Short Report

Consanguineous marriages in Jordan: why is the rate changing with time?

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The objective of this study was to explore the secular trend in consanguinity in Jordan and the subtypes of consanguineous marriages that may be undergoing a change. A total of 1032 individuals attending a diabetic clinic in Amman were interviewed. The questionnaire provided information on consanguinity status and date of marriage among three generations: the persons interviewed, their parents, parents of their spouses and their offspring. Data on consanguinity status among 5401 marriages was obtained. Generations were named generation 1 for marriages contracted before 1950, generation 2 for marriages contracted between 1950 and 1979, and generation 3 for marriages contracted after 1980. For generations 1, 2, and 3, first-cousin marriages constituted 20.2, 28.5 and 19.5% of all marriages, respectively, while the subtype of paternal parallel first-cousin marriages constituted 75.6, 60.3 and 43.3% of all first-cousin marriages, respectively. The offspring of first-cousin parents were significantly more prone to marry their relatives than the offspring of non-consanguineous parents, with rates of first-cousin marriages among offspring of first-cousin parents and non-related parents constituting 25.3 and 17.1% of all marriages, respectively. For generations 1, 2 and 3, the average coefficient of inbreeding was 0.0135, 0.02 and 0.0142, respectively. In conclusion, first-cousin marriage rate among a representative population from Amman showed a significant decline among marriages contracted after 1980 compared to marriages contracted between 1950 and 1979, but not to marriages contracted before 1950. The proportion of paternal parallel first cousins among first-cousin marriages showed a steady decline from one generation to the next.

**H Hamamy, L Jamhawi,
J Al-Darawsheh and K Ajlouni**

National Center for Diabetes, Endocrinology and Genetics, Amman, Jordan

Corresponding author: Prof. Hanan Hamamy, c/o Prof. Kamel Ajlouni, President of National Center for Diabetes, Endocrinology and Genetics, PO Box 13165, Amman 11942, Jordan.
Tel.: +962 6535 3374;
fax: +962 6535 3376;
e-mail: hhamamy@hotmail.com

Consanguineous marriages are marriages contracted between blood relatives. In clinical genetics, a consanguineous marriage is most commonly defined as a union between a couple related as second cousins or closer (1). It is estimated that globally about 20% of the human population live in communities with a preference for consanguineous marriage, and that at least 8.5% of children have consanguineous parents (2). Among Arabs, consanguineous marriages are customary and constitute 20–50% of all marriages (1, 3, 4). First-cousin marriages constitute almost one-third of all marriages in many Arab countries. The rates of these marriages differ between countries as well as within one country. For example, first-cousin marriages constitute 29, 30, 26, 24 and 32% of all marriages in Iraq, Kuwait, Saudi Arabia, Oman and Jordan, respectively (5–9). Marriages between first cousins and specifically the paternal parallel subtype are favoured culturally and socially and considered the 'usual' or 'expected' pathway in life for first cousins whether they were reared in close proximity or reared far apart.

Arabs culturally and socially favour consanguineous marriages. Numerous sociological studies have confirmed that consanguineous marriage is regarded as important in maintaining social stability and that when the couple are known to each other as family members, there is more likely to be compatibility between husband and wife, and wife and mother-in-law (10). Premarital negotiations regarding financial matters of marriage are more easily conducted and the costs of marriages

within the family are generally less than marriages from non-relatives.

Khoury and Massad (9) studied the consanguinity rate in Jordan through a stratified study obtaining information on about 2000 marriages contracted between 1969 and 1979, giving a rate of 32% for first-cousin marriages and an average coefficient of inbreeding of 0.0225. The present study aims at disclosing any change in the rate of consanguineous marriages in Amman in the recent generation and the specific subtypes of such marriages that are undergoing change.

Subjects and methods

The study was performed at the National Center for Diabetes, Endocrinology and Genetics (NCDEG) in Amman for the period from 15th June to 15th September 2004. The individuals chosen to be included in this study are the diabetic patients registered at the NCDEG in Amman. Cases attending the genetic clinic were strictly excluded. The physicians and staff members at the centre personally interviewed patients attending the diabetic clinic. About 90% of patients attending the clinic are resident in Amman, the capital city of Jordan, and the nearby cities. The overall prevalence of diabetes mellitus in Jordan is 13.4% among adults ≥ 25 years old (11). This high prevalence rate and the fact that it is not discriminated against in marriage decisions exclude diabetes as a confounding factor affecting the consanguinity rate. We therefore consider the subjects interviewed in this study as representing the whole range of socioeconomic classes in Amman and the surrounding cities of Jordan's Middle Region.

