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A school based intervention to reduce CVD risk factors: Baseline data from a Behavioral Modification Intervention Program for CVD Risks Prevention among secondary school children in Batang Padang District, Perak, a cluster randomized controlled trial

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ABSTRACT

Introduction: Globally, CVD was responsible for 17.5 million deaths or 46.2% of NCD deaths in 2012 while in Malaysia, CVD is the leading cause of death over the last 40 years with reported increasing trend in the prevalence of CVD risk factors in both adults and adolecents.

Methods: An analytic cross sectional study design was conducted at baseline involving 13-17 years old students in selected secondary schools in Batang Padang District, Perak as part of a cluster randomised controlled trial. Self-administered questionnaire was used for data collection on socio-demographic, dietary habit, smoking, self-esteem and CVD knowledge while weight, height and blood pressure was measured using standardised medical equipment. Analysis for baseline data was done using SPSS version 22. Outcome variables were compared at baseline. Descriptive results were presented as mean, frequency and percentage. Inferential statistics was utilized where appropriate.

Results: The overall prevalence of overweight and obesity was 10.9% and 5.5% respectively. The combined prevalence of pre-hypertension and hypertension was 10.6% (systolic bp) and 9.9% (diastolic bp). At baseline, 42.4% of the respondents reported low level of physical activity while 5.9% are regular smokers. Overweight and obesity contributed to higher mean Systolic (F=226.55, p=0.0001) and Diastolic BP (F=144.71,p=0.0001) while percentage of those with low level of physical activity were more in the overweight and obese respondents (F=538.71, p=0.0001). We found no difference in the main socio-demographic characteristics at baseline. We found higher baseline intake of high calories low nutrition food (t= -5.277,p=0.0001), vegetables (t= 3.416,p=0.001), sugar intake (t= -4.959,p=0.0001) and sugared non-carbonated drinks intake (t= -4.947, p=0.0001) in the Control group but no difference in carbonated drinks and alcohol intake. The mean self-esteem score (t= -1.97,p=0.049) and CVD knowledge score (t=-2.628,p=0.009) was higher in the Control group.

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Conclusion: The increasing trend of CVD risk factors among the adolescents in Malaysia is worrying. An effective intervention targeting to reduce all CVD risk factors among adolescents in Malaysia is needed to help reduce the overall prevalence of CVD in adulthood.
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Keywords: CVD risk factors, behavioral modification intervention, adolescents, schools

1.0 Introduction

Of 56 million deaths globally from all causes in 2012, 38 million were due to Non Communicable Diseases (NCDs), principally CVD, cancer and chronic respiratory diseases. CVD alone were the leading cause of NCD deaths in 2012. Globally, CVD was responsible for 17.5 million deaths or 46.2% of NCD deaths while in Malaysia, CVD have been the leading cause of death in Malaysia for the past 40 years (WHO 2014). In 2008, CVD alone is responsible for 32% of total deaths from all causes in Malaysia (WHO 2012). Research has shown that both genetics and lifestyle are important contributors to increased risk. The primary lifestyle components are diet, physical activity, and smoking (WHO 2014).

Obesity in children is showing a rising trend. It is estimated that over 42 million children under the age of five in 2013 were overweight and out of these close to 31 million are living in developing countries. It has affected many low- and middle-income countries, particularly in urban setting (WHO 2014). In Malaysia, obesity rate for children below the age of 18 is 11.9% (WHO 2010). Obesity in childhood and adolescents can continue up to adulthood and increases the chance of developing non-communicable diseases both in childhood and adulthood.

Physical inactivity is also a serious problem in today's world. Globally, 81% of adolescents aged 11−17 years were insufficiently physically active in 2010, i.e. they had less than the 60 minutes of moderate to vigorous daily physical activity, as recommended by WHO5. In Malaysia, the 2015 data showed that approximately 35.5% Malaysians are physically inactive (WHO 2010). As for smoking, there were some 1.1 billion smokers worldwide, with over 8 out of 10 tobacco smokers smoking daily, while 22.5% of Malaysians are smokers (WHO 2012).

In a study among 1,778 school children aged 13-17 years in the Putrajaya, Malaysia, showed that the overall prevalence of pre-hypertension and hypertension was 11.1% and 11.6% respectively (Rampal et al.,2010).The prevalence of hypertension was significantly higher in the adolescents who were overweight or obese. This indicates that CVD risks are on the increasing trend even in the adolescent age group in Malaysia with overweight or obesity as one of the most important risk factor. In a separate study in Klang, out of the 3,333 respondents of secondary school children, 11.4% were found to be at risk of overweight and 8.2% were overweight
(Rampal et al.,2007).

