

## Arabization and Islamization of Consanguineous Marriages: Is It Right?

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### ABSTRACT

Marriage is a topic of significant interest among anthropologists, sociologists, and geneticists. Consanguineous marriage is the union between descendants from the same ancestor. This kind of marriage is being practiced since the existence of man. Around the globe, consanguineous marriage is one of the most commonly discussed forms of marriage. Some of the discussion has been religiously politicized, contributing to more conflict, greater polarization, and so on. Contrary to the general opinion that consanguineous marriage is spread in Arabic/Islamic populations, it predates Islam, is quite common, and is practiced worldwide. Certain Arabic/Islamic communities, which form the majority of the population in many Asian and African countries, have a dearth of information. It is essential to understand the social and cultural foundations of this problem to set plans for strategic preventive measures. This study was conducted for this purpose using the PubMed, Scopus, and Google Scholar databases. The prevalence of consanguineous marriages depends on the characteristics of the population under study. It is more closely linked to nonreligious cultural and historical roots, which can outweigh religious reasons. In conclusion, Islamization/Arabization of consanguineous marriages is a misconception because it is practiced by non-Arabs and non-Muslims. Dramatic changes in Arabic/Muslim societies, such as raising the minimum age of marriage for females and demanding their consent, as well as the consolidation of knowledge among women and the activation of their role in the productive economy, can create more or less open and permissive generations.

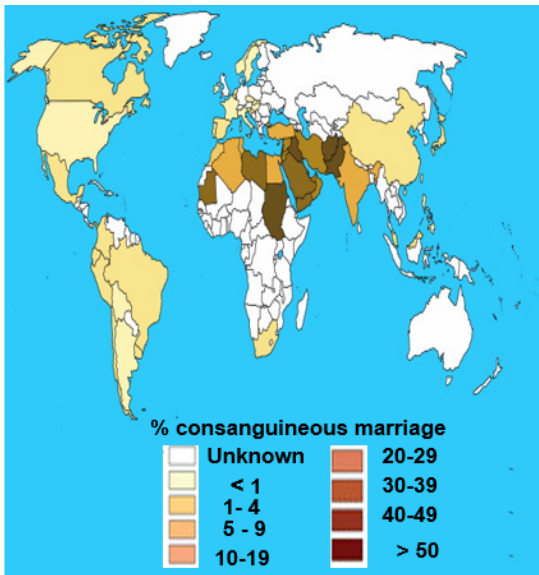
Keywords: Consanguineous marriage, cultural differences, public health, religions

### INTRODUCTION

Most anthropologists and historians indicate that marriage was, and is still, a natural duty or an individual strategic event that is being practiced since the early existence of modern humans. This practice reflects the socioeconomic, ethnic, cultural, and religious needs of humankind (1). In 2008, Adam Kuper (2) of Brunel University reported what Charles Darwin, the greatest naturalist of the age, stated in 1868 that "the existence of a great law of nature is almost proved; namely, that the crossing of animals and plants which are not closely related to each other is highly beneficial or even necessary, and that interbreeding prolonged during many generations is highly injurious." Kuper added that "Darwin thought this was probably true of human beings." In this context, Claude Levi-Strauss, who was one of the greatest anthropologists of the 20th century, published a study "*The elementary structures of kinship*," in which

he argued that "all the pre-modern societies of the world were on the basis of cross-cousin." However, the argument had an issue and the statement was criticized because Claude Levi-Strauss assumed that social structures progressed from a primitive to a civilized form.

The term *consanguinity* came from the Latin words: *con* meaning shared and *sanguis* meaning blood. Thus, "blood relation," derived from the Latin word *consanguinitas*, is the property of being from the same kinship as another. Thus, consanguineous marriage is a contract between blood relatives who have at least one common ancestor no more remote than a great-great grandparent. The famous people who married their cousins included Charles Darwin, Albert Einstein, Queen Victoria, Franklin Roosevelt, and so forth (3).



**Figure 1** Global frequency of second-cousin and closer consanguineous marriages. Overall, the world can be categorized into three main parts. The first includes Australasia, Central Africa, Russia, and Western Europe, where the prevalence of consanguineous marriages does not exceed 1%. The second category includes the Iberian Peninsula, Japan, and North and South America, where 1%–10% of marriages are consanguineous. The third region covers most of North Africa as well as West, Central, and South Asia, where the rate of consanguineous marriages accounts for 20%–50% of all marriages. Adapted from (1).

