

Original Article

Exploring the Relationship Between Consanguinity and Perinatal Outcomes: A Cross-Sectional, Comparative Study

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Abstract

Objective: To investigate how parental consanguinity might influence newborn health outcomes.

Methodology: This cross-sectional, comparative study was conducted from 1st September 2022 to 31st September 2023 at the Department of Obstetrics and Gynaecology in Fauji Foundation Hospital, Rawalpindi. Institutional review board approved this study. Following a careful selection process, patients were classified as consanguineous or non-consanguineous. We collected demographic and clinical information during delivery (both vaginal and cesarean). Newborns were closely followed until hospital discharge to assess key neonatal outcomes.

Results: The mean age of the study population was recorded as 28.53±4.9. The results of this study showed 1st cousin marriages in 28.6% (n=100) study population whereas, 2nd cousin marriages were observed in 14.3% (50) population. The ratio in study population that was not in a relation with consanguinity was found in 56.9% (199) population. Clinical parameters which were found to be significantly associated with consanguinity were threatened PTL (p=0.02), pre-term delivery(p=0.02), NICU admissions (p<0.01), and neonatal outcomes (p<0.01) respectively.

Conclusion: Consanguinity is deeply ingrained in some Pakistani communities. Surprisingly, even within a largely homogenous group, consanguineous marriages were strongly linked to increased risks of neonatal intensive care admission, stillbirth, perinatal mortality, and congenital abnormalities

Keywords: Cousin marriage, Pregnancy induced hypertension, pre-term delivery, Anomalous Baby.

Cite this article as: Masoud A, Abrar F, Saeed A, Fatima T Tabassum H, Noor M. Distribution of Robson Ten Group Classification System Among Patients Undergoing Caesarean Section. J Soc Obstet Gynaecol Pak. 2024; 14(2):232-238.

Introduction

Marrying close relatives, with roots in the Latin term "consanguineous" meaning "of the same blood," presents a fascinating contradiction. While Charles Darwin, famously married to his first cousin and sadly losing two children, expressed concerns about its suitability, this practice thrives in many traditional communities.¹ Some cultures strictly reject it, while others actively encourage it. Regardless of these differing views, family remains the cornerstone of social support across societies. For communities embracing consanguineous marriages, the intricate network of kinship fosters a strong sense of shared responsibility and obligation. While some Islamic texts don't actively promote consanguineous marriage, it remains a deeply ingrained social tradition in certain communities. It's crucial to differentiate between what's allowed and what's encouraged. Globally, about one-fifth of the

population practices consanguinity, particularly in regions like the Middle East, West and South Asia, and North Africa.² This trend extends to immigrant communities in North America, Europe, and Australia. In these areas, intra-family marriages can reach up to 50% of all unions. However, an increased risk of congenital disabilities and genetic disorders like metabolic malfunctions, deafness, and intellectual impairments has been associated with this practice.³

The practice of marrying close relatives (consanguinity) persists in some communities due to perceived social and economic benefits that apparently outweigh potential drawbacks. Culturally, it can strengthen shared values and tradition. However, in societies where prosperity and stability weaken the reliance on strong family ties, and economic opportunities diversify, the prevalence of cousin marriages tends to decline.

Authorship Contribution:^{1,3}Substantial contributions to the conception or design of the work or the acquisition, Final approval of the version to be published. ^{2,4,5}Drafting the work or revising it critically for important intellectual content,

Funding Source: none
Conflict of Interest: none

Received: Nov 22, 2023
Accepted: May 28, 2024

This "loosening of family bonds" is also a recognized issue in developed nations.⁴

Western societies often associate consanguinity with increased risk of physical and mental disabilities. This view stems partly from early 20th century eugenics movements. Notably, cousin marriage is legally prohibited in 24 US states but remains permitted in the UK, highlighting different legal and cultural stances on this practice.⁵

In the Netherlands, marrying first cousins is currently legal. However, the government is considering restricting consanguineous marriages to combat forced marriages. Studies have shown correlations between such marriages and lower socioeconomic status, illiteracy, and rural residency, but these associations can complicate analysis due to the presence of confounding factors.

