studied sample, their ages ranged between 15-<16 years, 35% of the

male students were in second year, while 46.8 % of the female students were 1st degree of family history consanguinity, while 52.8 % of the studied sample do not prefer consanguinity marriage.

Table (2) reveals that 58.7 % of male students had good knowledge regarding anatomy and physiology of male reproductive system after program implementation, while 49.5% of female students had good knowledge regarding anatomy and physiology of female reproductive system after program implementation. On the other hand, 24.3% of female students had poor knowledge regarding anatomy and physiology of male reproductive system after program implementation. All students (100%) had no knowledge about reproductive health concepts before program implementation. Although57.8% and24.1 % of male and female students respectively had poor knowledge about time of fertilization pre program, 50.8 % and40.0% of male and female students had good knowledge about time of fertilization after program implementation .While 47.4 % and 60.8% of male and female students had poor knowledge about relation of fertilization and pregnancy occurrence pre program, they improved to be 50.5 % and 49.5 % after program implementation. Regarding perceived suitable age of pregnancy 61.3% and 55.4% of male and female students had poor knowledge before program implementation, which improved to be 58.7 % and 48.1 % having good knowledge after program implementation. According to the importance of preconception care to reproductive health, 52.9% and 62.2% of male and female students had poor knowledge before program, while 45.3 % and 39.7% of the male and female students had good knowledge after program implementation.

Table(3) shows that 45.8% and 41.1% of male and female students had poor knowledge about risk of consanguinity marriage before program, which improved to 53.7% and 53.5% of male and female students having good knowledge after program implementation. According to genetic diseases resulting from consanguinity marriage 45.5% and 65.7% of male and female students had poor knowledge pre program but 47.4% and 49.5% of them had good knowledge post program implementation. While 32.9% and 57.6% of male and female students had poor knowledge about causes of increasing genetic disorders pre program, only 19.7% and 19.2% of them had poor knowledge post program.

Table (4) reveals that 91.1% and 74.3% of male and female students had poor knowledge about meaning of chromosomes. All (100%) male students and 87.3% of female students had poor knowledge about number of chromosomes, and 84.7% of male students and all(100%) female students had poor knowledge about transmission of genetic traits from parents to children, which improved after program to 41.1% and 49.7%,54.5% and 45.1% and 49.2% and 48.1% respectively having good knowledge.

Table (5) reveals that all(100%) male and female students had poor knowledge about meaning, community health services of primary prevention of genetic disorder, premarital investigations and genetic investigations during pregnancy preprogram, while their knowledge improved to good knowledge about the previous items (46.8% & 92.4%,66 % & 47.8%, 54.5% & 49.7%, and 41.1% & 50.5%) of male and female students post program implementation.

Table (6) and Figure (1) shows that a highly statistically significant difference was found between pre and post program implementation of secondary school students and their total knowledge **($p<0.001$).**

Table (7) reveals that a highly statistically significant differences were detected between socio-demographic characteristics of secondary school students and their total knowledge regarding sex, education grade and family history consanguinity **($p<0.001$),**while no statistically significant difference was found with age **($p>0.05$).**

Table (1): Demographic characteristics of the secondary school students under study (n= 750)

Items	Male (n =380)		Female (n=370)		Total (n=750)	
	No	%	No	%	No	%
Age (years):						
15-	140	36.8	144	38.9	284	37.9
16-	112	29.5	104	28.1	216	28.8
17-18	128	33.7	122	33.0	250	33.3
Education (grade):						
First	117	30.8	133	36.0	250	33.3
Second	133	35.0	117	31.6	250	33.3
Third	130	34.2	120	32.4	250	33.3
Family history consanguinity:						
1st degree	110	29.0	173	46.8	283	37.7
2nd degree	142	37.4	127	34.3	269	35.9
No consanguinity	128	33.7	70	18.9	198	26.4

Students opinion of consanguinity marriage						
Prefer	128	33.7	226	61.1	354	47.2
Do not Prefer	252	66.3	144	38.9	396	52.8

Table (2): Distribution of secondary school students according to their knowledge pre/post program about of reproductive system and health (n=750)

