

# The Relationship of Variables Predictor on FVC and PFR Post Fun Swimming Game Probability to Reduce Asthma Incidence in Children

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**Abstract**— The aim of study is to encourage children to participate physical activity (PA) with fun and happy. The study conducted in children for two months, an hour per week (n=60, 29male/31female). The mean data pre intervention: age (4.70 ± 0.82) years old, height (1.07 ± 0.07) m, weight (20.15 ± 6.95), Body Mass Index (BMI) by (16.96 ± 4.12) kg/m<sup>2</sup>, Force Vital Capacity (FVC) by (0.74 ± 0.26) L, Peak Flow Rate (PFR) by (102.57 ± 35.44) L/min. The result showed significant different between pre and post FSG on FVC (p = .001) and PFR (p = .001). Pre FSG the variables predictor of FVC affected by height, weight, and frequency a midnight cough, exercise frequency. But post FSG, the variable predictor of FVC affected by weight, and frequency of midnight cough. Furthermore, the predictor PFR pre FSG influenced by age, height, weight, asthma history, bedtime, and snore. Post FSG the variables of predictor PFR changed by age, height, and snore. Even though only one times a week for an hour, the FSG program improved FVC and PFR. This evidence can be suggestion program for parents, coach, teacher in kindergarten to encourage children participate in PA.

**Keywords**— *Fun Swimming Game, children, history of asthma symptom*

## I. INTRODUCTION

Asthma is a phenomenal disease caused by inflammation of smooth muscle in respiratory track system. During inflammation appears of cell mast, inflammatory cells, and mucus, this condition makes difficulty in breathing. In fact, the swelling of smooth muscle in bronchus makes narrowing airway. This condition causes chest tightness, wheezing, pain, cough and short in breathing [1].

According to To et al. reported that based on World Health Survey (WHS) at 2002-2003 in the 70 countries (178,215

person, age 18-45 years old) that there were increased adult went to clinic between question asthma symptoms and diagnosis of doctor. There are 4,3%, 4,5%, 8,6% and 21 times more than before. In Australia found that the highest diagnosis disease is asthma and wheezing. The data shown improves asthma and wheezing patient. There is 21%, 21,5 % and 27,4%. The asthma patient 24% is a smoker. The study also found that 20% of asthma patient didn't get treatment [2].

The WHO reported that 235 million people suffer from asthma. It occurs in all countries regardless of the level of development. Over than 80% of asthma deaths occurs in low and lower-middle-income countries [1]. The other study reported that more than 32 million people in United State have been diagnosed with asthma at some time. The 22 million United State resident who currently have asthma, there are 12 million people have an asthma episode or attack over the past year four thousand people die each year from asthma related causes, and asthma is contributing factor in another seven thousand death every year [3].

In 2009, current asthma prevalence was 8.2% of the US population (24.6 million people), within population subgroups it was higher among females, children, person of non-Hispanic black and Puerto Rican race or ethnicity, person with family income below with asthma missed 10.5 million school days and 14.2 million work days due to their asthma. In 2007, there was 1.75 million asthma- related emergency department visit and 456,000-asthma hospitalization. Asthma emergency visit and hospitalization rates were higher among females than males, among children than adults, and among black and white person [4]. In same study different years, Akinbami stated that the asthma prevalence increased from 7.3% in 2001

to 8.4% in 2010, from 25.7 million people suffered in asthma [5].

The increased of asthma incident need more attention how to reduce and increase of life quality. We tried to study in early younger age, to know how the effect of FSG for their FVC and PFR, also the questioner to the parents for anamnesis historical of asthma.

**II. MATERIALS AND METHODS**

This cross-sectional study was conducted from January 2016 to March 2016. Which was 12 times FSG package, every Saturday at 8.00 am to 9.00 am. It concerns 150-kindergarten student, selected to healthy school children, which is 60 students, based on inclusion and exclusion criteria. Children included were 4-6 years old, who passed a full clinical assessment and correctly performed FVC and PFR. Exclusion criteria involved any cardiorespiratory, neurological, or musculoskeletal diseases, high-level sport practice, and illness. The informed consent of parents was obtained prior to the study. The descriptive of characteristics the participants are shown in Table I.

We noted height and weight for every participant. For this study, we were measurements FVC (Takei Force Vital Capacity Machine, Japan) and Mini-Wright Peak Flow Meters (Clement Clarke International Ltd, London, United Kingdom). Each participant had to performed for FVC and PFR three times and the performance was retained and noted.

