

## Research Article

# High Levels of Cardiovascular Risk Factors among Pakistanis in Norway Compared to Pakistanis in Pakistan

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**Objectives.** Previous studies have shown that the Norwegian-Pakistanis had considerably higher prevalence for diabetes and obesity compared to Norwegians. We studied the additional risk of obesity, dyslipidemia, and hypertension among Pakistanis in Norway compared to Pakistanis living in Pakistan. **Method.** 770 Norwegian-Pakistani adults (53.9% men and 46.1% women) born in Pakistan from two surveys conducted in Norway between 2000 and 2002 were compared with a sample of 1230 individuals (29.1% men and 70.9% women) that participated in a survey in Pakistan in 2006. **Results.** Both populations had similar height, but Norwegian-Pakistanis had considerably higher mean weight. Of the Norwegian-Pakistanis, 56% of the males and 40% of the females had a BMI above 25 kg/m<sup>2</sup>, as opposed to 30% and 56% in Pakistan, for males and females, respectively. Norwegian-Pakistanis had higher total cholesterol. **Conclusion.** Obesity and an unfavourable lipid profile were widely prevalent in both populations; the highest level was recorded amongst those living in Norway. The increased risk for obesity and dyslipidemia may be ascribed to change of lifestyle after migration.

## 1. Introduction

The population in Pakistan has a high risk of diabetes and coronary heart disease [1], and common risk factors related to the two conditions are present at early ages [2]. This elevated risk amongst Pakistanis is demonstrated both in Pakistan and abroad [3–5]. Migrants from the Indian subcontinent living in Europe and America have higher rates of cardiovascular risk factors compared to the locals [6–10]. Few articles have compared the prevalence of risk factors in immigrants living in western societies with those still living in their homesteads in the subcontinent [11–14]. Two of these were comparisons of Indians living in London with people living in India. Both showed that British-Indians had unfavourable cardiovascular risk factor profile compared to those living in India [11, 12]. One team studied Indians in Australia and their relatives in India and found that women living in Australia had a more desirable risk profile compared to those still living in India. The researchers

concluded that the lack of undesirable weight gain was the reason for the lower risk [13]. The population of the Norwegian capital has been increasingly diversified during the last decades, and there is now a large Norwegian-Pakistanis population in Oslo [15]. The prevalence of obesity and diabetes in Oslo has proven to be very high especially amongst those from Pakistan [8, 16]. It has been suggested that migration from developing countries to developed countries leads to these changes [12]. No study has so far compared Pakistanis living in Norway with Pakistanis living in Pakistan. It is therefore necessary to find out whether there is an elevated prevalence of risk factors for cardiovascular disease in Pakistanis residing in Oslo compared to those living in the country of origin. In this paper, we compare two Pakistani populations, one in Norway and the other in Pakistan, for cardiovascular risk factors. Most Pakistanis living in Norway are from an area called Kharian, in Punjab, and therefore we chose this area for an epidemiological study.

## 2. Methods

**2.1. Norway.** Data were obtained from two population-based, cross-sectional surveys conducted in Oslo, Norway, between 2000 and 2002 with similar protocol. The Oslo Health Study (HUBRO) was a collaboration between the Norwegian Institute of Public Health, the University of Oslo and the Oslo Municipality (2000-01). All Oslo residents born in 1924, 1925, 1940, 1941, 1955, 1960, and 1970 were invited to a health survey. Of these 18,770 (46%) attended [17]. The second survey, the Oslo Immigrant Health Study, was conducted by the Norwegian Institute of Public Health and the University of Oslo in 2002. In this survey individuals born in Turkey, Iran, Pakistan Sri Lanka, or Vietnam between 1942 and 1971 were invited to participate, and the response rate for Pakistani immigrants was 31.7% [16]. In the present analysis, we have only included participants born in Pakistan. Of these, ten subjects were excluded due to invalid height/weight measurements. A total of 770 participants were included from the Norwegian material; 415 men, and 355 women were included in Norway while in Pakistan 358 men and 872 women were included.

**2.2. Pakistan.** Data was collected during spring and summer of 2006. Subjects were enrolled from 44 villages from this area, about 150 km from the capital Islamabad. This is primarily an agricultural community but has developed rapidly in the recent decades due to migration to the west. All participants were 20 years or older and met after fasting for 8–10 hours before the examinations. Verbal information was secured from all participants. Only subjects aged between 30 and 61 were included in the current analysis in order to match the Oslo sampling procedure. The methods for the survey in Pakistan are described in detail elsewhere [18]. From the Pakistani material, 1230 subjects were included, 358 men and 872 women.

