

# Prevalence of consanguineous marriages and associated factors among Israeli Bedouins

Wasef Na'amnih · Orly Romano-Zelekha ·  
Ahmed Kabaha · Liza Pollack Rubin · Natalya Bilenko ·  
Lutfi Jaber · Mira Honovich · Tamy Shohat

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**Abstract** The Bedouin population in Israel is a semi-nomadic traditional patriarchal society. Consanguineous marriages are very common, contributing to high rates of congenital malformations and genetic diseases, resulting in high infant mortality. Data on consanguineous marriages among Bedouins in Israel are limited. This study examined the current prevalence of consanguineous marriages and their determinants among Israeli Bedouins. One thousand two hundred

ninety Bedouin women who delivered in the maternity wards of the only hospital serving the Bedouin population were interviewed between November 2009 and January 2010. The prevalence of consanguineous marriages was 44.8 %. The most common type of spousal relationship was first cousins (65.7 % of all consanguineous marriages). The mean inbreeding coefficient was 0.0238. Factors significantly associated with consanguinity were less years of schooling (OR 0.94, 95 % CI (0.88–0.99),  $p=0.02$ ) and younger age at marriage of the wife (OR 0.90, 95 % CI (0.80–0.96),  $p=0.0002$ ). In conclusion, the rate of consanguineous marriages among Bedouins is very high, making this population at risk for congenital malformations and genetic diseases. Efforts should be directed at better education and provision of premarital and prenatal counseling on the health consequences of consanguineous marriages and the possibilities to lower those risks.

Wasef Na'amnih and Orly Romano-Zelekha contributed equally to this work.

W. Na'amnih (✉) · O. Romano-Zelekha · A. Kabaha · T. Shohat  
Israel Center for Disease Control, Ministry of Health, Gertner  
Institute, Sheba Medical Center, Tel Hashomer 52621, Israel  
e-mail: wasef.nhamnih@icdc.health.gov.il

L. P. Rubin  
Department of Maternal, Child and Adolescent Health, Public Health  
Services, Ministry of Health, Safed, Israel

L. P. Rubin  
School of Public Health, University of Haifa, Haifa, Israel

N. Bilenko  
Department of Epidemiology and Health Services Evaluation,  
Faculty of Health Sciences, Ben-Gurion University of the Negev,  
Beersheba, Israel

N. Bilenko  
District Health Office, Southern District, Ministry of Health,  
Beersheba, Israel

L. Jaber  
The Bridge to Peace Community Pediatric Center, Taibe, Israel

M. Honovich  
Public Health Nursing, Ministry of Health, Jerusalem, Israel

T. Shohat  
Department of Epidemiology and Preventive Medicine, Sackler  
School of Medicine, Tel Aviv University, Tel Aviv, Israel

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## Introduction

Bedouins are a subgroup within the Muslim Arab population in Israel, with unique cultural, historical, and social traits. Most of them live in the southern part of the country. Infant mortality rate among the Bedouins is the highest of all population groups in Israel—13.6 per 1,000 in 2010 compared with national figures 3.7 per 1,000 (Belmaker 2010). The primary cause of infant death among Bedouins was congenital malformations (5.8 per 1,000 live births in 2010) (Belmaker 2010). The most important factor contributing to the increased rate of congenital malformations among Bedouins and subsequent infant morbidity and mortality is consanguineous marriages (Bittles 2001; Jaber et al. 1998; Weitzman et al. 2000;

Bromiker et al. 2004; Hamamy 2012). Consanguineous marriages are very common among the Bedouins, and the reported rate was 60.1 % in 1992 (Vardi-Salitermik et al. 2002).

The aim of the present study was to estimate the prevalence of consanguineous marriages and associated factors among Israeli Bedouins.

## Materials and methods

### Study population

This study was conducted from November 2009 to January 2010. Included were all Bedouin women living in the Southern District of Israel who gave birth in the single regional hospital during the study period. These women are routinely interviewed by representatives of the District Public Health Services before discharge from the maternity wards.

### The questionnaire

Several questions were added to the routine interview, including the women's level of education, relatedness to their spouse, marital relatedness in the parental generation, household income, self-defined religiousness (yes or no), age at marriage, and number of children.

### Statistical analyses

The prevalence rate and 95 % confidence intervals (CIs) of consanguineous marriages were calculated. Factors associated with consanguineous marriages were studied in a univariate analysis. The *t* test was used to compare continuous variables, and the chi-squared test was applied for categorical variables. Statistically significant variables in the univariate analysis were included in the multivariate logistic regression models. Odds ratios (ORs) and 95 % CIs were derived from these models, controlling for confounding variables. A *p* value less

than 0.05 was considered statistically significant. All statistical analyses were performed using the SAS package (version 9.1, SAS, Cary, NC, USA).

