

Evolution of Systemic Hypertension in Pakistani Population

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ABSTRACT

The prevalence of essential hypertension is alarmingly increasing in Pakistani population inspite of the demographics being of lower BMI and nutrition. In this review, the possible factors responsible for this increase are identified by reviewing the population studies conducted in Pakistan. The prevalence rate is about 3 - 4% in childhood and steeply rises near the middle age. The factors peculiar to Pakistan were increased genetic susceptibility, environmental factors such as gender, females gender, urbanization, obesity and sedentary life styles particularly in middle age, cultural practices promoting sedentary life style in female.

Key Words: Risk factors. Modification of risk factors. Community intervention.

INTRODUCTION

The etiology of systemic hypertension is multifactorial involving multiple blood pressure regulatory systems. Some of these systems include renal enzymes, Glomerular Filtration Rate (GFR) under pressure-natriuretic control, sympathetic innervations of the renal arteries and aldosterone-mediated sodium reabsorption. Cardiac output and heart rate also contribute to the blood pressure regulation.¹⁻³ These regulatory mechanisms are controlled by complex set of genes which express at various stages in human life, beginning from childhood. Over expression of these genes may be responsible for hypertension which is defined as higher than normal blood pressure for a given age and gender. Monogenic Mendelian genetic model has been elucidated for few types of hypertension but the genetic control of essential hypertension remains unknown. Candidate genes regulating angiotensin-renin-aldosterone and sodium reabsorption channel have been identified,⁴ but how these candidate genes affect essential hypertension needs to be discovered.²⁻⁴ The genes controlling blood pressure regulation do express themselves early in childhood.

The blood pressure percentile graphs and charts generated for various children populations have allowed recognition of subjects which exceed these limits and these children exceeding the 95th percentiles of population charts tend to develop hypertension in adulthood.^{5,6} The tracking phenomenon is particularly strong in teenage and later childhood population. There is ample evidence to suggest that the children of

hypertensive parents tend to develop hypertension in adulthood and that the offspring of hypertensive parents tend to have higher percentiles of blood pressure profile in early life.⁷⁻⁹

The environmental factors such as obesity, sedentary life styles, diabetes, smoking and excessive salt and excessive alcohol consumption have profound effect on the increasing prevalence of essential hypertension in middle and later decades of life.^{10,11}

In view of the reports showing accelerated rates of hypertension prevalence in Pakistani population, we planned to review the studies on prevalence of hypertension in Pakistani children and adult populations, with the view to identify factors which may be accounted for the accelerated prevalence rates of hypertension.

METHODOLOGY

A review of the reported studies on prevalence of hypertension, by the author and others on Pakistani population was made.

Over the past decades hospital and community based studies in Pakistani children population have been reported showing variable prevalence rates of hypertension in children. In a school study involving 3,661 children, in urban Karachi by Raza *et al.* in 1996 - 1997, and by using a cut off of > 130/90 mmHg, showed a prevalence of 6.5%.¹² Zafar *et al.* in 4 - 15 years age, 999 school children and a cut off 95th percentile showed a prevalence of 7.6% on first reading and 2.8 on second visit and 1.9% in the third visit on same population of school children.¹³ This study clearly demonstrated that repeated measurements are needed to evaluate the actual prevalence rate in a population. Zaidi reported a prevalence rate of 8.8% for either systolic or diastolic pressure exceeding > 95th percentile and 1.7% for those with > than 95th for both systolic and diastolic blood pressure limits.¹⁴ A recent school study by Rehman *et al.* showed a prevalence of 3%, using 95th percentile cut off.¹⁵

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Received: November 07, 2013; Accepted: August 04, 2014.

The Pakistan National Health Survey (PNHS), conducted during 1990-1994 period by the Pakistan Medical Research Council, reported prevalence rate of hypertension of 3.4% in 5057 Pakistani children population, age 5 - 17 years.^{16,17} A community study in Karachi i.e. Metroville Health Study (MHS), showed a prevalence of 14.8% on first visit in children in 2 - 17 years old. This study was conducted during 1998 - 2003 period.¹⁷ In summary the prevalence rates in school studies ranged between 6.5 - 14.8% determined from the first visit blood pressure recording. Since repeated measurements in school children studies showed that the prevalence rates fall on repeat visits, the true prevalence may be close to 2 - 4% when one includes the PNHS all Pakistan based study.¹⁶

