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Consanguinity and Its Association with Genetic Disorders and Reproductive Outcomes in Benghazi

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زواج الأقارب وعلاقته بالاضطرابات الوراثية والنتائج الإنجابية في بنغازي

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Abstract:
Background: Consanguinity marriage is a normal cultural practice in most Arab societies including Libya where consanguinity marriages form a considerable percentage of marriages in this nation. This practice has the propensity of causing autosomal recessive genetic conditions because the chances of shared deleterious alleles between married couples are high. Although consanguinity is socially acceptable, it is a significant public health issue since it is linked to poor reproductive and health conditions.
Purpose: This paper was undertaken to find out the prevalence of consanguinity marriage in Benghazi, Libya and to examine its relationship with reproductive outcomes and genetic health conditions among the offspring, including diseases, neonatal outcomes and abortion rates.
Methods: A cross-sectional study design was chosen. The researchers have selected a sample of 699 married couples in Benghazi. Structured questionnaire was used to collect data on demographic factors, the level of consanguinity, reproductive history, and child health outcomes. The SPSS version was used to statistically analyze the data, including descriptive statistics and Chi-square tests to determine the relationship between variables, a significant level of $p < 0.05$.
Key Results: The results showed that consanguinity marriage is high in Benghazi with first-cousin marriages being the most prevalent one. The statistically significant relationship between consanguinity and prevalence of genetic diseases among offspring was found ($p < 0.001$). Nonetheless, there was no strong correlation between consanguinity and the rates of abortion ($p = 0.527$). There was an increased number of health problems in consanguineous families than non-consanguineous.
Inference: Consanguinity marriage is very high in Benghazi and has a significant connection in an elevated risk of genetic diseases in offspring. Though no significant effect was noted on the rate of abortion, overall findings indicate that consanguinity negatively affects child health and this may require a combination of public health interventions, genetic counseling, and awareness.

Keywords: Consanguinity, Benghazi, Genetic Disorders, Reproductive Health, Autosomal Recessive Diseases, Libya, Cross-sectional Study

الملخص
الخلفية: يُعدّ زواج الأقارب ممارسة ثقافية شائعة في معظم المجتمعات العربية، بما فيها ليبيا، حيث تُشكّل هذه الزيجات نسبة كبيرة من إجمالي الزيجات في البلاد. وتزيد احتمالية انتقال الأليلات الضارة بين الزوجين من خطر الإصابة بأمراض وراثية متنحية. ورغم أن زواج الأقارب مقبول اجتماعيًا، إلا أنه يُمثّل مشكلة صحية عامة خطيرة لارتباطه بتدهور الصحة الإنجابية.
الهدف: هدفت هذه الدراسة إلى تحديد مدى انتشار زواج الأقارب في بنغازي، ليبيا، ودراسة علاقته بالنتائج الإنجابية والحالات الصحية الوراثية لدى الأبناء، بما في ذلك الأمراض، ونتائج حديثي الولادة، ومعدلات الإجهاض.
المنهجية: اعتمدت الدراسة تصميمًا مقطعيًا. واختار الباحثون عينة من 699 زوجًا في بنغازي. واستُخدم استبيان مُنظّم لجمع البيانات حول العوامل الديموغرافية، ومستوى زواج الأقارب، والتاريخ الإنجابي، وصحة الطفل. استُخدم برنامج SPSS لتحليل البيانات إحصائيًا، بما في ذلك الإحصاءات الوصفية واختبارات مربع كاي لتحديد العلاقة بين المتغيرات، عند مستوى دلالة إحصائية $p < 0.05$.
النتائج الرئيسية: أظهرت النتائج ارتفاع نسبة زواج الأقارب في بنغازي، حيث يُعد زواج أبناء العمومة من الدرجة الأولى الأكثر شيوعًا. وُجدت علاقة ذات دلالة إحصائية بين زواج الأقارب وانتشار الأمراض الوراثية بين الأبناء ($p < 0.001$). مع ذلك، لم تُلاحظ علاقة قوية بين زواج الأقارب ومعدلات الإجهاض ($p = 0.527$) كما لوحظ ازدياد في عدد المشاكل الصحية في الأسر التي تضم أقارب مقارنةً بالأسر التي لا تضمهم.
الاستنتاج: يُعد زواج الأقارب شائعًا جدًا في بنغازي، وله ارتباط وثيق بزيادة خطر الإصابة بالأمراض الوراثية لدى الأبناء. على الرغم من عدم ملاحظة أي تأثير يُذكر على معدل الإجهاض، تشير النتائج الإجمالية إلى أن زواج الأقارب يؤثر سلبًا على صحة الطفل، وقد يتطلب ذلك مزيجًا من تدخلات الصحة العامة، والاستشارات الوراثية، والتوعية.