**Fig. 1** shows the prevalence of consanguineous marriages, which ranges from 80.6% in certain provinces in the Middle East, where consanguineous marriage is preferred and strongly encouraged, to less than 1% in the contemporary societies (4-8).

Consanguineous marriage has been practiced by many cultures worldwide from time immemorial and has been a part of most societies, as far back as the Old Testament of the Bible, and in the Arab countries before the arrival of Islam. Thus, it is not domination where the Islamic faith prevails. Consanguineous marriages are allowed within Islam, Buddhism, and Zoroastrianism, but are not allowed by Christian Orthodox churches and special permission is needed for members of the Roman Catholic Church (9). The rate of consanguineous marriages among Muslims was much lower than that among Hindus (20.0% vs. 54.7%, respectively) (Bittles 2012). Also, consanguineous mar-

riages have been found to be more prevalent among Hindus compared with the Muslim community (33.5% and 23.7%, respectively). Perhaps uncle–niece marriage is culturally endorsed in some Hindu communities living in South India. Contrary to this, Muslims showed 3.76 and 2.91 times more likelihood of having first-cousin and second-cousin marriages, respectively, compared with Hindus (11, 12).

Marriage between relatives is usually socially driven, but it can be genetically harmful. Despite the plethora of publications in some Arabic/Islamic countries, studies in other countries are rare. Some studies are either old, or partial, or sometimes conflicting. The widespread nature of this trend and its continuation within the younger age groups among recent generations raise the question regarding the extent to which the factors of social change influence the phenomenon of consanguineous marriage (6). This study updated the information on consanguineous marriage–related matters, but not exclusively. It is hoped that the discussion will draw a clear roadmap for healthcare providers and health policymakers to create efficient and cost-effective intervention programs and plans for preventing sociocultural and socioeconomic hardship. Faithful collaboration among the religious, public, governmental, and nongovernmental sectors will surely make it possible.

## METHODOLOGY

An online search using PubMed, Scopus, and Google Scholar databases was performed. The snowball method was used to extract other publications. The following keywords were used: Arab/Islamic communities/populations, consanguineous marriage, and consanguinity. Apart from the exception of the Islamic Jurisprudence Council of the Islamic World League in 1990, only studies between 2007 and February 2022, in English with titles and full text, were retrieved. After vigorous screening and detailed evaluation, only 73 studies were selected for data extraction.

## RESULTS AND DISCUSSION

### Types of consanguineous marriages

The geneticists used the coefficient of consanguinity (CC) or inbreeding coefficient (F) for classifying consanguineous marriage and comparing its frequencies

**Table 1** Degree of relationship and gene sharing

Degree of kinship	Proportion of shared genes	Coefficient of relationship ( <i>r</i> )*
Monozygotic twins	1.0	1.0
First-degree relation: parents, children, sibs, and dizygotic twins	½ (0.5)	¼ (0.25)
Second-degree relation: grandparents, grandchildren, half siblings, uncles, aunts, nephews, nieces, and double first cousins	¼ (0.25)	1/8 (0.125)
Third-degree relation: First cousin, half uncle-aunt, and half nephews-nieces	1/8 (0.125)	1/16 (0.0625)
Fourth-degree relation: half first cousin and first cousin once removed	1/16 (0.0625)	1/32 (0.03125)
Fifth-degree relation: Second cousins	1/32 (0.03125)	1/64 (0.015625)
Second cousin once removed	1/64 (0.015625)	1/128 (0.0078125)
Third cousins	1/128 (0.0078125)	1/256 (0.00390625)
Offspring of non-consanguineous (distant) marriage	0.0	0.0

\*(*r*) is the proportion of alleles in any two individuals that are identical by descent.

among populations. Consanguineous marriages increase the CC value, thereby increasing the chance that an individual will inherit two identical alleles at a given locus on two homologous chromosomes (i.e., homozygote) by descent. [Table 1](#) shows the six categories of consanguineous unions based on the individual's *F* value. Clinical geneticists define a consanguineous marriage as a union contracted between two individuals who are second cousins or closer, equivalent to a coefficient of inbreeding in their offspring of  $F \geq 0.0156$  ([Table 1](#)). Incestuous marriage, which is forbidden by law and religion, refers to a union between first-degree relatives (brother–sister, parent–child, uncle–nephew). However, marriages between double first cousins, which have the same coefficient of inbreeding ( $F = 0.125$ ), are recognized in Islam (7, 10).

