

# RISK FACTORS FOR EPSTEIN-BARR VIRUS INFECTION IN THAI INFANTS

Jutarat Mekmullica<sup>1</sup>, Supaporn Kritsaneepaiboon<sup>2</sup> and Chitsanu Pancharoen<sup>3</sup>

<sup>1</sup>Department of Pediatrics Bhumibol Adulyadej Hospital; <sup>2</sup>Directorate of Medical Services; <sup>3</sup>Department of Pediatrics, King Chulalongkorn Memorial Hospital, Bangkok, Thailand

**Abstract.** To identify the risk factors for Epstein-Barr virus (EBV) infection among infants in Bangkok, Thailand, a case-control study was conducted during 1997-1999. Blood samples were collected from 257 Thai infants aged 6 months to 2 years. Serum samples were assayed for specific EBV IgG antibodies based on a commercial enzyme-linked immunosorbent assay kit. The subjects' parents were interviewed with structured questionnaires to collect details about their infants' age, sex, socioeconomic background, and place of child rearing. The infants were classified into two groups: positive and negative EBV IgG; factors related to the risks of infection were also determined. The overall seropositivity rate of the study infants was 36.2%. Infants aged 1-2 years had a 3.64 times higher risk than those aged 6 months -1 year ( $p < 0.0001$ ). Infants living in families with an income of  $\leq 10,000$  baht/month (1 US\$  $\approx$  42 baht) had a 1.33 times higher risk than those with a family income of  $>10,000$  baht/month ( $p = 0.03$ ). Infants who were reared at home had a 2.92 times higher risk than those reared outside the home ( $p = 0.05$ ). By logistic regression analysis, age ( $> 1$  years) and family income ( $\leq 10,000$  baht/month) were the two risk factors associated with EBV infection.

## INTRODUCTION

Epstein-Barr virus (EBV) is the most common cause of infectious mononucleosis (IM). The spectrum of disease ranges from asymptomatic infection in infants and in young children to serious infection in older children and adults (Tamir *et al*, 1974). In developing countries, primary infection with EBV occurs early in life. Approximately 60% of infants ( $\leq 2$  years) are infected by EBV and 80-100% were infected by the age of 3-6 years (Sumaya *et al*, 1998). Previous studies showed that the factors influencing the seroprevalence of EBV infection were age, familial socioeconomic status, and the place of child rearing (Sumaya *et al*, 1975; Ferres *et al*, 1995; Poovorawan *et al*, 1997; Pancharoen *et al*, 2000; 2001a,b). However, data concerning the risk factors for EBV infection in Thai infant are lacking. This research was conducted in order to collect such data.

Correspondence: Dr Jutarat Mekmullica, Department of Pediatrics, Faculty of Medicine, Chulalongkorn University, Rama IV Road, Bangkok 10330, Thailand. Tel/Fax: 66 (0) 2256-4930  
E-mail: jmekmullica@hotmail.com

## MATERIALS AND METHODS

A case-control study was carried out at the Bhumibol Adulyadej Hospital and the Division of Preventive Medicine, Directorate of Medical Services, Royal Thai Air Force. Between 1987 and 1999, 189 previously healthy infants who were admitted to Bhumibol Adulyadej Hospital and 68 infants who attended the Well-baby Clinic of the Division of Preventive Medicine were recruited into the survey. Those who were diagnosed with primary immunodeficiency, HIV infection, cancers, chronic hepatic or renal disease, and those who had received blood or blood components during the previous three months were excluded. All the subjects' parents were interviewed with structured questionnaires in order to collect details about their children's age, sex, family income, number of children in the family, and place of child rearing. Two milliliters of blood were obtained and the separated serum was stored at  $-20^{\circ}\text{C}$  until testing. Specific EBV IgG antibodies were detected by a commercial enzyme-linked immunosorbent assay (ELISA) kit (Enzygnost Anti-EBV IgG kit, Behringwerke, Germany), according to the manufacturer's instructions. Sta-

tistics used for analysis included mean, range and percentage for the demographic data; the chi-squared test was used to test for differences in population proportions; Student's *t*-test evaluated the significance of the difference between the two population means; logistic regression was used to describe the relationship of several independent variables to dichotomous dependent variables.