**A. Participants**

Participants were 60 children (29 male, 31 female, mean age  $\pm$  SD (4.70  $\pm$  0.82) years old, mean BMI  $\pm$  SD = 16.96  $\pm$  4.12 (kg/m<sup>2</sup>). All participants were healthy and study in preschool Sabila Semarang.

**B. Fun Swimming Games (FSG)**

The participants were following the program of FSG in 12 times, every Saturday at 8 – 9 am in “Ciblon Swimming pool Semarang City”. We created easy game protocol and introduction water (2 times) to avoid participant afraid into water. After getting his or her passion in the water, we had difficulty game like take a coin into deep water; its mean every participant must be dived to took it. Than the basic of swimming breaststroke style step by step slowly but sure they enjoy following. And then we did the combination between game and swimming lesson in every meeting to avoid bored. The study conducted in 12 times.

**C. Forced Vital Capacity (FVC)**

To measure how much value of FVC in younger age we used Product from Takei Force Vital Capacity made in Japan. First, the subject’s stand and take the maximum inhaled. Then they exhale slowly to the maximum into the machine. This test did three times then taking for the best one written into data.

**D. Peak Flow Rate (PFR)**

To measure how many peaks expiratory flow we used Peak Flow Meter Mini-Wright made in England. Each

participant was the maximum exhaled for three times. Then the higher value will be added into data.

**E. Questioner**

The questioner we gave to parents the aim is to know about the history of the family and daily activity for the participants also the other factor that includes in asthma.

**F. Statistical Analyses**

Data was analyzed using SPSS 16. Normality was assessed using QQ plot and Kolmogorov-Smirnov test. Baseline difference for descriptive characteristics between age, sex, height, weight, BMI, FVC, PFR, the questioner data, were assessed using paired t-test. Regression test assessed to know which parameter have strong relation with the change value of FVC and PFR.

**III. RESULTS AND DISCUSSIONS**

TABLE I. Baseline Characteristics of The Study Population

Variable Category	Pre Swimming Game	Post Swimming Game	p Value
N	60	60	-
Sex (male/female)	29/31	29/31	-
Age (years)	4.70 $\pm$ 0.82	4.70 $\pm$ 0.82	-
Height (m)	1.07 $\pm$ 0.07	1.10 $\pm$ 0.08	< 0.001*
Weight (kg)	20.15 $\pm$ 6.95	20.35 $\pm$ 6.86	< 0.001*
BMI (kg/m <sup>2</sup> )	16.96 $\pm$ 4.12	16.40 $\pm$ 4.02	< 0.001*
FVC (liter)	0.74 $\pm$ 0.26	0.83 $\pm$ 0.26	< 0.001*
PFR (liter/minute)	102.57 $\pm$ 35.44	110.58 $\pm$ 33.52	< 0.001*

Data are showed as mean  $\pm$  SD. \*, p<0.05

The result of this study showed that following 12 weeks an hour’s FSG program significantly improves the parameter of respiratory function (FVC and PFR) also BMI in children. The results found significant between pre (before FSG program) compared to post FSG (after FSG program).

TABLE II. Characteristic of Questionnaire Study

Variable Category	Percentage
Asthma History (% yes)	15%
Bed Time (% 9 hours/day)	56.7%
Take a nap (% 1 hour/day)	85%
Family Smoking (% yes)	53.3 %
Main road living area (% yes)	26.7%
Flu, Caught, Breath disorder (% yes)	53.3 %
Midnight sleeping disorder + caught (% yes)	45%
Frequency of Midnight Cough/week (% > 3 times)	33.3%
Vegetables Consumption (% yes)	78.3%
Consumption Portion (2 times/day)	23.3%
Snore (% yes)	36.7%
Type of Activity (% active)	95%
Exercise Frequency (% > 3 times/week)	80%

The factors induce asthma in children's by 15% asthma history, 53.3% family smoking, 53.3% flu, caught, breath disorder, 45% midnight sleeping disorder and caught.