Consanguineous marriages are of three types. Type A is the marriage between cousins, that is, the children of two brothers (the father's brother's daughter or patrilateral parallel first cousins). Type B is the second most prevalent consanguineous marriage and unites the children of two sisters (matrilateral parallel cousins). Such marriages do not constitute a close family marriage because the marriage is between the children of two sisters, and the sisters may be married to different families (i.e., "not belonging" to the biological family of the mother). If the first two mar-

riages are unmanageable, the next ideal marriage is to mother's brother's daughter (13). This is type C, in which the male and the female involved are the sibs of the brother and his sister (cross-cousins or the mother's brother's daughter).

### Frequency of consanguineous marriages

[Fig. 1](#) shows that a consanguineous marriage accounts for around 20% of all marriages in the global population. On the other extreme, about 1.57 billion individuals (23% of the world's population, 6.8 billion) live in Arabic/Islamic countries, where consanguineous marriage is practiced routinely. These societies have a long history of consanguineous marriages, which accounts for 30%–50%, 20%–40%, and 10%–20% of all marriages in the Middle East, North Africa, and South Asia, respectively (6, 14, 15).

The specific types and frequencies of consanguineous marriages show wide variations among the Arabic ([Table 2](#)) and Islamic ([Table 3](#)) countries and within the same country (7, 16–18). However, several studies have reported a declining trend in consanguineous marriages in several Arabic countries (7, 8, 19–22). This is attributed to their contact with the outside world, besides increased awareness among the public of the possible role of consanguineous marriages in increasing the risk of having an affected child.

**Table 2** Summary of important statistics regarding the range of rates of consanguineous and first-cousin marriages in Arabic populations

Country		% Overall consanguineous marriage	% First-cousin marriage	Reference (s)
Algeria 55.06		22.60–34.00	11.30	(1)
		67.35	(15)	
Bahrain		10.90–45.50	21.00–47.20	(17, 20)
Egypt		20.90–80.40	14.30–50.00	(13)
Iraq		47.40–64.60	29.2.0–35.60	(33)
Jordan		27.50–68.8	19.5–39.03	(7)
Kuwait		22.50–64.30	16.90–31.70	(50)
Lebanon		12.80–42.00	6.70–31.60	(19, 31)
Libya		48.40	-	(4)
Mauritania		47.20–60.00		(4, 6)
Morocco 24.37		19.90–28.00	8.60–10.00	(4)
		63.18	(1)	
Oman 56.30–58.00		52.00	75.00	(7)
		24.10–34.00	(41)	
Palestinians	In the occupied territories	35.00–44.30	51.00	(21)
	In Gaza	–	31.60	(1)
	In Israel	36.30–50.00	20.00–50.00	(22)
Qatar		51.00–54.40	33.50–66.00	(6, 50, 51)
Saudi Arabia		42.10–66.70	24.6–42.30	(1)
Sudan		44.20–63.30	44.2–49.50	(6)
Syria		22.10–67.50	13.80–39.11	(16)
Tunisia 64.94		20.10–39.30	17.40–23.00	(18)
		47.29	(18)	
United Arab Emirate		39.00–54.20	20.70–30.00	(17, 73)
Yemen		40.00–44.70	71.60–85.00	(1)

**Table 3** Summary of important statistics regarding the range of rates of consanguineous and first-cousin marriages in Islamic populations

Country		% Overall consanguineous marriage	% First-cousin marriage	Reference (s)
Afghanistan		50.00	–	(54)
India		27.00–48.00	50.00	(11, 12)
Iran	Tabriz city	20.12	58.93	(24).
	South-west	65.70	51.80	(24).
Pakistan	Home	50.30–78.50	37.10–61.00	(10, 40, 43)
	Immigrants	76.00	59.00	(10)
Turkey		18.50	57.80	(26)

The data on the rate of consanguineous marriage are lacking in Indonesia, where 86.7% of the population are Muslims (23). However, the rate of consanguineous marriage is believed to be relatively high in Asian countries with large populations, such as Iran (24), Malaysia (25), Pakistan (26), and Turkey (27). In Pakistan, with 96.5% Muslims, the rate of consanguineous marriage was reported to be around 65.8% in 2014. The prevalence of consanguineous marriage ranged from 27.0% to 48.0% in India, which has the third-largest population of Muslims worldwide (11, 12).