الكلمات المفتاحية: زواج الأقارب، بنغازي، الاضطرابات الوراثية، الصحة الإنجابية، الأمراض المتنحية الجسدية، ليبيا، دراسة مسحيه

Introduction

Consanguinity marriage which is usually defined as a marriage between two individuals who are related as second cousins or even closer is a long-standing social and cultural practice in most parts of the world especially in the Middle East, North Africa and South Asia. Biologically, consanguinity is the commonality of shared ancestors and therefore it is more likely that both partners will have the same copy of some of the genes that they share. This genetic relatedness is usually measured with the help of the coefficient of inbreeding that quantifies the probability that an individual inherits two identical alleles of a common ancestor (Bachir & Aouar, 2019; Temaj et al., 2022).

Consanguinity marriages are deeply rooted in the social customs and are commonly linked to the perceived cultural, economic and family benefits. These can be maintenance of the family set up, social bonding, ease of getting married and economic gains like lowered dowry expectations. Although there is the growing urbanization and modernization, the practice has been prevalent among the Arab people. Research has demonstrated that consanguinity marriages constitute around 20 to 50 percent of all marriages in a number of Arab countries making it one of the most important demographic factors as well as population health issues (El Goundali et al., 2022; Popescu et al., 2025).

Consanguinity remains a common occurrence in Libya, especially in some areas and the rural parts. Despite the fact that national data on intra-family marriages are limited, local studies show that the intra-family marriages take up a significant percentage of all marriages. As an example, a recent study in Misurata indicated a high rate of consanguinity marriages and highlighted their correlation with poor health outcomes (Krayem, 2025). Nonetheless, the gap in region specific research is that the patterns and implications of such marriages might be different in eastern Libyan cities like Benghazi, where socio-cultural dynamics might act differently.

Genetically, the most important issue with regard to consanguinity is the effect it has on the expression of autosomal recessive diseases. In non-consanguinity populations, it is less likely that individuals will inherit two copies of a deleterious recessive gene. The likelihood of a father and a mother sharing the same recessive allele is greatly enhanced in the case of a consanguineous union. This means that their children are more likely to inherit genetic disorders that would otherwise be uncommon in the general population (Temaj et al., 2022; Khayat et al., 2024).

Autosomal recessive diseases linked to consanguinity include a broad spectrum of diseases, such as metabolic disorders, congenital anomalies, intellectual disabilities, hearing impairments and immunological deficiencies. A number of studies have reported increased rate of such conditions in children born in consanguinity couples. As an example, it has been shown that there are significant correlations between consanguinity and genetic disorders such as inborn errors of immunity and hearing and language impairments (El Hawary et al., 2022; Nasser et al.,

2025). Also, the concept of consanguinity has been associated with elevated levels of dental anomalies, which further supports the idea that consanguinity has a far-reaching effect on health outcomes (Abbas et al., 2022).

