



Genetic Disorders among Palestinians

By Ayman S. Hussein



Genetic analysis shows that Palestinians are of mainly Levantine ancestry, most similar to Syrians, Lebanese, Jordanians, Cretans, Egyptians, Turks (Anatolians), Armenians, and Iranians.ⁱ The Palestinian population was 3,761,646 in 2007; of these, 2,345,107 are residents of the West Bank, including 208,000 in East Jerusalem.ⁱⁱ Consanguineous marriages are allowed in Islam, and they are common in all the communities, including the Palestinian population. High consanguinity rates have been reported in Muslim Arabs (44 percent) and Druze (47 percent).ⁱⁱⁱ Of these, 22 percent are marriages between first cousins. The tradition of consanguineous marriages is deeply rooted in the country and with unknown reasons the rates are increasing rather than decreasing. It is obvious that marrying cousins increases the risk of about 140 of recessive genetic disorders. The chance that the children of two first cousins will have a serious genetic disorder is 1 in 8. The local population is also characterised by high fertility rates (4.6 percent) and large family size, with an average of 5.5 children per family.^{iv} Furthermore, women continue to reproduce well after the age of 40, and men well into their 60s.

Burden and magnitude of genetic disorders in the Palestinian population

There is little available data regarding genetic disorders in the Palestinian territories; however, there are hundreds of genetic disorders among Palestinians living in the West Bank/Gaza Strip or (Israel).

The effect of consanguinity rate on X-linked disorders and chromosome aberrations was studied. Reports showed no significant differences in the rate of consanguineous marriages between the parents and grandparents of children affected with trisomy 21 (Down syndrome) and the general population. Therefore, there is no evidence to conclude that there is an increased risk for trisomy in children/grandchildren of consanguineous parents.

Studies on rare autosomal recessive disorders, however, showed the effect of consanguinity rate. It was obvious that consanguinity rates among patients with rare autosomal recessive disorders were much higher than the rates among the general population (92.5 percent). The importance of genetic factors in various congenital malformations, such as neural tube defects and cleft lip/palate or in various forms of infertility, was confirmed by the observation of a significantly higher consanguinity rate in the parents of these patients than is observed in the general population.

Some of the disorders, such as thalassemia, Familial Mediterranean Fever (FMF), or G6PD deficiency, are found with relatively high frequency among the Palestinian population. The most common types of genetic

The Palestinian population is characterised by high consanguinity rates (about 44 percent), large family size (5.5 children per family), and pregnancies in women over the age of 45. These factors result in the high incidence of genetic disorders, particularly the increase in rare recessive genetic disorders. Genetic counselling for the Palestinian population, is therefore of great importance in order to avoid consanguineous marriages and to implement a screening programme for inborn errors of metabolism.

diseases among Palestinians are hemoglobinopathies, G6PD deficiency, FMF, and deafness. Other autosomal recessive diseases are rare in the general population but are frequent in one of the communities —either in a large kindred, a village, a region, or even, in some cases, in a whole community. Most of the rare diseases are present in one community only. In most of the diseases found in more than one community, different mutations have been characterised. These mutations are either newly found or ancient mutations.^v Many other mutations, particularly the most rare, have not yet been studied. For example, of the 577 recessive diseases that have been reported in Palestinian families, the responsible loci are not even reported.

Thalassemia is an example of a common hereditary disease whose occurrence is increased by consanguineous marriages. It is a blood disease that is characterised by severe anaemia due to early death of red blood cells. The diseased child is the product of marriages in which both parents



are thalassemia carriers. While the thalassemia carrier is a healthy person and needs no medications, the diseased child needs specialised medical care and regular blood transfusions every three to four weeks for the rest of his/her life.

The frequency of this thalassemia mutation is about 4.2 percent. In other words, there are more than 150,000 carriers of this mutation in the Palestinian territory. Carriers need no medical attention, but problems arise when two carriers get married, which means the chance of having a diseased child is 25 percent. Therefore, efforts have been made in the country to screen for thalassemia carriers before marriages in order to prevent the prevalence of the disease. Since then, the number of those born with thalassemia has fallen dramatically.

Molecular studies of disease-related genes began in the early 1980s

and relied on several approaches, including identification of mutation spectrums on X-linked disorders (e.g., Duchenne/Becker muscular dystrophy) and on recessive diseases (e.g., thalassemia, phenylketonuria), linkage mapping, and SNP arrays to study rare diseases. Genetic analysis of Palestinian families is often performed outside the region, in collaboration with Americans, Europeans, and other populations worldwide.^{vi} However, there are few Palestinian laboratories that are now capable of analysing some of the genetic diseases based on identification of mutations.^{vii} For example, there are two centres that are capable of performing analysis of genetic diseases. One of them is the newly established European Laboratory for Medical Analysis (www.eurolabpal.com) in Nablus, in the northern West Bank. The other laboratory belongs to Al-Makassed Hospital in East Jerusalem (www.almakassed.org).

A wide range of human traits, both rare and common, need to be evaluated; thus it is necessary to build a collaboration between the European Laboratory for Medical Analysis and others, which could have a significant impact on public health in Palestine.

It is estimated that 1 in 200 Palestinian newborns have inborn errors of metabolism (IEM). IEM are heritable metabolic disorders that result from biochemical alterations caused by mutations in genes that encode proteins involved in the various metabolic pathways in human beings. The mutations underlying these disorders have not been determined. Therefore it is essential to launch a screening methodology and research efforts in Palestinian institutions to study these inborn errors. In Europe, 46 diseases are screened in newborns. In Jordan, about 20 diseases are screened for. In Palestine, only one disease

(phenylketonuria) is screened for in Palestinian newborns.

It is obvious that we need to expend much effort in order to prevent genetic diseases, including inborn metabolic errors among Palestinians. This goal could be achieved partly by lowering the rate of consanguinity among the Palestinian population through genetic counselling. Other efforts should be focused on implementing a screening programme for inborn errors of metabolism. This programme should be offered for free by the Ministry of Health since it would prevent devastating diseases and avoid huge budget expenditures.

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^{iv} Ibid.

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