The prevalence of hypertension in Pakistani new-borns or infants has not been studied, but the incidence of 0.2 - 3% has been reported in the developed countries, secondary to problems such as cardiac, endocrine abnormalities, broncho-pulmonary dysplasia, renal abnormalities, umbilical indwelling catheters, special baby nursery care and medications.¹⁸

The babies with low birth weight tend to develop hypertension as adults. This fact is of grave concern for Pakistan, where large number of babies are born with low birth weight.¹⁹ We do not know the impact of the low birth weight babies on the prevalence of hypertension in Pakistan. In selected hospital-based studies, the incidence of low birth babies in Pakistan is reported to be 15 - 30% compared to 5% in developed countries.²⁰

Hypertension in adult Pakistani population: Pakistan National Health Survey (PNHS) showed that the prevalence of hypertension increased from less than 10% in 18 - 19 years old to greater than 60% in over 70 years age in males and similarly in females it increased from less than 5% at 18 - 19 years to a peak of 70% in 60 - 69 years age, the prevalence being higher in the female compared to male. In both males and females the prevalence rate increased steeply after 20 - 29 years age.^{16,22}

The PNHS showed that in the urban population the hypertension prevalence was higher than rural population and higher in females in both urban and rural populations.^{16,22,23} The other interesting point was the steep rise of hypertension prevalence rates after 20 - 29 years age which reached peak with advancing age in both urban and rural population (Figure A-B).¹⁶ In MHS an urban population similar pattern was seen but rates were much higher.

Factors identified account for increasing rates in Pakistani population

Genetic predisposition: Genetic predisposition to hypertension is reported in Pakistani population vis-a-vis USA and Europe. The combined blood pressure profile

of urban (MHS) and urban and rural population of PNHS plots showed that the diastolic blood pressure profile was higher in both genders of Pakistani children population compared to USA and Europe.^{16,22,24-26}

The age-adjusted blood pressure percentiles of the Pakistani population of PNHS, M.H.S and U.S.A NHANES population and showed higher diastolic pressure percentiles in Pakistani population (Figure 2 A-D). Thus genetic predisposition to essential hypertension may be higher in Pakistani population than U.S.A and Europe.^{22,26}

The prevalence rates of hypertension in PNHS represent genetic expression of hypertension, in families with history of hypertension which has also been demonstrated in Pakistani families but the later hypertension is environmental and much of it is associated with obesity Figure 1. The steep rise in prevalence rates after the third decade in Pakistani population seem to suggest that the environmental factors greatly stimulated the genetic predisposition during middle and later age so that the overall prevalence rate was similar to the highly developed countries, U.S.A and Europe.¹⁶

Environmental factors: The effect of environmental factors is a major contributor to prevalence of hypertension. Studies estimating genetic and environmental contribution have shown variable contributions of each. It is reported that the addition of one environmental factor to genetic pool results in skewing the blood pressure population Bell curve to the right with increased variability and addition of second and third factors incrementally skews the population BP curve farther to the right.¹ Thus the effect of environmental factors on the level of blood pressure and thus hypertension is undeniable. Furthermore, modification of these factors results in amelioration of the hypertension, lends further support to the fact that environments have profound influence on blood pressure. The steep rise in prevalence rate of hypertension in our population can be explained by change in the life styles of middle age more pronounced in the female. Because of inactive middle age the obesity prevalence increases as well.

Urbanization: The risk factors in rural and urban population of PNHS including hypertension were higher in urban than rural samples.^{16,22,23} Comparing males and females the risk factors including hypertension were greater in females in both urban and rural samples (Figure 3A and B). Hypertension was significantly more prevalent in urban population of PNHS compared to rural population. In MHS an urban community in a large metropolis of Karachi, the risk factor prevalence rates showed that urbanization was associated with increase in the risk factors of cardiovascular diseases such as obesity, hypertension, serum cholesterol, BMI i.e. over weight and diabetes, the prevalence rates trend was similar to the urban PNHS population but rates were

higher. Comparing male to female in urban MHS data showed that of the risk factors such as diabetes, hypercholesterolemia and hypertension and waist-hip ratio increased at a greater rate, greater in female than males.²³ The prevalence rates of obesity increased with age in similar manner as hypertension suggesting a causal relationship (Figure 4).