In addition to genetic disorders, consanguinity also has been linked with poor reproductive outcomes, such as high risks of neonatal mortality, stillbirths, and congenital malformations. Although some studies have also reported conflicting findings in terms of its association with spontaneous abortion, there is strong evidence that overall reproductive wastage could be higher in consanguineous marriages (Mofied et al., 2024; Jaber et al., 2023). These are usually suspected to be a result of the heightened expression of harmful genes that may jeopardize fetal development and survival.

The international approach to consanguinity highlights its complex implications which include anthropological, social, and biomedical implications. Although in certain societies, consanguineous marriage is still considered to be a good practice, the rising amount of scientific evidence demonstrates that there is a need to raise people awareness about the possible health risks of such practice. Recent reviews have highlighted the significance of combining genetic counseling and public health interventions to alleviate the negative consequences of consanguinity, especially in high-prevalence regions (Kalam & Pal, 2025; Reis et al., 2023).

Although the literature on the subject of consanguinity is wide, there is a pressing need to carry out research that is context specific and addresses the issue of the prevalence of consanguinity and its health implications in individual communities. There are limited empirical data available in Libya, and specifically in Benghazi, relating to the extent of consanguinity marriage and its direct influence on the reproductive and child health outcomes. Since the cultural norms of consanguinity are accepted and the possible implications on the general health of the population may be profound, such a research is a necessity in terms of informing evidence-based interventions and policy formulation.

Thus, the current research intends to fill this gap by exploring the prevalence of consanguineous marriage in Benghazi and finding its relationship with critical health indicators, including congenital diseases, disease rates among the offspring, and the pregnancy outcomes such as the survival rate of the newborn and the rate of abortion. This research aims to add to the current body of knowledge and help to develop specific health education and genetic counseling courses.

2. Literature Review

2.1 Arab Studies on Consanguinity

The high prevalence of consanguinity marriage has attracted a lot of research on the subject in Arab countries because of the high prevalence and the implications that the prevalence has on the health of the people. The Arab world is ranked as one of the regions with the highest rates of intra-family marriages in the world, wherein intra-family marriages are entrenched in the traditions of the cultures, society and economy. El Goundali et al. (2022) conducted a systematic review that revealed that consanguinity rates among the Arab populations vary between 20% and 50%. First-cousin marriages are the most common form of consanguinity. The paper identified that cultural norms, family cohesion, and economic factors are major factors that contribute to the continuation of this practice.

Studies have continuously proved that consanguinity is strongly associated with negative health outcomes, in the North African contexts (Algeria and Tunisia). In a study conducted by Bachir and Aouar (2019), in southwestern Algeria, the researchers found that consanguinity unions were linked with the high rate of early mortality and some congenital diseases, although the association with abortion was not statistically significant. In a similar study, Mezzi et al. (2023) conducted a study on the Tunisian population and reported that consanguinity plays a significant role in the dynamics of the genome, as it increases the homozygosity rate, which in turn increases the risk of inheriting genetic diseases.

The genetic burden of consanguinity has also been noticed in the Gulf region. Khayat et al. (2024) reviewed the relationship between consanguinity marriages and genetic disorders in Saudi Arabia and found more prevalence of autosomal recessive diseases, including metabolic disorders and congenital anomalies, among the children of related couples. The research emphasized the relevance of genetic screening and counseling programs in curbing the occurrence of such conditions.

These findings are further supported by Egyptian studies. El Hawary et al. (2022) studied the outcome of genetic testing in patients with inborn errors of immunity and reported that a significant percentage of the cases were associated with consanguineous relationships. Moreover, Nasser et al. (2025) observed that there was a great connection between consanguinity and hearing and language disorders in Egyptian children which permeated beyond life threatening disorders to developmental impairments.

In the Libyan context, there have been small yet significant research studies. Krayem (2025) discussed consanguinity marriage in Misurata and reported a high prevalence, and a significant rise in genetic diseases and adverse reproductive outcomes among affected families. Nevertheless, there is a lack of studies that specifically focus on Benghazi which suggests that the localized studies would be beneficial to understand the regional differences in prevalence and health outcomes.