Items	Pre						Post						Chi-square	
	Good		Average		Poor		Good		Average		Poor			
	N	%	N	%	N	%	N	%	N	%	N	%	X^2	*P*-value
Anatomy and physiology of male reproductive system														
Male	112	29.5	108	28.4	160	42.1	223	58.7	117	30.8	40	10.5	109.14	0.00
Female	105	28.4	101	27.3	164	44.3	178	48.1	102	27.6	90	24.3	40.39	0.00
Anatomy and physiology of female reproductive system														
Male	183	48.2	72	19.0	115	30.3	180	47.4	102	26.8	98	25.8	6.42	0.04
Female	73	19.7	54	14.6	243	65.7	183	49.5	72	19.5	115	31.1	95.60	0.00
Reproductive health concepts														
Male	0	0.0	0	0.0	380	100.0	179	47.1	103	27.1	80	21.1	477.50	0.00
Female	0	0.0	0	0.0	370	100.0	163	44.1	114	30.8	93	25.1	442.72	0.00
Time of fertilization														
Male	73	19.2	87	22.9	220	57.9	193	50.8	117	30.8	70	18.4	136.13	0.00
Female	46	12.4	135	36.5	89	24.1	148	40.0	177	47.8	45	12.2	59.56	0.00
Relation of fertilization and pregnancy occurrence														
Male	87	22.9	113	29.7	180	47.4	192	50.5	113	29.7	75	19.7	82.75	0.00
Female	77	20.8	68	18.4	225	60.8	183	49.5	72	19.5	115	31.1	78.92	0.00
Perceived suitable age of pregnancy														
Male	84	22.1	63	16.6	233	61.3	223	58.7	94	24.7	63	16.6	166.69	0.00
Female	79	21.4	86	23.2	205	55.4	178	48.1	111	30.0	81	21.9	95.07	0.00
Importance of preconception care to reproductive health														
Male	86	22.6	93	24.5	201	52.9	172	45.3	97	25.5	111	29.2	54.71	0.00
Female	53	14.3	87	23.5	230	62.2	147	39.7	96	26.0	127	34.3	74.34	0.00

Table (3): Distribution of secondary school students according to their knowledge pre/post program regarding risk from consanguinity marriage, genetic problems, and causes of increasing genetic disorders (n=750)

Items	Pre						Post						Chi-square	
	Good		Average		Poor		Good		Average		Poor			
	NO	%	NO	%	NO	%	NO	%	NO	%	NO	%	X^2	*P*-value
Risk of consanguinity marriage														
Male	105	27.6	101	26.6	174	45.8	204	53.7	106	27.9	70	18.4	76.17	0.00
Female	112	30.3	106	28.7	152	41.1	198	53.5	102	27.6	70	18.9	54.22	0.00
Genetic diseases resulting from consanguinity marriage														
Male	82	21.6	125	32.9	173	45.5	180	47.4	102	26.8	98	25.8	59.74	0.00
Female	73	19.7	54	14.6	243	65.7	183	49.5	72	19.5	115	31.1	95.60	0.00
Causes of increasing genetic disorders														
Male	92	24.2	163	42.9	125	32.9	223	58.7	82	21.6	75	19.7	93.76	0.00

Female	63	17.0	94	25.4	213	57.6	178	48.1	121	32.7	71	19.2	129.27	0.00

Table (4): Distribution of secondary school students according to their knowledge about nature of gene pre/post program (n=750)

Items	Pre						Post						Chi-square	
	Good		Average		Poor		Good		Average		Poor			
	NO	%	NO	%	NO	%	NO	%	NO	%	NO	%	X^2	*P*-value
Meaning of chromosomes														
Male	0	0.0	34	9.0	346	91.1	156	41.1	134	35.3	90	23.7	365.84	0.00
Female	52	14.1	43	11.6	275	74.3	184	49.7	115	31.1	71	19.2	226.92	0.00
Number of chromosomes														
Male	0	0.0	0	0.0	380	100.0	207	54.5	73	19.2	100	26.3	443.33	0.00
Female	28	7.6	19	5.1	323	87.3	167	45.1	83	22.4	120	32.4	232.26	0.00
Transmission of genetic traits from parents to children														
Male	0	0.0	58	15.3	322	84.7	187	49.2	104	27.4	89	23.4	332.15	0.00
Female	0	0.0	0	0.0	370	100.0	178	48.1	121	32.7	71	19.2	501.72	0.00

