Assessment of schoolchildren for congenital heart disease using murmurs and blood pressure as markers

Congenital heart disease (CHD) is one of the major causes of cardiovascular diseases in developing countries. CHD among neonates and young children is responsible for the largest proportion of mortality (30–50%) caused by birth defects[1]. Though there is a significantly reducing trend observed in both overall and infant mortality resulting from CHD in developed countries like USA and Europe, CHD contributes 14% among 10.3 million total deaths in India, with 1931 disability adjusted life years (DALYs) per 100,000 (refs 2, 3). Pattern of CHDs differs according to geographic location; ventricular septal defect (VSD), atrial septal defect (ASD), tetralogy of fallot (TOF), patent ductus arteriosus (PDA), pulmonary stenosis (PS), aortic stenosis (AS), coarctation of aorta (COA) and atrioventricular septal defect (AVSD) are the most common[3]. There are no prospective national cohort registries publishing CHD incidence rates. In India unadjusted CHD rates have ranged from 1.6% to 7.4% in rural populations, and 1% to 13.2% in urban populations[4]. CHD prevalence varies among the different ethnic groups within India[5]. In the context of North Indian population, there are no comprehensive data regarding the prevalence of CHD. In view of this, we report here preliminary data regarding prevalence of CHD among school-going children from upper Assam, NE India.

The study included 99 schools (lower primary: 72, middle English/middle vernacular: 16, Government aided/private: 4, provincialized: 5 and higher secondary: 2) which were chosen at random from the total of 1631 schools covering 180,153 schoolchildren in Dibrugarh, Assam. Schoolchildren aged 5–14 years, with informed consent by the parents, were chosen for the present study. A total of 10,003 schoolchildren underwent cardiovascular screening in addition to anthropometry and blood pressure examination. Those identified with abnormal heart sounds were referred to the Cardiology Unit of the Assam Medical College and Hospital. A second-level screening was done by cardiologists at the hospital and schoolchildren who need echocardiography examination for confirmation were identified. Echocardiographic examination was performed using Cardiac doppler (model Aloka SD 4000, Siemens). Standard supine with head extended position and left lateral positions was used to achieve parasternal, apical, subcostal and suprasternal views in supine and left lateral position, whenever necessary[5]. All the abnormal heart sounds including murmurs were subsequently identified as either innocent systolic murmur (murmur in which cardiological examination and echocardiography ruled out structural cardiac malformation), or due to CHD.

We identified 152 out of 10,003 schoolchildren who had cardiac murmur with normal pulse rate, except the sinus tachycardia by two independent clinicians (PKB and UD). Schoolchildren with murmurs were subsequently verified by the cardiologists clinically and by echocardiography examination. Twenty out of 152 schoolchildren had CHD (ASD = 7, VSD = 5, PS = 4, AS = 2, TOF = 2), giving a prevalence of 1.99/1000. Again, we did not find subjects with coarctation of the aorta, as its prevalence is very low 4/10,000. Majority of the critical CHD subjects die in the neonatal or infant stage itself[6].

The present study has reported prevalence of CHD in a well-represented sample of schoolchildren from Dibrugarh. In India, incidence of CHD varies from 0.8 to 4.2/1000, and such geographical variation is commonly observed across different studies[7–11]. The reported incidence in the Western literatures ranged from 0.65 to 11.9/1000 (ref. 7). According to a status report in India, 10% of the present infant mortality may be due to CHD[11]. A hospital-based study from India revealed CHD in 3.9/1000 live births[11]. Community-based studies from India revealed that prevalence of CHD ranging from 0.8 to 5.2/1000 in our population[7–11]. Meta analysis on the prevalence of CHD among schoolchildren revealed that it was 2.96/1000, with a total effect size of 116,658. Our finding reduced the overall prevalence from 2.96 to 2.88/1000, with a total effect size of 126,661 among schoolchildren (Table 1). The prevalence of CHD in upper Assam shows close proximity with the Indian population. However, the present study also has limitations. The prevalence reported here may be an underestimation of the actual estimates due to three possible reasons. We might have missed some of the CHD cases who died before the age of five years as our study was conducted among schoolchildren between the age group of 5 and 14 years. Children born with VSD

Table 1. Prevalence and meta analysis of congenital heart disease in India

Study	Age group (yrs)	Hospital-based/ community-based	Study sample	Prevalence/ 1000	Meta analysis	
					Total weight $\sum n$	Prevalence/ 1000 $\sum n_i \cdot p_i / \sum n$
Shresta and Padmavati[5]	5–16	Schoolchildren	34,198	3.2		
Gupta *et al.*[8]	6–16	Schoolchildren	10,264	0.8		
Vashishtha *et al.*[9]	5–15	Schoolchildren	8449	5.2		
Khalil *et al.*[7]	Live births	Hospital	10,964	3.9		
Thakur *et al.*[10]	5–16	Schoolchildren	40,950	2.25		
Chadha *et al.*[11]	<15	Schoolchildren	11,833	4.2	116,658	2.96*
Present study	5–15	Schoolchildren	10,003	1.99	126,661	2.88*

*Prevalence rate reduced from 2.96 to 2.88 after inclusion of the present study.

and ASD may have a natural closure before the age of five years. Further, we performed study in a school where it is expected that patients with severe CHD may not attend. Community-based study might have given more information and higher prevalence.