**2.3. Procedures for Anthropometry Measurements.** In Norway, weight was measured on a beam scale. This professional scale comes complete with an attached height rod, where both weight and height can be measured simultaneously. Waist and hip girths were measured with a steel measuring tape [19]. In Pakistan, the height was measured against a wall where a measuring tape was attached. Weight was measured with an electronic scale. Waist and hip girths were measured with a nonelastic plastic tape measure.

The participants in both countries were weighed wearing light clothing.

Normal weight was defined as BMI up to 24.9 kg/m<sup>2</sup>, and overweight was BMI between 25 and 29.9 kg/m<sup>2</sup>. Obesity was defined as a BMI  $\geq$  30 kg/m<sup>2</sup> [20]. Waist above 80 cm for women and 90 cm for men was labelled high. Waist-hip ratio cutoffs were set at 0.8 and 0.9 for females and males, respectively [21].

**2.4. Lipids, Blood Pressure, and Smoking Habits.** Total cholesterol and HDL were analysed in both countries using enzymatic methods. Total cholesterol levels higher than

5.0 mmol/L were considered high. HDL levels below 0.9 and 1.0 mmol for males and females, respectively, were regarded as low.

In Norway, blood pressure was measured with an automatic device (DINAMAP, Criticon, Tampa, Fla, USA), while a standard sphygmomanometer was used in Pakistan. Systolic pressure above 140 mmHg and diastolic pressure above 90 mmHg were classified as high.

Respondents in both countries were asked about their smoking habits. They were classified as either smokers, non-smokers or previous smokers.

**2.5. Statistics.** Mean values are presented with one standard deviation. Student's *t*-test was used to calculate *P* values when comparing two means.

Age adjusted prevalence and means using direct standardization with averaged weight as the standard population are presented in brackets or below the tables were applicable.

## 3. Results

Four hundred and fifteen Pakistani men and 355 women were included in Norway, while in Pakistan 358 men and 872 women were included. The mean age in Norway was 44.2 years for males and 42.4 for females (Table 1). In Pakistan, the mean age was 46.4 and 44.2 for males and females, respectively.

Both genders had similar height in Norway and Pakistan, but their weight on the other hand was not similar. Pakistanis living in Norway had significantly higher mean weight and BMI (Table 1). Being overweight and obese, in terms of having a BMI between 25 and 30 and above 30, was more commonly seen among Pakistanis in Norway (Table 2). More than one-fifth of the Pakistani males in Norway were obese, while only 7% of the males in Pakistan had a BMI above 30.

It was more common for males in Norway to have high waist girth and WHR compared to males in Pakistan. High WHR was more frequently observed in Pakistani female subjects. Pakistani males in Norway had higher waist circumference, as well as hip girth and waist-hip ratio (WHR), compared to males in Pakistan.

Women in Pakistan had higher systolic and diastolic pressure compared to females in Norway (Table 3). Men in Norway had higher systolic pressure compared to men in Pakistan. Hypertension appeared to be more common in Pakistan, especially among females.

Both males and females in Norway had higher total cholesterol compared to their counterparts in Pakistan. Women residing in Norway had higher HDL than women in Pakistan.

Systolic and diastolic blood pressure increased with increasing BMI for both genders in both Norway and Pakistan (Table 4). Not surprisingly, waist and WHR increased with BMI so did total cholesterol. With increasing BMI, HDL decreased in the Norwegian-Pakistanis but increased in those living in Pakistan. The highest standardized beta coefficient was seen for waist girth, with a standardized beta value of

TABLE 1: Age and physical characteristics of the Pakistanis in Oslo and in Pakistan. Numbers are mean values with one SD in brackets. *P* values for difference between Pakistanis and Norwegian-Pakistanis. Age adjusted values below.

|             | Males       |             |                | Females     |              |                |
|-------------|-------------|-------------|----------------|-------------|--------------|----------------|
|             | Norway      | Pakistan    | <i>P</i> value | Norway      | Pakistan     | <i>P</i> value |
| Age         | 44.2 (9.3)  | 46.4 (9.5)  | <.01           | 42.4 (8.6)  | 44.2 (8.6)   | <.01           |
|             | 45.2        | 45.3        |                | 42.9        | 43.9         |                |
| Height (cm) | 170.5 (5.9) | 170.6 (7.5) | .84            | 156.4 (5.6) | 156.6 (6.0)  | .69            |
|             | 170.5       | 170.7       |                | 156.5       | 156.6        |                |
| Weight (kg) | 79.8 (11.6) | 67.1 (14.1) | <.01           | 71.6 (12.9) | 64.1 (14.2)  | <.01           |
|             | 79.7        | 67.0        |                | 71.6        | 64.0         |                |
| BMI         | 27.5 (3.5)  | 23.0 (4.5)  | <.01           | 29.4 (5.0)  | 26.1 (5.5)   | <.01           |
|             | 27.5        | 23.0        |                | 29.4        | 26.1         |                |
| Waist (cm)  | 94.4 (10.2) | 86.9 (12.8) | <.01           | 89.0 (12.0) | 90.5 (12.9)  | .05            |
|             | 94.7        | 86.6        |                | 89.2        | 90.5         |                |
| Hip (cm)    | 100.4 (6.8) | 94.3 (9.9)  | <.01           | 104.6 (9.8) | 105.5 (13.2) | .21            |
|             | 100.5       | 94.2        |                | 104.6       | 105.5        |                |
| Waist/Hip   | 0.94 (0.07) | 0.92 (0.07) | <.01           | 0.85 (0.08) | 0.86 (0.07)  | .08            |
|             | 0.94        | 0.92        |                | 0.85        | 0.86         |                |