This review showed that urban population in Pakistan had higher prevalence rates of hypertension in urban

than rural Pakistani population similar to other developing countries. Our studies showed that children are similarly affected in urban population vis-a-vis the increased risk factors. In rural children population the obesity was much less than urban sample.¹⁷

The present observation of rising role of urbanization is similar to other Asian countries with transition to urban living^{28,29} and drastic changes in the life styles. The developing countries such as India, Hong Kong, Indonesia, Taiwan and Korea increased their fat consumptions with increasing urbanization, raising the prevalence of coronary arterial disease. The increased caloric consumption and refined products including salt were blamed. The rate of urbanization is proportional to the industrialization and job creation which lead to improved economic status and provision of fast foods and sedentary life styles, use of transport and job nature. The food consumption is affected in that oil

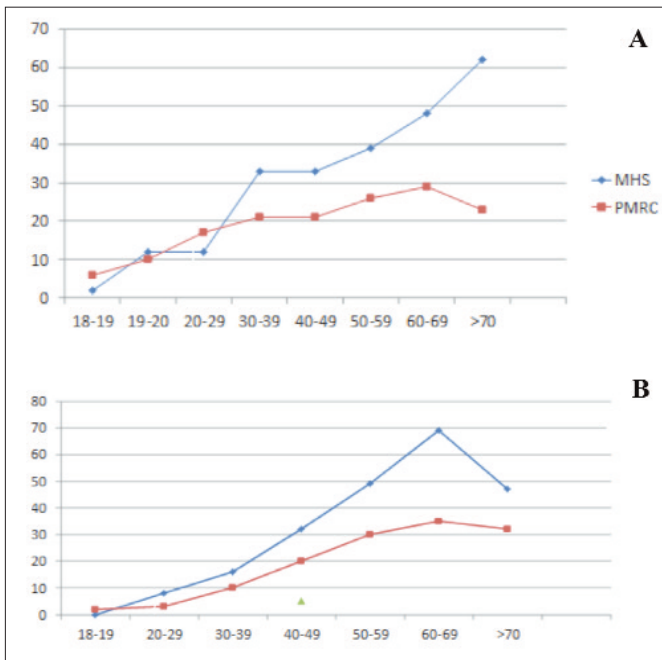


Figure 1 (A,B): Age related prevalence rates of hypertension Y axis in MHS (green line) and PNHS (red line) in women figure A and men figure B plot against age groups. Note steep rise in prevalence rates after 20 - 29 years age in both men and women (arrows). Also the prevalence rates are much higher in urban MHS than Pakistani population which is mostly rural.

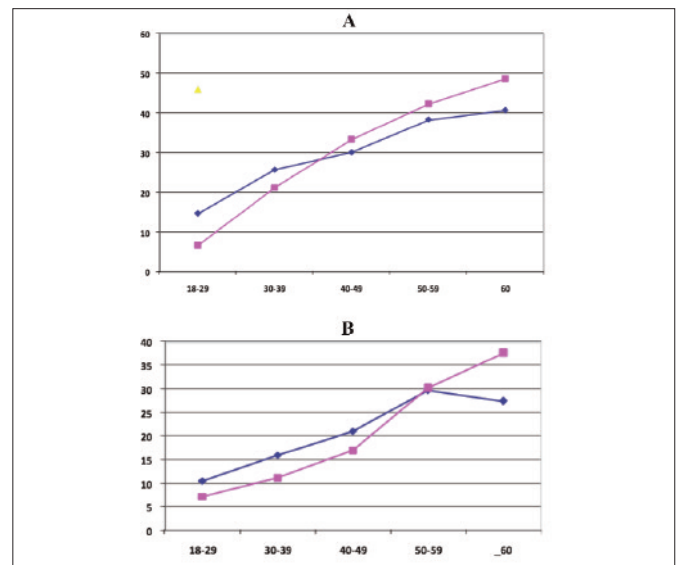


Figure 3 (A,B): (A) comparison of urban male (blue) with urban female (red) showed that the prevalence rates of hypertension in PNHS population were higher than for females in the later years than males. The rates were higher for both compared to rural population.¹⁶ (B) Comparison of rural male (blue) with rural female (red) in PNHS rural population shows that the prevalence rates of hypertension in female increased in the older age compared to males.¹⁶