The problems of CVD among adults has reached an epidemic proportions and needs to be controlled. Therefore, the prevalence of CVD in Malaysia should be reduced. To achieve this, prevention program must start as early as possible, preferably among the school children. Intervention to reduce CVD and its risk factors must start as early in life as possible for it to

be effective, preferably during the school going age. With behavioural change still remaining a driving force against CVD , there is an urgent need for an innovative behavioural modification preventive interventions among adolescents. This research will help us to obtain valuable information and knowledge to plan and implement an effective nationwide CVD prevention program in all the schools. This paper intends to report the findings at baseline of a behavioral modification intervention for CVD risks prevention among secondary school children in Batang Padang District, Perak.

2.0 Materials and Methods

2.1 Study Design

This paper represents a cross sectional study at baseline as part of a cluster randomized controlled trial. The research protocol was approved by the ethics-committee of University Putra Malaysia. An approval from the national, state and district education authorities were obtained. Parental and school consent was also obtained prior to the commencement of this research.

2.2 Sampling and randomization

We recruited respondents from 11 secondary schools in Batang Padang district in Perak, Malaysia and paired them according to size, ethnicity, and sub-urban or rural location through a systematic & stratified random sampling. A proportionate allocation technique was used to provide estimate on the numbers of students from each school that should be sampled A power calculation indicated that the study would have 80% power to detect an underlying difference in means of a normally distributed outcome measure of >1.8 standard deviations at the 5% significance level. This took into account the cluster randomization design with an effect size of 1.9 and attrition rate of 20%. A total of 3676 students were included at the start of the study. Each school was treated as a cluster. We then randomized the clusters to receive the intervention or to serve as the control schools. The intervention schools received the Behavior Modification Intervention To Reduce CVD Risk Factors In Secondary School Children in Batang Padang District module while the control schools were waitlisted for similar intervention later.

2.3 Main outcome measures

We collected data on mean physical activity score, weight, BMI, dietary habit, smoking status, self-esteem score, body esteem score and blood pressure at baseline.

2.3.1 Anthropometric measurement

Anthropometric measurement for the students was standardized by the use of TANITA model HD-309 for weight and SECA body meter model 208 for height for all respondents. BMI was classified using the Age For Percentile Chart (CDC 2010).

2.3.2 Blood Pressure

The blood pressure was measured using a standard bp set for all respondents (Omron Professional Automated BP Set : Model HBP 1300). Calibration was done once every 600 measurements. An average of 2 bp readings were taken (measurements at 20 minutes apart). The bp was measured by trained(qualified) Staff Nurses/Paramedics**.** Classification of hypertension among the respondents was done following the WHO 2013 guidelines for the classification of hypertension in children and adolescent age group

2.3.3 Physical Acitivity

Physical activity was measured by using the physical activity questionnaire for children and adolescents (Kowlaski K.C.et al.,2004). It is a self-administered, 7-day recall instrument to assess general levels of physical activity for secondary school students. A score of 1 to 1.99 indicates low physical activity, 2.00-2.99 moderate physical activity whereas a score of 3.00 to 5.00 indicates high physical activity.

2.3.4 Dietary information

A 30 days diet recall instrument with 126 food items commonly found in Malaysian multi-racial society based on the nutrient composition of Malaysian food was used (Tee et al.,1997). We analysed the information for frequency of consumption of high calories low nutrition foods, drinks high in sugars, fruit, and vegetables intake.

2.3.5 Psychological measures.

We used a validated self administered instrument divided into two sections to assess self esteem and body esteem score among the students. The first section utilises the Rosenberg Self Esteem Scale to measure self esteem score in a 30 points scale while the second section measures body size perception by Childress at al.

2.4 Statistical analyses

Descriptive data at baseline was analysed using SPSS version 22 and was presented as means ± SD or percentages (and 95% CI).

2.5 Funding

This work was supported by The University Putra Malaysia research grant (Grant No: 9359000).

2.6 Research flow chart

The baseline data-collection flow chart is as below (See diagram 1).

