

Association of Dietary Calcium Intake and Body Fat with Hypertension in Indian Adolescents

To explore association of dietary-calcium intake and body-composition with blood-pressure, 417 apparently healthy adolescents (218 boys) were studied for anthropometry, blood pressure, body composition and nutrient intakes using standard protocols. Blood pressure correlated negatively with dietary calcium ($r = -0.120$, $P < 0.01$) and positively with body fat ($r = 0.56$, $P < 0.001$). Low dietary-calcium intakes and high adiposity may increase risk of hypertension in Indian adolescents.

Keywords: Adiposity, Body composition, Nutrients.

Low dietary calcium intakes are related to conditions other than bone health, such as hypertension, with possible involvement of renin-angiotensin system [1]. Objective of this study was to explore association of dietary calcium intake and body composition with blood pressure (BP) in 10-14 year-old Indian adolescents.

Four hundred and seventeen apparently healthy adolescents [218 boys, mean (SD) age 12.0 (1.3) years] were enrolled from schools catering to affluent classes from Pune after institutional ethics approval and appropriate consents. Standing height, weight, waist, blood pressure were measured. Body mass index (BMI) and Z scores were computed using standard procedures and reference values. Body composition (body fat% and muscle mass) were measured using Tanita-SC-240, Tetra polar bioelectrical impedance analyzer (Tanita Corporation, Tokyo, Japan) with children wearing minimal clothings, using standard protocol [2]. Three non-consecutive day 24 hour-diet recalls (including one Sunday) were recorded using standardized questionnaires, and nutrient data were analysed using cooked [3] and raw food data base [4].

Prevalence of hypertension (BP $>95^{\text{th}}$ centile) was more in boys (7%) than in girls (5%) [5]. Children with pre-hypertension (BP between 85^{th} and 95^{th} centile) and hypertension had significantly higher weight and BMI Z-scores, waist circumference (WC), fat% and lower percent muscle mass ($P < 0.05$) than children with normal BP. One-fourth of the children were overweight and more than 10% were obese. Majority of micronutrients (mineral and vitamins) intakes were lower than recommended daily allowance (RDA) for corresponding age group. Calcium intakes were significantly lower in group with hyper-

tension ($P < 0.05$) than normal BP groups. Eight percent of children from hypertension group had daily calcium intakes below RDA as against 58% children with normal BP. Only 20% of all children satisfied RDA for dietary calcium. Dietary calcium intakes negatively correlated with BP ($r = -0.120$, $P < 0.01$) (unadjusted and after adjusting for energy intake). BP was positively correlated with BMI ($r = 0.54$), WC ($r = 0.52$) and body fat percent ($r = 0.56$) ($P < 0.001$). Generalized linear model analysis revealed that BP was positively associated with body fat % ($\beta = 0.48$, $P = 0.001$) and WC ($\beta = 0.32$, $P = 0.001$) and negatively associated with dietary calcium ($\beta = 0.02$, $P < 0.0001$) after adjustment for height.

Higher prevalence of hypertension along with higher adiposity has also been reported in previous studies [6]. Lower consumption of calcium has also been reported earlier in adolescents [7]. Beneficial effects of increased calcium intakes/supplementation with calcium on BP have also been reported [8,9]. Mushengezi, *et al.* [10] reported higher BMI and WC as predictor of mean arterial pressure (MAP), whereas our results indicate that body fat% and WC were predictors of BP.

In conclusion, low dietary calcium intakes and high adiposity contribute to risk of hypertension in Indian adolescents. Thus, meeting RDA for calcium seems to be critical not only for bone health but also for prevention of hypertension, especially in presence of adiposity.

Acknowledgements: Director, HCJMRI, Dr. Uma Divate for giving permission for carrying out this study.

Contributors: NAK, ZM, VVK, SAC and AVK: designed research; NAK, AVK were involved in data collection; All authors were involved in data analysis and manuscript writing; AVK has primary responsibility for final content. All authors read and approved the final manuscript.

Funding: Corporate Social Grant: Novo Nordisk India Pvt. Limited; *Competing interests:* None stated.

NEHA A KAJALE,[#]ZULF MUGHAL,
VAMAN KHADILKAR, SHASHI A CHIPLONKAR AND

*ANURADHA KHADILKAR

From Hirabai Cowasji Jehangir Medical Research Institute,
Jehangir Hospital, Pune. Maharashtra, India; and
[#]Department of Paediatric Medicine, Royal Manchester
Children's Hospital, Manchester, UK.