2.2 Global Studies on Consanguinity

Consanguinity has been investigated in different populations all over the world and has been found to provide important information on the biological and social implications of consanguinity. Although in the Western world the practice is less widespread, it is still prevalent in some of the Asian, African, and Latin American regions. Kalam and Pal (2025) offered a global approach to the topic of consanguinity with a detailed overview of its anthropological background, genetic health risk factors, and its current importance. Their analysis highlighted how consanguinity marriage still prevails in most societies despite the modernisation due to the deeply rooted cultural values.

Reis et al. (2023) focused on consanguinity in Brazil and reported that even in those populations where consanguinity is not so culturally dominant, it nevertheless leads to an even greater prevalence of genetic diseases. The paper emphasized the need to know the local trends of consanguinity and their health consequences even in non-traditional contexts.

Genetically, Temaj et al. (2022) examined in detail the role of consanguinity on human health with a particular focus on rare diseases. The authors found that consanguinity has a great impact on homozygous mutations, which cause many rare genetic disorders. This augmented genetic danger is a phenomenon cut across the board, irrespective of geographic location.

More so, Jaber et al. (2023) did an international review of consanguinity and reproductive outcomes, and established that children born to consanguineous couples are at a greater risk of poor health outcomes, including congenital anomalies and early mortality. It was also observed in the study that the extent of such risks differs with factors like the amount of relatedness and the genetic makeup of the population.

Through a literature review, Popescu et al. (2025) studied the social and demographic determinants of consanguinity marriage and found that such factors as the level of education, rural residence, and socioeconomic status have a significant impact on the prevalence of consanguinity marriage across the world. The implications of these results are that the interventions to be used to reduce the risk associated with consanguinity need to factor in the broader social determinants, in addition to the genetic factors.

2.3 Past Results: Diseases, Mortality, and Abortion.

There has been a significant number of studies on the health outcomes relating to consanguinity marriage especially with reference to genetic diseases, mortality and reproductive indicators like abortion.

Congenital Disorders and Genetic Diseases.

The most perpetually documented in the literature is the higher rate of genetic disorders among children born in a consanguineous marriage. The study by Abbas et al. (2022) has shown that consanguinity and dental anomalies are significantly correlated, implying the overall substantial impact of genetic factors on physical development. Likewise, Khayat et al. (2024) and Temaj et al. (2022) found higher prevalence rates of autosomal recessive diseases, such as metabolic and neurological disorders in populations with high consanguinity rates.

Moreover, El Hawary et al. (2022) pointed out the role of consanguinity in raising the incidence of inborn errors of immunity, whereas Nasser et al. (2025) highlighted the relationship between consanguinity and sensory and developmental disorders, such as hearing and language impairments. All these results indicate a large spectrum of the health conditions affected by consanguinity.

Mortality and Reproductive Outcomes.

Consanguinity has also been associated with the high mortality rates especially in young age. Bachir and Aouar (2019) discovered that the early mortality rate was significantly higher among the children born to consanguineous parents. In a similar way, Jaber et al. (2023) presented the higher risks of neonatal mortality and stillbirth in consanguineous populations.

The authors of Mofied et al. (2024) tested the impact of consanguinity on reproductive wastage and the perinatal outcomes, finding that consanguineous marriages were linked to increased rates of adverse outcomes, such as

stillbirths and neonatal complications. Such results are usually explained by the fact that more dangerous recessive genes are expressed which can severely hinder the development of the fetus.

Abortion

The connection between consanguinity and abortion is less steady in the researches. Although there has been a proposal that there may be an increase in the spontaneous abortion, some other researchers have established that there is no significant relationship. As an example, Bachir and Aouar (2019) found that there was no statistically significant correlation between consanguinity and abortion, which also reflects the results of a number of other studies in the literature. This discrepancy indicates that other factors other than genetic relatedness such as maternal health and environmental factors may also be a key determinant in influencing abortion outcomes.