The questionnaire sheet included the following direct questions:

1 Are you related in blood to your husband/wife? If yes, what is the exact relationship? The answer is written in Arabic exactly as said by the interviewed person.
2 If the answer to the previous question is no, then the individual is specifically asked if there is any blood relation to his/her spouse from the mother's side. This question was considered imperative to include in the questionnaire, because the Jordanian society is a patrilineal society, and consanguinity in the minds of many only means a paternal blood relation. If the answer is yes, then the relationship is written in Arabic using the exact words of the person interviewed.
3 The year of marriage is recorded.
4 The above three questions were repeated for consanguinity and date of marriage for the

interviewed person's parents, his/her spouse's parents and for all married offspring.

Marriages were divided into three groups according to their dates of contraction. The division was based on the understanding that a generation encompasses 30 years. Generation 1 included individuals whose marriage was contracted before 1950, generation 2 involved marriages contracted between 1950 and 1979, and generation 3 represented the present generation marriages contracted between 1980 to date.

Consanguineous marriages were classified into double-first cousins, first cousins, first cousins once removed and second cousins. Beyond second cousins marriages and those reported as from the tribe were considered non-consanguineous. Particulars about the subgroups of first-cousin marriages were also recorded and included parallel paternal first cousins (fathers are brothers), parallel maternal first-cousin (mothers are sisters), cross first-cousin type I (wife is daughter of husband's maternal uncle, cross first-cousin type II (wife is daughter of husband's paternal aunt) and double-first cousins (all grandparents are shared).

Total number of interviewed individuals reached 1032, and the total number of marriages from all three generations with information on consanguinity amounted to 5401.

Statistical analysis was done using Chi-square test with p-value determination.

Results

Number and rates of marriages as related to consanguinity are presented in Table 1. First-cousin marriages constituted 20.2, 28.5 and 19.5% of all marriages contracted before 1950 (generation 1), between 1950 and 1979 (generation 2) and 1980 to date (generation 3), respectively. The difference in rates was highly significant ($p < 0.001$) when comparing generations 1 and 2, and generations 2 and 3, but not generations 1 and 3 ($p = 0.38$). Consanguinity rates for generations 1, 2 and 3 were 23.8, 36.1 and 25.6%, respectively.

Among 1150 first-cousin marriages, the number and rates of the different subtypes are presented in Table 2. Paternal parallel first cousins, constituted 15.1, 16.9 and 8.1% of all marriages in generations 1, 2 and 3, respectively. The difference was highly significant ($p < 0.001$) when comparing the rates in generations 1 and 3, and generations 2 and 3, but not generations 1 and 2 ($p = 0.21$). When the proportions of paternal parallel first cousins from the total first-cousin marriages were compared, the figures declined from 75.6% in generation 1 to 60.3% in generation 2 to 43.3% in generation 3;

Table 1. Consanguineous and non-consanguineous marriages among three generations

Spouse relationship	Generation 1 (marriages before 1950)	Generation 2 (marriages 1950–1979)	Generation 3 (marriages 1980 to date)	Total number of marriages
Double-first cousins	5 (0.3)	8 (0.6)	17 (0.7)	30
First cousins	303 (19.9)	360 (27.9)	487 (18.8)	1150
First cousins once removed	15 (1)	53 (4.1)	109 (4.2)	177
Second cousins	40 (2.6)	45 (3.5)	48 (1.9)	133
Beyond second cousins	167 (11.1)	114 (8.9)	76 (2.9)	357
Not related	990 (65.1)	707 (54.9)	1857 (71.6)	3554
Total	1520	1287	2594	5401

Values are expressed as n (%).

the difference was highly significant between any two generations (p < 0.001). Maternal parallel first cousin rate increased from 1.8% among all marriages in generation 1 to 4.3% in generation 2 and 5% in generation 3. The difference was highly significant between generations 1 and 2, and generations 1 and 3 (p < 0.001), but not between generations 2 and 3 (p = 0.35). Cross first-cousin type I marriage rates were comparable to the rates of maternal parallel first cousins in all three generations and were almost double the rates of cross first-cousin type II (Table 2). Differences between generations for cross first-cousin types I and II were significant for the same groups as for maternal parallel first cousins.

Among interviewed individuals whose marriages were contracted between 1950 and 1979, 549 had married offspring at the time of study, with an average of 3.8 married offspring/family (Table 3). Among 33 interviewed individuals married before 1950, the average number of

married offspring/family was higher reaching 6.8 (Table 4).

Consanguineous couples were more prone to have their offspring contracting consanguineous marriages. The first-cousin marriage rates among offspring of first-cousin parents and non-related parents from generation 2 were 25.3 and 17.1%, respectively (Table 3). The difference was statistically highly significant (p < 0.001). The first-cousin marriage rates among offspring of first-cousin parents and non-related parents from generation 1 were 31.6 and 25.2%, respectively (Table 4). The difference was not significant (p = 0.48). The consanguinity rates were generally higher among the offspring of generation 1 who belong to generation 2 than the offspring of generation 2 who belong to generation 3, in accord with the figures of Table 1.