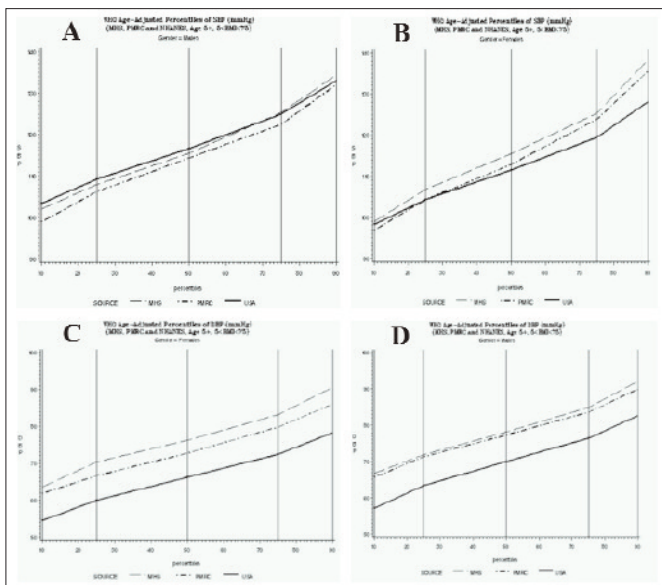


Figure 2: Age adjusted percentiles of systolic and diastolic blood pressure are plotted for MHS, interrupted single (Dash Dot), PNHS, dot dash dot and USA (uninterrupted line). note higher diastolic percentiles for diastolic pressure compared to USA population for both females A and males B.²²

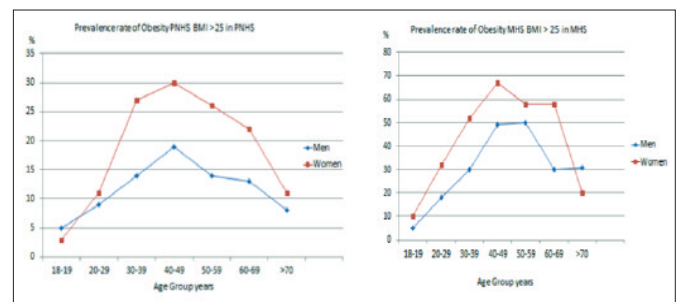


Figure 4: The prevalence rates for obesity are plotted for each age group comparing men with women and in PNHS and MHS. Note rates are much greater in urban Metroville than PNHS representing whole of Pakistan largely rural. The rates are much higher than in females (red) than males (blue). Note falling of rates in later years.^{21,22} These plots are similar to Indian reports.²⁸

consumption rises and the use of refined products in the food increase along with increased calorie consumption. Physical activities are reduced leading to obesity, which in the west has reached alarming proportions in both children and adult.

Diet: The diet patterns were studied in MHS which was a diet modification study for risk factor improvement. The study showed that on average a household uses 5.1 ± 5.4 kg fat (*Ghee*) per month, and 6.0 ± 4.2 kg of vegetable oil so that slightly less than half of fat used is saturated. Salt used per month was 280 gram per month.²² This study showed that food saturated fats and salt based. Cereal are the basic diet in villages, vegetables are expensive as is the meat, fish and chicken. These are used more in affluent population in cities. This diet is unhealthy and is a cause of high prevalence of risk factors including hypertension i.e. in most communities in Pakistan.^{21,23,25,29}

Obesity: Obesity prevalence profile similarly increased with age in both MHS and PNHS population but the rates were greater in urban MHS population. The prevalence rate of obesity showed similar steep rise after 30 years age in both gender. The rate was greater in urban population of Pakistan than rural and greater prevalence was seen in female than male in both rural and urban Pakistan.²³ Middle age aggregate risk factors and thus the steep rise in prevalence rates in hypertension obesity and diabetes suggesting profound effect of environment (Figure 4 and 5). Diabetes and essential hypertension prevalence in children is rising the world over.³⁰

Smoking: In MHS, the prevalence rate was 17% in 18 - 19 years age and increased to 30 - 43% in 30 - 59 years age and peaked to 60% in over 70 years age the prevalence was 30% overall. In PNHS population, the trend was similar but rate was lower from 12 to 33% in 20 - 69 years age group. Smoking was confined to the rural and urban males, the females by and large did not smoke in Pakistan except affluent teen agers.²² The tobacco use is present in both males and females in the form such as chewing and sniffing and *Hooka* or *Shesha* smoking. Women on average had prevalence of 7% in MHS compared to 4% in PNHS. In MHS in above 50 years age group the smoking rate was 13 - 27% and increased to 69% in over 70 years age group.²²

Alcohol: Alcohol consumption is not a major factor in a vast majority of Pakistani population because of religious taboo with the exception of high middle class flouting communities.