Table (5): Distribution of secondary school student according to their knowledge about primary prevention of genetic disorders pre/post program (n=750)

Items	Pre						Post						Chi-square	
	Good		Average		Poor		Good		Average		Poor			
	NO	%	NO	%	NO	%	NO	%	NO	%	NO	%	X^2	*P*-value
Meaning of primary prevention of genetic disorders														
Male	0	0.0	0	0.0	380	100.0	178	46.8	80	21.1	122	32.1	390.60	0.00
Female	0	0.0	0	0.0	370	100.0	194	52.4	105	28.4	71	19.2	501.72	0.00
Community health services of primary prevention of genetic disorders														
Male	0	0.0	0	0.0	380	100.0	137	36.1	135	35.5	108	28.4	423.61	0.00
Female	0	0.0	0	0.0	370	100.0	177	47.8	83	22.4	110	29.7	400.83	0.00
Premarital investigations														
Male	0	0.0	0	0.0	380	100.0	207	54.5	73	19.2	100	26.3	443.33	0.00
Female	0	0.0	0	0.0	370	100.0	184	49.7	115	31.1	71	19.2	501.72	0.00
Genetic investigations during pregnancy														
Male	0	0.0	0	0.0	380	100.0	156	41.1	134	35.3	90	23.7	468.94	0.00
Female	0	0.0	0	0.0	370	100.0	187	50.5	112	30.3	71	19.2	501.72	0.00

Table (6): Distribution of secondary school students according to their total knowledge about primary prevention of genetic disorders pre/post program (n=750)

Items	Total knowledge						Paired t-test	
	Range			Mean	±	SD	t	*P*-value
Pre	30	-	70	45.9	±	12.78	25.16	<0.001*
Post	40	-	100	85.9	±	9.54		

Figure (1) Distribution of secondary school students according to their total knowledge about primary prevention of genetic disorders pre/ post program (n=750)