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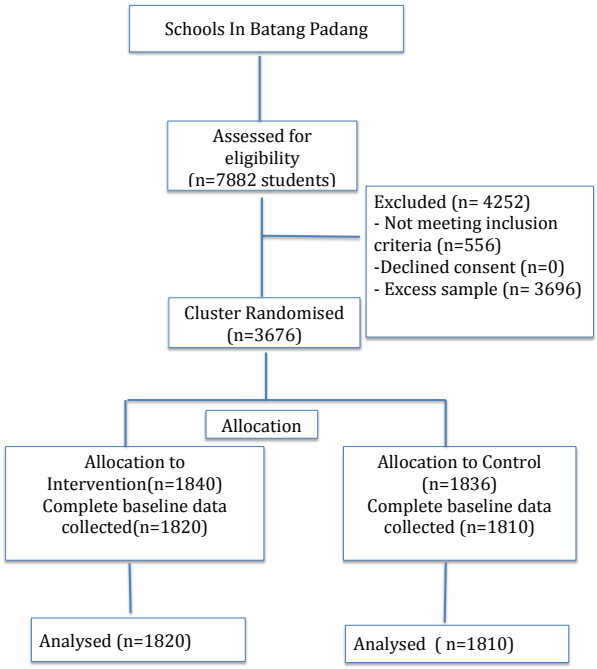
Diagram 1: The baseline data collection flow chart



3.0 Result

3.1 Socio-demographic characteristics

The overall mean age was 14.26 (SD = 1.22, 95%CI = 14.22-14.29) years and ranged between 13 to 17 years old. 50.1% of the respondents were Male while 49.9% were Female. Majority of the respondents were Malay (55.4%), followed by Chinese (25.3%), Indian (13.6%), Orang Asli (5.2%) and others (0.5%) who were among natives of East Malaysia such as Iban, Kadazan, Dayak and Dusun. There was no significant difference in the mean or proportion of age ($X^{2=}$1.614,p=0.25), gender (X^2=2.883,p= 0.090) , ethnicity(X^2= 2.900, p= 0.575) and family income (X^2=327.551, p= 0.192) between the intervention and control group. However, despite randomization, the intervention and control group differ significantly in the proportion of mother's education classification (X^2= 112.592, p= 0.001) and father's education (X^2= 78.952,p=0.001) The differences is mainly in the proportion of no formal education part which is higher in the control group (n=164) than in the intervention group (n=50) for mother's education while for father's education the difference is mainly in the proportion of higher learning which is higher in the control group (n= 372) than in the intervention group (n= 252). There was no significant difference in the proportion of those with family history of CVD (X^2=0.330,p=0.720), Obesity (X^2= 5.101,p=0.066) and hypertension (X^2=6.435,p=0.092) between the two groups at baseline.

3.2 Prevalence of CVD risk factors at baseline

The overall prevalence of overweight was 10.9%, obesity 5.5%, smoking 5.4% and physical inactivity 42.4% in all the respondents. The overall prevalence of those with pre-hypertension and hypertension (combined) was 10.6% (systolic bp classification) and 9.9% (diastolic bp classification). Overweight and obesity contributed to higher mean systolic (F=226.55, p=0.0001) and diastolic bp (F=144.71,p=0.0001) while percentage of those with low level of physical activity were more in the overweight and obese respondents (F=538.71, p=0.0001). The overall mean dietary intake score was 3.55 (SD=1.05) for High Calories Low Nutrition Food (HCLN), 3.92 (SD=1.20) for plain sugar, 2.86 (SD=1.43) for carbonated drinks, 3.10 (SD=1.55) for sugared non-carbonated drinks, 3.98 (SD=1.1) for vegetables and 1.34 (SD=0.88) for alcohol intake.

3.3 Baseline comparison on nutritional status of the respondents, physical activity score, prevalence of smoking

At baseline, the mean BMI is slightly higher in the intervention group with mean BMI of 21.80 as compared to mean BMI of 21.38 (t=2.473,p=0.013) in control group. However, when classified into the nutritional status classification, the proportion is comparable between the two groups (X^2=0.258,p=0.968). The mean physical activity score was also higher in the control group with mean physical activity score of 1.43 versus 1.40 of the intervention group (t= -1.874,p=0.02). When we compare the physical activity level based on classification of low, moderate and high physical activity level, there is no significance difference between the intervention and control group. (X^2=3.842,p=0.175). There was also no difference in the proportions of students who ever smoke (X^2=1.431,p= 0.489) and current smokers (X^2=1.139,p=0.566).