## RESULTS

Of the 257 infants, 152 were boys and 105 were girls; their mean age was 1.18 ( $\pm 0.49$ ) years. The rate of EBV-IgG positivity was 36.2%. After classifying the subjects into seropositive and seronegative groups, it was found that the infants in the former group were significantly older and were more likely to have been reared at home than those in the latter group (Table 1).

Risk factors for EBV infection included age, family income, and place of rearing. Infants, aged 1 - 2 years, had a 3.64 times higher risk than those aged 6 months - 1 year (OR = 3.64; 95% CI = 2.12 - 6.24;  $p < 0.0001$ ). Infants living in families whose income  $\leq 10,000$  baht/month (1 US\$ = 42 baht) had a 1.33 times higher risk than those from families whose income  $> 10,000$  baht/month (OR = 1.33; 95% CI = 0.72 - 2.47;  $p = 0.03$ ). Infants who were reared at home had a 2.92 times higher risk than those who were reared outside

the home (OR = 2.92; 95% CI = 0.96 - 8.85;  $p = 0.05$ ). Sex and number of children in the family were not risk factors for EBV infection (Table 2). By logistic regression analysis, the only two factors that had statistical significance were age ( $> 1$  year) and family income ( $< 10,000$  baht/month) ( $p < 0.0001$  and  $0.006$  respectively).

## DISCUSSION

The seropositivity rate of EBV infection in our study was lower than those of previous reports, which were 45 - 60.6% (Pereira *et al*, 1969; Porter *et al*; 1969; Puthavathana *et al*, 1980; Ferres *et al*, 1995; Chan *et al*, 2001). This may be explained by the fact that the changing of standard of living of Thai people at present including small family members and new methods of infant feeding have resulted in decreased viral transmission through the saliva of children and adults.

Our study showed that age was a risk factor for EBV infection. This is logical: as the children grew, they were more likely to contract the virus. The second risk factor was low familial income ( $\leq 10,000$  baht/month), which may reflect low socioeconomic status, a factor shown by previous studies to be associated with a higher risk of infection (Sumaya *et al*, 1975; Ferres *et al*, 1995; Poovoravan *et al*, 1997).

In summary, our study showed that the seropositivity rate of EBV infection in infants from

Table 1  
Age, sex, income of family, number of children in family, the place of child rearing of the studied infants (6 months - 2 years) by EBV seropositivity.

Characteristics	EBV seropositive infants (n = 93)	EBV seronegative infants (n = 164)	p-value
1. Age (years)	1.43 $\pm$ 0.46	1.04 $\pm$ 0.45	$< 0.0001^a$
2. Boys : Girls	1 : 0.72	1 : 0.67	0.79
3. Family income (baht per month)	12,486.02 $\pm$ 17,188.67	13,128.66 $\pm$ 11,716.99	0.72
4. Number of children in family	2.10 $\pm$ 1.20	1.93 $\pm$ 0.99	0.24
5. Place of rearing home : others	1 : 0.05	1 : 0.13	0.05 <sup>a</sup>

Note: home = children were reared at home during the course of the normal working day.

<sup>a</sup> = statistically significant ( $p < 0.05$ ).

Table 2  
Risk factors for EBV infection.

Risk factors	Indicators	EBV seropositive infants (%)	EBV seronegative infants (%)	p-value	Odds ratio	95%CI
Age (years)	> 1	67.7	36.6	<0.0001 <sup>a</sup>	3.64	2.12-6.24
	≤ 1	32.3	63.4			
Sex	M	58.1	59.8	0.79	0.93	0.56-1.56
	F	41.9	40.2			
Family income (baht/month)	≤ 10,000	72.0	58.5	0.03 <sup>a</sup>	1.33	0.72-2.47
	> 10,000	28.0	41.5			
Number of children in family	> 1	67.7	63.4	0.49	1.21	0.71-2.08
	≤ 1	32.3	36.6			
Place of rearing	Home	95.7	88.4	0.05 <sup>a</sup>	2.92	0.96-8.85
	Outside home	4.3	11.6			

Note: home = children were reared at home during the course of the normal working day.

<sup>a</sup> = statistically significant (p < 0.05).

suburban Bangkok was 36.2%. Age and family income were the two risk factors for infection.

#### ACKNOWLEDGEMENTS

We would like to thank Associate Professor Dr Parvapan Bhattarakosol of the Department of Microbiology, Faculty of Medicine, Chulalongkorn University, for conducting the serological tests.

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