3. Methodology

The research design used in this study was a cross-sectional research design to investigate the prevalence of consanguinity marriage and its health implications in Benghazi, Libya. The cross-sectional approach was considered to be suitable as it allows assessing the relationship between variables at a certain timepoint, which gives a clear picture of the current situation regarding consanguinity marriage and its possible impact on reproductive and child health in the community under study.

The sample population was 699 married couples who lived in Benghazi. The stratified sampling was used to select the participants in order to represent the different socioeconomic and geographic groups in the city. This sample was deemed to be adequate to give confident estimates of the prevalence of consanguineous marriage, as well as, studying their relationship with several health indicators prevalent in the community.

A structured questionnaire was used to collect the data, which aimed to provide a comprehensive information about demographic characteristics, the degree of biological relationship between the spouses, the reproductive history and health outcomes among the offspring. It was also carried out in face-to-face interviews with the data collectors being trained and this served the purpose of enhancing the response accuracy and completeness. The questionnaire was checked before the collection of data to determine the clarity and relevance of the questionnaire to the study objectives.

To analyze the data, the information collected was inputted into a statistical software and analyzed with the Statistical Package of Social Sciences (SPSS). The data was summarized and the data characteristics of the study population were described using descriptive statistics such as frequencies, percentages, means, and standard deviations.

Inferential statistical tests were used to test the relationship between consanguinity and health outcomes. Chi-square test was applied to test the associations between categorical variables e.g. type of marriage and the presence of diseases or reproductive outcomes e.g. abortion and neonatal status. A significance level of $p < 0.05$ was taken to identify statistical significance. This method of analysis allowed discovering significant correlations between the consanguinity type of marriage and the examined health variables.

4. Results

Table (1): Distribution of Consanguinity Types in Benghazi

Type of Relationship	Frequency (N)	Percentage (%)
First cousin	280	40%
Second cousin	11	2%
Third cousin	3	2%
Far relation	5	1%
Total Consanguinity	324	46%
Non-consanguinity	375	54%
Total	699	100%

The results indicate that consanguineous marriage is highly prevalent in Benghazi, accounting for 46% of the total sample. First-cousin marriages represent the dominant type, reflecting strong cultural and familial preferences for intra-family unions.

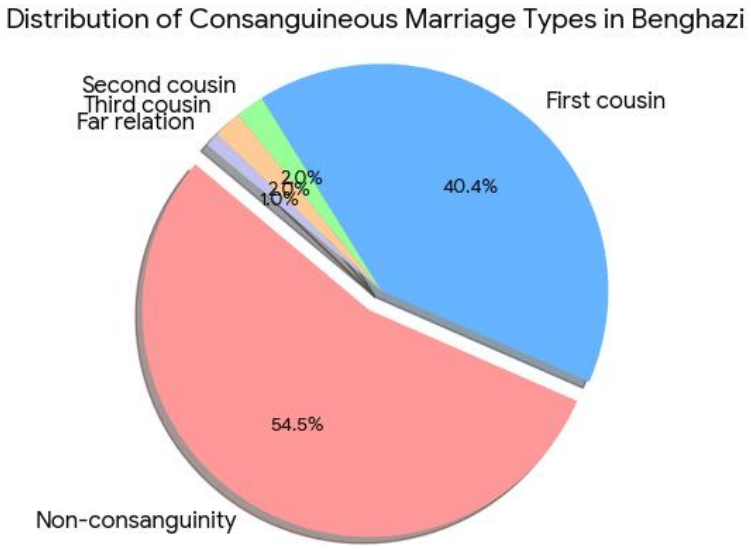

Figure (1): Distribution of Consanguinity Types in Benghazi

Table (2): Consanguinity and Abortion in Benghazi

Type of Marriage	Abortions (Observed)	Expected	Total
Consanguineous	424	415.6	3589
Non-consanguineous	382	390.4	3372
Total	806	—	6961

Chi-Square Test (Abortion)

Test	Value	df	Sig
Pearson Chi-square	0.400	1	0.527

The results show that there is no statistically significant relationship between consanguinity and abortion in Benghazi ($p > 0.05$), indicating that abortion rates are not influenced by parental genetic relatedness.

