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Original Article

Consanguinity Associated with Child and Adult Mortality in 24 Asian and African Countries, an Ecological Study

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Abstract

Background: Although numerous studies have found deleterious effects of inbreeding on childhood and pre-reproductive mortality, one question remains inadequately addressed: Dose inbreeding lead to increased childhood mortality rates in countries with high level of consanguinity? **Methods:** To evaluate the public health impact of inbreeding on offspring mortality, the association between mean of inbreeding coefficient (α) and sex specific child and adult mortality rates in 24 countries from Asia and Africa was analyzed. **Results:** Statistical analysis showed that countries with relatively higher rates of consanguineous marriages have higher mortality rates than the countries with lower consanguinity rates. Also, countries with relatively higher GDP per capita have lower mortality rates. After controlling the GDP per capita, significant positive correlations between α and child (Female: r=0.4355, df=21, *P*=0.038; Male: r=0.3991, df=21, *P*=0.059) mortality rates were observed. There was no significant correlation between α and adult (Female: r=0.2977, df=21, *P*=0.168; Male: r=0.2207, df=21, *P*=0.312) mortality rates, after controlling for GDP per capita. **Conclusion:** It is concluded that consanguinity influences child deaths rate independent of the GDP per capita and that a large proportion of deaths could be attributed to inbreeding in several countries due to high frequencies of consanguinity.

Key words: *Consanguinity, Mortality rates, GDP, Asia, Africa, Ecological study*

Introduction

Many studies reported deleterious effects of inbreeding on mortality of offspring. Consanguineous marriages showed significantly higher rates of abortion and still births plus neonatal, post-neonatal, infant, less than 5 yr and pre-reproductive mortalities in general (1-6).

For countries such as Iran, where the consanguineous marriages are common (7), the association between consanguinity and mortality, is highly important for public health programs. Therefore, the present study was done. To evaluate the public health impact of inbreeding on offspring mortality the association between mean of inbreeding coefficient (α) and sex specific child and adult mortality rates in 24 countries from Asia and Africa was analyzed. We included the Asian and African countries in the present study because the prevalence of consanguinity is high in these countries.

Materials and Methods

Inbreeding coefficient is the probability that an individual has received both alleles of a pair from an identical ancestral. In addition this value represents the proportion of loci at which he is homozygous by descent. At population level, usually the mean of inbreeding coefficient (α) of a population calculated. The F was calculated for each couple and the α estimated for each population as described previously (8). Data of mean of inbreeding coefficient (α) was obtained from the data presented on the web site http://www.consang.net. In the web site the data were summarized based on the published articles in scientific journals. The mean of inbreeding co-

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efficients (α) values for different countries was not related to a same year.

Child mortality is defined as the probability of dying before age 5 yr per 1000 for specific sex. Adult mortality defines as the probability of dying between 15 and 59 yr per 1000 for specific sex. The gross domestic product (GDP) per capita is the per capita market value of the total final output of goods and services produced in a country over a specific period. Data about the mortality rates (for 2001) and GDP per capita (for 2000) were obtained from the data presented on the World Health Organization web site http://www.who.int.

Inclusion criteria were location of country (Asia and Africa), and available data about GDP per capita, mortality rates, and mean of inbreeding coefficient of the country. Countries including the study were: Algeria, Bahrain, Bangladesh, Egypt, Guinea, Indonesia, Iran, Iraq, Jordan, Kuwait, Lebanon, Malaysia, Nigeria, Oman, Pakistan, Philippine, Saudi Arabia, Singapore, Sri Lanka, Sudan, Tanzania, Tunisia, Turkey, and UEA. Table 1 shows the countries including the study, α, GDP per capita, and sex specific mortality rates of childhood and adulthood of the countries. Correlations between the variables were determined using parametric Pearson's correlation coefficient analysis. Moreover the partial correlation coefficient analysis was done. Statistical analysis was performed using SPSS (version 11.5) statistical software package. *P*-value less than 0.05 considered statistically significant.

Table 1: Mean of inbreeding coefficients α), GDP per capita, and sex specific mortality rates of childhood and adulthood of the study countries