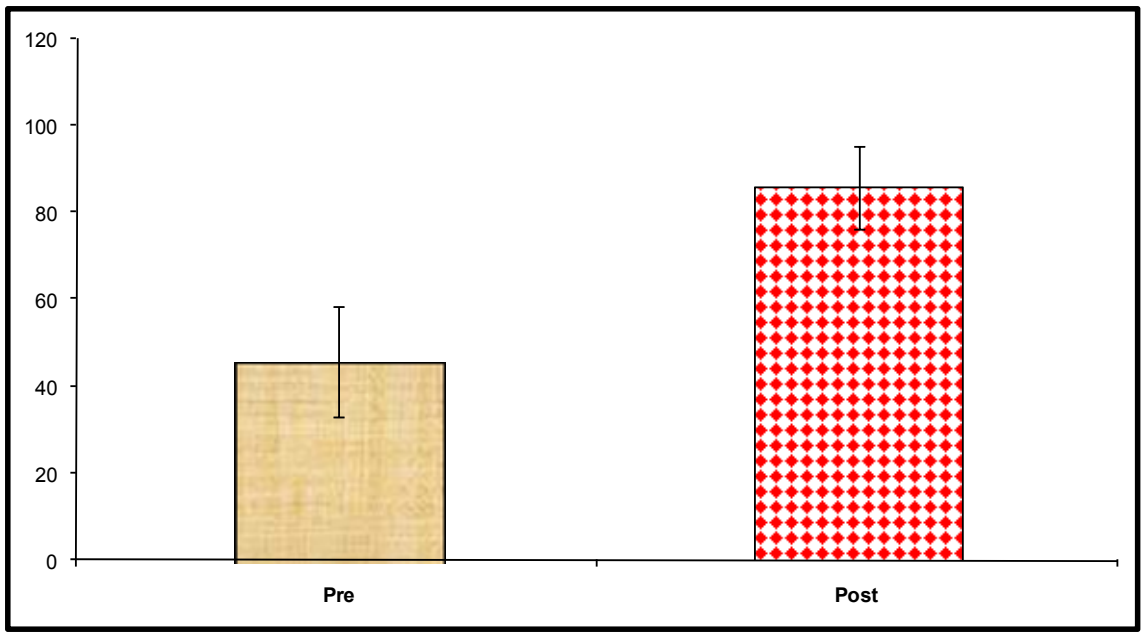

Table (7): Correlations between socio-demographic characteristics of secondary school students and their total knowledge (n=750)

Socio-demographic Characteristics		No	Total Knowledge	ANOVA and T-test	
			Mean±SD	test value	*P*-value
Sex	**Female**	370	55.87±10.12	t=21.10	<0.001*
	Male	380	36.17±14.92		
Age	**15-**	284	46.21±10.12	f=1.086	0.11
	16-	216	45.12±12.65		
	17-18	250	46.19±10.14		
Education (grade)	**First**	250	35.55±8.16	f=35.87	<0.001*
	Second	250	43.50±10.55		
	Third	250	58.62±10.89		
Family history consanguinity	**1st degree**	283	50.40±11.49	f=18.55	<0.001*
	2nd degree	269	45.12±12.90		
	No consanguinity	198	40.49±9.66		
Students opinion of consanguinity marriage	**Prefer**	354	45.0±9.55	t=1.80	0.07
	Do not Prefer	396	46.69±15.15		

4. Discussion:

Genetic disorders are diseases that are not acquired or caused from infection or trauma, but rather children inherit the gene from their parents. It could be congenital, if the disease appears at birth immediately but sometimes, if children have the gene, the disease will develop later on (El-Sobkey, 2007).

According to the socio-demographic characteristics of the study sample their age ranged between 15-18 years, concerning to educational grade one third of them (males and females) in 2nd and 3rd grade respectively. These results are similar to that of Mohamed (2007) who found in her studied sample that their age ranged between 16-20 years, while concerning their educational level she focused on secondary school do not studied medical science The finding of the study results agreed with Abd Al Azeem *et al.* (2011) who indicated that most of their studied

candidates were in the age group less than 20 years. Males represented 40% of the studied candidates, while females represented 60%.

Regarding to the residence, the entire studied sample was from rural region this finding is similar to that of Neeru *et al.* (2004) that all the sample was from rural region.. However these results were in disagreement with Mohamed (2007) whose sample distribution was 45.4% from urban areas and 54.6%from ruralareas. This result differs with Badawy(2002) whose respondents represented 48.4% from rural areas and 51.6% from urban areas, The present studied sample was recruited from rural region because their culture prefers consanguinity marriage, although it sometimes lead to genetic disorders and almost two thirds of them do not prefer consanguinity marriage.

The current study results indicated that nearly two fifths of male students and nearly half of female students were1st degree of family history consanguinity, while more than one third and almost one third of males and females were second degree consanguinity (Table 1)these results were in accordance with Al-kotb (2009),whose study finding indicated that more than half of spouses were 1st degree family history consanguinity and less than two quarters were 2nd degree family history consanguinity. According to Albar (2004) who revealed that, first consanguinity degree had four genetic diseases. diabetes mellitus was the commonest followed by down syndrome (DS), renal and blindness .The second degree consanguinity nine genetic disorders were found diabetes mellitus indeed was the most common followed by blindness, down syndrome, hearing loss, epilepsy, cystic fibrosis, muscle atrophy, hemophilia and sickle cell anemia. In concerning third consanguinity degree thalassemia and sickle cell anemia were the two only genetic diseases found.

Concerning students opinion of consanguinity marriage in the present study, about two thirds of males did not prefer, while d nearly three fifths of females prefer consanguinity marriage. This result is congruent with Al-kotb (2009), as her study findings revealed that less than three quarters prefer consanguinity marriage according to their beliefs and culture.