Extensive research exists on the potential effects of marrying close relatives (inbreeding) on offspring's health and reproduction. However, findings are mixed. While some studies link consanguineous marriages to increased risks of autosomal recessive diseases, birth defects, mental disabilities, lower birth weight, and higher infant mortality, others find no significant association.⁶ These discrepancies might be due to limitations in research design, such as small sample sizes and insufficient control for confounding factors. For example, a study in Oman found no connection between consanguinity and fertility, childhood mortality, or fetal loss after accounting for relevant social and demographic factors.

In Pakistan and other developing nations, discouraging consanguineous marriage based solely on potential health risks often arises as a suggestion.⁷ However, this approach faces criticism from various professional groups for being:

- Unethical: It doesn't align with the core principles of genetic counseling, respecting individual autonomy and informed decision-making.
- Dismissive: It overlooks the social and cultural values associated with consanguineous marriage in many communities.
- Potentially ineffective: Imposing restrictions might not yield desired outcomes.

Therefore, this study aims to analyze the prevalence and characteristics of women engaged in consanguineous marriages in Pakistan. Furthermore, it

examines the impact of such marriages on reproductive behavior, pregnancy complications, and fetal outcomes.

Methodology

This research employed a cross-sectional, comparative design to investigate the potential link between consanguineous marriage and pregnancy outcomes. The study was conducted from 1st September 2022 to 31st September 2023 at the Department of Obstetrics and Gynaecology in Fauji Foundation Hospital, Rawalpindi.

The researchers used Raosoft, an online sample size calculator to determine the required number of participants. Assuming a 50% potential impact of consanguinity on birth outcomes, a 2.65% margin of error, and a 95% confidence interval, the calculated minimum sample size was 350. Due to specific participant criteria, a non-probability purposive sampling technique was employed. After obtaining ethical approval from the hospital's committee, 350 pregnant women were enrolled in the study. Our study focused on pregnant women with singleton pregnancies, at or beyond 26 weeks of gestation, who received labor/delivery or cesarean section care (excluding private patients). To minimize the impact of socioeconomic factors, we ensured participants shared a similar social class, had access to free healthcare, and had spouses with comparable literacy levels.

We divided patients into consanguineous and non-consanguineous groups to study the impact of consanguinity on perinatal outcomes. Data collection included demographic information (age, education, ethnicity, age at marriage) and clinical factors (parity, previous miscarriages, contraceptive use, PIH (pregnancy induced hypertension), PTL (threatened preterm labour), preterm delivery at the time of delivery. Newborns were monitored until hospital discharge to assess outcomes such as LBW, congenital abnormalities, NICU (neonatal intensive care unit) admissions, early recovery, IUD (intrauterine death), and ENND (early neonatal deaths).

We analyzed the data using statistical software (SPSS-24) to examine the relationship between being in a consanguineous marriage (having a blood relative as a spouse) and various factors potentially affecting pregnancy outcomes (covariates) and the health of newborns (perinatal outcomes). We calculated frequencies and percentages for all non-numerical data. To account for the influence of social and demographic

factors, such as maternal age and spacing between pregnancies, on birth outcomes, we employed a logistic regression analysis. This method allowed us to estimate the odds of experiencing specific negative outcomes (low birth weight, birth defects, etc.) associated with consanguinity, while considering other known contributing factors. We considered results with a p-value of 0.05 or lower to be statistically significant.

Results

In this study, 350 patients were enrolled according to the inclusion criteria. The mean age of the study population was recorded as 28.53±4.9. The distribution of study population according to the age group is mentioned in table I.

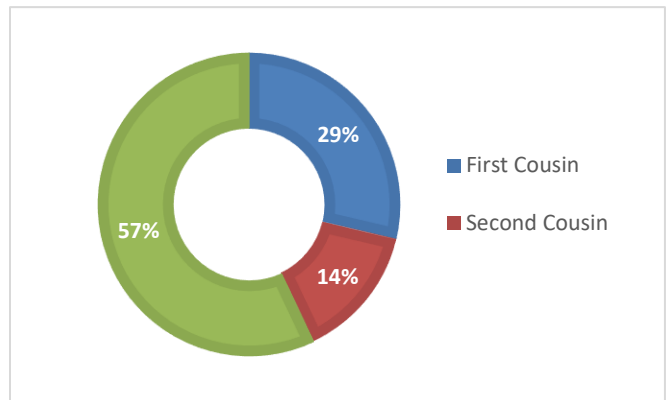
		Consanguinity				Total	
			1 st Cousin	2 nd Cousin	No relation		
Age group	16-19	Count	1	0	0	1	
		% within Age group	100.0%	0.0%	0.0%	0.0%	100.0%
		% within consanguinity	100.0%	0.0%	0.0%	0.0%	0.3%
	20-24	Count	0	3	1	9	13
		% within Age group	0.0%	23.1%	7.7%	69.2%	100.0%
		% within consanguinity	0.0%	3.0%	2.0%	4.5%	3.7%
	25-30	Count	0	26	15	43	84
		% within Age group	0.0%	31.0%	17.9%	51.2%	100.0%
		% within consanguinity	0.0%	26.0%	30.0%	21.6%	24.0%
	>30	Count	0	47	20	87	154
		% within Age group	0.0%	30.5%	13.0%	56.5%	100.0%
		% within consanguinity	0.0%	47.0%	40.0%	43.7%	44.0%
Total	Count	1	100	50	199	350	
	% within Age group	0.3%	28.6%	14.3%	56.9%	100.0%	
	% within consanguinity	100.0%	100.0%	100.0%	100.0%	100.0%	