Country	α	GDP	Mortality rates [a] Childhood		[b] Adulthood	
			Female	Male	Female	Male
Algeria	0.0152	3960	44	55	129	164
Bahrain	0.0165	15609	7	9	89	123
Bangladesh	0.0045	1239	84	82	258	251
Egypt	0.0122	3604	44	46	160	230
Guinea	0.0131	1675	153	172	327	407
Indonesia	0.0095	3121	40	50	213	246
Iran	0.0185	6120	39	45	137	209
Iraq	0.0225	2809	111	122	180	258
Jordan	0.0235	4012	24	27	122	193
Kuwait	0.0210	18350	10	12	66	87
Lebanon	0.0091	5884	28	34	140	204
Malaysia	0.0038	9315	11	13	108	194
Nigeria	0.0242	884	152	159	360	419
Oman	0.0169	15808	22	24	106	182
Pakistan	0.0282	1834	115	105	203	229
Philippine	0.0003	4966	33	46	141	272
Saudi Arabia	0.0218	13019	27	30	115	193
Singapore	0.0020	25840	4	4	54	92
Sri Lanka	0.0092	3303	18	22	123	247
Sudan	0.0237	1072	117	124	291	378
Tanzania	0.0236	457	152	163	502	552
Tunisia	0.0213	6717	27	33	117	174
Turkey	0.0073	6455	40	46	118	206
UEA	0.0223	25853	11	13	124	171

[a] Child mortality is defined as the probability of dying before age 5 per 1000 for specific sex.
[b] Adult mortality defines as the probability of dying between 15 and 59 yr per 1000 for specific sex.

Results

Table 2 shows the correlation between the study variables using the Pearson's correlation coefficient analysis. There are significant negative correlations between GDP per capita and either child or adult mortality rates. On the other hand, there are significant positive correlations between the mean of inbreeding coefficient (α and either child or adult mortality rates. Countries with relatively higher rates of consanguineous marriages had higher mortality rates than the countries with lower consanguinity rates. In addition, countries with relatively higher GDP per capita had lower mortality rates.

In order to show the net correlation between consanguinity and mortality rates and rule out the confounding effect of GDP per capita on the mortality rates, partial correlation analysis was carried out. After controlling the GDP per capita, significant positive correlations between α and sex-specific child (Female: r= 0.4355, df= 21, *P*= 0.038; Male: r=0.3991, df= 21, *P*= 0.059) mortality rates were observed. There was no significant correlation between α and adult (Female: r= 0.2977, df= 21, *P*= 0.168; Male: r= 0.2207, df= 21, *P*= 0.312) mortality rates, after controlling for GDP per capita.

Table 2: Pearson's correlation coefficients between the study variables

		α	GDP	Adult female mortality rate	Adult male mortality rate	Child female mortality rate
GDP	r	-0.093				
	P	0.665				
Adult female mortality rate	r	0.292	-0.611			
	P	0.167	0.002			
Adult male mortality rate	r	0.227	-0.656	0.956		
	P	0.286	0.001	0.000		
Child female mortality rate	r	0.391	-0.648	0.898	0.862	
	P	0.059	0.001	0.000	0.000	
Child male mortality rate	r	0.361	-0.658	0.902	0.880	0.995
	P	0.083	0.000	0.000	0.000	0.000

Note: df=22

Discussion

The key finding of the present study is a significant positive correlation between α and child mortality rate, after controlling the GDP per capita, in an ecological study based on data of 24 Asian and African countries. The observed association is in the same directions as that reported by investigators from different populations (1-5, 9-14). Furthermore the present results confirmed our previous ecological study which investigated the association between inbreeding and its relevance to early and pre-reproductive mortality in Iran (6). Generally, inbreeding is associated with loss of biological fitness (8, 10, 11). In populations where inbred unions are common, increased levels of morbidity and mortality caused by the action of detrimental recessive genes can be predicted. Empirical studies on the progeny of first cousins indicate morbidity and mortality levels to be higher than in the offspring of unrelated couples (12). The contribution of recessive genes as predisposing factors in common diseases of adulthood is of great interest and significance. Higher levels of inbreeding were reported in patients with a range of major adult disorders, including some

common cancers and cardiovascular disease (10, 12-14). Improving socioeconomic conditions, the incidence of "environmental disease" is declining in most developing countries such as Arabian States of Persian Gulf, where the socioeconomic circumstances have become favorable and have translated into advanced diagnostic and health care facilities. Thus genetic disorders now account for an increasing proportion of morbidity and death. Therefore it is concluded that consanguinity influences child deaths rate independent of the GDP per capita and that a large proportion of deaths could be attributed to inbreeding in several countries due to high frequencies of consanguinity.

Finally it should be mentioned that the present study has some limitations. First of all, the present study is an ecological study, therefore has limitation of ecological studies. Second, GDP is not the target confounding variable per se. So there would be a certain degree of residual confounding still present in the calculated partial correlation coefficients. Third, as mentioned in Materials and Methods section the mean of inbreeding coefficients (α) for the study countries was not related to a same year. Several studies described that prevalence of consanguinity marriages are depended to socio-demographic and socio-cultural factors (8, 15, 16). Very recently I showed that there was very high correlation between prevalence of consanguinity within ethnical populations and prevalence of consanguinity reported in their folktales (17). Therefore, it is suggested that the historical background is very important in attitude and practice about marriages between relatives (17).

Taken together, although published *P* values for the study countries reported in different years, it can not influence so much on the results presented here.

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