3.4 Baseline comparison on mean blood pressure, prevalence of hypertension, CVD knowledge score and self-esteem score

The mean systolic blood pressure for the intervention group was 112.34 while the mean systolic blood pressure for the control group was 112.18(t=0.367, p=0.714). The mean diastolic blood pressure was slightly higher in the control group with the mean of 65.83 as compared to 64.22 in the intervention group (t=-5.032,p=0.001). When we classify the the blood pressure to normal, pre-hypertension, class 1 hypertension and class 2-hypertension, we found no significant difference in the systolic blood pressure classification between the two groups (X^2=4.435,p=0.218). However, the proportion of pre-hypertensive and hypertensive students using diastolic blood pressure classification is higher in the control group than in the intervention group (X^2=24.826,p=0.001). The mean self-esteem score is slightly higher in the control group at 2.97 as compared to the intervention group at 2.94(t= - 1.97,p=0.049). The mean CVD knowledge score is also slightly higher in the control group at 10.61/30.0 as compared to the intervention group at 10.07/30.0 (t=-2.628,p=0.009).

3.5 Baseline comparison on mean dietary score

We found slightly higher mean dietary score in the control group as compared to the intervention group for high calories low nutrition food intake (mean score =3.65, t= -5.277,p=0.0001), vegetables intake (mean score= 4.04, t= 3.416,p=0.001), dairy products intake (mean score=2.98,t= -3.365,p=0.001), sugar intake (mean score=4.03, t= -4.959,p=0.0001), sugared non-carbonated drinks intake (mean score= 3.23, t= -4.947, p=0.0001) and sweet snacks intake (mean score = 4.07,t= -6.357, p= 0.0001). The intake of energy drink (t= 5.541,p= 0.0001) and eggs (t =1.957, p = 0.017) are higher in the intervention group with mean score of 3.45 and 3.62.There were no differences in the baseline mean score for carbohydrate intake, Non-seafood protein, carbonated drinks, condensed milk and alcohol intake.

Table 1.0: Baseline comparison on socio-demographic characteristics between intervention and control (n=3630)

Variables	Frequency, n (%)		Total	Test type	p-value
	Intervention (n=3620)	Control (n=3610)			
Age group (years)					0.25
13	620 (34.1)	645 (15.6)	1265(34.8)	X^2	
14	620(34.1)	633(35.0)	1253(34.5)		
15	1(0.0)	2(0.0)	3(0.1%)		
16	577(31.7)	528(29.2)	1105(30.4)		
17	2(0.0)	2(0.0)	4(0.1)		
Total	1820(100.0)	1810(100.0)	3630(100.0)		
Mean, SD	14.37 (1.24)	14.11 (1.19)	14.26(1.22)	*t*	0.10
95% CI	14.32-14.43)	(14.05-14.17)	(14.22-14.29)		
Gender					
Male	912(50.1)	856(48.4)	1768(48.7)	X^2	0.09
Female	908(49.9)	954(51.2)	1862(51.3)		
Ethnicity					
Malay	1009(55.4)	987(54.5)	1996(55.0)	X^2	0.575
Chinese	460(25.3)	439(24.3)	899(24.8)		
Indian	247(13.6)	281(15.5)	528(14.5)		
Orang Asli	95(5.2)	94(5.2)	189(5.2)		
Lain-lain	9(0.5)	9(0.5)	18(0.5)		
Total	1820(100.0)	1810(100.0)	3630(100)		

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Family Income	519(28.5)	573(31.7)	1092(30.1)	X^2	
≤500	276(15.2)	228(12.6)	504(13.9)		
501-999	636(34.9)	608(33.6)	1244(34.3)		0.192
1000-2999	177(9.7)	176(9.7)	353(9.7)		
3000-4999	58(3.2)	61(3.4)	119(3.3)		
5000-6999	23(1.3)	29(1.6)	53(1.5)		
7000-8999	24 (1.3)	29(1.6)	53(1.5)		
≥9000					
No Info	107(5.9)	103(5.7)	210(5.8)		
Total	1820(100.0)	1810(100.0)	3630(100)		

Significant at p<0.05

Table 2.0: Baseline comparison on parent's education status between intervention and control (n=3630)