### Reasons for consanguineous marriages

In most Muslim communities in the Middle East, the marriage among patrilateral parallel first cousins is believed to be the duty for the male and an obligation for the female to accept. Although many single individuals do not prefer this type of consanguineous marriage, they proceed with it when faced with the situation. The determinants of consanguineous marriages in Middle Eastern communities have been recently reviewed (8). In fact, the causes for this kin marriage are not easy to disentangle. However, the determinant factors include the rise of a new kind of family business and the emotional structure of the new families. Several factors may drive and encourage consanguineous marriages. One simple explanation for the high incidence of consanguineous marriage includes socioeconomic, sociocultural, religious, and demographic factors (5, 28, 29).

The reasons most frequently given for the attractiveness of consanguineous marriages are a strong family tradition of consanguineous unions and the desire to keep wealth possession within the family (28, 29). In addition, consanguineous marriages have financial advantages related to the need of less transaction of gifts and dowry or Mahr (the money given by the grooms' side exclusively to the bride as written in the marriage contract), bride-wealth payments, ease of marital arrangements, and a closer relationship between the wife and her in-laws (14). Other causal factors include the belief that consanguineous unions maintain family structure and stability, as the husband and wife can easily adjust because they have been raised in the same environment under the same family structure (3). Other reasons behind this trend of consanguineous marriages are thought to be the fear of marrying into an unknown family, which increases the possibilities of hidden uncertainties in health and

financial issues (3). The question whether consanguineous marriage is a blessing or menace at the population level was raised (30). However, only one published study was conducted to compare the divorce rates of consanguineous and non-consanguineous marriages among Arabs. In Jordan, a survey was carried out in 2018 (7). The risk of divorce/separation and polygyny was found to be less among women with consanguineous marriages. Further, consanguineous marriages were more successful than non-consanguineous marriages.

In a broader perspective, consanguineous marriage is believed to be less prevalent among individuals with high education (7, 28, 31-33). Age is also an important factor (17, 21, 34). Another fundamental factor that affects the level of consanguineous marriages is the place of residency; consanguineous marriages are more widespread among girls living in the countryside compared with their urban counterparts (35, 36). Further, unemployed women are almost two to three times more likely to marry a relative as opposed to women in the labor market (7, 8, 31).

The knowledge of genetic risk related to consanguineous marriages was lacking in some countries; 17.8% in Nigeria (37), 26.9% in Sudan (38), 28.8% in Saudi Arabia (39), and 35% in Pakistan (40). Poor knowledge of the language and misinterpretations of Islamic law were the main causes of poor practice (39, 41). The frequency of consanguineous marriages was higher in rural areas, as well as among less-educated and low-socioeconomic status groups in Afghanistan (42), Iran (24), Pakistan (43), and Turkey (27). Also, studies in Pakistan as well as in the Pakistani diaspora have demonstrated that a first choice is articulated for marriage within the extended family or *Biraderi*. Close relatives do often marry in most regions of Pakistan, for a variety of pragmatic reasons, not because the ideology tells them to do so (10, 26). In India (44), the practice of consanguineous marriage has been higher among the Muslims of the North and Hindus of the South, and among the other backward classes and the less-educated population with the middle and higher wealth index.

### Health impact of consanguineous marriages

Parental consanguineous marriages have palpable impacts on family and public health. The only exception to the deleterious consequences of consanguineous marriages has come from a recent survey

(45), which reported that the rate of COVID-19 and mortality due to COVID-19 was lower in countries with a high prevalence of consanguineous marriages than in countries having a low level of marriage with relatives.

In the Middle East and North Africa, consanguineous marriage has been associated with an increased incidence of some adult diseases of multifactorial origins, including diabetes, hypertension, kidney diseases, and certain types of cancer (46, 47). Consanguineous marriages do not change the allele frequencies of common defects. However, it does increase the probability that an allele will become identical in a descendant. Consanguineous marriage is often observed in rare autosomal recessive genetic diseases from a union between two closely related individual heterozygotes due to the expression of homozygotes and increased chances of carrying the same recessive mutant allele of an abnormal gene compared with less closely related or unrelated couples (4).