The status of the study population's education is shown in table 2 which reveal that majority of the study participants were middle passed followed by 80 participants with SSC, 74 with primary, 31 with HSSC and 21 with graduation. Only 7 patients were recorded as illiterate. Table II)

The marriage age groups of the study participants are mentioned in the following table III.

The results of this study showed 1st cousin marriages in 28.6% (n=100) study population whereas, 2nd cousin marriages were observed in 14.3% (50) population. The ratio in study population that was not in a relation with consanguinity was found in 56.9% (199) population. The results are mentioned in figure 1.

The pregnancy and neonatal outcomes are shown in table 5 and 6. Clinical parameters which were found to be significantly associated with consanguinity were threatened PTL (p=0.02), pre-term delivery(p=0.02), NICU admissions (p<0.01), and neonatal outcomes (p<0.01) respectively.



		Consanguinity				Total	
			1 st Cousin	2 nd Cousin	No relation		
Education	Illiterate	Count	1	0	0	1	
		% within Education of Pt	100.0%	0.0%	0.0%	0.0%	100.0%
		% within consanguinity	100.0%	0.0%	0.0%	0.0%	0.3%
	Primary	Count	0	4	1	2	7
		% within Education of Pt	0.0%	57.1%	14.3%	28.6%	100.0%
		% within consanguinity	0.0%	4.0%	2.0%	1.0%	2.0%
	Middle	Count	0	29	10	35	74
		% within Education of Pt	0.0%	39.2%	13.5%	47.3%	100.0%
		% within consanguinity	0.0%	29.0%	20.0%	17.6%	21.1%
	SSC	Count	0	44	19	73	136
		% within Education of Pt	0.0%	32.4%	14.0%	53.7%	100.0%
		% within consanguinity	0.0%	44.0%	38.0%	36.7%	38.9%
HSSC	Count	0	13	10	57	80	
	% within Education of Pt	0.0%	16.3%	12.5%	71.3%	100.0%	
	% within consanguinity	0.0%	13.0%	20.0%	28.6%	22.9%	
Graduation	Count	0	6	7	18	31	
	% within Education of Pt	0.0%	19.4%	22.6%	58.1%	100.0%	
	% within consanguinity	0.0%	6.0%	14.0%	9.0%	8.9%	

Graduation	Count	0	4	3	14	21
	% within Education of Pt	0.0%	19.0%	14.3%	66.7%	100.0%
	% within consanguinity	0.0%	4.0%	6.0%	7.0%	6.0%
Total	Count	1	100	50	199	350
	% within Education of Pt	0.3%	28.6%	14.3%	56.9%	100.0%
	% within consanguinity	100.0%	100.0%	100.0%	100.0%	100.0%

Discussion

Consanguineous marriages are associated with an increased risk of cognitive decline in children, as seen in studies from Saudi Arabia, Southern India, and populations of British Pakistani origin. Research with a representative sample of 3,203 children (grades 4 and

