SEASONAL VARIATION OF EXERCISE-INDUCED BRONCHOCONSTRICTION IN CHILDREN WITH ASTHMA : A LONGITUDINAL COHORT STUDY IN TAIWAN

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Background

Exercise-induced bronchoconstriction(EIB) can be triggered by inhaling cold and dry air, and its prevalence is relatively higher in temperate zones during the season of winter. There are still differences in bioenvironmental condition between hot and cold seasons in Taiwan with subtropical climate. Hot seasons and cold seasons are defined as May to October and November to February respectively according to the temperature of Central Weather Bureau. The aim of this study is to find seasonal variation in the presence and severity of EIB in children with asthma in Taiwan.

Methods

68 asthmatic children above 5 years of age underwent the standardized treadmill exercise challenge test in hot and cold seasons once each from January 2016 to December 2017. We compared the EIB positive status and environmental factors of hot seasons to cold seasons.

Results

The presence of EIB was significantly different between hot and cold seasons, and there were more children with EIB in hot seasons (51.5% in hot seasons, 22.1% in cold seasons). The decrement percentage of forced expiratory volume in 1 second (FEV1) was greater in hot seasons (13.2±1.2 in hot seasons, 7.3±1.1 in cold seasons, p = 0.001). However, there was no statistically significant in the climate between hot and cold seasons. Additionally, The birth weight was greater in patients with EIB presenting in hot and all seasons, and the decrement percentage of FEV1 was correlated with birth weight (25±1.0 in hot seasons, 22.9±2.9 in cold seasons, 32.7±3.5 in all seasons, p = 0.01, r = 0.205).

Table 1. Clinical characteristics of subjects with or without EIB.

Clinical features	EIB(-)	EIB(+)	p-value
Age (year)	6.5±0.3	7.1±0.2	0.193
Female	22.7%	37%	0.241
BH (cm)	121.9±2.1	124.6±1.5	0.303
BW (kg)	24.6±1.7	26.3±1.2	0.400
BMI (kg/m ²)	16.3±0.7	16.7±0.5	0.668
FVC (%) ^a	69.9±4.1	72.0±3.1	0.696
FEV ₁ (%) ^a	73.4±4.4	73.8±3.3	0.948
FEV ₁ /FVC (%) ^a	90.1±8.3	100.8±3.1	0.147
PEF (%) ^a	78.9±6.2	75.0±4.4	0.617
FEF ₂₅₋₇₅ (%) ^a	84.1±8.2	85.5±5.2	0.366
Acute exacerbation	81.80%	87%	0.576
Atopy			
breast feeding (year)	5.9±1.1	4.4±0.7	0.263
actopic dermatitis	40.9%%	43.50%	0.841
parental atopy	72.70%	71.10%	0.322
Serum IgE (kU/L)	897.9±209.9	1049.5±193.6	0.626
ECP (ug/L)	24.4±4.9	24.4±4.9	0.271
Medication			
LTRA	13.60%	8.70%	
ICS	0%	8.70%	
ICS/LABA	86.40%	78.30%	
LTRA+ICS/LABA	0%	4.30%	

Table 5. The time and percentage of maximal decline in FEV1 of EIB in hot or cold season

	hot seasons	cold seasons	p value
Decrement FEV ₁ %	13.2±1.2	7.3±1.1	0.001
Time of maximal ΔFEV ₁ (minute)	6.8±1.1	9.7±1.1	0.088

Table 2. Clinical characteristics of subjects with EIB in different seasons

Clinical features	hot seasons	cold seasons	all seasons	P
age	6.7±0.2	7.0±0.8	8.1±6.9	0.051
female	9(31%)	4(57.1%)	4(40%)	0.427
BW	25±1.0	22.9±2.9	32.7±3.5	0.01
BH	122.4±1.8	124.7±4.6	130.9±2.8	0.082
BMI	16.5±0.4	14.5±1.4	16.7±0.5	0.021
FVC	73.3±3.8	81.4±10.2	61.5±4.7	0.131
FEV1	74.7±3.4	80.7±9.7	66.4±5.1	0.415
FEV1/FVC	102.6±3.6	91.7±13.8	101.7±2.8	0.473
PEF	74.8±6.1	79.4±8.7	72.6±8.3	0.899
FEF25-75	86.6±7.5	93.4±10.5	76.8±7.3	0.621
Acute exacerbation	79.30%	100%	100%	0.132
Atopy				
IgE	977.3±253.6	932.3±187.5	1319.2±165.2	0.752
ECP	23.1±7.0	33.4±14.5	20.9±9.2	0.697
breast feeding	5.3±1.0	2.3±1.0	3.3±1.8	0.279
actopic dermatitis	9(31%)	6(85.7%)	5(50%)	0.029
parental atopy	19(65.5%)	5(71.4%)	9(90%)	0.333
medication				
LTRA	13.80%	0%	0%	
ICS	10.30%	14.30%	0%	
ICS/LABA	75.90%	71.40%	90%	
LTRA+ICS/LABA	0%	14.30%	10%	

Table 3. Environmental factors of hot and cold seasons

	hot seasons	cold seasons	p-value
EIB incidence	51.5%	22.1%	
acute exacerbation	60.3%	57.4%	
temperature (°C)	28.7±2.0	19.3±3.0	<0.001*
relative humidity (%)	80.9±3.9	83.1±4.2	0.200
SO ₂ (ppb)	2.9±0.4	2.5±0.3	0.007*
CO (ppm)	0.26±0.04	0.34±0.05	<0.001*
O ₃ (ppb)	28.4±5.5	35.9±3.6	0.001*
PM ₁₀ (μg/m3)	38±7	48±8	0.002*
PM _{2.5} (μg/m3)	18±4	23±4	0.007*
NO _x (ppb)	16.86±2.38	18.13±3.37	0.299
NO (ppb)	3.75±0.48	3.82±0.85	0.807
NO ₂ (ppb)	13.11±2.12	14.31±2.70	0.239

Table 4. Positive rate and specific IgE levels of aeroallergens in subjects with or without EIB

Aeroallergen	EIB(-)	EIB(+)	p-vaule
<i>Dermatohagoides pteronyssinus</i>			
Positive rate	33(100%)	15(93.8%)	0.147
Specific IgE (kU/L)	61.5±9.3	65.7±6.1	0.697
<i>Dermatophagoides farinae</i>			
Positive rate	33(100%)	16(100%)	
Specific IgE (kU/L)	56.5±9.1	59.8±6.2	0.759
<i>Blomia tropicalis</i>			
Positive rate	31(93.9%)	15(93.8%)	0.979
Specific IgE (kU/L)	16.5±5.6	16.7±3.2	0.977
House dust (Greer labs)			
Positive rate	27(81.8%)	14(87.5%)	0.614
Specific IgE (kU/L)	4.2±1.1	3.7±0.9	0.745
Cockroach			
Positive rate	8(24.2%)	7(43.8%)	0.165
Specific IgE (kU/L)	0.6±0.4	1.0±0.5	0.571

Reference

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