A majority of studies among Arab/Islamic communities showed high rates of hereditary diseases and birth disorders compared with the rates in industrialized Western countries and with the figures for the general population (7, 17, 18, 20, 24, 35, 39, 40, 48, 49-51). This was also true for recurrent miscarriage and postnatal mortality. These results suggested that the detrimental genes affecting prenatal and infant life might be transmitted. An average excess of 1.1% of deaths occurred among offspring from first-cousin marriages during the neonatal period (10, 15).

In the Arabian/Muslim populations, an association existed between consanguineous marriage and congenital heart (34), neural tube defects (17), and hereditary deafness (18, 52).

The consanguineous families in Afghanistan and Pakistan experienced higher rates of abortions/miscarriages, stillbirths, and congenital abnormalities in offspring compared with those of non-consanguineous families (2, 10, 53, 54).

### **Islamic position on consanguineous marriages**

No obvious differences have been reported in the attitude of major religions toward close kin marriages. Muslim regulations on marriage parallel the Christian Judaic patterns detailed in The Holy Books: The Qur'an, The Bible, and The Leviticus. The religious rules refute and disprove extremely close intermarriage. Such relationships are discouraged. However,

marriages between distant relatives are preferred and recommended, since blood relation is unhealthy and weakens the offspring (55). All cultures and religions consider such a relation as a taboo, and penalty is imposed on the wrongdoers (56). However, the Pharaohs and the old Persians certified marriages between brothers and sisters (56). In addition, the Old Testament (Book of Genesis) has claims regarding the marriage between Abraham and his half-sister Sarah, as well as the incest relation between "Lot" and his two daughters (56). Islam does not accept such promiscuous and incest claims.

Some opponents criticize Islam by saying that it prescribes the practice of the union of relatives. The basis of such claims is that two wives of the Prophet Mohammad (Peace Be Upon Him, PBUH) were his biological relatives, and he also married his daughter Fatima to Ali, the son of his paternal uncle (10). They add that Islamic inheritance laws mandate that a daughter should have a share of the inheritance from her father. In their opinion, this law could divide the wealth of families in agricultural, patrilineal societies unless the daughter also married into her father's descent line (56). The property argument was debunked (57), and researchers supported the hypothesis that the prevalence of consanguineous marriage was high in traditional societies where land was inherited through the male line and daughters moved in with their husband's families. Although a few Islamic groups exhibited an agnatic bias in describing descent and determining inheritance, this was not a norm in regulating marriage negotiations. The consolidation of property appeared a plausible explanation for consanguineous marriage; it was rarely perceived as a contributing factor among the Pakistani women interviewed (10).

Islam recognizes the importance of sex, advises marriage, and does not endorse celibacy. It controls sexuality in marriage and strongly prohibits sex outside of it because it is considered extreme behavioral misconduct not advantageous to a respectful, healthy society. Homosexuality and same-sex marriage are firmly and powerfully forbidden by Qur'an's injunctions and Islamic conventions and remain sternly prohibited laws against nature in the opinion of Muslim scholars. According to Islamic legislation, the offenders and breachers are punished.

Furthermore, sex between immediate, close relatives (incest marriage) is absolutely not authorized by Islamic legislation. Islam has clearly detailed the women whom a man cannot marry (The Holy Qur'an,

Surat Al-Nisa'a; Verses: 22 and 23). This includes sexual relations between parent and child, or sisters and brothers, or uncle and niece, or aunt and nephew. Marriage is not allowed between specific blood relatives and between persons who concurrently share breastfeeding with the same woman. The simultaneous combination in a marriage with two sisters or a woman and her aunt is not permitted. Incest marriage is considered as a form of fornication or adultery that may threaten not only the family but also society as a whole. Severe punishment on sex outside marriage and secularization of marriage may seem absurd or even cruel to opponents, but it turns out to be extremely difficult to ease the regulations necessary for the preservation of the institution of the family, social purity, and genealogy.