Variables	**Frequency, n (%)**	**Total**		**Test type**	**p-value**
	Intervention	Control			
Father's Education					
No Formal Education/ Primary School	289(16.0)	396(21.9)	685(18.9)	X^2	0.001
Secondary School	1253(69.2)	1028(56.8)	2281(62.8)		
Higher Learning	252(13.9)	372(20.6)	624(17.2)		
No Information Available	26(1.4)	14(0.8)	40(1.1)		
Total	1820(50.1)	1810(100.0)	3630(100)		
Mother's Education	50(2.7)	164(9.1)	214 (5.9)	X^2	0.001
No Formal Education					
Primary School	281(15.4)	279(15.4)	560(15.4)		
Secondary School	1210(66.5)	980(54.1)	2190(60.3)		
Higher Learning	252(13.8)	372(20.6)	624(17.2)		
No Information Available	27(1.5)	15(0.8)	42(1.2)		
Total	1820(100.0)	1810(100.0)	3630(100)		

Significant at p<0.05

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Table 3.0: Mean BMI, systolic bp, diastolic bp, physical activity score , CVD knowledge score and self esteem score comparison between intervention and control

Outcome measures	Mean (SD)		Mean Difference	95%CI	Test	p-value
	Intervention	Control				
Mean BMI	21.80(5.01)	21.38(5.24)	0.42(0.17)	0.09-0.75	t	0.01
Overall Mean BMI	21.59 (5.24)					
Systolic BP	112.34(13.23)	112.18(13.15)	0.16(0.44)	0.10-0.39	t	0.71
Overall Mean Systolic BP	112.26 (13.19)					
Diastolic BP	64.22(9.29)	65.83(9.93)	1.6 (0.32)	1.10-1.80	t	0.01
Overall Mean Diastolic BP	65.02(9.65)					
Physical Activity Score	2.97(0.63)	3.06(0.60)	0.09(0.02)	0.05- 0.13	t	0.02
CVD Knowledge Score/30	10.07(6.18)	10.61(6.27)	0.54(0.21)	0.14-0.95	t	0.01
Overall Mean Score	10.34(6.23)					
Self Esteem Score	17.64(2.32)	17.79(2.27)	0.15(0.23)	0.14-0.50	t	0.05
Overall Mean Score	17.72(2.29)					

Significant at p<0.05

Table 4.0: Baseline distribution of nutritional status and physical activity level, for all respondents (n=3630)

Variables	Frequency,n (%)
Nutritional Status	
Underweight	137(3.8)
Normal Weight	2898 (79.8)
Over Weight	395(10.9)
Obese	200 (5.5)
Total	3630 (100)
PA Level	
Low	1539(42.4)
Moderate	1931 (53.2)
High	160 (4.4)
Total	3630 (100)

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Table 5.0: Comparison of prevalence of ever smoke and current smoker between intervention and control

Variables	Frequency, n (%)		Total	Test type	p-value
	Intervention	Control			
Ever Smoke					
Yes	192(10.5)	171(9.4)	363(10.0)	X^2	0.49
No	1628(89.5)	1639(90.6)	3267(90.0)		
Total	1820(100.0)	1810(100.0)	3630(100.0)		
Current Smoker					
Yes	109(5.9)	97(5.4)	206(5.4)	X^2	0.57
No	83(4.6)	74(4.1)	157(4.3)		
Never Smoke	1628(89.5)	1639(90.5)	3267(90.3)		
Total	1820(100.0)	1810(100.0)	3630(100.0)		

Significant at p<0.05

Table 6.0: Baseline comparison on distribution of blood pressure classification between intervention and control

Variables Blood Pressure	Frequency, n (%)		Total	Test type	p-value
	Intervention	Control			
Systolic					
Normal	1614(88.7)	1630(90.1)	3244(89.4)	X^2	0.218
Pre-HPT	106(5.8)	97(5.4)	203(5.6)		
Stage 1 HPT	86(4.7)	64(3.5)	150(4.1)		
Stage 2 HPT	14(0.8)	19 (1.0)	33(0.9)		
Total	1820(100.0)	1810(100.0)	3630(100.0)		
Diastolic					
Normal	1683(92.5)	1584(87.5)	3267(90)	X^2	0.01
Pre-HPT	66(3.6)	110(6.1)	176(4.8)		
Stage 1 HPT	60 (3.3)	97(5.4)	157(4.3)		
Stage 2 HPT	11(0.6)	19 (1.0)	30 (0.8)		
Total	1820(100.0)	1810(100.0)	3630(100.0)		

Significant at p<0.05

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Table 7.0: Baseline comparison on mean dietary score between intervention and control