Awareness: Awareness of hypertension in PNHS population was 15.4% in men and 36% in women and under treatment for hypertension were 8.7% and 18.6% and compared to awareness in USA population of 65% and 78% in men and women, the under treatment were 45 - 53%.²⁵ The lack of awareness about heart disease

and hypertension is severe in Pakistani population and contributes to rising prevalence of hypertension even in the poor.³¹ The approach to treatment was evaluated in selected urban sample and showed unusual practices not based on awareness of hypertension causation and treatment.³²

Gender factor: Women in our culture have traditionally sedentary life styles and compared to males show a worst risk factor profile in both urban and rural setting. The women do not exercise, are home bound and do not do jobs, particularly middle age women, their exercise is limited to house work and shopping trips to the market. Obesity, increased to alarming proportions particularly in urban population although it was significantly present in rural population as well. There is a similarity of trends of rising prevalence rates for obesity and hypertension suggesting obesity as the cause of accelerated hypertension in both urban and rural Pakistan. The middle age is when the rates of obesity and hypertension tend to show a steep rise. This is related to the sedentary life styles of middle age. The effect is much exaggerated in women who show greater rates of obesity and hypertension.^{16,23}

Life styles: The sedentary life styles are prevalent in urban as well as rural Pakistan. MHS baseline assessment of exercise in men and women showed that games running were almost not indulged by women and even men, young men played games that too sparingly. The main activity of men was walking stairs and shopping trips and these were performed by women even less than men.²⁹ The accelerated rates of hypertension in the early middle age particularly women is demonstrated in this review and that risk factors tend to aggregate in middle age leading to two-third of the female population being hypertensive in late years.^{16,23} Obesity in underdeveloped country like Pakistan is a paradox and may be related to the sedentary life styles both in men and women particularly in urban setting. The reports show that prevalence of obesity is accelerated in middle age and risk factors follow the similar trend with age. The cultural attitudes to women who are confined to home environments exacerbate trends to obesity. Obesity is one single factor responsible for rising rates of hypertension prevalence the world over.^{30,33,34}

Environment constitutes a large share of hypertension and genetic factors probably only small proportion thus the modification of environmental factors is the key to prevention. This may be achievable if environmental factor modification and physically active life styles are instituted in early childhood.³⁵ In Pakistan, traditional attitudes to women need change which is not an easy matter. For the short term, efforts be directed at the household level; the role of the media would be crucial in creating dramas stories highlighting healthy physically active lifestyles wherever possible. The MHS showed

that diet can be modified, however, sustainability was the major issue.²¹

The strategy of a targeted prevention at an early age by the paediatricians and physicians is a solution but physicians need to be trained in public health. We in Pakistan, cannot afford to wait for the community infrastructures to develop before instituting prevention at the community level so that efforts need to be structured for prevention strategy application by the physicians who are practicing in the community.

Urbanization is rapidly progressing in Pakistan and has badly affected the risk factor profile of Pakistani population. Obesity is rising particularly in middle age, children of affluent families are getting obese and sedentary life styles and fast food and saturated *Ghee*-based cooking in Pakistan, all these factors continue to increase the rates of hypertension. There is compelling evidence that the environmental factors can be modified in population and behaviour change accomplished.²¹ The maintainability is a problem which requires community will to change and as Karelia study experience shows a strong integrated community health delivery infrastructure is a pre-requisite.³⁶ The changing of life style in middle age has not been successful even in the developing countries, obesity has increased to epidemic proportion inspite of all the preventive efforts. The habits are so fixed in adults that change in life styles and food may be changeable in the short-term but not over an extended period.

We in Pakistan need to plan our cities and for the most part it has not been achieved so far. Rural development seems a reasonable solution so that jobs, schools, food and other items of daily life, health facilities adequate for the rural population are available within the rural infrastructure. Rural communities are small and more manageable for implementing prevention strategies. The women in Pakistan are at greater risk for developing hypertension. Their life styles need to be improved on priority basis both in villages and urban setting. Primary early prevention beginning from childhood is the key for the underdeveloped countries, to be applied in children by the family physician and at community level. Infrastructure need to be developed around the community centers which need to be created. This requires political, will short of which the preventive efforts at community or national level cannot succeed.

CONCLUSION

In this review, female gender, genetic predisposition, urbanization, obesity, smoking in men, cultural factors in women and sedentary life styles have been identified as the factors accelerating the prevalence of hypertension in Pakistani population. Many of these tend to aggregate in middle age when sedentary life style is adopted particularly in women.

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