The rationale behind these constraints probably arises from not only religious beliefs but also psychological, fitness, and vigor causes. Islamic vision summarizes the aims of a lifelong union to provide a stable, secure, peaceful, and comfortable environment to family and society. Islam wants to improve the position of women by minimizing the risks of maltreatment from a husband bound by family ties, and also to minimize the possibility of divorce. In the Islamic point of view, children have a right to be protected and reared under ideal family conditions. Therefore, for groups within Islam, intermarriage is only allowed outside this family circle. The Holy Qur'an and The Hadith [the pronouncements of Prophet Mohammad (PBUH)] stressed the importance of "selection of compatible couples" and delineated inheritance in children (56). In fact, intermarriage or exogamy [marriage outside the tribe (hamula or kabeela)] was in high demand to increase cultural exchange and religious influence (56). Islam urges husband and wife to take vital measures, including early diagnosis and intervention, to protect their health as well as the health of their offspring. The Qur'an explicitly permits marriage of a Muslim man to a faithful woman of the People of the Books, a term that including Jews and Christians (56).

### Preventive measures

Many people within some Arab/Muslim societies regard marriage as a basic institution; family matters and marriage choices should be left to couples and families to decide (17). However, from the clinical geneticist's point of view, marriage is a major public health issue and is not a private personal contract because marriage patterns play a significant role in the

distribution of most genes among individuals over generations. So, it must be closely monitored because it determines the fate of the genetic heritage of the entire population (15). Blood genetic diseases, due to their chronic nature, impose heavy medical, economic, and psychosocial burdens on the family and on the governmental authorities that result from seeking treatment for chronic and disabling hereditary diseases (58).

Preventive strategies for health problems are highly prioritized besides care and rehabilitation of the affected in the community (15). Islam concentrates on the avoidance of genetic diseases rather than curing them. It encourages distant marriages and forbids incestuous marriages and adultery. The Prophet Mohammad (PBUH) guided individuals planning for marriage to choose disease-free offspring with good character. Practicing premarital examination is welcomed by Islamic teachings, especially in a community where the rate of consanguineous marriages is high (56).

The implementation of premarital medical testing for prospective couples has been made compulsory by a number of Arabic governments, including Bahrain (20), Saudi Arabia (39, 59), Sudan (38), Kuwait (50), as well as Egypt, Jordan, Lebanon, Morocco, Syria, Tunisia, and UAE (7, 17, 56). Similarly, the test has been enforced by law in several Islamic countries such as Nigeria (60), Iran, Turkey (56), and Malaysia (25). Following the implementation of the genetic preventive campaign, secular reductions in the rate of consanguineous marriages, accompanied by a corresponding decrease in the rate of genetic diseases, have been recorded in Bahrain (61), Jordan (7, 62), Kuwait (50), Indonesia (23), Iran (63), Saudi Arabia (64), and Syria (16).

Even when the test is performed, many couples take it as the last step in the process of marriage and some decide on their own and proceed with the marriage regardless of the results of the premarital testing. Thus, it is noteworthy that withdrawing from marriage on the basis of the results of the test is sometimes extremely difficult in conservative societies. Also, individuals and couples can practice their autonomy by deciding whether, when, and under what circumstances they will try to have children.

An increasing number of parents now request premarital information on the risk of having genetically affected offspring. A complementary approach to providing parental screening is important, but at the same time, counseling is associated with some of

the most difficult issues in the whole field of bioethics and health management. On the one hand, it is beneficial to lower the rate of serious diseases, particularly among children. On the other hand, it can lead to prejudice against carriers. However, this enables an individual or a family to make appropriate, informed decisions about the options for selecting a partner. Reproductive options should be discussed with the related party. Unlike contraception, which is a permissible temporary measure under Islamic law, sterilization is not acceptable and adoption is abrogated by the Qur'an.

If a pregnancy test confirms the existence of genetic defects in the fetus, selective abortion is considered. This option is often agonizing for the people involved (65). The termination of pregnancy is allowed under certain specific conditions according to "Fatwa" number 4 (66). This Fatwa legalizes the abortions of fetuses with serious congenital diseases if carried out prior to the 120th day of conception (67). In Iran, an amendment of the law, originally forbidding medical abortion, led to a 70% cut in the annual rate of defective births (17). Although the medical termination of pregnancy is sometimes legalized, it remains an unacceptable choice in certain groups, primarily due to religious beliefs. Some at-risk Arabic/Islamic parents prefer not to think of undertaking prenatal diagnosis because it is associated with the principle of abortion and it is deeply believed that having a malformed child is only the God's will (34).