TABLE 2: Prevalence of obesity (per 100) among Pakistanis and Pakistanis residing in Oslo. Age adjusted values in brackets.

| Males      | Norway  | Pakistan | <i>P</i> value |
|------------|---------|----------|----------------|
| BMI > 25   | 56 (56) | 23 (23)  | <.01           |
| BMI > 30   | 22 (22) | 7 (7)    | <.01           |
| High waist | 63 (64) | 36 (35)  | .01            |
| High WHR   | 69 (70) | 60 (59)  | .01            |
| Females    |         |          |                |
| BMI > 25   | 40 (40) | 33 (33)  | <.01           |
| BMI > 30   | 40 (41) | 23 (23)  | <.01           |
| High waist | 73 (73) | 76 (76)  | .28            |
| High WHR   | 70 (71) | 82 (82)  | <.01           |

High waist: above 90 for males and 80 for females.

High WHR: above 0.9 for males and 0.8 for females.

*P* values for difference between Pakistanis and Norwegian-Pakistanis.

approximately 0.8 for all groups. The standardized beta value for WHR was 0.48 and 0.52 for males in Norway and Pakistan, respectively. Females however had a considerably lower standardized beta value for WHR. Females in Pakistan had the lowest.

Smoking habits were unfortunately not recorded in all of those living in Pakistan. However, the results obtained in Pakistan ( $n = 401$ ) were similar to those in Norway. In Pakistan, 40.5% of the males and 2.8% females were current smokers; in Norway, 34% of the males and 3.8% of the females were smokers. None of the females in Pakistan said they were previous smokers, while 2.2% of the females in Norway said so. Among the males in Pakistan, 7.4% said they were previous smokers, of the Norwegian-Pakistanis, 18.5% were previous smokers.

#### 4. Discussion

We demonstrated high prevalence of obesity and cardiovascular risk factors in both populations, this is in line with earlier studies [11, 12]. Obesity, overweight, and having high levels of lipids were more common in Norway, while high blood pressure was seen more frequently in Pakistan. We believe that the two populations are comparable because the majority of the Pakistanis living in Norway actually migrated from this particular area in Pakistan, an area called Kharian in the district of Gujrat. Therefore, it is reasonable to postulate that the populations are genetically and culturally comparable. The differences we observe between the two populations could therefore be due to the effects of migration and changes in lifestyle from a low-income to a high-income country.

The difference in weight and BMI are of such a magnitude that they cannot be explained by possible measuring error. This is particularly true for the males; the difference is more than 10 kg, whilst it is almost 8 kg in women. This difference is reflected in the BMI; increased BMI in Oslo among the Pakistani population may only be explained by added weight in this population, since height remains the same in both populations.

The difference between the populations in waist and hip girth are also evident among the males. The men living in Norway have almost a waist of more than seven cm greater than the males in Pakistan; similarly, the hip is also more than six cm larger in the Norwegian-Pakistanis. The differences between the females on the other hand are small. Some women in Pakistan might have been reluctant to remove their clothes for the measurement of the waist and hip girth even though same gender investigators did all the measurements. Women living in rural Pakistan might also have had a higher number of pregnancies, which could have resulted in a higher waist, hip, and waist-hip ratio. On the other hand, the WHR

TABLE 3: Differences in clinical features among Pakistanis in Oslo and in Pakistan. Numbers are mean values with one SD in brackets. *P* values for difference between Pakistanis and Norwegian-Pakistanis. Age adjusted values below.