The average coefficient of inbreeding was calculated according to the formula $F = \Sigma PiFi$. For generations 1, 2 and 3, the average coefficient of inbreeding was 0.0135, 0.02 and 0.0142, respectively.

Table 2. Subgroups of first-cousin marriages among three generations

First-cousin marriages	Generation 1 (marriages before 1950)			Generation 2 (marriages 1950–1979)			Generation 3 (marriages 1980 to date)			All marriages
	n	%[a]	%[b]	n	%[a]	%[b]	n	%[a]	%[b]	
Paternal parallel first cousins	229	15.1	75.6	217	16.9	60.3	211	8.1	43.3	657
Maternal parallel first cousins	27	1.8	8.9	55	4.3	15.3	130	5	26.7	212
Cross first-cousin type I[c]	30	2	9.9	60	4.7	16.7	90	3.5	18.5	180
Cross first-cousin type II[d]	17	1.1	5.6	28	2.2	7.8	56	2	11.5	101
Total	303	19.9	100	360	27.9	100	487	18.7	100	1150

[a]Percentage among all marriages.
[b]Percentage among first-cousin marriages.
[c]Wife is daughter of the husband's maternal uncle (matrilineal).
[d]Wife is daughter of the husband's paternal aunt (patrilineal).

Table 3. Number of married offspring of parents in generation 2 and the consanguinity rates among their marriages

	First-cousin marriages	Beyond first-cousin marriages[a]	Non-consanguineous marriages[b]
Number of marriages 1950–1979	156	54	339
Number of married offspring	597	211	1301
Average number of married offspring/family	3.8	3.9	3.8
Offspring marriages, n (%)			
First cousins	151 (25.3)	35 (16.6)	223 (17.1)
Beyond first cousins[a]	43 (7.2)	22 (10.4)	60 (4.6)
Not related[b]	403 (67.5)	154 (73)	1018 (78.2)

[a]First cousins once removed and second cousins.
[b]Marriages beyond second cousins.

Discussion

Results of this study show that a significant decrease in consanguinity rate in Amman, Jordan has occurred in the recent generation for marriages contracted after 1980 as compared to the previous generation for marriages contracted between 1950 and 1979. However, the consanguinity rate for marriages contracted before 1950 was comparable to that for marriages contracted after 1980. The proportion of paternal parallel first-cousin marriages among first-cousin marriages showed a consistent decline over the years.

Total population in Jordan, a Middle Eastern country, rose from half a million in 1952 to 5.5 millions in 2003, with two millions inhabiting Amman, the capital of the country (12). In 2003, the infant mortality rate was 22/1000 live births, and life expectancy at birth was estimated at 70.6 years for men and 72.4 years for women (12). Two major population influxes into Jordan following the 1948 and the 1967 wars in the Middle East could have contributed to this 10-fold increase in the population number over a 50-year period and resulted in a partial or total admixture of the incoming individuals with the basal population. The effects of such changes in the society on consanguinity rates are manifold. For example, at the outset of their new residence, newcomers tend to intermarry more because they have not yet intermingled into the general population. As time passes, the tendency to intermarry is reduced leading to reduction in consanguinity rates. This hypothesis can explain the higher consanguinity rates among marriages contracted in 1950–1979 (generation 2) in this study as compared to generations 1 and 3 (36.1% vs 23.8 and 25.6%, respectively). Marriage patterns in a Muslim village in Israel showed a similar rise and fall with time in consanguinity rates, where first-cousin marriages constituted 19.8, 26.2 and 17.5% of all marriages when birth year of woman was 1920–1939, 1940–1959, and 1970 and after, respectively (13).

The Jordanian society has experienced several changes over the past 50 years, among these are the higher number of females continuing into higher education levels, the improved economic status of families and the increased movement of the population from rural to urban settings. Previous studies have shown that such factors had an influence on consanguinity rates in Arab countries and particularly in Jordan (9, 14–16). For example, in Jordan, it was shown that the higher the level of education of the female partner, the lower the consanguinity rate, with first-cousin marriages constituting 38 and 12% of all marriages of females with primary and university levels of education, respectively (9). The rate did not show a difference among males with primary and university levels of education, where first-cousin marriages constituted 33 and 38% of all marriages, respectively (9). In Yemen, the

Table 4. Number of married offspring of parents in generation 1 and the consanguinity rates among their marriages

	First-cousin marriages	Beyond first-cousin marriages[a]	Non-consanguineous marriages[b]
Number of marriages before 1950	10	6	17
Number of married offspring	57	49	119
Average number of married offspring/family	5.7	8.2	7
Offspring marriages, n (%)			
First cousins	18 (31.6)	13 (26.5)	30 (25.2)
Beyond first cousins[a]	3 (5.3)	4 (8.2)	12 (10.1)
Not related[b]	36 (63.2)	32 (65.3)	77 (64.7)

[a]First cousins once removed and second cousins.
[b]Marriages beyond second cousins.

same inverse association between consanguineous marriages and women's education was seen, whereas higher educated men were more likely to be married to cousins (14). In the years between 1950 and 1960, female students comprised only 25% of all student enrolment in schools in Jordan (12). This percentage rose to 46% in 1980 and to almost 50% in 2003, with 7% of all female students being university students (12). These recent rates reflect the increased interest of families in educating their girls and the larger number of females undertaking higher education levels. This could represent a major factor that could contribute to the decrease in consanguinity rates in Jordan.