An alternative offer proposed for a consanguineous couple at risk is the preimplantation genetic diagnosis (PGD). This procedure involves in vitro fertilization, followed by genetic screening to select and implant the eggs in the uterus free from genetic disorders. This method is permissible in Islam on the condition that the sperms and oocytes are from the husband and wife (56). Donation of a sperm or an ovum or pre-embryo technologies, such as using the uterus of a foster mother, are not acceptable and are refuted in the view of Islamic teachings on the grounds that procreation must be only within the bounds of wedlock without the intervention of a third party (56).

Genetic engineering technologies, such as stem cells and DNA fingerprinting for therapeutic purposes, have been approved by Islamic Fiqh councils, ethics committees, and institutes around the world as long as they do not cause further damage. The practical applications of these protocols are available

in Saudi Arabia and the UAE (55), as well as in North America (68), Turkey, and Malaysia (69). Human cloning is forbidden in Islam. Most Islamic jurors authorize human embryonic stem cell research if its source is lawful. DNA fingerprinting may be restricted to certain conditions.

No discussion is complete without criticizing some of the vital and complex social, political, economic, and cultural variables. The services that provide prenatal screening and PGD of genetic disorders are not available or are relatively expensive and unaffordable in certain Islamic countries (41, 56). Some people are either unaware of prenatal testing or are still reluctant (41) or are against it or not satisfied with the premarital screening program (50, 70). This attitude is mainly due to the fear that the screening test may affect future marriage opportunities (62).

Moreover, millions of people are living in low-income and lower-middle-income countries such as some Arab states (17), Bangladesh (71), and Indonesia (23). For example, the annual treatment cost for thalassemia in a child was estimated to be \$6000 in Pakistan, with a per capita income of \$1380. Although a majority of Malaysians, about 54.4%, positively responded to thalassemia screening, only 13.6% of married participants actually were tested (72). The cultural beliefs and misinterpretation of religious guidelines by the public have led to an increased prevalence of thalassemia in Pakistan (73). More recent studies from Malaysia (25) and Indonesia (23) demonstrated that the major reason behind parents' denial of thalassemia testing was the confidence that the absence of the disease in their family members meant that their offspring were not at risk.

### Limitations

The limitations of the present study and other similar studies were the restricted access to information in the official files in many countries. In addition, some of the studies mentioned in the present study were either old or based on a small sample size. Another drawback was that it did not include many non-English important studies. In certain surveys, possible confounding variables associated with consanguineous marriages were not fully analyzed or discussed. Therefore, the information in the present study might not fully represent or reflect the actual situation of the whole Islamic/Arabic population today.



## CONCLUSIONS

Arab and non-Arab nations experienced consanguineous marriages before the birth of Islam. Nonreligious country- and culture-specific determinants of consanguineous marriages play a key role (6, 8). No specific guidance exists in the Holy Qur'an that can be interpreted as encouraging consanguineous marriages. Islam accepted some types of consanguineous marriages but denied other types. Unfortunately, some extreme Muslim groups still believe that marriage among cousins is a form of marriage prescribed by the sunnah (deeds) of the Prophet Mohammad (PBUH). Some complex dilemmas remain to be answered and wide gaps need to be filled regarding the knowledge and understanding of Islamic teachings and their application in consanguineous marriages. The dearth of epidemiological data can be attributed to the belief that Arab/Muslim inbreeding is a huge unsolved problem, and nobody wants to talk about it. The best policy is to more effectively and actively educate people about the dangers of this type of marriage and encourage young individuals planning the marriage to acquire knowledge on healthcare facilities from Islamic references rather than through friends and colleagues. The related people must know that, sometimes, autosomal recessive genes stay hidden within the family for generations and then show up in a new consanguineous marriage within the family. It is the responsibility of the public health sectors and the Islamic scholars to warrant the application of educational programs targeting youths and to continually assess the knowledge and awareness of the health consequences of consanguineous marriages on progeny health.

We must admit that cost, public accessibility, and ethical issues are still challenging. Other influencing factors include an insufficiently updated medical education system, poor infrastructure, and absence of comprehensive health. Valid or convincing explanations for the motivation of consanguineous marriages among Middle Easterners still exist. This study could not cover the subject effectively in large populations as large and diverse as those in Arabic/Islamic countries. However, the present study added more to the literature from these countries examining this topic. Future studies should focus on specific regional and population patterns. Specialized investigations in this challenging area are warranted.

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