Outcome measures Dietary Score	Mean (SD)		Mean Difference	Test	p-value
	Intervention	Control			
Carbohydrate	4.90(0.46)	4.92(0.39)	0.02(0.01)	t	0.240
Protein (Non-seafood)	3.96(1.44)	3.94(1.45)	0.02(0.01)	t	0.599
Protein (Seafood)	3.28(1.20)	3.73(1.06)	0.45(0.15)	t	0.0001
High Calories Low Nutrition Food	3.46(1.08)	3.65(1.09)	0.19(0 .09)	t	0.0001
Vegetables	3.92(1.13)	4.04(1.07)	0.12(0.06)	t	0.001
Fruits	3.76(1.02)	3.94(0.99)	0.18(0.09)	t	0.0001
Dairy Products	2.82(1.45)	2.98(1.50)	0.16(0.08)	t	0.001
Sugar (plain)	3.80(1.40)	4.03(1.30)	0.23(0.12)	t	0.0001
Carbonated Drinks	2.86(1.41)	2.86(1.45)	0.00(0.00)	t	0.967
Condensed Milk	2.44(1.46)	2.34(1.45)	0.10(0.05)	t	0.335
Energy Drink	3.45(1.34)	3.19(1.55)	0.26(0.09)	t	0.0001
Sugared Non-Soda can/packet Drinks	2.97(1.65)	3.23(1.45)	0.26 (0.07)	t	0.0001
Alcohol	1.37(0.89)	1.31(0.87)	0.06(0.01)	t	0.88
Sweet Snacks	3.85(1.02)	4.07(0.99)	0.22(0.11)	t	0.0001
Egg Score	3.62(1.00)	3.56(1.05)	0.06(0.03)	t	0.017

4.0 Discussion

In this study, standard medical and anthropometric measurement equipments were used. The nurses and paramedics employed by the researcher to measure the outcome at baseline and post-intervention had no idea which groups the students in each school belong to. This has helped the researcher to reduce potential measurement bias The sample size used in this study is big. This has helped to increase the chance of finding significant difference between the groups and reduced the margin error if any. Larger sample size also increases the external validity of this study by being representative of the full spectrum of diversity of the population from Batang Padang District, Perak where the sampling came from.

To be able to assess the effectiveness of an intervention, ideally, the socio-demographic and outcome factors measured should be comparable for both groups at baseline. However, in reality, we can only systematically control for some common socio-demographic factors through stratified sampling at baseline but this is limited to race, age, and type of schools in

this study. Other factors such as family income and parents education are difficult to control during sampling and randomisation. In this study, while other socio-demographic parameters are comparable between both groups the parents education status were slightly different. We also found slight differences in the mean BMI, physical activity score, diastolic blood pressure, CVD knowledge score and self esteem score between the two groups. These differences is expected to have mimimal impact on the assessment of the effectiveness of the intervention within the intervention group but may reduce the magnitude of differences between the two groups after intervention.

At baseline, the overall percentage of overweight and obesity was 10.9% and 5.5%, pre-hypertension and hypertension was 10.6% with systolic bp and 9.9% for diastolic bp, prevalence of smoking was 5.4% while 42.4% had low level of physical activity. The prevalence of overweight and obesity is high among those with low level of physical activity while prevalence of pre-hypertension and hypertension are more in the overweight and obese respondents. This finding is consistent with the findings by Rampal et al in 2007 and 2010. Based on this, we would expect that by increasing the level of physical activity, we may have a positive effect on weight and systolic bp reduction. Due to limitations in time and manpower, the researcher was not able to follow up and manage all the pre-hypertensive and hypertensive respondents at baseline. However, in view of the "do no harm" principles of medicine, all the respective parents of hypertensive respondents were informed and was advised to have their children's bp profile taken over 2 weeks to confirm the diagnosis and assessed by a doctor for further management. The researcher had no control over possibility of the parents getting medical treatment for their hypertensive children during the intervention period. All the respondents who remained pre-hypertensive and hypertensive after the intervention ended were referred to the nearest government health clinic by the researcher for further management as a secondary preventive measure. Another limitation is, due to feasibility issue, prevalence of hyperlipidemia as one of CVD risk factor was not measured.

