



Blood Pressure Status and Physical Activity among Adolescents of Hilly area

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Abstract

Blood pressure is listed as an important physiological condition of the adult and geriatric population. The high blood pressure observed among children living at high altitude may be due to greater effects of high altitude on body weight and height, blood viscosity, and cardiac output than on peripheral vasodilatation. A cross sectional study was conducted on school and college going adolescent group (Class 9-12) of Bandarban district. A total of 297 students whose age was in the range of 14-18 years and had consented to be a respondents were included in the study. A semi-structured questionnaire and a checklist were used for data collection through a face to face interview procedure. In this study about 57.6% were female of 16 years of age (33.7%). About 12.8% respondents had family history of hypertension in spite of good physical activity (77.4%). Mean of systolic blood pressure of male respondents were 123.52 ± 10.19 mm of Hg and in female respondents were 120.20 ± 10.10 mm of Hg. Mean of diastolic blood pressure of male respondents were $71.88 (\pm 7.18)$ mm of Hg and in female $72.23 \pm (7.78)$ mm of Hg. Mean of pulse pressure of male respondents were $51.63 (\pm 7.86)$ mm of Hg and in female $47.97 \pm (7.61)$ mm of Hg. Mean of mean arterial pressure of male respondents were $89.09 (\pm 7.44)$ mm of Hg and in female $88.22 \pm (7.84)$ mm of Hg. Strenuous efforts targeting detrimental behaviors and imparting the sense of healthy lifestyle enhancing practices are vital to control this situation.

Keywords: Blood pressure, Physical activity, Adolescents, Hilly area.

Introduction

Blood pressure is listed as an important physiological condition of the adult and geriatric population^{1,2}. During the past 30 years, prevalence has increased in the infant-juvenile age group in the world scenario³. National and international publications have shown a prevalence of high arterial pressure in children and adolescents, ranging between 1% -12% and 2%-10%,

respectively^{3,4,5}. In the context of hypertension in infancy and adolescence, the main risk factors of elevated primary levels of arterial pressure are family history of the disease, overweight, smoking (passive and/or active) and alcohol consumption^{6,7}. The main repercussions of the disease in adulthood and old age are the cerebrovascular diseases, coronaries, cardiac and chronic renal failure and other vasculopathies⁷.

During acute exposure to hilly/high altitude area, important ventilatory and cardiovascular adaptations develop in response to changing environmental conditions^{8,9}, in particular to hypo-baric hypoxia, in order to maintain homeostasis⁹. The reduction in oxygen partial pressure in the inspired air determines a reduction in venous blood re-oxygenation^{9,10}.

As a consequence of reduced quantity of blood transported oxygen, oxygen extraction to peripheral tissues is also reduced¹¹, leading to a significant reduction in exercise capacity^{11,12}. A proper adaptive cardiovascular response to altitude is thus essential¹².

The high blood pressure observed among children living at high altitude may be due to greater effects of high altitude on body weight and height¹³, blood viscosity¹³, and cardiac output¹³ than on peripheral vasodilatation^{13,14}. Another explanation is insufficient vascular adaptive changes at this age group since high altitude did not result in hypertension in adults^{15,16}.

Materials and Methodology

Study Population, Setting, and Design

A cross sectional study was conducted on school and college going adolescent group (Class 9-12) of Bandarban district. A total of 297 students whose age was in the range of 14-18 years and had consented to be a respondents were included in the study.

Data Collection Instruments

A pre-tested semi-structured questionnaire consisting information about socio-demographic characteristics and physical activity status of respondents which was adopted from International Physical Activity Questionnaire-Short Form¹⁷ was used for data collection. A checklist was used to evaluate blood pressure, height and weight and they were measured by using an automated digital blood pressure machine, metal measuring tape and digital weight measuring machine, respectively.

Data Collection Techniques

Data was collected by face to face interview. At a time 10 students were taken to a room and were

allowed to sit for 10 minutes. Meanwhile, in order to make them relaxed the purpose and procedure of the study was explained to them. The respondents were instructed to avoid caffeine, exercise and smoking for at least 30 min before measurement and ask to empty their bladder if there was an urge and avoided talking during blood pressure measurement was properly maintained¹⁸. Appropriate size cuff as per arm circumference was used to measure blood pressure. The cuff was placed 2-3 cm above the antecubital fossa with rubber bag centralized over brachial artery. Blood pressure was measured in the seated position with the right arm supported at heart level. Blood pressure was taken three times with 5 minutes' interval¹⁹.

Results

In this cross-sectional study among 297 respondents about 57.6% were female of 16 years of age (33.7%). About 12.8% respondents had family history of hypertension in spite of good physical activity (77.4%). Prevalence of paternal, maternal, paternal grandparents' and maternal grandparents' history of hypertension are enlisted in **table 01**. About 37.7% took extra salt during meal and 80.8% took salt preserved fish with meal. About 8.8% respondents used tobacco for smoking purpose (**Table 01**).

Mean of systolic blood pressure of male respondents were 123.52 ± 10.19 mm of Hg and in female respondents were 120.20 ± 10.10 mm of Hg. Mean of diastolic blood pressure of male respondents were $71.88 (\pm 7.18)$ mm of Hg and in female $72.23 \pm (7.78)$ mm of Hg. Mean of pulse pressure of male respondents were $51.63 (\pm 7.86)$ mm of Hg and in female $47.97 \pm (7.61)$ mm of Hg. Mean of mean arterial pressure of male respondents were $89.09 (\pm 7.44)$ mm of Hg and in female $88.22 \pm (7.84)$ mm of Hg (**Table 02**).