*anuradhavkhadilkar@gmail.com

REFERENCES

1. Yuasa S, Sumikura T, Yura T, Takahashi N, Shoji T, Uchida K, *et al.* Effect of low dietary calcium intake on blood pressure and pressure natriuresis response in rats: a possible role of the renin-angiotensin system. *Blood Press.* 1996;5:121-7.
2. Barreira TV, Staiano AE, Katzmarzyk PT. Validity assessment of a portable bioimpedance scale to estimate

- body fat percentage in white and African American children and adolescents. *Pediatric Obes.* 2013;8:e29-e32.
3. C Diet: version 2. Xenios technology, 2012 .
 4. Gopalan C, Ramasastri BV, Balasubramanian SG. Nutritive value of Indian foods, National Institute of Nutrition, Hyderabad, 1993.
 5. Raj M, Sundaram R, Paul M, Kumar K. Blood pressure distribution in Indian children. *Indian Pediatr.* 2010;47:477-85.
 6. Raj M, Sundaram KR, Paul M, Deepa AS, Kumar RK. Obesity in Indian children: time trends and relationship with hypertension. *Natl Med J India.* 2007;20:288-93.
 7. Sanwalka NJ, Khadilkar AV, Mughal Z, Sayyad MG, Khadilkar VV, Shirole SC, *et al.* A study of calcium intake and sources of calcium in adolescent boys and girls from two socioeconomic strata, in Pune, India. *Asia Pac J Clin Nutr.* 2010;19:324-9.
 8. Morikawa Y, Nakagawa H, Okayama A, Mikawa K, Sakata K, Miura K, *et al.* A cross-sectional study on association of calcium intake with blood pressure in Japanese population. *J Hum Hypertens.* 2002;16:105-10.
 9. Dwyer JH, Dwyer KM, Scribner RA, Sun P, Li L, Nicholson LM, *et al.* Dietary calcium, calcium supplementation, and blood pressure in African American adolescents. *Am J Clin Nutr.* 1998;68:648-55.
 10. Mushengezi B, Chillo P. Association between body fat composition and blood pressure level among secondary school adolescents in Dar es Salaam, Tanzania. *Pan Afr Med J.* 2014;19:327.

High Mobility Group Box 1 in Preterm Infants with Intraventricular Hemorrhage

We studied the level of high mobility group box 1 (HMGB1) in preterm infants with intraventricular hemorrhage (IVH). Using enzyme-linked immunosorbent assay (ELISA), the concentration of HMGB1 in cord blood obtained from 41 infants with IVH and 67 infants without IVH were measured. The cord blood concentration of HMGB1 in infants with IVH were significantly higher than those without IVH ($P=0.041$). Increased levels of HMGB1 might be associated with IVH in preterm infants.

Keywords: HMGB1, Intraventricular Hemorrhage, Prematurity.

Intraventricular hemorrhage (IVH) often occurs in premature infants and results in increased morbidity and mortality in survivors [1]. Intrauterine infection may predispose to IVH through inflammation [2]. In this pathophysiological process, many pro-inflammatory cytokines such as High mobility group box 1 (HMGB1) may be involved. We conducted this study to explore relationship between HMGB1 and IVH in preterm infants.

All infants enrolled in this study were delivered less than 32 weeks of gestation and treated in the neonatal intensive care unit (NICU) of the First Affiliated Hospital, College of Medicine, Zhejiang University, China, between April 2012 and July 2014. Umbilical venous blood was obtained from all infants immediately after birth, and centrifuged at 2000 rpm for 10 min. The serum was separated and stored at -70°C before analysis. HMGB1 was measured with commercially available ELISA kits (Shino-Test, Kanagawa, Japan) according to the manufacturer's recommendations.

The clinical data were collected from the infants' records. Diagnosis of IVH was made by cranial ultrasonography. IVH was classified in four grades [3]. Written informed consent was obtained from one of the parents. The study was approved by the ethics committee of the Affiliated Hospital of Jiangsu University.

Forty-one infants with IVH and 67 infants without IVH were enrolled in this study. Of the 41 infants with IVH, 21 had grade I, 12 had grade II, 6 had grade III, and 2 had IV IVH. Other characteristics of the participants are shown in **Table I**. There were no significant differences in baseline characteristics between the two groups.

The levels of HMGB1 were 108.6 (37.3, 400.9) $\mu\text{g/L}$ in infants with IVH, and 61.5 (26.8, 508.3) $\mu\text{g/L}$ in infants without IVH. As shown in **Fig. 1**, the levels of HMGB1 in infants with IVH were significantly higher than in those without IVH ($P=0.041$). There was no significant difference of HMGB1 levels among infants with different grades of IVH.

In recent years, HMGB1 has been proposed as a late mediator during inflammation [4]. Some researches

TABLE I CHARACTERISTICS OF PARTICIPANTS IN THE STUDY

	Intraventricular hemorrhage		P value
	Present (n=41)	Absent (n=67)	
Gestational age (wk)	30.6 (1.37)	30.3 (1.15)	0.656
Birth weight (g)	1647 (207)	1671 (187)	0.813
Male	25	39	0.776
Cesarean birth	31	40	0.091
1 min Apgar	8 (5-8)	9 (5-9)	0.882
5 min Apgar	9 (5-9)	9 (6-9)	0.892