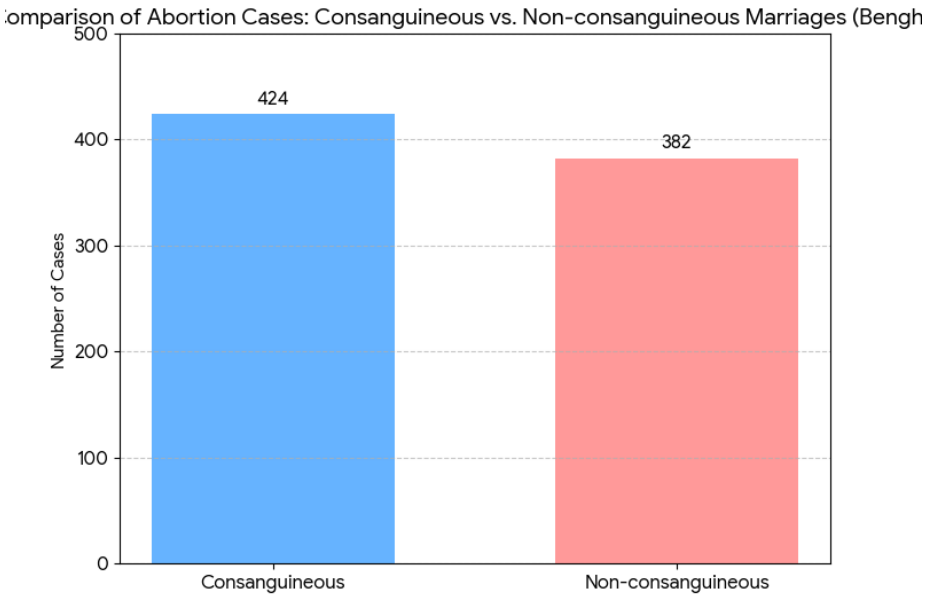

Figure (2): Relationship Between Consanguinity and Abortion in Benghazi

Table (3): Consanguinity and Diseases in Benghazi

Type of Marriage	Infected	Non-infected	Total
Consanguineous	463	2714	3177
Non-consanguineous	316	2662	2978
Total	779	5376	6155

The findings reveal a higher prevalence of diseases among children born to consanguineous marriages compared to non-consanguineous unions, suggesting a potential genetic influence.

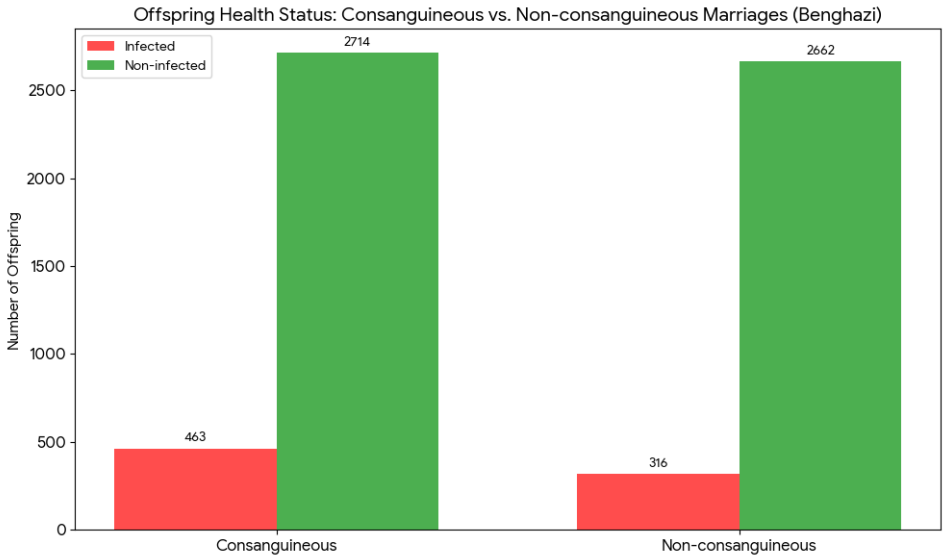

Figure (3): Disease Prevalence in Consanguineous vs Non-Consanguineous Marriages

Table (4): Chi-Square Test (Diseases)