|                  | Males        |              |                | Females      |              |                |
|------------------|--------------|--------------|----------------|--------------|--------------|----------------|
|                  | Norway       | Pakistan     | <i>P</i> value | Norway       | Pakistan     | <i>P</i> value |
| SysBP            | 128.8 (14.2) | 123.7 (16.8) | <.01           | 120.9 (18.2) | 125.5 (17.1) | <.01           |
|                  | 129.3        | 123.4        |                | 121.3        | 125.5        |                |
| DiaBP            | 78.0 (10.1)  | 79.4 (11.4)  | .07            | 71.3 (11.0)  | 80.8 (10.5)  | <.01           |
|                  | 78.3         | 79.3         |                | 71.5         | 80.8         |                |
| % Sys $\geq$ 140 | 18           | 20           | .59            | 14           | 24           | <.01           |
|                  | 19           | 19           |                | 14           | 24           |                |
| % Dia $\geq$ 90  | 13           | 28           | <.01           | 5            | 31           | <.01           |
|                  | 13           | 28           |                | 5            | 31           |                |
| TotChol (mmol/L) | 5.4 (1.0)    | 4.5 (1.0)    | <.01           | 5.1 (1.0)    | 4.7 (1.0)    | <.01           |
|                  | 5.5          | 4.5          |                | 5.1          | 4.7          |                |
| HDL (mmol/L)     | 1.1 (0.2)    | 1.0 (0.5)    | .38            | 1.2 (0.3)    | 1.0 (0.4)    | <.01           |
|                  | 1.1          | 1.0          |                | 1.2          | 1.0          |                |

TABLE 4: Association between BMI and other clinical features.

|         | Males   |                |         |                | Females |                |         |                |
|---------|---------|----------------|---------|----------------|---------|----------------|---------|----------------|
|         | $\beta$ | <i>P</i> value |
| SysBP   | 0.19    | <.01           | 0.35    | <.01           | 0.15    | <.01           | 0.25    | <.01           |
| DiaBP   | 0.11    | .02            | 0.35    | <.01           | 0.07    | .18            | 0.27    | <.01           |
| Waist   | 0.78    | <.01           | 0.84    | <.01           | 0.78    | <.01           | 0.80    | <.01           |
| WHR     | 0.48    | <.01           | 0.52    | <.01           | 0.27    | <.01           | 0.12    | <.01           |
| TotChol | 0.01    | .80            | 0.20    | <.01           | 0.12    | .01            | 0.10    | .01            |
| HDL     | -0.16   | <.01           | 0.11    | .06            | -0.24   | .00            | 0.09    | .02            |

Standardized coefficients, only adjusted for age.

did not increase as steeply with increasing BMI among the females in Pakistan as it did amongst the Pakistani females in Norway. One study has shown that expatriate Indian women in Australia did in fact have a better risk profile than their counterparts still living in India [13].

There are large differences in the levels of total cholesterol especially for the males. The difference between females in the two populations was also considerable. However, this is not surprising since obesity was highly increased among the Pakistani population residing in Oslo.

Several studies have showed that people from South Asia living in western societies have a relatively low level of physical activity [22, 23]. This might be the cause of the high level of adiposity among the Pakistanis living in Norway. In addition, higher consumption of unhealthy fatty foods, which is available in Oslo due to privileged income and sedentary lifestyle, may have contributed to the observed conditions.

There are some interesting differences in blood pressure between these two populations. The Pakistanis living in Norway have lower pressures, except for the systolic pressure in males. We do not have data on use of antihypertensive drugs in Pakistan, but we find it reasonable to believe that such medication might be less common than in Norway. Due to low access to doctors, undiagnosed hypertension might be more common in rural Pakistan compared to Oslo. Earlier studies have showed that the awareness about hypertension

is low in Pakistan, and few patients have had their blood pressure measured [24, 25]. It is also important to note that the blood pressure was measured differently in the two populations. Dinamap was used in Norway, in Pakistan we used a standard sphygmomanometer. The different measuring methods might have yielded different results. Cautiousness should therefore be applied when comparing blood pressure in the two populations and interpreting these results. High levels of hypertension have been reported earlier amongst Pakistanis [3, 4], although, some large studies have reported considerably lower prevalence of hypertension [26, 27]. Comparison between most of these studies is hampered by diverging measuring techniques.

Smoking is common amongst Pakistani males both in Norway and in Pakistan; women, however, are fortunately spared. This pattern of smoking has been demonstrated in several studies that have looked at smoking habits amongst Pakistanis in Pakistan and abroad [2, 4, 5].

## 5. Conclusion

Our data demonstrate differences in cardiovascular risk factors in these two populations, possibly as a consequence of migration and related changes in lifestyle. More research is needed on the modification of lifestyle and food habits following migration. Nevertheless, Pakistanis living in Norway have proven to have higher levels of diabetogenic and cardiovascular risk factors and therefore should be treated as “high risk group” for both prevention and treatment.

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