The overall mean dietary intake score was 3.55 (SD=1.05) for High Calories Low Nutrition Food (HCLN), 3.92 (SD=1.20) for plain sugar, 2.86 (SD=1.43) for carbonated drinks, 3.10 (SD=1.55) for sugared non-carbonated drinks, 3.98 (SD=1.1) for vegetables, 3.85 (SD=1.00) and 1.34 (SD=0.88) for alcohol intake. Even though the consumption of healthy food such as fruits and vegetable was high among the respondents, consumption of unhealthy food such as HCLN food, sugar as well as sugared sweetened drinks (carbonated and non-carbonated) were also high. Overall alcohol intake was low. The intake rate for all the food items above were consistent with the Malaysian Nutrition Survey 2014. For the intervention to be effective in reducing CVD risk factors, the vegetables and fruits intake must be increased while the HCLN food, sugar and sugared sweetened drinks must be reduced. These specific focused targets were based on the evidence of the effect of all these food items on reducing or increasing the CVD risks. A healthy diet rich in fruits and vegetables can substantially lower the risk of CVD and the BP (11/6 mmHg in hypertensive patients and 4/2 mmHg in patients with high normal BP) (WHO 2012). Fruits and vegetables intake are associated with lower risk of developing CVD and cancers (Oyebode O et al., 2014). Excessive salt and sugar intake (with subsequent diabetes) is known to contribute significantly to a rise in CVD and other chronic diseases (WHO 2014). A systematic review and meta analysis of 88 studies found clear association of soft drink intake with increased caloric intake and body weight (Vartaian et al., 2007). In children and adolecents, a more recent meta-analysis estimates that for every additional of 12 ounce serving of sugary beverage consumed each day, BMI increases by 0.08 units (Malik VS et al., 2009). Another meta analysis finds that adults who regularly drink

sugared beverages have a 26% higher risk of developing type 2 diabetes than people who rarely drink sugared beverages (Hu FB et al., 2010). There are also emerging evidences to support the link between high sugary beverages intake and heart disease (Malik VS et al., 2010). High calories low nutrition food or more commonly known as fast food, is known for its large portions,low prices, high sugar and fat contents, high calories but low in nutrition as well as high palatibility. There are significant evidences from studies in teens and adults that frequent high calories low nutrition food consumption is associated with over-eating and weight gain (Rosenheck R et al., 2008).

5.0 Conclusion

The increasing trend of CVD risk factors among the adolescents in Malaysia is worrying and will lead to negative economic and social implications as well as worsening the national health burden. CVD in adolescents will eventually lead to CVD in adulthood. Because of this, CVD risk preventive measures must start as early as possible in life, preferably among the school children.

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References

Childress AC, B. T. (1993). The Kid's Eating Disorder Survey (KEDS) : A Study of Middle School Students . *Journal of American Academy of Child & Adolescent Psychiatry , 10* (1097).

Dietary Guideliness Advisory Committee USDA. (2010). *Report of the Dietary Guidelines Advisory Committee, 2010 Dietary Guidelines for Americans.* USDA.

Duffey KJ, G.-L. P. (2007). Differential associations of fast food and restaurant food consumption with 3 year change in body mass index: the Coronary Artery Risk Development in Young Adults Study . *American Journal of Clinical Nutrition* (85), 201-208.

Duffey KJ, G. L. (2009). Regular consumption from fast food establishments relative to other restaurants is differentially associated with metabolic outcomes in young adults. *J Nutrition* (139), 2113-2118.

Dobbins M, H. H. (2013). School Based physical activity programs for promoting physical activity and fitness in children and adolescents aged 6 to 18. *Cochrane Database of Systematic Reviews* (2), 1465-1858.

Eaton DK, K. L. (2008). *Youth risk behaviour surveillance-United States 2011 Morbidity and Mortality Weekly Report, Center for Disease Control and Prevention.*

European Society of Hypertension. (2010). *ESH International Protocol Revised.*

Fredman DS, K. L. (2005). Relationship of childhood BMI overweight to coronary heart disease risk factors in adulthood: the Bogalusa Heart Study. *Pediatrics* (115), 22-27.

Guthold R, O. T. (2008). Worldwide variability in physical inactivity a 51-country survey. *Am J Prev Med* (34), 486-494.

Hayman LL, M. J. (2010). *Primary prevention of cardiovascular disease in nursing practice: focus on children and youth: A scientific statement.* American Heart Association Committee on Cardiovascular disease in young, Council on cardiovascular diseases.

Hu FB, M. V. (2010). Sugar-sweetened beverages and risk of obesity and type 2 diabetes: epidemiologic evidence . *Physiological Behavior* (100), 47-54.