## Results

A total of 1,290 Bedouin women (99.2 % response rate) were interviewed for this study. The mean age of the participants was  $29.5 \pm 6.0$  years, and the mean number of children was  $3.9 \pm 2.7$ . Thirty-eight percent of the women had  $\leq 8$  years of schooling and only 10 % had  $>12$  years of schooling. The total prevalence of consanguinity was 44.8 % (95 % CI 41.8–47.2). The most common type of spousal relationship was first cousins (65.7 % of all consanguineous marriages). Table 1 presents the distribution of consanguineous marriages by the spousal relationships. The mean inbreeding coefficient was 0.0238 for the whole sample. In the univariate analysis, there was a significant association between consanguinity and women younger age at marriage ( $20.1 \pm 2.9$  vs.  $21.1 \pm 3.4$ ,  $p < 0.001$ ), fewer years of schooling of the wife ( $8.8 \pm 4.2$  vs.  $9.5 \pm 3.9$ ,  $p = 0.004$ ), higher years of schooling of the husband ( $10.7 \pm 3.2$  vs.  $10.3 \pm 3.6$ ,  $p = 0.04$ ), lower monthly income of household (41.3 vs. 48.8 % reported on US\$2,400 or above,  $p = 0.05$ ), and consanguinity in the parental generation (51.3 vs. 39.0 %,  $p < 0.0001$ ). Defining oneself as religious was not significantly associated with consanguinity (20.9 % of the related couples were religious vs. 17.2 % of the non-related couples,  $p = 0.13$ ). In the multivariate analysis, woman's age at marriage and years of schooling remained significantly associated with consanguinity (Table 2).

## Discussion

High prevalence of consanguineous marriages among the Israeli Bedouins was reported before. It was 60.1 % among 278 Bedouin women who were interviewed after delivery in

**Table 1** The type of consanguineous marriages among Israeli Bedouins

Type of consanguinity	No.	Percent of consanguineous marriages (95 % CI)	Percent of all marriages (95 % CI)
Double first cousins	41	7.1 (5.2–9.6)	3.2 (2.3–4.3)
First cousins	380	65.7 (62.5–70.4)	29.5 (27.1–32.2)
First cousins once removed	20	3.5 (2.2–5.4)	1.6 (0.9–2.4)
Second cousins	64	11.1 (8.7–14.1)	5.0 (3.9–6.3)
More distant relatives	66	11.4 (9.1–14.5)	5.1 (4.0–6.5)
Unknown	7	1.2 (0.7–2.8)	0.5 (0.2–1.3)
Total consanguineous marriages	578	100	44.8 (41.8–47.2)
Total marriages in the sample	1,290	–	100

**Table 2** Multiple logistic regression model for factors associated with consanguineous marriages among Bedouins

Variable	Adjusted OR	95 % CI	<i>p</i> value
Years of schooling (women interviewed)±SD	0.94	0.88–0.99	0.02
Monthly income			
≥US\$2,400	1	0.98–2.20	0.06
<US\$2,400	1.46		
Age at marriage	0.90	0.80–0.96	0.0002
Consanguinity in parents			
No	1	0.92–2.03	0.1
Yes	1.40		

1990–1992 (Vardi-Saliternik et al. 2002). The mean inbreeding coefficient ( $F$ ) in the present study was 0.0238. This is higher than the reported figure in a national sample of non-Bedouin Arabs ( $F=0.192$ ) (Jaber et al. 1994) and in four selected Arab villages between 2000 and 2004 ( $F$  ranged from 0.004906 to 0.016452 according to the village) (Sharkia et al. 2008).

Although the consanguinity rate in the present study is lower than the previously reported, it is still very high. These high rates reflect the great importance of this cultural trend in the Bedouin society. Raz and Atar (2004) have demonstrated that the majority of Bedouins in their study supported and practiced cousin marriages despite their awareness of the association between cousin marriages and genetic diseases. The respondents confirmed the social advantages of consanguinity (Raz and Atar 2004).

Our findings demonstrated that younger age at the time of marriage and lower levels of education of the wife were significantly associated with consanguineous marriages. In the univariate analysis (but not in the multivariate analysis), consanguinity was significantly associated with higher education in Bedouin men. It is possible that educated men are considered an asset to the family because they may earn more and can support large families and accumulate assets and property, and hence, their commitment to marry a relative is greater. It has been shown that lower consanguinity rates were found among educated women but not among educated men (Tadmouri et al. 2009). This is borne out by the finding in a 2004 report that 44.7 % of the Bedouin women in Israel completed only 6 years of schooling (Israel Center for Disease Control 2008).

An estimated 43 % of all Bedouin infant deaths are attributed to congenital malformations and hereditary diseases (5.8 per 1,000 live births) compared with 14.5 % (0.61 per 1,000 live births) among the Jewish population in the same district (Belmaker 2010; Central Bureau of Statistics Israel 2012). This can largely be attributed to high consanguinity rates and marked underutilization of prenatal genetic counseling and prenatal diagnostic services by the Bedouin population (Shohat and Romano-Zelekha 2011; Weitzman et al. 2000).

Since consanguineous marriage is culturally established, providing information about the health consequences of consanguineous marriages is the most important. The Israeli Ministry of Health supports educational programs conducted in schools and in family health centers by the local health departments (Belmaker 2010). These programs are aimed to inform about the risks of consanguineous marriages and the association between consanguineous marriages and hereditary diseases and tests that could be done to prevent the birth of infants with congenital malformations. Raz et al. (2003) assessed the knowledge and the attitude of schoolchildren and their teachers towards genetic testing in a consanguinity Bedouin community, 4 years after a community-based genetic educational program was established and found that knowledge on genetics and positive attitude towards genetic counseling were positively correlated. They also found that the participants were afraid from the stigma associated with positive carrier status, especially women because it can make it difficult for her to get married as first wife. In that case, it is better to require genetic screening before marriage and avoiding of marriages between carriers (Raz et al. 2003). It is the duty of the public health professionals to ensure accessibility to counseling services and to periodically evaluate the knowledge and awareness of the health consequences of consanguineous marriages on offspring health.

**Compliance with ethics guidelines** We declare that the experiments comply with the current laws in Israel.

**Conflict of interest** The authors declare that there are no conflicts of interest.

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