TABLE III. Univariate Correlation and Multiple Linear Regressions With FVC and PFR in All Participants Pre FSG

Variable of category	FVC	FCV	PFR	PFR
	r	p Value	r	p Value
Sex	-0.149	0.257	-0.098	0.455
Age	0.142	0.281	0.614	< 0.001*
Height	0.401	0.001*	0.562	< 0.001*
Weight	0.349	0.006*	0.365	0.004*
BMI	0.116	0.337	-0.038	0.773
Asthma History	0.032	0.806	-0.276	0.033*
Bed Time	0.110	0.404	0.263	0.042*
Take a nap	-0.038	0.771	0.098	0.455
Family Smoking	0.038	0.775	0.164	0.211
Main road living area	-0.103	0.436	-0.196	0.134
Flu, Cough, Breath disorder	0.142	0.279	0.187	0.152
Midnight sleeping disorder + cough	-0.062	0.638	-0.143	0.277
Frequency of Midnight Cough/week	-0.338	0.008*	0.016	0.900
Vegetables Consumption	0.240	0.065	0.101	0.441
Consumption Portion	-0.155	0.237	0.155	0.237
Snore	0.043	0.745	-0.382	0.003*
Type of Activity	-0.091	0.490	-0.054	0.685
Exercise Frequency	-0.312	0.015*	-0.108	0.411

\*p<0.05 is considered significance by Univariate Spearman correlation and Multiple linear analysis with backward method.

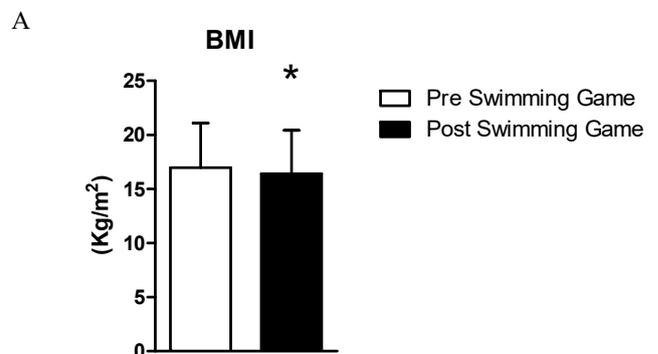
The correlation of pre FSG on FVC to the factors prevalence of asthma in children found significantly different on height, weight, and frequency of midnight cough/week and exercise frequency. Pre FSG on PFR found significantly different with the factor prevalence of asthma, there are age, height, weight, asthma history, bedtime and snore (Table III).

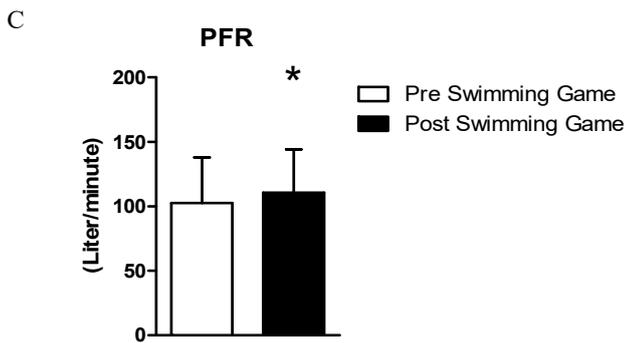
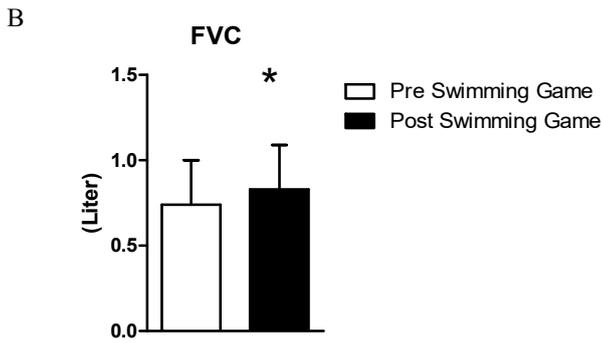
TABLE IV. Univariate Correlation and Multiple Linear Regressions With FVC and PFR in All Participants Post FSG

Variable of category	FVC	FVC	PFR	PFR
	$\beta$	p Value	$\beta$	p Value
Sex				
Age			13.642	0.023*
Height	0.413	0.366	117.912	0.037*
Weight	0.015	0.001*	0.240	0.740
BMI				
Asthma History			-5.949	0.553
Bed Time			1.886	0.734
Take a nap				
Family Smoking				
Main road living area				
Flu, Cough, Breath disorder				
Midnight sleeping disorder + cough				
Frequency of Midnight Cough/week	-0.176	0.006*		
Vegetables Consumption				
Consumption Portion				
Snore			-10.374	0.027*
Type of Activity				
Exercise Frequency	-0.140	0.062		

\*, p<0.05 is considered significance by Univariate Spearman correlation and Multiple linear analysis with backward method.