Table III: Marriage age-group Cross-tabulation

			Consanguinity			Total
			1 st Cousin	2 nd Cousin	No relation	
Marriage age-group	16-19	Count	28	15	52	95
		% within marriage age-group	29.5%	15.8%	54.7%	100.0%
		% within consanguinity	28.0%	30.0%	26.1%	27.2%
		% of Total	8.0%	4.3%	14.9%	27.2%
	20-24	Count	63	30	119	212
		% within marriage age-group	29.7%	14.2%	56.1%	100.0%
		% within consanguinity	63.0%	60.0%	59.8%	60.7%
		% of Total	18.1%	8.6%	34.1%	60.7%
	25-30	Count	7	4	24	35
		% within marriage age-group	20.0%	11.4%	68.6%	100.0%
		% within consanguinity	7.0%	8.0%	12.1%	10.0%
		% of Total	2.0%	1.1%	6.9%	10.0%
>30	Count	2	1	4	7	
	% within marriage age-group	28.6%	14.3%	57.1%	100.0%	
	% within consanguinity	2.0%	2.0%	2.0%	2.0%	
	% of Total	0.6%	0.3%	1.1%	2.0%	
Total	Count	100	50	199	349	
	% within marriage age-group	28.7%	14.3%	57.0%	100.0%	
	% within consanguinity	100.0%	100.0%	100.0%	100.0%	
	% of Total	28.7%	14.3%	57.0%	100.0%	

Table 5: Pregnancy Outcomes Cross-tabulation

			consanguinity			Total
			1 st Cousin	2 nd Cousin	No relation	
Pregnancy Outcome	Threatened Preterm Labor	Count	4	8	8	20
		% within Pregnancy Outcome	20.0%	40.0%	40.0%	100.0%
		% within consanguinity	4.0%	16.0%	4.0%	5.7%
		% of Total	1.1%	2.3%	2.3%	5.7%
	PIH	Count	11	5	23	39
		% within Pregnancy Outcome	28.2%	12.8%	59.0%	100.0%
		% within consanguinity	11.0%	10.0%	11.6%	11.2%
		% of Total	3.2%	1.4%	6.6%	11.2%
	Preterm Delivery	Count	11	5	14	30
		% within Pregnancy Outcome	36.7%	16.7%	46.7%	100.0%
		% within consanguinity	11.0%	10.0%	7.0%	8.6%
		% of Total	3.2%	1.4%	4.0%	8.6%
	Anomalous Baby	Count	4	4	6	14
		% within Pregnancy Outcome	28.6%	28.6%	42.9%	100.0%
		% within consanguinity	4.0%	8.0%	3.0%	4.0%
		% of Total	1.1%	1.1%	1.7%	4.0%
	Low Birth weight	Count	4	3	8	15
		% within Pregnancy Outcome	26.7%	20.0%	53.3%	100.0%
		% within consanguinity	4.0%	6.0%	4.0%	4.3%
		% of Total	1.1%	0.9%	2.3%	4.3%
None	Count	66	25	140	231	
	% within Pregnancy Outcome	28.6%	10.8%	60.6%	100.0%	
	% within consanguinity	66.0%	50.0%	70.4%	66.2%	
	% of Total	18.9%	7.2%	40.1%	66.2%	
Total	Count	100	50	199	349	
	% within Pregnancy Outcome	28.7%	14.3%	57.0%	100.0%	
	% within consanguinity	100.0%	100.0%	100.0%	100.0%	
	% of Total	28.7%	14.3%	57.0%	100.0%	

6) in the Arab educational system in Israel supports this, revealing poorer performance on cognitive tests by children from double-cousin marriages. While our analysis didn't focus on double consanguinity specifically, it's important to note that multiple generations of consanguinity within ethnic groups can also increase the risk of malformations.^{8,9} In Southern

renowned Birmingham study reveals a significant disparity in the prevalence of congenital and genetic disorders between North European and British Pakistani children. In North European populations, the prevalence of all such disorders was 4.3%, with definite, probable, or possible recessive disorders accounting for 0.28% (6.5% of the total). However, in