Test	**Value**	**df**	**Sig**
Pearson Chi-square	21.831	1	0.000

There is a highly significant association between consanguinity and the occurrence of diseases ($p < 0.001$), confirming that genetic relatedness increases the risk of inherited disorders.

Table (5): General Pregnancy Statistics (Benghazi Sample)

Statistical Indicator	Value
Sample Size (N)	699
Mean	6.44
Median	6.00
Mode	5
Std. Deviation	3.19
Minimum	0
Maximum	20

The descriptive statistics show variability in pregnancy outcomes among the studied population, with an average of 6.44 pregnancies per family.

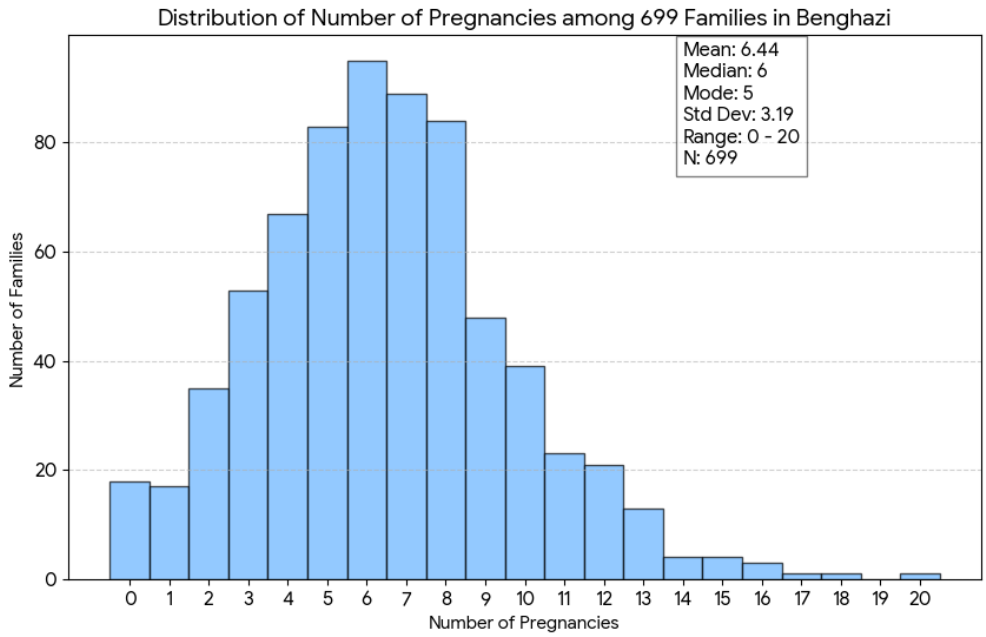

Figure (4): Distribution of Pregnancy Frequency in Benghazi Families

Table (6): Neonatal and Abortion Summary (Benghazi)

Variable	Number
Neonatal	6155
Abortions	806

The data indicate a high number of neonatal births compared to abortions, suggesting that most pregnancies resulted in live births across the sample.

5. Discussion

The results of the current study are significant to the prevalence as well as the health implications of consanguineous marriage in Benghazi, Libya. The findings revealed that consanguineous marriages form a significant percentage of marriages with first-cousin marriages being the largest percentage. Such a pattern is similar to other studies that have been conducted in Arab populations that reported the same, that consanguinity rates often range between 20% and 50% (El Goundali et al., 2022; Popescu et al., 2025).