Regarding the secondary school students' knowledge, results revealed that, more than two fifths of males and females had poor knowledge before program implementation in relation to the anatomy and physiology of male and female reproductive system. This result is similar to that of Mohamed (2007) whose study findings indicated that 94.3% don't know all parts of reproductive system. H oever this result contracted with El-Adawy (2005), who reported that 66.6% of his sample had good knowledge about structure of reproductive system of male and female.

Regarding to the reproductive health concept, the findings of the present study revealed that before the program implementation, all the studied sample had poor knowledge. This result was in agreement with Mohamed (2007), who found that half of the sample was familiar with the meaning of reproductive health. However, this finding is contradicting with Badawy(2002) and El-Adawy(2005), who studied knowledge of adolescents toward reproductive health among university students, they found that the majority of the sample (81% & 80.6% respectively) were familiar with the term of reproductive health. While this study coined with the finding of Qaued(1999) who studied knowledge of youth adolescents toward reproductive health and found that 24.3% and 19% respectively only know the term of reproductive health.

Concerning time of fertilization and its relation with pregnancy occurrence, approximately half of the studied males and two fifths of the females sample had good knowledge after program implementation. This finding is similar to that of Mohamed (2007), who found that after the program the minority of young females (34.8% & 28.8% respectively) have correct answer about time of fertilization and its relation with pregnancy. According to Kim *et al.* (2001) study, about adolescent girls initiative for reproductive health project found that their knowledge about how women gets pregnant less than 10% after the project implementation, while ninety three percent mentioned that pregnancy occur as the causes of fertilization , and in Bidecom (2006), and Patterson study on adolescent sexual and reproductive health, in Ghana, showed that their knowledge about how pregnancy occurs is inadequate and only 26.4% know fertile period and 60% of their sample have perception that women get pregnant due to fertilization.

Regarding to perceived suitable age of pregnancy, the present study result showed that three fifth of the studied males sample had poor knowledge about perceived suitable age of pregnancy before program implementation, versus more than half of the females.this result is congruent with Mohamed (2007), who found that nearly half (47.7%) of young females noted that suitable age of pregnancy is between 20-30 years old. This finding is also similar to that of Jewell and Donovan (2000), which study on teenage pregnancy; they found that the ideal age for starting a family was 17–25 years.

Concerning the importance of pre-conception care to reproductive health, the current study finding showed that more than half of the studied males sample had poor knowledge before program implementation compared to more than three fifths (Table 2). This result is in agreement with Mohamed (2007), who found that 42.8% don't have an idea about pre-conception care to reproductive health and 20.3% of their answers were to born healthy child.

According to the risk from consanguinity marriage, genetic diseases, and causes of increasing genetic disorders more than half, nearly half and nearly three fifths of the studied sample respectively had good knowledge after program implementation (Table 3). This finding was congruent with Albar (2004) ,who stated that many of the world most common diseases have a hereditary component, as diabetes mellitus, hypertension, and ischemic heart diseases. Similarity, blood diseases are caused by a monogenic hereditary factor, which plays an important role in their causation.These findings were in congruence with Mokthar and abdel Fattah (2001), who found that family history of the previous genetic diseases was present in nearly the majority of the couples, while Albar (2004) reported that first cousins have sixteenth of their genes in common because all individuals are carriers of five to seven recessive genes. In a similar study, Dale *et al.* (2001) emphasized that one objective in medical genetic counseling is to identify the family genetic risk. Family tree is a powerful diagnostic tool for this purpose, taking and interpreting a basic family history to identify reproductive risk as an important element in preconception and early pregnancy care.

As regards the ing studied sample's knowledge about nature of gene, most or almost all had poor knowledge in the meaning, number of chromosomes, and about transmission of genetic traits from parents to children, while this knowledge improved after the program implementation (Table 4). In accordance with Abdel Meguid *et al.* (2000) in their study about premarital genetic investigations, they found that they had lack of knowledge about the importance of chromosomal analysis as part of genetic investigations

The present study result showed that, all the studied sample had poor knowledge before program implementation about meaning of primary prevention of genetic disorders, community health services of primary prevention of genetic disorders, premarital investigations and genetic investigations during pregnancy (Table 5). These findings were in accordance with Hosny *et al.* (2008) who reported that their sample perceptions regarding premarital testing, lacked of knowledge, which may prevent them for undergoing procedure regarding premarital testing.