Table 1: Socio-demographic characteristics, smoking behaviours and eating habits of respondents

Traits	Hilly (%)	p Value
Gender		
Male	42.4	0.118
Female	57.6	
Age		
14	7.7	
15	28.3	
16	33.7	<0.0001
17	25.3	
18	5.1	
Religion		
Muslim	27.6	
Hindu	6.4	
Buddhist	36.7	0.000
Christian	16.2	
Krama	13.1	
Level of education		
Class 9	18.2	
Class 10	43.1	0.000
Class 11	22.9	
Class 12	15.8	
Familial history of hypertension		
Father	6.4	0.868
Mother	9.1	0.676
Paternal Grandparents	0.7	0.020
Maternal Grandparents	1.0	1.000
Behaviour Characteristics		
Consumption of extra table salt with meal	37.7	0.101
Consumption of salt preserved fish	80.8	0.000
Use of tobacco	8.8	0.000
Category of physical activity		
Low	22.6	
Moderate	54.9	0.000
High	22.6	
BMI status		
Under weight	25.9	
Normal weight	70.0	0.000
Over weight	3.4	
Obese class I	0.7	

Table 2: Means of different measures of blood pressure of respondents

	Blood Pressure	Hilly (%)	p Value
Male	SBP	123.52 ± 10.19	<0.0001
	DBP	71.88 ± 7.18	0.000
	PP	51.63 ± 7.86	0.000
	MAP	89.09 ± 7.44	0.000
Female	SBP	120.20 ± 10.10	0.000
	DBP	72.23 ± 7.78	0.043
	PP	47.97 ± 7.61	0.000
	MAP	88.22 ± 7.84	0.000

SBP= Systolic Blood Pressure, DBP= Diastolic Blood Pressure, PP=Pulse Pressure, MAP= Mean Arterial Pressure

Discussions

The high blood pressure observed among adolescent living at hilly area may be due to greater effects of

altitude on body weight and height, blood viscosity, and cardiac output than on peripheral vasodilatation. Another explanation is insufficient vascular

adaptive changes at this age group since high altitude did not result in hypertension in adults²⁰. A few studies in this regard reveal contradictory views on difference of blood pressure of people living in high and low altitude areas. It is generally believed that both systolic blood pressure (SBP) and diastolic blood pressure (DBP) are lower in the high than in the low-altitude populations²¹. Initial exposure to high altitude leads to increase in BP which is attributed largely to increased autonomic or sympathetic activity. SBP and DBP gradually decline, after years of residence at high altitude, even falling below those observed at sea level²². Compared with residents living at sea level, Andean residents at high altitude have lower resting BP, especially SBP. Furthermore, high altitude residents who migrate to sea level show gradual elevations in BP levels²³. Studies on US Whites born at low altitude living at high altitude showed that the degree of decline in systemic BP is a function of length of time at residence at high altitude²⁴. The long-term residents and natives of high altitude Andes show reduced BP, lower rates of hypertension, and lower cardiac anomalies. This observation is also observed in some other high-altitude populations like Sherpa's, natives of Tien Shan and the Pamir and the people in the Ambers region in Ethiopia²⁵. The cause of decline in BP at high altitude has been attributed to relaxation of vascular smooth muscle, an increase in collateral circulation, increased vascularization, higher red blood cell level and haemoglobin level, hypocaloric stress and diseases like respiratory tract ailments^{25,26,27}. Some studies on the natives of Andes, native Americans of Chile, natives of Mongolia and an agricultural population of India did not find any effect of altitude on BP²⁸. However, a few studies on high altitude natives of Ethiopia, high altitude natives of Saudi Arabia, Tibetans of Lhasa and high altitude cold zone cattle-breeders of Mongolians showed just the opposite relationship, that is, high-altitude residents showing higher BP²⁹. Another study on Tibetans from a refugee settlement in India at low altitude report lower BP values¹⁷. Studies on other high-altitude Himalayan

populations like Sherpa, who trace their ancestry to Tibet reported lower blood pressure at high altitude and a much smaller age-related increase in blood pressure. But a recent study on Sherpa in the modernizing Nepal showed elevated BP for both the altitudes¹⁸.

The risk factors independently associated with high BP in this study are obesity, altered food habits, and physical inactivity³⁰. In obese children, activation of sympathetic nervous system shifts the arterial pressure control mechanism of diuresis and natriuresis to higher BP levels might be the possible reason illuminating the association³¹.

Conclusions

Systolic blood pressure, diastolic blood pressure, mean arterial pressure and pulse pressure were almost similar in both gender in spite of their good physical exercise. Most of them consume salted fish product which may be a significant cause of blood pressure variation. Strenuous efforts targeting detrimental behaviors and imparting the sense of healthy lifestyle enhancing practices are vital to control this situation.

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Limitations

In this present study, as a hilly area Bandarban was selected purposively. So the conclusion from this study may not necessarily represent the all hilly areas in Bangladesh. Fast food and alcohol consumption was not measured in this study. As physical activity was assessed using IPAQ (short)

questionnaire, there could have been some recall bias when respondents tried to recall their 7-day activities in responses to questions asked.

Declarations

Funding: No funding.

Conflict of Interest: No competing interests relevant to this study to disclose for all authors. Full forms submitted and on file for all authors.

Ethical Approval: All the procedures were conducted following the ethical guidelines of institution's ethical committee (Institutional Review Board) at National Institute of Preventive and Social Medicine (NIPSOM). The ethical standards as laid down in the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards will be followed wherever applicable. Before initiation of data collection, a brief introduction on the aims and objectives of the study were presented to the school and college authority. They were informed about their full right to participate or refuse to participate in the study.

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