The correlation and regression multifactorial for PFR on post FSG program showed different on prevalence factor of asthma. The factor prevalence of asthma correlate to PFR there are: age, height, and snore. Post FSG on FVC showed that changed the prevalence factor to be weight and frequency of midnight cough/week (Table IV).





The graphic a, b and c, showed significantly effect FSG to BMI, FVC and PFR between Pre FSG and post FSG.

After we found multifactorial factor predictor in FVC and PFR, continue the analysis with multiple ordinal logistic regression to know how much the relationship of predictor variable to the dependent variable (FVC and PFR).

The analysis found that frequency of a midnight cough has significantly effect to FVC with odds ratio (0.036 – 0.586). In other independent variables for exercise frequency showed significantly effect for FVC (0.037 – 1.130) (Table 5).

Age is one of independent variables that showed significantly on changing of PFR (1.191 – 12.503), and bed time also effect on value of PFR ((1.509 – 11.917) (Tables VI).

TABLE V. The relationship of predictor variables and FVC to asthma incidence probability post Fun Swimming Game treatment

Covariates	OR	P-value	95% CI for OR
Height	0.194	0.704	(0.000 - 13.241)
Weight	1.076	0.164	(0.969 - 1.202)
Frequency of midnight cough	0.147	0.007*	(0.036 - 0.586)
Exercise frequency	0.204	0.006*	(0.037 - 1.130)

Multiple ordinal logistic regression analysis between FCV (dependent variable) and the independent variables shown. P values and OR (95% CI) are given. \* Significant with  $p < 0.05$ .

TABLE VI. The Relationship of Predictor Variables and PFR to Asthma Incidence Probability Post FSG

Covariates	OR	P-value	95% CI for OR
Age	3.857	0.024*	(1.191 – 12.503)
Height	0.0001	0.092	(0.000 - 16.693)
Weight	1.101	0.147	(0.965 - 1.266)
Asthma History	0.479	0.384	(0.091 – 1.179)
Bed Time	4.241	0.006*	(1.509 – 11.917)
Snore	0.498	0.113	(0.210 - 1.179)

Multiple ordinal logistic regression analysis between PFR (dependent variable) and the independent variables shown. P values and OR (95% CI) are given. \* Significant with  $p < 0.05$ .

The pulmonary function had correlation between height and age [6]. The previous study state that sex difference did not influences in respiratory parameter in younger children (3-6 years old but it detected in older children [6]. The stated finding was inline with this study, there were no significant difference FVC between boys and girls in young children 4-6 years old.

Walking and playing away from home significantly increases the volume of children’s physical activity [7]. In our study we introduction the water games to engage children into water. After they have bravery and enjoy in water, we add basic program of breaststroke swimming. Each times we makes program like a game but also the basic swimming into in. Even though only one times a week the FSG practices have benefit for younger children in respiratory function.

Several previous studies have undertaken to mention the benefits of training on asthmatic children. The study found a positive affect on children’s coordination in line with the finding [8]. The high PA level is manifest to a possible protective factor for respiratory improvement [9]. The PA in children would be developed social relations more enjoyable [10]. The British Heart Foundation National center recommended children and young people should undertake a minimum of 60 minutes of moderate to vigorous activity every day [11].

Swimming is one of a form physical activity that recommended for children and also advantageous sports in asthmatic children since the humid environment of swimming pool is considered protective against exercise-induced bronchoconstriction [12]. Amelia stated that Children who learn to swim at an early age show advanced development in: motor skills, reaction time, power of concentration, intelligence, social behavior, Social interaction, self-confidence, independence, disentanglement in new and unknown situations. Children who participated in swimming programs are better adapted than those who do not [13].

In addition when children engage in physical activity they will get many advantages. The study about physical activity during physical education in elementary school, for two years within the frequency three times a week, found that the physical education class enhanced their physical fitness [14].

Thus study was inline with researcher finding, even though only one time but has beneficial effect to physical fitness especially on respiratory function.

#### IV. CONCLUSION AND SUGGESTIONS

Even though only one times a week for an hour, the FSG program improved FVC and PFR. This evidence can be suggestion program for parents, coach, teacher in kindergarten to encourage children participate in PA.

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