Comparing it with regional researches, the prevalence in Benghazi is similar to that in other countries of North Africa. As an example, the high levels of consanguinity marriages were also reported in the studies in Algeria and Tunisia and emphasized their association with the increased genetic disease burden (Bachir and Aouar, 2019; Meerzier et al., 2023). In the same way, research on Saudi Arabia and Egypt has continually demonstrated that consanguinity is associated with a greater occurrence of inherited disease and developmental defects (Khayat et al., 2024; Nasser et al., 2025). These parallels indicate that the trend that was observed in Benghazi is a larger trend within the region.

The present research also indicated that there was a statistically significant relationship between consanguinity and genetic diseases in offspring. This observation is strongly supported by the previous literature, which confirms that consanguineous marriages predispose the risk of developing autosomal recessive disorders because there is an increased risk of inheriting the identical deleterious alleles because of common ancestors (Temaj et al., 2022; Jaber et al., 2023). In this regard, genetic disorders like congenital anomalies, hearing impairments, and intellectual disabilities are more inclined to exist in children born to related parents.

Genetically, the mechanism of autosomal recessive inheritance, whereby harmful recessive genes are concealed in heterozygous carriers, but expressed when both parents carry the mutation in question. Homosexual marriages enhance homozygosity among children and this elevates the chances of expression of these harmful genes. This physiological process can be used to explain the increased prevalence of diseases seen in the research population (Kalam & Pal, 2025).

Conversely, the research did not show any significant relationship between consanguinity and the rate of abortions. The result is in line with some of the previous studies like Bachir and Aouar (2019) who also did not report a statistically significant relationship between consanguinity and spontaneous abortion. This implies that it is possible that environmental, maternal and obstetric factors may have an increased influence on abortion as opposed to genetic relatedness alone.

The overwhelming consanguinity in Benghazi can be explained by a number of socio-cultural and economic factors. These are that family traditions were strong, the preference was in maintaining family wealth, social cohesion and the trust between known families increased. Moreover, the factors of lower awareness about genetic risks and limited access to premarital genetic counseling may also lead to the continuation of such a practice (El Goundali et al., 2022; Popescu et al., 2025).

In general, the results of the study support the notion that although consanguinity marriage is still socially accepted, it is linked with a greater number of genetic diseases, which underlines the necessity of implementing interventions in the realms of health and social life of the target population.

6. Conclusion

The findings of this study are that consanguinity marriage is very high in Benghazi with first-cousin marriage being the most prevalent form. The outcomes indicate the presence of a statistically significant and positive relationship between consanguinity and higher rates of genetic diseases among children.

Nonetheless, it was not possible to establish a significant correlation between consanguinity and abortion rates. The results are a strong indication that consanguinity leads to the higher expression of autosomal recessive genetic disorders, which are harmful to the child health outcomes.

Overall, the effect of consanguinity marriage on the overall health within a community, specifically Benghazi, can be measured with respect to hereditary diseases and other long-term child health outcomes.

7. Recommendations

According to the results of this paper, one can make a number of recommendations that will help to decrease the health burden in consanguineous marriage:

Health Awareness Programs: The need is to raise the level of awareness among the population about the genetic risk involved in consanguinity marriage through education and community outreach activities.

Premarital Genetic Screening: Mandatory or voluntary premarital genetic screening and genetic counseling programs can be implemented to help identify carriers of genetic disorders and minimize risk of affected offspring.

Reinforcement of Health Policies: The health authorities are supposed to establish and enforce policies that would promote genetic counseling services and introduce them into the primary healthcare systems.

Educational Interventions: Educational interventions such as incorporation of genetic education into school and university curricula can enhance knowledge about the risks associated with heredity in younger generations.

Future Research: In Libya, more region-specific studies are necessary to investigate genetic illnesses among various populations and to aid the planning of health based on evidence.

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