Table 6: Neonatal Outcomes Cross-tabulation

			Consanguinity			Total
			1 st Cousin	2 nd Cousin	No relation	
Neonatal Outcome	Baby Nursery	Count	78	35	141	254
		% within Neonatal Outcome	30.7%	13.8%	55.5%	100.0%
		% within consanguinity	78.0%	70.0%	70.9%	72.8%
		% of Total	22.3%	10.0%	40.4%	72.8%
	NICU	Count	16	10	35	61
		% within Neonatal Outcome	26.2%	16.4%	57.4%	100.0%
		% within consanguinity	16.0%	20.0%	17.6%	17.5%
		% of Total	4.6%	2.9%	10.0%	17.5%
	ENND	Count	4	1	19	24
		% within Neonatal Outcome	16.7%	4.2%	79.2%	100.0%
		% within consanguinity	4.0%	2.0%	9.5%	6.9%
		% of Total	1.1%	0.3%	5.4%	6.9%
	IUD	Count	2	4	4	10
		% within Neonatal Outcome	20.0%	40.0%	40.0%	100.0%
		% within consanguinity	2.0%	8.0%	2.0%	2.9%
		% of Total	0.6%	1.1%	1.1%	2.9%
Total		Count	100	50	199	349
		% within Neonatal Outcome	28.7%	14.3%	57.0%	100.0%
		% within consanguinity	100.0%	100.0%	100.0%	100.0%
		% of Total	28.7%	14.3%	57.0%	100.0%

India and socioeconomically disadvantaged populations, consanguineous marriage remains a significant factor in adverse pregnancy outcomes, aligning with our findings.

A large meta-analysis (38 studies), primarily from low-resource countries, found a 4.4% increase in infant mortality among children of first cousins compared to unrelated couples. Importantly, outcomes may differ between countries based on access to medical care: congenital disorders in low-resource settings can be fatal due to inadequate treatment, while similar cases might be treatable in countries with more resources. Despite slight increases in fertility, consanguineous marriages do not appear to affect miscarriage rates. Our study supports this finding and further indicates no significant difference in age at marriage between consanguineous and non-consanguineous groups.

The risk of serious congenital and genetic disorders increases in offspring of consanguineous marriages, rising from 2.0-2.5% for children of unrelated parents to 4-6.5%. Stillbirths and infant mortality rates are also higher, with an estimated 3-3.5% increase in birth defects. Our study aligns with these findings. The

British Pakistani children, the prevalence of all congenital and genetic disorders doubled to 7.9%, while the prevalence of recessive disorders increased tenfold to 3.0-3.3%. This study underscores that populations with higher rates of consanguineous marriage carry a greater genetic burden and require more specialized genetic counseling services. These recommendations are equally relevant to our study.

While Iran and Saudi Arabia offer positive examples of disability prevention through carrier detection and counseling, and Bahrain shows promising results in reducing sickle cell anemia and consanguineous marriages, these strategies may not fully address the potential negative effects of consanguinity on children's cognitive abilities.¹⁰⁻¹⁴

A large-scale household survey in Pakistan uncovered strong evidence that consanguineous marriages are associated with lower cognitive abilities and increased risk of severe stunting in children. Furthermore, World Bank findings suggest an approximate 4.4% increase in pre-reproductive mortality risk, often due to major congenital defects. This risk for adverse health outcomes is especially high within the first year of life.⁷

While our study didn't track outcomes long-term to directly confirm this association, we did find an interesting difference from previous research: consanguinity was not associated with lower educational status, early marriage, or limited contraceptive use within our sample. This is likely because we focused on a homogenous group wives of lower-rank military personnel who share the same socioeconomic class and access to free health services.

The closer the biological relationship between parents, the higher the risk their children will inherit identical copies of harmful recessive genes. First cousins, who share 12.5% of their genes, have a 6.25% chance of their children being homozygous for such genes.^{12,15} Our study confirms this increased risk. Even closer consanguineous relationships, like double first cousins, can triple the rate of birth defects found in the general population, a trend also reflected in our findings. Consanguineous marriages not only pose risks to child health, but also increase the strain on families and healthcare systems. This can have a significant negative impact on a family's finances and overall productivity.¹⁶

Consanguineous couples have a higher risk of having children with metabolic and other medical disorders.¹⁷⁻²⁰ Research from India and Pakistan²¹ confirms an increase in adverse pregnancy outcomes and child mortality associated with consanguinity, a trend mirrored in our study. It's important to note that couples may conceal their consanguineous relationship due to social stigma, discrimination, and potential legal repercussions. Openly discussing these fears and exploring the impact of family and community attitudes is crucial. Targeted education campaigns have proven effective in raising awareness and reducing the prevalence of consanguineous marriages in some countries like Saudi Arabia, Turkey, and Jordan, though this trend hasn't been observed in Iran.

Conclusion

Consanguinity is deeply ingrained in some Pakistani communities. Surprisingly, even within a largely homogenous group, consanguineous marriages were strongly linked to increased risks of neonatal intensive care admission, stillbirth, perinatal mortality, and congenital abnormalities.

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