According to community health services of primary prevention of genetic disorders, Khater and El Ghazaly (2003), identified that in Egypt, the first checkup center has been operating since mid-2001. Despite the success of this center in control of many health problems, attendants' number is still few. It seems that many young couples remains suspicious, questioning about the usefulness of pre –marriage checkup (PMC) and less likely to convince. On the other hand, according to WHO (2000), a medical certificate has often been provided without the medical checkup being carried out. Nowadays, the PMC became compulsory by law in many Arab countries including Egypt (UNFPA, 2010).

As regards correlations between socio-demographic characteristics and total knowledge of the studied sample there were highly statistically significant differences between their total knowledge and their sex, education grade and family history consanguinity (Table 7). There was a big lack in knowledge related to reproductive health even among educated persons, about the term of premarital care (PMC). This could be due to inadequate information expected in youngsters, premarital care should be an essential part of primary and preventive care. As well, a large number of health providers in primary care and maternal and child health services require basic training in PMC as identified by the WHO(2000).

This study showed that there was a highly statistically significant difference between pre and post program implementation of secondary school students and their total knowledge (table 6). This results in accordance with Abd Al Azeem *et al.* (2011), who reported a significant improvement in knowledge observed in the components on reproductive health. Components of the premarital package according to integrated standards of practice, settled by Ministry of Health and Population (MOHP), in 2005 are premarital counseling, premarital history taking and examination, premarital investigations and premarital immunization Khater &EL Ghazaly (2003) and (MOHP, 2005). Health education is one of the tools to provide individuals with the knowledge, skills, and motivation to make healthier targeted (Nazli & Umit, 2005).

Conclusion:

According to the results and research hypothesis, this study showed that less than third of the male students 1st degree of family history consanguinity; while more than half of the studied sample does not prefer consanguinity marriage. The male and female students' knowledge regarding the reproductive health concepts, fertilization, risk of consanguinity marriage, causes of increasing genetic disorders , transmission of genetic traits from parents to children, also primary prevention of genetic disorders were improved after the program from poor to good. There were highly statistically significant differences between pre and post program implementation, and between socio-demographic characteristics of secondary school students and their total knowledge regarding sex, educational grade and family history consanguinity (p<0.001).

Recommendations:

Based on the findings and conclusion of this study, the following recommendations are suggested:

-Continuous health educational programs for students in different grades focusing on primary health care on reproductive health, and genetic services
-Family health care program for women in different setting as Maternal and Child Center (MCHC), Family Health Center (FHC) for pregnancy prevention of genetic diseases for their children.
-Mass media, including radio, TV and newspapers should include in their programs; PMC programs that should be prepared on scientific basis with the help of specialists.

Corresponding author
Hemat Abd Elmonem Esayied
Department of Community Health Nursing, Faculty of Nursing, Ain Shams University,
mohamed.hemat@yahoo.com

References:

Abd Al Azeem, S.T., Elsayed, E.T., El Sherbiny,N.A. & Ahmed,L.A.,(2011). Promotion of knowledge and attitude towards premarital care: An interventional study among medical studentS in Fayoum University. Journal of Public Health and Epidemiology; 3(3) 121-128, March .Available online at: http://www.academicjournals.org/jphe ISSN 2141-2316 ©2011 Academic Journals

Abdel-Meguid, N.A., Zaki, M.S.&Hammad, S.A. (2000). Premarital genetic investigations: Effect of genetic counseling. Eastern Mediterranean .Health J.; 6(4): 652-660.

Albar,M. (2004). Counseling about genetic diseases: an Islamic perspective. Eastern Mediterranean Health Journal;5(11):1129-1133

Al-Kotb,H.B.(2009). Genetic counseling for spouses with consanguineous relation. Unpublished Doctorate Thesis, Faculty of Nursing, Ain Shams University, Egypt, pp.103-114.