CHD leads to high morbidity and mortality among infants and children. In developing countries like India, a substantial number of infants or children with CHD remains undetected leading to high morbidity and mortality. The present study highlights the burden among school-going children that needs to be properly investigated to identify the risk factors and measures to alleviate the same.

1. Roger, V. L. *et al.*, *Circulation*, 2011, **123**(4), e18–e209.
2. Dolk, H., Loane, M. and Garne, E., *Circulation*, 2011, **123**(8), 841–849.
3. Dolk, H., Loane, M. and Garne, E., *Adv. Exp. Med. Biol.*, 2010, **686**, 349–364.
4. Saxena, A., *Indian J. Pediatr.*, 2005, **72**(7), 595–598.
5. Shrestha, N. K. and Padmavati, S., *Indian J. Med. Res.*, 1980, **72**, 403–407.
6. Bjornard, K., Riehle-Colarusso, T., Gilboa, S. M. and Correa, A., *Birth Defects Res. Part A*, 2013, **97**, 87–94.
7. Khalil, A., Aggarwal, R., Thirupuram, S. and Arora, R., *Indian Pediatr.*, 1994, **31**, 519–527.
8. Gupta, J., Gupta, M. L., Parihar, A. and Gupta, C. D., *J. Indian Med. Assoc.*, 1992, **90**, 57–59.
9. Vashishtha, V. M., Kalra, A., Kalra, K. and Jain, V. K., *Indian Pediatr.*, 1993, **30**, 1337–1340.
10. Thakur, J. S., Negi, P. C., Ahluwalia, S. K., Sharma, R. and Bhardwaj, R., *Indian Heart J.*, 1995, **47**, 232–235.
11. Chadha, S. L., Singh, N. and Shukla, D. K., *Indian J. Pediatr.*, 2001, **68**, 507–510; http://dx.doi.org/10.1007/BF02723241.

Received 28 June 2015; revised accepted 26 September 2015

PRASANTA K. BORAH[1]
UTPALA DEVI[1]
HEM CH KALITA[2]
SUMAN K. PAINE[1]
MEENAKSHI SHARMA[3]
JAGADISH MAHANTA[1,*]

[1]*Regional Medical Research Centre, NE Region (ICMR), Dibrugarh 786 001, India*
[2]*Assam Medical College, Dibrugarh 786 002, India*
[3]*Indian Council of Medical Research, Ansari Nagar, New Delhi 110 029, India*
**For correspondence.*
e-mail: jmahanta@hotmail.com

Comparative evaluation of protein content in groundnut samples by near infrared reflectance spectroscopy and Skalar colorimetric methods

A lot of research has been done in developing groundnut cultivars with high-quality oil. As a result, methods for routinely determining oil content and quality have been developed and utilized[1]. However, groundnut is also a source of protein, and obviously, there is a need to develop a rapid, accurate and economic method that can be routinely used for screening a large number of groundnut cultivars for protein content. At the ICRISAT analytical service laboratory, protein (total N) in various crops is routinely determined by colorimetric method using Skalar autoanalyser. However, near infrared reflectance spectroscopy (NIRS) also provides an opportunity to determine protein content in groundnut samples; and the method seems attractive as it is low cost, simple and rapid. The NIRS based method provides an automated measurement and has the potential to become a valuable tool for providing analytical support for agricultural research[2,3]. The objectives of this study were to estimate and compare the relative efficacy of the NIRS method, with that of a conventional colorimetric method, following digestion of ground samples, using Skalar autoanalyser for determining protein in groundnut samples.

In this study, a total of 928 groundnut samples were selected. The samples were kept in an oven at 60°C for 48 h for drying, and then ground (<0.5 mm) using porcelain mortar and pestle.

Powdered groundnut (20–30 g) was loaded into sample cell and scanned by NIRS (Foss XDS rapid content analyser) to develop calibrations for protein analysis. Each sample was scanned thrice, and nearly 60 sec was required for each scan. The absorbance bands of N–H bonds in protein at 2 nm wavelength intervals within the range 400 to 2498 nm were recorded, using Win ISI software (version 4.5.0). Other chemical bonds like C–H, C–O, H–O, etc. in groundnut were not considered in the analysis, though they may appear in the overtone bands in NIR region. Brilliant reflectance spectra was generated in the solid, with high scatter coefficients[4].

The modified partial least square regression (MPLS) method was used to develop the calibration equation. Before scanning, all calibration samples were analysed by Skalar method, reference method and the predicted protein values determined by NIRS were also validated with Skalar data by regression parameter.

Finely ground groundnut samples (0.3 g) were digested with 2.5 ml of concentrated sulphuric acid-selenium (Se) mixture (sulphuric acid containing 0.4% Se, v/w, was heated to dissolve Se)[5], and total N (%) in the digests was analysed using Skalar autoanalyser. All samples were analysed in three replications, and the results presented are the means of three independent analyses. Nitrogen (%) was converted into protein by multiplying with a factor of 5.46.

The data were statistically analysed, and the significance of the results by the two methods was tested for protein analysis. Correlation between the values of protein in groundnut samples by NIRS and Skalar methods was determined, and regression equations were developed to predict protein content.

The precision obtained in determining protein content in groundnut samples by NIRS and Skalar methods was