Janz KF, D. J. (2002). Increase in physical fitness during childhood improves cardiovascular health during adolescence: the Muscatine Study . *Int J Sports Med.* (23(S1)), S15-S21.

Jonathan A. Kropski1, P. H. (2008). School-based obesity Prevention Programs: An Evidence Based Review. *Journal of Obesity , 16* (5).

Jounala M, M. C. (2010). Influence of age on associations between childhood risk factors and carotid intima media thickness in adulthood. *JAMA* (122), 2514-2520.

Kowalski K, C. P. (2004). The Physical Activity Questionnaire for Older Children (PAQ-C) and Adolescents (PAQ-A) Manual, College of Kinesiology, University of Saskatchewan.

Malik VS, P. B. (2010). Sugar-sweetened beverages and risk of metabolic syndrome and type 2 diabetes: a meta analysis. . *Diabetes Care* (33), 2477-2483.

Malik VS, W. W. (2009). Sugar-sweetened beverages and BMI in children and adolescents: reanalyses of a meta-analysis. . *American Journal of Nutrition* (89), 438-439.

Mendis S, P. P. (2011). *Global Atlas on Cardiovascular Disease Prevention and Control* . World Health Organization in collboration with World Heart Federation and World Stroke Organization.

Meyer AA, K. G.-W. (2006). Improvement of early vascular changes and cardiovascular risk factors in obese children after a six-month exercise program. . *J Am Coll Cardiol.* (48), 1865-1870.

Michelle Mann, C. M. (2004). *self-esteem in a broad spectrum approach for mental health promotion* (Vol. 19). Oxford University Press .

Ministry of Health . (2014). *Malaysian Adult Nutrition Survey Report (NMHS 2014)* . Institute of Public Health .

Ministry of Health . (2014). *Malaysian Nutrition Survey Report (NMHS 2014)* . Institute of Public Health.

Ministry of Health Malaysia. (2015). *National Morbidity & Health Survey* . Institute for Public Health .

Nader PR, B. R. (2008). Moderate to vigorous physical activity from ages 9 to 15 years . *JAMA* (300), 295-305.

Oyebode, O. (2014). Fruit and vegetable consumption and all-cause,cancer and CVD mortality: analysis of Health Survey for England data. *Journal of Epidemiology Community* .

Rampal, G. L., Sherina, Sanjay, W. Y., Chow, P. L., Liew, J. S., & Shum, Y. S. (2007). Prevalence of Overweight among Secondary School Students in Klang District,Selangor. *Malaysian journal of Nutrition , 13* (1), 1-8.

Rampal, L., Choon, N. K., & Izhar. (2010). Prevalence of Hypertension Among Malay Adolescents in Putrajaya Secondary Schools, Malaysia . *Malaysian Journal of Medicine and Health Sciences , 7* (2), 53-60.

Rosenberg M. (1965). *Society and the adolescent self-image.* Princeton, New Jersey: Princeton University Press.

Rosenheck. (2008). Fast food consumption and increased caloric intake: a systematic review of a tracjectory towards weight gain and obesity risk. *Obesity Review* (9), 535-547.

Taylor F.Eagle, B. S.-W.-D. (2012). Understanding Chilhood Obesity in America Linkages Between Household Income, Community Resources and Children's Behaviour. *American Heart Journal , 163* (5), 836-843.

Tee ES, M. I. (1997). *Nutrient Composition of Malaysian Foods* (4th Edition ed.). Kuala Lumpur , Malaysia : Malaysian Food Composition Database Programme .

Vartaian LR, S. M. (2007). Effects of soft drink consumption on nutrition and health: A systematic review and meta-analysis. . *American Journal of Public Health* (97), 667-675.

World Health Organization. (2014). *Global Status Report on Non-Communicable Diseases.*

World Heart Federation . (2014). *CVD risk factors* .

World Health Organization. (2012). *Non-communicable Diseases in The Western Pacific Region: A Profile Report by WHO Western Pacific Region.* World Health Organisation.

World Health Organization. (2002). *The World Health Report 2002: Reducing Risks, Promoting Healthy Life* . Geneva .

World Health Organization. (2010). *Global Recommendations on Physical Activity for Health* .

World Health Organization . (2013). *A global brief on hypertension.*

World Health Organization. (2009). *WHO Summary Report On Diet and Physical Activity In Adolescent,What Works.* WHO.