Badawy, K.A., &d Sittin, A. (2002). Knowledge, attitude and practices toward reproductive health in Dakahlia, Mansoura Medical Journal;, 33(1): 245-260.

Bidecom, A. & Patterson, K. (2006). Adolescent sexual and reproductive health in Ghana, Occasional report No.22, Gutmacher Institute, Available at www.guttmacher .org

Dale,F., Hernandez,C., Singleton,J.& Arozon,D. (2001).Genetic perceptions and prenatal counseling.(1st ed) Philadelphia: Lippincott, pp. 47-51.

Edwards, L. (2008). Research priorities in school nursing, Journal of School health; 72: 173-177.

El-Sobkey, E. (2007).Down Syndrom E in Egypt, The Egyptian Journal of Human Genetics;5 (2):67-78.

El-Adawy, N.M. (2005). Knowledge and attitude toward reproductive health among Al–Mansoura university students, M.Sc., Thesis, in Faculty of Medicine. Al Mansoura University.

Gomaa, A. (2007). Genetic eye diseases and genetic counseling in Egypt ,community eye health Journal, March;20(61):11-20.

Hosny,L., Hammad, S., & Shihab, M. (2008).Clinical presentation of chromosome aberrations. Journal of Arab Child,Oct;,19:285-287.

Jewell, D. & Donovan, J. (2000). Teenage pregnancy, Journal of Family Practices; 17: 522-528.

Khater T.R., &El Ghazaly, H.S. (2003). Pre-marriage Checkup in Egypt. BMJ; 4: 111-118.

Kim, Y.M., Kols, A., & Nyakauru, R. (2001). Promoting sexual responsibility among young people. Journal of International Family Planning Perspectives; 27(1):11–19.

Ministry Of Health and Population (MOHP) (2005). Standards of practice for integrated MCH/RH Services: 1st ed. Available at : http://www.drguide.mohp.gov.eg/newsite/E-Learning.

Ministry of Health [MOHP] (2010). Standards of practice for integrated MCH/RH Services: First Edition. Available at: http://www.drguide.mohp.gov.eg/newsite/E-Learning.

Mohamed, S. (2007): Perceptions and practices of young females in relation to reproductive health, Unpublished Master Thesis, Faculty of Nursing, Ain Shams University, Egypt, pp. 96-112 .

Mokhtar, M. & Abdel-Fattah,M. (2001). Consanguinity and advanced maternal age as risk factors for reproductive losses in Alexandria, Egypt . Journal of Epidemiology; 17:259-262.

Nazli, A. & Umit, A.A. (2005). Pilot project to develop and assess health education program for type 2 diabetes mellitus patients. Health. Educ. J; 64(3): 39-46.

Neeru, G., Mathur, A.K., & Singh, M.P. (2004). Reproductive health awareness of school–going, unmarried, rural adolescent. Indian. Journal of Pediatrics; 71:797-801.

Qaued, M. H. (1999). Knowledge, attitude and practices study on reproductive health among youth in Assiut Governorate, Egypt summary of final report prepared for the women's studies project. Assiut Med.J; 323 (1) 175-194.

Seronson,J. & Cheuvront,B. (2005).The Human Genome Project and Health Education. Research J;4:584-59.

Starfield, B. (2007): U.S. Child Health: What's a miss, and what should be done about it? J Child and Adolescent Health,.165-170.

Temtamy,S., Ashour, A., El-Badry,T., Helmy,N. & Hussien, H.(2007).Genetic studied of conginetal contractures of limbs, Egypt J Med Genetics; 6(2):1-5

United Nations Fund Population Agency (UNFPA) (2010). Premarital manual. Egypt. Accessed from: www.unfpa.org.eg.

Vessey,V. & Jackson, P.,(2006).Primary care of the child with genetic disorders,3rd ed . New York: Mosby Co:,pp.336-445,105.

World- Health Organization (WHO) .(2000). Source book for HIV /AIDS counseling training. Geneva, 4: 65-78.