Reports from some Arab countries have shown that consanguinity rates are higher in rural as compared to urban settings. In Jordan, first-cousin marriage rates have been reported to be 38 and 30% of all marriages in rural and urban settings, respectively (9). In Egypt, first-cousin marriage rates were 17 and 9% in rural and urban settings, respectively (15), with similar findings reported from Algeria (16). The present study was conducted on inhabitants of Amman and the nearby areas, where 90% of the population are in urban setting (11). The lower first-cousin rate of 28.5% observed in this study as compared to the rate of 32% reported in a previous study in Jordan (9) covering the same time period, could be due to the fact that our study was undertaken in Amman with its high urban setting, while the previous study covered all Jordan where urban settings constituted about 79% (12).

Reports showed that the consanguinity rates in at least some Arab countries are not decreasing with time, as for example in the UAE and Yemen (14, 17). In Algeria, consanguinity rates seem to be increasing in present generation in rural settings, while they remain more or less stable in urban settings (16). Among Muslim Arabs in Israel, rates of first-cousin mating were stable over time, in contrast to the significant decrease in the rates of distant consanguineous mating (18). However, another study among the Israeli Arab community revealed a significant decrease in the frequency of consanguineous marriage from 52.9% in the period 1961–1970 to 32.8% in the period 1991–1998 (19).

In this study, the main subtype that showed a significant reduction in the recent generation is the paternal parallel subtype, where it dropped from 15 and 16.7% to 8.1% among all marriages in generations 1, 2 and 3, respectively. Among all first-cousin marriages, the proportion of paternal parallel subtype dropped from 75.3% in generation 1 to 60.1% in generation 2 to 43.3% in generation 3 (Table 2). This decrease may reflect

a new concept in the mind of people that relatives are not only paternal relatives. This concept can explain the increasing rates of the other subtypes of first-cousin marriages in recent generation, where maternal parallel first-cousin rate rose from 8.9% to 15.3 and 26.7% among all first-cousin marriages in generations 1, 2 and 3, respectively. A similar pattern was revealed for both subtypes of cross first cousins (Table 2). It seems that type I cross first-cousin marriages are contracted at a rate almost twice that for type II cross first cousins, probably due to the closer relationship of the man with his maternal uncle's family than with his paternal aunt's family, and to the preference of the mother that her son marries her niece rather than her husband's niece. Another factor contributing to the decrease in the proportion of paternal parallel first-cousin marriages may be the lower availability of partners in this group to marry due to the decreasing fertility rate in Jordan. Total fertility rates in 1976, 1990 and 2003 were 7.4, 5.6 and 3.7, respectively (12). Similar findings were reported from a Muslim village in Israel, where the proportion of paternal parallel marriages among all first-cousin marriages dropped from 75% in the older generation to 44.1% among women born after 1960, with an increase in the proportion of maternal parallel first cousins (13).

When parents are consanguineous, offspring are more prone to enter into a consanguineous marriage (Tables 3 and 4). This finding was significant when the parents belonged to generation 2 (Table 3), but not when the parents belonged to generation 1, probably due to the small numbers in generation 1 (Table 4). A higher rate of consanguineous marriages among offspring of consanguineous parents than among offspring of non-related parents was previously reported in Jordan (9).

Conclusions and recommendations

There is a changing secular profile in the rates of consanguinity in general and of the specific subtypes of cousin marriages in particular in Jordan. The proportion of paternal parallel first-cousin marriages among first-cousin marriages is showing a steady decline from one generation to the other. These changes could be attributed to several factors such as population influxes, the increasing rate of female education in general and of female higher education in particular, lower fertility rates resulting in less available cousins to marry, mobility from rural to urban settings, better economic status of families and an increased awareness of the effects of consanguineous marriages on children when there is an inherited recessive disease in the family.

Consanguineous marriage is an integral part of cultural and social life in Jordan, and attempts to discourage it at the population level are inappropriate and undesirable. The World Health Organization recommended an approach to minimize the disadvantages of consanguineous marriages on health based on the identification of families at increased risk of a genetic disease and the provision of prospective genetic counselling (1).

Acknowledgements

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